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Graduate School of Management

Master in Management Program

THE INFLUENCE OF INTERNET OF THINGS ON CUSTOMER EXPERIENCE IN RETAIL

Master's Thesis by the 2nd year student

Master in Management

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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ABSTRACT

Master Student's Name	Semenov Ivan Vladimirovich
Academic Advisor’s Name	Zyatchin Andrey Vasilevich
Master Thesis Title	The Influence of Internet of Things on Customer Experience in Retail
Description of the goal, tasks and main results the research	The purpose of this work was to find out the influence of the application of Internet of Things methods on customer experience in retail. In order to achieve this goal, the following tasks were set: • Conduct an analysis of the literature of relevant sources on the topic of customer experience, the Internet of things and retail. • Draw up a diagram of the relationship between customer experience and company loyalty based on the hypotheses derived. • Compile a questionnaire for the experiment • Carry out a statistical analysis of the obtained data • Confirm or refute the hypotheses Main results: • Received a framework that reflects the impact of customer experience on company loyalty • The positive impact of the use of the Internet of Things on the connections of the components of the compiled framework was confirmed • Proposed and ranked list of IoT devices
Keywords	IoT, Internet of Things, customer experience, customer loyalty

АННОТАЦИЯ

Автор	Семенов Иван Владимирович
Научный руководитель	Зятчин Андрей Васильевич
Название ВКР	Влияние применения методов интернета вещей на качество обслуживания клиентов в розничной торговле
Описание цели, задач и основных результатов исследования	Целью это работы было выяснить влияние применения методов интернета вещей на клиентский опыт, а также лояльность компании в розничной торговле. Для того чтобы достичь этой цели были поставлены следующие задачи: • Провести анализ литературы актуальных источников на тему клиентского опыта, интернета вещей и ритейла. • Составить схему взаимоотношения клиентского опыта и лояльности компании основываясь на выведенных гипотезах. • Составить опросник для проведения эксперимента • Провести статистический анализ полученных данных • Подтвердить или опровергнуть поставленные гипотезы Основные результаты: • Получен фреймворк, отражающий влияние клиентского опыта на лояльность компании • Было подтверждено положительное влияние применения интернета вещей на связи компоненты составленного фреймворка • Предложен и ранжирован список IoT устройств
Ключевые слова	Интернет вещей, клиентский опыт, лояльность покупателя

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INTRODUCTION

In recent years, the environment in which companies compete is changing faster and stronger than ever before. The competition between retailers is growing and attracting customers is becoming increasingly expensive. In such conditions, the most modern and environmentally friendly way to stand out in the market is to improve the experience that customers have when they interact with the business. Customer will have experience with or without companies, but it is better for business to start worrying about how it fits in customers lives.

Most of the articles where the customer experience was studied mentioned loyalty as a result of improved customer experience. Loyalty is the widespread and very quality indicator that companies seek to monetize today. Long-term and mutually beneficial relationships with customers are the key to business stability during the period of economic transformation. However, according to the McKinsey study, up to 70% of loyalty programs do not achieve their goals. Thus, companies should seek for replacements for the traditional loyalty programs and create loyalty using other instruments.

Internet of Things (further can be reduced to IoT) is a developing concept that is in great demand now and will be even more in demand in the future. At the same time, in the rapidly evolving retail landscape, consumers' needs still drive their purchase decisions. Yet new technologies such as IoT, newer business models, and big data/predictive analysis suggest that the shopping process is going to change drastically in the nearest future (Grewal et al., 2017).

The big reason to pay attention to the Internet of Things were market indicators. Globally the IoT market in retail in 2020 was estimated at 35,63 billion dollars, the predicted size of the market in 2026 is estimated at 67,60 billion dollars (Karin, 2021). We can see that the market is waiting for significant development.

The IoT have been already widely used in manufacturing and in logistics, where it has already proved its usefulness. In academic articles, Internet of Things is considered mostly from the perspective of implementation in supply chain management and inventory management. The role of this technology in creating experiences for customers and in direct contact while shop clients make their shopping is understudied. But at the same time, I suppose, it has great potential and may change people's daily habits in shopping. I was inspired by Amazon Go shops, that were opened for the staff of the company in 2016. By 2020 Amazon had already opened 26 stores in different cities across the United States of America. This is an example of one of the approaches to the question of how the grocery industry will change in the future.

The retail industry is currently changing. When I was choosing the topic, the main driver was COVID-19 pandemic. However, I would like to mention that even the direct effects of pandemic were diminished and government regulations had been loosened, customers had changed their habits and they will not change them back to the pre-pandemic state. One of the main changes is how companies interact with their customers in pandemic and post-pandemic era. Retail companies change the way they operate. Such turbulence periods are the high time to make innovations to attract and retain clients. Loyal customers help business stay resilient during such tough conditions brought by crisis periods. In order to increase the number of such clients, a company should improve customer experience. Digitalization and Internet of Things would be useful tools for such purposes.

Besides considering customer experience and Internet of Things, I would also like to pay attention to the brand loyalty, its nature and its connection with customer experience. I already mentioned that customer experience has an influence on attraction and retention of customers. It is mostly based on the common sense and in this work, I will study the mechanism a bit deeper.

Above I mentioned, to my point of view, main points in support of relevance of the considered topic. In the following parts I will describe all these topics in more detail with an analysis of relevant academic papers on this topic.

Additionally, I have studied smart devices that are used in the IoT assemblages, that would be used in the interconnection with the customer. Most often the Internet of things is used imperceptibly for the buyer, and the buyer receives the results. However, the IoT devices might be obvious for the customers and serve as a marketing competitive advantage.

The main goal of this research is to identify the influence of Internet of Things on the customer experience and customer loyalty and their interconnections in retail. Brand loyalty here is presented as a specific competitive advantage that a company receives if it enhances customer experience. It is expressed by the specific actions that a customer does that creates benefits for the company. Additionally, as a practical thing I would like to specify the IoT devices that customers perceive as an additional value

In order to achieve the formulated goal, the following task were completed. Firstly, the theoretical framework for each concept was identified and described based on the corresponding academic literature. Secondly, the relations between customer experience and customer loyalty were identified. Based on these connections the visual model was created. Thirdly, the online questionnaire was created and distributed mostly among students via student chats. Additionally, IoT smart devices were identified and ranged based on the customers' opinion.

CHAPTER 1. THE ROLE OF INTERNET OF THINGS IN CUSTOMER EXPERIENCE

This chapter is devoted to give a theoretical background for the proposed research topic and the research gap. I am going to provide an analysis of the literature on basic concepts, the latest academic articles and current trends in the field of the Internet of things and customer experience. This would be useful to build the comprehensive model of relations among the mentioned concepts. This chapter is organized in the following way. Firstly, the information about the concept of Internet of things is provided. Secondly, the chapter covers the topic of customer experience, customer loyalty and customer commitment in more detail. The modern retail industry and trends are being considered. Finally, the links among the concepts are set up.

1.1. Internet of things

1.1.1. Concept of Internet of Things

The expression "Internet of Things" was created in 1999 by Kevin Ashton, the cofounder of Auto-ID Center at the Massachusetts Institute of Technology (MIT). He was making a presentation for Procter & Gamble's CEO to persuade them to put radio frequency identification (RFID) tags on the products of the company in supply chain. The tags and sensors would generate data about the location of the products, whether they had been scanned in warehouse, or placed on the shelf, or sold (Elder, 2019). The presentation needed the name that would make an impact on the decision of the company. The phrase "Internet of Things" did not become very popular immediately, but in 2008-2009 it grew far beyond the small community of computer science experts and became widespread. That anticipated the fact that after 2 years in 2011 the number of interconnected devices on the planet overtook the actual number of people (Gubbi, 2013).

What is implied by the IoT? This concept has several definitions and descriptions.

The first definition describes the IoT in a conceptual way as an extension of interconnection between people and electronic devices. The Internet of Things is a combination of a technological push and a human pull for more and ever-increasing connectivity with anything happening in the immediate and wider environment – a logical extension of the computing power in a single machine to the environment: the environment as an interface (Kramp et al., 2013). The second definition shows functional characteristics and goals of IoT implementation. A Network of interconnected objects that not only harvests information from the environment (sensing) and interacts with the physical world (actuation/command/control), but also uses existing Internet standards to provide services for information transfer, analytics, applications, and communications (Yan et al., 2008). The worldwide network of interconnected objects uniquely addressable based on standard communication protocols (Atzori et al., 2010). Interconnection of sensing and

actuating devices providing the ability to share information across platforms through a unified framework, developing a common operating picture for enabling innovative applications. This is achieved by seamless ubiquitous sensing, data analytics and information representation with Cloud computing as the unifying framework (Gubbi et al., 2013). Most fully and detailed this concept was described by Taradi (2016). IoT is assembly of things, machines, objects, components and their communication using internet. It is a global network infrastructure, linking physical and virtual objects using cloud computing, data capture, and network communications. It allows devices to communicate with each other, access information on the Internet, store and retrieve data, and interact with users, creating smart, pervasive and always-connected environments (Taradi, 2016). Thus, the Internet of things not only many different devices and instruments interconnected with wired and wireless channels connected to the Internet, but also strong integration of real and virtual environment, where communication between people and devices takes place.

