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PROFITABILITY ANALYSIS OF DIGITALIZATION TOOLS FOR SMALL HOSPITALITY SERVICE PROVIDERS: A CASE STUDY

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ABSTRACT

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Master's Thesis

2019

68 pages, 14 figures, 14 tables and 11 appendices

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Keywords: Hospitality, Digitalization, Personalization, Profitability, Management System

The hospitality industry has a great impact on the worldwide economy. In 2017, the hotels and resorts field made a profit of $878 billion and recruited 4.3 million people (Uniting travel). Over recent years development of leading technologies in the industry changed the way services are provided. Digitalization is playing more and more significant role. In this paper, various digitalization tools and their profitability will be examined in the context of a small hotel business. The way adoption of new technologies can ease the leading of business and what kind of benefits small and medium businesses working in the sphere of hospitality can acquire are to be studied in this paper. What is more, it will be researched how digitalization can improve guest experiences.

The research is built upon case study. The author worked at the hotel, got an insight on how the business functions and what kind of problems it is facing. Information received from the owners of the hotel is the basis of the profitability analysis. Results of the research revealed that there are several profitable option to select from for a small hotel business. Combination of a centralized management system without monthly fee with a key door boxes was considered to be the most feasible option.

ACKNOWLEDGMENTS

I want to express my sincere gratitude to Mariia Kozlova for her instrumental role in the guidance of my research. I would also like to show my appreciation to Professor Mikael Collan for his valuable contribution to the thesis.

Tatiana Yaldaie

Lappeenranta 16.12.2019

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1 INTRODUCTION

Travel and hospitality is a multibillion market that plays an important role in the global economy. It is one of the European GDP's major contributors and its third employer. Hospitality industry is constantly developing and such trend as digitalization is playing a more noticeable role. Different digital resources are in demand and the market is growing rapidly. (Team, J., 2017)

We are currently living in the digital era, and in order to be competitive and attract customers, the hospitality industry should keep up with new technologies. People choose digital hotel booking platforms over other methods of booking. It is easy and time-saving. Customers want a more personalized service that forecasts their needs. Digitization can help meet a wide range of different needs and provide better service. Digitalization is an efficient way to reach millions of people. A well-designed and user-friendly website can deliver meaningful information to millions of people. A hotel needs to adopt and operate a Content Management system, which is a digital Content Management software, in order to achieve this aim. (Team, J., 2017)

A well-designed online platform that hospitality providers use offers benefits such as better communication, an effective reservation system, and ultimately lower operating costs due to better management. Customer experience plays a vital role in the maximization of the average revenue per customer. (Onyx CenterSource, 2015)

Large corporations and chains in the accommodation sector have reached such a development stage when the international market is dominated by a few major companies as a consequence of an expansion mainly achieved via franchising. However, it is obvious that the overwhelming majority of the players within the accommodation sector may be regarded as small and medium-sized organizations. Due to the finite resources and lack of marketing and management functions, they tend to rely on intermediaries to promote and distribute their goods. Consequently, small and medium-sized enterprises face difficulties in coping with their larger counterparts. (Anckar, B.& Walden, P., 2001)

Despite the widespread of global distribution systems (GDSs), many European providers of accommodation. Because of these limitations, not only small and medium-sized enterprises, but also tourists, whose choice of service providers is severely restricted, are disadvantaged. Thus, the rise of global electronic markets on the Internet can give smaller suppliers a comparative

advantage. (Anckar, B.& Walden, P., 2001) Information technologies help small businesses to represent themselves in the electronic marketplace.

Notwithstanding steady growth in the hospitality sector, to maintain this growth company must continue to improve the form and quality of hospitality services and adapt to the changing customer base's consumption and travel styles. Especially, these improvements aim to target the new generation of technophile individuals who travel on a limited budget. Personalization of experiences and digitalization of services is the goal of these improvements. Personalization helps to create flexible and customized packages for different travelers allowing them to choose the services they want. Creating custom proposals for each guest involves a lot of effort on the parts of both the guests and the service providers. By using an efficient technology platform for handling guest and service provider communication, the process can be simplified. (Kansakar, P. & Munir, A. & Shabani, N., 2018)

Service digitization facilitates the experience of travelers and allows them to search, schedule and pick up events of their preference, thereby enabling the smooth incorporation of technology into their travel experience. Many guests prefer services such as online booking, location-based services, personalized communication and social media. There are quite many existing platforms that allow, for example, do reservations online but there are some costs the users have to pay. That is why it is important for the accommodation providers to create their own applications which enhanced better services to guests. Such incentives like cheaper price, loyalty points, coupons and bonuses can encourage guests to use in-house applications over applications from the side. (Kansakar, P. & Munir, A. & Shabani, N., 2018)

Provision of digital services of equal quality as third party applications requires a working infrastructure. Internet of things (IoT) plays not least role in providing services of high quality. The IoT is the symbiosis of ordinary physical devices such as sensors, identification tags, mobile devices, actuators, etc. in order to communicate directly or indirectly with each other via local communication networks or the Internet. The IoT offers hospitality service providers means to communicate with guests, collecting their online data that allows to create more personalized services. The IoT improves multi-department back-end productivity, such as front desk, housekeeping, distribution, marketing, etc., as well as helping to enforce cost-reduction measures such as smart energy management. (Kansakar, P. & Munir, A. & Shabani, N., 2018)

Small and medium hospitality service providers can benefit from digitalization by reducing their costs, improving their services and attracting more travelers.

1.1 Research problem and research questions

Nowadays many big companies operating in the sphere of hospitality and catering have already adopted digitalization into their processes. However, small enterprises lack digitalization in their everyday operations that may affect their business. The aim of this paper is to analyze the profitability of various digitalization options that can be adopted by a small hotel business.

The objectives of the research include:

- To research what role digitalization plays in case of a small hotel business
- To identify the digital tools that can be adopted by small hotels to optimize their business and cut the costs
- Analyze above-mentioned digitalization tools' profitability for a small hotel

Research question:

What kind of digitalization tools are profitable for a small hotel business?

1.2 The case company

The case company operates in the field of hospitality. It is a small hospitality provider with under ten employees. The company is located in Lappeenranta, Finland. The firm provides accommodation services for tourists both from Finland and abroad, including individual travelers and groups. The company operates in the market for more than five years.

The owners of the hotel are taking care of all the operations themselves. Currently there is no centralized management system that could be used to track the bookings, costs, cash flows, personnel, etc. The reservations are done via online reservation services, hotel's website and via phone/messengers. There is lack of management which results into certain mess in reservations, low level of services and customers' theft. All these impact the hotel's reputation.

The hotel does not have a 24/7 reception, however, guests are encouraged to check in at any time. The hotel uses keys to open the room door that they should get themselves at the reception. Often this causes certain inconvenience for the customers because the guests are not familiarizing themselves with the instructions sent to them (sometimes instructions are not sent at all) and there is nobody to ask regarding the check-in procedure at the reception.

1.3 Research structure

There are seven chapters in this thesis. Chapter 1 is an introductory section. Chapter 2 goes in depth about the digitalization as a phenomenon, explains how digitalization is used in the hospitality industry today and discusses the existing barriers that stop hospitality service providers from adopting digitalization tools.

Chapter 3 explains what profitability and profitability analysis are and lists the methods to measure the profitability. Chapter 4 goes through the literature review, examining the challenges faced by the hospitality providers and ways to solve them. Many examples of the hotels businesses illustrate the application of digitalization and how hotels are benefiting from it.

Methodology and data used are described in chapter 5. Applied research methods are listed and described. Data upon which the research is built is presented in the chapter. Results of the research are presented in chapter 6 and the last chapter 7 finalizes the report giving some concluding remarks, ideas for future research and limitations. The research structure is drawn in figure below.

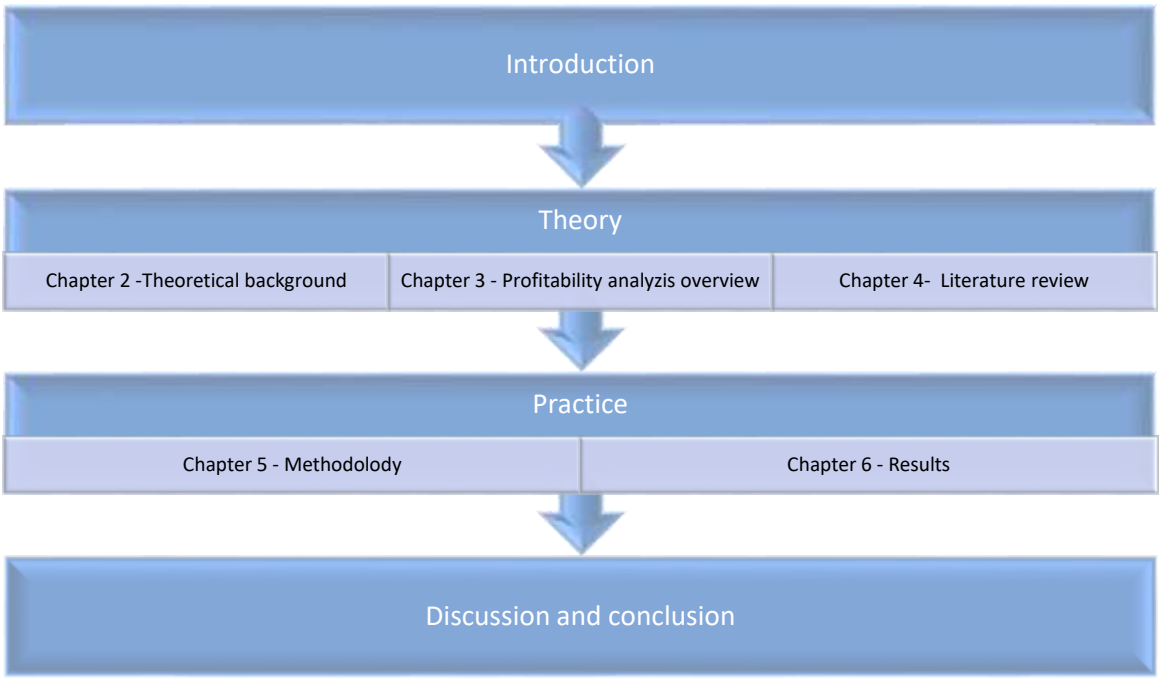

Figure 1 *Research structure (Author)*

2 THEORETICAL BACKGROUND

2.1 Digitalization as a phenomenon

Digitalization is creating a big number of opportunities for innovation across all industries. In different fields, from retail to life sciences, a full reinvention of goods, services and experiences is being introduced to the market. Many companies are undergoing the process of becoming a digital enterprise by automating their business processes. (Marsh, D., 2018)

According to the Gartner (2018) CIO Agenda Industry Insights report, industries list business digitalization to be one of their top 10 business objectives. Based on the responses from 98 countries covering 15 main industries, CIOs of 11 industries out of 15 stated that they ranked digitalization among the top three business targets for 2018.

Digitization that encompasses the interaction between people and things as well as the confluence of the real and virtual worlds created by IT will become one of the most important factors of innovation in the coming years, serving as a catalyst for the next era of innovation. Such fields as energy, mobility, healthcare and manufacturing will be transformed resulting into increasing pressure for today's value chains and business models. Markets are experiencing a disruptive

impact due to the digitalization. For instance, traditional car manufacturers are wondering if they can make the shift required to manufacture smart, self-driving cars, or they will have to compete with the new players from the IT industry. (Kagermann, H., 2014)

The process of digitization is happening quite rapidly. Number of mobile subscriptions is growing. The overall number of smartphone users in the world by the end of September 2013 was approximately 4.5 billion. According to the estimations, there will be 6.5 billion individuals and 18 billion devices connected to mobile networks by 2020. (Ericsson, 2013The study conducted on behalf of the BITKOM (Federal Association of Information Technology, Telecommunications and New Media), Fraunhofer ISI, predicts that the economic benefit of digitization and raised real-world networking in such spheres as energy, healthcare, transportation, education and government reaches approximately EUR 56 billion per year. (BITKOM, Fraunhofer ISI, 2012).

The impact of digitization concerning the transformation of the world can be compared to the past waves of innovations such as mechanization and electricity triggered ones. In recent years, the digitization has progressed exponentially, and while technological developments on their own appear to be more evolutionary in nature, their effect will be felt to be truly revolutionary. (Kagermann, H., 2014)

The next innovation era is powered by the Internet of Things, Data and Services, an “Internet of everything” that enables real-time interaction between subjects and objects. The Internet of Things, Data and Services is not a result of a single innovation, instead the outcome of a continuous development of technologies that date back to the introduction of the first electronic computers in the late 1940s. Processing power, memory size and network capacity are increasing rapidly nowadays, whereas their costs are decreasing at a proportionally proving the law of Moore, which states that the power of computer processing will double nearly every two years. (Mattern, F., 2003)

The Internet of Things, Data and Services is not only driven by the rate of development of these performance parameters. Rather, the integration of various accessible technologies (see Figure 1) is the main trigger for generating synergies that in turn lead to completely outstanding opportunities. (Kagermann, H., 2014)

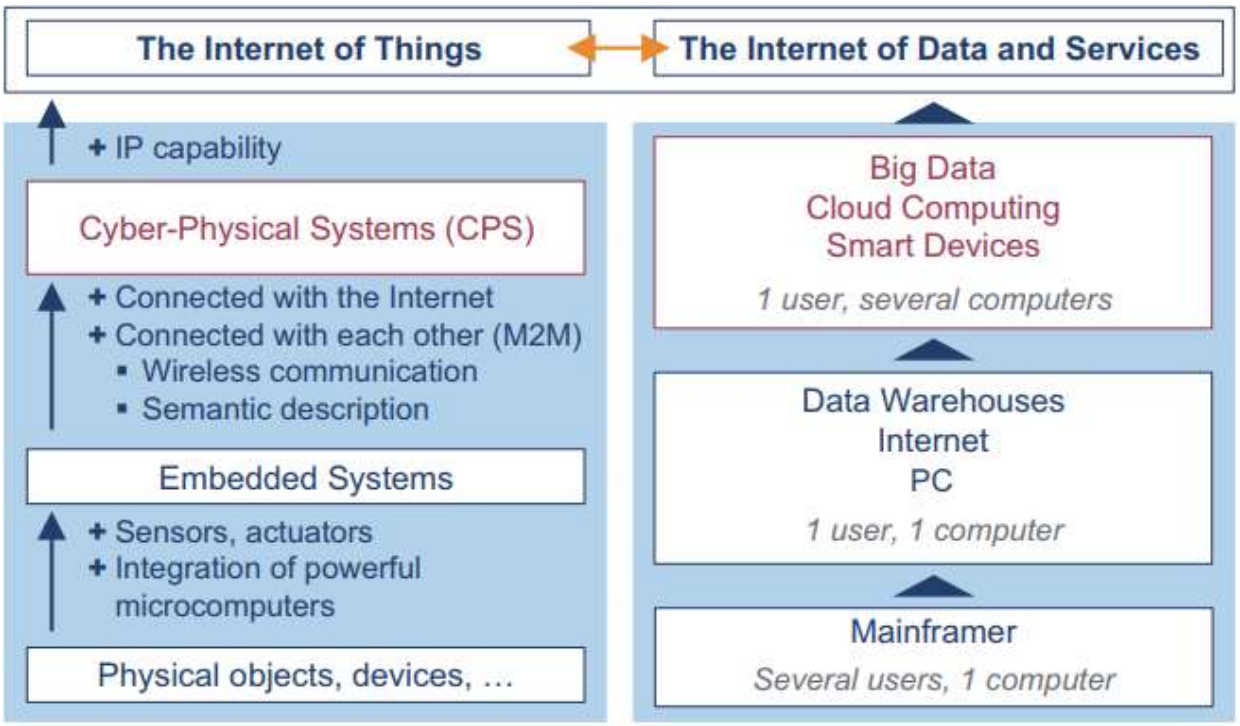

Figure 2 *Converging technological developments convergence (Kagermann, H., 2014)*

The trend rests on the embedded systems, representing powerful microcomputers that can be placed into some kind of form of object. Due to the expansion of RFID (Radio-frequency identification) technology, today embedded systems are treated as a standard technology. Alongside, many data coming from the surroundings can be captured, stored and processed by embedded systems equipped with sensors and actuators and then impact the environment. Embedded systems transform objects into intelligent objects and environments into intelligent environments. (Kagermann, H., 2014)

A significant expansion of the Internet has been undertaken along with the growth of embedded systems, mobile communications and WLAN, along with the implementation of the IPv6 Internet protocol in 2012. The fact that today there is a sufficient number of IP addresses required for current needs allows the embedded systems to interconnect, connect to the Internet, enable data exchange and make all these capabilities available online. (Kagermann, H., 2014)

Moreover, cloud computing creates affordable storage for the rapidly increasing amount of generated data. This data can be made sense of with help of smart algorithms that are based on calculations of correlations and probability. The information that can be linked to create new expertise is generated after the data have been processed and the patterns have been identified.

