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IS A MOBILE APPLICATION NECESSARY IN HEALTH AND FITNESS BUSINESSES FROM THE VIETNAMESE CUSTOMER'S PERSPECTIVE?

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I.   Introduction:

Godfrey Reggio, an American Director of experimental documentary film, once said that "It's not that we use technology, we live technology." (Reggio, n.d.). Technology development is increasing rapidly, alongside the rise in living standards. In other words, it means that eventually, there will be technological involvement in every aspect of our daily lives. Over the last 2 years, the fitness market has taken a direct hit due to the impact of the Covid-19 pandemic. With the situation of people being restricted to staying indoors, businesses needed to find a way to cope with the circumstances. In a broad view, the use of virtual sessions and online connectivity with customers through a mobile application (app) is what every business has done.

However, this highly sought-after health & fitness communication solution may only be a temporary answer to the situation at hand and whether the users of these apps continue to feel the need of keeping them is a big concern. In this context, the management problem at hand, especially for small to medium businesses is that it is to be considered if formulating a strategy around developing such an online mobile application is applicable or if would it not be of interest to the consumers at large and could potentially end up as a loss in revenue and investment. In this paper, I intend to analyze this issue from the perspective of the Vietnamese market's customers, expecting to help businesses that operate in the health and fitness sectors build a long-term strategy regarding consumer engagement that involves the usage of mobile applications.

It has always been my goal to develop a technology that is beneficial for improving the physical conditions of athletes and recreational gym enthusiasts in Vietnam for a brighter chance to compete at the global level. What I have noticed is that the fitness market of Vietnam has only been blooming in recent years which leaves room for growth. Many fitness applications have been developed and used for decades in other countries and they have proven to be effective in enhancing the overall performance and physical ability of their users. There are several types of health and fitness apps in the market including those that are solely for training such as workout plan builders, apps that are mainly focused on the nutrition side such as meal planners, fitness club apps, or even all-in-one type of apps that have a little bit of everything which are the most versatile ones. To be more consistent in this paper, I will proceed with the definition of a health and fitness mobile application in the sense that it is a super app that contains both nutrition plans and body metrics tracking, with exercises and performance tracking.

One of the most well-known fitness apps in the market is MyFitnessPal by Under Armour which is reported to be useful in helping its users track their calories intakes (diet) and burn rates (exercises) as it can register their goals and aid them in achieving as well as

maintaining them (Zlatopolsky, 2023). With a proven testimony app such as that in the foreign market, I was sparked with the idea of building a fitness mobile application for the same purpose of supporting gym enthusiasts and athletes in reaching their training and physical objectives. Among the methods I have researched, a mobile application that concentrates on delivering both nutrition plans, body data tracking, and exercise suggestions are one of the most efficient ways in assisting the tracking of the health and fitness level of a person (Sama, Eapen, Weinfurt, Shah, & Schulman, 2014).

However, despite how efficient an approach to the health and fitness market is, it is gated by the financial capability of a company to pursue such a strategy. Smaller companies do not have the luxury to opt-in for all strategies simultaneously as doing that would not only disperse their resources but also hinder all the progress by not focusing on any specific strategy and that is not a promising investment plan. As such, it is not recommended to pursue both website-based and mobile application-based platforms at the same time, especially for companies that are just starting. Even with the assumption that a mobile application for health and fitness performs better than a website-based platform, many companies would start with a website-based instead to lessen the initial cost when penetrating the market and imprinting their footprints on the industry gradually.

However, a recent study has proven that it was not the case for consumers as they are becoming more prone to use mobile applications than other sources of Internet usage (Venkatesh & Sridhar, 2014). As a result, this means that companies would reap greater benefits by preemptively investing in a mobile application first instead of going all-in for a web-based strategy or splitting resources between both tactics. But the managerial question is about how much of a trade-off is worth the risk of pouring capital into a mobile application before a company can be certain of its survivability. Therefore, I wanted to perform a study on the importance of a health and fitness mobile application from the perspective of the consumers in the Vietnamese market to understand more about the app usage behavior of gym enthusiasts and athletes as well as to gain insights on how to determine if investing in such an application would worth the risk for small to medium companies.