In addition to the fact that devices themselves exist, read information, exchange it with each other without the need for constant human intervention, it is worth noting that smart devices included in the Internet of Things networks individually are less useful than in a bundle. It does this by creating additional value for the individual.

Kevin Ashton (2009) in the expert view that he gave to RFID Journal expressed his belief that the IoT can change the world as the Internet made it. He underlined that people should not treat RFID technology just as the better bar code, but as the thing that can make people's lives different. He explained that by the problems of human beings: limited time, attention and accuracy. And all of the mentioned, in author's opinion, interfere people with collecting data about things in the real world. Economy, society and survival are based on the things. If people had computers that gather all the information from the things directly, they would be able to count and track everything. Recent information technology is too dependent on the data originated by human and that is the problem (Ashton, 2009).

The Internet of Things is often associated with such concepts as radio frequency identification (RFID) and wireless sensor networks (WSN).

RFID technology uses electromagnetic waves to identify and track tags attached to the objects. It enables design of microchips for wireless data communication. There are two types of RFID tags: active and passive. Passive tags do not have its own battery and being activated by other devices (readers). This resulted in many applications in transportation and retail. Another example is that this technology is used in bank cards. Active readers have their own battery supply

and can instantiate communication. The main applications of active tags are in port containers for monitoring cargo (Juels, 2006). I gave a few examples of implementation of RFID technology, but the spheres where they are already used or could be implemented are countless.

WSN refer to networks of spatially dispersed and dedicated sensors that monitor and record the physical conditions of the environment and forward the collected data to a central location. WSNs can measure environmental conditions such as temperature, sound, pollution levels, humidity and wind (Ullo & Sinha, 2020).

Besides two mentioned above other technologies are used in the IoT. More than that RFID and WSN are not just separate things. Nowadays more and more devices are becoming “smart”. Traditional items familiar to us could now be equipped with different sensors, processors and actuators which allows to expand their functionality. Such devices could be found everywhere: factories, shops, city streets, even in homes. Many everyday items will soon be included in the general network. Communication between devices is one of the key features of the Internet of Things. The interaction of smart devices not only with a person, but also with each other contributes to the emergence of synergy in which the totality of smart devices in their application will be much more valuable than the sum of individual parts. This was described by Hoffman and Novak (2018) in an assemblage theory approach to the Internet of Things. Authors mention that smart objects have significant abilities to affect and be affected by each other. A part could both exist as a separate thing by itself, but also it could be a part of the larger assemblage. In these cases, experiences produced by this device could be completely different. Working together devices could achieve things that none of them could achieve individually. Assemblages could also be a part of a bigger assemblage.

Assembled internet connected constituents (ICCs) (Hoffman & Novak, 2018) are the traditional objects that are connected via the internet. These objects influence customer experiences via traceability transparency and convenience. They also improve service, give real-time insights, increase switching costs and help to create personalized products and services (Matthijsen et al., 2017).

IoT enables device to send and receive information to each other. Networks of communicated devices generate a huge amount of information that companies can use to improve their productivity and provide their customers with the products and services they truly need. IoT technology provides companies with uninterrupted source of data which give valuable insights about customer behavior. Great opportunities arise for companies that use this information to drive relevant and compelling innovation. All this helps to understand who the company's

customers are, what they need, how they use the company's products and what communication channels are the most effective when interacting with them.

1.1.2. Internet of things in retail

Around 20 years ago the traditional retail system has changed. All of this time companies tried their best to develop methods to gather valuable information and make sure to provide the consumer with exactly what he needs and avoid unnecessary costs. Due to the increase in the competition companies are even more concerned about retention of their customers. The major driving force in the IoT technology in order to provide customers with the best inside store experience in retail industry (Singh et al., 2020).

Today retail companies have started to implement some of the IoT technologies in order to get insights into customers' needs and deliver effective promotions and boost sales. Some possible things used by companies: smart shelves with RFID tags and readers on goods and surface of the shelve, Bluetooth beacons, robots, digital signages (Singh et al., 2020).

Current levels of implementation and investment levels into IoT by CPG (consumer packaged goods) and retail industry is lower than other sectors (Kindström et al., 2013).

The ultimate objective of the connectivity of devices and data is to provide value-added services to users. The context information could be gathered from different sources broaden by the IoT systems. Retail companies get the information not only from the cashier's check but also from mobile apps, cameras, smart shelves, beacons, etc. The customers in their turn get more detailed information from different sources.

The applications of IoT in retail are various and could be split into two segments: those directly consumer/shopper facing and those more related to business infrastructure and processes. The first segment contains following examples of practices: geo-targeting, personalized offers, customized purchase experience cross selling and upselling tailored pricing, direct payment, automatic replenishment, drawing shoppers to store, in store digital interactive screens, gamification, product and offer cocreation. The second segment of infrastructure and process related practices contains following examples: shopper in store movement and behavior monitoring, intelligent store ambient and store layout, loyalty program, dynamic pricing, demographic and behavioral targeting, inventory and stock management, supply chain management, collaborative supply chain, tracking assets and equipment, payment process , in-store staff management, seamless cross channel experience, real-time processes and activities

monitoring, new business models and revenue streams. There are a number of different technology solutions for IoT: RFID, NFC, BLE, Wi-Fi, Zwave and others (Singh et al., 2020).

1.2. Customer experience

This work is directly related to customer experience and brand loyalty. In this section, I am going to analyze current academic sources that will help to reveal the main concepts and relationships in customer experience and brand loyalty theory.

1.2.1. Customer experience concept

Recently, customer experience (CX) has been closely studied by companies. The reason is it is believed that CX is one of the most important factors that helps to maintain competitive advantage. Customers now have greater influence on companies, since they tend to have more information about products, services, competitors, prices, etc. Nowadays, if a company wants to have a competitive advantage it will not be enough just to provide customers with a simple product or service. Customers seek more than just mere services and products, but experiences they would like to pay for (Pine and Gilmore, 1998). It is necessary to provide them with something that customers will memorize. And if this experience is positive, they are more likely to visit a company in the future to buy products or use its services again.

Customer experience is a personal thing that occurs at different levels and involves both the customer, the product (service), and the company that offers it (Gentile et al., 2007). CX is totally subjective and internal, and it is generated through different contact points with a company (Meyer and Schwager 2007). Thus, it is not limited by the stage of purchase, but also applied to activities before, during and after a purchase (search, purchase, consumption, after-sale support, etc.). All activities influence the current decision and repurchase intentions in the future.

Customer experience created not only by factors that a company can control (price, service, interface, retail atmosphere), but also by the elements that a retailer cannot control (influence of other people, purpose of shopping, etc.).

Customer experience is holistic in nature, incorporating the customer's cognitive, emotional, sensory, social, and spiritual responses to all interactions with a firm (Lemon & Verhoef, 2016). It is the internal and subjective response customers have to any direct or indirect contact with a company (Meyer & Schwager, 2007). There are also more definitions of the customers experience in the literature. It has multidimensional view and is identified by five types of experiences: sensory (sense), affective (feel), cognitive (think), physical (act), and social-identity (relate) experiences (Schmitt, 1999). Customer experience in retailing is a

multidimensional and holistic construct, that involves the customer's cognitive, affective, emotional, social, physical responses to the retailer (Verhoef et al., 2009). Customer experience is subjective, internal consumer responses (sensations, feelings, and cognitions) and behavioral responses evoked by brand-related stimuli that are the parts of a brand's design (Brakus et al., 2009). Grewal (2009) has identified customer experience as something that includes every point of contact at which the customer interacts with the business, product, or service. Zhao and Deng (2020) described the concept as a feeling of consumers in the shopping process affected by retailer's services, product price, quality and shopping environment.

To sum up the most complete definition of customer experience was given by Verhoef et al. (2009). Thus, customer experience is a holistic multidimensional construct. This feeling involves cognitive, emotional, affective, social and physical responses. It appears in interconnection between customer and retailer. Customer experience encompasses all experience throughout the whole customer journey.

1.2.2. Customer experience dimensions

This part is dedicated to the dimensions of customer experience. There is no consensus in the academic community about what customer experience includes and into what parts it can be decomposed. Some dimensions are more common, others are used in fewer articles. More than that the approach to the dimension of the customer experience depends on what area or industry it is studied in. Knowing the customer experience dimensions helps to deeper understand the concept itself and allows to find right instruments to estimate it.

