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**Factors influencing the adoption of Depression Chatbot
Applications: analysis based on the 4 Gaps Model of Quality of
Service**

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Master Thesis

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Abstract

Chatbot Applications can help users to deal with Depression symptoms, since they are applications installed in mobile cell phones that allows users to have helpful conversations about some Mental Health issues that are affecting them. The feedback of the effectivity of the use by the users was collected through the user reviews of these Chatbot Applications on its Google Play Store Reviews, aiming to understand what the real perception of these users about the Chatbot Applications are. After have a first analysis on 420 applications (listing all applications associated with the tags *Depression* and *Anxiety* on Google Play Store) it was applied three criteria to filter the Chatbot Applications that were be used in this project ([The application had to show reviews in its Google Play Store website], [These reviews had to be in English] and [the Chatbot Application had to have any type of AI functionalities: Chatbot, Questionnaire or Recommendation]). After that, this project's author collected the user reviews for the 5 selected Chatbot Applications (*Wysa*, *Woebot*, *Nuna*, *MaRCO* and *Moodcare*) to analyse its' user reviews and extract the most relevant Adoption Factors related to its' use. This extraction was realized through a Web-Scraping tool called *Outwit*. From the user reviews, this project's author extracted 81 topics, that later were consolidated to 56 Topics, which generated 15 Adoption Factors, which could be included in 5 Themes. It was made a deep dive on these Adoption Factors, analysing firstly if they were representing positive or negative perceptions of the users. This analysis allowed this Project's author to associate the users' perception of Adoption Factors with the main steps of the Service provided by the Chatbot Applications, through a comparison with the 4 Gaps Model of Service Quality. This association described that the most part of the problems of the analysed Chatbot Applications are related to the Performance of the applications, mostly associated with the understanding and effectivity of AI, but, in the other way it was reinforced that the main proposition of these Chatbots Application using AI have good signals of reception by the users too, illustrated by positive Adoption Factors related to the good sensation to talk easily to someone/something.

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List of Abbreviations

- *INESC TEC*: Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência;
- *AI*: Artificial Intelligence;
- *ML*: Machine Learning;
- *NLP*: Natural Language Processing;
- *UTAUT*: Unified Theory of Acceptance and Use of Technology.

1 Introduction

Depression is one of the most influential mental health issues affecting people in the recent years, and, according to Institute of Health Metrics (2019), 3.8% of the global population is affected with these problems, including 5.0% among adults and 5.7% among adults older than 60 years. Chatbot applications can play a key role in helping to reduce some of these symptoms, and by 2025, there will be a projected 7.49 billion mobile users worldwide (The Radicati Group, 2021) The feedback of the application's users after use (written in these Chatbot applications' page on Google Play Store, for example) is an extremely valuable source of information of how the real perception of these chatbots applications are effective helping to face some of the important mental health issues, as Depression.

The main objective of this project is to understand in which stages of the Service offered by these Chatbot applications are the most relevant Adoption Factors for its users. The process of understanding these Adoption Factors is done through a qualitative analysis and posterior quantitative evaluation based on the 4 Gaps Model of Service Quality.

1.1 Project background

This project was developed towards the development of a final Dissertation of the Master's Degree of Services Engineering and Management of Faculty of Engineering of University of Porto (FEUP). The main motivation of the author was to apply the knowledge acquired in this Master's Degree to a real problem, which is increasing in the last years, in a way that can effectively help people.

1.2 Problem Description

With the increasing of the quantity of people understanding the need of learning ways to deal with mental health problems, like depression and anxiety, it is important to adapt the most recent and innovative technologies to help them to deal with this new need.

Taking in consideration the *explosion* of mobile applications offering functionalities related to these mental health problems, it is extremely important to develop a way to understand which are the main concerns and perceptions of these applications' users, towards informing the improvement of the respective services offered.

These main concerns and perceptions, which in this project were systematized to Adoption Factors, are the inputs of the analysis based on the evaluation of the quality of the services offered by the selected mobile applications analysed in this project (Chatbot applications which met a set of criteria defined for this study).

1.3 Objectives

The first objective of this project is to understand which are the most relevant factors that affect the adoption of one Chatbot application, instead of another. This understanding will increase the comprehension of the Chatbot applications' developers about which aspects of their service offering have to be improved to generate a significant impact to the users.

The second objective of this dissertation is to connect these Adoption Factors with the perception of these Chatbots applications' users (customer experience), through a Service Quality model, allowing an understanding about in which steps of the Service offering are the most relevant users' needs.

The last objective of this project is understand which Adoption Factors are mostly associated with each one of the 4 Service Gaps for the Chatbot Application analysed, aiming to help the Chatbot Applications' developers to improve the most valuable stages of the service offered, according to the users' perceptions.

1.4 Research Questions

- What are the most important Adoption Factors that influence an user to choose a Chatbot application?
- Which are the main aspects of the service offering that can influence (positively or negatively) the adoption of a Chatbot application?
- Which Adoption Factors are mostly associated with each one of the 4 Service Gaps for the Chatbot Application analysed?

1.5 Methodology

In this project a *mixed-method* research was used, because initially the author made a qualitative research, focused on the understanding of the Adoption Factors based on the Chatbot applications' user reviews, and after that it was held a part of a quantitative research, where the association of these Adoption Factors with the gaps of the Gaps Model of the Service Quality was based on the quantities of positive or negative topics related to each Adoption Factor.

In the initial part of the project, a qualitative approach was selected to analyse the user-generated content (*user reviews*) of the Chatbots applications selected, aiming to collect the most important Adoption Factors related to the use of Chatbot applications. The user reviews of the Chatbot applications selected were arranged into topics, then it was made another grouping from topics to Adoption Factors and, finally, it was categorised into themes. The reasons behind the choosing of which set of groupings were created respected a qualitative approach, based in grouping topics with similar characteristics. It is important to observe that the association of topics with positive or negative status also followed a qualitative approach.

The final part of the project was related to a quantitative approach, in which the Adoption Factors were divided into 4 states based on the amount of positive or negative topics were related to each one. These segregations of the Adoption Factors per state were the basis of the discussion of the relationship between these Adoption Factors, the 4 Gaps of the Quality Services Model and the Scale of States of Positivity or Negativity.

1.6 Dissertation Structure

This dissertation starts with a Literature Review in the Chapter 2, aiming to provide the most significant theoretical background in the fields covered in this work. Then in Chapter 3 it detailed the selected methods in this project, listing the activities performed by the author to obtain the data analysed in this project. The most relevant results of the methods applied are presented in the Chapter 4. So, in the Chapter 5 it is discussed the key understandings about the

results encountered in this project, aiming to direct the conclusion of the project. Finally, in Chapter 6, is described the main conclusions of this dissertation, including if it achieved its key objectives. Also, Chapter 6 provides some guidelines for future research based on the previously identified aspects.

2 Literature Review

This section describes the most important concepts related to the theoretical background adopted in this project, focused mainly in 2 different topics: *Services* and *Artificial Intelligence (AI)*.

2.1 Services

Aiming to provide a more effective understanding about the most significant concepts related to Services applied in this project, in this section firstly the definitions of the main concepts of Services are discussed, then the key characteristics of services are detailed, including how these characteristics differentiates the concepts of *Services* and *Products*. After that, the concepts of *Service-Dominant Logic* and *Value Co-Creation* are explained, and to finalize the idea of *Service Quality*, the most important topics for this study are characterized.

2.1.1 Definition

There are several different definitions for the concept of Services, for example. For Lovelock & Wirtz (2007) services are actions offered by one side to another, usually transforming situations to get required outcomes and these results could appear directly applied to the beneficiaries or in terms of physical items which the customers have some accountability. Still according to Lovelock & Wirtz (2007), usually there is a generation of value for the customer, in exchange for their cash or time but they do not typically take ownership of any of the tangible aspects involved. Adding in this conceptualization, for Guy (2018), a service is a way of providing benefits to customers by enabling outcomes that clients intend to accomplish without having particular expenses and consequences.

According to Fitzsimmons & Fitzsimmons (2001), several descriptions of service are presented but all include a conventional idea of abstractness and synchronized utilization. Therefore, in this project, the biggest concern of the author was to clarify the main idea of the concept, in a way that was found to be most appropriate to the specific aspects described in the next sections.

2.1.2 Key Characteristics

Kotler & Keller (2007) describe that there are four distinguishing characteristics of Services:

- *Intangibility*: Services cannot be watched, tasted, felt, heard or smelled before they are purchased;
- *Inseparability*: Services are normally created and utilized concurrently;
- *Variability*: Since the value of services varies on who offers them, when and where, and to whom, services are extremely unpredictable;
- *Perishability*: Services cannot be stored, so their perishability can be a trouble when the necessity for the service oscillates.

However, with the evolution of studies related to Services, some authors added some characteristics to this list, aiming to detail more aspects of the Services, Claessens (2015) designated that these characteristics can be useful generally to any service, in a way that make services exclusive and different from goods, introducing the concepts of *User participation* (a service cannot be disconnected from its provider, but neither can it be parted from its user) and *Lack of ownership* (you cannot have and stock a service like you can do with a tangible item). This feature is deeply associated to numerous additional qualities of services, for example intangibility, perishability, and inseparability. Figure 1 shows these attributes of services:

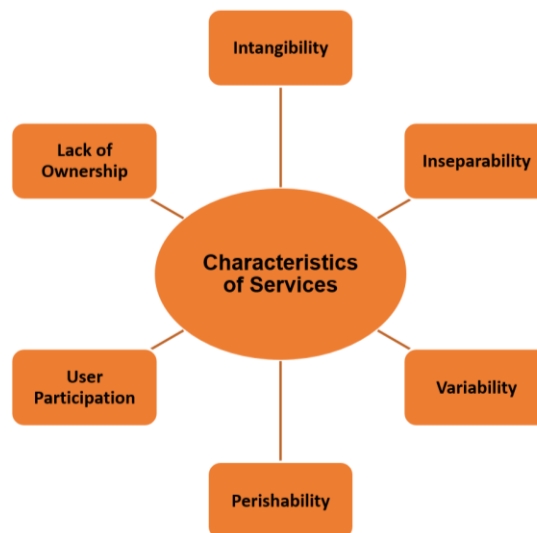


Figure 1: 6 Key Characteristics of Services.

Source: Own Elaboration, based on Claessens (2015)

2.1.3 Service-Dominant Logic and Value Co-Creation

According to Vargo & Lusch (2011), in a market perspective, the businesses exists to produce and trade supplies, following a Goods-dominant (G-D) Logic, characterized by:

- Objective of profitable occupation is to get and deliver parts of production, if possible tangible (for example, commodities);
- Supplies are incorporated with functionality (value) during production;
- Purpose is to increase income due to a cost-effective construction and circulation of exports, that must be consistent, generated away from the market, and inventoried till demanded.

Figure 2 illustrates this G-D Logic, explained by Vargo & Lusch (2011):

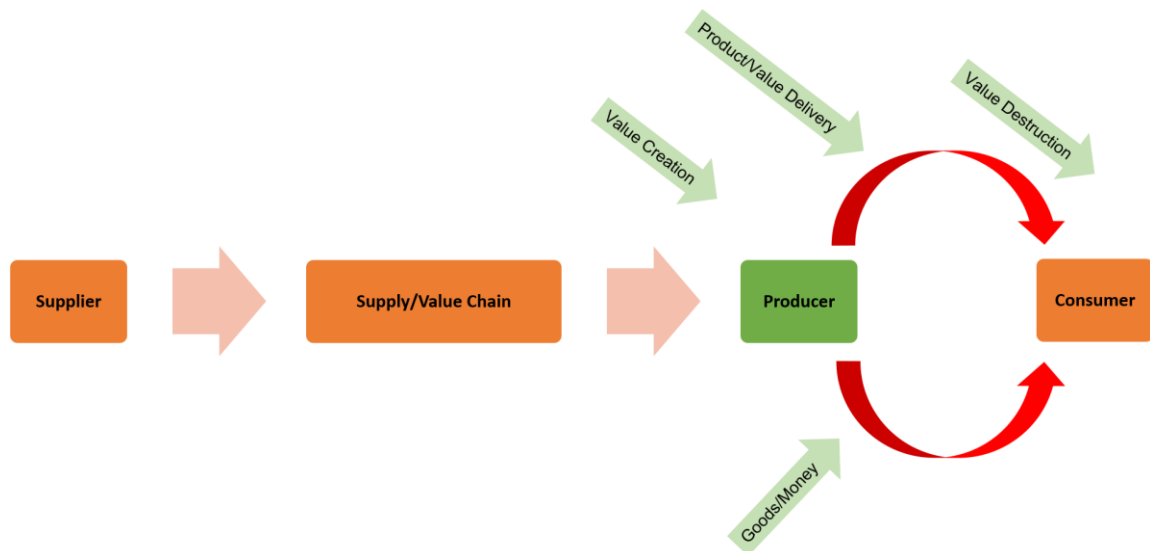


Figure 2: Goods-Dominant (G-D) Logic.

Source: Own Elaboration, based on Vargo & Lusch (2011)

Wennerholm (2012) identifies a transformation of attention from products to services, that has been defined in the literature as being a transition from a goods-dominant logic (G-D) to a service-dominant (S-D) logic.

Vargo et al. (2020) detail the service-dominant (S-D) logic as a service-centred focus that redescribes the intention and method of economic trade. Moreover, Vargo et al. (2020) add that the S-D logic practices service as a viewpoint to comprehend the nature of swap throughout all areas and circumstances, rather than restraining the importance of service to those settings in which the swap outputs are differentiated by the services individualities of intangibility, inseparability, heterogeneity, and perishability.

An extremely important concept from the service-dominant (S-D) logic is the understanding that the customer becomes responsible for the Co-Creation of Value, which, according to Prahalad & Ramaswamy (2004), is the collaborative foundation of value by the business and the clients, permitting the clients to co-construct the service experience to fit their situation.

Payne et al. (2008) argue that the S-D logic proposes pertinent implications that are formed by the experiences a client has during the period of execution, in a way that the S-D logic puts the clients as key actors who must co-develop and customize their associations with providers, and assume distinct functions. Payne et al. (2008) also add that a valuable idea is that the co-creation of experiences is enabled by the existence of the value proposition of the service offer business. Producing the experience of the client is less regarding to manufactured goods and more regarding to interactions which the client has an active participation. The perception of *Customer Experience* will be detailed in the next Section.