1. The rise of mobile apps

The economy has come a long way from the Age of Manufacturing (1900 – 1960) to the Age of Distribution (1960 – 1990), then to the Age of Information (1990 – 2010) and now, we are entering the Age of the Customer (2010+) (Bernoff, Cooperstein, Lussant, & Munchbach, 2011). According to research done by Forrester's experts – Bernoff et. al. (2011), the market has expanded significantly, for instance, back in the day of the manufacturing age, owning a factory leads to the domination of that market sector while in the distribution age, the key to gaining competitive advantage is to set up an optimal distribution network. However,

with the development of the internet, from 1990 onward, it became a massive information competition where those that were able to grasp the information flow overtook their brand rivals, and now that the internet and cloud computing have provided adequate accessibility, the remaining competitive edge that is available to the corporates in the market lies within the connection of them with the customers in terms of comprehending, associating, and serving their customers (Bernoff, Cooperstein, Lussant, & Munchbach, 2011). To understand this concept better, the representatives of each of these eras would be companies such as Ford & Boeing in the 1900s; the spotlight would then fall onto Walmart, Toyota, P&G, and UPS from the 1960s onward; after that, companies such as Amazon, Google, Microsoft would thrive in the 1990s; and later, the market welcomes the birth of new companies that are tech-heavy such as Uber, Airbnb, Spotify, etc. in 2010s and they will continue to prosper for the year to come. The question is: "What caused this change?".

To answer the question above, technological development must be taken into account. The rise of the factories-acquisition race led to the development of distribution channels worldwide due to globalization; the information war happened due to the birth of the Internet, and by 2010, when almost everyone had access to the Internet, the market was no longer controllable by just one party as it was saturated with knowledgeable consumers who chose brand meticulously by researching their transparency before purchasing. All of these factors were caused by the development of technology, particularly in this era of smart devices, the strategy to develop business plans that revolve around the development of mobile applications and software has become the focus of numerous companies because by 2021 there were approximately 6.3 billion smartphone users globally (O'Dea, 2021) as well as nearly 1.14 billion tablet users across the globe (Vailshery, 2021).

According to research done by the eMarketer (Wurmser, 2020), during a sample period of 4 hours, 88% of the mobile time of the average US adult user is spent on Apps compared to mobile web browsers, and it was predicted to grow for years to come. Among them, the percentage is different for the time spent on Apps for tablets (83% in 2020) and for smartphone devices (90% also in 2020) as tablets are still used for shopping more, and this is mostly done in a web-based environment (Wurmser, 2020). Regardless, these figures have shown that there was indeed a trend regarding the rise in app usage and it will continue for a long time in the future.

2. Changes in the health and fitness situation

The Covid-19 pandemic in 2020 has changed this industry drastically, leaving many gyms and fitness businesses nearly bankrupt when the order to quarantine was forced to be carried out, leaving them with few to no customers. Not only did these businesses suffer from a sudden monetary crisis, but the customers also had it rough when their membership could

expire or the gym that they registered with could have gone out of business. According to research done on American consumers by the International Health, Racquet & Sportsclub Association (IHRSA), the industry of fitness was estimated to be approximately $94 billion in 2018 in terms of value, with almost 70 million gym go-ers (also known as gymmers) frequented health and fitness clubs in 2017, and there were 60.9 million Americans among them who held a membership at those clubs (Rodriguez, 2018). These data show that there was a trending healthy lifestyle that people pursue, however, it all changed when the pandemic hit and the industry was left in an awkward position where the places that were designed to improve one's health were deemed as one of the most contagious areas to spread Covid-19 and as such, many gyms had to close down or ceased operation temporarily by the government's policies. It is estimated that around 38,000 gyms and health communities in the US had to be shut down, and nearly 500,000 employees in this sector lost their job due to the Covid-19 situation (Harrison & Byrne, 2020).

On the other hand, although it took a direct hit on the health and fitness market, amid this "chaotic" period, a solution was found, and it was in the form of online workouts or also known as a home gym which includes self-workout at home, video classes, group exercises through online meetings or calls, and other formats related to online methods (Benveniste, 2020). It is noteworthy that this concept has taken many forms beforehand which had grown from the blue ocean strategy into the red ocean marketplace nowadays, for instance, various training programs have adopted the video-based training program and circulated them on the internet where the user only had to pay a one-time fee to obtain a bundle that contains a workout plan and some videos regarding the exercises, some of which were deemed as not being a reliable program designed for proper exercise (Stein, 2014). However, due to how easily such content gets pirated, the training programs in the form of software are now revamped to be in the format of web-based, membership-oriented courses such as Masterclass where consumers need to make a subscription payment to get access to the desired content. Nevertheless, this type of self-motivated training was not designed for the majority of the public interest, hence, a more exhilarating method became trending instead which was the online personal or group workout where a designated Trainer would lead and supervise an exercise class through the internet which later.