In the academic literature I have analyzed there are several approaches to identify dimensions (attributes, factors) influencing customer experience in retail industry. As it was mentioned above in some definitions of the customer experience, the concept includes cognitive, emotional, sensory, social, and spiritual responses. These dimensions were identified by Lemon and Verhoef (2016), but sometimes researches in addition to presented five types of responses suggested extra aspects. To be more specific and to explore these dimensions more in depth I would like to provide a classification presented in the article by Camila Bascur and Cristian Rusu (2020).

- Cognitive. This component involves mental processes of a person, in addition to conscious thoughts. The offer might engage people in expressing their creativity and approaches to problem solving. Examples of such products could be puzzles, or quest performances.

- Emotional. This component involves the affective system of a person, which generates feelings, emotions, moods. The good example of the product that creates an emotional linkage is Kinder surprise.
- Sensorial. This component is focused on stimulating or affecting the senses (hearing, sight, touch, smell and taste) to awaken various sensations in people. The example of such experience is a smell of fresh baked bread in a bakery, or bakery section of a store.
- Relational. This component involves a person, beyond their social context, their relationships, or ideal self. The offering could leverage this aspect of customer experience by encouraging people to consume product, or use a service together. Example provided by author of the article is Disneyland parks. Also, this aspect is well-expressed in luxurious things, that allow their owners express their belonging to a certain social category.
- Pragmatic. This component occurs when a person performs a practical act. It includes the factor of usability, which exists on all stages of the product life cycle. Author provides an example of Apple iMac as a device that was designed to provide extraordinary practical experience for users based on usability standards.
- Lifestyle. This component relates to the values of people that represent their lifestyle or behavior. Frequently such products provide this type of experience since the offering itself or its consumption embodies certain values. As an example, I can mention eco-friendly companies.

These dimensions were also used by other authors considering customer experience. Exactly such or similar definitions were used in articles written by Schmitt (1999), Gentile er al. (2007), Verhoef et al. (2009), Brakus et al. (2009), Lemon and Verhoef (2016). These studies were considering customer experience in experiential marketing domain.

However, there are other approaches to the dimensions of the customer experience. They are dedicated to the specific characteristics. Other approaches presented further would be more functional and service related. What complies with the concept of this work better since it was stated that grocery retailers mainly create loyalty primarily because of the quality of their service and not the quality of the product, since they don't have much opportunities to adapt the products, while the service quality is under their control.

For example, Grewal et al. (2009) consider customer experience dimensions as factors that depend on the micro environment of the organization (promotion, price, merchandise, supply

chain, location). Similar dimensions were provided by Ismail (2001): store environment, service interfaces, store atmosphere, service quality, price). Jones (1999) suggested: personnel, service elements, selection, price, design, display, layout, atmospherics, social aspects, tasks, the purchase, time, mood.

Thus, we can see how different are approaches to the customer experience. If we compare two big approaches: experiential and functional I would say that the last one is more suitable for this work. Experiential approach would be better for considering products and it would be hard to have estimates for all the responses of the customer, since it is a rare product that can enable all elements. This can make estimations less relatable. Functional approach, in its turn considers factors that could be easily understood by respondents and show their attitude to the company.

1.2.3. Customer experience in retail

Traditionally, retail companies were concentrated on selling goods from physical locations. Customer experience was predicated around elements defined by physical nature of touchpoints. Thus, the main factors were directed to the reachability of the shops, helpfulness of staff, availability of products customers are looking for, convenient return policies, etc.

However, retail is evolving nowadays, influenced by external factors. COVID-19 pandemic forced companies to change the way they operate. Retail market did not stay away from this global trend. People are less likely to leave their homes and are more inclined to shop online. Companies started to implement technologies more actively to have their own share in this market. In such condition, customer experience has also evolved. Now it consists of multiple interactions in several touchpoints to make sure that customer needs are satisfied no matter what option is chosen to contact with the company.

Thus, we came to one of the main current trends in retail for the 2021. Successful retail brands use omnichannel approach. That means that they combine digital and physical channels. At the same time striving as much as possible to work as a single business without distinguishing into online and offline parts. Many traditional retail stores now use the power of electronic commerce to satisfy their customers' needs and make a company's products as accessible as possible. In current realities omnichannel approach is the necessity for business to maintain the growth, however, it requires customer experience management across multiple touchpoints what cause additional challenges.

A lot of efforts are being made towards listening to the customers in order to get feedback to make sure that all aspects in omnichannel approach are convenient and optimized. Thus, many

retailers invest their resources into instruments to collect customers' opinions, different methods of experiential retailing, technologies to combine digital and offline storefronts, customer loyalty and retention mechanisms.

In online retail, one of the main factors is the speed. It concerns the time a customer needs to make a purchase or to find desired information, make a comparison between products and make a decision. In order to provide clients with such opportunity to get fast access to everything they need, a company should constantly collect feedback (Delighted, 2020).

1.3. Concepts integration

The peculiarity of customer experience in grocery retail industry is that it is mainly based on the interactions within the store.

The Covid-19 pandemic that broke out at the end of 2019 has been a test for businesses in all spheres. Retail was one of the first areas that had to quickly change its strategies and look for new approaches and tools in order not to lose customers. COVID19 has affected the popularity of online shopping. However, brick and mortar stores are still more popular (Sheth, 2021). There is an omnichannel trend. Companies are looking forward to create equally good experience through all of their channels through digitalization (Von Briel, 2018).

The Amazon Go store, equipped with a set of sensors, advanced computer analytics and cameras, where customers can simply take products from the shelves and leave with no paying for them at the cash register point (Millman, 2016).

The solutions cited above limit or virtually completely eliminate inconveniences associated with the purchasing process, thereby increasing the number of positive brand interactions as part of the purchase process (Marek, 2017).

The IoT is a tool used more and more often in the area of customer experience management, aiming to increase customers' satisfaction, loyalty and trust.

Amazon, Nike, Sephora, and Tesla are among the global corporations that have already included the Internet of Things into their marketing efforts. As a result, these businesses have created mutual communication devices-enabled products and services, utilizing them as instruments for creating a unique customer experience, forging emotional links with customers, and gaining a competitive edge (Marek, 2017).

Traditional marketing communications are also altering as a result of the Internet of Things. Shopping centers, sales networks, public utilities, and outdoor advertising suppliers have all

adopted IoT technology to provide individualized information, customized advertising messages, and sales promotion offers to their clients, according to Mittal (2012).

By encouraging users to interact, providing value or responding to the users' needs or aspirations, these products create the positive customer experience.

1.3.1. Hypothesis formulation

It is widely believed that the use of Internet of Things increases capabilities of delivering a superior customer experience and that IoT has the potential to create new and innovative ways to understand and influence customer behavior. (Kocher, 2017; Martin, 2017; Raftery, 2017; Rossi, 2017).

Customer loyalty get a significant attention in research since the appearance of the loyalty loop is a desired outcome of a customer journey for any brand (Court et al., 2009). In the recent research on customer loyalty, two constructs are considered as its strongest predictors: customer experience with the brand and commitment of a customer to the brand. Positive customer experience with the brand creates a sense of brand value for the customer and this way contributes to the formation of loyalty (Petzer & Roberts-Lombard, 2021). In addition, positive experience may lead to the higher appreciation of the brand, development of attachment of the customer to it and, as a result, commitment of the customer to the brand (Siqueira et al., 2021). And commitment to the brand was also found to positively influence the customer loyalty (Fullerton, 2005). Based on that, we put forwards the following hypotheses:

- H1: Customer Experience has a positive impact on Commitment
- H2: Commitment has a positive impact on Customer Loyalty
- H3: Customer Experience has a positive impact on Customer Loyalty
- H4: IoT strengthen the impact of Customer Experience on Commitment
- H5: IoT strengthen the impact of Commitment on Customer Loyalty
- H6: IoT strengthen the impact of Customer Experience on Customer Loyalty
- H7: Customer Experience with IoT is significantly higher
- H8: Commitment with IoT is significantly higher
- H9: Customer Loyalty with IoT is significantly higher

1.4. Research gap

After analysis of the literature, I came up with the further research gaps.

- IoT technology offers retailers opportunities in three critical areas 1) supply chain and logistics 2) new channels and revenue management 3) customer experience. However, much focus has been on the first two areas. (Balaji et al., 2016)
- Technical solutions in the field of the Internet of things in most cases are considered in terms of benefits for the store, and not the creation of a new experience for the buyer.
- A limited number of researches studying customer perception of IoT from the perspective of superior customer experience.

The following research questions were also formulated.

