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Factors influencing the user acceptance of adapting microchip implants for different purposes

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Table of contents

Abstract

Constantly developing technology now take a further step to the future going under the skin, with microchip implants, which allows users to have their data, health parameters, keys and many more things with them wherever and whenever they want. Thus, like all the technologies, and this specific technology being under the skin, made it a whole new area of human behaviors and acceptance towards microchip implants to discover. This research aims to uncover consumer typologies and discover the reasons for and against accepting microchip implants. For this purpose, 160 people participated in an online survey, and two-step cluster analysis was conducted with fourteen indicators. The results implied a four-cluster solution, and the clusters were profiled according to their acceptance level. The clusters were named 'Highly optimistic towards acceptance', 'Prone to acceptance', 'Neutral towards acceptance' and 'Highly negative towards acceptance'. According to our results, implications for brand awareness, improvements to encourage acceptance, possible marketing strategies are discussed.

Keywords: radio frequency implant devices (RFID), microchip implants, behaviors, technology marketing, e-health.

1. Introduction

The Internet of Things (IoT) has advanced significantly in recent years, enabling consumers to access a variety of data from anywhere and at any time. If we check examples such as smartwatches and other wearable technology such as rings, bracelets, we see that they are also a part of the Internet of Things. These devices enable their users to have instant access to a variety of information such as health parameters, medical information, and their physical activity. But as we know, these devices are still vulnerable to theft, loss or can get broken easily.

With the improving technology that is going from biggest to smallest during the years, now we have come to an era where technology can go under our skin and provide the data we have never reached before from the most reliable source, which is our body, with the help of microchip implants.

Microchip implants have evolved over the years from being only an animal identification device, to be used in humans for several different purposes. Microchip implants are tiny little devices that enable the user to be connected in a way that they don't need to worry of losing it or needing to charge it, and enable people to reach the information anywhere, anytime. This cutting-edge technology has also been accepted as the potential unique lifetime identifier (ULI) embedded inside the human body in the past years (Michael, Michael, & Ip, 2008). Even, started to be used for medical purposes such as temperature tracking, that has the potential to replace wearables. (Roberts, 2021)

The widespread idea of microchip implants has started to change with the discovery of its convenient uses. The acceptance of microchip implants shows the concept of human enhancement, the willingness to adapt a technology that makes their life relatively easier and convenient. However, besides the people that already adapted this technology into their life, there is still little attraction to microchip implants. The main reasons are seen as lack of law regulations, possible complications that it might create, ethical concerns and idea of being tracked, according to past research. The negative implications are mostly generated because of lacking knowledge about microchip implants.

The aim of this paper is to discover what are the main reasons for and against microchip implant acceptance for several purposes, from a behavioral aspect. While looking at past research, it is observed that the media side of microchip implants has not been the topic so far. In this paper, we have included questions to discover the knowledge people has regarding microchip implants and present possible strategical solutions to overcome these obstacles.

Firstly, we will conduct a literature review of microchip implants, its past to this day evolution, observing related studies conducted. Following with a methodology section, explaining the technique of our study, with its result and analysis. Finally, we will be discussing the results and how to improve the obtained reasons for and against microchip implants and reflect possible marketing strategies that should be implemented and aim to attract a wide audience of consumers. In that regard, the analysis of the possible target audience habits allows us to determine what marketing strategies could be adapted to bring the consumer closer to microchip implants.

2. Literature review

2.1. RFID technology

To understand the history of microchip implants, we should first look at the history of Radio frequency identification (RFID) technology. Radio Frequency Identification (RFID) tags can be of 3 types: passive (inactive), semi-passive (semi-active) or active (active). The RFID tags that we will focus on in this paper are passive implantable RFID that use electromagnetic fields to communicate, so they do not require a battery or a power. Its common use is to identify an object in a unique way. A basic RFID system consists of three components: tags, readers, and an application system (Gillenson, Zhang, Muthitacharoen, & Prasarnphanich, 2019).

If we look at the past, the first ancestor of RFID devices with memory was claimed to be made by Mario Cardullo, in 1973 (Ahmad & Nababa, 2021). If we go even more to the past, we can see that this technology was also used in World War II to differentiate enemy planes from allied planes using radar. So, contrary to popular belief, RFID

technology has been in our life for a long time (Ludhiyani, Katiyal, Parandkar, Joshi, & Pathak, 2010).

Thanks to the growth of this technology, even if we do not recognize it, RFID technology has brought enormous comfort into our daily lives. We can use the term "smart tags" for this specific technology that we call RFID. RFID tags are commonly embedded in or attached to a person, livestock, pets or clothing for the purpose of radio wave identification and detection (Gaffney & Gopini, 2020). The data stored in these "smart tags" can be read by the RFID reader. This cutting-edge technology protects our privacy significantly in our daily life, such as its use in ID's, key badges, cards etc. It can be one of the fastest methods of identifying a thing or an object (Ahmad & Nababa, 2021).

Start of the use of RFID technology as tags on clothing, livestock identification, tracking of goods or for automated control of logistics has changed and even revolutionized the way of supply chain management, logistics, manufacturing in many businesses, it provided a big professional efficiency to the way the businesses work (Liao, Lin, & Liao, 2011).

In the study "I'VE GOT YOU UNDER MY SKIN: THE PAST, PRESENT, AND FUTURE USE OF RFID TECHNOLOGY IN PEOPLE AND ANIMALS", we see that they separate RFID tags on animals and humans in two categories, which is "people or animals carrying RFID chips and "people or animals with implanted chips" (Gillenson, Zhang, Muthitacharoen, & Prasarnphanich, 2019). In this paper we are going to focus on implanted microchips on people, but we need to acknowledge that RFID is a technology that has a wide range of uses that can be completely different from the Microchip implants, such as microchipping pets to track their information in the cases that they go missing, traveling to another country or microchipping/tagging livestock animals with RFID to control diseases like "mad cow disease".

2.2. Microchip implants for humans

The first human experiment with microchip implant implanted as a form of identity was performed by Kevin Warwick, in 1998. He inserted an RFID implant to his arm in order to use it to open doors entering buildings, opening lights, or to cause verbal output in a

building, that was saying “Hello Professor Warwick”. Kevin Warwick states in his book “Modified: Living as a Cyborg” that this experience was great fun. He mentions that it was fantastic that doors were opening for him automatically. He also even mentions that when the chip implant was taken out a few weeks later, he felt a sense of loss (Warvick, 2021).

What we can see from here is how human beings can adapt to convenient situations. How technology improves and enters more into our lives each day, is also an example of this adaptation. We humans tend to adapt to anything that provides us convenience. From the past to now, we have changed many habits, like now we can not go out without our phones. It became like a new organ to our body, that keeps us connected to life wherever we are, whenever we want. So just like Kevin Warwick felt, when our phone's battery dies, or we forget it at home, we feel a sense of loss, because now it is a part of our body.