Thus cloud computing acts as a basis for innovations in new services that utilize the obtained expertise. New emerging service infrastructures suggest a broad variety of smart services for every sphere of people's lives including business. (Kagermann, H., 2014)

Using the Internet of Things, Data and Services, any digital technology can allow high-speed information exchange with other devices or individuals all over in the world. The instantaneous status of personal devices and their environment can be obtained at any time. Physical distances are not an obstacle for monitoring and operating of technology infrastructure. Networking allows a wide range of diverse technical processes to be regulated and organized. (Kagermann, H., 2014)

Many industries are already benefiting from the developments in sphere of technologies and tourism is not an exception. Technology's significance in tourism has long been known (Poon, A., 1993). Pauline Sheldon (1997) in her book "Tourism Information Technology" states that tourism is an "information intensive" field and describes different IT applications in several tourism-related areas. The book by Werthner and Klein's (1999) "Information Technology and Tourism: A Challenging Relationship" also illustrates the modifications that IT in general and the Internet in particular have brought about. Currently more and more researchers are conducting their studies on the role of IT in tourism (Xiang, Z., 2018). Travel and hospitality is a large market with revenues that constitute billions of dollars. This sector has a significant weight in the global economy including passenger airlines, travel agencies, hotels, museums, theaters, cultural attractions and multinational hotel groups. Moreover, travel and hospitality represents the third contributor for the European GDP and its third employer. (Jahia, 2017)

2.2 Digitalization in hospitality

Nowadays digitalization is a rapidly developing trend. According to the World Economic Forum the estimates state that between 2016 and 2025, the digital transformation of the travel and hospitality industry may:

- Value production up to $305 billion by increased productivity
- Relocating $100 billion to new competitors from established players
- Create gains for customers and society at an estimated $700 billion through decreased impact on the environment, improved safety and security, and time and expense savings for consumers

- Bring the reduction of existing jobs in the industry that is projected to be partially launched by the creation of jobs that require skills within and outside the travel ecosystem of the next generation. (White Paper, 2017)

In the past, tourism was an industry that rests on relations and connections of individuals, where the trends along with travelers' decisions were set by international tourism and travel enterprises. The transparency of "hidden markets" was exposed as a consequence of the digital revolution, and a number of other variables should now be taken into account. Nowadays traveller's decision can be impacted by group influences, cultural environment, education, family commitments and so on (see Figure 2). (Zsarnoczky, M., 2018)

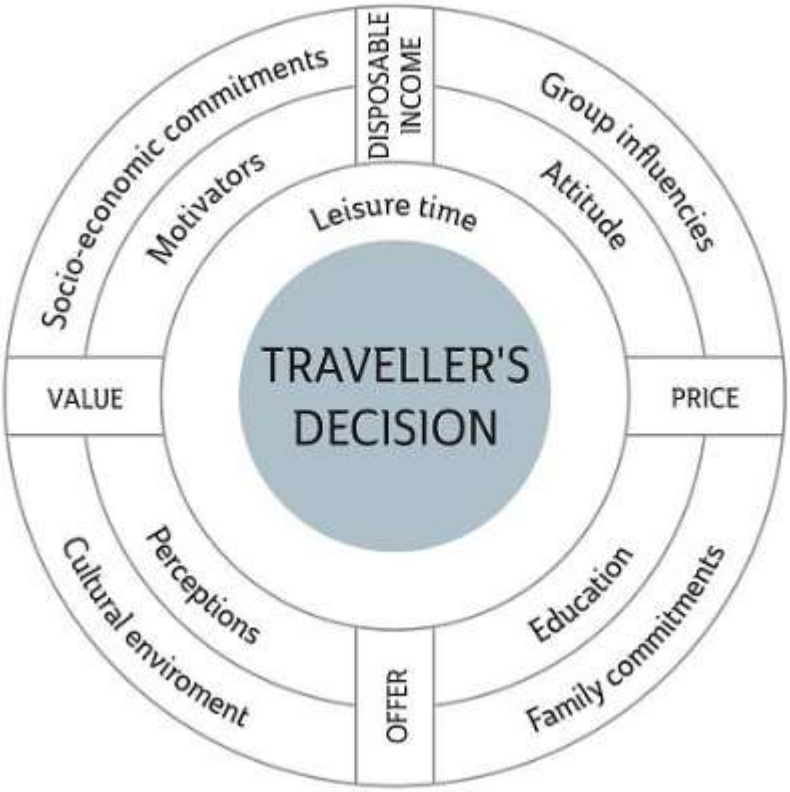

Figure 3 *Traveller's decision (Zsarnoczky, M., 2018)*

It is impossible to stop the technological development and tourism industry should prepare for the future growing challenges. In the tourism of the future, new priorities and new demands will be brought by new consumers. As a revolutionary approach, the IoP (Internet of People) community members devote their time to reach joint IT/industrial objectives, where frameworks are created according to other people's preferences. (Zsarnoczky, M., 2018)

Hotel service providers invests large sums into technological infrastructure base. Mainly midscale and luxury hotels allocate budgets for IT advances, focusing on digitalization of the service platform. Usually hotels concentrate on innovations in smart devices and IoT. Guests are offered to use on-screen and online interfaces via guest-facing systems that are not only convenient for guests, but also allow service providers to collect data. (Langford, G., 2016) Digitalization may help to boost operational efficiencies, enhance management effectiveness, decrease the expenses, increase profits and improve sustainability (Kasavana, M. L., 2014). The system guests are interacting with should be easy and user-friendly. Guest-facing systems depicted in Figure 1 include mobile applications for hospitality services, point-of-sale (POS) terminals, hand-held devices, thin-client terminals, etc. It is important that the system works seamlessly throughout all the stages of the guest cycle: before-sale, at the moment of sale, and after-sale phases. Guest-facing systems enhance guest experience in several different ways. Such system allows guests to control their environment by controlling their environment. Guest-facing systems (see Figure 1) allow guests to perform procedures such as automated check-in and check-out, keyless entry facilities, in-room function control, etc. (Wang, Y. & So, K. K. F. & Sparks, B. A., 2017) For example, such hotels like Hilton and Starwood provide automated check-in and keyless service to guests using their mobile applications. (Ukpabi, D. C. & Karjaluoto, H., 2017).

Figure 4 State-of-the-art hospitality services (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

There are mobile applications that allow guests to manage in-room IoT devices. Guests, for instance, can control lights, power outlets & temperature settings. (DePinto, J., 2016) Hotels start using such new interfaces for controlling the guestroom like bedside tablets and voice control (VenturePact, 2015) Peninsula Hotels provide guests with their own line of patented in-room tablets that enable guests to order room service, communicate with the concierge, organize transfer, make free VOIP calls and pick TV channels and media to be streamed to the hotel room TV. Marriott Hotels is a hotel brand that is enhancing the guest room experience through IoT. Recently, the chain has started working with Enseo, a Texan company, one of the first providers of Netflix, the streaming TV and film service. IoT technology is about collecting data that, in effect, will help hotels predict the needs of a guest without calling to the front desk. (Shallcross, J., 2016)

There are such recent developments in digital guest experience, like door unlocking with mobile phone, digital check-in and room selection, used in Sheraton, Hilton and "W" hotel chains. These are location-based services that improve guests' satisfaction. (Tossell, D., 2015) Approximately 30% of hotels allocated location-based technology budgets in 2016 (DePinto, J., 2016). Location-

based guest-facing systems provide guest services on-site and off-site, such as digitally guided tours, suggestions of local events and landmarks, dining recommendations and leisure time options (see Figure 1). The above services not only help guests get around, but also allow service providers to earn additional revenue by guiding guests to places and establishments that profit the providers of hotel services.

Industry practitioners tend to measure the effect of IoE (Internet of everything that includes linking autonomous, unrelated devices and transactions to meaningful experiences to improve guest hospitality) initiatives as customer loyalty achieved through enhanced guest experience. There is a number of possibilities associated with guest touch-points as well as there are the potential innovations accomplished by point-to-point data sharing. For example, guests can keep track of discounts and rewards using hotel loyalty mobile apps, get updates about deals and special offers. Guest-facing systems used to offer services to guests are driven by sophisticated BoH (Back-of-House) management systems. Such programs are designed to align costs and revenue with staff management without losing service quality. BoH management systems include the system of property management, as well as management of customer relationships, income and sales control, maintenance technology for housekeeping, etc. (Kasavana, M. L., 2014) Installing additional sensors, tools and actuators greatly enhances BoH management systems capabilities. For example, in-room thermometers, motion detectors, and illumination sensors (see Figure 1) can be used to monitor in-room temperature and lighting when nobody is in the room, reducing energy consumption and cutting the costs by 20 - 45%. The "daylight harvesting" of Starwood Hotels and Resorts is an energy-saving strategy that saves electricity and improves the quality of indoor lighting by changing the energy-efficient LED lighting automatically based on the natural light observed in the hotel room. (DePinto, J., 2016)

Hotel need to identify the guests' needs and try to satisfy them to the best of their ability. There are many digital solutions for hotels that can provide a pleasant staying for a guest. Staying at the hotel can be seen as a guest's journey and it is divided into Pre-Stay, Stay and Post-Stay phases (see Figure 3). There are digital solutions for each of these phases. (Betterspace, 2019)

Figure 5 *Digital solutions phases*

Fast and stable wireless network in hotels should be a must. Today if a hospitality provider does not have a wireless network, a lot of possible guests are automatically lost. A lack of or non-functioning internet in hotels may result into poor hotel reviews and declining numbers of visitors. Almost half of the negative online ratings are accounted for poor wireless network. A stable internet connection with a wireless LAN are preconditions for the hotel digitization. (Betterspace, 2019)

Personalization in hotel industry is becoming a trend. To create a more smooth guest experience, hoteliers use revolutionary technology-driven tools. When potential guests are booking a room and looking through the services on a hotel's website, the properties have the opportunity to demonstrate their commitment to the individual preferences that visitors may have. This can be achieved through website personalization technology, enabling hotels to offer customized rates to the expectations of each user in certain room categories, package types, and even rates. (Duetto and Skift, 2018) Guest-facing technology changes are reshaping the complex customer relationships between guests and hotel service providers. Guest-facing systems allow service providers to gather data on specific preferences, behaviors and locations of guests. (Piccoli, G & Lui, T.-W. & Grun, B., 2017) Service providers use this data to create tailored guest profiles that

they use to configure services suggested to repeated customers. What is more, custom guest profiles allow hotel service providers to motivate clients to use their services through targeted advertising and exclusive guides and deals from insiders. Another important management task carried out by the BoH management systems is to develop the online brand value of hotel service providers. (Lee, S. A. & Jeong, M., 2014) Good customer connections are sustained through the successful usage of the social media platform, which involves guests providing online portal rates and reviews of services. Hotel rating and its income stream are intertwined. Approximately 90% of today technophile travelers make judgements based on the feedback they can find on the internet when they purchase hospitality. Even a one bad review can result into a large loss of clients. BoH management systems therefore need to search online portals for negative ratings and reviews and take the necessary steps to mitigate their impact. Good example of such actions is presence of a live chat assistance for prompt responses to guest complaints. In addition, BoH management systems can help to increase revenue per available room (RevPAR) by optimizing the processes of housekeeping and maintenance. (Altin, M. & Schwartz, Z.& Uysal, M., 2017) BoH management systems enable efficient scheduling of housekeeping services, which, in turn, Lowers downtime in hotel rooms, increases the use of labor resources and dramatically boosts the satisfaction of guests. Salary costs can be reduced by 10% to 20% by the use of housekeeping management systems and applications. (Kasavana, M. L., 2014)

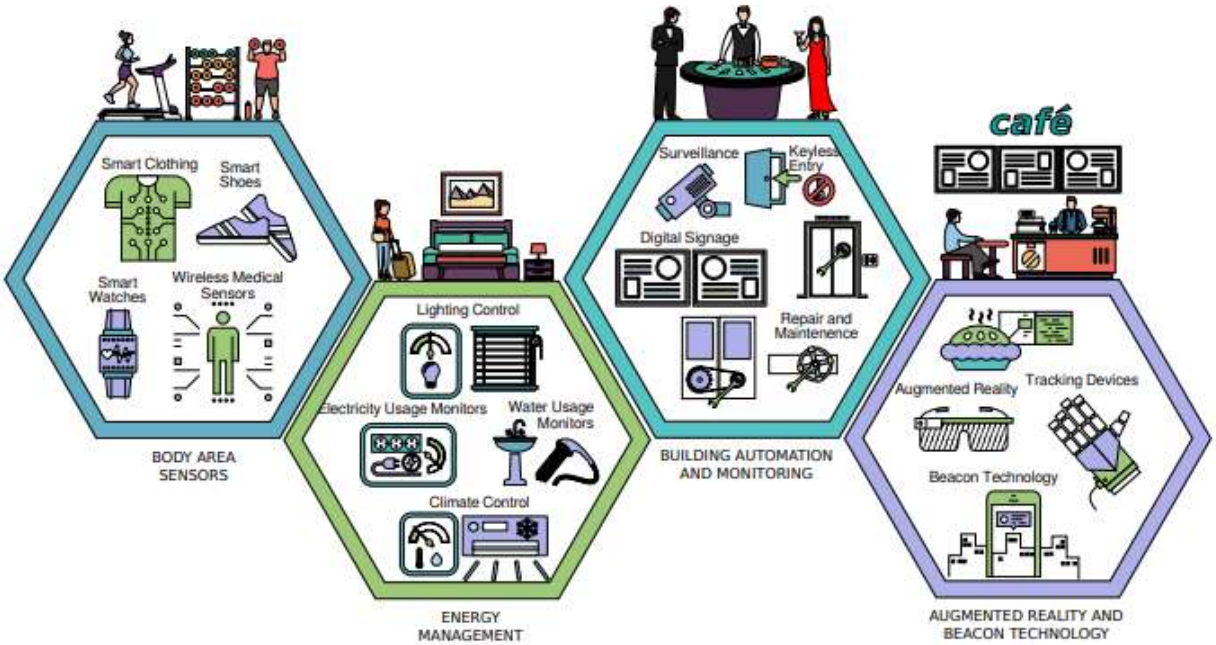

Figure 6 Scope of future services in the hospitality industry (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

Due to the penetration of the IoT ecosystem into different facets of daily life, digitalization may be even more extensive in the future. It may be expected that every physical device a person uses would aggregate and analyze the data and automatically suggest the services. The hospitality field tends to follow this rising trend to provide its guests with new kinds of services while lowering costs. Figure 2 demonstrates examples of IoT sensor and devices that can be utilized by different service categories. Body Area Sensors are widespread already now. Except such everyday devices like smartphones, smart watches, smart garments, smart shoes, etc. are gaining the popularity. These devices tend to collect user data like body temperature, heart beat, location, sport activities etc. Wireless medical sensors are regarded as one of the most significant innovations that could revolutionize the future. Such devices are able to accumulate extensive data about organs and systems of the body. (Minaie, A. & Sanati-Mehrizy, A. & Sanati-Mehrizy, P. & Sanati-Mehrizy, R., 2013) These devices can become handy for hospitality service providers because they enable the host to provide new facilities for travelers such as automatic indoor temperature adjustment based on human body temperature, lightning adjustments based on guest sleeping cycle, meal options provision depending on the desired wellness target of the guest, etc. Using such devices, hospitality service providers can offer special facilities to a guest according to the type of medical devices they use. For instance, high carbohydrate food and meal options that are rich in sugars can be filtered out from the menus aimed for diabetic guests.

Augmented Reality and Beacon Technology can be incorporated into hotels' on property system enabling offering guests facilities like digitally sightseeing tours, in-room updates, immediate sign and other written material translation services, digital restaurant menus with dish previews, critical reviews, data on food allergies, etc., as well as online quiz games on the estate's areas of interest. (Tussyadiah, I. P. & Jung, T. H. & tom Dieck, M. C., 2017) The above-mentioned services can also be offered to the guests as a part of in-house loyalty applications. What is more, such services can be beneficial for the hospitality service providers because they allow to gather data and advertise new services to improve guest preference profiles (Hospitalitytech, 2015).

IoT technology may help hospitality service providers to enact cost-reduction strategies to control energy consumption of the property. In many hotels, energy-saving technologies are used, including smart lighting, systems that control temperature, and low-power devices such as compact florescent bulbs, LED lights, etc. (Lee, W.-H. & Cheng, C.-C., 2018) However, IoT

software could significantly increase the range of energy-saving systems. For instance, IoT-enabled power outlets or IoT-enabled smart devices warn workers if over a given period of time a particular outlet hits a certain power consumption limit. In addition, workers can monitor whether visitors are responsible for extra power usage or whether energy leaks due to malfunctioning devices. (Hsiao, T.-Y. & Chuang, C.-M. & Huang, L, 2018) IoT technology can also be used to reduce water use by allowing smart bathrooms with special shower heads, sinks, and toilets where flow can be controlled, etc. Automation and Monitoring will be useful for guests. Guest satisfaction can be tremendously improved by such services like entry without a key, automated check-in and check-out, mobile concierge, etc. Not only are these programs targeted for technophile clients, but they can also be useful for some group of visitors, such as people with disabilities. Automation can improve operational and managerial efficiency. In-room monitoring systems, for example, may be useful in detecting if a room is free and if housekeeping services can be scheduled. IoT can help to spot out any faults and malfunctions so that required preventive maintenance services can be arranged before any issues are spotted out by regular inspections. (Vermesan, O & Friess, P., 2014)

2.3 Barriers to digitalization

Although it is correct that the quality of services plays a major role in the accommodation sector making the visitors enjoy their stay and repeat the visit and the technology itself cannot enhance the quality of the services provided, however, it can help to attract potential guests' attention and increase bookings. Professionally built website gives first impression of the accommodation provider. If booking process is not easy and convenient, it can affect the number of reservations. Moreover, the website should provide the visitors with full and updated information regarding all the available services and their prices. Secure payment option, professional photos of the site, reviews listed on the website also impact the decision to reserve a room. (Insights, 2016) If the web services of the hotel are restricted to price and availability inquiries via e-mail, telephone or walk-in approach, its competitive advantage will be lost. If IT knowledge is lacking, small- and medium-sized enterprises can not take advantage of any incentives for improving efficiency and supporting promotion of enterprise. Poor IT knowledge of the hotel management may result into loosing potential client to those accommodation providers who are IT savvy. Resistance to any developments related to IT is a obstacles arising from a reluctance to change at management and/or worker level (Anckar, B., & Walden, P., 2001).

Managers (and workers) may resist technological innovation for a variety of reasons. Changes are seen challenging especially in the absence of consultation. Workers may be hesitant regarding their jobs, and also they may be afraid to appear incompetent. And the opposite, the staff, that has received sufficient consultations and has been involved in initiation and application of new technologies, is likely to welcome new working procedures (Baines, A., 1998). Slow adoption of e-procurement is explained by the lack of knowledge, skills, and trust (Sigala, 2006). Adoption of technology is a lengthy process that is impacted by internal and external influences.