Notwithstanding, it should be taken into account that the pandemic has slowed down almost all sectors of the economy including the health and fitness industry, hence, this virtual method has only truly blossomed after the peak of the pandemic where trainers and nutrition specialists earned an average of $52,518 per year compared to the traditional approach that yielded only $34,585 for the same period (Turner, 2022). Covid-19 has changed the behavior of people when they exercise whether they like it or not, for instance, there was a finding that the general population who usually work out 1-2 times a week reported an increase of 88% of the exercises on average or there are others who have changed their mindset so much that they were ready to cancel their gym membership to adopt fully home workouts (Rizzo, 2021). Additionally, another study concluded that 64% of Americans are now more intrigued by the

option to work out from home, using their equipment while participating in virtual classes (Freeletics, 2020).

3. The Vietnamese health and fitness market

In December 2020, the size of the health and fitness industry market in Vietnam was tremendously large. It was estimated to be $186 million with more than 640 clubs and approximately 4 million VND in average gym membership annual spending (Cekindo Vietnam, 2021). Even throughout the Covid-19 period, this industry stood firm against the catastrophe and was still growing without a sign of stopping soon as gyms and other forms of business were able to resume operations as soon as September 21, 2021, in some provinces and on October 1, 2021, in Ho Chi Minh City, this gave a massive head start in the recovery of citizens right after the peak of the pandemic (Briefing, Shira, & Associates Staff, 2022).

It must be considered that Vietnam has taken the same damaging effect as other countries, with its GDP being the lowest since 2010 (although it was still a net positive of 3.8%), however, Vietnam ended its quarantine or also known as "suspension of nonessential activities" in only 22 days which was remarkable compared to other nations and it was due to the growth of the middle class along with disposable earnings that enabled domestic consumption to play a big role in retaining Vietnam's GDP, helping it stabilizing the economy through the pandemic (Delteil, Francois, & Nguyen, 2020). Also, according to a survey conducted by McKinsey & Company (2020), despite many sectors facing a decline in spending, the health and fitness sector on the other hand, gained a 2% rise while it was even expected to grow by 27% post-pandemic, factoring a major change in consumers' behavior throughout the country. In addition, Rakuten Insight has organized a study that questioned if gym membership holders in Vietnam would go back to the gym post-Covid-19, the author of that study, Hirschmann, R. (2021) has found that 49% of the survey participants would be willing to go back to the gym after the regulation about compulsory mask requirement for outdoor or crowded indoor activities. Surprisingly, an astounding 96% of the sample population asserted that they would pick up their routines again when the lockdown situation improved (Hirschmann, 2021).

Nevertheless, the situation regarding Covid-19 may get better in the future, however, such a big hit would leave an aftermath for any industry, especially for the health and fitness industry when there are numerous public gyms and open-spaced facilities for exercising. As such, by sharing the same space, there will always be a risk of getting contagious diseases, and this is lethal for those who have not taken the necessary vaccines. Vietnam is not an exception to this; people have been looking forward to going back to the gym as soon as the duration of the compulsory quarantine is lifted (Hirschmann, 2021). However, there is also a sizable portion of people who are willing to keep the practice of working out from home rather than

joining the fitness club too soon and risk catching an unworthy disease. This was proven by the astoundingly high demand for ordering workout equipment for homes and residences during the pandemic, and it is highly unlikely that these items would get abandoned even after Covid-19 has passed (VNA, 2021).

4. The Purpose and the Scope of Study

Many companies have been struggling with deciding on investment in their mode of business, especially for new startups who want to enter the health and fitness market but only have limited funds and cannot afford to pour all the capital into a dead-end expenditure. This is not only narrowed down to small and medium businesses but also for major firms to take advantage of this study to determine if the market of mobile applications in such an industry is worthwhile the investment, for the Vietnamese market in particular, and the world as a whole.

This leads to the management problem of deciding on the mode for conducting business as the management style of companies varies depending on the adopted platform. Especially when it comes to bearing the initial and maintenance costs of developing a mobile application, consumers would need free access to ensure customer retention before applying any charges (Swani, 2021). Fees charging on app users should only happen after a certain time has passed or there should be a premium upgrade option for when the users have taken a liking to the app and decided to purchase those premium offers for long-term usage, while keeping free membership as always available such that the financial circumstances of the user have changed, this is known as the Freemium Model in a mobile application (Liu, Au, & Choi, 2014). According to Liu et. al. (2014), the freemium model poses various advantages as the customers get to experience the app before buying, while having them exposed to privileges brought by the premium version of a mobile application may positively impact their app-purchasing decision-making process which leads to higher sales and effectively boosting revenue for the creator of the app.

Keeping these factors in mind and taking into account the situation of both mobile applications and the health & fitness sector, especially in Vietnam, the purpose of this study is to find out the answer to the question of whether a mobile application is necessary for the development of a "new normal" in health and fitness industry. As discussed, mobile applications have seen a rise in both their development and usage, ranked 9th in a total of 20 popular categories of most downloaded apps on the Apple App Store in 2021 (Ceci, 2022); taking up 3.58% of all active apps which ranges up to more than 3 million of them according to Statista (2021). Thus, this study hopes to reach a conclusion that can support the answer to the management question of whether mobile applications are imperative to health and fitness businesses.