In 2004, USA Food Administration and Drugs (FDA) approved Verichip, an implantable radio frequency identification device, for healthcare and medical purposes, which would enable doctors to access patients' medical records. Doctors believed this to be a better way to treat patients (Tanne J. H., 2004). Verichip became the first FDA approved RFID implant. It opened the way to creating the first human regulation regarding chip implants to be used for healthcare and medical purposes. This implant is a glass-encapsulated RFID chip in the size of a grain of rice that is put into the human body using a local anesthetic between the thumb finger and forefinger area (Tanne J. H., 2004).

Verichip implants enabled fast treatment for emergency patients, that assign 16-digit identification codes that can be used to identify and get insight into patients’ medical history, such as their blood type, past treatments, and organ donation. This, when considering an urgent situation, comes very handy for rapid response to the patient.

Now the most use cases of microchip implants are happening in Sweden. We can say that Sweden is the early adopter of microchip implants. In 2014, a group of people met in Gamla Stan in Stockholm to put NFC chips into their hands, later on they founded the Swedish Biohacking Organization. This is accepted as the starting point of Swedish microchipping on a larger scale that will lead to the use of microchips even in trains by

many people (Weller, 2017). According to eufactcheck.eu by 2022, 6000 Swedish have gotten microchipped, reaching its peak years in 2014-2016 (Starczewska, Polcyn, & Nel, 2020).

In 2017, microchip implant use is adopted by a group of employees to use in their daily life and in their office. The daily use campaign was started by a company called "Three Square Market", who implanted the microchip to dozens of their employees. It allowed them to buy from the vending machine, open the doors and log into their computers with their chip implants (Patel, 2018).

Nowadays, a company called Dsruptive Subdermals, based in Sweden and Spain has started experimenting with temperature sensor equipped health logging microchip implants, that enables users to get their personalized temperature profile (Pratty, 2021).

As we can see microchip implants for humans evolved during the last 10 years from identification purposes to medical purposes, what we can say is that this cutting-edge technology has a big potential to revolutionize the daily life to more convenient and paperless way. This opens the way for converting ordinary routines of daily life to efficient and fast chip scan. Such as transportation, ID cards, entering gym, payment, keys, and health logging purposes and this will generate more free time for the individuals without having the stress of losing or forgetting things and staying.

Microchip implants are already highly accepted by many groups, which are growing day by day and are interested in this cutting-edge tech. What we want to discover here is; what is their motivation and aim to accept this technology? and for those who are skeptical; what is the part that makes them skeptical about this technology?

2.3. Acceptance

To understand the factors influencing the acceptance of microchip implants, we should look at technology acceptance in general. Technology acceptance model (TAM) is widely used to determine the level of technology acceptance. It has two factors that influence the use of technology: perceived usefulness and perceived ease of use. However, TAM helps to examine the topics from a broad aspect, it can be applied for

any technology, but in this research, TAM is not enough to discover the reasons for and against the acceptance of use of microchip implants from the behavioral aspect. Instead, we choose to use the behavioral reasoning theory method and segment our sample into groups.

Microchip implants are in the early-stage development, where computers were at 60s. To this extent, use of this method will help us to obtain the possible profiles to target and find solution according to the sample results. It is beheld, like mentioned before, Sweden is a country that the microchip implants are highly adopted. This can be linked to Sweden being a tech capital of Europe. This can be concluded from the implementation of the railway company called SJ in Sweden, that allows people to use their microchip implants as ticket. Over 4000 people are using this method for travelling right not in Sweden (Duffy, 2020).

On the other hand, we may consider the different uses of implants to evaluate the behavioral acceptance factors. According to Duffy's interviews, surveys show that older generation is more prone to accept microchip implants for health logging purposes. They see many benefits in checking their health via microchip implants and accept the physical intervention for this purpose. While younger generation show more interest in using microchip implants for payments, security access and identification (Duffy, 2020). Yet there are many more aspects that influence people willingness to accept the use of microchips, such as ethical concerns, health concerns, implantation procedure, privacy and security, and legislations towards.

3. Research approach

To acquire insights into consumers behavior regarding their attitudes towards the use of microchip implants a survey has designed. It aims to obtain significant results to analyze reasons for and against, utilizing Behavioral Reasoning Theory, segmenting the results into groups. As Westaby states, "Reasons are specific cognitions connected to a behavioral explanation." (Westaby, 2005). The reasons have a big effect on the decisions we take in our daily life, it explains our intentions and behaviors towards specific things (Sahu, Padhy, & Dhir, 2020).

Behavioral beliefs, according to classical thinking, make future contingency projections based on current conditions. The value of something is related to its outcome. That's why it is important how people react towards a product, the reasons for, defines the attitudes.

As mentioned before researchers have used various methods such as Technology Acceptance Model to understand the specific factors influencing people's perception by Perceived Usefulness, Perceived Ease of Use and Behavioral Intentions to Use. Even though TAM Model is a great way to see the acceptance criteria, it is limited to give us what we exactly need. TAM takes the topic from a generalized perspective that can be applied to any technological device. Since microchip implants is a very early-stage technology that is invasive, which requires a method that will show the different aspects and reasons clearer to come up with a proper solution. That's why we have chosen the behavioral reasoning theory method creating our sample.

3.1. Behavioral reasoning theory

Behavioral reasoning theory is a theoretical framework that gives researchers a behavioral reasoning viewpoint on motives underlying human actions. According to this idea, intentions predict behavior, global motives and reasons predict intentions, beliefs and values predict reasons (Westaby, 2005). The Figure 1 below conceptualizes this theory.

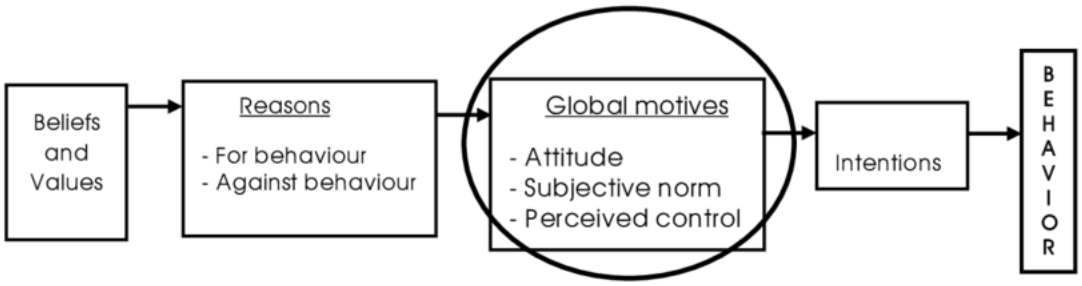

Figure 1: Behavioral reasoning theory

Source: (Westaby, 2005)

It is very important to understand the factors and psychological processes happening in consumers positive and negative attitudes (Claudy & Peterson, 2013). Behavioral reasoning theory, unlike classic intention models, proposes that reasons for and against attitudes are predicted affirmatively "because they help individuals justify and defend their behaviors, which supports and protects their self-worth." (Westaby, 2005).

3.2. Conceptual framework

The aim of this research was to find answers to these following questions:

What are the major reasons against using microchip implants?
What are the major reasons for using microchip implants?