2.1.4 Service Quality

To describe this topic in a more effective way, this section is divided in two parts: firstly the *Main Concepts* of Service Quality are detailed and after the most effective ways to help *Measuring Service Quality* are discussed.

2.1.4.1 Main Concepts

Ghobadian et al. (1994) explains that how much a service produced go through the client's hopes, more it can be told that this service offered had a good quality. Both the service result and the service way of development influences actively the perception of quality. For Ramya et al. (2019), service quality is about the capacity of the service supplier to fulfil the client's expectations in an effective way while the business performance increases.

To understand how the Service Quality is related to the Customer Satisfaction, the author used a definition from Albari (2019), who argues that the Product Quality, the Service Quality and the Price presented by a corporation together get a positive influence on Customer Satisfaction and have an impact on Customer Loyalty. This association is represented by the Figure 3, as follow:

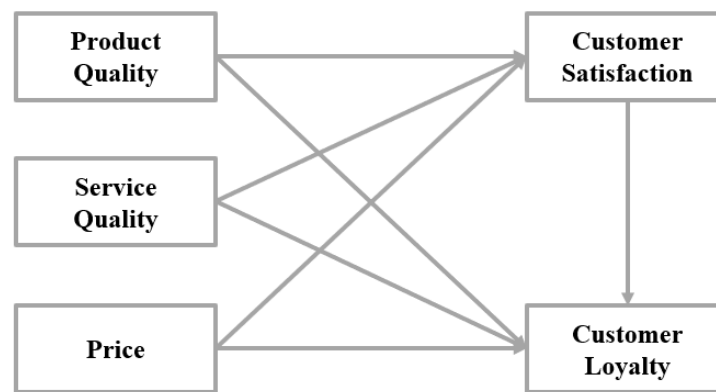


Figure 3: How Product Quality, Service Quality and Price affects the Customer Satisfaction and Loyalty?

Source: Own Elaboration, based on Albari (2019)

Adding to the definition of Albari (2019), the author understands that it is possible to create one more dimension in this relationship, focused on the *Perceived Value* and on the *Comparison with Expectations*, as follow in the Figure 4:

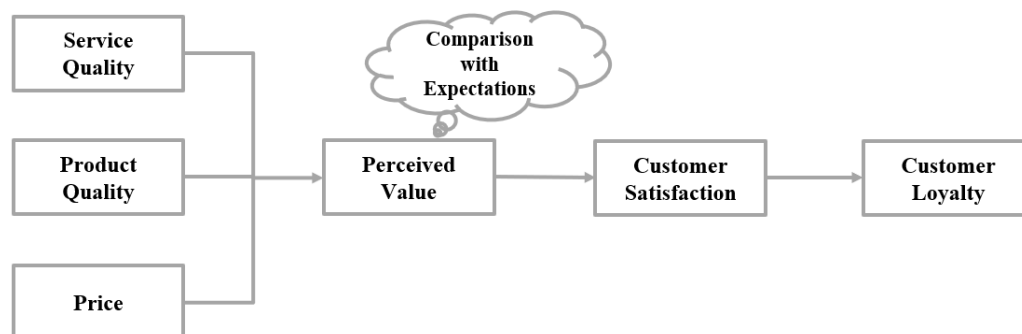


Figure 4: How the Perceived Value affects the Customer Satisfaction and Loyalty.

Source: Own Elaboration, based on Albari (2019)

Besides the several definitions for *Customer Satisfaction*, as those provided by Farris et al. (2010) [*Customer Satisfaction* is the amount of clients, or percentage of total clients, whose signalized good involvement with a business, its tangible goods, or its services overcomes the expected objectives] and the definition provided by Gupta (2021) [*Customer Satisfaction* is an evaluation of how precisely a business' tangible goods, services, and involvement in general go through the clients' expectations], the author understands that the most significant enablers for the *Customer Satisfaction* are the *Perceived Value of the Service Offered* and the *Expected*

Value to Receive by the Service Offering, Companies have to be extremely careful in the setting of expectations of their service offers, in comparison with the current level of Service Quality that is being offered.

Based on the study of Forero & Gómez (2017), the author understands that *Customer Satisfaction* can be obtained as result of the subtraction of *Perceived Performance* by *Expected Performance*, strengthening the fact that companies really need to monitor the satisfaction of their customers.

Bowen & Chen (2000) studied the relationship between *Customer Satisfaction* and *Customer Loyalty* to a specific sector of business (hotels) and have concluded that a slight rise in customer satisfaction enhanced customer loyalty intensely, emphasising the necessity of companies to focus on *Customer Satisfaction*, moreover *Service Quality* and *Customer Expectations*.

In the next section, the author presents a way to measure Service Quality.

2.1.4.2 Measuring Service Quality

The explanation of how to measure Service Quality is divided in 2 parts: the first focusing on the *SERVQUAL Scale* and the last going on a deep dive on *The 4 Gaps Model of Service Quality*.

Related to the SERVQUAL Scale, Parasuraman et al. (1988) defines the five main dimensions for the Service Quality (SERVQUAL) scale measurement:

- *Tangibles*: Physical resources, equipment, and presence of workers;
- *Reliability*: Skill to execute the suggested service consistently and precisely;
- *Responsiveness*: Commitment to support clients and deliver timely service;
- *Assurance*: Expertise and gentility of workers and their talent to encourage responsibility and faith;
- *Empathy*: Compassionate, tailored consideration that the business offers to its clients.

This SERVQUAL scale is represented in the Figure 5:

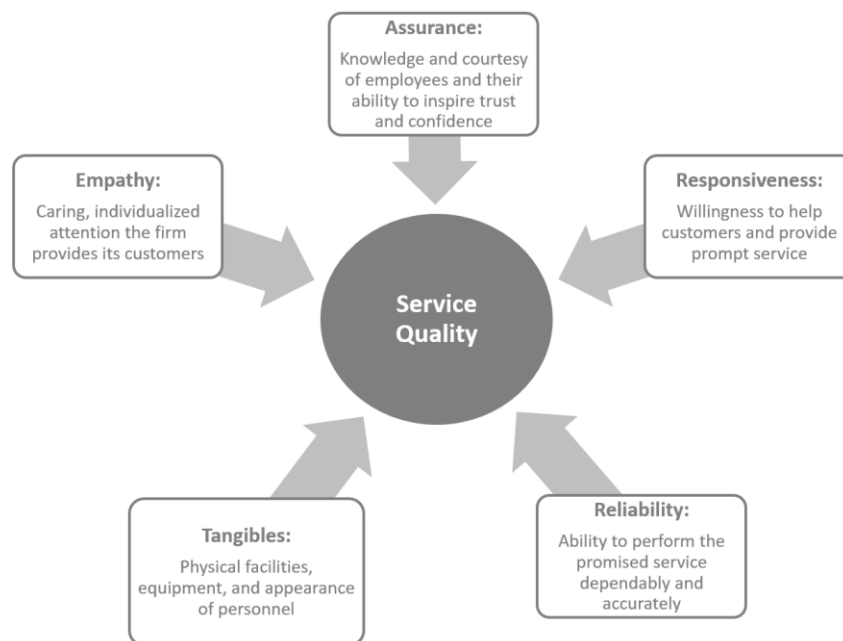


Figure 5: The SERVQUAL Scale.

Source: Own Elaboration, based on Parasuraman et al. (1988)

Shahin (2006) utilized the SERVQUAL scale to measure the Service Quality in an investigation realized in a catering company and concluded that its' use as an option for measure the difference between expectations and perceptions proved itself as very useful for assessing levels of service quality. Based on this study, in the next section it will be conceptualized the 4 Gaps Model of Service Quality to measure the quality of a service offered in this project.

2.1.4.2.1 The 4 Gaps Model of Service Quality

The framework of the 4 Gaps Model of Service Quality, proposed by Zeithaml & Bitner (2010), has a strong significance in the services field. It has as focus on the management of service quality and aspects related to the innovation based on customer-driven services. For Tan et al. (2016), the GAPS model of service quality is extremely helpful in supplying leaders with instruments that assist the increase of the service quality levels offered by service companies.

The concepts of 4 Gaps Model, according to Zeithaml & Bitner (2010), are listed as follow:

- *Customer Gap*: The distinction between client expectations and perceptions;
- *Company Gap 1 – Listening Gap*: Not understanding what clients demand;
- *Company Gap 2 – Service Design and Standards Gap*: Not getting the correct service design and standards;
- *Company Gap 3 – Performance Gap*: not providing to the service standards previously defined;
- *Company Gap 4 – Communication Gap*: not fitting execution to what were guaranteed before.

Furthermore, according to a study by Zeithaml & Bitner (2010), Figure 6 represents visually the 4 Gaps Model:

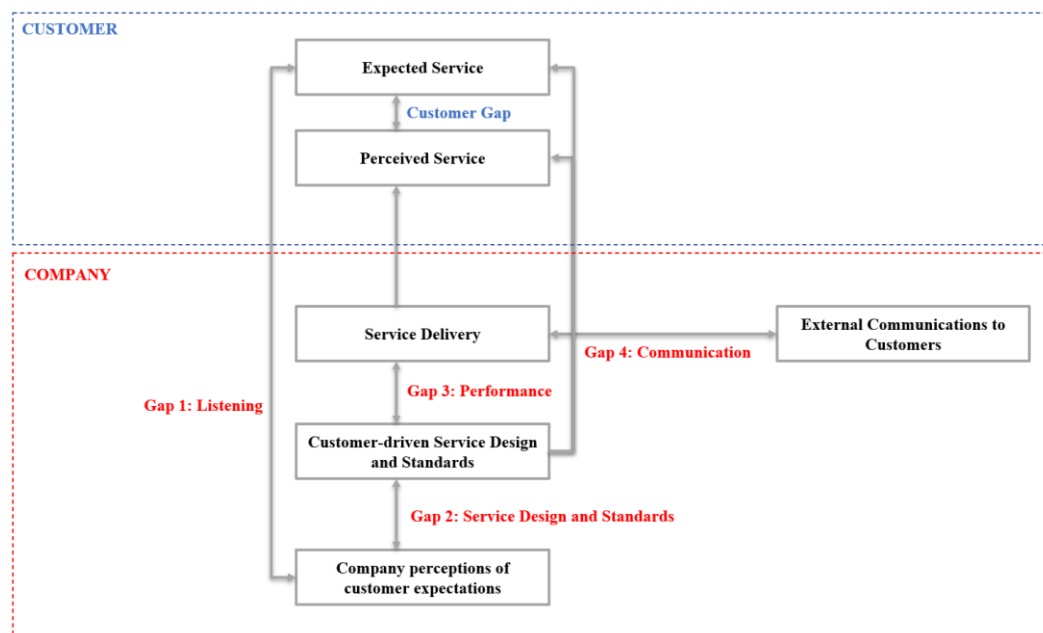


Figure 6: The 4 Gaps Model of Service Quality.

Source: Own Elaboration, based on Zeithaml & Bitner (2010)

More details about each one of the 4 gaps, related to the company providing the service, according to Kobiruzzaman (2021), are listed:

- *Company Gap 1 – Listening Gap:* This gap in service quality represents the gap between clients' hopes for the business and its activity of offering that service. It recognises what clients need from the business and what the business usually presents to the clients;
- *Company Gap 2 – Service Design and Standards Gap:* This gap is the variation between administration insights of the client desires and the transformation of those insights into service delivery procedures and guidelines. This gap emerges because of the difference between what the client needs and what administration delivers for the clients;
- *Company Gap 3 – Performance Gap:* This gap is the divergence between the specification of the service delivery procedures of the company and the genuine provision of the service. This gap in service quality occurs when the business cannot sustain the level of products and services offered to clients. This gap might happen for one of the following reasons: message deliver failure, inadequate knowledge or bad management on conceptualizations in the business provider;
- *Company Gap 4 – Communication Gap:* This gap implies the distinction among what the business publicises about its' services and what is given to the client. It appears when the firm cannot offer services corresponding to what were promise. It is a crucial aspect because it could generate a client frustration.

this project is focused on the 4 Company Gaps (*Listening, Service Design and Standards, Performance and Communication*).

2.2 Artificial Intelligence (AI)

To have a complete understanding of the most significant concepts related to AI applied in this project, this section of the Literature Review is separated in 4 main topics: firstly, the several *Definitions* related to AI are listed, then the main *Methods Applying AI* are studied, afterwards the idea of *ML and NLP supporting Chatbots* is discussed and, finally, the notion of *AI Applied to Services* is described.

2.2.1 Definitions

There are different definitions for the concept of Artificial Intelligence, but the first one was introduced by McCarthy (2004), which described AI as the discipline of developing smart systems and computer programs, in a way that there is no need of biological understandings to get to a computer the capacity of comprehend the human intelligence.

Other significant contribution related to this definition was offered by Alan Turing, in his paper *Computing Machinery and Intelligence*. Turing (1950) described AI as the *father of computer science* and defined that AI is the science and engineering of creating intelligent systems, mainly smart computer systems.

Turing (1950) also made relevant contributions through the conceptualization of the *Turing Test*, that was illustrated by IBM (2020) as an occasion which a person would attempt to realize if an answer were written by a machine or by another person.

IBM (2020) also reinforced that this Turing Test persists as an essential component of the history of AI. Aiming to add an alternative definition, Team (2022) argues that AI is the skill of a machine to execute tasks usually related to humans.

Independently of the diverse range of definitions for AI on the literature, in this project the author refers to the most significant AI functionalities and applications, centralizing the focus of the project to these functionalities and applications, instead of the *most correct* definition.

2.2.2 Methods Applying AI

There are several methods applying Artificial Intelligence, but at this project the author focuses on two of the most significant: Machine Learning (ML) and Natural Language Processing (NLP), and how these methods can support the Chatbots applications, the key item studied in this project.

2.2.2.1 Machine Learning (ML)

For Duin & Bakhshi (2017), machine learning is the practice of a computer distilling regularities from training data. In the other way, according to Burns (2021), machine learning (ML) is a kind of artificial intelligence (AI) that permits digital products to turn out to be more correct at forecasting results without necessarily being designed to it. Burns (2021) also adds that machine learning procedures utilize past information as input to forecast original outputs.

For Fumo (2017), there are 4 distinct categories of machine learning algorithms: Supervised learning, Unsupervised Learning, Semi-supervised Learning and Reinforcement Learning, but, for the purpose of this project, it is not relevant to deep dive on these definitions.