- How customer experience and brand loyalty are interrelated in retail industry?
- Does the IoT influence the interrelations between customer experience and brand loyalty?
- How does Internet of Things influence perceived customer experience in retail?
- How does Internet of Things influence brand loyalty in retail?
- What IoT devices could be used in order to increase in-store customer experience?

CHAPTER 2. FRAMEWORK ELABORATION

2.1. Research design

The aim of this research was to understand the influence of implementation of the Internet of Things on perceived customer experience and brand loyalty. Based on the literature review hypotheses were formulated and interrelation between customer experience and brand loyalty was established with mediating role of customer commitment. The visual framework for these interrelations will be provided further in this chapter. In addition to the graphically generated framework, scales for each component will also be developed in this part.

I have decided to conduct an online experiment with the questionnaire. This was made in a format close to the A/B testing where the same questions were asked but the conditions are different. Respondents were supposed to be divided into two groups. The first is the regular group, but the other group is manipulated. The manipulation lies in the fact that the experimental group was offered a description of a store equipped with smart IoT devices.

To do this, a study was made of IoT devices that can be used in the store. These devices will be featured in the descriptive part of the manipulation experiment in order to give respondents an idea of what a high-tech store would look like.

Based on the scales and subsequent analysis of the data, a general outline of the questionnaire will be developed.

After the experiment was conducted in order to compare two groups: test group and experimental group. Test group was asked to estimate their regular shopping experience. Experimental group was manipulated by the additional text describing Internet of Things layout.

This chapter will also describe the statistical approaches needed for further data analysis.

2.2. Framework

Based on hypotheses presented previously I have created several visual schemes that allow to understand the interconnections between concepts. I have separated the one possible scheme into several to make it visually more understandable. I would like to mention that further in the analysis part it will be combined. The first framework represents the default framework of Customer Experience, Customer Commitment and Customer Loyalty interrelations. This scheme is based on the first three hypotheses (H1, H2, H3). It shows the mediating role of the Customer Commitment.

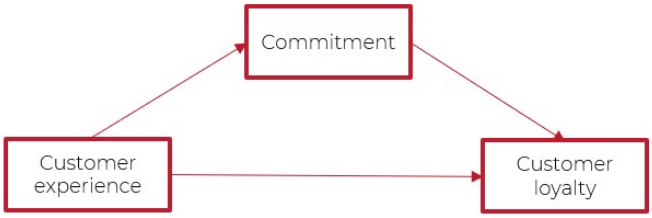

Figure 1. Default framework

On the second figure I put the IoT component and showed its moderating role on the interconnections among the concepts. These arrows were based on the on the second three hypotheses (H4, H5, H6). In the analysis part I will test whether the influence of IoT exists and significant. I will also test the regression weights here.

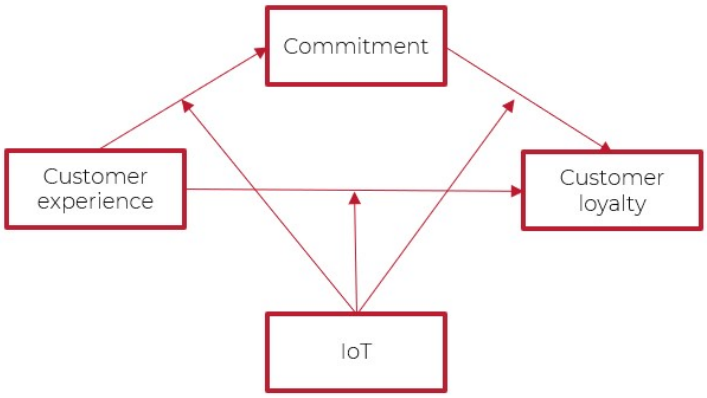

Figure 2. Internet of things moderating effect

The third figure shows the regular influence of the IoT manipulation on the variables. This scheme is based on the last three hypotheses, which imply the direct effect on the components of the framework.

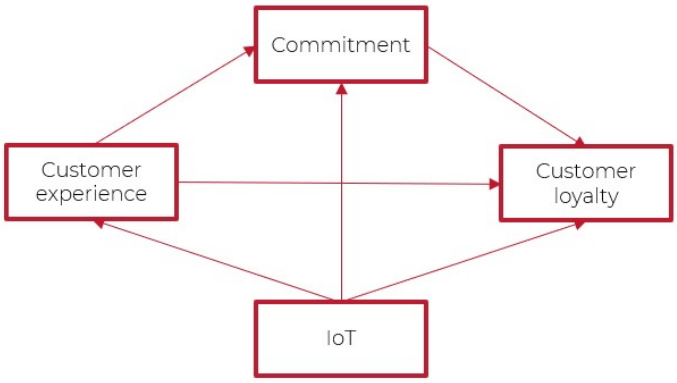

Figure 3. The influence of IoT on the model components

2.3. Measurement

There are several popular methodologies, that are used to estimate customer experience, brand loyalty or customer satisfaction. They are represented by simple surveys, that include one or several questions that suggest giving a particular score on a Likert Scale. I would like to cover the following metrics can be used NPS, CSAT, CES, CSI, since they are widely represented in search results. More than that they were also studied as a part of university marketing classes.

Net Promoter Score or NPS is used and interpreted as the measurement of the loyalty of a company's customers. This instrument was developed by Fred Reichheld, who registered trademark in conjunction with Satmetrix Bain & Company (Reichheld, 2003). This metric shows the client's attitude towards company's product, site, service and helps to find out with what probability he will recommend you to his friends or relatives. Thus, people are asked to estimate their intention to recommend company to someone else by giving a score from 0 to 10, where 10 is "I will definitely advise" and 0 is "Definitely won't recommend". This metric is aimed to distinguish respondents into several groups: "Promoters", "Passives" and "Detractors". Identifying these groups is useful while making marketing, sales, and other business decisions.

Customer Effort Score or CES measures the difficulty for customers to accomplish their intent. Customers want to achieve their goals without any serious effort. The more it takes to make a purchase/subscribe/sign up, and so on, the more likely it is that the customer will not accomplish what he was intended to accomplish and a company will lose a client along the way. This metric can provide a company with the information about the optimization of processes interconnected with a customer journey. People are usually asked to estimate the difficulty of accomplishment of the task.

Customer Satisfaction or CSAT is the metric which helps companies to understand how satisfied clients with the company. CSAT directly measures customers satisfaction. It is useful for

making enhancements for some products or services when the score is relatively low. Clients are asked how satisfied they are with the company as a whole or with a specific scenario. The way they are measured is the same as for other metrics – Likert scale.

Customer Satisfaction Index or CSI is a modified version of CSAT. First, the overall level of satisfaction with the product here is made up of the levels of satisfaction with its individual parameters. For example, site loading speed or registration process. These parameters and their number are determined within the company - usually they choose the main "pain" points. Another big feature of CSI is that respondents must evaluate the importance of each of these parameters for them personally.

These metrics could be easily implemented if a customer interacts with a company through online channels. However, the same measuring strategies could be implemented if a customer makes a purchase offline. Sometimes it requires receiving additional messages, links, etc. and complete surveys outside of the store, but some companies gather metrics through kiosks. These instruments are placed in the stores and designed to collect feedback right after the purchase without additional pains for the clients.

The question based on the NPS adapted as the scale CL3. However, it is modified in connection with the general concept of work. Similar questions were mentioned in the works of Helm et al. (2009) and Muntinga et al. (2011). CSAT index was adapted for the Customer Experience scale. Questions suggested by Fullerton (2005) allow to estimate the Customer Experience in the functional approach to the customer experience dimensions. At the same time it does not consider variety of functional factors separately rather by giving the full picture of the customer experience.

Customer commitment scale was adapted from the Houkooper's (2018) work. The scale considers both sides of commitment attitudinal and continuance. Thus, covering both the emotional component, which is not always rationally explained, and the pragmatic part, expressed in the benefits and losses that arise when changing companies.

Customer loyalty presented in the straightforward format. Scales for this metric were adapted from different sources, however, it clearly shows to dimensions of customer loyalty. First is interconnected with repeated purchases (the action made by the customer) and the second describes advocacy options (recommendations, therefore increasing the number of customers).

Table 1. Questions for the scales

Scale	Question	Adapted from
CX1	I believe that the store is competent in meeting my needs	(Fullerton, 2005)
CX2	I am satisfied with the quality of service in the store	
CX3	I am generally satisfied with the store	
Com1	I feel an emotional attachment to the store	(Houtkooper, 2018)
Com2	My habits would change if I switched the store	
Com3	It would be hard for me to find a worthy replacement for this store	
CL1	This store is my first choice when I go shopping	(Helm, Eggert, Garnefeld, 2009) (Muntinga, Moorm, Smit, 2011)
CL2	I prefer to visit this store over competitors	
CL3	I recommend the store to my friends and family	

2.4. In-store IoT devices

I would like to cover devices that were presented to the respondents more in detail since I would stress the point that these devices are beneficial both for customers and companies. These devices are not widely used in the retail industry yet, but more and more stores that are considered to be technically advanced are staring to implement them more often. Since I am considering the internet of things from the customer experience perspective, the devices were chosen by the principle where customers may experience direct interaction with such devices.