Figure 2 presents a visual representation of the topics that the research is based on. As seen in Figure 2, reasons for adoption and reasons against adoption is separated into 4 topics respectively. The main topics have been discussed to be the main reasons for and against in people's conception as seen in the diagram.

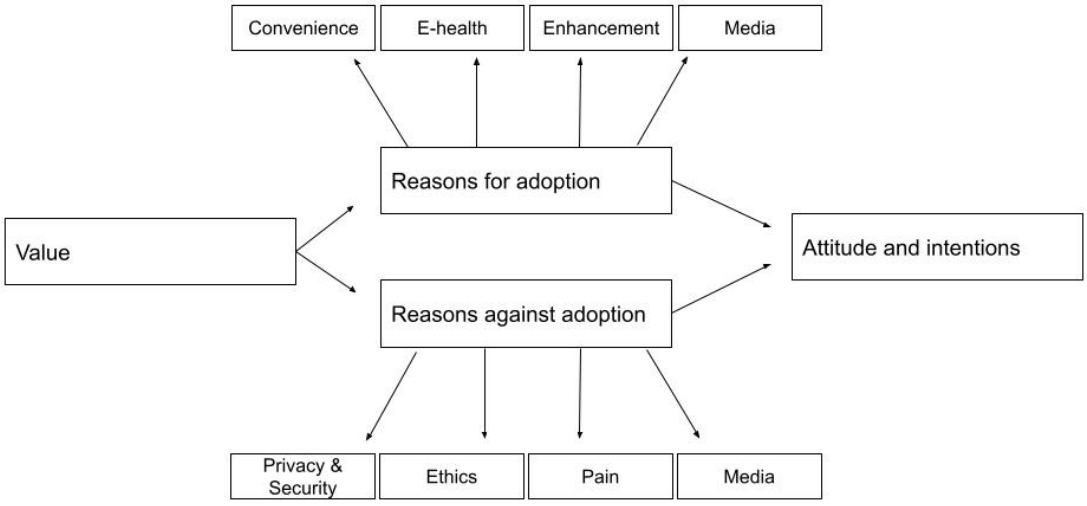

Figure 2.

Conceptual model of the study

What is also have been considered is the effect of media, which is not a developed topic for microchip implants yet, since there hasn't been a big media campaign done about microchip implants, but it is foremost to investigate to see if people have seen anything about microchip implants in media or ever heard about it. Media has a significant role to make a product known either in a bad way or in a good way. Especially social media produces a significant rise in web traffic, and higher social media campaigns tends to result in higher number of sales, as Facebook being the most effective channel, which can help creating brand awareness (Dolega, Rowe, & Branagan, 2021).

The research is based on the sample of questions we have prepared that represents reasons for and against adoption that will further be explained in the next section.

3.2.1 Reasons for acceptance

The convenience microchip implants provide to the individual is expected to have a positive effect on its adoption. Microchip implants turns mundane daily routines and tasks to an efficient microchip swipe, generating more free time for the user. Just like any other technology adaptation, the convenience it provides, motivates people to adapt it more into their life (Gaffney & Gopini, 2020).

Another important reason for acceptance is, improving e-health and use of implants in the medical field. With the improving technology and internet over the years, the traditional health started revolutionizing its own information technology industry. E-health is defined as "an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies." It is more a dynamic environment, that is constantly moving (Eysenbach, 2001).

Internet of things (IoT) also entered healthcare perspective with electronic health, wearables, mobile health and helped collecting and sharing data through sensors. During the past years, the use of wearables increased significantly. Wearables provide so many biometric data such as sleeping patterns, heart rate, temperature, and physical activities, from the most reliable source, which is our own body, and this data collection helps people get their personalized health patterns and opens the way to get a better treatment or diagnosis (Holländer-Mieritz, Johansen, & Pappot, 2020).

According to a study done 2018 on 136 non-pregnant women, it also showed that it is possible to track ovulation with wrist skin temperature with the help of wearables (Shilaih, et al., 2018). Which can open the way for couples trying to conceive a big convenience. Besides, it may help women avoid conceiving without hormonal supplements.

In the year 2021, health logging ways started going even under our skin, this time for health purposes. Microchip implants nowadays are being tested for health logging purposes. Dsruptive Subdermals is revolutionizing the way of health tracking with the use of their microchip implants. The implant they designed is used for temperature tracking with its tiny little sensors. They are using artificial intelligence to analyze the data and create the patients personalized temperature profile that can indicate many things for the person if tracked properly, such as fertility tracking as mentioned earlier and preventing pandemics (Home: Dsruptive Subdermals, 2022).

This step towards health tracking from Dsruptive Subdermals, opens the way to reach the data that we have never reached before from our body, that will be a step forward to the future of healthcare.

This step might change people's mind about microchip implants. There are very few studies done investigating people's opinion about microchip implants for health purposes, but according to a study done in 2018 on 475 people from different locations via survey with several questions showed that, %44 of the respondents were willing to get a microchip implant for health purposes. This data shows us that people are more willing to get an implant if they will get a real value out of it (Gaffney & Gopini, 2020).

3.2.2 Reasons against acceptance

In all societies, ethical and traditional values have a great effect on people's acceptance of new technology, generally influencing people negatively towards unknown and new technology. The main ethical concern in the society about microchip implants comes from the problem of losing individual's personality and humanity. It is the same thinking for esthetic operations and anything that changes the human body. Microchip implants are used for enhancement of the human body and that is thought to lose the humane feelings and become cyborglike (Gauttier, 2019).

Hansson also states in his paper that it can revoke some social separation in the society. Because there are worrying problem areas in terms of ethical and legal aspects, such as the emergence of a class with advanced abilities as the biggest risk of this technology, and the abilities of people belonging to this class going beyond the general population. As an example of the latter category, having a phone, colored television at the time was an exciting technology which showed individuals social status very openly (Hansson, 2005).

If we look at the case in Three Square Market implanting its employees voluntarily, revoke attention of journalists from a few aspects, according to the Gautier's research. The most mentioned one was privacy and surveillance, which is the concern of tracking employees. Second one was security, which is the concern of misuse and hacking can happen. And the third health and safety, which we will mention later (Gauttier, 2019).

Another ethical concern comes from the religious groups. Tattoos, piercings, and body modifications are prohibited in Christianity, Judaism, and Islam, that's why this religious groups may prohibit the use of microchips. Especially many Christians' feel that microchip implants are what is known in the bible as "Mark of the Beast" (Haven, 2019). Many Christian groups take microchip implants as a big threat against Christianity and believe it to be the "Mark of the Beast". When we visit several microchip implant companies websites or social media, we clearly see the people's opposing the idea with their comments about microchip implants being unethical. Besides, the media has a big effect on people's aggression on microchip implants. Media is prone to provocate the people against the controversial topics.

Furthermore, another important topic for reasons against is health related concerns, which is negatively influencing people's attitude towards microchip implants. The main worries consist of getting infections, reactions, or any health risks inside the body after the implantation. Besides these concerns also there are some concerns such as how it affects us in our daily life, in examples such as MRI scans, airport security controls etc. Following with the lack of research proving its safety is also withholding people from give an opportunity to try its uses.