The study will be conducted in the form of an online survey questionnaire for scalability and data accuracy while retaining the respondent's anonymity. Regarding the location, the two largest cities of Vietnam which are Hanoi and Ho Chi Minh City shall be the chosen places for surveying as a matter of fact that these two areas consist of most of the gym centers in Vietnam, with Ho Chi Minh City leading the chart with a whopping number of 48 fitness chains (Nguyen, 2021). Although it should be noted that since the survey is done online with the use of Google Forms and spread through the Facebook platform, there is no guarantee that the respondents come strictly from the mentioned cities, and in addition. obtaining a diversified view on the matter also benefits this study in general. The targeted audiences shall be young adults to elder citizens in the age range of 18 - 57 who go to the gym often. This age range can be divided into three separate groups which are Generation X (1997 – 2012), Millennials (1981 – 1996), and Generation Z (1965 – 1980). However, in reality, when conducting this survey, there would be a consideration for 5 age groups by accounting for those who are younger than Generation Z and those who are older than Generation X because there could be potential prospects outside of the intended consumer group. Besides the geographical and biological elements, other aspects fall within the scope of this study as they are used as control factors for analyzing the result which will be discussed later regarding their impacts on the key constructs.

5. Problem Formulation and Research Question

One of the most common mistakes businesses make is establishing a biased assumption about the market based on what they have known previously and operated from there onward without consulting any form of market analysis. This behavior often leads to the presumption in the way these businesses run, overly relying on previous data instead of adapting to new trends and applying appropriate market research which may ultimately result in a dead-end operation because their products failed to launch or survive long enough for the company to breakeven and turnover their investment (Schneider & Hall, 2011). To avoid this, a comprehensive market analysis beforehand is highly recommended for any company nowadays as it gives those businesses clearer insights into their development pathway.

In this paper, the viability and necessity of a mobile application (app) in the health and fitness sector will be assessed, especially for the trend in apps tailored for gyms and exercises rather than apps that focus solely on diet and nutrition. This type of app has unlimited upgrade pathways as it can be added with online web-based exercises similar to the methods mentioned above and it can also be expanded in the direction of welfare and general life satisfaction with an incentive-based system and with the possible addition of insurance (Minh, 2020). On the other hand, the health and fitness industry in Vietnam is reaching an important turning point where gym brands may choose to stick with their conventional approaches or adopt the usage of a mobile application to satisfy and adapt to a new change in consumer behavior regarding workout routines.

However, this raises a big problem which is the fact that there is no current official academic research on the matter in Vietnam and this leaves Vietnamese gym businesses in a tight spot where they cannot proceed without ascertaining the involved risks or they would just give in and follow the traditional gym methods which in turns is an opportunity cost as well as leaving a large portion of the "new normal"(also known as gym businesses who take new approaches) unattended that may lead to losses in potential clients. There are many other elements to consider in the adoption of a fitness mobile application, notwithstanding, the question remains whether this was the right move for said businesses as the acquisition and maintenance of such apps costs more than just sustaining a website (Musienko, 2021).

Therefore, taking this matter into account, I will illustrate the perspective of Vietnamese consumers on the usage of health and fitness mobile applications. In this paper, I aim to deliver an answer to this problem and contribute to the strategic decision in health and fitness businesses in Vietnam and developing countries. This paper focuses on the consumer perspective and usage behavior of health and fitness apps, particularly for apps that are tailored towards gymmers and apps that serve the purpose of exercising and dieting. The outcome is subjected to other demographic factors and will be discussed during the research progress. Based on this problem formulation, the research question of this paper would be:

Is an application necessary in health and fitness businesses from the Vietnamese customer's perspective?

6. Chapter I Summary

In this first chapter, I demonstrated my motivation to draft this paper, along with explaining the situation regarding the rapid revolution of mobile applications ever since smartphones have become an essential part of the daily lives of consumers. What piqued my curiosity that led to the development of this paper is that online training has been around for somewhere along the line of a decade, but it was never such a popular option until the global pandemic known as Covid-19 hit and forced people to stay indoors. For those who go to the gym to train or those who want to keep an eye on their health and fitness level, they are presented with an option to continue their training to maintain their fitness progress right at home without going to the gym.

However, what was thought to be a temporary fix to the situation turned out to be more than it seems when there were gym enthusiasts who kept the habit that they developed during the pandemic and decided to stick with using a health and fitness mobile application, so much

that it could become a business opportunity for companies who are willing to invest in that market. As such, I produced the question that this paper focuses on to decipher gym-goers' mobile app usage behavior, with the current geographical limit set to Vietnamese consumers.