2.2.2.2 Natural Language Processing (NLP)

To understand the most significant definitions of Natural Language Processing (NLP), Chowdhury (2003) describes it as an section of exploration and use that investigates how machines could be capable of recognize and handle natural language content or dialogue to accomplish valuable ideas. In another way, for Hirschberg & Manning (2015), Natural language processing utilises methods from machines for the objective of discovering, have a perception and creating human language content. Recent studies improve and exploit such tools in real-world purposes, producing verbal conversation structures and speech-to-speech conversion mechanisms, extracting social media content for get new data regarding well-being or economics, and recognising sentiment and feeling concerning tangible goods and services, for instance.

2.2.3 ML and NLP supporting Chatbots

For Techopedia (2019), Chatbot is an artificial intelligence (AI) system that replicates collaborative human dialogue by applying significant pre-determined client. Other definition from Hopkins (2020) details chatbots as programmed interfaces put on sites, gadgets, and social media which can have conversations. More sophisticated chatbots will be driven by AI, but numerous eldest types of AI are rule centered. Usually, the most competent and user-friendly chatbots are developed on an AI structure.

Krayewski (2022) describes that the latest generation of chatbots are NLP-operated simulated instruments that become wiser on a daily basis, as they follow the knowledge during the course

of the discussion and absorb instantaneously. Krayewski (2022) also catalogued several crucial components of an NLP-operated chatbot, as follow:

- Dialogue Management follows the status of the dialogue, in a way that the essential parts of dialogue management in AI chatbots involves a perspective — collecting and distributing information traded in the discussion — and session — one dialogue from the beginning to the end;
- Human Handoff is related to the continuous interaction and implementation of a handoff from the AI chatbot to a person;
- Business Logic Integration is relevant to NLP for the reason that the chatbot has to be structured in line with the company's distinctive business logic;
- Rapid Iteration suggests to get the quickest direction to the correct result, in a way that the Chatbot is smooth and effortlessly programmable;
- Training and Iteration is related to ensure that the NLP-operated chatbot does not go in an incorrect way, so it is needed to methodically give instructions, practice and send feedback to progress its comprehension of client objectives utilizing actual dialog information being created transversely different channels;
- Natural Language Processing refers to several concepts, like utterances (situation of an client say about a detailed purpose), intent (the connotation of the choice of words made by an user), entity (specifics that are significant to the purpose which a client says, for instance specific periods or places), context (which supports the storage and diffusion of important aspects related to a dialogue);
- Simplicity is related to the objective to get the most out of the simulated agent, in a way that the language has to be as simply as possible, with all features needed.

Taking these definitions in consideration, the author understands that the Machine Learning functionality allows Chatbots applications to learn from the history of interactions, while the Natural Language Processing functionality helps the Chatbots applications to understand the language and context efficiently to build dialogues with the users of the chatbots.

2.2.4 AI Applied to Services

Besides Chatbots, there are many examples of Artificial Intelligence functionalities applied in the most different services. For example, Bansal (2020) listed the 15 top applications of AI that includes services (*Personalized Online Shopping, Smart Cars, Marketing, Enhanced Images, Social Media, Surveillance, Agriculture, Customer Service, Video Games, Healthcare, Banks, Smart Homes, Virtual Assistance and Space Exploration*), but there are more examples of services that can be improved by AI, as identified by Chowdhury (2021): *Education, Human Resource Management and Navigation and Travel* are among those.

Table 1 shows some examples of several areas that already uses AI functionalities to help people to solve the most diverse range of problems and situations:

Table 1: Examples of Areas that AI is applied.

Source: Own Elaboration

Source	Area	Contributions
(Norris, 2021)	Marketing	Starbucks Uses Predictive Analytics to Serve Personalized Recommendation
(Lisowski, 2021)	Smart Cars	WAYMO works on the world's first autonomous ride hailing service and autonomous trucking for local delivery solutions, based on a network of radars, lidars, and cameras
(Daley, 2022)	Healthcare	PathAI develops machine learning technology to assist pathologists in making more accurate diagnoses. The goals include reducing error in cancer diagnosis and developing methods for individualized medical treatment
(Gossett, 2022)	Banks	Socure's identity verification system uses machine learning and artificial intelligence to analyze an applicant's online, offline and social data to help clients. The system runs predictive data science on information to investigate whether an applicant's information is being used legitimately
(Gupta, 2020)	Education	Duolingo is a language-learning tool that leverages AI to deliver a placement exam and optimize and personalize sessions

2.3 Relation between New Technologies Diffusion and Service Adoption

For Liu & Miguel-Cruz (2022), technology diffusion defines the cooperative acceptance process of groups of persons who adopt a technology over time. Figure 7 describes how technology use spreads through a population, in a way that the rate of individual adoption over time shapes the population technology diffusion curve. According to Liu & Miguel-Cruz (2022), adoption (micro perspective on change) refers to the particular decision point if the person will utilize a technology or not, and diffusion (macro perspective) is related to the adjustment of adoption rate through the years, referring to the shared adoption decision of specific groups or people if they will utilize a technology or not:

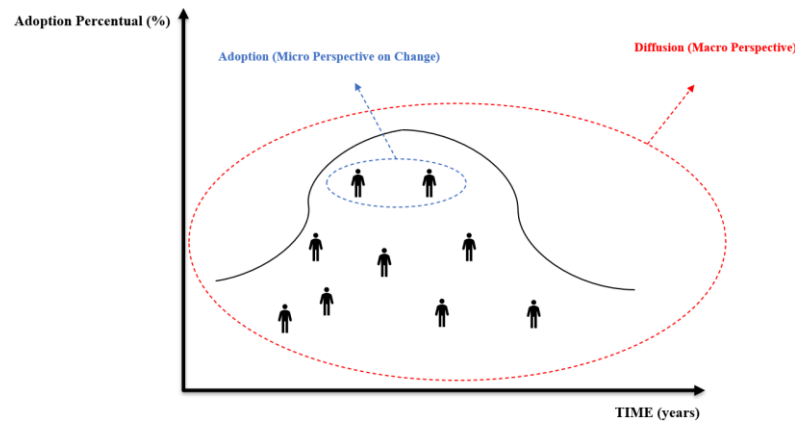


Figure 7: Illustration about difference between Diffusion and Adoption of Technologies.

Source: Own Elaboration, based on Liu & Miguel-Cruz (2022)

Figure 8 illustrates the difference of the Adoption Rate on United States households of several historical Technologies, as electricity or air-conditioning through the decades, since 1900 until 2005. It is important to notice that the most recent technologies illustrated on Figure 8 have extremely steep adoption rates, for example cell phones and Internet, in comparison with telephone and stove, as follow:

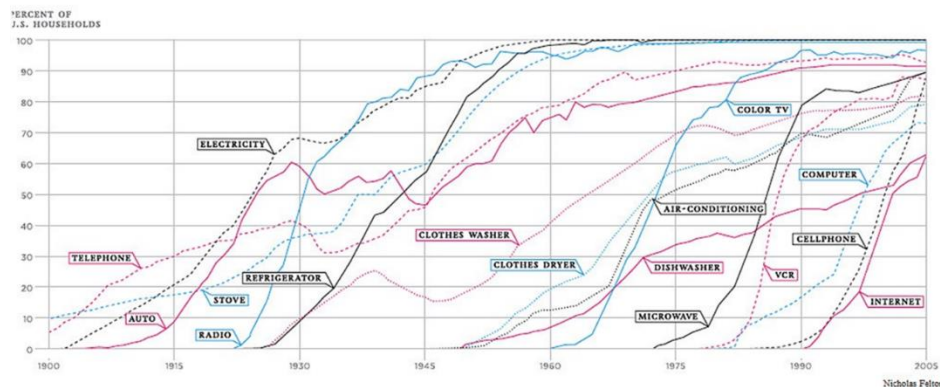


Figure 8: Relation between diffusion of technologies and adoption.

Source: "The New York Times - How Americans Spend Their Money" by davidcrow is licensed with CC BY-NC-SA 2.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-sa/2.0/>

Kollmann (2004) reinforces the need of differentiation between the terms Adoption and Acceptance. According to his study, the word *adoption* must only be applied for the choice of buying/adoption from the client (first time use) and the term *acceptance* only for the uninterrupted use. Taking this understanding in consideration, this project aims to understand the main Adoption Factors that influences an user to choose a Chatbot application.

One way to guide the study of a service adoption could be based on the UTAUT model (*Unified Theory of Acceptance and Use of Technology*), proposed by Venkatesh et al. (2003), that describes the main user intentions to use an information system and the aspects related to its subsequent behaviour about the continuity of using such system. This theory is based on 4 key constructs: *Performance Expectancy*, *Effort Expectancy*, *Social Influence* and *Facilitating/Enabling Conditions* which differs from consumer to consumer and influences each consumer technology acceptance and use. Moreover, *UTAUT* is more pertinent to clients than businesses and it focuses mainly on human factors, according to Kiwanuka (2015).

There are some projects applying UTAUT to try to understand the main factors that influence adoption of a new technology for a new context, for example, the study of BenMessaoud et al. (2011) focused on discover the facilitators and barriers to adopting Robotic-Assisted Surgery through the UTAUT application. Other example is the study conducted by Gagnon et al. (2016), focused on integrate existing expertise of the factors affecting healthcare professional acceptance of mobile health (m-health) applications¹.

It is relevant to highlight that the factors analysed in the current studies related to the Technology adoption, namely through the UTAUT, are strongly in line with the 4 Gaps Model of Service Quality. Therefore, using a service perspective, this study will identify the factors that influence the adoption of chatbots for support/monitoring of mental illness and associate these factors with the 4 Gaps Model of Service Quality, to propose ways to improve the service provided.

¹ mHealth or mobile health is related to medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices, according to World Health Organization (2011)

3 Selected Methods in the Project

In this section the methods used to perform the analysis described in this project are consolidated, divided in 5 different parts: firstly, the main aspects about *Data Source* are detailed, followed by the steps related to *Data Consolidation* and *Criteria for Selection*. Finally, it is detailed how the *Data Extraction* was performed and, after that, the main characteristics about the *Data Processing* are explained.

3.1 Data Source

This project initiated with several searches in Google Play Store's website. Aiming to understand how many applications were displayed when using the search function of the website, the author put two tags in the search button: *depression* and *anxiety*. It has been shown around 50 applications in the list for each tag, with some application displayed at the same time in both lists, related to the 2 tags.

With the objective of expanding the universe of applications encompassed in this project, the author decided to search through the following steps: putting *depression* and *anxiety* tags in the search button; clicking on *view more* button in the category. In this way, the website displays 250 applications for each tag.

After consolidating 250 applications displayed for the first tag (*depression*), and 170 for the second tag (*anxiety*), the author determined the boundaries of the object of the study, focused initially in these 420 applications. (ps.: Only 170 applications were selected for the second tag, *anxiety*, because 80 applications displayed in this search were already displayed in the first search, related to the *depression* tag, so it would be unnecessary to replicate the same information twice.)

3.2 Data Consolidation

The information was consolidated in an Excel file, containing the most important characteristics of the applications for this study, described below:

- Index;
- Tag (Word searched on Google Play Store: *depression* or *anxiety*);
- Application Name;
- Company Developer;
- Application Version (to consolidate the version of analysed user reviews);
- Payment Type (Financial Model of each application: Free or Freemium);
- Evaluation Rating (Final Rating, consolidated of all user reviews, when applicable);
- Number of Evaluations (Total number of user reviews displayed on information page, when applicable);
- Show Reviews?
- Use AI? (First approach if the application contains any type of AI);
- What Type or Tool of AI? (Chatbot, Questionnaire² or Recommendation);
- Main Features (Mood tracker, Tests, Meditation Exercises, etc);

² When the author refers to Questionnaire, it is related to the type of functionality seen by the user, but, in terms of technology, it refers to automatized succession of rules and decision trees.

- AI Status (a second confirmation if the application really has any AI feature);
- Chatbot Status (a validation if the application has the chatbot's feature);
- Language;
- Chatbot as the main functionality?

The construction of the consolidation file had two main objectives: keep the traceability of all steps followed according to the criteria chosen and allow a quick visualization of which are and how many applications were respecting all the criteria and filters selected.

3.3 Criteria for Selection

In the beginning, while the author was collecting data, three main criteria were applied to make an initial filter in the applications:

- The application had to show reviews in its Google Play Store website;
- These reviews had to be in English;
- After a previous analysis of the author in the application description, screenshots and reviews, the application had to have any type of AI functionalities (Chatbot, Questionnaire or Recommendation).

The applications that showed reviews, in English, and seemed to have any type of AI functionalities were selected for the next phase of Data Processing (62 applications, from the initial 420).

Given the deadline's restriction of this project, the author decided to focus this study on the applications that certainly have Chatbot functionalities, excluding the applications that had other AI functionalities from the list (Questionnaire and/or Recommendation). At this phase, the object of study was reduced from 62 to 14 applications.

When the author made a deeper analysis on the reviews of the listed applications, it was identified that in the applications that had more than one functionality (like, for example, mood tracker or meditation exercises), most of these reviews were focused on these functionalities, decreasing the reviews about the functionality of the chatbots. So, it was applied one more dimension of filter that selected only the applications that had Chatbots as its only functionality, reducing the selected list from 14 to 5 applications.

3.4 Data Extraction

The object of study, represented by these 5 chatbots applications, was analysed in more detail, aiming to understand the main factors influencing their adoption by users. To support this analysis, it was collected all reviews of these applications, sorted by chronological order, through a web scraping tool, called *Outwit*. At the same time, it was extracted both print screens of the pages containing the main information of the applications and of the review pages, containing the users' reviews.

The 5 chatbot applications were divided in two groups, according to their number of user reviews (Group A with two applications: *Wysa* and *Woebot* and Group B with the three remaining: *Nuna*, *MaRCO* and *Moodcare*).

The two applications with more quantity of user reviews (Group A) had to have different criteria to select the terms of data extraction, as follow:

- *Woebot*: It was collected the most applicable³ user reviews since the launching of the application version 4.4.0 (November 19th, 2021), the latest version at the time, until May 15th, 2022;
- *Wysa*: As this application has a very significant amount of new user reviews per day, and due to a technical constraint of the Google Play Store website (when there are so many user reviews displayed on the screen, the website automatically sorts the order, losing the chronological order of the reviews), the author could not extract all user reviews related to the launching of the most recent version (3.0.2), so it was collected the most applicable³ user reviews between May 1st, 2022 and May 15th, 2022. (Note: as this application has so many new user reviews per day, the amount of user reviews collected just for this time range (15 days) was bigger than all other applications analysed).