Peripheral location may make the obstacles to implement IT to be even greater in peripheral regions, where latest technologies are not that rapidly grasped by the service providers. The obstacles that emerge from infrastructure services; because of the limited demand, large bandwidth Internet connections may be too costly. In some peripheral areas technological infrastructure can be. In such areas Internet connection can be slow and it may be difficult to find IT-competent workers and skilled consultants. Thus, it may be challenging for service providers to developers or employees capable of operating the systems. As a result, many small- and medium-sized enterprises are unable to capitalize on the Internet. It is therefore common for small and medium-sized businesses to create a simple, informative website that lacks usability, with reservation requests and confirmations sent via e-mail; or use an intermediate web service provider which offers online reservations. (Anckar, B., & Walden, P., 2001)

Considering all the above-mentioned barriers, small- and medium-sized enterprises are recommended to look for practical, affordable systems that take into account their specific requirements or purchase system licenses for fees that are not as high as fees for more advanced hotel management systems for hotel chains. (Anckar, B., & Walden, P., 2001)

Even though there are still many barriers and obstacles, quite many hospitality providers, especially big ones, have already understood the benefits the technologies can give them. For example, Leung, D., Lee, H. A. and Law, R in their study on “Adopting Web 2.0 technologies on chain and independent hotel websites: A case study of hotels in Hong Kong” have noted down that more and more hotels are adopting Web 2.0 technologies that allow them to improve their business processes. The top management started recognizing potential benefits of Web 2.0 technologies and offered to embed them as one more Internet marketing strategy. Wober and Gretzel (2000) stated that managers who possess extended knowledge in the sphere, would have

fewer cognitive obstacles in adopting latest technology.

Some research was conducted on the use of the Internet in terms of attitudes and expectations towards application of the Internet in the housing industry (Garau Vadell, 2005; Ayeh, 2006), integration of sales processes and internet-based marketing tools (Gregory, Kline, & Breiter, 2005). Even though more and more small and medium enterprises are now represented ‘‘online,’’ the data on their websites are obsolete and of bad quality (McGrath, 2007; Buhalis & Kaldis, 2008). Similarly, a case study conducted in Thailand revealed that even though all hotels had websites and e-mail to communicate with customers, not all of them used them for communication and transaction purposes (Sahadev & Islam, 2005).

Figure 7 Technological challenges in the hospitality industry (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

Certain challenges associated with successful IoT implementation in the hospitality sector include interoperability, security and privacy, data management and responsiveness. (see Figure 3). These challenges are important to keep in mind to sustain steady growth. (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

Interoperability

Interoperability applies to the ability to interact between different systems and business processes, promote data exchange and facilitate information and knowledge sharing (Maheshwari, D. & Janssen, M., 2014). There are four interoperability levels. First level includes data, procedure,

laws, artifacts, software systems and cultures interoperability. Second level consists of information, facilities, interoperability of digital identification and social networking. Third level is related to the cloud interoperability, allowing data to be stored on the cloud. The fourth level is interconnectivity and ecosystem interoperability. It enables seamless communication of all technologies and applications. (Buhalis, D. & Leung, R., 2018) Previous findings indicate that implementing IT can improve a company's competitive advantage (Eraqi, 2006). The domain name is a key component for online companies, and Gertner, Berger, and Gertner (2006) stated how critical it is to have an unique web name and address because it can increase the competitive advantage of tourism websites. Hashim and Murphy (2007) investigated the use of domain names in hotels in Malaysia and concluded that the domain name is related to the size, class and affiliation of hotels and the liberal use of the Internet.

However, there is a lack of standardization in the hospitality industry, which is why many service providers develop their own patented solutions based on their own standards and methodologies (Special-Nodes, 2013). Such solutions can fulfill all the demands of one service provider, but be absolutely useless for another one (Wood, R. C., 2013). Interoperability results into functionality drawbacks for unequal guest profiles. Service providers were therefore unable to provide their customers with customized services. Guest experience may also be affected by the interoperability issues as they create inconveniences. What is more, guests have to get used to a nonstandardized systems during their staying at different hotels. Standardized systems and solutions for hospitality industry tend to provide a more seamless experience. (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018) Even though, currently the standardization appears to be an impossible mission, Dell'Erba, Fodor, Hopken, and Werthner (2005) created a digital interoperable network with a device translation framework for a smooth data exchange demonstrating how interoperability might be achieved.

Data Management

Aggregating and evaluating guest information is an vital part of the hospitality business. Data volume in the hospitality industry is going exponentially due to the personalization of guest experience. As personalized services become common in the hospitality industry, hospitality service providers should treat each of their guests as unique individuals, keeping record of their guests' preferences accurate and up-to-date. Information can be gathered by using both guest-facing systems and private guest devices connected to the hotel network. Hotel management

systems are expected to handle large amounts of guest information from a wide range of sources. Management systems deliver customized services by analyzing and matching the guest preferences profile with the surrounding environment captured from IoT devices / sensors. (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

To promote contact between business managers and IT technicians, internal IT capabilities and competence need to be established. Such specialists collect, organize, and retrieve technology information and direct it to managers. Moreover, these professionals can give a piece of advice on the latest technical advances and how to integrate them into business decision-making process. They can also pass the aims and strategies of the business managers to the technical experts. As a result, the position of the IT department can be expanded from providing technical support to providing advice to top management on how to implement IT to achieve business goals. (Law, R., Leung, R., & Buhalis, D., 2009).

Research findings from developing countries showed that IT executives have a decent level of technical competence, but they need to further develop their enterprise and communication skills. (Tetteh & Snaith, 2006). It has also been noted that more seasoned hotels tend to be more creative (Jacob & Groizard, 2007). IT can be subcontracted, and research shows that many hotel managers talk about outsourcing IT not only for cost savings, but for strategic reasons as well. (Espino-Rodrı´guez & Gil-Padilla, 2005). Beritelli and Schuppisser (2005) argued that the initial start is the most critical stage during the new mobile project implementation and that the feasibility of new business models can be tested through tourist trials.

Hospitality and tourism industries are highly dependent on IT, which can have catastrophic consequences in the scenario of system failure (Lu & Law, 2007). Such crises can be handled more effectively with help of knowledge-based systems (Mistilis & Sheldon, 2006). Spread of diseases can be prevented if websites are used as crisis communication channel, and act as a mean to share information during crises (Volo, 2007).

Security and Privacy

As mentioned earlier, providers of hospitality services need to track guest preferences, behavior, and location in order to provide tailored services. In turn here comes another challenge. To avoid any physical, economic, and societal threats, guest data must be properly managed and stored.

Guest-facing networks and point-of-sale terminals are the most vulnerable to security threats in hotels. It is important to ensure secure and private interactions with customers through the use of reliable information leakage and fraud security measures. (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

Risk management implies the management of client data. More hotels are now launching their own loyalty programs and promotional campaigns that require online registration of customers. However, a research by O'Connor (2007) discovered that only a few companies exhibit privacy certificates from third parties to ensure that data from guests is protected from inappropriate use. O'Connor (2006) also points out that it is possible to use cookie technology for gathering user personal identity data.

Payment is one of the most essential aspects of e-commence. In order to ensure secure payment, secure transactions should be provided to protect consumer data (Wu & Chang, 2006). Chen (2006) proposed a model on a travel-related website and depicted the major determinants of consumer trust. Nonetheless, another study found that only a very limited number of Canadian websites utilized secured servers to manage online reservations for small hotels. (Hudson & Gilbert, 2006). Except for payment, there are some issues concerning terms and conditions; Wilson (2007) stressed that many reservation operations do not require customers to accept the terms and conditions of the company in order to be completed.

It is also important to remember that not only external security (the Internet) is to be considered, but also internal security of the network. Cobanoglu and DeMicco (2007) reported that around 15 percent of hotels reported virus attacks, 7.7 percent of which reported attacks on “Denial of Service”.

Responsiveness

Providers of hospitality services must respond promptly to requests and complaints from the guests. Services delivery should also be swift. Digitizing the communication between guests and providers of hospitality services can help in achieving this goal. Moreover, when dealing with guests, guest facing systems and IoT sensor / device automatic control can reduce the need for human communication and intervention. Such programs can also help reduce communication problems and misunderstanding when processing requests from customers. Such systems can also

facilitate quicker fulfillment of guests' requests, improving responsiveness and providing the seamless experience. As for the hotel's house-keeping services and maintenance, responsiveness not the least part of it. Late or no reply to the need for repair and maintenance can reduce the revenue of the hotel per available room (RevPAR). (Altin, M. & Schwartz, Z.& Uysal, M., 2017)

Hospitality industry today has to make many crucial changes to reorganize its business infrastructure in order to keep up with the modern technological environment. Personalization and digitalization of the services are the main area to be focused on. It is highly likely that technological solutions of future in the hotel industry will be equipped with geo-distributed systems capable of supplying regionalized information and services, large volume data storage, data protection, and responses to low latency events via power-efficient computing and bandwidth-efficient communication tools. (Prasanna Kansakar, Arslan Munir, & Neda Shabani, 2018)

3 PROFITABILITY ANALYSIS

3.1 Profitability

Any business is aiming to be profitable. No business can function if it is not profitable. Income and expenses can show if the business is profitable or not. Activities of the business generate income. In case of hotel business, income comes from the services sold. Expenditures are the cost of resources used by the operations of the organization. To maintain the business functionality, the hotel has to confront some expenses, such as monthly expenses like salary for staff, bills, etc. (Hofstrand, D., 2009)

In general expenses can be split into direct and indirect ones. Direct expenses are expenses that vary directly with changes in the volume of a cost object. An object of cost is any commodity for which costs are calculated such as goods, product lines, services, distribution areas, staff and clients. Indirect expenses are expenses not varying with changes in a cost object's volume. (Accounting tools, 2018) The expenses and revenues encountered by the hotel are presented in the table below.

Table 1 Expenses and revenues of a small hotel (Author)

Expenses	Revenues

Direct Expenses:	○ Reservation fees ○ Linen expenses ○ Laundry and toiletries ○ Guests supplies ○ Food and beverages ○ Cleaning staff ○ TV & cable license ○ Cleaning supplies ○ Office related expenses ○ Uniforms expenses	○ Rooms ○ Parking ○ Food and beverages ○ Additional services provided by the hotel
Indirect Expenses:		
• **Fixed charges**	○ Rent ○ Insurance ○ Property taxes ○ Interest expense ○ Depreciation and Amortization ○ Front desk, guest services, reservations salaries ○ Cable television ○ Contract services ○ Linen and uniform purchases ○ Equipment purchase ○ Decorations ○ Accounting ○ All overhead expenses and salary ○ All owner expenses	
• **Variable expenses**	○ Electricity, energy and water expenses ○ Marketing Expense ○ Administrative & General Expenses ○ Property Operations and	

	Maintenance o Room attendant payroll and benefits o Credit card commissions o Telephone expense	
Income Taxes		

According to the table above, the direct expenses include:

- Reservation expenses: In case of a small hotel, these can be the payments to various booking systems hotel is working with.
- Linen expenses account for purchasing of new linen
- Laundry and toiletries. Laundry expenses can be outsourced to a third party, it is much cheaper than having a laundry at a small hotel.
- Food and beverages
- Cleaning staff can be hired from cleaning agencies, especially in case of small and middle size hotels or workers can be permanent.
- Guest supplies expenses include various items provided for free to clients.
- TV & cable license
- Cleaning supplies expenses include various cleaning items and liquids used to keep hotel premises tidy, for example, detergents, cleaning cloths, mops, brushes, disinfectants, and other cleaning items.
- Office related expenses, including registration related forms, printed material for guests, various office supplies, etc.
- Uniforms expenses consist of uniform purchasing, cleaning and repairing.

Indirect expenses encompass a big number of various costs encountered by the hotel, including rent, if premises are rented, insurance payments, property taxes, salaries, and different bills.

Revenues can be received from rooms' reservations and other services hotel is ready to offer. Additional services can be different starting from offering food and beverages to spa packages and transportation of guests. Small hotels usually tend to get revenues mainly from reservations, other services are limited.

For successful functioning, hotel revenues should be much bigger than the expenses. In this case, hotel can be seen as a profitable business. Profitability measures the possibility to gain profit from all the operations of a company. What is more, profitability displays how well the company's management is able to generate earnings by using the resources available.

Profitability can be represented as either accounting profits or economic profits. Accounting profits provide an indirect view of the business profitability. Even losses encountered within one year does not necessarily cause harm to the business, several years of losses may endanger the business viability. Economic profits are computed by deducting business expenses and opportunity costs. Economic profits reveal a long-term business perspective. Profitability is a way to determine the operational efficiency of an enterprise. The best wat to judge the return on capital employed is by profit, not by the investments. (Hofstrand, D., 2009)

Profitability can be measured from different perspectives:

- Profitability concerning management
- Profitability concerning shareholders
- Profitability concerning creditors
- Profitability concerning customers (Bharti, B., 2016)

The profitability is seen as the money earned on the investment capital as far as management is concerned. In case profits are generated on the invested capital, it can be treated as profit. Increasing sale and regularly made payment of operating expenses signalizes of management efficiency. (Bharti, B., 2016)

Shareholders see the profit as the money (dividends) earned after the taxes and interests of the company are paid. The above-mentioned profit can later be reinvested. (Bharti, B., 2016)

Creditors see the profit as an interest they receive from the loans and expenditures incurred by them. It is also important for them to make sure that the repayment of the loans and receiving of the interest is taking place on the regular basis. (Bharti, B., 2016)

Customers perceive profit as a way of to getting the best quality at the minimum cost. Companies see customer profitability as a profit obtained from the clients served. (Bharti, B., 2016)

“Profitability is the net result of a large number of policies and decision” (Weston J.F. & Brigham E.F., 1968) Profitability rests on operating performance and business efficiency. Bad operating performance results into decreased sales and profits. Profitability also acts as a measure of public acceptance of the product or service, confirming the competitiveness of an enterprise. (Bharti, B., 2016)

3.2 Profitability analysis

Profitability analysis is one of the companies ' most significant accounting management practices. The system of cost accounting plays a key role in providing information for regular profitability analysis. The relative profitability of various products and services is determined by the regular profitability analysis to which the marketing effort should be directed. The basis for managing the existing mix of activities is based on a company's periodic profitability analysis. Analysis of productivity provides a strategic review of the costs and profitability of the goods, consumers and distribution channels of a company. (Drury, C., & Tayles, M., 2006). Current paper utilizes profitability analysis to decide if digitalization tools suggested are worth acquiring or not.

3.3 Methods to measure profitability

A number of ways are used to measure profitability. These methods are:

- Profitability indicators
- Scenario Analysis
- Sensitivity Analysis
- Break-even Analysis
- Monte Carlo Simulation

3.3.1 Profitability indicators

- Payback period

The payback period is one of the simplest and most commonly used methods of measuring profitability (Bierman, H. & Smidt, S, 1986). Payback Period (PP) represents the smallest number of periods during which an investment opportunity returns its investment at a defined rate along with interest. PP is determined using either the risk-free discount rate, r, or a discount rate that is

equal to zero. The first one is called "discounted payback period. (Lohmann, j. R., & Baksh, S. N., 1993)

Some researchers claim that payback methodology does not calculate the projects' profitability but rather their time risk and liquidity impact. Nevertheless, payback method is often used as a main tool for evaluating investment. The payback period (n_p) shows how long it takes to recover an investment's cost. (Yard, S., 2000) The shorter the time of payback, the more appealing the investment will be. (Ong, T. S. & Thum, C. H., 2013) By dividing the investment outlay by expected annual cash flow, the payback period can be calculated (Bierman, H. & Smidt, S, 1986). Payback period formula is represented below:

$$n_p = \frac{I_0}{S}$$

where:
I_0 = Investment outlay
S = Future annual cash flow

The decision rule states that the proposal should be approved if the payback period is less than the total reasonable payback period. Otherwise, the project should be ignored. The maximum feasible payback period is randomly chosen. (Lohmann, J. R. & Baksh, S. N., 1993)

Payback period method is also used to recognize the investment opportunities with shortest payback periods. This method has straight-forward calculations and, what is more, it provides an indication of a project's liquidity and risk. However, payback period method has two weak spots: cash receipts received after the payback period cannot be considered and the differences in the timing of the proceeds earned before the payback date are not taken into account. (Bierman, H. & Smidt, S, 1986)

- Discounted payback period

The discounted payback period is a form of capital budgeting used to determine a project's viability. A discounted payback period offers the number of years it takes to break even from initial investment, by discounting future cash flows and considering the time value of money. The discounted payback period is used to assess the viability and profitability of a given project. (Ong, T. S. & Thum, C. H., 2013)

The discounted payback period is calculated in two steps. First, the net cash flows that will occur during each year of the project must be discounted. Second, to get the discounted payback period, the discounted cash flows must be subtracted from the initial cost amount. Once the discounted cash flows are measured for each project duration, they should be subtracted until zero is reached from the initial cost estimate. (Kruschwitz, L. & Loeffler, A., 2006)

Discounted payback period (DPP) is calculated according to the following formula:

$$DPP = \min n; \sum_{i=1}^{n} \frac{CF_i}{(1+r)^{\ddot{i}}} \geq I_0$$

where:
CF = Cash flows
r = Discount rate
I = Investments (Chuvashov, A. V., 2019)

Decision rule states that a project is acceptable if *n* is less than its useful life or any predetermined period of time. If two mutually exclusive projects are considered simultaneously, then the one with shorter DPP is preferred. (Bhandari, S. B., 1985)

Those projects that are accepted according to the DPP criterion are considered to be profitable. Since the time value of money and discounting cash flows at the needed rate of return are taken into account, it ensures project's profitability in the same way as the Net Present Value method. DPP also serves as a base for decision making because in case identical data is used, the projects' assessment outcome is going to be the same. However, this does not work with Payback period method because the choice of minimum acceptable payback period is arbitrary. (Bhandari, S. B., 1985)

Another advantage of DPP method is its computation easiness and simplicity of understanding. What is more, DPP is a more conservative indicator of an investment's relative liquidity compared to the traditional definition of payback. DPP is always greater than Payback Period that is why any investment that appears to be liquid according to the Payback Period criterion may be rejected according to the DPP criterion. (Bhandari, S. B., 1985)

Discounted payback period is a better indicator of break-evenness that is the PP. PP is the period beyond which a project generates accounting profit, whereas DPP is the period beyond which a

project generates economic profit. What is more, DPP measures at what extend the project associated uncertainty is being resolved. PP measures the time period required for the cumulated expected inflows to become equal to the original investment. Thus, it specifies the rate at which the project's uncertainty is going to be resolved. The same applies to DPP, just with more confidence. (Bhandari, S. B., 1985)

In the event that cash inflows of a company are always the same number, its profit rate (IRR) is the reciprocal of its payback period. If the equipment's lifetime is infinite, then IRR is overestimated by the corresponding PP. The greater will be the overestimation of IRR by the reciprocal of PP, the shorter the life of the project. DPP always exceeds PP. Thus, the shorter the lifespan of the project, the closer will be the approximation of DPP reciprocal to IRR than to the reciprocal of PP. In this case the DPP method ensures a minimum return rate and its reciprocity provides a better estimation of the project's total return rate. (Bhandari, S. B., 1985)

It is quite interesting to relate DPP to other discounted cash flow metrics, including NPV, IRR, and PI. The project's DPP is the time horizon in which the accumulated NPV is equal to zero, IRR is equal to the capital cost, and PI is equal to one. Another benefit of DPP is that accepting-rejecting decisions for independent projects will be the same as those for NPV criteria and will therefore be compatible with the capital-maximization goal of the stockholder. (Bhandari, S. B., 1985)

There are some limitations on the DPP. It disregards cash flows beyond the determined DPP. This fact cannot be avoided because of the way DPP is defined. However, the importance of cash flows beyond DPP is questionable because they are remote and unclear. Often the project's useful life itself is unclear. Usage of NPV, IRR or PI as decision criterion in this case is less advantageous than DPP because calculation of DPP is not based on useful life of the project (N). Moreover, as for dependent projects, where only an accept-reject decision has to be made, neglecting cash inflows beyond DPP is not going to display a significant difference. (Bhandari, S. B., 1985)

In capital budgeting, the Net Present Value (NPV) principle guarantees profitability but not liquidity. The payback period (PP) guarantees liquidity, but not profitability. The discounted payback period (DPP) guarantees both of them. The DPP rule has majority of the features of an perfect criterion of decision. The useful life of a project is exposed to the risk of changes in

political, technological, and regulatory factors, as well as consumer taste. This proves once again that it becomes less desirable to use the NPV, the IRR, the PI as the criterion for decision-making than the DPP. (Bhandari, S. B., 2009)

- Accounting rate of return

The accounting return rate (ARR) is not only a central feature of any fundamental text on the presentation of financial statements, but also a common component in the review of corporate financial performance by investment analysts. (Whittington, G., 1988). The accounting rate of return (R_t) is the investment profitability metric and is determined by dividing the annual net income of a plan by either the original maximum or average investment. (Levy, H. & Sarnat, M., 1993) In traditional ratio analysis, this ratio is considered as the primary summary measure. (Lohmann, j. R., & Baksh, S. N., 1993).