In a more recent study, fifty-three people with microchip implants were put through an MRI to see how effective the chips were after being exposed to magnetic fields. As a

result of the study, the chips worked regularly for all fifty-three patients (Haifley & Hecht, 2012).

The implantation procedure is always considered safe as long as it is performed by an experienced professional body piercer or medical professionals that are expert in this area with proper equipment and cared afterwards carefully afterwards by the person (Gaafstra, 2016). Nevertheless, it is considered as a negative aspect by the people.

Additionally, As Timmer states in his study "The Associated Press has produced an extensive report on the potential risks of RFID devices, which have been approved for use in humans. The report cites a range of animal studies that have linked similar devices to cancers in experimental animals, such as mice and rats. The report is generally well prepared and raises both scientific and ethical issues." (Timmer, 2007). But still further studies need to be done to verify and validate the results related to health risks to the people and animals to eliminate or minimize the health risks of microchip implants (Gillenson, Zhang, Muthitacharoen, & Prasarnphanich, 2019). Over time, research have shown that microchip implants do not pose a severe threat to those who wear them. Even Nevertheless, hard proof should be produced to show that the devices are safe and pose minimal health hazards (Carr, 2020).

Privacy and security concerns causes people to have negative and skeptical thinking over microchip implants. In our daily life, we always carry our important belongings with us, such as our ID, credit cards, or any document that may contain many important data like our social security number, address, accounts, birthday, phone number and many more things. Or most importantly our mobile phone that has any kind of information about us, from our hobbies to where we go to take coffee or even where our home is. When we consider all these, if something we carry all day long is stolen, it can led to giving up our identity and data relating us. Considering the privacy and security aspect, the use of microchip implants can open the way for consumers and businesses to get rid of use of papers and cards for identity, payment, which has a big power to prevent loss, theft or even forgetting such belongings (Patel, 2018).

But still there is a concern about using chip implants. The safety and security concerns are primarily linked to the use of RFID technology in tracking people. The use of RFID

can be denied due to misuse of technology and its systems. A study conducted by Liz McIntyre shows that people are mostly concerned about the government tracking or controlling with such devices and track every movement of the user (McIntyre & Albrecht, 2005). As Patel states, since the birth of this technology, controversial thoughts whether its safety design, tracking capabilities and privacy has become a concern for many potential consumers (Patel, 2018). However, microchip implants are tiny little passive devices that cannot hold a GPS or a battery.

In recent years, we have also seen that governments are already using ways to track their citizens, by means something that we never leave by our side, phones. We can see this example clearly in Cambridge Analytica 2018 scandal, that the company accessed 87 million of users' data for the political campaign purposes (Hanna & Isaak, 2018).

As new technology arises, rules must be revised to fit it to protect customers and the public's safety when using the technology. The major concern is the access to the data of the consumer stored inside the microchip implants. Consumers would be protected from unauthorized individuals gaining confidential information if regulations were in place requiring legal authorization.

As Mark Gasson discusses, there is a huge gap in law about defining the status of microchip implants. He states that EU law provides a generic framework for electronic privacy but neither of them defines human microchip implants and there seems to be a big scope to understand and perceive laws (Gasson, Kosta, & M, 2012).

As seen in Figure 2 media can have both positive and negative influence on microchip implant acceptance according to our sample.

In today's world, media has a great impact on people's views over products and new technologies. Especially after the covid-19 pandemic, consumers have increased their use of social media as as a tool for identifying products (Mason , 2020). Now all the brands have a digital existence not only with their websites but also with their social media accounts. It is a crucial necessity to have a social presence for your brand on Instagram, Twitter, Facebook and especially TikTok for a younger audience and keep up with trends (Mou, 2020).

When we look on the microchip implant businesses, that are very few on the market, we do not see big campaigns or advertisements to promote the product. They are all present in social media but not with a proper campaign to make people aware of microchip implants or to introduce microchip implants to people. Besides, they do not market their product user friendly and include a techy language that makes it even harder to reach out to a wider audience.

On the other hand, we have the traditional media channels, such as news, newspapers, magazines, or digital newspapers, that constantly writes about microchip implants. Besides giving general tech news sometimes this news can be conspiracy theories that lead people to believe in something that does not really exist.

Recently, a video of microchip implants by Ruptly went viral. The video was about how the microchip implants was used as Covid pass in daily life. Later, while video went viral and a lot of media channels in different countries started generating several different contents around it. This media exposure came out from an example usage of microchip implants as storage for storing Covid pass like any other data that can be stored, but media showed it as microchip implants exist only for this purpose and created a conspiracy theory that makes people skeptical and afraid of this early-stage technology, generating idea of governments controlling people while covid passport was already a controversial topic (Videos: Ruptly, 2021). This media exposure created lots of skeptical thoughts from people with an interest to people that hate it. But people were not only afraid but also eager to know this technology. Since the technology it's on its very early stage and invasive, it is very much easy to get potential negative reaction and skeptical thoughts over it. But as we can see media has a big effect on what people can assume from a new technology.

To understand the place microchip implants, take in media, further studies need to be done. As I am doing my research, I realized that there has no study done on this topic, thus it is something that requires to be developed in marketing aspect of this technology.

4. Methodology

This section describes the scientific approach to research design and how data was acquired to reach conclusions and deductions giving give details about applied theories and methodologies conducted throughout the data collection and its results.

4.1. Questionnaire and sample

As we chose behavioral reasoning theory method to define the factors and psychological processes happening in consumers reasons for and against adapting microchip implants, we have selected to conduct an online survey. The research questions have been defined to be an indication for the survey that has been conducted to people. Survey came out the be the reasonable way to collect data, enabling people to stay anonymous and allowing the respondent to have time to answer.

The questionnaire of 26 questions, 3 of them being optional and open ended, has been prepared to find answers to the indicator topics mentioned above, that we will rely on, on this paper. The survey has been conducted internationally, allowing users around the world to participate. Likert scale have been used in the survey to allow us to gather information using scaled measurements to be able to see diversity of the answers obtained from people, also allowing them a wide scale of answers enabling us to measure their level of agreement and disagreement (Pimentel, 2010). For the dataset sample, we choose to survey internationally to a wider audience, everyone from anywhere could join the survey. The reason to conduct the survey internationally was to evaluate it regardless of the country.

The survey had 3 open ended questions to further analyze if the respondent chose to give opinions about microchip implants. Open ended questions were added to see additional detailed answers to discover what can be done further to reduce their concerns about microchip implants. We collected 160 units of answers with our sample, 35% male, 3% prefer not to say and 61,9% female with being the dominant respondent group (Figure 3). High majority of the respondents is residing in Turkey (53,1%) and following Spain with 15%, enabling us to analyze these two countries further. However, there were respondents from all over the world.