The three applications of Group B (*Nuna*, *MaRCO* and *Moodcare*) had less user reviews, so it was possible to extract all user reviews displayed at each application's page on Google Play Store.

3.5 Data Processing

This section explains the methods used for Data Processing. To comprehend all aspects related to the data processed in this project, this section is divided in 7 parts: the first is related to the *Processing of 81 Topics from User Reviews*, which the author focused on how to extract relevant topics from the User Reviews of the 5 applications studied in this project. Later, these 81 topics were synthesized in 56, according to its' meanings, in the section *Consolidation of 56 Topics from User Reviews*. Subsequently the author aims to understand and extract the Adoption Factors from these 56 topics, in the section *Association between the 56 Topics and the 15 Adoption Factors*. Afterwards, from these 15 Adoption Factors the 5 main Themes utilized in this project are extracted, in the section *Association between the 15 Adoption Factors and the 5 Themes*.

After the extraction/consolidation of these Topics, Adoption Factors and Themes, the author performed an *Analysis of Scale of States of Topics for each Adoption Factor*, finalizing the section with the 2 key connections between these concepts, with a *Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps* and, in the other way, with a *Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States*.

³ Applicable: the author used the sentence *the most applicable* user reviews because it was applied an additional criterion for the selection of user reviews of application with too many user reviews (Group A): remotion of the user reviews that could not add any relevant contribute to this object study, mainly focused on understanding factors that could influence an adoption of a Chatbot application for an user. It was removed in this phase: Emotions reviews: *I loved this app*, *I hate this app* and short sentences without any mention to positive or negative factors about the application.

3.5.1 Processing of 81 Topics from User Reviews

This section consists of the description of the methods used for the processing of topics extracted from the user reviews collected from the applications' page on Google Play Store.

After reading all user reviews selected, the author listed both positive and negative topics for each application, totalizing 81 topics. At this stage, it was possible to have the same topic expressed in different words for different applications, but with the same meaning.

3.5.2 Consolidation of 56 Topics from User Reviews

This section is focused on the consolidation of the main ideas expressed by each topic, independently if the idea was expressed for different applications.

At this phase, the number of topics decreased from 81 to 56 topics, in a way that the author kept the number of times that each topic repeated and in which applications that repetition occurred.

3.5.3 Association between the 56 Topics and the 15 Adoption Factors

Advancing in the analysis, the author correlated each one of these 56 topics with an Adoption Factor, aiming to systematize the analysis. This consolidation of 56 topics resulted in 15 Adoption Factors, which will be detailed in the Section 4.3.3.

3.5.4 Association between the 15 Adoption Factors and the 5 Themes

In the same way, the author made an association between each one of these 15 Adoption Factors and 5 Themes. This association will be detailed in the Section 4.3.4.

3.5.5 Analysis of Scale of States of Topics for each Adoption Factor

Each one of these 15 Adoption Factors has some topics related to its Adoption Factor, independent if the topic is positive or negative. Aiming to understand better this relationship, the author created a scale of 5 states, based on the amount of positive or negative topics are related to each adoption factor:

- *Completely Positive*: 100% of topics are positive;
- *Mostly Positive*: more than 50% of topics are positive;
- *Neutral*: 50% of topics are positive and 50% are negative;
- *Mostly Negative*: more than 50% of topics are negative;
- *Completely Negative*: 100% of topics are negative;

3.5.6 Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps

After the understanding of Adoption Factors in terms of positive or negative states, the author correlated this Adoption Factors with the 4 Gaps Model of Quality of Services, intending to discuss what are the main relation between these Adoption Factors analysed in this project and the perceived value of the service for the customer, represented by each one of the gaps, which will be more detailed in the Section 4.3.6

3.5.7 Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity

Advancing in this analysis, the author made an association between the 4 Gaps described before, the 15 Adoption Factors analysed in this project and the Scale of States, which will be more detailed in the Section 4.3.7.

4 Results

In this chapter the results of application of the steps described in Chapter 3 (*Selected Methods in the Project*) are detailed. This chapter initiates with a consolidation of the results of *Data Collection*, *Data Consolidation and Criteria for Selection*, followed by results of *Data Extraction* and, finally, the results of *Data Processing* are detailed, going on a deep dive of each Adoption Factor and Theme.

4.1 Data Collection, Data Consolidation and Criteria for Selection:

This section shows the results of application of the steps described in the Sections 3.1 (*Data Source*), 3.2 (*Data Consolidation*) and 3.3 (*Criteria for Selection*). Table 2 represents the consolidation of all filters and criteria applied to the five selected applications studied in this project:

Table 2: Data Source, Consolidation and Criteria for Selection results

Source: Own Elaboration

Index	Tag	Application Name	Developer	Version	Type	Rating	Number of Evaluations	Show Reviews?	Use AI?	What Type or Tool of AI?	Main Features	AI Status	Chatbot Status	Language	Chatbot as the main functionality?
15	Depression	Wysa: Anxiety, therapy chatbot	Touchkin	3.0.0	Freemium	4.7	115,835	Yes	Yes	Chatbot	Chatbot that uses AI to react to the emotions expressed + MoodTracker + Daily Meditation Guides + Mental Health Assessment with Depression and Anxiety Tests	Certainly have IA	Yes	English	Yes
53	Depression	Woebot: Your Self-Care Expert	Woebot Health	4.5.1	Free	4.6	11,47	Yes	Yes	Chatbot	Chatbot	Certainly have IA	Yes	English	Yes
59	Depression	Nuna: Mental Health Companion	Nuna	2.9.5	Freemium	-	-	Yes	Yes	Chatbot	Chatbot	Certainly have IA	Yes	English	Yes
96	Depression	MARCo: Anxiety Relief & Depression Support Robot	MARCo Technologies Limited Liability Company	2.3.5	Freemium	-	-	Yes	Yes	Chatbot	Chatbot	Certainly have IA	Yes	English	Yes
159	Depression	Moodcare: Therapy & Psychology	Moodcare	1.1.6	Freemium	-	-	Yes	Yes	Chatbot	Chatbot + Moodtracker + Exercises + Source of Information	Certainly have IA	Yes	English	Yes

In the entire universe of 420 applications assessed in this project, five applications met the requirements imposed for the purpose of this study, that can be summarized as follow:

- Show User Reviews in English;
- The application has any AI functionality;
- The chatbot is the main functionality.

4.2 Data Extraction

This section shows the results of application of the steps described in the Section 3.4 (*Data Extraction*). Table 3 represents the quantitative components (number of reviews extracted and time range of each application's extraction) of the data extraction:

Table 3: Data Extraction Results

Source: Own Elaboration

	Index	Application Name	Amount of Reviews Extracted	Timerange of Reviews Extraction	Version of Application
Group A	53	Woebot: Your Self-Care Expert	+200	from November 19th, 2021 to May 15th, 2022	4.4.0
Group A	15	Wysa: Anxiety, therapy chatbot	+200	from May 1st, 2022 to May 15th, 2022	3.0.2
Group B	59	Nuna: Mental Health Companion	18	from August 29th, 2020 to May 15th, 2022	3.0.2
Group B	159	Moodcare: Therapy & Psychology	9	from May 27th, 2021 to May 15th, 2022	1.1.6
Group B	96	MARCo: Anxiety Relief & Depression Support Robot	3	from June 16th, 2021 to May 15th, 2022	2.3.5

While Group B applications (*Nuna*, *MaRCO* and *Moodcare*) did not have any new user reviews in months, Group A applications (*Woebot* and *Wysa*) had a strongly significant quantity of new user reviews per day, mainly *Wysa*.

4.3 Data Processing

This section shows the results of application of the steps described in the Section 3.5 (*Data Processing*). The results extracted from user-generated content are presented following the flow from the user reviews, becoming Topics (*Processing of 81 Topics from User Reviews* and *Consolidation of 56 Topics from User Reviews*), then Adoption Factors (*Association between the 56 Topics and the 15 Adoption Factors*) and, finally, Themes (*Association between the 15 Adoption Factors and the 5 Themes*).

Afterwards the key connections between these Topics, Adoption Factors and Themes with the Scale of States ([*Analysis of Scale of States of Topics for each Adoption Factor*] and [*Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity*]) and with the 4 Gaps Model of Service Quality (*Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps*) are presented.

4.3.1 Processing of 81 Topics from User Reviews

At this stage of the project, the results of processing 81 topics from User Reviews are described.

81 topics were identified in the five applications, divided in 41 positives and 40 negatives. The tables containing the topics extracted from the user reviews of each application are included in the Appendix section, as follow:

- Group A: 15 positive and 17 negative Topics of *Woebot* (Appendix A);
- Group A: 14 positive and 10 negative Topics of *Wysa* (Appendix B);
- Group B: 7 positive and 7 negative Topics of *Nuna* (Appendix C);
- Group B: 3 positive and 3 negative Topics of *Moodcare* (Appendix D);
- Group B: 2 positive and 3 negative Topics of *MARCo* (Appendix E);

4.3.2 Consolidation of 56 Topics from User Reviews

This section presents a consolidation of topics with the same meaning, reducing from the previous 81 topics to 56 topics, with 30 negative and 26 positive topics.

Table 4 contains the negative topics extracted from the user reviews of each application, the number of repetitions of each topic and in which application it was repeated:

Table 4: Consolidation of the 30 Negative Topics

Source: Own Elaboration

Type	Topics	Repetitions	Applications
Negative	App just works online. Offline it doesn't work	1	15 - Wysa
Negative	Bad AI Functionalities (Lack of options or word recognition)	1	53 - Woebot
Negative	Bad Assertivity of Chatbot/IA after longer chat-session	1	15 - Wysa
Negative	Bad communication with users	1	59 - Nuna
Negative	Bad experience using a chatbot (flowchart of pre-written statements and arbitrary tools)	1	53 - Woebot
Negative	Bad programming of IA scripts and sentences	1	53 - Woebot
Negative	Bad User Experience with the Chatbot/IA	3	159 - Moodcare 53 - Woebot 59 - Nuna
Negative	Basic questions and predictable answers	1	53 - Woebot
Negative	Chatbot/IA misunderstands about simple words	1	15 - Wysa
Negative	Despite the application be paid, it is in free category of store	1	15 - Wysa
Negative	Lack of accomplishment of expectations	2	59 - Nuna 96 - MARCo
Negative	Lack of adaptability of Chatbot/AI, that could change/update the responses	1	15 - Wysa
Negative	Lack of efectivity using AI (focus on keywords, not on the overall message - bad understanding of context)	1	53 - Woebot
Negative	Lack of interpretation of free text by Chatbot/IA	1	53 - Woebot
Negative	Lack of more functionalities of Free plan	1	15 - Wysa
Negative	Lack of new updates of contents	1	53 - Woebot
Negative	Lack of options to pay (people wants to watch advertisings instead of pay)	1	15 - Wysa
Negative	Need of improvement on understanding human emotions + words	1	15 - Wysa
Negative	Obligation of create an account before using the app	1	53 - Woebot
Negative	Obligation of pay before use the app	1	15 - Wysa
Negative	Obligation of pay to use the best functionalities of the app	1	59 - Nuna
Negative	Obligation to answer surveys and questions before the customer get help	1	53 - Woebot
Negative	Payment/Price Issues	3	59 - Nuna 159 - Moodcare 96 - MARCo
Negative	Privacy issues (Google tracking personal information)	1	53 - Woebot
Negative	Scripts repetitive and unhelpful	1	53 - Woebot
Negative	Technical Difficulties	2	96 - MARCo 53 - Woebot
Negative	Update Issues	1	59 - Nuna
Negative	Usability Issues	5	15 - Wysa 59 - Nuna 159 - Moodcare 53 - Woebot
Negative	User wants a option to go back to the previous question (Usability Issues)	1	53 - Woebot
Negative	User wants more options to interact with Chatbot/AI	1	53 - Woebot

Table 5 contains the positive topics, the number of repetitions of each topic and in which application it was repeated:

Table 5: Consolidation of the 26 Positive Topics

Source: Own Elaboration

Type	Topics	Repetitions	Applications
Positive	AI doesn't sounds like a machine	1	59 - Nuna
Positive	Customer feels good/happy	2	159 - Moodcare 96 - MARCo
Positive	Doesn't need to log in to use the app	1	15 - Wysa
Positive	Ease to use	1	53 - Woebot
Positive	For one type of people, it is cheap, compared to traditional therapy. For others, it is expensive, so they just can use the free trial period	1	15 - Wysa
Positive	Good and useful functionalities	2	53 - Woebot 59 - Nuna
Positive	Good assertivity from Chatbot/AI	3	59 - Nuna 15 - Wysa 53 - Woebot
Positive	Good design/layout	2	15 - Wysa 59 - Nuna
Positive	Good experience using the chatbot	1	53 - Woebot
Positive	Good range of functionalities	2	159 - Moodcare 59 - Nuna
Positive	Good relation cost/benefit about price	1	53 - Woebot
Positive	Good sensation after use the app	3	15 - Wysa 96 - MARCo
Positive	Good sensation of improvement of mental health without the need of talking to a real therapist	1	53 - Woebot
Positive	Good source of information in the app, making productive the time using the app	1	53 - Woebot
Positive	Good that the app is free and doesnt show advertisings	1	53 - Woebot
Positive	Good Usability (User Experience)	1	53 - Woebot
Positive	Improvement of mental health after use the app, so it really works	1	53 - Woebot
Positive	No one judges you	1	15 - Wysa
Positive	Possibility to chat with professionals therapists	1	15 - Wysa
Positive	Possibility to talk to "someone" without make an appointment	1	59 - Nuna
Positive	Sensation of safety using the app	1	15 - Wysa
Positive	Sensation that using the app is worth it in the long term	1	53 - Woebot
Positive	Sounds like a real therapist	1	15 - Wysa
Positive	Sounds like you have someone to listen to you	7	53 - Woebot 15 - Wysa 59 - Nuna 159 - Moodcare
Positive	The Chatbot/AI improves and learns with the responses	2	53 - Woebot 15 - Wysa
Positive	The Chatbot/AI needs some time to understand you, but after that it works very well	1	15 - Wysa

4.3.3 Association between the 56 Topics and the 15 Adoption Factors

At this stage of the project, it was made a consolidation of topics in Adoption Factors, in a way that one topic only could be associated with one Adoption Factors, but one Adoption Factor could contain one or more topics.