II.   Literature Review and Hypotheses

1. Usability Models

Since the main question of interest is to evaluate if health and fitness mobile applications apply to businesses, it is important to test their practical usability, hence, Usability Models are used to measure the effectiveness of such mobile applications. One of the research papers of Computer Science & Information Technology (CS & IT) has conducted a study in an attempt to analyze the obesity situation of Saudi Arabians and assessed whether the use of a fitness application is pragmatic in a general context (Alturki & Gay, 2017). In their research, Alturki, R. & Gay, V., (2017) has chosen an Arabian-language fitness mobile application called "Twazon" with Saudi citizens as target audiences to test effectiveness, efficiency, satisfaction, memorability, errors, learnability, and cognitive load attributes. Firstly, this paper has identified "obesity" as excessive storage of energy in the form of fat (Simopoulos & Van Itallie, 1984) and the authors have set the goal of the study to test the usability of fitness mobile applications. They have found out that although the Arabian market comprises a wide range of such apps, they are not up to expectations regarding the aim of enhancing usability to motivate people to lose weight.

Usability is deemed as one of the fundamental criteria to evaluate the success of a smartphone (Baharuddin, Singh, & Razali, 2013), taking a more in-depth view, this term can be used for a broader sense where it reaches the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (International Organization for Standardization, 1998). In other words, for this case, it measures the efficacy of Twazon fitness application usage (which are effectiveness, efficiency, and satisfaction) in an attempt to combat the obesity level of Saudi Arabians (which are the specified goals and the specified users respectively).

There were three models involved in the assessment of Usability which is: the "ISO Usability Model", "The Nielsen Usability Model", and "The PACMAD Usability Model" (Alturki & Gay, 2017). Initially, the ISO Usability Model[1] was developed by ISO98 that contains three aspects which are Effectiveness, Efficiency, and Satisfaction where Effectiveness illustrates the precision and completeness of goal accomplishment, Efficiency

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[1] Appendix Figure 1

depicts the maximization of the optimal resources, and Satisfaction indicates positive emotion while using the application (International Organization for Standardization, 1998). With these elements in mind, ISO98 assessed the users, main objectives, and the background of use that influences the design of an application. However, the Nielsen Usability Model[2] adjusted the precedent model and included Learnability which is known as the ability of the software to recognize patterns and to produce better output, Memorability or also known as how easily memorable the system is that new users do not have to spend much effort to learn from scratch, and Errors that are software issues while using applications, whilst removing Effectiveness from the equation (Nielsen, 2012). This enhanced design allowed for more utility as Nielsen characterizes that concept as how successfully the framework can meet the needs of users (Nielsen, 2012). Although this concept does not intercept usability, it is more closely matched to that of an isolated framework attribute, hence, for a product system to be incomplete of the necessary functions and features, it is deemed as possessing excessive utility and will not be of assistance for the user to achieve their objectives (Alturki & Gay, 2017).

However, as time passes, recent research has suggested that mobile applications have been tremendously popularized by the rapid development of smart devices that have been arising across the globe and this gives Usability new areas to explore as the market is constantly evolving. Therefore, a new Usability model was established as a response to newly growing issues and to explore the new opportunities of this period, it is called the PACMAD[3] model which stands for "People At the Centre of Mobile Application Development" (Harrison, Flood, & Duce, 2013). This model was introduced to solve the latest problems and overcome limitations met by previous models by considering attributes that were left out. The shape of the model changed from horizontal listing to vertical connections by breaking down Usability into User, Task, and Context (with a stress on this factor as context plays an essential role in mobile application usage), where the connections are made to reach Effectiveness, Efficiency, Satisfaction, Learnability, Memorability, and Errors, with the addition of Cognitive Load (Harrison et. al., 2013). Cognitive Load is construed as the "cognitive process level" that is mandatory for users to effectively use mobile apps and this attribute stands out in the PACMAD model as it is the signature attribute that distinguish this model from the ISO Usability Model and Nielsen Usability Model (Alturki & Gay, 2017). It thrives in the belief that the user of a mobile application is exposed to multitasking during the course of using the app.