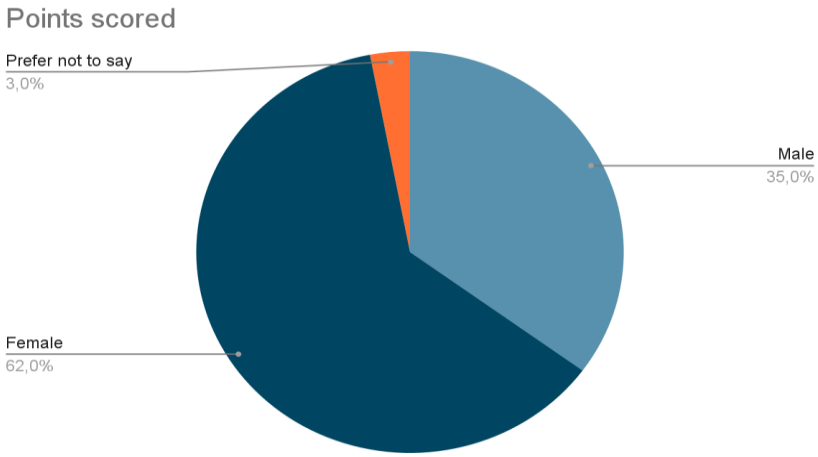

Figure 3

Gender characteristics of the respondents

The microchip implant knowledge rate of the respondents was nearly even, 53,1% having knowledge about microchip implants and 46,9% with no background knowledge about implants.

We have also asked respondents, if they have a microchip implant to be able to analyze and segmentate into groups and 8,8% (160 out of 14) of respondents has microchip implants.

The majority of the respondents to our sample was from Turkey and Spain, which enables us to analyze some cultural and religious patterns regarding our indicators. (Figure 4). Respondents from Turkey accounts for 62,5% being the largest group of respondents, following with Spain with 17,6% and 19,9% from different countries around the world.

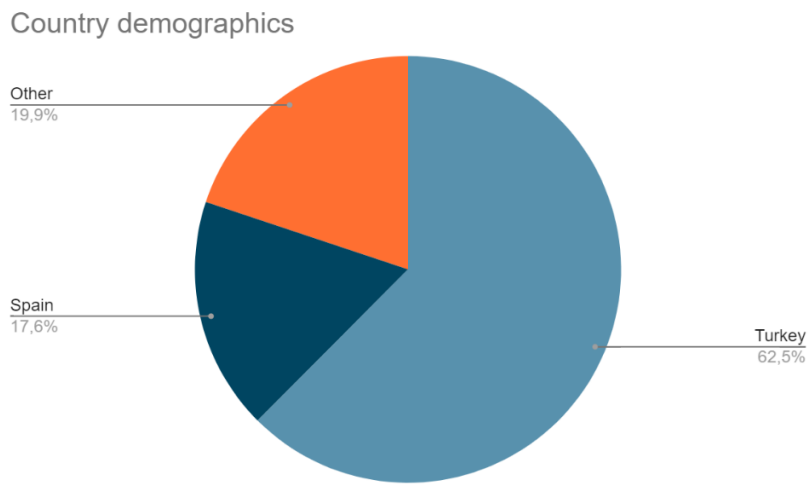

Figure 4
Country Demographics

Majority of the answers show that people are neutral towards microchip implants. This can be explained because of microchip implants being the early-stage unknown technology. Because as we see in the survey, 66,3% of respondents haven't seen anything on media about microchip implants, which is the greatest tool to create brand awareness. We see that the awareness and knowledge of people about microchip implants could be increased with consistent informative campaigns.

Furthermore, the people are more eager to get a microchip implant for health purposes (65%) and most respondents agree (41,4%) to get cardiac pacemakers, cochlear implants etc. more for medical treatment purposes. (Figure 5)

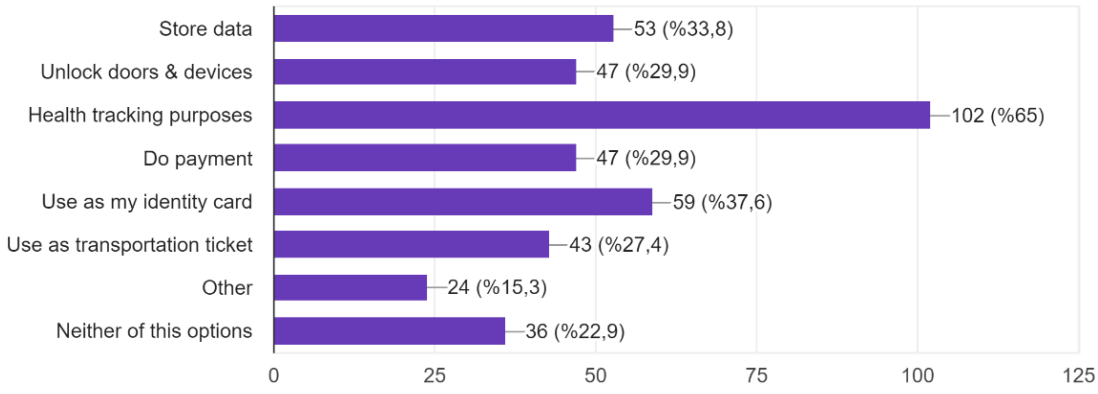

Figure 5

Respondents' preference for use of microchip implants

In the survey, open ended questions indicates that the main concern about microchip implants is the safety and security issue. Respondents indicate that their concern would be reduced if the security and safety of microchip implants would have universal law of regulations.

4.2 Statistical methodology

In order to develop understanding of the market, segmentation study carried out based on the indicators mentioned above in Figure 1, using the statistical software IBM SPSS. We have carried out a segmentation study based on cluster analysis. In order to obtain meaningful groups with different characteristics, a two-step cluster analysis was performed to identify the segments.

The first step was to determine the number of segments to determine our clusters within the sample. The clusters were profiled according to 14 psychographic indicators, that were mentioned earlier in literature review, reasons for and reasons against section. Finally, we acquired 4 clusters to determine different results.

The Two-Step cluster analysis is a hybrid approach that first uses a distance measure to separate groups and then employs a probabilistic approach select the best subgroup model. As its name employs, it relies on two passes of dataset. The first pass splits the data into a rough sub-cluster and the second pass groups the sub-clusters into wanted number of clusters. This algorithm depends on the order of the samples and may produce different results depending on the first order of the samples (Gelbard, Goldman, & Spiegler, 2007).

When compared to more traditional techniques, this technique has several advantages, such as determining the number of clusters based on a statistical measure of fit (AIC or BIC) instead of an undefined choice, utilizing categorical and multiple variables, assessing atypical values, and being able to handle large datasets (Benassi, et al., 2020).

Two-step cluster analysis is considered as one of the most reliable regarding comparative studies, in terms of subgroups detected, individual classification probability of subgroups and reproducibility of the data the findings and other kinds of data (Ivleva, et al., 2012). Two-step Cluster Analysis is a procedure useful for obtaining natural groupings of different variables (Bafadal, s.f.).

5. Results

The results obtained within this research aims to answer the objective of the study. In this sections we will examine the results obtained, combining it with other possible factors such as demographics of the respondents.