This consolidation of the 56 topics generated 15 Adoption Factors which were analysed in this project. The detail of each Adoption Factor and the representation of all topics related to each one of the 15 Adoption Factors is illustrated in the next sections.

The consolidation of the 56 topics followed the idea of merging of topics related to similar aspects or characteristics in a qualitative way, so the author made an interpretation of the type of situation held in the topic and grouped in Adoption Factors, independently if the topics are positive or negative.

The recognition of the need of keep separated some individual topics, that were not related to any other, was also an important aspect of these association between topics and Adoption Factors. For instance, the Adoption Factors 1 (*Good sensation to talk to someone*), 3 (*Dissatisfaction with methods of payment*), 5 (*Privacy Issues*) and 12 (*Technical issues related to Payment*) referred to specific needs of users that were found in the analysis held in this project.

The Adoption Factor 6 (*Quality of Functionalities*) is constituted by 3 positive and 1 negative topics, that are mainly related to different good or bad aspects of the functionalities presented by the 5 applications analysed. This Adoption Factor is significantly different from the Adoption Factor 7 (*Range/Variety of Functionalities*), which 5 topics (3 positive and 2 negatives) are focused on the diversity (or lack of diversity) of functionalities available in the 5 applications analysed, instead of the quality of its functionalities. The relation between topics and Adoption Factors are presented in detail in the following subsections.

4.3.3.1 Topics related to the Adoption Factor 1: *Good sensation to talk to someone*

In Figure 9 is described the Topic related to the Adoption Factor 1: *Good sensation to talk to someone*:

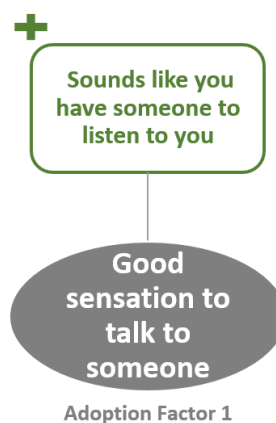


Figure 9: Topics related to the Adoption Factor 1: *Good sensation to talk to someone*.

Source: Own Elaboration

Related to this Adoption Factor, the only topic is positive (with the text: *[Sounds like you have someone to listen to you]*).

4.3.3.2 Topics related to the Adoption Factor 2: *Happiness with the use of the app*

In Figure 10, are described the Topics related to the Adoption Factor 2: *Happiness with the use of the app*:

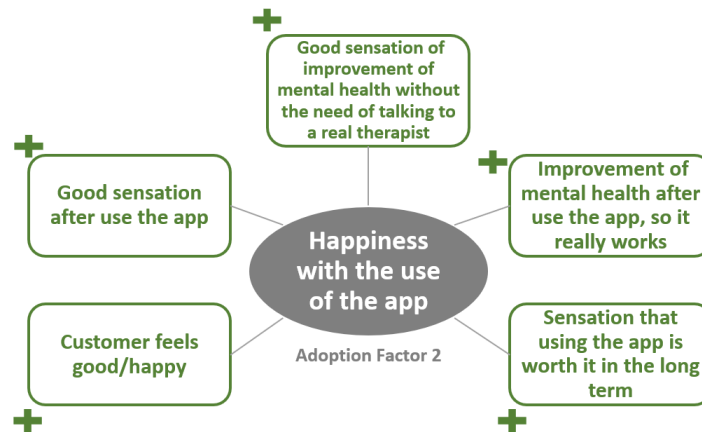


Figure 10: Topics related to the Adoption Factor 2: Happiness with the use of the app.

Source: Own Elaboration

Related to this Adoption Factor, all 5 topics are positive (with the texts: *[Customer feels good/happy]*, *[Good sensation after use the app]*, *[Good sensation of improvement of mental health without the need of talking to a real therapist]*, *[Improvement of mental health after use the app, so it really works]* and *[Sensation that using the app is worth it in the long term]*).

4.3.3.3 Topics related to the Adoption Factor 3: *Dissatisfaction with methods of payment*

In Figure 11, are described the Topics related to the Adoption Factor 3: *Dissatisfaction with methods of payment*:

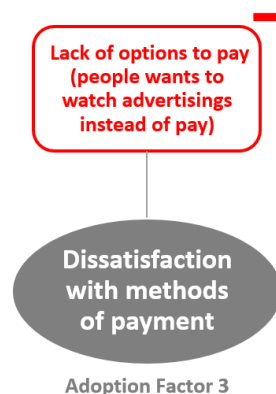


Figure 11: Topics related to the Adoption Factor 3: Dissatisfaction with methods of payment.

Source: Own Elaboration

Related to this Adoption Factor, the only topic is negative (with the text: *[Lack of options to pay (people wants to watch advertisings instead of pay)]*).

4.3.3.4 Topics related to the Adoption Factor 4: *Lack of Updates*

In Figure 12, are described the Topics related to the Adoption Factor 4: *Lack of Updates*:

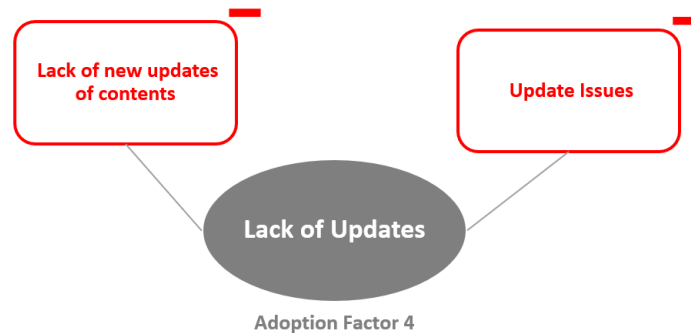


Figure 12: Topics related to the Adoption Factor 4: Lack of Updates.

Source: Own Elaboration

Related to this Adoption Factor, all 2 topics are negative (with the text: [*Lack of new updates of contents*] and [*Update Issues*]).

4.3.3.5 Topics related to the Adoption Factor 5: *Privacy Issues*

In Figure 13, are described the Topics related to the Adoption Factor 5: *Privacy Issues*:

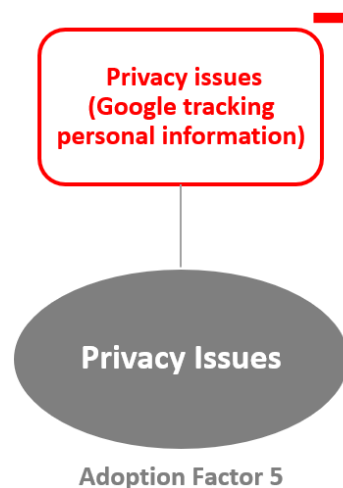


Figure 13: Topics related to the Adoption Factor 5: Privacy Issues.

Source: Own Elaboration

Related to this Adoption Factor, the only topic is negative (with the text: [*Privacy issues (Google tracking personal information)*]).

4.3.3.6 Topics related to the Adoption Factor 6: *Quality of Functionalities*

In Figure 14, are described the Topics related to the Adoption Factor 6: *Quality of Functionalities*:

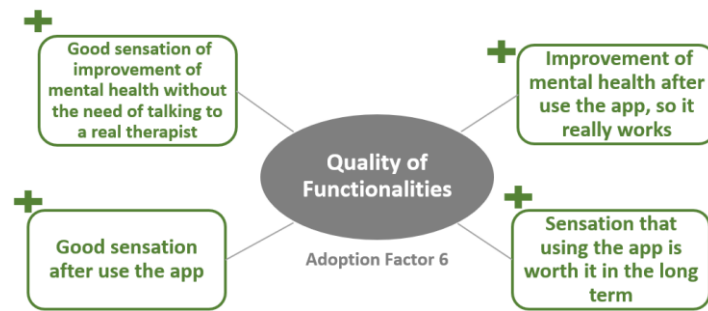


Figure 14: Topics related to the Adoption Factor 6: Quality of Functionalities.

Source: Own Elaboration

Related to this Adoption Factor, there are 3 positive topics (with the texts: [*Sounds like a real therapist*], [*Good source of information in the app, making productive the time using the app*] and [*Good and useful functionalities*]), and 1 negative topic (with the text: [*Bad AI Functionalities (Lack of options or word recognition)*]).

4.3.3.7 Topics related to the Adoption Factor 7: *Quality of Responses from IA*

In Figure 15, are described the Topics related to the Adoption Factor 7: *Quality of Responses from IA*:

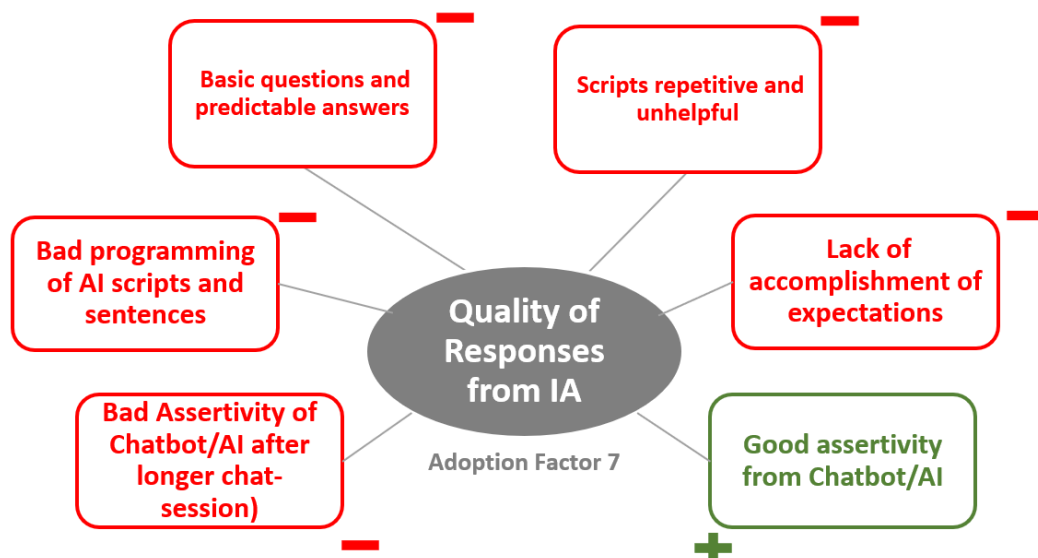


Figure 15: Topics related to the Adoption Factor 7: Quality of Responses from IA.

Source: Own Elaboration

Related to this Adoption Factor, there are just 1 positive topic (with the text [*Good assertivity from Chatbot/AI*]), and 5 negative topics (with the texts: [*Lack of accomplishment of expectations*], [*Scripts repetitive and unhelpful*], [*Basic questions and predictable answers*], [*Bad programming of IA scripts and sentences*] and [*Bad Assertivity of Chatbot/AI after longer chat-session*]).

4.3.3.8 Topics related to the Adoption Factor 8: *Range/Variety of Functionalities*

In Figure 16, are described the Topics related to the Adoption Factor 8: *Range/Variety of Functionalities*:

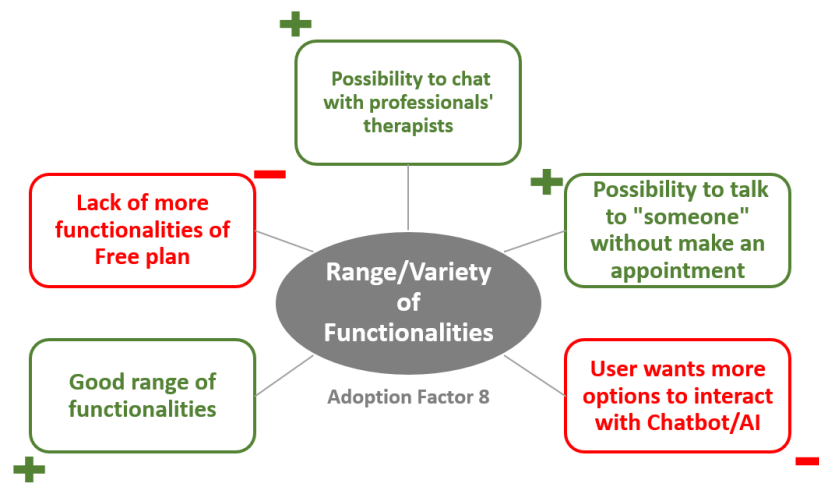


Figure 16: Topics related to the Adoption Factor 8: Range/Variety of Functionalities.

Source: Own Elaboration

Related to this Adoption Factor, there are 3 positive topics (with the texts: [*Good range of functionalities*], [*Possibility to chat with professionals' therapists*] and [*Possibility to talk to someone without make an appointment*]), and 2 negative topics (with the texts: [*Lack of more functionalities of Free plan*] and [*User wants more options to interact with Chatbot/AI*]).

4.3.3.9 Topics related to the Adoption Factor 9: *Relation Cost/benefit*

In Figure 17, are described the Topics related to the Adoption Factor 9: *Relation Cost/benefit*:

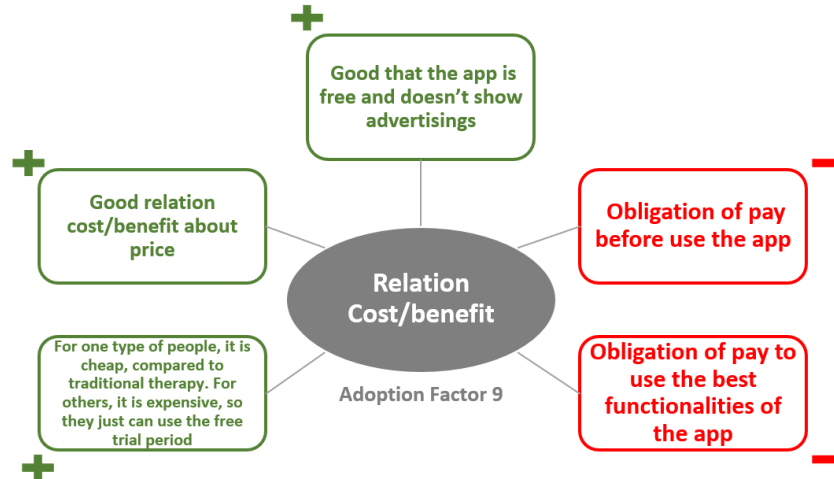


Figure 17: Topics related to the Adoption Factor 9: Relation Cost/benefit.

Source: Own Elaboration

Related to this Adoption Factor, there are 3 positive topics (with the texts: [*For one type of people, it is cheap, compared to traditional therapy. For others, it is expensive, so they just can use the free trial period*], [*Good relation cost/benefit about price*] and [*Good that the app is free and doesn't show advertisings*]), and 2 negative topics (with the texts: [*Obligation of pay before use the app*] and [*Obligation of pay to use the best functionalities of the app*]).