Nevertheless, in this paper, I will not proceed with the Usability models to pursue the answer to the original question of whether a mobile application is relevant and applicable in Vietnam post-pandemic. This is because utilizing the framework from the Usability models to assess the hypothesis, which will be disclosed in the later part of this paper, requires a present mobile application to evaluate its attributes, thus, this paper could not apply the same mode of evaluation. Though, there is various research that explored this health and fitness sector using

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[2] Appendix Figure 2
[3] Appendix Figure 3

the UTAUT model while combining with survey distribution through the network of databases within a mobile application such as in the case of the paper "Understanding and Predicting the Adoption of Fitness Mobile Apps: Evidence from China" by Wei, Vinnikova, Lu, & Xu (2020) where the authors conducted their survey by sending questionnaires to users of the Boohee health and fitness app. Notwithstanding, the constructs of the UTAUT model can be assessed through other means and platforms and not restricted to survey circulation within a mobile application. The UTAUT model is discussed further in the next section.

2. The Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT concept was first developed by Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003) to formulate the behavior around using and accepting technology which attempts at deciphering their intentions. The four key constructs indicated in this theory are "performance expectancy", "effort expectancy", "social influence", and "facilitating conditions", Venkatesh, et al. (2003) demonstrated the connection that can be used to explain the acceptance of technology and the following usage behavior which are controlled by demographic characteristics: gender, age, experience, and voluntariness of use. This theory is formulated by scientific reviews and assessment of other eight well-known core concepts as follows: the Theory of Planned Behavior (TPB) (Ajzen, 1991), the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1977), the Technology Acceptance Model (TAM) (Davis, A technology acceptance model for empirically testing new end-user information systems: Theory and results, 1985), the Motivational Model, a mixed TPB/TAM (Ajzen & Fishbein, 1977), the Model of PC Utilization (Mawhinney & Lederer, 1990), Innovation Diffusion Theory (IDT) (Rogers, 1962), and Social Cognitive Theory (SCT) (Bandura, 1986) which resulted in the finding of the UTAUT model[4] that outperforms each of the previous models (Williams, Rana, & Dwivedi, 2015). The UTAUT model aims to capture the fragmented theories proposed by the other eight theoretical models by unifying crucial elements into a single model through empirical assessment of conceptual similarities across those eight research (Venkatesh, Morris, Davis, & Davis, 2003).

As previously mentioned, this model suggests that there is a correlation between users' intention and their behavior toward modern technology as well as considering the influence of demographic characteristics. Among the four key constructs, "Performance Expectancy" measures the advancement through the use of the system, improvement of productivity, positive impacts on performance, and usefulness for the user. Meanwhile, "Effort Expectancy" assesses the ease of usage, the propensity of interaction stress level, and the essentials of use. In addition, "Social Influence" involves how peers, close friends, and families perceive technology. Whereas "Facilitating Conditions" calculates the availability of the technology and calibrates the knowledge to operate that technology. Throughout the years, the UTAUT model

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[4] Appendix Figure 4

has been adopted as a theoretical base by a wide range of empirical research regarding user intention and behavior as well as the fact that the original article was endorsed and cited approximately 5,000 times (Williams, Rana, & Dwivedi, 2015). As such, the model can be deemed as a credible, long-standing theoretical model that assesses the likelihood of a person accepting and adopting innovative technology. The model is built on several constructs which are Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Behavioral Intention, Use Behavior, and Demographic factors as well as Experience and Voluntariness of Use.

Performance Expectancy tackles the belief of the user of a new technology to answer whether it would help one in achieving a desired objective, hence, it is defined as the degree to which a person would place trust in that new technology to obtain predetermined goals (Venkatesh, Morris, Davis, & Davis, 2003). The related theories to Performance Expectancy are perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job fit (MPCU), relative advantage (IDT), and outcome expectations (SCT). Based on the results from the original study, Venkatesh, et al. (2003) have found the Performance Expectancy construct in each model too has the most prominent predictor of intention and persists substantially at all points of assessment in both voluntary and compulsory settings.

The next construct in line is Effort Expectancy where the ease of technology usage is taken into account. Effort Expectancy is defined through the assessment of how easy for a new technology to be operated, and this construct was made based on three existing models which are perceived ease of use (TAM/TAM2), complexity (MPCU), and ease of use (IDT) (Venkatesh, Morris, Davis, & Davis, 2003). In addition, the original research found that this construct was significant for both spontaneous and compulsory usage contexts but at the same time, limited to the duration of the first period (post-training, T1) only, and it became negligible over an extended course of usage.

The following construct in the UTAUT model is known as Social Influence which indicates the magnitude of how one perceives the reaction of the people around him or her regarding the new technology to assess whether it should be used (Venkatesh, Morris, Davis, & Davis, 2003). This construct captures the element of human interaction and uses it as a base to study the behavior of the user in question, to see if the environment around a person influences the decision-making process in adopting new technology as it is an immediate determinant of behavioral intention which is represented as the three concepts of the subjective norm in TRA, TAM2, TPB/DTPB and C-TAM-TPB, social factors in MPCU, and image in IDT (Venkatesh, Morris, Davis, & Davis, 2003). Despite having various labels, these constructs point toward the explicit and implicit idea that one's behavior is affected by how he or she perceives others will see them after having used the innovative technology.