5.1. Cluster analysis

The clusters were named as 1) 'highly optimistic towards acceptance' 2) 'prone to accept' 3) 'neutral towards acceptance' 4) 'highly negative towards acceptance'. The number of cases in each cluster was 53 (33,8% of the sample), 58 (36,9% of the sample), 35 (22,3% of the sample), 11 (7,0% of the sample), respectively. Detailed cluster sizes are presented in Table 1.

Table 1

Cluster size

		N	% Combined	% total
Cluster	1 Highly optimistic towards acceptance	53	33,8%	32,9%
	2 Prone to accept	58	36,9%	36,0%
	3 Neutral towards acceptance	35	22,3%	21,7%
	4 Highly negative towards acceptance	11	7,0%	6,8%
	Combined	157	100,0%	97,5%
Excluded cases		4		2,5%
Total		161		100,0%

It is seen that the largest segment of the sample is of the people that **are 'prone to acceptance' (cluster 2)**, accounts for 36,9% of people. The highest score for this cluster is the universal law indicator, which is that they agree to the fact that microchip implants require adapted universal laws. Another important indicator for this group is that they score lower to the religious indicator, showing that religion is not a negative factor for its adaptation. They believe microchip implants growth and normalization into human life in the future, and they would like to get more information. It is observed that they are neutral towards safety, privacy, and ethical indicators and they score higher for the convenience indicator. They disagree microchip implants are threatening human health and are positive towards using microchip implants for emergency situations.

The following largest group is of the people that are **'Highly optimistic towards acceptance' (cluster 1)**, accounts for 33,8% of people. The highest score for this cluster is the normalization indicator. The most important indicator for this group is they score

higher on all the positive indicators (reasons for) and score lower on the negative indicators (reasons against). They score lower for the indicators of afraid, religion, ethics, and threat, which show that the negative indicators do not influence their decision on microchip implant acceptance. Again, in this group it is observed that they are eager to get more information about implants.

Third largest group is of the people that are **'Neutral towards acceptance' (cluster 3)**, accounts for 22,3% of people. The highest score for this cluster is obtained in the universal law indicator. It is observed that they are neutral towards most of the indicators. They are relatively afraid of the implantation process but could get an implant for a specific condition for health purposes. Second highest scored indicator becomes the information indicator. They are willing to get more information about microchip implants. Such as other groups, it is also observed that religion score is lower (2,14) which means that religion does not have significant influence on their decision on microchip implant acceptance.

The smaller group is of the people that are **'Highly negative towards acceptance' (cluster 4)**, accounts for 7,0% of people. It is observed that they relatively score lower with the positive indicators (reasons for) and score higher with the negative indicators (reasons against). The highest score is seen in the privacy indicator, following with ethical and threat indicators, being close to strongly agree scale. They are slightly neutral (2,55) about getting more information. Even though the religion indicator is slightly higher than the other clusters in this group, it is still low, which indicates even for the negative group, religion is not a significant factor effecting microchip implant acceptance. Their highest score observed in reasons for indicators is seen in microchip implants use for emergency situations, with the score of 3,09.

Besides, Cluster 2 and Cluster 3 having slightly similar characteristics, we observe that in all the groups we observe some similar characteristics. In all the groups, religion indicator has the lower score, meaning that the religion is not a factor that has an influence on the decision of getting a microchip implant. Furthermore, it is observed that all the groups relatively score higher for the universal law indicator, meaning that, it is crucial to improve or work on universal laws around microchip implants. In all the clusters, emergency indicator is scored slightly higher compared to the other indicators,

which shows that it is an indicator that has a positive influence on people's decisions or adaptation of microchip implants. Another slightly high scored indicator in 4 clusters is the more information indicator, showing that people are willing to know more about microchip implants and there is a lack of knowledge about it. Additionally, it is observed that the first and second clusters scored higher for normalization indicator, while the third and fourth cluster score neutral to the topic.

Detailed cluster characteristics are presented in Table 2

Cluster characteristics	*1 Highly optimistic*	*2 Prone to*	*3 Neutral*	*4 Highly negative*	*Sample average*
Table 2					
B1_Safe	4,09	2,98	2,80	1,55	3,22
B2_Convenient	4,00	3,52	2,77	1,64	3,38
B3_Threat	1,79	2,97	3,00	3,82	2,64
B4_Privacy	2,08	3,40	3,37	4,82	3,04
B5_Unethical	1,66	3,16	3,29	4,45	2,77
B6_SecureID	3,98	3,69	2,83	2,09	3,48
B7_Emergency	4,49	4,05	3,17	3,09	3,94
B9_MoreInfo	4,38	4,19	3,49	2,55	3,98
B10_WouldGetDL	4,17	3,34	2,49	1,45	3,30
B11_WouldGetSC	4,55	3,97	3,23	1,91	3,85
B12_WNOTAfraid	1,74	2,57	3,26	2,09	2,41
B13_WNOTReligious	1,15	1,62	2,14	1,73	1,59
B14_UniversalLaws	4,40	4,22	3,94	3,09	4,14
B15_Normaliz	4,60	3,95	3,17	3,00	3,93

Table 2 Cluster Characteristics

5.2. Socio-demographic results

As mentioned earlier, we will relate our cluster results with the socio-demographic variables of our respondents, age, gender, nationality, and level of education.

Gender

Linking the gender variable to our segments, the results show that in cluster 1, the percentage of male respondents is significantly higher (60,4%) than of female (35,8%) respondents. While in cluster 2, the percentage of female (72,4%) respondents are significantly higher than that of male (25,9%). In cluster 3, female respondents have a

percentage of 77,1% while men respondents have a percentage of 17,1%. Finally, in cluster 4, female respondents have a percentage of 81,8% and men has 18,2%.

			Número de clúster bietápico				
			1	2	3	4	Total
Gender	**Male**	Recuento	32	15	6	2	55
		% dentro de Gender	58,2%	27,3%	10,9%	3,6%	100,0%
		% dentro de Número de clúster bietápico	60,4%	25,9%	17,1%	18,2%	35,0%
	Female	Recuento	19	42	27	9	97
		% dentro de Gender	19,6%	43,3%	27,8%	9,3%	100,0%
		% dentro de Número de clúster bietápico	35,8%	72,4%	77,1%	81,8%	61,8%
	Prefer not to say	Recuento	2	1	2	0	5
		% dentro de Gender	40,0%	20,0%	40,0%	0,0%	100,0%
		% dentro de Número de clúster bietápico	3,8%	1,7%	5,7%	0,0%	3,2%
Total		Recuento	53	58	35	11	157
		% dentro de Gender	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 3. Gender Crosstab

Age

As we observe in age demographics, we did not get noteworthy results that can be analyzed within our clusters. It is identified that the age group that has the highest percentage in all the cluster is 19-25 years, with 47,2%, 46,6%, 57,1% respectively in cluster 1,2 and 3, except Cluster 4 having the age group 26-35 highest with 54,5%. Which does not provide us an indicator to further analyze our segments.