2.4.1. Smart carts.

Smart carts are already beginning to be implemented at some supermarket chains in the US. The development of smart devices is carried out both by individual companies specializing in high-tech devices in order to sell them to other companies in the future, and by retailers themselves. In the first case, an example is the startup Caper, which, according to Cnews (2019), raised three million dollars in private investments in 2019 and now the startup is already working with the Kroger chain of stores in a test mode. In the second case, I can give an example of Amazon, which itself is a high-tech company, which allows the company to develop solutions for its retail stores on their own. Also in the above article, Rostec's interest in the production of smart carts was noted.

In the article published by ITSoftWeb (2021) the example of smart carts produced by Caper is considered. Carts work as smart scales. A customer put all their personal items (such as a wallet) in a basket in front, under the screen. Packages and bags should be placed in the main

compartment, and then weighed. Afterwards the customer can go and put any product (vegetables or fruits) in the cart, or straight to the bag, that is placed inside the cart. Then continue the route. With the computer vision, the smart cart understands what exactly the customer puts inside, and at the same time weighs the new product. The client just has to confirm on the screen that this is exactly what they bought. As planned by Kroger and Caper, it turns out much faster than approaching the scales with fruit, and then standing in line there.

As noted above, the smart cart is equipped with a touch screen that shows the contents of the main compartment of the cart. With this monitor, the customer confirms the purchased item. It also allows company to offer the buyer goods depending on preferences and the current content of the basket. This is beneficial both for the customer, as it allows them to receive relevant recommendations, as well as keep the shopping list in front of their eyes without having to take out additional devices or pieces of paper. In turn, the store benefits, since in this case the cost of the consumer basket can be increased through recommendations.

The smart cart is equipped with cameras that allow the use of computer vision functionality to identify products that have been placed in the basket or have been removed from it. In addition to cameras, RFID tags and scanners are also used to identify products. The smart cart developed by Caper calculates the cost of the items placed in it, which is further convenient for instant payment at the self-service checkout, or directly through the terminal located on the smart cart itself.

This smart cart seems to me as an ultimate solution in the sphere of smart carts for the current moment. However, nowadays the stores are more widely represented by solutions with simpler functionality than described above. Most often, these are ordinary trolleys combined with a personal barcode reader. This certainly reduces the time for accounting and paying for goods, however, such devices are less involved in the Internet of Things system and solve fewer inconveniences than more complex counterparts.

Smart carts follow the frictionless retail concept, which aims to make the customer's journey through the company as smooth as possible by reducing the pain points that appears throughout the interconnection between customer and company.

2.4.2. Contactless self-service checkouts

Contactless self-service checkouts. Self-service checkouts turned out to be a real lifesaver during the pandemic, when any contact could be dangerous. The coronavirus has become a less problem, but the habit of independence has remained. Not only introverts like this payment

method: buyers can plan their own time and avoid spontaneous queues. According to X5 retail group research, up to 45% of shoppers pay for purchases through machines, and according to Briskly, the average check when paying through machines grows by 15-19%. Therefore, despite the high cost of purchase and maintenance, more and more retailers are installing self-service checkouts in stores. True, so far there are still some restrictions about self-checkouts that still exist. Customers cannot buy alcohol and tobacco through CSR independently. They still need either stay in a line to traditional cashier, or wait for a store employee who will confirm that the buyer has reached the age of majority. But this restriction in the future could be solved with big data, machine vision, machine learnings and smart devices that might be used on self-service checkouts. Internet of things could make the interaction with self-service check-outs even smoother for customers and secure for the shop. Today, customers should check all of the products by themselves manually, but we already have an example of Amazon Go where clients just walk in and walk out and the only thing, they need is to scan QR code at the entrance. It is possible thanks to the IoT technology, that is based on computer vision and big data analysis. The shop could include to the mechanism smart carts that were mentioned previously. Smart carts help to track items that a customer is going to buy.

2.4.3. Digital price tags.

First of all, electronic (or digital) price tags have a great value to the company, as they significantly simplify the process of adjusting and updating prices in the store. Placing prices on the shelves of goods is a very time-consuming process in the work of any store. In most cases, this process requires manual labor and consists of many steps. Often this factor is the cause of errors and discrepancies between the number on the price tag and in the database. Promotions for certain goods in the store also complicates the process of changing price tags. This requires a lot of time and resources. There are not so many stores where this process is automated. However, there are already some technological solutions that allow companies to automate and significantly simplify the registration and inventory control of price tags. One of such solutions is digital price tags.

Electronic price tags give companies complete control over in-store prices and eliminate the source of typical store errors—the discrepancy between the price at the store's checkout and the price on the item's shelf. Customers will always see the current price of products and items, the same as the prices at the cash decks, because pricing takes place within a single computer system. This approach removes all risk for retailers and helps maintain a quality level of customer service.

More than that, electronic price tags have a number of advantages. Their use significantly optimizes the process of changing prices at any time of the day, more opportunities for promoting goods on store shelves.

Besides providing customer with the relevant prices for the products smart price tags are able to provide customers with additional information if necessary. For example, some models of digital price tags allow to show images on it which makes it easier for customers to find the price of the product they need.

2.4.4. Digital stands with shop navigation and digital signages.

Digital stands greatly simplify store navigation. This device is especially useful for large stores where it is difficult for a customer to find the product they need among many different departments. This smart device allows customer to reduce the feeling of frustration that the client experiences, and also allows not to waste the human resources of the employees of the trade hall to find the necessary goods. A digital stand can provide information about whether the product the customer is looking for is in the store and in which department it is located. When interacting with other smart devices within the Internet of Things, such stands can provide even more information about products, including the exact quantity and expiration dates of products.

Digital signage is a fairly simple device compared to other devices described in this section. Most often, this is a regular monitor that plays records according to a pre-selected scenario. However, with the help of other devices, digital signage can show current offers depending on who is on the trading floor. In this case, the sequence of information presented will be automatically adjusted based on information received from other devices in the system. For example, customer-authorized carts or smart vision cameras, that will tell about customers preferences.

2.4.5. Smart shelves.

Some products are in greater demand than others. At the same time, demand often changes depending on the current needs of buyers, which are influenced by many factors that are not always easy to predict in advance. These needs might be different at each moment of time. This leads to the fact that the buyer may not find the product he needs on the shelf due to the increased demand for it. It may force customer to use another store the next time. Thus, besides losing the money because of unsold goods a company might lose loyalty of a customer. A large stock of goods in the store, in its turn, is not beneficial for the company, as it takes up space that could be allocated for other goods, and can also lead to the fact that some of the products will deteriorate because they were not sold, and conditions in the trading floor were not provided for long-term storage.

In many ways, the use of smart shelves is suitable for solving this kind of problems. Smart shelve is extremely useful instrument to automatically track inventory in real time. Smart shelve uses RFID technology, including RFID tags, RFID readers and antennas. Besides, it uses weight sensors that might be installed withing the device or underneath it. All these sensors help to track if something is out of stock, it can also alert a company to the theft of products. Smart shelves are also useful for further predictions since they gather additional information about the number of products and the time they were taken from the shelf, which could be used in order to adjust processes to improve customer experience.

With interconnection with a mobile app a smart shelve may provide a customer with even smoother experience by guiding them to the desired products.

2.4.6. Mobile app.

In the description of previous devices, I repeatedly wrote that when interacting with each other, they have more functionality and can bring a more valuable customer experience to the buyer. This corresponds with what I wrote earlier about the Internet of Things. However, it is worth noting that the devices mentioned earlier can work without binding between different categories of devices. For example, a smart cart will perform a significant part of its functionality without interacting with a smart shelf or digital price tags. Some of the devices are IoT builds in their own right. For example, a smart cart includes simpler devices that are interconnected (radio sensors, scales, cameras). Smart shelves are also combined with various weight sensors and RFID readers. Of course, all of them will be practically useless without a server part that will report the necessary information and perform the necessary calculations. However, all these devices, being built into the store system, are constantly in it, collect and transmit information.

This is the peculiarity of this point. The mobile phone is not built into the store ecosystem by default and is fully owned by the customer. However, a mobile app installed on a device can embed the mobile device into the store's systems, resulting in a greater customer experience for the client. In combination with other devices in the store, the phone can help personalize offers by reading information about the shopping list and the content of the cart, as well as finding the goods the customer needs. By interacting with location services and tags within the store, the phone can trigger other devices, like digital signages, to show relevant information. Another scenario is that the buyer, passing by the store, may receive notifications that certain promotions of interest to him are being held right now. Naturally, this feature must be customizable so that the buyer does not feel uninvited interference in his life. Thus, the phone can serve as a tool to provide the customer

with additional information about products and at the same time most accurately identify the buyer for the store.