Accounting rate of return on total investment:

$$R_t = \frac{S - D}{I_0}$$

Accounting rate of return on average investment:

$$R_a = \frac{S - D}{I_0/2}$$

where:

D = depreciation (Levy, H. & Sarnat, M., 1993)

Some researchers claim that the ARR lacks economic importance, making it a very deceptive indicator of profitability (Brief, R., P. & Lawson, R. A., 1992). Fisher and McGowan (1983, 90), for example, state that nothing can be inferred about relative economic profitability by looking at ARR.

- Expected profit

The expected profit used as an indicator of the expected profitability of an investment and the variance used as an indicator of its risk is the most widely used risk analysis method.

$$E(x) = \sum_{i=1}^{n} Pr_i x_i$$

where:

E(x) = expected value of the project

x_i = i_{th} possible outcome (profit)

Pr_i = probability of obtaining the i_{th} outcome x_i

n = number of possible outcomes (Levy, H. & Sarnat, M., 1993)

- Discounted Cash Flow (DCF) techniques

Discounted cash flow (DCF) is a method for calculating the value of an asset based on its future cash flows. DCF analysis utilizes a discount rate to measure the current value of the projected future cash flows. A present value estimate is used to evaluate a potential investment. If the value obtained by calculating DCF is higher than the investment's current cost, it is worth considering the opportunity. Discounted DCF cash flow approaches take into consideration the time value of money. (Kruschwitz, L. & Loeffler, A., 2006)

$$DCF = \left(\frac{S_1}{(1+r)^1}\right) + \left(\frac{S_2}{(1+r)^2}\right) + \left(\frac{S_3}{(1+r)^3}\right) + \cdots + \left(\frac{S_n}{(1+r)^n}\right)$$

where:

n = time periods from one to infinity (Levy, H. & Sarnat, M., 1993)

- Net present value method

Net Present Value (NPV) is the present value of all future cash flows (positive and negative) throughout the lifespan of a discounted investment to the current one. NPV analyzes are used to determine the value of any investment, project or cash flow sequence. (Corporate finance institute) A positive net present value means that the projected earnings produced by the projected earnings of a project or expenditure are greater than the expected costs. Therefore, it is only profitable to invest with a positive NPV. (Ong, T. S. & Thum, C. H., 2013)

$$NPV = \sum_{t=1}^{n} \frac{S_t}{(1+k)^t} - I_0$$

where:

S_t = the projected net cash receipt at the end of year t

I_0 = the initial investment outlay

k = the discount rate, and

n = the project's duration in years

The project should be accepted if NPV > 0. (Levy, H. & Sarnat, M., 1993)

The net present value can be characterized as the overall financial gain (or loss) from a project, calculated by the project-related current and future cash inflows and outflows. (Götze, U. & Northcott, D., & Schuster, P., 2015).

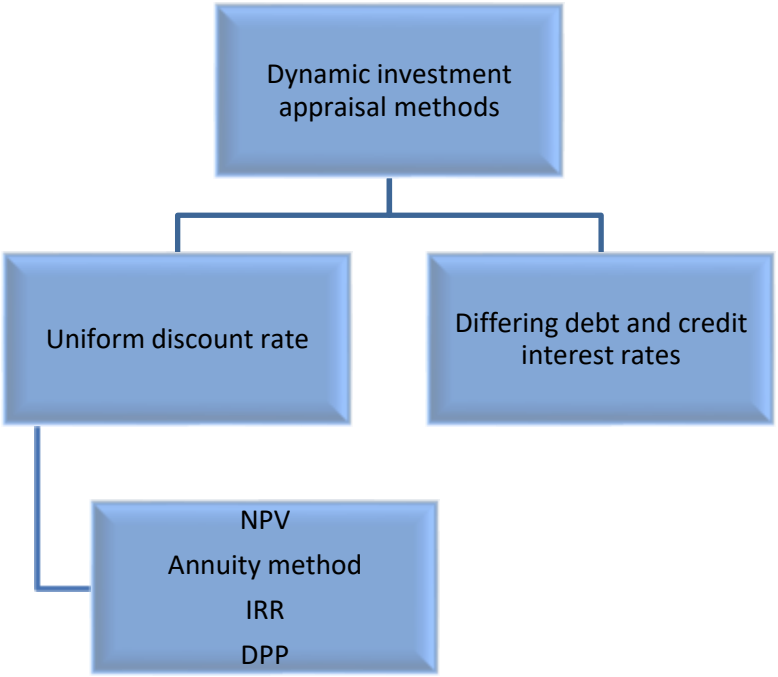

Figure 8 Discounted cash flow methods (Götze, U.& Northcott, D., & Schuster, P., 2015)

NPV is an essential component of the DCF. The discounted cash flow methods that include NPV, Annuity method, IRR, and DPP can be classified as dynamic investment assessment methods that, unlike static methods, take into account more than one time period and recognize the time value of money. Investment ventures can be seen during their economic life as sources of cash inflows and outflows. It can be concluded that these money inflows and outflows represent all applicable effects of alternative investment programs, and no other effects need to be considered. Thus, only (discounted) cash flows are taken into account as the target criteria used to assess investments. In addition, all cash flows can be foreseen and assigned to fixed periods of the same lengths. (Götze, U. & Northcott, D., & Schuster, P., 2015)

In case of the NPV method, all investment project related future cash flows are discounted back to time 0 (t = 0), as the beginning of the investment plan. The NPV represents a specific type of PV. Although all cash flows can be discounted and multiplied to a later point in time, e.g. to the end of the investment plan, it is more common to use t = 0 as this is the time when the investment decision has to be made. (Götze, U. & Northcott, D., & Schuster, P., 2015)

The NPV method's most static premises apply to the presence of a perfect (unrestricted) capital market. For this market, the single interest rate reflects the rate at which lending or investment can be made without limitations. That is why, this rate is used to discount and aggregate cash flows to any point in time. (Götze, U. & Northcott, D., & Schuster, P., 2015)

- Internal rate of return method

An alternative to the NPV approach is the internal rate of return (IRR). The fundamental rationale behind the IRR method is that it offers a single number that summarizes a project merits. The number obtained by the IRR model is not based on the capital market interest rate. This is why it is termed the internal rate of return; the figure is inherent in the project and only depends on the cash flows of the company. (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008)

Internal Return Rate (IRR) is an index utilized to measure the effectiveness of potential capital budgeting investments. The internal rate of return acts as a zero discount rate for the net present value (NPV) of all cash flows from a specific project. IRR calculations derive from the same formula as NPV. (Beaves, R., 1993) IRR is used to find a single return rate that sums up project's merits. (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008).

$$I_0 = \sum_{t=1}^{n} \frac{S_t}{(1+R)^t}$$

where:

R = internal rate of return (IRR) discount rate

The project should be accepted if R > k. (Levy, H. & Sarnat, M., 1993)

Despite its shortcomings, IRR remains commonly used in practice as a criterion for assessing investment projects ' desirability. (Schall, L. D., et al., 1978; Stanley, M.T. & Block, S. B., 1984;

Graham, J. R. & Harvey, C. R., 2001; Brounen, D. et al., 2004). Finance textbooks (e.g., Brealey, R. A. & Myers, S. C., 1991; Berk, J. & DeMarzo, P., 2007) recognize profitable investments as those that have positive net present value (NPV). IRR does not provide a particular value that can be contrasted with the company's bottleneck rate to a decision in accordance with the NPV rule (Samuelson, P. A., 1937). In the literature, several ways of solving this problem have been suggested to guarantee presence and distinctiveness, however, they tend to cause changes in the underlying problem. For example, if intermediate project cash flows are treated differently according to their signs, this results into the modified internal rate of return. (DuVillard, E. E., 1787); if the time horizon is truncated to maximize NPV, this leads to a different project (Arrow, K. J. & Levhari, D., 1969); or if the objective is changed from maximizing value to maximizing growth (Dorfman, R., 1981). All of the above is contrary to the NPV rule (Weber, T. A., 2014).

When the selective IRR is used instead, the issues with IRR stemming from its generic non-existence or non-uniqueness vanish. The selective IRR is built on the basis of the investment rate of the project and therefore inherits its NPV consistence. The selective IRR has no drawbacks, including the mixing inconsistency for the investment rate of the project (PIR), that other rate of return criteria have. (Weber, T. A., 2014)

- Net terminal value method

Terminal value (TV) measures a business's or project's worth beyond the forecast period when it is possible to estimate future cash flows. This approach allows a business to be evaluated with greater accuracy. Two methods are available for calculating the terminal value: "perpetual growth" and "exit multiple". The "perpetual growth" model assumes that a company continues to generate cash flows indefinitely at a constant rate, whereas the "exit multiple" model suggests that an enterprise is sold for multiple of certain market metrics. This assumes that a company will continue to generate cash flows at a constant rate, while the latter assumes that a company will be sold for multiple market measures. The "exit multiple" approach is preferred by investment professionals, while researchers favor the "perpetual growth" model. "Exit multiple" is preferred in Investment analysis. (Steiger, F, 2008)

$$Terminal\ Value = \sum_{t=1}^{t=\infty} \frac{FCFF_t}{(1 - WACC)^t}$$

where:

t = time

WACC = weighted average cost of capital or discount rate

FCFF = Free Cash Flows to Firm

- Profitability index

The profitability index (PI) aims to assess a planned project's cost-benefit relationship using the ratio (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008). PI is specified as the present value (PV) of the project divided by its initial outlay (IO).

$$PI = \frac{PV}{IO}$$

The project should be accepted if the index > 1. (Levy, H. & Sarnat, M., 1993)

3.3.2 Scenario Analysis

Scenario Analysis is the method of measuring the cost of a particular investment in a variety of scenarios. These scenarios spectrum is from those that are highly likely to occur to less likely to occur. Scenario analysis has no dependency on past results; instead, historic data suggests a framework within which future scenario analysis can be conducted. (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008)

The purpose of scenario analysis is to calculate risks and identify future problems beforehand. Scenario analysis helps investors and managers to determine the amount of risk they take before they invest or start a new project. Because scenario analysis allows to spot out potential future problems, necessary precautions can be taken to avoid problems or reduce their effects. (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008)

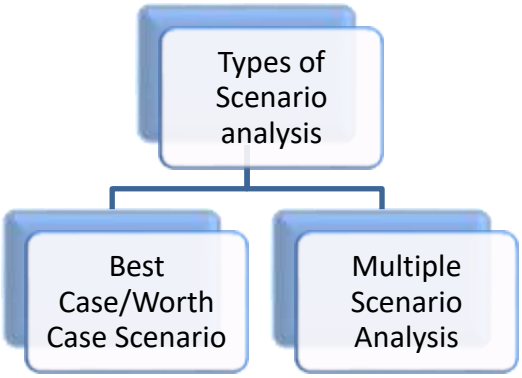

Figure 9 Types of Scenario analysis (Author)

Scenario Analysis has some issues. Scenario analysis alongside with sensitivity analysis attempts to give an answer to the question "What if?" However, despite the frequent use of both analyzes, each has its own shortcomings. Scenario analysis encompasses specific scenarios such as inflation changes, government regulation or the number of competitors. Notwithstanding the evidence that technique is often very beneficial and cannot address all sources of variability. In fact, under a single economic scenario, projects seem to show a great deal of variation. Scenario analysis success cannot be forecasted. Even if an adequate extended analysis of the scenario is performed, the facts are correct, clear assumptions are made about all the scenarios, it can never be known for sure if the scenario is playing out exactly as expected. There are also some concerns related to cognitive bias. In some situations, decision-makers take multiple scenarios and divide them into best, average and worst. However, due to the human nature, the occurrence of average scenario is considered to be the most common. Thus, decisions are based on average scenarios. What is more, scenarios require continuous revision. A scenario considered today may change in the near future drastically. Thus, the scenario analysis must be periodically updated. (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008)

3.3.3 Sensitivity Analysis

Scenario analysis is often confused with sensitivity analysis. Even though these two types of analysis are based on similar concepts, meaning that they predict events given certain situations, they vary significantly. Analysis of sensitivity is a factor in scenario analysis that is useful in recognizing areas where risk prediction is particularly severe. The basic idea behind the sensitivity analysis is to see how sensitive the NPV estimate is when all other variables remain unchanged to changes in one variable. Sensitivity analysis allows change of only in one variable at a time.

By contrast, many variables are likely to move simultaneously in the real world. (Ross, S., Westerfield, R. W. & Jordan, B. D., 2008)

Analysis of sensitivity explores how uncertainty in system performance can be assigned to various sources of uncertainty in the input of the model. Simply saying the sensitivity analysis studies how dependent variables are impacted by the independent variable, in case of hospitality business, it will be studied how the cost of a new digital platform impacts the profitability of the hotel operations. (Saltelli et al., 2004)

Sensitivity analysis may be carried out for a range of reasons, including the need to make a decision regarding:

- Parameters that need more work to improve the knowledge base and thus lowering the uncertainty of output
- Parameters which are negligible and which can be omitted from the final model
- The parameters that contribute most to the variability of output
- The most highly related with the output parameters
- What may happen if a given input parameter is changed. (Hamby, D. M., 1994)

First, independent and dependent variables of a system should be described in order to perform the sensitivity analysis and functions of probability density should be assigned to each input parameter. Afterwards, an input matrix is generated using a suitable random sampling process, defining an output vector and evaluating the influences and relative importance of each input / output relation. (Hamby, D. M., 1994)

Sensitivity analysis can be evaluated by different methods:

- Differential sensitivity analysis

Differential techniques are based on the model's behavior provided a specific set of parameter values and factor sensitivity magnitude depends on the base-case scenario. Such sensitivity analyses are computationally efficient but the effort needed to solve these equations can be quite large. (Hamby, D. M., 1994)

- One-at-a-time sensitivity measures

The above sort of analysis is the simplest method for sensitivity analysis because it only tackles sensitivity roughly equal to the point estimates chosen and not for the whole distribution of

parameters (Hamby, D. M., 1994).

- Factorial design

Factorial analysis, a certain number of samples is selected for each parameter and the model is used for all sample combinations. The results obtained this way are later used to estimate parameter sensitivity. (Hamby, D. M., 1994)

- The sensitivity index

It is another simple method is to assess the sensitivity of parameters by measuring the percentage difference between one input parameter and its maximum value. (Hamby, D. M., 1994).