			Número de clúster bietápico				
			1	2	3	4	Total
Age	18 or under	Recuento	0	1	1	0	2
		% dentro de Age	0,0%	50,0%	50,0%	0,0%	100,0%
		% dentro de Número de clúster bietápico	0,0%	1,7%	2,9%	0,0%	1,3%
	19-25 years	Recuento	25	27	20	5	77
		% dentro de Age	32,5%	35,1%	26,0%	6,5%	100,0%
		% dentro de Número de clúster bietápico	47,2%	46,6%	57,1%	45,5%	49,0%
	26-35 years	Recuento	19	21	8	6	54
		% dentro de Age	35,2%	38,9%	14,8%	11,1%	100,0%
		% dentro de Número de clúster bietápico	35,8%	36,2%	22,9%	54,5%	34,4%
	36-45 years	Recuento	4	5	2	0	11
		% dentro de Age	36,4%	45,5%	18,2%	0,0%	100,0%
		% dentro de Número de clúster bietápico	7,5%	8,6%	5,7%	0,0%	7,0%

	46 or above	Recuento	5	4	4	0	13
		% dentro de Age	38,5%	30,8%	30,8%	0,0%	100,0%
		% dentro de Número de clúster bietápico	9,4%	6,9%	11,4%	0,0%	8,3%
Total		Recuento	53	58	35	11	157
		% dentro de Age	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 4. Age Crosstab

Country

Since we have significant amount of responds from Turkey compared to other countries, we have divided the country groups into two segments as Turkey and Other countries. In Cluster 1 and 2, the percentage of respondents from Turkey is higher with 52,8% and 62,1%. While in Cluster 3 and 4, the majority of the respondents are from other countries with 54,3%, 72,7%, respectively.

			Número de clúster bietápico				
			1	2	3	4	Total
Country	Other countries	Recuento	25	22	19	8	74
		% dentro de Country	33,8%	29,7%	25,7%	10,8%	100,0%
		% dentro de Número de clúster bietápico	47,2%	37,9%	54,3%	72,7%	47,1%
	Turkey	Recuento	28	36	16	3	83
		% dentro de Country	33,7%	43,4%	19,3%	3,6%	100,0%
		% dentro de Número de clúster bietápico	52,8%	62,1%	45,7%	27,3%	52,9%
Total		Recuento	53	58	35	11	157
		% dentro de Country	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 5. Country Crosstab

5.3. Additional variables

Knowledge

As an important indicator for segmentation, we have asked people if they have a background knowledge about microchip implants. Linking it to our segments we see that, in Cluster 1, 81,1% of respondents have knowledge about implants. In Cluster 2 we observe that the knowledge percentage goes down with a rapid decline to 37,9% and following with Cluster 3 having the lowest percentage of knowledge with 37,1%. Finally, in cluster 4, we again observe an increase in the percentage with 45,5%.

Número de clúster bietápico	Total

			1	2	3	4	
Knowledge	No	Recuento	10	36	22	6	74
		% dentro de Knowledge	13,5%	48,6%	29,7%	8,1%	100,0%
		% dentro de Número de clúster bietápico	18,9%	62,1%	62,9%	54,5%	47,1%
	Yes	Recuento	43	22	13	5	83
		% dentro de Knowledge	51,8%	26,5%	15,7%	6,0%	100,0%
		% dentro de Número de clúster bietápico	81,1%	37,9%	37,1%	45,5%	52,9%
Total		Recuento	53	58	35	11	157
		% dentro de Knowledge	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 6. Knowledge Crosstab

Microchip implant users

As being one of the important indicators, we see that 26,4% of the respondents in Cluster 1 has a microchip implant, while in other clusters we did not observe any microchip implant user.

			Número de clúster bietápico				
			1	2	3	4	Total
Micro_YN	No	Recuento	39	58	35	11	143
		% dentro de Micro_YN	27,3%	40,6%	24,5%	7,7%	100,0%
		% dentro de Número de clúster bietápico	73,6%	100,0%	100,0%	100,0%	91,1%
	Yes	Recuento	14	0	0	0	14
		% dentro de Micro_YN	100,0%	0,0%	0,0%	0,0%	100,0%
		% dentro de Número de clúster bietápico	26,4%	0,0%	0,0%	0,0%	8,9%
Total		Recuento	53	58	35	11	157
		% dentro de Micro_YN	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 7. Microchip implant users Crosstab

News

As observed from the results, we see that the 84,9% of the respondents in Cluster 1 has seen news about microchip implants in the news having the highest percentage, while we see that in the following Clusters 2 (63,8%), 3 (54,3) the percentage slightly goes down and in Cluster 4 (63,6%), we observe a slight increase.

			Número de clúster bietápico				
			1	2	3	4	Total
News_YN	No	Recuento	8	21	16	4	49
		% dentro de News_YN	16,3%	42,9%	32,7%	8,2%	100,0%
		% dentro de Número de clúster bietápico	15,1%	36,2%	45,7%	36,4%	31,2%

	Yes	Recuento	45	37	19	7	108
		% dentro de News_YN	41,7%	34,3%	17,6%	6,5%	100,0%
		% dentro de Número de clúster bietápico	84,9%	63,8%	54,3%	63,6%	68,8%
Total		Recuento	53	58	35	11	157
		% dentro de News_YN	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 8. News Variable Crosstab

Advertisement

Another variable to link is to see if the respondents have seen any advertisement related to microchip implants. It shows us that the percentage of the people that has not seen advertisement about microchip implants is higher in all the clusters, being 81,8% in cluster 4, 77,1% in cluster 3, 70,7% in cluster 2, 50,9% in cluster 1.

			Número de clúster bietápico				
			1	2	3	4	Total
Ads_YN	No	Recuento	27	41	27	9	104
		% dentro de Ads_YN	26,0%	39,4%	26,0%	8,7%	100,0%
		% dentro de Número de clúster bietápico	50,9%	70,7%	77,1%	81,8%	66,2%
	Yes	Recuento	26	17	8	2	53
		% dentro de Ads_YN	49,1%	32,1%	15,1%	3,8%	100,0%
		% dentro de Número de clúster bietápico	49,1%	29,3%	22,9%	18,2%	33,8%
Total		Recuento	53	58	35	11	157
		% dentro de Ads_YN	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 9. Advertisement variable

6. Discussion and implications

This study was to first identify typologies of people and their reasons for and against accepting microchip implants. Four distinct groups emerged from the analyses. Before discussing each group, some overall points can be pointed out.

The groups are named as, highly optimistic, prone to, neutral and highly negative. Regarding the demographics, we have concluded significant results only from the gender and country factor. While the age, education level factors did not show noteworthy results. Some additional variables were also useful for us to identify and find solution to the issue, such as knowledge, news, and media factors.

According to our sample, the highly optimistic towards microchip implant acceptance consist of females from Turkey, the people that are prone to acceptance consist of males

from Turkey, while the neutral and negative groups mostly consist of females from Other Countries.