2.5. Questionnaire creating

As already mentioned, to conduct an online experiment, a questionnaire is needed that can be distributed. To understand the structure of the questionnaire, I want to consider its section by section.

The first section will contain a standard greeting and thank you for agreeing to participate in the study. Next, information was collected on how often respondents make purchases, their favorite store, and the importance of store characteristics.

In the next section, there is a division into a test group and an experimental group. In this case, the test group is asked to evaluate their experience in the store they selected in the previous section. The experimental group is asked to imagine that the store where they shop has implemented the presented IoT devices. All devices are presented simultaneously. Afterwards the experimental group is asked to rank the devices from the most desirable the less desirable.

The third section collects demographic characteristics such as gender, age, educational level, and income. This is necessary in order to understand how the compared groups are demographically similar.

2.6. The choice of statistical methods

First, I decided to do the Exploratory Factor Analysis (EFA). The scales were adapted from different authors, some of them were changed in order to comply with the context of retail industry. Thus, EFA is useful to make the first tests about the framework.

The framework built above is too complexly structured to be able to apply the usual regression equation. Thus, for the analysis the Structural Equation Modelling (SEM) method was chosen. SEM along with Confirmatory Factor analysis and Path Analysis is a multivariate method to measure the latent variables and the structural relationships among the study variables (Wan, 2002). It is used to determine whether the independent variables are casually related to the dependent variables. This method is a form of multivariate correlational statistics that allows to test the hypothesized relationships among several factors of theoretical model.

This method uses two statistical analyses. At first, we use Confirmatory Factor Analysis to evaluate the validity of the indicators that are associated with the considered theoretical constructs. The second step is multivariate analysis of the structural relationships among the studied variables.

It provides the support to the theoretically specified framework. It also gives advice to improve the framework (Fielder, 2012).

When adding the reliability tests on surveys based on the theoretical constructs this analysis can overcome challenges that are major to the research. They are validity and reliability. Thus, the statistical testing conclusions can be formulated and considered as credible.

Structural Equation Modelling is relevant in exploratory studies. In particular in those involving psychological or behavioral issues that have complex interrelations among variables. Thus, SEM is widely used in research studies in the field of Marketing, Human Resource management, social works and allied fields.

CHAPTER 3. APPLICATION OF THE DEVELOPED FRAMEWORK

3.1. Data collection process

In order to test the created framework, I used questionnaires, that included scales that were developed in the previous part of this article. The survey was created on the Google Forms platform, because it is free and allows to formulate all the questions that were implied by the study. The questionnaire was distributed through the social networks. Since I am student and has more students or just people of my age that I know. So, I expected that the results will be dominated by the responses of people of a certain age group. Thus, I tried to use other channels of communication that would help to cover the gap that existed with elder age groups.

After clearing not suitable responses I have received 248 responses left, 124 for each of the groups. The demographic characteristics of both groups were roughly equal. Which allows us to compare these groups.

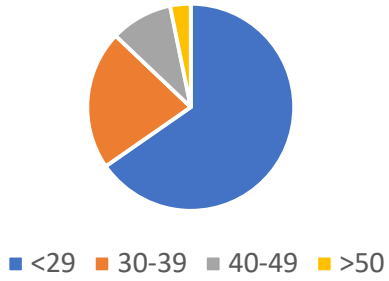

Figure 4. Share of the age groups in experimental group

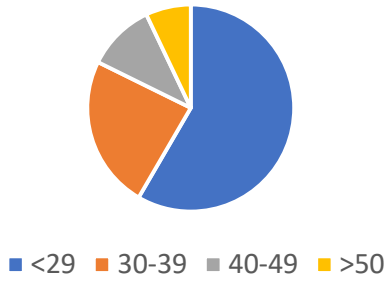

Figure 5. Share of age groups in test group

3.2. Analysis of the data

The data analysis was conducted with Microsoft Excel, IBM SPSS statistics 23 and IBM SPSS AMOS software. Answers for the questionnaire were first transferred from Google Forms into Excel, where the data was cleaned, categorical variables were codified for the further analysis.

Then the data was transferred to SPSS statistics where descriptive statistics and Exploratory Factor Analysis were made. Next, I used SPSS AMOS. This is powerful Structural Equation Modelling software that supports research and theories by extending standard multivariate analysis methods. The main advantage of this software is that it allows to use SEM approach without manually writing codes, but using graphical instruments in order to establish connections and dependencies. Thus, I used AMOS to conduct Confirmatory Factor Analysis and Path Analysis. In order to compare two groups and test how significant the difference between two model is I conducted multi-group analysis.

3.2.1. Mean comparison

At the beginning I would like to test the difference between two groups based on the manipulation characteristic or basically were there any significant differences between answers given by the test group, where people shared their regular shopping experience and the experimental group that was presented with the smart store that has various IoT solutions to solve the problems of the respondents. Thus, the grouping variable was categorical value IoT.

To compare means I have decided to conduct a non-parametric test for independent samples.

Table 2. Non-parametric test statistics

	Mann-Whitney	Wilcoxon	Z	Significance	Mean difference
CX1	6000	13750	-3,092	0,002	0,45
CX2	5832	13582	-3,423	0,001	0,67
CX3	6192	13942	-2,792	0,005	0,32
Com1	4984	12734	-4,845	0,000	1,16
Com2	5712	13462	-3,544	0,000	0,9
Com3	5048	12798	-4,731	0,000	1,12
CL1	3806	11556	-7,080	0,000	1,22
CL2	3384	11134	-7,852	0,000	1,41
CL3	3642	11392	-7,356	0,000	1,51

The mean difference was calculated by extracting mean of the tested group from the mean of the experimental group for each different scale. As we can see from the table the mean differences are positive for each scale that means that the experimental group gave higher points

for each question. More than the test showed significance for each variable. That means that we can assume that the points given by these two groups are significantly different.

3.2.2. Exploratory Factor Analysis

First, I conducted EFA in SPSS. This analysis allows to determine correlations in the dataset and group variables considering strong correlations. EFA gives a factor structure not considering any theory about variables and their belonging to constructs. In this regard, EFA may identify problematic variables and prepare data for the further analysis. Since the scales and constructs were adapted from different articles, I found it necessary to make this type of analysis.

I have started with Kaiser-Meyer-Olkin criterion (KMO) and Bartlett's test of sphericity to test whether the obtained data is suitable for the factor analysis. KMO Measure of Sample Adequacy showed the value equals 0,848. In general values between 0,8 and 1 means that the sample is adequate. Kaiser proposed that more than 0,9 is marvelous result, less than 0,9 but more than 0,8 is meritorious result (Kaiser & Rice, 1974). Thus, the dataset passes the KMO test. Bartlett's Test of Sphericity is significant ($p<0,05$) for the considered sample. The dataset is suitable for the factor analysis.

Table 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,848
Bartlett's Test of Sphericity	Approx. Chi-Square	1621,184
	df	36
	Sig.	0,000

I used Principal Component Analysis extraction method and Varimax with Kaiser Normalization rotation method in order to create rotated component matrix which allows to identify factors. As we can see in the table below the software suggested dividing 9 constructs into 2 components. For Customer Experience this is clearly first component since all three variables belong to it. For the Customer Commitment the situation is also clear because all three variables belong to the second component. For both construct loadings of the variables are higher than 0,7 which is great. However, we can see that Customer Loyalty construct is not derived to its independent component.

Table 4. Rotated component matrix.

	Component	
	1	2
CX1	0,839	
CX2	0,867	
CX3	0,844	
Com1		0,819
Com2		0,842
Com3		0,833
CL1	0,577	0,526
CL2	0,646	0,513
CL3	0,555	0,612

According to the literature review Customer Loyalty should be the separate component. On this stage we just assume that the factors are formed due to the literature review. Further, in the CFA part I will give an additional proof that the suggested component structure works well. Before moving on to the Confirmatory Factor Analysis I have conducted reliability analysis measured by Cronbach's alpha. The results of the analysis are presented in the table below. Cronbach's alpha shows the internal consistency of characteristics that describe one object, but is not an indicator of the homogeneity of the object. The coefficient is often used in the social sciences and psychology when constructing tests and to test their reliability. The closer the value to the 1 the better the consistency of the factor. General rule for the alpha coefficient is that it should be greater than 0,7. If it is greater than 0,8 then the value is good, if it is greater than 0,9 the value is excellent. Thus, we can conclude that the factor analysis is reliable.

Table 5. Reliability analysis with Cronbach's alpha.