4.3.3.10 Topics related to the Adoption Factor 10: *Sensation of safety/reception*

In Figure 18, are described the Topics related to the Adoption Factor 10: *Sensation of safety/reception*:

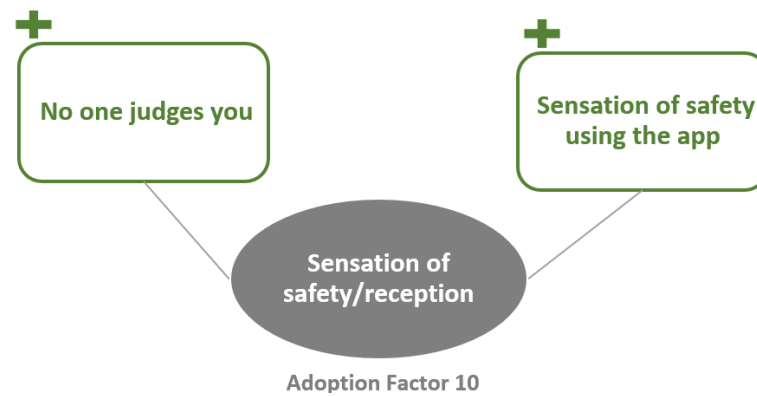


Figure 18: Topics related to the Adoption Factor 10: Sensation of safety/reception.
Source: Own Elaboration

Related to this Adoption Factor, there are just 2 positive topics (with the texts: [*No one judges you*] and [*Sensation of safety using the app*]).

4.3.3.11 Topics related to the Adoption Factor 11: *Technical Issues*

In Figure 19, are described the Topics related to the Adoption Factor 11: *Technical Issues*:

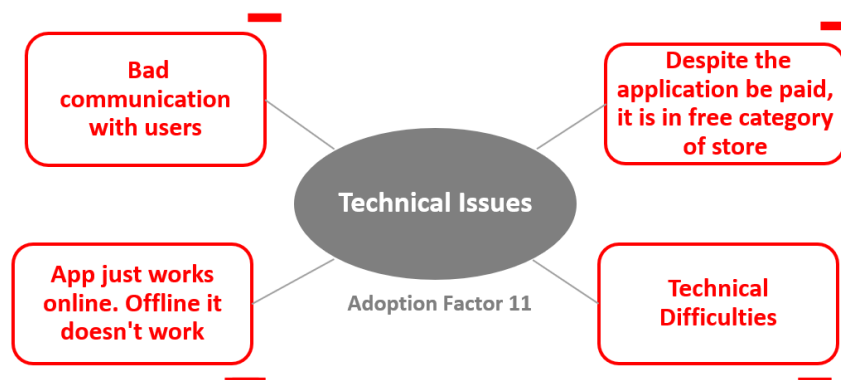


Figure 19: Topics related to the Adoption Factor 11: Technical Issues.
Source: Own Elaboration

Related to this Adoption Factor, there are just 4 negative topics (with the texts: [*App just works online. Offline it doesn't work*], [*Bad communication with users*], [*Despite the application be paid, it is in free category of store*] and [*Technical Difficulties*]).

4.3.3.12 Topics related to the Adoption Factor 12: *Technical Issues related to Payment*

In Figure 20, are described the Topics related to the Adoption Factor 12: *Technical Issues related to Payment*:

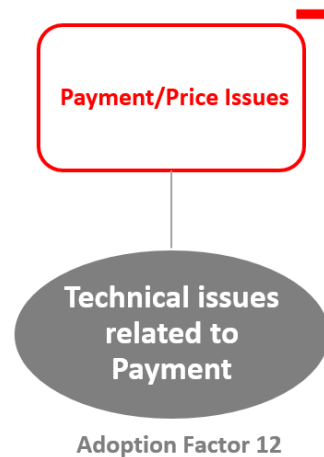


Figure 20: Topics related to the Adoption Factor 12: Technical Issues related to Payment.

Source: Own Elaboration

Related to this Adoption Factor, there are just 1 negative topic (with the text: [*Payment/Price Issues*]).

4.3.3.13 Topics related to the Adoption Factor 13: *Understanding from AI*

In Figure 21, are described the Topics related to the Adoption Factor 13: *Understanding from AI*:

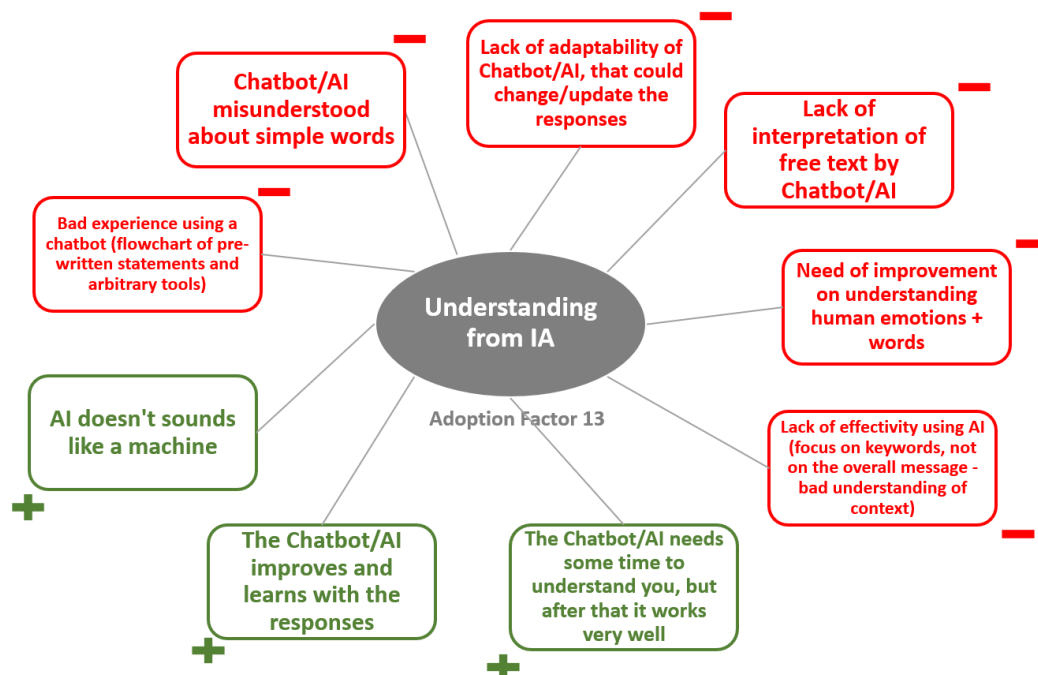


Figure 21: Topics related to the Adoption Factor 13: Understanding from AI.

Source: Own Elaboration

Related to this Adoption Factor, there are 3 positive topics (with the texts: [*AI doesn't sounds like a machine*], [*The Chatbot/AI improves and learns with the responses*] and [*The Chatbot/AI needs some time to understand you, but after that it works very well*]), and 6 negative topics (with the texts: [*Bad experience using a chatbot (flowchart of pre-written statements and arbitrary tools)*], [*Chatbot/AI misunderstood about simple words*], [*Lack of adaptability of Chatbot/AI, that could change/update the responses*], [*Lack of effectivity using AI (focus on*

keywords, not on the overall message - bad understanding of context)), [Lack of interpretation of free text by Chatbot/AI] and [Need of improvement on understanding human emotions + words]).

4.3.3.14 Topics related to the Adoption Factor 14: Usability

In Figure 22, are described the Topics related to the Adoption Factor 14: Usability:

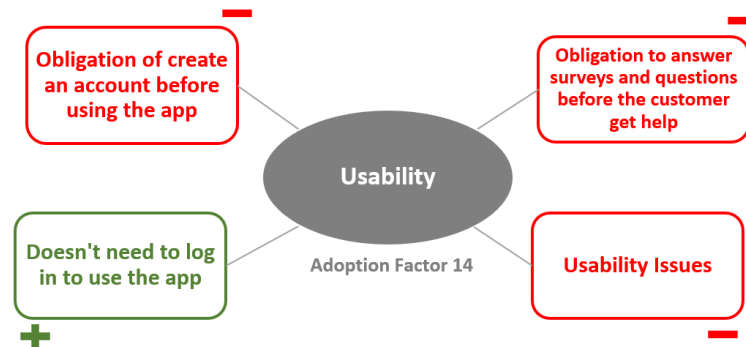


Figure 22: Topics related to the Adoption Factor 14: Usability.

Source: Own Elaboration

Related to this Adoption Factor, there are just 1 positive topic (with the text: [Doesn't need to log in to use the app]), and 3 negative topics (with the texts: [Obligation of create an account before using the app], [Obligation to answer surveys and questions before the customer get help] and [Usability Issues]).

4.3.3.15 Topics related to the Adoption Factor 15: UX/UI

In Figure 23, are described the Topics related to the Adoption Factor 15: UX/UI:

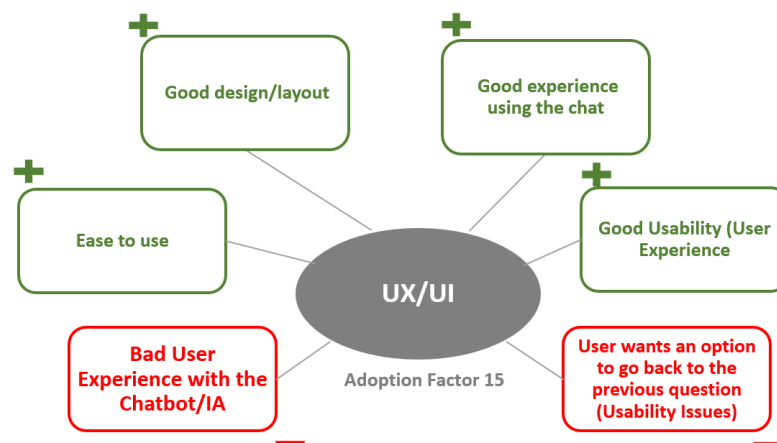


Figure 23: Topics related to the Adoption Factor 15: UX/UI.

Source: Own Elaboration

Related to this Adoption Factor, there are 4 positive topics (with the texts: [Ease to use], [Good design/layout], [Good experience using the chatbot] and [Good Usability (User Experience)]) and 2 negative topics (with the texts: [Bad User Experience with the Chatbot/IA] and [User wants an option to go back to the previous question (Usability Issues)]).

4.3.4 Association between the 15 Adoption Factors and the 5 Themes

In this section it was made a consolidation of Adoption Factors into themes, in a way that one Adoption Factor only could be associated with one theme, but one theme could contain one or more Adoption Factors.

This consolidation of the 15 Adoption Factors generated the 5 Themes. The detail of each theme and the representation of all Adoption Factors related to each one of the 5 Themes is illustrated in Appendix F:

Summarizing, the list of 5 Themes that emerged were:

1. *Efficiency of IA;*
2. *Functionalities;*
3. *Personal wellbeing after using the app;*
4. *Price;*
5. *Usability/User Experience.*

Aiming to facilitate the visualization, Table 6 is summarizing the information related to the Themes and Adoption Factors:

Table 6: Association between Adoption Factors and Themes

Source: Own Elaboration

Theme	Adoption Factor
efficiency of IA	Quality of Responses from IA
	Understanding from IA
Functionalities	Quality of Functionalities
	Range/Variety of Functionalities
Personal wellbeing after using the app	Good sensation to talk to someone
	Happiness with the use of the app
	Sensation of safety/reception
Price	Insatisfaction with methods of payment
	Relation Cost/benefit
	Technical issues related to Payment
Usability/User Experience	Lack of Updates
	Privacy Issues
	Technical Issues
	Usability
	UX/UI

The author kept the same direction to consolidate the 15 Adoption Factors in the 5 Themes, with the grouping related Adoption Factors in broader themes. For example, the Adoption Factors 6 (Quality of Functionalities) and 7 (Range/Variety of Functionalities) were grouped under the same Theme [*Functionalities*].

It is interesting to understand the reason that made the Theme [*Usability/ User Experience*] have the bigger quantity of Adoption Factors associated in (5 Adoption Factors). This theme is constituted by two distinct types of Adoption Factors: the ones which have more than 2 topics related to it (Adoption Factors 14 [*Usability*] and 15 [*UX/UI*]) and the ones which have less than 2 topics related to it (Adoption Factors 4 [*Lack of Updates*], 5 [*Privacy Issues*] and 11

[*Technical issues*]). When a user writes an user review in an application page on the Google Play Store, it is expected that he/she gives an opinion, a suggestion or a reclamation about his/her specific situation using this application, so it increases the chance of this review to be grouped in this Theme.

4.3.5 Analysis of Scale of States of Topics for each Adoption Factor

Aiming to summarize the relationship between the Adoption Factors and the scale of states (positive or negative), contextualized in section 3.5.5 [*Analysis of Scale of States of Topics for each Adoption Factor*], the author could understand which are the levels of positivity or negativity of each Adoption Factor, illustrated in Table 7:

Table 7: Levels of Positivity and Negativity of each Adoption Factor

Source: Own Elaboration

Adoption Factor	Quantity of Negative Topics	Quantity of Positive Topics	Total	% of Negative Topics	% of Positive Topics	Levels
Good sensation to talk to someone	0	1	1	0%	100%	Completely Positive
Happiness with the use of the app	0	5	5	0%	100%	Completely Positive
Insatisfaction with methods of payment	1	0	1	100%	0%	Completely Negative
Lack of Updates	2	0	2	100%	0%	Completely Negative
Privacy Issues	1	0	1	100%	0%	Completely Negative
Quality of Functionalities	1	3	4	25%	75%	Mostly Positive
Quality of Responses from IA	5	1	6	83%	17%	Mostly Negative
Range/Variety of Functionalities	2	3	5	40%	60%	Mostly Positive
Relation Cost/benefit	2	3	5	40%	60%	Mostly Positive
Sensation of safety/reception	0	2	2	0%	100%	Completely Positive
Technical Issues	4	0	4	100%	0%	Completely Negative
Technical issues related to Payment	1	0	1	100%	0%	Completely Negative
Understanding from IA	6	3	9	67%	33%	Mostly Negative
Usability	3	1	4	75%	25%	Mostly Negative
UX/UI	2	4	6	33%	67%	Mostly Positive
Total	30	26	56			

Taking into account these levels of positivity and negativity of each Adoption Factor, the author could advance in the analysis of their relationship with the 4 Gaps Model of Quality of Services, aiming to present these results in section 4.3.6 [*Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps*].