Regarding voluntary testing, Venkatesh et al. (2003) discovered that none of the Social Influence constructs are substantial, notwithstanding, it is not the same for mandated usage testing and it is also regarded as being profoundly complicated. It affects individual behavior through three mechanisms which are compliance, internalization, and identification, with the latter two changing a person's belief structure and/or making an individual respond to a social status benefit (Venkatesh, Morris, Davis, & Davis, 2003). On the other hand, the compliance mechanism affects an individual in the sense that one only has to modify his or her intention to answer to the social pressure, especially towards expectations from others that possess the ability to reward the desired behavior or punish misbehavior (Venkatesh, Morris, Davis, & Davis, 2003).

The next construct in the line is Facilitating Conditions that by definition are the level to which a person believes that an institutional or technical framework exists to assist the use of the system (Venkatesh, Morris, Davis, & Davis, 2003). Also, according to Venkatesh et al. (2003), this construct was built on the foundation laid out by the other 3 distinguished theories which are perceived behavioral control (TPB/DTPB, C-TAM-TPB), facilitating conditions (MPCU), and compatibility (IDT); in addition, these constructs were created on the mindset of technological and/or organizational environment that are predetermined to remove barriers to use. Moreover, since the construct was aimed towards a deciphering behavioral factor that involves removing those barriers, some similarities overlapped with Effort Expectancy in terms of ease of use. Hence, if Effort Expectancy was absent from the model, (as is the case with TPB/DTPB), then Facilitating Conditions are expected to become a predictor of intention (Venkatesh, Morris, Davis, & Davis, 2003). Lastly, demographic factors, experience, along with Voluntariness of Use were taken into consideration by Venkatesh et al. (2003) to produce the theoretical model of UTAUT.

One of the reasons that I have decided to apply the UTAUT model to the analysis of this paper instead of the Usability models, besides the fact that the attributes of Usability models required to be surveyed through a present mobile application in the market are that the UTAUT model involves with various key management concepts that significantly impact the management of a company and postulate the functions as well as decisions of a manager within a company, especially for startup businesses that cannot afford to make the wrong (initial) investment. Among the theories that were introduced in the model, Technology Acceptance, Innovation Adoption, and Change Management are the most likely concepts of management that are noteworthy.

Technology Acceptance alludes to the method by which people and organizations embrace and utilize modern technologies (Karulkar, Pahuja, Uppal, & Sayed, 2019), in which the UTAUT model provides a hypothetical system for understanding the variables that impact technology acceptance and can be utilized by managers to plan and actualize strategies to advance innovation appropriation and utilize inside their institutions.

Innovation Adoption invokes the method by which modern ideas, products, or administrations are embraced by people or organizations (Venkatesh et. al., 2003). The UTAUT model can be used to understand the elements that affect innovation adoption and to create techniques for advancing modernization within corporates.

Change Management points out the method of arranging, executing, and overseeing changes inside organizations while remaining a fairly strong path coefficient with the construct of Social Influence (Casey & Wilson-Evered, 2012). The UTAUT model can be utilized to get the components that impact the acknowledgment and appropriation of innovations and to create methodologies for overseeing the change process and advancing effective technology adoption (Mosweu, Bwalya, & Mutshewa, 2016). By connecting the UTAUT model to these key management concepts, managers can gain valuable insights on how to advance technology acceptance and innovation development with their organizations, and how to oversee the change process effectively.

For this paper, I will solely use the UTAUT model to prove my hypothesis even though there are other frameworks to consider, such as the Usability models (with the abovementioned reasons) and the Health Belief Model. Despite being excluded from the survey, it is still crucial to understand the reason behind the omission of the Health Belief Model, hence, I will introduce that model in the following section.

3. The Health Belief Model (HBM)

The Health Belief Model[5] (HBM) was first developed in the 1950s by Hochbaum (1958), and Rosenstock (1966), along with other social psychologists in the U.S. Public Health Service with the initial aim to study the reason that led to people failing to take part in disease prevention and detection programs. (Rosenstock, I. M., 1974) This model was later developed to examine the behavioral response they give to health-linked conditions (Rosenstock, Strecher, & Becker, 1988). Social scientists' interest has long been piqued by their curiosity regarding human behavior-related health-associated conditions, especially for those that failed to participate in such programs that were proven to be beneficial to their well-being, as such, researchers have begun their work with the starting point from analyzing demographic characteristics like age, gender, ethnicity, socio-economic status, etc. that were linked to preventive health-connected behavior patterns (Abraham & Sheeran, 2015).