Factor	Cronbach's alpha
Customer Experience	0,888
Customer Commitment	0,867
Customer Loyalty	0,911

3.2.3. SEM. Confirmatory Factor Analysis

After I finished EFA I moved to the next step which is Confirmatory Factor Analysis. This analysis is required to confirm the factor structure that was derived from the literature review.

In order to prove that at first, I have conducted the discriminant validity analysis using Fornell-Larker criterion. The discriminant validity test itself shows to which extent the factors are distinct and uncorrelated. The principle of Fornell-Larker states that the squared correlations should be below Average Variance Extracted (AVE). This analysis is presented in the table below. The main diagonal which is highlighted by the bold font shows the results for AVE analysis. The lower part below the diagonal shows correlations between the concepts. The upper angle shows the squared correlations. From the table we can see that AVE is higher in all cases, which means that current factor division works well. That is also supported by the according to Hair et al. (2010) the AVE coefficient should be higher than 0,5. In all cases it is far more than the threshold value.

Table 1. Correlations, AVE and squared correlations.

	Experience	Commitment	Loyalty
Experience	**0,75**	0,317	0,408
Commitment	0,563	**0,69**	0,425
Loyalty	0,639	0,652	**0,77**

In the conceptual model we have 3 latent variables and 9 observed variables. Here I am not considering categorical variables here, that were included in the dataset. Here are questions that implied answers given with the Likert Scale, which represent the scales of components. In order to check the validity of the model I have built the CFA model represented on the picture below.

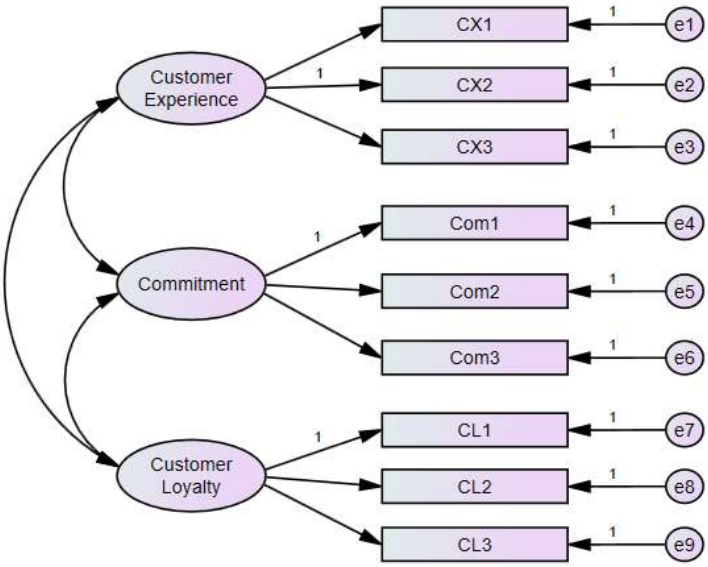

Figure 6. Confirmatory Factor Analysis

CFA allows to estimate the goodness-of-fit of the model. And if the model is not good enough it suggests the modification indices that allows to identify the problematic variable and adjust the model to make it better. There are several indices that says about the validity of the model suggested by Hu & Bentler (1999). They are presented in the table below.

Table 2. Validity indices.

Measure	Value	Threshold
CMIN/df	2,252	<3 good, <5 sometimes permissible
p-value	0,169	>0,05
CFI	0,996	>0,95 great, >0,9 traditional, >0,8 sometimes permissible
GFI	0,95	>0,95
RMSEA	0,04	<0,5 good; 0,5-1 moderate, >1 bad
PCLOSE	0,596	>0,5

Based on the values suggested above we can come to the conclusion that the model is valid. Values received from the CFA analysis meet all the threshold values.

3.2.4. SEM. Path Analysis

Moving on to the path analysis. According to the framework that was developed in chapter two, I created the scheme in the SPSS AMOS that included the same paths. All the paths represented on this picture are significant, which means that all connections are supported.

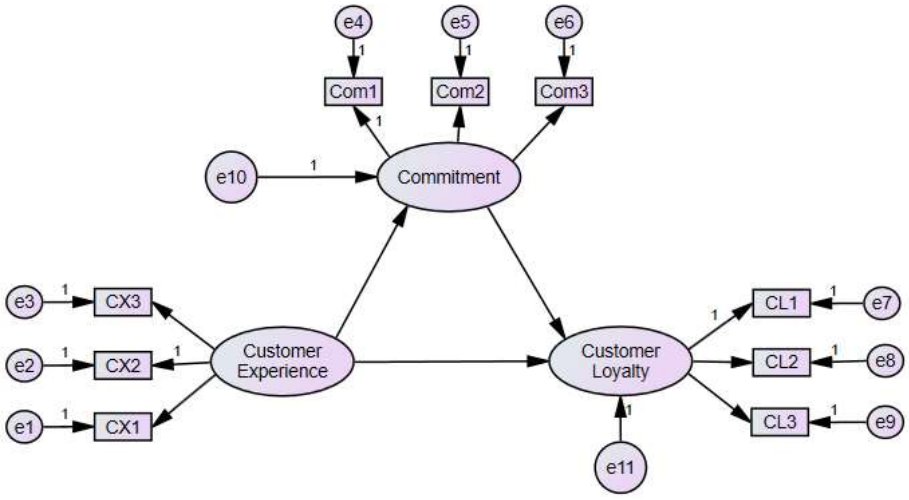

Figure 7. Framework in AMOS.

Customer Commitment has partial mediation effect in the interrelation between Customer Experience and Customer Loyalty. All connections in this framework are significant. However, I have tested the regression weights without Customer Commitment and wit Customer Commitment. The analysis showed that the total effect with the mediator is higher than without it.

In order to identify the influence of the Internet of things on the client side on the connections between the components, in other words, to check the moderating effect of this categorical variable, a division into two groups was made depending on the presence of the client experience factor. In the image below, we see the regression weights for these two groups. The weights obtained in the IoT group are marked in red, the weights received in the NoIoT group are marked in black. In this case, all paths remain significant.

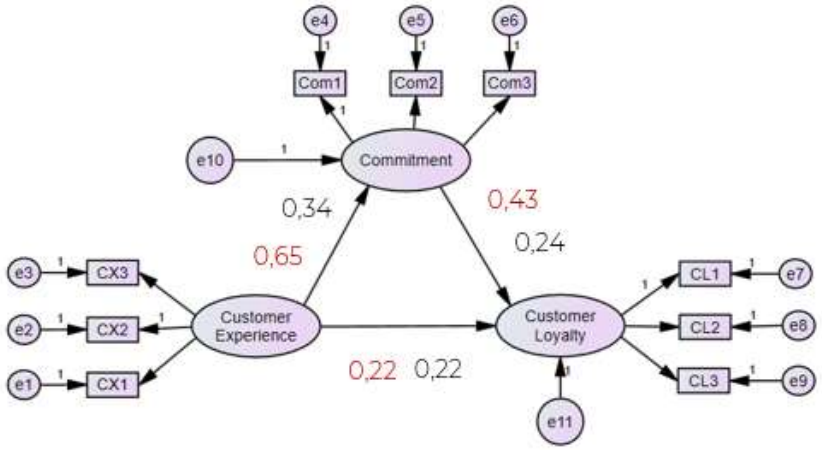

Figure 8. Regression weights comparison

However, there is a need to test how significant the difference between the groups is. Visually, there are changes in the Customer Experience to Commitment and Commitment to Customer Loyalty routes. You can't see the change in the Customer Experience to Customer Loyalty route. However, let's do a multi-group analysis with constraints in order to identify the significance in difference between the regression's weights. The analysis showed that in the first two cases the changes are significant, while in the last one there is no such significance.

3.3. Ranking of the IoT devices

Experimental group was asked to estimate devices from the most desirable to the less desirable. The data was codified in the following way, if the device gets the first place in ranking it gets 5 points if the last place it gets 0 points. Then the points are summarized and the ranking is established.

Table 3. Devices ranking

IoT device	Rank	Number of ponts
Smart cart	1	588
Contactless self-service check outs	2	489
Mobile app	3	315
Smart shelves	4	240
Digital price tags	5	180
Digital stands with shop navigation	6	48

3.4. Hypotheses testing

I would like to start with hypotheses that were formulated previously in this work.

Hypotheses H1, H2, H3 were supported since the p-values for all paths in AMOS framework were significant.

H1: Customer Experience has a positive impact on Commitment

H2: Commitment has a positive impact on Customer Loyalty

H3: Customer Experience has a positive impact on Customer Loyalty

Hypotheses H4 and H5 were supported since the moderating role of IoT in the cases was supported. H6 was not supported since there was no significant difference in regression weights in two models.