- Importance factors

Importance factors include the following:

- ✓ Uncertainty parameter (defined as two normal input deviations) multiplied by sensitivity parameter (represented as output change divided by input change)
- ✓ Positive difference between the output peak and the output minimum
- ✓ Third, the importance of using the output sample variance is estimated. (D. M. Hamby, 1994)

- Subjective sensitivity analysis

The approach rests on analysis of individual parameters. It is a simple and qualitative method that relies on experienced researchers ' opinions to determine which parameters can be excluded due to insignificant impact on the output of the model. (Hamby, D. M., 1994)

3.3.4 Break-even Analysis

Break-even Analysis is a helpful tool for assessing the effect of technological, economical and administrative decisions on the feasibility of a project. It is a widely used financial analysis tool. In essence, it applies only to short-term monetary aspects of the interventions, providing the order of magnitude of the variables analyzed over a short span of time. (Morano, P., & Tajani, F., 2013)

Assessment of break-even takes into account the debt value of a hotel asset. Furthermore, it defines the point that a hotel is doubtful to default on its payment of interest. Lenders tend to use this method to determine a hotel property's default risk margins. Break-even analysis takes into account a hotel's total cash costs, representing the level above which a hotel is likely to begin to generate profits for its owner. (Younes, E. & Kett, R., 2003)

Analysis of break-even is a widely used method to evaluate the relationship between sales volumes and profitability. Breakeven thinking is a way to compare the effect of an expected transition with the current situation. (Cafferky, M., 2010) A break-even point determines when a positive return is created by an investment. Analysis of break-even can be generalized to illustrate how shifts in fixed cost-variable relationships, commodity prices, and sales can impact profit levels and break-even points. (P.H. Gutierrez, P.H. & Dalsted, N.L.)Traditional breakeven formula is represented below:

$$Break\ even\ in\ Units\ to\ be\ sold = \frac{Fixed\ costs}{(Contribution\ Margin\ per\ unit)}$$

In case, the desired result is expressed in monetary units, the following formula is used:

$$Break\ even\ in\ Dollars\ to\ be\ sold = \frac{Fixed\ costs}{(Contribution\ Margin\ Ratio\ per\ unit)}$$

The break-even point is an effective management tool in terms of the planning process because it provides a relatively easy and quick basis for evaluating the volume of sales required to cover operating costs and fixed costs. However, when using the estimate in predicting, it is important to remember that the estimates must provide for changes in operational efficiency as well as for the likely impact of inflation. (Lesure, J. D., 1983)

3.3.5 Monte Carlo Simulation

Monte Carlo simulation is a computer based computational method that explains the risk through quantitative analysis and decision-making. (Sobol, I. M., 1994). Monte Carlo simulation works in a similar way like analytical mathematics to find a distribution of statistical samples and check their behavior in random samples. To keep track of the behavior of statistics, Monte Carlo simulation utilizes random samples from existing populations of simulated data. The core idea of the simulation of Monte Carlo is that if the sampling distribution of the statistics is the density function of the values that could be assumed in a given population, then its approximation is the relative frequency distribution of the values of that statistics already seen in many samples from that population. (Mooney, C. Z., 1997)

The idea behind Monte Carlo simulation is that the behavior of a statistics in random samples can be measured through the experimental process of writing a lot of random samples and then their action analysis. This technique creates an artificial reality that resembles the real world, or pseudo-population. This pseudo-population, in addition, involves computational methods for creating sets of numbers that represent real population data samples. This pseudo-population is then used to perform several statistical procedure tests to analyze the procedure's actions across samples. (Mooney, C. Z., 1997)

The Monte Carlo method is a method for analyzing phenomena by using computational algorithms relying on generating random numbers. Random numbers are often used in a data encryption, including Bitcoin transactions, credit card payments. In addition, many internet services utilize random number generation for personal data protection. Monte Carlo methods are also applied in science, business, mathematics, logistics and many other fieldsThese methods allow generating highly reliable algorithms to predict probabilistic processes (with random elements) such as movement of particles or transfer of information over the Internet. The Monte Carlo approach is also useful in case of complicated problems that require numerical solutions whcih cannot not be solved analytically. (Savin, I. & Pushkarev, A., 2015)

The Monte Carlo Simulation is applied for the situations with significant uncertainty in the forecast making process or estimation. Monte Carlo simulation is quite a useful technique in risk analysis and finance. (Arnold, U., & Yildiz, Ö., 2015)

In Monte Carlo, simulation risk analysis can be done by building models of possible outcomes and replacing a range of values — a probability distribution — for any parameter with inherent uncertainty. Then results are calculated repeatedly, using a separate set of spontaneous values from the probability functions, based on the number of uncertainties and the ranges specified for them. It can require quite a large number of recalculations before a Monte Carlo simulation is complete. The simulation produces possible outcome values distributions. (Arnold, U., & Yildiz, Ö., 2015)

The input variables should be viewed as separate random quantities to apply the Monte Carlo simulation in the right way, meaning they must be fully uncorrelated. Otherwise, this may result in errors in simulation and risk management interpretation issues. Nevertheless, if there are

interdependencies between two input quantities, it is possible to decouple the two by standardizing one output factor by the other. (Arnold, U., & Yildiz, Ö., 2015)

Monte Carlo simulation's critical step is to determine the probability density functions expected for random input parameters. To apply Monte Carlo simulation, the (input-) pdfs of the random system input variables must already be identified. If the necessary pdfiis can not be obtained due to insufficiency of adequate data, an empirical approximation based on knowledge can be used. (Arnold, U., & Yildiz, Ö., 2015)

The basic Monte Carlo procedure is the following:

- In symbolic words, the pseudo-population definition can be used to produce samples. Typically it includes software algorithm creation which produces information in a particular way.
- Pseudo-population survey in a way that reflects the statistical situation of interest, e.g. with the same sampling method, sample size, etc. Estimator, θ, calculation in the pseudo-sample and storing it in a vector θ.
- Repetition of 2d and 3d steps t times, where t is the number of trials
- Implementation of a relative frequency distribution of the resulting θt values, which is the Monte Carlo approximation of the sampling distribution of the θ under the conditions specified in the pseudo-population and sampling procedures. (Mooney, C. Z., 1997)

Common probability distributions are:

- Normal or standard Gaussian distribution has pdf

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}, x \in R$$

The corresponding location-scale family of pdfs is therefore

$$f(x; \mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2}, x \in R$$

Normal distribution plays a key role in statistics and inevitably emerges through the central limit theorem as the limit of the number of iid random variables. The main feature is that any affine configuration of standard unbiased random variables is again normal. (Kroese, D. P. & Taimre, T. & Botev, Z. I., 2011)

- Log-normal

The log-normal distribution with scale parameter σ > 0 and location parameter μ $\in R$ s defined via the pdf

$$f(x;\mu,\sigma) = \frac{1}{x\sigma\sqrt{2\pi}}\exp\left(-\frac{(\ln(x)-\mu)^2}{2\sigma^2}\right), x \in R$$

The characterizing property of the distribution LogN(μ, σ^2) is that if X ~ LogN(μ, σ^2), then lnX~N(μ, σ^2). It therefore occurs as the scaled limit of iid random variables properties, just as the normal distribution emerges for quantities through the central limit theorem. The log-normal distribution is not defined solely by its moments. (Kroese, D. P. & Taimre, T. & Botev, Z. I., 2011)

The following factors influence the decision whether to apply analytical (e.g. deterministic equations) or simulation (e.g. Monte-Carlo) methods:

- Complexity. Better physical representation of a complex system analysis can be accomplished by simulation than a series of equations, which helps to visualize the output.
- Scope. For example, simulation is preferred to analytical models when dealing with complex repair policies.
- Accuracy. Though analytical models are deterministic, they typically consist of simplifying assumptions to make the model analytically tractable. Such conclusions must be clarified.
- Future development. If a model is to be developed further, it may not be an initial prototype that can initially be analytically tractable if additional development criteria are added. From the start, a simulation model may be preferable.
- Application. Due to their speed of execution, analytical models may be preferred for rapid look analysis. The repetitive running involved in the simulation of Monte-Carlo could trigger long execution times before estimates of interest system parameters are obtained. (Aderibigbe, A., 2014)

Constraints of Monte Carlo Simulation are the following:

- Problem in assessing the best and worst case scenarios for each variable input.
- All input variables may not be simultaneously at their best or worst point.
- Decision making can be difficult because more than one scenario is considered.
- The bigger the number of considered cases, the more complicated the model versioning

and storing becomes. (Raychaudhuri, S., 2008)

Table 2 Main Advantages and Disadvantages of Analytical and Monte-Carlo Simulation Models (Aderibigbe, A., 2014)

	Simulation Method	
	Analytical	**Monte-Carlo**
Advantages	Provides exact results	Flexibility
	Output can generally be quickly received once the model is created.	Can be easily enhanced and developed when required
	Computer is not always needed.	Easier to understand for non-mathematicians.
Disadvantages	Restrictive assumptions are required to make the problem tractable.	Computer required.
	Less flexible. Model extension or development may be limited.	Longer calculations.
	Model may be just understood by mathematicians. Therefore, when output is in conflict with preconceived designers' or management' theories, this can result in credibility issues.	Solutions are not reliable since they reflect the number of repeated runs used to generate statistics on the output. Therefore, projections are all outputs.

The Monte-Carlo simulation method is a type of sampling technique, so any output is not precise, but a statistical approximation and its precision rests on the amount of missions or failures produced. For example, if mission parameters are crucial, the number of simulated missions is the key parameter. If in1000 missions simulated, only 5 system failures are generated, then the number of system failures produced does not necessarily matter. In the output of system statistics derived from Monte-Carlo simulation models, confidence intervals are usually given to indicate

the precision of parametric estimates. (Aderibigbe, A., 2014)

3.3.6 COCOMO model

COCOMO model is considered to be the best documented and transparent model. Constructive cost model (COCOMO) is a regression model that rests on a number of Lines of Code. COCOMO is used to assess the schedule and effort needed to produce the software (Geeksforgeeks). COCOMO mainly focuses on estimation of the 15 cost drivers' influence on the development effort. In order to do the estimation, the size of software should be identified. COCOMO itself does not participate in the size estimation stage, but only provides equations that are based on 63 accomplished projects. The equations reflect the connection between size and effort and between effort and development time (see table 4). (Heemstra, F. J., 1992).

The quality of any software products is defined by effort and schedule. Effort is the amount of work needed to accomplish a task and it is computed in person-months units. Schedule is the amount of time necessary to finish the task and it is expressed in the units of time. (Geeksforgeeks)

Different Cocomo models have been suggested to forecast the cost estimation at multiple levels. Projects can be:

- Organic (relatively small teams, the problem is well established and has been resolved before. Members of the team have some knowledge of the issue)
- Semidetached (team size is bigger than organic, project is less familiar, hard to develop and need more knowledge and better supervision)
- Embedded (software project has the top degree of difficulty, larger team size is required, sufficient level of experience is required) (Geeksforgeeks)

The simple Cocomo model is calculated based on the following formula:

$$E = a * (KSLOC)^b$$

where

E = the effort applied in person-months

KLoC = the estimated number of delivered lines of code for the project, and EAF is the

factor computed above. The coefficient a_i and the exponent b_i are given in the table below.

Table 3 Software project planning (Image.slidesharecdn)

Project	a_i	b_i
Organic	3.2	1.05
Semidetached	3.0	1.12
Embedded	2.8	1.20

4 LITERATURE REVIEW

There is a limited research on digitalization in hotel sphere. The current literature review covers the digitalization practices described by other researchers. Many examples mainly concern small- and medium sized hotels are listed.

IT and tourism research has demonstrated an overall understanding of how technology is changing society and economy. Recently the way the information technology is perceived in regards to tourism has changed from a marketing approach to a knowledge-building tool (Xiang, Z., 2018) Digitalization is playing a more and more noticeable role in hospitality. Velina Kazandzhieva, Hristina Filipova and Galina Ilieva (2017) in their research on “The impact of technological innovations on hospitality service” point out that online booking systems, social media, customer relationship management, and smartphones are reshaping the hospitality industry. Various advances used in hospitality will have even greater influence in the future. Already today such things like light, temperature, alarms, TV, and room service can be controlled from a single device via mobile application. How actively these advances are going to be adopted depends on the readiness of end users (employees and clients). In spite of the changes that are brought by these technological innovations, they are there to enhance hospitality business. The authors created a conceptual framework to study the effects of technological innovations in hospitality that was defined based on the “Guest cycle” model. It is also highlighted that the fundamental pillars of the industry are providing a customer service of high quality, and the technologies can ease the deliver of memorable experience to guests.

However, some researches claim that digitalization is at the low level at small- and medium

enterprises, especially at peripheral ones. Electra Pitoska (2013) in her research on E-tourism in Greece states that even though touristic businesses in Greece appears to be utilizing Information and Communication Technologies, many companies are still not familiar with the Electronic Customer Relationship Marketing (E-CRM) systems.

In turn, online reservation systems are widely used and their usage is expected to double in five years. E-marketing is used at satisfactory level and most of respondents think that e-marketing plays a key role for the well-being of an enterprise. (Pitoska, E., 2013) Gerald C. Kane in his paper on digitalization uses Marriott hotel group as an example. He states that he was a witness of how travel industry continued to be disrupted by digital. He states that websites such as Expedia, Travelocity, and others have brought about a shift in customer buying experience from being done through hotel call centers or offline travel agents to those using online travel agents (OTAs) and third parties. These sites appeared to be a massive disruption to the hotel industry because reservations and transactions through them were more costly to the hotel chain than booking through their own direct channels. However, this fact prompted the hotel chain to develop their digital channels to reach the consumer directly. (Kane, G. C., 2017)

Having faced these challenges, it became clear for the Marriott chain that new strategies and methods have to be adopted to attract consumers at the early stages of consideration and assessment. Hotels of the chain had to place the right content on the digital platform to be spotted out by Google. If content is neglected, sale is either going to be lost, or will go to a third party resulting into a higher costs of booking. (Kane, G. C., 2017)

There is now a major shift to digital users and it is another major disruption because all the interactive services built up over the years have to be moved to a smaller screen. Previous digital platform at Marriott was mainly focused on the reservation experience and the transaction, but now the focus is shifted to the strategy called “win-the-stay”, which is where different levels of guest services are provided through the mobile app. (Kane, G. C., 2017)

Another research in the sphere of E-tourism in Greece also proves that even though many hospitality companies have implemented ICT systems, have presence on the internet via websites and are curious in ecommerce, application of these advances is going on at slow pace. The paper also states that even though most of companies perform many processes and operations

electronically, there are still companies whose staff does not have sufficient knowledge regarding basic IT tools, like communication via email, electronic booking and so on. The overall findings displayed that majority of small- and medium hospitality providers have knowledge and interest in IT technologies, some consulting is still required. There is some progress in e-tourism adoption, but still quite many changes can be done. (Cvsblock, 2014)

Digitalization always brings some changes and some researchers studied how these changes can be adopted. Paper on "Tackling the digitalization challenge: how to benefit from digitalization in practice" (Parviainen, P., Kääriäinen, J., Tihinen, M. & Teppola, S., 2017) discusses digitalization based on a multiple of case studies conducted to gather data from several companies. The paper represents the first variant of the model of digital transformation generated from the synthesis of the industrial cases. A starting point for a systematic approach to digital transition is defined in the research. The above-mentioned model is designed to help companies to navigate digitalization transitions systematically. The model consists of four steps. Firstly, it starts with identifying company's position in digitalization and setting goals. After that, the current state of the company is analyzed in terms of digitalization goals. Finally, a plan is developed and enforced to achieve the goals. These steps can help to consistently address digitalization and take advantage of it.

There are some studies made on platforms which are digitalization tools used by the hospitality service providers. Such platforms are represented by accommodation services like Airbnb, hotel reservations - Booking.com, etc. Paper by Oskam, J., and Boswijk, A. (2016) examines Airbnb system. Airbnb is a recent trend that displays a rapid growth. The paper analyses its potential future development and the effect this development will have on tourism, hospitality service providers and city destinations. A literature review, together with scenario workshops and a Delphi panel are the methods used in the study. Using these techniques, current trends and uncertainties are plotted. Using the input, future scenarios were designed using the Global Business Network method. Airbnb appears to be a challenging innovation whose impact has resulted into a call for regulatory policies. The paper in question seeks to synthesize the amount of its effects, making room for the identification of roles and strategies for companies and local governments.

Christian Longhi (2008) in his paper on the "Usages of the internet and e-tourism" examines the influence of internet on the industry organization and the market dynamics, focusing on Europe.

Tourism involves many functions of the information and communication economy. While e-tourism accounts for a small proportion of the overall tourism sector, the author argues that the Internet practically explains the organization of the activities and markets that are appearing today. The analytical framework capable of understanding these dynamics is identified. The principle of a sectoral system of production and innovation is displayed to capture the fundamental changes of the tourism industry in order to provide a specific analytical framework. Tourism is digitally focused industry. Data is its competitive advantage.

Even though Internet provides many opportunities for small- and medium-sized enterprises to reach customer and it is becoming more and more obvious that hospitality may benefit from digitalization tools adoption, there are still some barriers from capitalization on IT and the Internet. Limited financial resources, lack of IT expertise, reluctance to change, and a service provider's remote location are among the most severe constraints. (Anckar, B., & Walden, P., 2001)

A good website is an important attribute that not only creates more economic opportunities, but also enhances the image of an organization and supports customer interactivity. Good website is about providing a pleasant usability experience, including professional design and layout, high quality content, navigation, and interactivity issues (Corfu & Kastenholz, 2005). Website effectiveness is also impacted by aesthetics, informativeness, and interactive features (Han & Mills, 2006b), whereas usability and content play an integral role in user satisfaction (Klausegger, 2005). Several researchers stated that usage simplicity is one of the main factors reflecting the quality of the website (Au Yeung & Law, 2006; Cho & Agrusa, 2006; Jeong, Oh, & Gregoire, 2005; Park, Gretzel, & SirakayaTurk, 2007). Software automation can make analysis of websites more efficient and accurate (Chan & Law, 2006). Good website features include inclusiveness and the ability to meet the needs of various online users, including visually impaired and handicapped users. (Han & Mills, 2007; Shi, 2006; Williams & Rattray, 2005; Williams, Rattray, & Grimes, 2006). Web designers should also keep in mind that language and culture are affecting a website's success. (Kale, 2006). A professional Web site as well as a sensible Internet strategy may require quite large investments that small- and medium-sized enterprises may not afford. This creates a barrier. It is rare for such companies to have in-house expertise to start an e-commerce project with no external assistance. (Schneider, G. P. & Perry, J. T., 2000).

Content of the websites related to travelling provides a destination image. Stepchenkova and Morrison (2006) performed an evaluation of the content of U.S. and Russian-based websites and concluded that both technological and functionality changes were required on Russian-based websites. Use of the Technology Acceptance Model was applied to examine traveller's incentives to look for information on tourism related websites (Luo, Remus, & Sheldon, 2007). Upon analyzis of the development and use of advertising elements on the Internet, Baloglu and Pekcan (2006) concluded that the Turkish hotel did not make successful use of either e-marketing or the full capacity of the Internet. Case studies of Greek hotel websites showed that smaller innovative Greek hotels have better online booking and pricing information sections than the top 25 hotel brand websites (Zafiropoulos & Vrana, 2006; Buhalis & Kaldis, 2008). It is also common that hotel websites purely act as digital brochures (Zafiropoulos, Vrana, & Paschaloudis, 2006).

Moreover, digitalization may reshape the labour market. “Digitalisation of the economy and its impact on labour markets” by Christophe Degryse (2016) provides a description of the new opportunities provided by the Fourth Industrial Revolution, addressing labor market problems, job status, employment conditions and training. It studies the role that trade unions can play in the online economy and the major measures that have already been implemented at European trade union level. In response to digitalization, some jobs will be at higher risk and may disappear.