4.3.6 Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps

In Figure 24, it is represented the relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps, from the 4 Gaps Model of Quality Services:

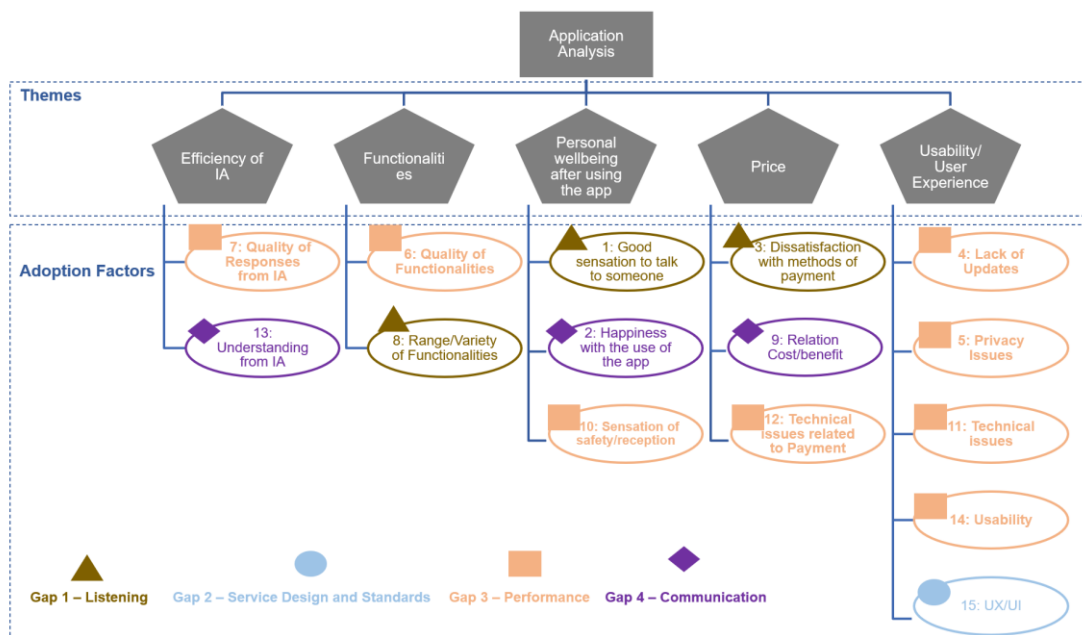


Figure 24: Relationship between Themes, Adoption Factors and Gaps

Source: Own Elaboration

In Figure 24, each Gap is represented by one color and shape (Gap 1: Triangle Gold; Gap 2: Circle Light Blue; Gap 3: Square Light Orange and Gap 4: Rhombus Purple). While associating each box of Adoption Factor with the color and shape that represents each Gap, the Author wanted to reinforce, in a more visual way, the relationship between the 4 Gaps of Quality Services and the Adoption Factors, extracted from the user reviews, aiming to facilitate and support the analysis and discussion held in the Section 5.1 [*Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps*].

4.3.7 Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity

Taking into account the relationship between the Gaps and the Adoption Factors held in Section 4.3.6, the author advanced in the analysis and correlated these with the Scale of States, represented in the section 3.5.5 [*Analysis of Scale of States of Topics for each Adoption Factor*].

Figure 25 represents the relationship between the 4 Gaps, from the 4 Gaps Model of Quality Services, the 15 Adoption Factors and the 4 States, from the Scale of States:

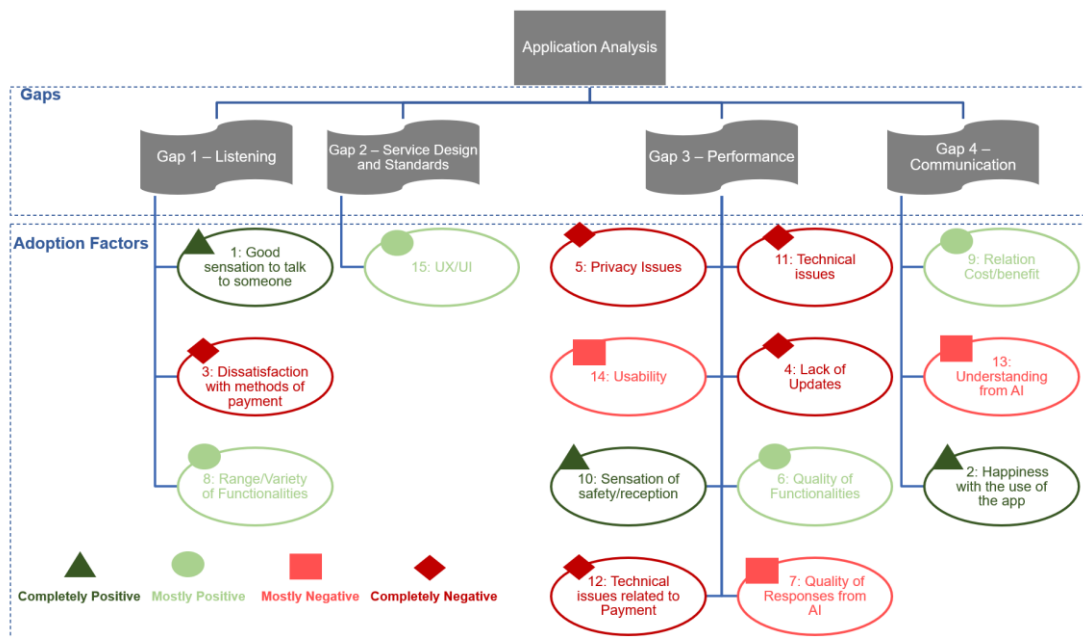


Figure 25: Relationship between Gaps, Adoption Factors and Scale of States

Source: Own Elaboration

In Figure 25 each State is represented by one color (Completely Positive: Triangle Dark Green; Mostly Positive: Circle Light Green; Mostly Negative: Square Light Red and Completely Negative: Rhombus Dark Red). While associating each box of Adoption Factor with the color and shape that represents each Gap, the Author wanted to reinforce, in a more visual way, the relationship between the 4 Gaps of Quality Services and the Adoption Factors, extracted from the user reviews, aiming to facilitate and support the analysis and discussion held in the Section 5.2 [Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States].

5 Discussion

In this Section the main aspects related to the Adoption Factors analysed in this project are debated, first focusing on the *Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps* and later focusing on the *Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity*.

5.1 Relationship between the 5 Themes, the 15 Adoption Factors and the 4 Gaps

With the association of the 15 Adoption Factors and the 4 Gaps the author aimed to understand with which one of the 4 aspects of the Gaps Model of Service Quality (*Listening, Service Design and Standards, Performance or Communication*) is related to the bigger concerns of the users, based on the Adoption Factors extracted from the analysis of its user reviews.

Taking into consideration that users' perception of the Service Quality is extremely associated with the difference between perceived performance and expectations, the author used this Gaps Model to systematize the analysis.

The fact that more than 50% of the Adoption Factors (8 of 15 available) are associated with one Gap (Gap 3 – Performance) shows that the bigger concerns of users are mainly connected with the delivery of the services as designed and specified, therefore when a user downloads a Chatbot application, it is extremely important that this application works very well according to what is informed in the application information page.

Proceeding in this discussion, the author understands that is not a coincidence that the Gaps 1 (Listening) and 4 (Communication) have the same quantity of Adoption Factors related (each one of them has 20% - 3 of 15 available). The reasons for these similar quantities are associated with the constant developers' need of focus on knowing what the users really expect, and deliver the service focused on matching its performance with what was promised to the user. When the Chatbot application's users understand that one of these two aspects were not delivered, it is expected that the user writes a review aiming to help the developers to improve the service offered by the Chatbot applications.

Finally, only 1 Adoption Factor of 15 available is related to the Gap 2 (Service Design and Standards), which means that having set the better service design and standards does not seem to be a such priority for Chatbot applications users. This Gap is most associated with having effective physical evidence of the service offered, with tangibles items to remark the brands perception on users' mind and the author understands that these aspects of the service could not be the most important for Chatbot applications users. Other significant interpretation of this fact is related to the understanding that, for users, this aspect of Service Design and Standards is not a problem, so the users' expectations related to the design and standards of applications are been met with what are being delivered by the Chatbot applications studied in this project.

These results (more than 50% of the Adoption Factors [8 of 15 available] associated with Gap 3 – Performance) are in line with the studies conducted by Zhu et al. (2018), which reinforced that users' experience of effectiveness is the greatest secure and valuable antecedent of comportment purpose in nearly all healthcare IT configurations, including mHealth, and by Yu et al. (2019), who demonstrated that, in that project, in terms of perceived benefit, the perceived usefulness takes a positive consequence on perceived value, for the reason that the perceived usefulness is associated to the Performance of the Chatbot Applications, which imaginable

disappointments on execution are showed in these Adoption Factors related to the Gap 3 (Performance).

One strong relevant characteristic of the Chatbots application is the possibility of automatic improvement of the understanding of user reviews, through NLP techniques, after interactions with users. If the Chatbot applications developers focus on the improvement of this functionality, it could be an excellent way to answer to the main problems related to Gap 3 (Performance). This quality of chatbots is also an outstanding example of Value Co-Creation between the Service Provider and the User, because the more the users continue to interact with the Chatbot applications, the more effective and assertive its' answers will be.

5.2 Relationship between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity

To support the discussion between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity, the author refers to the concepts of Adoption Factors with more or less than 2 topics related to it. These concepts about the Adoption Factors helped the author to associate an Adoption Factor with a specific gap, taking into consideration their state of positivity or negativity.

For a better preparation of the discussion about the relationship with the 4 Gaps, the author started by understanding the relationship between the 15 Adoption Factors and the Scale of States of Positivity or Negativity.

All 6 Adoption Factors that have less than 2 topics related (Adoption Factors 1 [*Good sensation to talk to someone*], 3 [*Dissatisfaction with methods of payment*], 4 [*Lack of Updates*], 5 [*Privacy Issues*], 10 [*Sensation of safety/reception*] and 12 [*Technical issues related to Payment*]) are completely positive or completely negative, so it is expected that the lower is the quantity of topics related to an Adoption Factor, the bigger is the probability of this Adoption Factor be considered as one of the *extreme* states (*Completely Positive* or *Completely Negative*).

Differently, 7 Adoption Factors of the remaining 9 that have more than 2 topics related (Adoption Factors 6 [*Quality of Functionalities*], 7 [*Quality of Responses from IA*], 8 [*Range/Variety of Functionalities*], 9 [*Relation Cost/benefit*], 13 [*Understanding from IA*], 14 [*Usability*] and 15 [*UX/UI*]) are mostly positive or mostly negative, so it is expected that the bigger is the quantity of topics related to an Adoption Factor, the bigger is the probability of this Adoption Factor be considered as one of the *intermediary* states (*Mostly Positive* or *Mostly Negative*).

The only two Adoption Factors that do not follow those patterns (Adoption Factors that have more than 2 topics related but still are associated with an *extreme* state: [*Completely Positive* or [*Completely Negative*]) are the Adoption Factors 2 [*Happiness with the use of the app*] and 11[*Technical Issues*].

An important clarification that supports this discussion is the explanation of what means an Adoption Factor be positive or negative. In practical terms, the positive or negative *status* related to each Adoption Factor is a consequence of the number of positive or negative topics associated to it, but, in a more subjective way, it means that most part of users share the same feeling about these subjects. For example, the fact that the Adoption Factors 1 [*Good sensation to talk to someone*] and 10 [*Sensation of safety/reception*] are positive means that users, in general, have excellent perceptions about the idea of use a Chatbot Application to help facing mental health issues, but, in the other way, the conclusion that Adoption Factors 7 [*Quality of*

Responses from IA] and 13 [*Understanding from IA*] are negative means that there is still a problem to solve, related to the performance of AI functionalities applied in the Chatbot Applications studied in this project.

With the previous context, it is possible to evolve to the discussion between the 4 Gaps, the 15 Adoption Factors and the Scale of States of Positivity or Negativity.

For Gap 1 (Listening), it is in consonance with the expected that all two Adoption Factors which have less than 2 topics related (status of Adoption Factor 1 [*Good sensation to talk to someone*]: Completely Positive; status of Adoption Factor 3 [*Dissatisfaction with methods of payment*]: Completely Negative) are associated to the possibility of Chatbot application's developers knowing (or not) what the users expect from the product.

It is also important reinforce that some Adoption Factors have just one Topic related (for example, the Adoption Factor 3 [*Dissatisfaction with methods of payment*] have just one topic associated [*Lack of options to pay (people wants to watch advertisings instead of pay)*]), so the author understands that these needs are specifics for one person, not for a entire group of people.

Moreover, the analysis of the remaining Adoption Factor which have more than 2 topics related (status of Adoption Factor 8 [*Range/Variety of Functionalities*]: Mostly Positive) shows that the analysed applications have an excellent understanding of what are the most important expectations from the users, because its' *Mostly Positive* status shows that the range of functionalities offered by the Chatbot applications studied in this project are in line with customers' expectations.

The discussion for Gap 2 (Service Design and Standards) indicates that, in relation to the specification of good service design and standards, the perception of users is pretty good, because the only Adoption Factor associated with this Gap is the Adoption Factor 15 (UX/UI), which has its topics classified as *Mostly Positive*.

The most relevant problems for the 5 applications analysed are related to Gap 3 (Performance). A significant indicator that the users believe that there are some issues related to this gap shows that 6 of 8 Adoption Factors have the status associated with *Completely Negative* or *Mostly Negative* (Adoption Factors 4 [*Lack of Updates*], 5 [*Privacy Issues*], 7 [*Quality of Responses from IA*], 11 [*Technical Issues*], 12 [*Technical issues related to Payment*]) and 14 [*Usability*]), while just the remaining 2 are associated with positive states (Adoption Factors 6 [*Quality of Functionalities*] and 10 [*Sensation of safety/reception*]).

Detailing more this analysis, it is possible to recognize that 3 of the 4 Adoption Factors associated with the *Completely Negative* status (Adoption Factors 4 [*Lack of Updates*], 5 [*Privacy Issues*] and 12 [*Technical issues related to Payment*]) have less than 2 topics related, while just the remaining one (Adoption Factor 11 [*Technical Issues*]) has more than 2 topics related. This analysis can reduce the *negative* interpretation of this Gap, because if the most part of the *Completely Negative* Adoption Factors are related to few topics, it is possible that this negative perception could be associated with a small part of the users.