The clusters common main concerns against adoption in general are microchip implants lacking universal laws around, safety, health threat and ethics. On the contrary, religion came out to have no significant effect on microchip implant acceptance. According to the indications, legislations should be regulated for microchip implants with a complete General Data Protection Regulation (GDPR) for secure data safety relief to the users, avoiding misuse as the most important aspect to be improved for the adaptation of this innovative technology. Besides, research done about microchip implants should be increased and scientific data should be presented to public, showing different uses of microchip implants securing that the microchip implants does not generate health problems to the human body.

Another important aspect to consider is information indicator. Our respondents were willing to get more information about microchip implants. As seen in Table 10, high majority of cluster 2,3 and 4 don't have any knowledge about microchip implants. Even though microchip implants are in their early stage, companies should work on awareness strategical marketing campaigns to create knowledge about microchip implants in general and their use cases to succeed.

			Número de clúster bietápico				
			1	2	3	4	Total
Knowledge	No	Recuento	10	36	22	6	74
		% dentro de Knowledge	13,5%	48,6%	29,7%	8,1%	100,0%
		% dentro de Número de clúster bietápico	18,9%	62,1%	62,9%	54,5%	47,1%
	Yes	Recuento	43	22	13	5	83
		% dentro de Knowledge	51,8%	26,5%	15,7%	6,0%	100,0%
		% dentro de Número de clúster bietápico	81,1%	37,9%	37,1%	45,5%	52,9%
Total		Recuento	53	58	35	11	157
		% dentro de Knowledge	33,8%	36,9%	22,3%	7,0%	100,0%
		% dentro de Número de clúster bietápico	100,0%	100,0%	100,0%	100,0%	100,0%

Table 9. Knowledge variable

In Cluster 1, we observe that the respondents are mostly male and from Turkey. 26,4% of this group are users of microchip implants, while in other groups we do not have respondents that has microchip implant. They highly believe that the microchip implants

will become a normal technology that takes part in our life, however this group is also willing to get more information about microchip implants, and they are more positive towards its use in emergency, daily life. They had low scores regarding the reasons against for microchip implant acceptance and high scores for the reasons for. They are the group with the highest score in knowledge variable, which indicates that having an idea about microchip implants helps people to have positive thoughts around it. Cluster 1 shows us that, when the use of it is adapted, the negative thinking towards it decreases.

Companies should start integrating their technology with people like in Cluster 1 to create awareness. These people may help to display with a real-life use. It is particularly important to give people a real-life experience, giving stories and telling the value it provides to create awareness. The product should have a story to tell and provide a value to the user's daily life, the way which microchip implants are improving.

In the second identified cluster, the respondents are mostly female and from Turkey. It is observed that this group has a low score in knowledge variable. The results of this group indicates that they have seen news about microchip implants, but they have not seen ads. We see that none of the respondent in this group has microchip implant, but their scores show that they are prone to accepting and adapting it into their life. The fundamental factors for this cluster are that they believe its convenience and its use in emergency cases. However, like in cluster 1, they are willing to get more information. Highest score in this group is seen in universal laws indicator, which is a common indicator with high score we observe in all the clusters. It is seen that they score slightly above neutral for the secure identification indicator, which clarifies that the lack of information for this group creates skeptical thoughts. It is also seen that this group score high for the normalization of microchip implants.

Regarding the results obtained from Cluster 2, the companies should work on displaying information to people about microchip implants. As is evident in Cluster 1, even when the people are optimistic towards it, there is still lack of information provided to them. Perhaps the image and conspiracy theories about microchip implants in media cause negative thoughts about microchip implants that hold people back from it. The image of microchip implants should be improved with research evidence of its safety and use cases.

The third identified cluster consist of people that are neutral towards microchip implants. This group consists mostly of female respondents that are from other countries, being slightly close to the number of respondents from Turkey. The knowledge variable for this segment is very low just as seen in the cluster 2. Again, in this segment we do not have respondents with microchip implant. It is seen that they mostly do not see news or ads about microchip implants. Just like in the cluster 2, this segment also believes that there must be universal laws around microchip implants. This segment of people seems more neutral, due to the lack of information issue being dominant. They are below neutral for microchip implants being safe and convenient, while for threat, privacy, ethics, and emergency uses they are more above neutral and more positive. The most fundamental factor for this segment is seen as the lack of information and lack of universal laws. Even though in this group religion is not the biggest issue, compared to the other clusters we see that the respondents that are most concerned about religion, is in this segment. What is also beheld is that the respondents from cluster 2 are mostly afraid of the implantation process, while in other clusters we see that this is not considered as a problem.

The fourth identified cluster consists mostly of female respondents from other countries that are highly negative towards microchip implant acceptance and most of the respondents does not have knowledge about microchip implants nor seen news or ads. While being very negative towards the safety, privacy, security, and its convenience, we see that they remain neutral to get more information, emergency use of microchip implants, universal laws and normalization factors. We can see that this group highly agrees to the fact that microchip implants are not a secure identification way and are unethical. Anew, we note that the religion is not an against factor for this group. It can be concluded that, even though people in this specific group is highly negative for microchip implant acceptance, thus far, they remain neutral for getting more information and emergency uses. What must be carried out to target this specific segment is to integrate them more into the new technologies, since they are very skeptical, they might need hard proofs of the safety of microchip implants. Anew, just like implied in other segments, right marketing of the product is very crucial, especially for this segment.

In today's world influencer marketing plays a crucial role for the brands and each brand knows how to reach their target with specific influencers. Regarding microchip implants, the companies should not only market their product with tech influencers but also include

wide range of influencers with different profiles to market their product, to show the real-life use. By all means, this requires a well-planned marketing strategy. It is seen that a marketing strategy for microchip implants has not been done by any companies yet and they do not go outside their community that is already interested in trying cutting edge technology. What should be done is to go and think beyond the audience microchip implants already has right now. Additionally, companies should reduce using techy language with their users and be more user friendly. By using techy language, they lose the potential audience they might reach, due to complex unknown words people get more skeptical towards it. The language should be to communicate with a wider audience and should be explained and displayed with real life experiences reaching out to a wider audience to create awareness regarding microchip implants.

7. Conclusion and further research

The main purpose of this study was to gather information to find out the reasons for and against adoption of microchip implants. Regarding our sample size, we did not get a significant demographic result, yet we conclude fundamental behavioral factors. The results showed that the people are more prone to use microchip implants for health purposes, such as its use in emergency cases, health logging, improving health. The main reasons against came out to be as expected, these were the privacy, safety, and lack of universal legislations. These issues must be improved to encourage its use and acceptance. Another important aspect is the marketing side of microchip implants. What this study included unlike other studies was to investigate the media side of microchip implants and we have concluded that companies lacking the marketing of their product does not help them to reach out to a wider audience other than their existing community. Besides, the research that has been done on microchip implant acceptance, microchip implants in media or marketing plans, are very limited. Various research can be done to widen the knowledge on understanding behaviors and developing marketing strategies. The possible future research can be done about a possible marketing plan for microchip implants, which can be a case study to investigate the behaviors and reactions it arose from the audiences.

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