Erik Brynjolfsson and Andrew McAfee (2011) also emphasize the importance of technologies in the future, which will change millions of people's incomes and jobs. They state that information technologies will advance even further that will affect jobs, skills, and the economy. Technologies will represent a challenge to human labour, bringing a drastic economic shift, creating new job opportunities, although along with this increasing unemployment in under- or medium-sized jobs.

Digitalization is implemented in hospitality business and as a result, some tasks in this sphere will be substituted or are already partly substituted by machines. Nowadays there are some hotels that have no reception and guests are checking in and out on their own, for example Omena Hotels. These strategies allow them to operate in a cost-effective way. The concept of the hotel is to keep it simple. (Omenahotels) More technological advances can be seen at Yotel hotel in New York. The hotel is aimed for tech-savvy travellers who value time and efficiency (Yotel). Except for self check-in, the hotel has a robot, bellboy called Yobot, who is ready to take care of the traveler’s luggage (Khanna, P & Khanna, A., 2011).

All in all, successful customer relationships is a balance between digitalization and the human touch. It is becoming more and more common for consumers to use technology to communicate with businesses. Digital transformation leads to the success of these companies, but ensuring that workers maintain the human touch is crucial. As the virtual interface is becoming popular everywhere, it will be the psychological, human element in a successful business relationship. (Van Belleghem, S., 2015)

5 DATA AND METHODOLOGY

5.1 Methodology

The research method of this thesis is a single-hotel case study. The purpose is to present different digitalization tools and to analyze their profitability for the chosen small hotel business.

The current research combines qualitative and quantitative techniques. Qualitative approach seeks to explore phenomena. In addition, the research problem must be understood from the perspective of the local population.. Qualitative approach is successful in gathering certain cultural data regarding individual populations ' beliefs, views, attitudes, and social contexts. The value of qualitative research is the capacity to explain how a particular research problem is experienced by people. This provides information on a so-called "human" side. (Qualitative Research Methods: A Data Collector’s Field Guide)

Qualitative research focuses on interpreting a research question as an approach that is humanistic or idealistic. Qualitative method is useful in terms of understanding convictions, experiences, attitudes, behaviors, and relations of the people. This type of research produces non-numerical data. The incorporation of qualitative research into intervention studies is a research strategy which draws more publicity. Although considered philosophically dissonant with experimental research, qualitative research is valued for its potential to generate new criteria to interventional studies that could not be attained by measuring only variables (Gibson, G. et al., 2003) Initially used in psychological studies, qualitative research is currently applied in other research fields too (Pathak, V. et al., 2013).

Qualitative research encompasses observational studies, interview and documentary/textual

analysis of different written records (Pope, C. & Mays, N., 1996). Qualitative research permits participants of the study to express their opinion (Gibson, G. et al., 2003). In the context of digitalization studies in hospitality, it encourages individuals to express their opinion regarding the digitalization tools they have used. This, in turn, can show the studies to the researchers at another angle. Qualitative study increases the involvement of all the people who are connected to the study. The subjects tend to have a study background that is inspiring. Furthermore, the use of qualitative methods creates a far less formal relationship between the one who conducts the research and the one who is participating in it comparing tot the quantitative research.. (Pathak, V. et al., 2013)

In hospitality-related research, qualitative research can make a significant contribution. Studies should be well designed for qualitative research; the study's objectives and protocols should be carefully assessed. In order to nullify research bias, studies should have pre-determined methods. Qualitative research, combined with quantitative methods, can provide a better understanding of the problems related to hospitality. (Pathak, V. et al., 2013)

The quantitative approach aims at verifying theories about phenomena. The processed data has numerical format. Instruments used in the quantitative approach have a more inflexibility in getting answers to questions and categorizing them. (Qualitative Research Methods: A Data Collector’s Field Guide) Since quantitative approach is numeric-based, it is considered to be a more reliable method that can be replicated by other scientists (Pathak, V. et al., 2013).

Quantitative research focuses on various types of classification, causality analysis, correlation, and phenomenon explanations by quantitative variables. For quantitative research, mathematical and numerical methods of measurement are used. (Jyväskylän yliopisto)

Figure 10 *Research strategies (Jyväskylän yliopisto)*

Quantitative experiments have a standard format to generate a hypothesis to be accepted or rejected, subject to some minor interdisciplinary variations. Mathematically and statistically, this hypothesis must be proven. It is necessary to have any study groups randomized and to include a control group. A well-structured quantitative layout should only modify one factor at a time or the statistical analysis can become doubtful. Ideal work should be designed in such a way that others can replicate the experiment and achieve similar results. (Shuttleworth, M.)

In order to better identify the needs of a small hotel, the author was working at a small hotel located in Lappeenranta for six months. Along the work, several interviews were conducted with the owners and staff to calculate the losses the hotel has. These interviews were part of qualitative research. The focus of the interviews was to identify the losses: how often guests leave without having paid for the night, how common cases of theft and damage are, and how to manage food and beverage supplies more economically. During the interviews, the author also aimed to find out owners' and staff's attitude towards digitalization and their knowledge about various digital tools. In addition, some numbers regarding the expenses and revenues were reviewed. Moreover, the working at the hotel allowed the author to study the way the hotel functions more in detail and this knowledge enabled to point out the problems that may need digital tools to solve them.

Having conducted the research to spot out the problems to work with, the author suggested several

digitalization tools that could help to minimize the losses. Qualitative part of the research was to calculate their profitability for the small hotel business in question and the most feasible solution was identified. Profitability analysis was selected for this research as the most straight forward method to decide if the tool is worth investing in or not. Such indicators as Internal Rate of Return, Net Present Value, Profitability Indicators and Discounted Payback Period were analyzed and compared. The above-mentioned indicators were selected due to their simplicity and easiness of application.

One of the suggested digitalization tool was embedded to the existing website reservation system. Constructive cost model (COCOMO) was applied to identify the cost of the reservation system. There is a number of companies to refer to in order to get this system functioning on the hotel's website. The author identified the features needed by the hotel and conducted the estimation of possible cost of such a reservation system. The system does not include any complex solutions that is why the project was considered to be organic.

Due to possible impression in losses calculations, sensitivity analysis was also performed to one of the indicators of profitability analysis for each suggested option. Some conclusions are made based on the sensitivity analysis too. Sensitivity analysis was preferred to Monte Carlo simulation due to its simplicity. Break-even analysis that is an extension of sensitivity analysis can be applied in possible further research.

An overview of methods used is listed below:

Table 4 Methods Overview (Author)

Method	Qualitative/Quantitative	Purpose
Interviews	Qualitative	To identify the expenses and revenues To find out the owners' and staff's attitude towards digitalization To get an insight regarding the owners' and staff's level of knowledge about

		digitalization
Profitability Analysis	Quantitative	To calculate profitability indicators, including NPV, PI, IRR and discounted payback period. To estimate the avoided losses for each option.
Constructive cost model (COCOMO)	Quantitative	To estimate the schedule and effort needed to produce the software.
Sensitivity analysis	Quantitative	To see how NPV is impacted by change in losses losses avoided and costs of the system.

5.2 Data

The data used for the research is obtained from the hotel management. In order to calculate the possible benefits of digitalization, annual losses of the hotel were estimated. These particular losses were selected because these were identified by the management. It is a small hotel and there no other expenditures. Annual losses and their percentage to the losses over the course of the year are represented in the table.

Table 5 Sources of losses (Author)

Sources of losses	Annually	%
Unpaid staying	2000	55.56
Food and material mismanagement	480	13.33
Damage	320	8.89
Theft	800	22.22
Total loses	3600	

Estimated losses include:

- Unpaid staying is the sum lost due to guests leaving the hotel without having paid for the

night.

- Food and material mismanagement is the result of bad estimation of how much food and beverages is needed for certain period of time. Due to short expiry date of some items, a lot of food was disposed resulting into financial losses.
- Damage is typically caused by careless or intentional behavior of guests. Examples of damage are broken furniture and items located in rooms and public spaces
- Theft is also mainly caused by the guests who steal items from the room and public spaces.

6 RESULTS

In order to reduce the costs listed in data section, the following ways were suggested:

- Centralized management system
    - With monthly fee
    - Without monthly fee
- Combination of simple digitalization tools (including door code boxes, excel program with room reservations and salary calculation)
- Website upgrade (adding reservation system with an opportunity to pay for the booked room) and keyless system installation
- Combination of a centralized management system with a website upgrade
- Combination of simple digitalization tools with a website upgrade

All the above-mentioned options were evaluated based on five-year period.

6.1 Centralized management system

The first option is to acquire ready-made management system. In order to compare various hotel management systems, data related to pricing and features was collected from the systems' own websites and from Capterra resource (Capterra). According to the table below (see full version of table in App. 4), price of ready-made systems ranges between 99 and 167 euros a month. This package includes all the features needed by the hotel in question, in particular: Customer-relationship management (CRM), employee management, online booking.

Table 6 Hotel management systems' comparison (Capterra)

Hotel management systems' comparison					
# of rooms	20				

Name of the system	**Cloudbeds**	**Hotelfriend**	**Hotelist**	**Seekom**	**Uplisting**
Price per month	167	99	136.84	100	150
Rating	4.5	-	5	4.5	5
Ease of use	4.5	-	5	4	5
Value for Money	4.5	-	5	4.5	5
Features:					
CRM	✓	✓	✓	✓	✓
Employee Management	✓	✓	✓		
Loyalty Program		✓	✓	✓	
Maintenance Management	✓	✓	✓		
Online Booking	✓	✓	✓	✓	

Adoption of the hotel management system allows the hotel to save money lost on unpaid reservations, diminish issues related to the employees' management and have a centralized system that is easy and comfortable to use.

All above-mentioned management systems will help to save 2000 euros per year on average due to online booking system. It will allow to eliminate unpaid staying.

6.1.1 Estimates for a centralized management system with a monthly fee

Table 7 Estimates for a centralized management system with a monthly fee (Author)

Centralized management systems, with fee	PI	DPP, years	NPV	IRR
Cloudbeds	0.86	Not profitable	€ (1,361.05)	0%
Hotelfriend	1.46	4.3	€ 2,718.95	20%
Hotelist	1.05	5.71	€ 448.55	7%
Seekom	1.44	4.34	€ 2,658.95	20%
Uplisting	0.96	Not profitable	€ (341.05)	4%

According to the profitability estimation, Hotelfriend, Hotelist and Seekom systems are profitable. Hotelfriend, Hotelist and Seekom systems have profitability indices more than 1, thus these systems are feasible for a small hotel business in question.

According to the discounted payback period calculations, Hotelfriend and Seekom systems have the shortest discounted payback periods, 4.3 years and 4.34 years respectively, Hotelist has a discounted payback period of 5.71 years.

According to NPV, systems Hotelfriend and Seekom are the most profitable, Hotelist is less profitable, Cloudbeds and Uplisting are not profitable at all.

Internal rate of return (IRR) also proves the above-mentioned conclusions stating that IRR is the highest in case of Hotelfriend and Seekom systems. (Detailed calculations can be found in App. 5)

To sum up, such systems like Hotelfriend, Hotelist and Seekom will allow to save 2000 euros per year. These are losses avoided due to unpaid nights.

6.1.2 Estimates for a centralized management system, without monthly fee

As it can be seen from the calculations, ready-made systems with monthly fee are less profitable than ready-made systems without monthly fee. Management system purchase is a more budget option and the prove can be seen from the table below (see table 8). All the indicators show that such systems are profitable and like systems with monthly fee, they will also enable the hotel to save 2000 euros annually by avoiding unpaid nights (for more detailed calculation see App. 6). However, it has some limitations, like no or limited support, no updates. In case of any issues and malfunctioning, the costs will have to be covered by the hotel itself. Hotel Application service provides offers management systems with standard, professional or enterprise licenses. The cheapest option is standard package that includes one hotel license but does not provide any support or free updates. Its price is 99 euros. Standard package supports all the features like professional and enterprise packages required for a small hotel business, that is why there is no need to choose a more expensive option. (Hotelmanagementsystem)

Table 8 Estimates for a centralized management system, without monthly fee (Author)

Centralized management systems, purchased	**PI**	**DPP, years**	**NPV**	**IRR**

System	87.46	1.05	€ 8,559.95	2020%

6.2 Combination of simple digitalization tools

Another option is to create a combination of simple digitalization tools including door code boxes, excel program with room reservations and salary calculation. Simple excel program can be used to keep track of the reservations.

Door code boxes

Keyless system is expensive to install and it may be not feasible for a small hotel to acquire it. Instead, code boxed can be purchased from Ebay to store key in it. Boxes can be placed next to the room doors and guests can get access to the rooms by entering the code on the code box and receiving the key. The codes will be randomly generated in the excel file and staff will be entering them to the code boxes and sending to the guests before arrival. In case of last-minute reservations, the staff can send the code for the door by phone or email.

Figure 11 *Door code box from ebay*

Door code boxes are needed to restrict access to the rooms by people who do not live at the hotel. There is a problem that anybody passing by can just come in, take the key and stay overnight. Since the reception is not open 24/7, it is possible that the guest checks out before reception opens without paying for staying. In order to eliminate such opportunity, door code boxes can be installed next to each room's door. There are 20 rooms and apartments at the hotel, thus 20 door code boxes are needed. The price of one door code box is about 13 euros per item (ebay.com).

Total price is 260 euros plus installation costs.

Reservations

It is common for small hotels not to have centralized management system due to its price. Often reservations are handled over phone, email, via website and booking website. There is no centralized system where all the bookings are gathered. The hotel management is not willing to spend money on the professional website with a reservation system. The excel reservation file can be created to improve the booking handling. Example of excel reservation system is shown in Appendix 3.

Even though the excel program can bring some order to the work, it is unable to reduce the amount of unpaid nights spent at the hotel by itself.

Traveler's card

Traveler's card can be created in Google drive (see App. 1) and this process can become paperless. Every guest will be offered to fill in the requested information on stationary computer at the hotel premises or link can be sent to the traveler's email and filled in via guest's device.

Salary

Salary calculation is another issue existing in the hotel in question. Salary is paid per hour and hours are often calculated wrong. In order to avoid mistakes in the calculation another section can be added to the same excel file where workers can mark down their hours and they will be automatically calculated, displaying the number of hours, salary before and after tax (See App. 2).

Such excel file is easy to make and there are quite many examples of how it can look like on the internet. The owner can make it himself and it will not cost anything.

Digitalization tools listed above will allow to reduce costs associated with theft (800 euros). Profitability analysis is represented in the table below (see table 9) (for more detailed calculation see App. 7):

Table 9 Estimates for a combination of simple digitalization tools (Author)

Combination of simple digitalization tools	Profitability Index	Discounted payback period, years	NPV	IRR
	13.32	1.34	€ 3,203.58	307%

As it can be seen from the table 9 such option is profitable, however, it does not cover the losses associated with unpaid staying. It just helps to avoid losses associated with theft.

6.3 Reservation system on the website and keyless system

Reservation system

Currently hotel website is purely static with no online reservation system available. The only possible way to book a room is via phone/email/ booking or via form on the website. Availability cannot be checked immediately. Website can be upgraded by adding online reservation system with an opportunity to pay for the booked room. Such feature has to be added by a professional.

In order to estimate possible cost of adding such a feature, Constructive cost model or COCOMO is used. This model is also used to estimate the schedule and effort needed to produce the software.

Table 10 Estimates for COCOMO model calculation (Author)

Function	Count	Weighting Factor
Number of user input	60	3
Number of user output	2	5
Number of inquiries	9	6
Number of files	3	10
Number of external interfaces	1	5

FP (Function points)= (60*4) + (2*5) + (9*6) + (3*10) + (1*5) = 339

SLOC (Source lines of code) = 339 * 67(PHP) (Calleja, A. & Tapiador, J. & Caballero, J.)= 22713 PHP(67)

KSLOC (1000(K) Source Lines of Code) = 22713 / 1000 = 22.71

This project in question is organic which means it is a simple project, thus coefficients for organic

projects are applied. The team needed for the project is small, the problem is well understood and has been solved in the past and the team members have a nominal experience how to deal with it (Geeksforgeeks).

Effort E = (PM - Staff members needed)) = a * (KSLOC)^b
E = 3.2 * 22.71^1.05 = 84.95

Estimate Time (in days)
• D = c * E^d
• D = 2.5 * 84.95^0.38 = 13.52 days
• People required
• E/D = 84.95 / 13.52 = 6.28 ~ 7 people

Based on the COCOMO calculation, the price of the reservation system development is going to be around 28512 euros.
13.52 days * 6.28 people * 8 hours/day = 158.4 hours
158.4 hours*180 euros = 28512 euros
Average Hourly Rates for Offshore Development Services: Software Development Costs Guide 2019: 180 euros (Rumyantseva, S., 2019)

Keyless system
Running a hotel business requires high security measures in place, otherwise the risk of theft increases and it can restrict guests from wanting to use the hotel. Many actions can be taken to prevent criminal activities or reduce it; usage of keyless system instead of traditional keys is one of them.

These have proved to be both a secure and cost-effective way to improve hotel security as they are directly connected to a computer system that can be tracked and alerted by staff when a crime occurs. Furthermore, If a card is lost or stolen, it can easily be deactivated, ensuring that no rooms can be accessed – a huge advantage for visitors as they feel more comfortable using your services.

Keyless system is a way to limit unwanted guests to the rooms. The door can be opened with a smart phone, card or by entering door code. The system functions with batteries and it is easy to

install.

Figure 12 *Keyless system, ebay.com*

Keyless system can be purchase from ebay.com. Price starts from 70 euros per set (Ebay). Taking into account that there are 20 rooms at the hotel, total price for the keyless system will be 70 euros * 20 rooms = 1400 euros plus installation costs.

Keyless system can protect from theft of hotel property by unknown people who could get into the room. Damage from theft is 800 euros a year.

Table 11 Reservation system on the website and keyless system (Author)

Reservation system on the website and keyless system	**PI**	**DPP, years**	**NPV**	**IRR**
	0.12	12.22	€ (26,448.42)	-21%

As it can be seen from the calculations, reservation system on the website and keyless system is not a profitable. PI is less than 1, NPV is negative. Thus, such option should not be adopted by the hotel.

6.4 Combination of a centralized management system without monthly fee with key door boxes

Cost of the centralized management system without monthly fee is 99 euros and it saves 2000 euros annually, helping to avoid unpaid nights. The price of one door code box is 260 euros and

it saves 800 euros annually, protecting from theft. As it can be seen from the table 12 such option is profitable for the small hotel in question and may be implemented. PI is more than 1, NPV is positive.