Other positive interpretation for the relationship between Gap 3, the Adoption Factors and the Scale of States is related to the understanding that the Adoption Factor 6 (*Quality of Functionalities*) is associated with the status *Mostly Positive*. It shows that the users understand that the quality of functionalities proposed by the Chatbot applications analysed are good, but, with all the other Adoption Factors associated mostly with negative status, there are several problems related to the execution of the functionalities proposed.

The discussion of Gap 4 (Communication) is mostly focused on the understanding if the users' expectations were matched with the Chatbot applications services offered. The author understood that, for the purpose of this project, yes, the analysed applications had a good match of their performances with the user expectations, but there are still some problems related to the effectivity of the Artificial Intelligence's main functionalities.

All of the 3 Adoption Factors related to this Gap (Adoption Factors 2 [*Happiness with the use of the app*], 9 [*Relation Cost/benefit*] and 13 [*Understanding from IA*]) had more than 2 topics related to them, so the perceptions are significant enough to consider all of them, because are associated with more than just the opinion from few users.

The fact that the Adoption Factor 2 (*Happiness with the use of the app*) is associated with a *Completely Positive* status shows that one of the biggest objectives of these Chatbots applications was achieved, related to the promise of improve the self-esteem and mood of the users. The other Adoption Factor associated with a positive status (Adoption Factor 9 [*Relation Cost/benefit*]) expresses that there is a positive feeling about the performance of the Chatbot applications analysed and the users' expectations.

Furthermore, it is truly clear in this analysis that there are several problems related to the effectivity of the Artificial Intelligence's main functionalities. The Adoption Factor 13 (*Understanding from IA*) has 9 topics related to it, which is a strong signal of the relevance of this problem. These problems are related to Gap 4 because when an user downloads a Chatbot application, it is expected that the functionalities related to the Artificial Intelligence of the Chatbot works as promised, but the results reveals that this is not what happens.

This discussion is aligned with Persad & Padayachee (2015), who concluded that the customer's experience is crucial to the acceptance/refusal of the usage of services, but in this dissertation the author focused on the factors that could help to influence the decision of users to accept or refuse the usage of a service, not the factors of acceptance or refusal. In this case, in this project the author directed the study to understand which were the factors that could influence the users' perception, which could influence the decision, but were not studied the decision factors.

Ahmed et al. (2022) concluded that both users of chatbots intended for anxiety and depression feel welcome using applications more easy to operate, and which are cheap and free, which is in line with the discussion of the positive Adoption Factors found in this project, and also the negative results are consistently, as Ahmed et al. (2022) reinforces that users do not choose chatbots with fewer innovative content and discussions and those that are excessively welcoming.

It is important to reinforce that the Adoption Factor which have more negative topics associated (Adoption Factor 13 [*Understanding from IA*]) highlights that, although the technology and the most innovative functionalities are very important to generate value co creation, there is still a lot to be done in this area to effectively have the intended result in terms of adoption and Value Co-Creation. Also, these AI functionalities can contribute to overcoming the difficulties involved in the negative topics associated to the Adoption Factor 13 (*Understanding from IA*), because improving the NLP functionalities, the chatbot enhances the learning of the user-generated content, refining the Value Co-Creation between the Chatbot application and their users.

6 Conclusion

This section is composed by 4 parts: in the first one is discussed if were achieved the main *Project's Objectives*, then the author expresses the *Main Contributions* of this project for the literature, also taking in consideration its' most relevant *Limitations*. So, to finalize this section is described some guidelines to help some *Future Research*.

6.1 Project's Objectives

The author understands that all 3 objectives of this project were achieved, since the most relevant Adoption Factors of the Chatbot applications were identified, and it was explained which the main steps of the Service offer were the problems and improvements needs of these Chatbot applications users. Also was identified which Adoption Factors are mainly related with each one of the 4 Service Gaps for the applications considered, assisting the developers of these applications to enhance in the most effective way the service offered, according to the users' experiences.

6.2 Main Contributions

The main contributes of these projects are related to the Chatbot applications' developers and to the researchers interested in the literature focused on the intersection of Service Quality and Chatbot applications (or Artificial Intelligence functionalities applied on Mobile applications).

The contribution for the Chatbot applications' developers relates to the comprehension of which aspects of its services offered are most relevant to the users, and in which steps of its process are the most significant positive and negative points, in the users' points of view.

This dissertation is also an addition to the literature for the Service Quality area in a way that applies the 4 Gaps Model (which is one SERVQUAL scale method) to help to understand the most important Adoption Factors that influences the users to choose one specific type of depression chatbot. This application of the Model contributes to the literature of this field, similar to the project held by Tan et al. (2016): "A case study of the application of the model for the top three largest local bank in Malaysia".

This project is also an addition for the studies related to the intersection of Service Quality and Artificial Intelligence areas, in a way that applies a Service Quality model to evaluate the Adoption Factors of Chatbots which use AI.

6.3 Limitations

This project had a limitation caused by the short deadline for its development. Because of these short deadlines, the author had to apply some important criteria to filter the data collected, for instance, only the Chatbot applications were selected to this analysis, instead of the other applications with different Artificial Intelligence functionalities (Recommendation and/or Questionnaire, for example). The results of the project could vary in a significant way if these other AI functionalities were included in the analysis.

These criteria applied on the data collected limited the sample of the analysis, in a way that only applications presented in the English language were analysed in this project, for example.

Other limitation of this project is related to the focus of the author on the factors that could help to motivate users to accept or reject the usage of a service, not the decision of acceptance or rejection of a service, so it did not focused on systematizing of what makes the user decides.

6.4 Future Research

It is suggested to extend this research to applications with other Artificial Intelligence functionalities, like Recommendation and/or Questionnaire, in a way that other researchers can study if the addition of one specific functionality can change the main results of the analysis held in this project.

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APPENDIX A: <Group A: 15 positive and 17 negative Topics of *Woebot*>

Table 8: Group A: 15 positive and 17 negative Topics from *Woebot*

Source: Own Elaboration

Group A	
53 - Woebot (from 19/11/2021 to 15/05/2022)	
Positive	Negative
Good sensation of have a friend available 24/7	User wants more options to interact with Chatbot/AI
Good Usability (User Experience)	User wants a option to go back to the previous question (Usability Issues)
Good sensation of improvement of mental health without the need of talking to a real therapist	Usability Issues (App deletes the progress already made)
Sensation that using the app is worth it in the long term	Bad User Experience with the Chatbot/IA
Ease to use	Lack of interpretation of free text by Chatbot/IA
Improvement of mental health after use the app, so it really works	Bad experience using a chatbot (flowchart of pre-written statements and arbitrary tools)
Good experience using the chatbot	Privacy issues (Google tracking personal information)
Good that the app is free and doesnt show advertisings	Lack of new updates of contents
Good source of information in the app, making productive the time using the app	Usability Issues (problem with notifications)
Good and useful functionalities	Obligation of create an account before using the app
Good sensation after use the app	Bad AI Functionatilities (Lack of options or word recognition)
Sounds like you have someone to listen to you	Lack of efectivty using AI (focus on keywords, not on the overall message - bad understanding of context)
Expectation that the Chatbot/IA improves with the time	Basic questions and predictable answers
Good assertivity of Chatbot/IA	Technical Issues (difficulty to create an account)
Good relation cost/benefit about price	Scripts repetitive and unhelpful
	Bad programmation of IA scripts and sentences
	Obligation to answer surveys and questions before the customer get help

APPENDIX B: <Group A: 14 positive and 10 negative Topics of Wysa>

Table 9: Group A: 14 positive and 10 negative Topics from Wysa

Source: Own Elaboration

Group A	
15 - Wysa (from 01/05/2022 to 15/05/2022)	
Positive	Negative
Good sensation after use the app	Bad Assertivity of Chatbot/IA after longer chat-session
Sounds like you have someone to listen to you	Chatbot/IA misunderstands about simple words
Doesn't need to log in to use the app	Lack of more functionalities of Free plan
Possibility to chat with professionals therapists	Obligation of pay before use the app
Good assertivity of Chatbot/AI	App just works online. Offline it doesn't work
Good design/layout	Lack of adaptability of Chatbot/AI, that could change/update the responses
No one judges you	Need of improvement on understanding human emotions + words
Sounds like you have someone to listen to you	Lack of options to pay (people wants to watch advertisings instead of pay)
Sensation of talking to a good friend	Usability Issues
Sensation of safety using the app	Despite the application be paid, it is in free category of store
The Chatbot/AI needs some time to understand you, but after that it works very well	
For one type of people, it is cheap, compared to traditional therapy. For others, it is expensive, so they just can use the free trial period	
Sounds like a real therapist	
The Chatbot/AI improves and learns with the responses	

APPENDIX C:<Group B: 7 positive and 7 negative Topics of *Nuna*>

Table 10: Group B: 7 positive and 7 negative Topics of *Nuna*

Source: Own Elaboration

Group B	
59 - Nuna (from 29/08/2020 to 15/05/2022)	
Positive	Negative
Sounds like you have someone to listen to you	Usability Issues
Good and useful functionalities	Payment/Price Issues
Possibility to talk to "someone" without make an appointment	Update Issues
Good range of functionalities	Lack of accomplishment of expectations
Good assertivity from Chatbot/AI	Bad communication with users
Good design/layout	Bad User Experience with the Chatbot/IA
AI doesn't sounds like a machine	Obligation of pay to use the best functionalities of the app

APPENDIX D: <Group B: 3 positive and 3 negative Topics of *Moodcare*>

Table 11: Group B: 3 positive and 3 negative Topics of *Moodcare*

Source: Own Elaboration

Group B	
159 - Moodcare (from 27/05/2021 to 15/05/2022)	
Positive	Negative
Good functionalities (no related to chatbot, per example: moodtracker)	Payment/Price Issues
Customer feels good/happy	Bad User Experience
Sounds like you have someone to listen to you	Usability Issues

APPENDIX E: <Group B: 2 positive and 3 negative Topics of *MARCo*>

Table 12: Group B: 2 positive and 3 negative Topics of *MARCo*

Source: Own Elaboration

Group B	
96 - <i>MARCo</i> (from 16/06/2021 to 15/05/2022)	
Positive	Negative
Good sensation after use the app	Technical Difficulties
Customers feels good/happy	Lack of accomplishment of expectations
	Payment/Price Issues

APPENDIX F: <Association between the 15 Adoption Factors and the 5 Themes>

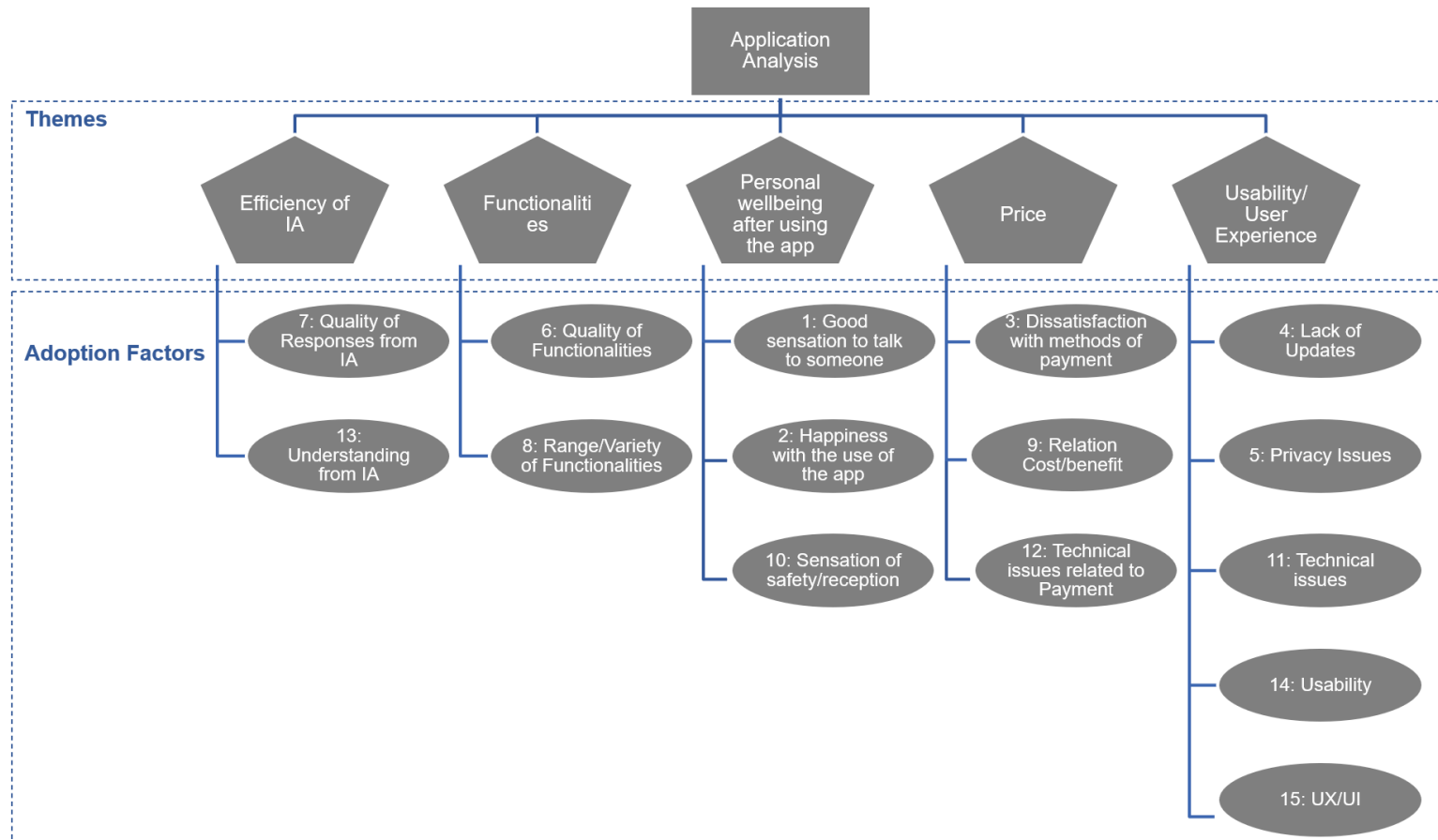


Figure 26: Association between the 15 Adoption Factors and the 5 Themes

Source: Own Elaboration