H4: IoT strengthen the impact of Customer Experience on Commitment

H5: IoT strengthen the impact of Commitment on Customer Loyalty

H6: IoT strengthen the impact of Customer Experience on Customer Loyalty

Last three hypotheses were supported. This conclusion is based on the Mann-Whitney U test analysis and the fact that the difference between means was positive for values in IoT group.

H7: Customer Experience with IoT is significantly higher

H8: Commitment with IoT is significantly higher

H9: Customer Loyalty with IoT is significantly higher

3.5. Theoretical and practical contributions of the work

3.5.1. Theoretical contributions

This study proposes a framework in which commitment acts as a mediator between customer experience and company loyalty. In turn, the Internet of Things acts as a moderating factor. In this framework, all relationships are significant, and all coefficients responsible for the validity of the framework correspond to thresholds.

From a theoretical point of view, we can say that we tested nine hypotheses, one of which was not confirmed. In this study, we see an overall positive effect of the application of IoT methods on customer experience and company loyalty. However, an unconfirmed hypothesis suggests that the Internet of Things does not increase influence directly, but through commitment. Thus, the Internet of Things creates additional value for the buyer, which is emotional or pragmatic.

3.5.2. Practical contributions

The study showed that customers rate their customer experience, as well as their potential loyalty to the company, much higher if they have a perception of some unique offer in the format of the experience offered to them by the store. Thus, it can be said that the Internet of Things can serve as a marketing tool. The ranked list of devices obtained during the work can help in the creation of marketing messages. For example, a company may talk about the presence of certain devices, which may arouse interest among buyers. Also, a ranked list, maybe one of the clues for the smart device adoption queue.

This research can show companies that the use of the Internet of things gives them a competitive advantage in the form of a loyal audience. This study also shows a general trend towards digitalization. This suggests that those companies that do not take care of this in advance may be at risk.

3.6. Limitations and opportunities for further research

The main limitation is that the study was based on hypothetical situation due to inability to conduct an experiment or to test customer experience in the conditions of the store that already has implemented Internet of Things system that aims to create additional value for the customer.

The survey was conducted among 248 respondents, 124 for test group and 124 for experimental group. The number of respondents was enough to build default SEM model, but for multi group analysis it would be better to have more respondents, since in this case the sample becomes twice less. The prevailing part of the respondents was students. Thus, this study could be improved by interviewing people in an age proportion closer to that in the real world. Thus, more adequate results could be obtained.

Another limitation is connected with practical implications and smart devices' part of this study. Since the main goal was to understand the influence of IoT on customer experience in retail the difference in experiences for each smart device were not measured. Thus, the store was presented as a monolith assemblage where all devices work together. For better understanding of implementation priority, it would be better to build separate scenario for each smart device and compare results. Another obstacle to implementing such an approach is the fact that this is an educational project in which it would be difficult to collect the required number of responses to obtain a relevant sample for each individual scenario. In this way more relevant results for practical application could be obtained.

Nowadays privacy in digital world is an important issue. This study does not consider barriers for the IoT implementation since it is a quite complicated theme and requires additional research. However, it would be the great topic for the further research.

CONCLUSION

The industry has come a long way from traditional ways of doing business to a state where a company has to fight for every customer, and need to be more and more innovative. The Internet and digitalization have created new competition for brick-and-mortar stores in the form of online shopping. In recent years, this has changed even more strongly under the influence of the pandemic caused by the coronavirus. Competition has intensified, and the threats to brick-and-mortar stores have only increased. Consumer habits have also changed. However, the omnichannel trend has also recently emerged, which can be a lifesaver for offline stores. Digitization of retail space can create the same experience for the customer that he gets with online shopping, thereby leveling the problems that exist in traditional retail. The Frictionless retail concept will become more and more popular in the future. Loyal customers in an industry such as grocery retail will be a very big competitive advantage, since not all stores are yet able to create such an experience for the client that he will become loyal. Thus, there is still opportunity for the stores to offer something outstanding.

The Internet of Things has recently been developing strongly in conjunction with the development of machine vision and big data analytics. The number of devices connected to various networks is growing every year, as is the volume of market capitalization. With these parameters, we should expect further development in the future. The Internet of Things can be the tool to create a unique customer experience for customers.

The goal of this master thesis was to find out the influence of Internet of things implementation on customer experience in retail.

The study showed that the Internet of things affects customer experience and loyalty. At the same time, the overall impact of customer experience on loyalty was strengthened, but not directly, but through customer commitment. Thus, we can conclude that the perceived value of customers increased the value for them, justified by emotional or practical approaches.

Despite the fact that this work showed an overall positive effect on creating a competitive advantage for the company, it has its drawbacks, which were described above in the limitations part. This work can serve as a reason for further research in this topic.

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APPENDICES

Appendix. Questionnaire content

Исследование отношения покупателей к интернету вещей в продуктовом ритейле.

Спасибо за то, что согласились принять участие в опросе. Данное исследование проводится в рамках написания магистерской диссертации. Этот опрос посвящен изучению отношения потребителей к интернету вещей в продуктовом магазине. Заполнение анкеты займет у вас не более 10 минут. Ваши ответы будут анонимными, а собранные данные будут использоваться исключительно в научных целях.

Раздел 1.

Как часто Вы покупаете продукты в магазине?

- Каждый день
- Несколько раз в неделю
- Раз в неделю
- Реже чем раз в неделю

В каком из следующих магазинов Вы предпочитаете покупать продукты?

- Перекрёсток
- Лента
- Ашан
- Billa
- Магнит
- Дикси
- Пятёрочка
- О'кей
- Spar
- ВкусВилл
- Prisma
- Азбука вкуса
- Другое

Что для Вас наиболее важно при выборе продуктового магазина? (Выберите не более 3 вариантов)

- Расположение

- Наличие доставки
- Ассортимент
- Программа лояльности
- Качество продуктов
- Качество обслуживания
- Уровень цен

Раздел 2 (Тестовая).

Опираясь на ощущения, связанные с магазином, в котором Вы предпочитаете совершать покупки, ответьте, насколько Вы согласны или не согласны со следующими утверждениями по семибалльной шкале.

1 - полностью не согласен

2 - не согласен

3 - скорее не согласен

4 - отношусь нейтрально (затрудняюсь ответить)

5 - скорее согласен

6 - согласен

7 - полностью согласен

Раздел 2 (Экспериментальная).

Представьте себе гипотетическую ситуацию, в которой в вашем любимом магазине продуктов начали использовать следующие умные устройства и технологии:

1) Умная тележка, автоматически рассчитывающая стоимость помещенных в нее товаров

2) Бесконтактные кассы самообслуживания, позволяющие не пробивать каждый товар по отдельности

3) Электронные ценники, показывающие актуальную стоимость товара

4) Цифровые стенды с картой магазина для поиска необходимого вам товара

5) Умные полки, помогающие отслеживать наличие товара в торговом зале

6) Мобильное приложение, которое присылает вам оповещение с персональными акциями, когда вы входите в магазин

Пожалуйста, снова оцените те же самые утверждения, но в НОВОМ контексте.

Раздел 2 (Вопросы)

Customer Experience

Я считаю, что магазин компетентен в удовлетворении моих потребностей

Я доволен качеством сервиса в магазине

Я в целом доволен магазинами сети

Customer Commitment

Я чувствую эмоциональную привязанность к магазинам сети

Мои привычки бы изменились, если бы я сменил магазин

Мне бы было тяжело найти достойную замену этому магазину

Customer Loyalty

Этот магазин - мой приоритетный выбор, если я иду за покупками

Я предпочитаю посещать этот магазин, а не магазины конкурентов

Я порекомендую магазин моим друзьям и родственникам

Раздел 3 (Демографические данные)

Укажите ваш возраст

- <29
- 30-39
- 40-49
- >50

Укажите ваш пол

- Мужской
- Женский
- Не скажу

Укажите уровень вашего образования

- Среднее
- Среднее специальное
- Неполное высшее
- Высшее (бакалавриат, специалитет)
- Высшее (магистратура)
- Другое

Укажите ваше материальное положение

- Мне не всегда хватает денег на еду
- У меня хватает денег на еду, но покупка одежды - серьезная проблема
- Мне хватает на еду и одежду, но покупка мелкой бытовой техники (такой как микроволновка или тостер) вызывает затруднения
- У меня достаточно денег на покупку мелкой бытовой техники, но купить телевизор, холодильник или стиральную машину мне будет сложно
- Я могу позволить себе покупку основной бытовой техники, но на автомобиль не хватает
- Моих средств хватит на все, кроме таких крупных приобретений как квартира или загородный дом
- У меня нет никаких финансовых затруднений, при необходимости я могу купить квартиру или дом

Раздел 4 (Благодарность)

Спасибо что прошли опрос! Не забудьте нажать кнопку «отправить».