Table 12 Combination of a centralized management system without monthly fee with key door boxes (Author)

Combination of a centralized management system without monthly fee with a key door boxes	**PI**	**DPP, years**	**NPV**	**IRR**
	33.77	1.13	€ 11,763.53	780%

6.5 Combination of a centralized management system without monthly fee with a keyless system

Cost of the centralized management system without monthly fee is 99 euros and it saves 2000 euros annually, helping to avoid unpaid nights. Total price for the keyless system is 1400 euros and it saves 800 euros, protecting from theft of hotel property by unknown people who could get into the room.

Table 13 Combination of a centralized management system without monthly fee with a keyless system (Author)

Combination of a centralized management system without monthly fee with a keyless system	**Profitability Index**	**Discounted payback period, years**	**NPV**	**IRR**
	8.09	1.56	€ 10,623.53	186%

6.6 Overall estimation of different digitalization tools

In this section all above-mentioned digitalization tools are to be compared. Their profitability indicators are presented in Table 14.

Table 14 Overall estimation of different digitalization tools (Author)

Options	**Investment cost, €**	**Total savings, €**	**PI**	**DPP, years**	**NPV**	**IRR**

1. Centralized management systems, with monthly fee						
Cloudbeds	10,020	10,000	0.86	Not profitable	-€ 1,361.05	0%
Hotelfriend	5,940	10,000	1.46	4.3	€ 2,718.95	20%
Hotelist	8,210.4	10,000	1.05	5.71	€ 448.55	7%
Seekom	6,000	10,000	1.44	4.34	€ 2,658.95	20%
Uplisting	9,000	10,000	0.96	Not profitable	-€ 341.05	4%
2. Centralized management system, purchased ones						
	99	10,000	87.46	1.05	€ 8,559.95	2020%
3. Combination of simple digitalization tools						
	260	4,000	13.32	1.34	€ 3,203.58	307%
4. Reservation system on the website and keyless system						
	29,912	*14,000*	*0.12*	12.22	-€ 26,448.42	none
5. Combination of a centralized management system without monthly fee with key door boxes						
	359	14,000	33.77	1.13	€ 11,763.53	780%
6. Combination of a centralized management system without monthly fee with a keyless system						
	1,499	14,000	8.09	1.56	€ 10,623.53	186%

Based on the profitability analysis of different digitalization tools it can be concluded that the most profitable ones are:

- Centralized management system, without monthly fee (1)
- Combination of a centralized management system without monthly fee with a key door boxes (5)
- Combination of simple digitalization tools (3)
- Combination of a centralized management system without monthly fee with a keyless system (6)

6.6 Sensitivity analysis

6.6.1 Combination of a centralized management system without monthly fee with key door boxes

This section is dedicated to the sensitivity analysis which is conducted due to some imprecision in estimates. Combination of a centralized management system without monthly fee with key door boxes was selected for the sensitivity analysis because it appears to be the most profitable option. This analysis will examine how costs of this combination (359 euros) and avoided losses impact NPV.

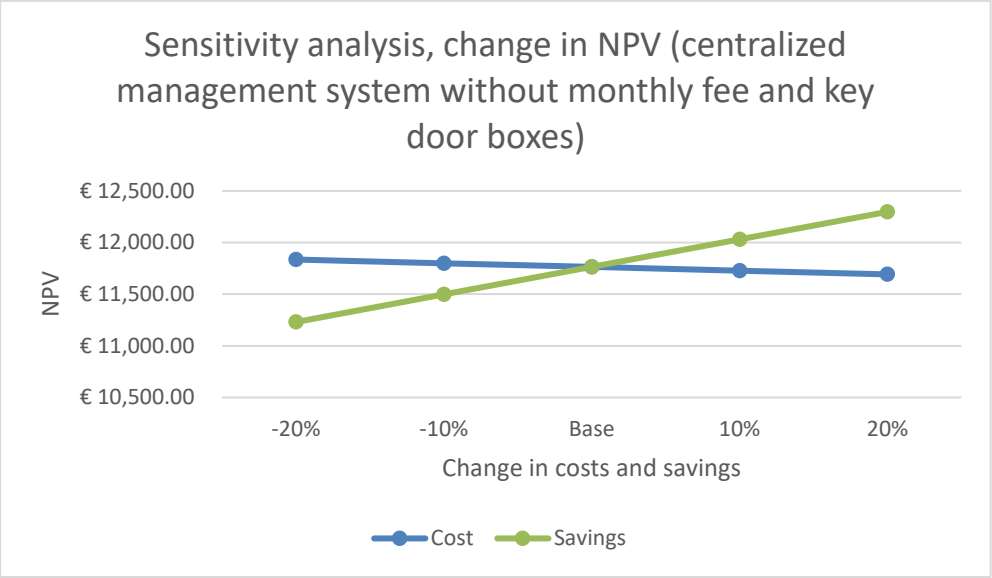

Figure 13 *Sensitivity analysis, change in NPV (centralized management system without monthly fee and key door boxes) (Author)*

From the sensitivity analysis it can be concluded that the lower the costs and the higher the savings are, the higher the NPV is. (for detailed calculations see App. 11)

6.6.2 Sensitivity analysis for the reservation system embedded to the website

Based on the COCOMO calculation, the price of the reservation system development is going to be around 28512 euros. There is some degree of imprecision and the sensitivity analysis is conducted to see the variation in NPV depending on change in losses avoided and costs of the system.

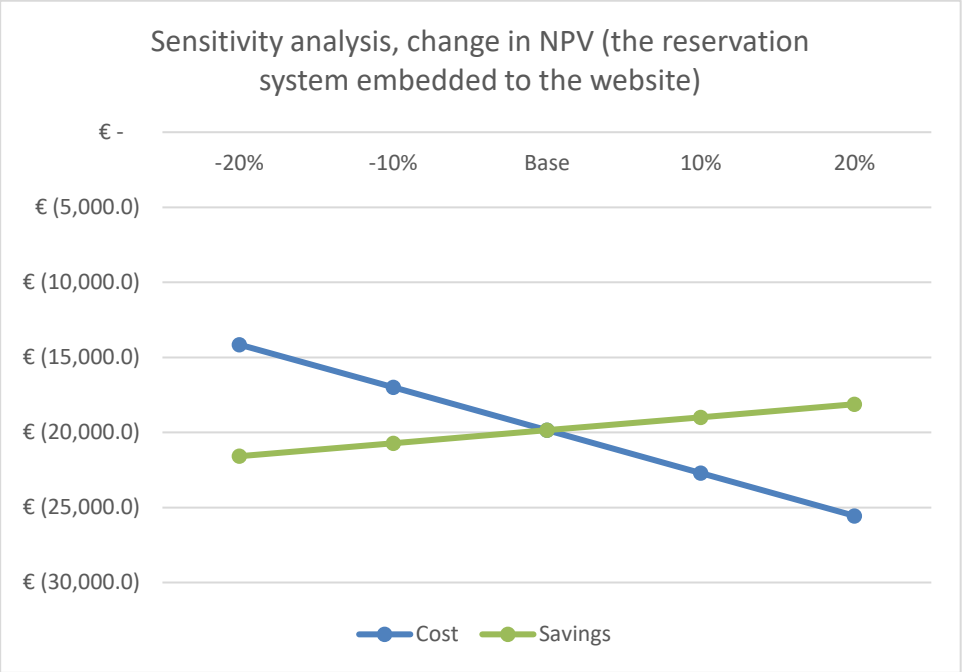

Figure 14 *Sensitivity analysis, change in NPV (the reservation system embedded to the website) (Author)*

As it can be seen from the chart above, adding online reservation system to the hotel's website is going to be more profitable if the expenses associated with the system decrease and savings, in turn, increase. (for detailed calculations see App. 11) The lower the costs are and the higher the saving are, the higher NPV becomes.

7 DISCUSSION AND CONCLUSION

7.1 Main Findings and Contributions

The research question posed in this thesis was "What are the most profitable digitalization tools can be adopted by a small hotel business?" A literature review revealed that there is a limited research made in sphere of digitalization and how it is applied to the real business environment. However, there is a growing interest and understanding that the digitalization is the future and more efforts should be made in order to adopt this technologies. Nowadays big hospitality providers are launching digitalization solutions into their work. More and more hotels are acquiring their own management systems, installing various digital tools that can cut costs on electricity and water consumption, make guests' experience more pleasant and personalized. Big hospitality providers already have the understanding how important digitalization is in terms of increasing number of visitors, both those who are staying at the hotel for the first time, and

returning guests.

However, literature review and theoretical background revealed some challenges and problems faced on the way of digitalization tools implementations. There were challenges associated with reluctance of management to introduce any changes, financial issues, possible complexity of the matter as a whole. The nature of the tourism and hospitality industries is traditionally customer-oriented, that is why for many managers it is hard to see the relation of IT and services, they see them as two unrelated concepts. Thus, IT may often play a secondary role. Despite the increasing emphasis on IT, many managers are often either reluctant, or even resistant to incorporate IT into their decision-making processes. Communication between managers and IT technicians leaves much to be desired, if managers do not have sufficient knowledge in IT sphere and are unable to assess the benefits associated with digitalization. It is important that managers stay open towards new technological advances and be ready to adopt the most suitable ones. The IT knowledge and skills of staff should also be upgraded constantly, because this is the way to assure the overall technical proficiency.

The conducted research identified several options of digitalization transformation, performed their valuation and suggested the most profitable ones. The following options were considered to be the most profitable ones for the small hotel business in question, they are the following:

- Centralized management system, without monthly fee
- Combination of simple digitalization tools
- Combination of a centralized management system without monthly fee with a key door boxes
- Combination of a centralized management system without monthly fee with a keyless system

Among them, the combination of a centralized management system without monthly fee with a key door boxes was considered to be the most profitable one. It helps to avoid the losses associated with unpaid nights and theft.

Sensitivity analysis performed to examine how costs of this combination and avoided losses impact NPV revealed that the lower the costs and the higher the losses avoided are, the higher the NPV is.

The current research contributed to the studies made in sphere of hospitality and digitalization tools application. There is some research made concerning big hotel chains or large hospitality service providers, but studies on small accommodation providers are scarce.

In terms of the industry as a whole, hospitality field is developing quite fast. However, some enhancements need to be implemented in the hospitality field to reshape its service platform to fit into the modern technological landscape. Personalization of experiences and digitalization of services are the fronts to focus on. Some hospitality service providers have taken radical steps to change their services. Smaller service providers are still pondering upon adoption of these services due to their cost. However, already now it is clear that progress in this sphere will be just growing and such advances like body area sensors, augmented reality, and so on will become quite widely spread in future.

Adoption of digitalization tools brings new issues to deal with. For example, security of customer data. Privacy of all customer related information should be maintained at high level.

7.2 Limitations and Future Research

The main complication concerning this research is related to limited theoretical base on the subject. The topic is quite new and the research is quite limited. There are not that many scientific publications on digitalization in hospitality industry. Even less publications exist on the practical adoption of digitalization tools, especially concerning small- and medium-sized enterprises.

However, all these limitation allow for quite extended future research in this field. One future research opportunity is to investigate if digitalization is a feasible solution for rural hospitality service providers. Can digitalization affect the number of visitors of a sight or a resort? What digitalization tools are particularly valuable when talking about increasing profits and number of customers in small- and medium-sized hotels?

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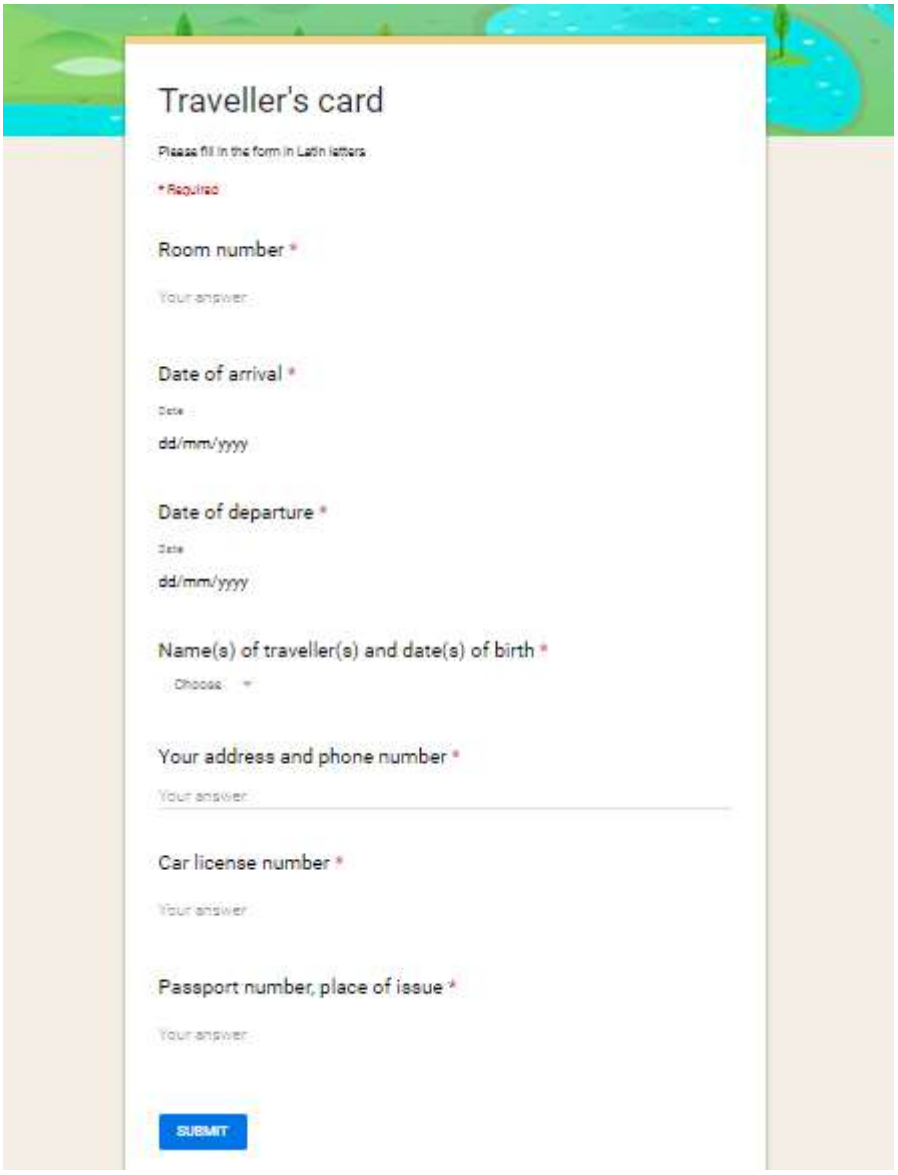
Appendix 1. Traveler's card



Traveller's card

Please fill in the form in Latin letters

* Required

Room number *

Your answer

Date of arrival *

Date

dd/mm/yyyy

Date of departure *

Date

dd/mm/yyyy

Name(s) of traveller(s) and date(s) of birth *

Choose

Your address and phone number *

Your answer

Car license number *

Your answer

Passport number, place of issue *

Your answer

SUBMIT

Appendix 2. Hours and salary calculation

Month			**January**			
Worker			**Worker A**			
Date	**Shift**			**Hours**	**Double salary**	**Total**
1.01	8:00		13:00	5:00	5:00	
2.01	8:00		11:55	3:55		
3.01	8:30		11:50	3:20		
4.01	8:30		11:50	3:20		
5.01	8:00		13:00	5:00		
6.01	8:00		11:55	3:55		
7.01	8:30		11:50	3:20		
Week 1	hours			27:50:00	5:00:00	32:50:00
8.01	8:00		13:00	5:00		
9.01	8:00		11:55	3:55		
10.01	8:30		11:50	3:20		
11.01						
12.01	8:00		13:00	5:00		
13.01	8:00		11:55	3:55		
14.01						
Week 2					0:00:00	0:00:00
15.01	8:00		13:00	5:00		
16.01	8:00		11:55	3:55		
17.01						
18.01						
19.01	8:00		13:00	5:00		
20.01	8:00		11:55	3:55		
21.01	8:30		11:50	3:20	3:20	
Week 3	hours			21:10:00	3:20:00	24:30:00
22.01	8:00		13:00	5:00		
23.01	8:00		11:55	3:55		
24.01	8:30		11:50	3:20		
25.01	8:30		11:50	3:20	3:20	
26.01	8:00		13:00	5:00		
27.01	8:00		11:55	3:55		
28.01	8:30		11:50	3:20		
Week 4	hours			27:50:00	3:20:00	31:10:00
29.01	8:00		13:00	5:00		
30.01	8:00		11:55	3:55		
31.01	8:30		11:50	3:20		
Week 5	hours			12:15:00	3:20:00	15:35:00
Total, hours				**89:05:00**	**15:00:00**	**104:05:00**
Tax percentage		10				988.79
Pension contributions		6.75				808.34
Social contributions		1.5				

Appendix 3. Excel reservation system

CONFIG | RESERVATIONS | AVALIABILITY | RECEIPT | REPORTS | INSTRUCTION

ANALYSIS

Start date	1/1/2019															
Room number	Room type	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed
		2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1	12/1	13/1	14/1	15/1	16/1
10	double															
11	double															
12	double															
14	quad															
20	triple															
21	triple															
22	double															
23	triple															
24	double															
25	Presidential															
26	single															
27	single															
30	single															
31	triple															
32	single															
33	triple															
34	single															
35	triple															
asunto 4	double															
asunto 5	triple															

Subtitle
Available
Not available
Double booking

CONFIG | RESERVATIONS | AVALIABILITY | RECEIPT | REPORTS | INSTRUCTION

CHECK-IN/OUT | EXPENSES

Guest name	Check in	Check-out	Nights	Adults	Children	Total	Type	Total Daily	discounts	Losses	Total
guest 1	12/1/2019	13/1/2019	1	2	0	6	single	49	€ 5.00	€ -	€ 44.00
guest 2	12/1/2019	13/1/2019	1	2	0	2	asunto 4, 2h	80	€ 1.00	€ -	
guest 1	12/1/2019	13/1/2019	1	2	0	1	double	65	€ 1.00	€ -	€ 64.00
guest 1	12/1/2019	13/1/2019	1	2	0	6	asunto 10	€ 145.00			€ 145.00
guest 2	12/1/2019	13/1/2019	1	2	0	2	asunto 5	99			€ 99.00
guest 1	12/1/2019	13/1/2019	1	2	0	1	triple	75			€ 75.00

Appendix 4. Hotel management systems' comparison

Hotel management systems' comparison					
# of rooms	20				
Name of the system	**Cloudbeds**	**Hotelfriend**	**Hotelist**	**Seekom**	**Uplisting**
Price per month	167	99	136.84	100	150
Ideal number of Users	1 - 1000+	100-499	2-9	1000+	1 - 1000+
Platform	Cloud/Windows/Apple				
Rating	4.5	-	5	4.5	5
Ease of use	4.5	-	5	4	5
Customer Support	4.5	-	5	4.5	5
Features & Functionality	4.5	-	4.5	4	4.5
Value for Money	4.5	-	5	4.5	5
Features:					
Built-in Accounting	✓	✓	✓		
Catering		✓	✓		
CRM	✓	✓	✓	✓	✓
Employee Management	✓	✓	✓		
Extended Stay	✓				
GDS/OTA Integration	✓	✓	✓	✓	✓
Loyalty Program		✓	✓	✓	
Maintenance Management	✓	✓	✓		
Marketing Automation	✓	✓	✓		
Multi-Property	✓	✓	✓	✓	✓
Online Booking	✓	✓	✓	✓	
Point of Sale (POS)	✓	✓	✓		
Single Property	✓	✓	✓	✓	✓
Vacation Rental	✓	✓	✓	✓	✓

Appendix 5. Profitability analysis for Centralized management systems (with monthly fee)

1. Profitability Index calculations

Profitability index estimation for each system for five years time period:

Profitability Index (Cloudbeds) = (-1,361.05 + (167 euros *12 months *5 years)) / (167 euros *12 months *5 years) = -1,361.05 + 10,020 /10,020 = 0.86

Profitability Index (Hotelfriend) = (2,718.95 + (99 euros *12 months *5 years)) / (99 euros *12 months *5 years) = (2,718.95 + 5940) /5940 = 1.46

Profitability Index (Hotelist) = (448.55 + (136.84 euros *12 months *5 years)) / (136.84 euros *12 months *5 years) = (448.55 + 8210.4) / 8210.4 = 1.05

Profitability Index (Seekom) = (2,658.95 +(100 euros *12 months *5 years)) / (100 euros *12 months *5 years) = (2,658.95 + 6000) / 6000 = 1.44

Profitability Index (Uplisting) = (-341.05+(150 euros *12 months *5 years)) / (150 euros *12 months *5 years) = (-341.05+ 9000) / 9000 = 0.96

2. Discounted payback period

First, cash flows are calculated. Cost of the project is monthly pay multiplied by number of months and multiplied by number of years. All the systems listed are aimed to save 2000 euros per year. Discount rate is based on Weighted Average Cost of Capital (WACC) and equals 5%.

WACC is calculated based on the following data:

Cost of equity (rE) = 5%

Total equity (E) = 1,000,000 euros

Cost of debt (rD) = 0%

Total debt (D) = 0

Corporate tax rate (t) = 35%

Cost of the system

Cloudbeds	10020
Hotelfriend	5940
Hotelist	8210.4
Seekom	6000
Uplisting	9000

Cloudbeds				**Hotelfriend**			
Pay back period				**Pay back period**			
Year	**CF**	**Balance**		**Year**	CF	Balance	
0	-$10,020.00	€ (10,020.00)		**0**	€ (5,940.00)	€ 5,940.00)	
1	2000	€ (8,020.00)		**1**	2000	€ (3,940.00)	
2	2000	€ (6,020.00)		**2**	2000	€ (1,940.00)	
3	2000	€ (4,020.00)		**3**	2000	€ 60.00	
4	2000	€ (2,020.00)		**4**	2000	€ 2,060.00	
5	2000	€ (20.00)		**5**	2000	€ 4,060.00	
	5.01	**years**			**2.97**	**years**	
Discounted payback period (DBP)				**Discounted payback period (DBP)**			
Year	CF	PV CF	Balance	**Year**	CF	PV CF	Balance
0	€ 10,020.00)	€ (10,020.00)	€ (10,020.00)	**0**	€ (5,940.00)	€ (5,940.00)	€ (5,940.00)
1	2000	€ 1,904.76	€ (8,115.24)	**1**	2000	€ 1,904.76	€ (4,035.24)
2	2000	€ 1,814.06	€ (6,301.18)	**2**	2000	€ 1,814.06	€ (2,221.18)
3	2000	€ 1,727.68	€ (4,573.50)	**3**	2000	€ 1,727.68	€ (493.50)
4	2000	€ 1,645.40	€ (2,928.10)	**4**	2000	€ 1,645.40	€ 1,151.90
5	2000	€ 1,567.05	€ (1,361.05)	**5**	2000	€ 1,567.05	€ 2,718.95
		Not profitable				**years**	**4.30**

Hotelist				**Seekom**			
Pay back period				**Pay back period**			
Year	**CF**	**Balance**		**Year**	**CF**	**Balance**	
0	€ (8,210.40)	€ (8,210.40)		**0**	€ (6,000.00)	€ (6,000.00)	
1	2000	€ (6,210.40)		**1**	2000	€ (4,000.00)	

2	2000	€ (4,210.40)		**2**	2000	€ (2,000.00)	
3	2000	€ (2,210.40)		**3**	2000	€ -	
4	2000	€ (210.40)		**4**	2000	€ 2,000.00	
5	2000	€ 1,789.60		**5**	2000	€ 4,000.00	
	4.1052	**years**			**3**	**years**	
Discounted payback period (DBP)				**Discounted payback period (DBP)**			
Year	CF	PV CF	Balance	**Year**	CF	PV CF	Balance
0	€ (8,210.40)	€ (8,210.40)	€ (8,210.40)	**0**	€ (6,000.00)	€ (6,000.00)	€ (6,000.00)
1	2000	€ 1,904.76	€ (6,305.64)	**1**	2000	€ 1,904.76	€ (4,095.24)
2	2000	€ 1,814.06	€ (4,491.58)	**2**	2000	€ 1,814.06	€ (2,281.18)
3	2000	€ 1,727.68	€ (2,763.90)	**3**	2000	€ 1,727.68	€ (553.50)
4	2000	€ 1,645.40	€ (1,118.50)	**4**	2000	€ 1,645.40	€ 1,091.90
5	2000	€ 1,567.05	€ 448.55	**5**	2000	€ 1,567.05	€ 2,658.95
		years	**5.71**			**years**	**4.34**

Uplisting			
Pay back period			
Year	**CF**	**Balance**	
0	€ (9,000.00)	€ (9,000.00)	
1	2000	€ (7,000.00)	
2	2000	€ (5,000.00)	
3	2000	€ (3,000.00)	
4	2000	€ (1,000.00)	
5	2000	€ 1,000.00	
	4.5	**years**	
Discounted payback period (DBP)			
Year	CF	PV CF	Balance
0	€ (9,000.00)	€ (9,000.00)	€ (9,000.00)
1	2000	€ 1,904.76	€ (7,095.24)
2	2000	€ 1,814.06	€ (5,281.18)
3	2000	€ 1,727.68	€ (3,553.50)

4	2000	€ 1,645.40	€ (1,908.10)
5	2000	€ 1,567.05	€ (341.05)
		Not profitable	

3. Net Present Value (NPV)

WACC	**5%**					
Cloudbeds						
Year	0	1	2	3	4	5
FCF	-10020	2000	2000	2000	2000	2000
NPV	€ (1,361.05)					
DFCF	€ (10,020.00)	€ 1,904.76	€ 1,814.06	€ 1,727.68	€ 1,645.40	€ 1,567.05
NPV	€ (1,361.05)					
Hotelfriend						
Year	0	1	2	3	4	5
FCF	-5940	2000	2000	2000	2000	2000
NPV	€ 2,718.95					
DFCF	€ (5,940.00)	€ 1,904.76	€ 1,814.06	€ 1,727.68	€ 1,645.40	€ 1,567.05
NPV	€ 2,718.95					
Hotelist						
Year	0	1	2	3	4	5
FCF	-8210.4	2000	2000	2000	2000	2000
NPV	€ 448.55					
DFCF	€ (8,210.40)	€ 1,904.76	€ 1,814.06	€ 1,727.68	€ 1,645.40	€ 1,567.05
NPV	€ 448.55					
Seekom						
Year	0	1	2	3	4	5
FCF	-6000	2000	2000	2000	2000	2000
NPV	€ 2,658.95					
DFCF	€ (6,000.00)	€ 1,904.76	€ 1,814.06	€ 1,727.68	€ 1,645.40	€ 1,567.05
NPV	€ 2,658.95					
Uplisting						
Year	0	1	2	3	4	5
FCF	-9000	2000	2000	2000	2000	2000
NPV	€ (341.05)					
DFCF	€ (9,000.00)	€ 1,904.76	€ 1,814.06	€ 1,727.68	€ 1,645.40	€ 1,567.05
NPV	€ (341.05)					

4. Internal Rate of Return (IRR)

Rate	**5.00%**								
Cloudbeds		Hotelfriend		Hotelist		Seekom		Uplisting	
Year	CF	Year	CF	Year	CF	Year	CF	Year	CF
0	€ (10,020.00)	0	€ (5,940.00)	0	€ (8,210.40)	0	€ 6,000.00)	0	€ (9,000.00)
1	2000	1	2000	1	2000	1	2000	1	2000
2	2000	2	2000	2	2000	2	2000	2	2000
3	2000	3	2000	3	2000	3	2000	3	2000
4	2000	4	2000	4	2000	4	2000	4	2000
5	2000	5	2000	5	2000	5	2000	5	2000
IRR	0%	IRR	20%	IRR	7%	IRR	20%	IRR	4%

Appendix 6. Profitability analysis for Centralized management systems (without monthly fee)

1. Profitability Index calculations

Profitability Index = (8,559.95 + -99) / -99 = 87.46

2. Discounted payback period

Discounted payback period (DBP)			
Year	CF	PV CF	Balance
0	€ (99.00)	€ (99.00)	€ (99.00)
1	2000	€ 1,904.76	€ 1,805.76
2	2000	€ 1,814.06	€ 3,619.82
3	2000	€ 1,727.68	€ 5,347.50
4	2000	€ 1,645.40	€ 6,992.90
5	2000	€ 1,567.05	€ 8,559.95
		years	1.05

3. Net Present Value (NPV)

WACC	**5%**					
Year	0	1	2	3	4	5
FCF	€ (99.00)	2000	2000	2000	2000	2000
NPV	€ 8,559.95					

4. Internal Rate of Return (IRR)

Rate	**5.00%**
Year	CF
0	€ (99.00)
1	2000
2	2000
3	2000
4	2000
5	2000
IRR	2020%

Appendix 7. Profitability analysis for a combination of simple digitalization tools (Excel file and door code box)

1. Profitability Index calculations

Profitability Index = (3203.58 + -260) / -260 = 13.32

2. Discounted payback period

Discounted payback period (DBP)			
Year	CF	PV CF	Balance
0	€ (260.00)	€ (260.00)	€ (260.00)
1	800	€ 761.90	€ 501.90
2	800	€ 725.62	€ 1,227.53
3	800	€ 691.07	€ 1,918.60
4	800	€ 658.16	€ 2,576.76
5	800	€ 626.82	€ 3,203.58
		years	1.34

3. Net Present Value (NPV)

WACC	**5%**					
Year	0	1	2	3	4	5
FCF	€ (260.00)	800	800	800	800	800
NPV	€ 3,203.58					

4. Internal Rate of Return (IRR)

Rate	**5.00%**
Year	CF
0	€ (260.00)
1	800
2	800
3	800
4	800
5	800
IRR	307%

Appendix 8. Profitability analysis for a reservation system on the website and keyless system

1. Profitability Index calculations

Profitability Index = (-26,448.42 + -29912) / -29912 = 0.12

2. Discounted payback period

Discounted payback period (DBP)			
Year	CF	PV CF	Balance
0	€ (29,912.00)	€ (29,912.00)	€ (29,912.00)
1	2800	€ 2,666.67	€ (27,245.33)
2	2800	€ 2,539.68	€ (24,705.65)
3	2800	€ 2,418.75	€ (22,286.91)
4	2800	€ 2,303.57	€ (19,983.34)
5	2800	€ 2,193.87	€ (17,789.47)
		years	12.22

3. Net Present Value (NPV)

WACC	**5%**					
Year	0	1	2	3	4	5
FCF	€ (29,912.00)	800	800	800	800	800
NPV	€ (26,448.42)					

4. Internal Rate of Return (IRR)

Rate	**5.00%**
Year	CF
0	€ (29,912.00)
1	2800
2	2800
3	2800
4	2800
5	2800
IRR	-21%

Appendix 9. Profitability analysis for a combination of a centralized management system without monthly fee with a key door boxes

1. Profitability Index calculations

Profitability index of the keyless system is the following:

Profitability Index = (11763.53 + -359) / -359 =33.77

Cost of the centralized management system without monthly fee is 99 euros and it saves 2000 euros annually, helping to avoid unpaid nights. The price of one door code box is 260 euros and it saves 800 euros annually, protecting from theft.

2. Discounted payback period

Discounted payback period (DBP)			
Year	CF	PV CF	Balance
0	€ (359.00)	€ (359.00)	€ (359.00)
1	2800	€ 2,666.67	€ 2,307.67
2	2800	€ 2,539.68	€ 4,847.35
3	2800	€ 2,418.75	€ 7,266.09
4	2800	€ 2,303.57	€ 9,569.66
5	2800	€ 2,193.87	€ 11,763.53
		years	1.13

3. Net Present Value (NPV)

WACC	**5%**					
Year	0	1	2	3	4	5
FCF	€ (359.00)	2800	2800	2800	2800	2800
NPV	€ 11,763.53					

4. Internal Rate of Return (IRR)

Rate	**5.00%**
Year	CF
0	€ (359.00)
1	2800
2	2800
3	2800
4	2800
5	2800
IRR	780%

Appendix 10. Combination of a centralized management system without monthly fee with a keyless system

1. Profitability Index calculations

Profitability index of the keyless system is the following:

Profitability Index = 10,623.53 +-1,499.00) / -1,499.00= 8.09

Cost of the centralized management system without monthly fee is 99 euros and it saves 2000 euros annually, helping to avoid unpaid nights. Total price for the keyless system is 1400 euros and it saves 800 euros, protecting from theft of hotel property by unknown people who could get into the room

2. Discounted payback period

Discounted payback period (DBP)			
Year	CF	PV CF	Balance
0	€ (1,499.00)	€ (1,499.00)	€ (1,499.00)
1	2800	€ 2,666.67	€ 1,167.67
2	2800	€ 2,539.68	€ 3,707.35
3	2800	€ 2,418.75	€ 6,126.09
4	2800	€ 2,303.57	€ 8,429.66
5	2800	€ 2,193.87	€ 10,623.53
		years	1.56

3. Net Present Value (NPV)

WACC	**5%**					
Year	0	1	2	3	4	5
FCF	€ (1,499.00)	2800	2800	2800	2800	2800
NPV	€ 10,623.53					

4. Internal Rate of Return (IRR)

Rate	**5.00%**
Year	CF
0	€ (1,499.00)
1	2800
2	2800
3	2800
4	2800
5	2800

IRR	186%

Appendix 11. Sensitivity analysis

Sensitivity analysis for the combination of a centralized management system

5 year project sensitivity analysis				
	Input	Min	Base	Max
Costs	€ (359.00)	€ (359.00)	€ (359.00)	€ (359.00)
CF per year 1	€ 2,800.00	€ 2,600.00	€ 2,800.00	€ 3,000.00
CF per year 2	€ 2,800.00	€ 2,600.00	€ 2,800.00	€ 3,000.00
CF per year 3	€ 2,800.00	€ 2,600.00	€ 2,800.00	€ 3,000.00
CF per year 4	€ 2,800.00	€ 2,600.00	€ 2,800.00	€ 3,000.00
CF per year 5	€ 2,800.00	€ 2,600.00	€ 2,800.00	€ 3,000.00
Interest rate	5%	4%	5%	6%
NPV	€ 11,763.53			

		Cost of the option				
	€ 11,763.53	€ (339.00)	€ (349.00)	€ (359.00)	€ (369.00)	€ (379.00)
Losses avoided	€ 3,200.00	12164.487	12154.487	12144.487	12134.487	12124.487
	€ 3,000.00	11974.011	11964.011	11954.011	11944.011	11934.011
	€ 2,800.00	11783.535	11773.535	11763.535	11753.535	11743.535
	€ 2,600.00	11593.058	11583.058	11573.058	11563.058	11553.058
	€ 2,400.00	11402.582	11392.582	11382.582	11372.582	11362.582

Sensitivity analysis for the reservation system embedded to the website

	Input	**Min**	**Base**	**Max**
cost	€ 28,512.00	€ 28,512.00	€ 28,512.00	€ 28,512.00
CF per year 1	€ 2,000.00	€ 1,800.00	€ 2,000.00	€ 2,200.00
CF per year 2	€ 2,000.00	€ 1,800.00	€ 2,000.00	€ 2,200.00
CF per year 3	€ 2,000.00	€ 1,800.00	€ 2,000.00	€ 2,200.00
CF per year 4	€ 2,000.00	€ 1,800.00	€ 2,000.00	€ 2,200.00
CF per year 5	€ 2,000.00	€ 1,800.00	€ 2,000.00	€ 2,200.00
Interest rate	5%	4%	5%	6%

NPV	€ 19,853.05			

		Costs of the option				
	€ 19,853.05	€ 26,512.00	€ 27,512.00	€ 28,512.00	€ 29,512.00	€ 30,512.00
Losses avoided	€ 2,400.00	35551.90	36551.90	37551.90	38551.90	39551.90
	€ 2,200.00	35361.42	36361.42	37361.42	38361.42	39361.42
	€ 2,000.00	35170.95	36170.95	37170.95	38170.95	39170.95
	€ 1,800.00	34980.47	35980.47	36980.47	37980.47	38980.47
	€ 1,600.00	34790.00	35790.00	36790.00	37790.00	38790.00