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[5] Appendix Figure 5

From then, the scientists established the four key constructs which are "perceived susceptibility", "perceived severity", "perceived barriers", and "perceived benefits"; these key constructs are responsive to their designated areas within human behavioral changes, for instance, the author of the Health Belief Model article – Green, E. C., Murphy, E. M., & Gryboski, K. (2020) – has given the example regarding the HIV infection. During the initial stage of the thought process, a person would question their susceptibility to a particular health issue, then that person would question the severity of such disease; then came the assessment of the belief in the effectiveness of the new behavior such as whether the usage of condoms helps to prevent HIV transmission; this, later introduces a new construct that is "cues to action" and signifies the perceived benefits of prevention activities, for example, even though the needle exchange clinic is far away, clean needles help to prevent HIV being injected into new patients' bloodstream which makes the journey to that clinic worth the trouble, effectively validating its perceived value; notwithstanding, there are mental behavior barriers to be aware of in the thought process including resistance to changes, individual preferences towards new behavior or alternative methods, financial blockade, etc.

Based on the foundation of such studies, the HBM suggests that inside the six particular variables (or constructs), there are generally two aspects related to health and health behavior that can be summarized as threat perception and behavioral evaluation. Within the belief construct of threat perception, an illness is perceived based on susceptibility and severity as well as exposure to such disease's consequences whereas, within the belief construct of behavioral evaluation, the benefits of an endorsed health behavior as well as the barriers to that health behavior are considered (Abraham & Sheeran, 2015). In the same book section as written in the Predicting and Changing Health Behaviour: Research and Practice with Social Cognition Models (2015), it is worth noting that certain cues to action can trigger health behavior when pertinent beliefs are held including cues such as individual awareness of symptoms, social impact, and health education campaigns, followed by one's general health motivation which was added later into the model that translates to the readiness to be attentive to health issues (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977).

With this, the purpose of the Health Belief Model can be understood as a theoretical model that can be used to navigate health promotion and disease prevention programs (Luszczynska & Schwarzer, 2015). Although this model in conjunction with the UTAUT model produces a theoretical framework that describes the target audience of a working health and fitness mobile application, such a factor has been proven by other research. Thus, I will not be proceeding with this model in the research methodology as it is redundant to assess the self-efficacy and motivation of the participating candidates considering the underlying meaning and findings conveyed by the Health Belief Model structure.

4. Analysis of The Theoretical Models

Understanding the importance of market research, many companies have opted for specialists to analyze the sector in which they are running their business. In the case of health and fitness mobile applications, Wei, J., Vinnikova, A., Lu, L. & Xu, J. (2020) have done a study on this matter in the Chinese market and they have made a major consideration of the driving factors that influence the actual usage of mobile applications.

As such, the purposes, or intentions of using such apps were continuously being measured and monitored as a side-by-side comparison to the actual usage of those apps. They have applied the Unified Theory of Acceptance and Use of Technology (UTAUT) in combination with the Health Belief Model (HBM) to study the health behavior of fitness app adoption by the public mass. They have created a new model[6] that proposed the intertwinement between the UTAUT and the HBM with an addition of the HealthIT element. As such, it effectively represents their hypothesis that there is a correlation between health-related behaviors and the adoption of fitness apps. Originally, this model is used to assess the likelihood that a person picks up exercising habits and other healthcare actions to prevent obesity (Hochbaum, Rosenstock, & Kegels, 1952) and the likelihood that they apply technology in achieving that goal.

The key idea that Wei, J., et al. (2020) proposed was that they wanted to test whether the Chinese citizens as a whole were willing to adopt a mobile application to serve the purpose of preserving general health and fitness. However, the major difference between the study conducted by Wei, J., et al. (2020) and this paper is that the profile of the target audience would be more tailored towards the end goal of predicting the app usage behavior of people who have already aware of their health and wellbeing as well as people who have been going to the gym frequently pre-pandemic. As a result, the HBM is assumed to be always active where the sample size consists of candidates who are ready to exercise or look after their health and well-being.

Therefore, the study will revolve around the UTAUT model where regular gym go-ers are questioned whether they are keen on using a mobile application to track their workout progress or to monitor their health status. Behaviors around adopting a new habit stem from the perceived benefits that those activities bring about which effectively serves as a source of motivation for participating. This philosophy was greatly emphasized in the UTAUT model and in this case, a mobile application in the health and fitness sector may be perceived as beneficial by the users so that they would keep using them even after the Covid-19 lockdown regulation has passed.

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[6] Appendix Figure 6

In general, all the models work well in assessing the behavior of users regarding adopting recent technology for health purposes. However, the Usability models are used to evaluate such behaviors based on a present application while the premise of this paper functions on the pre-release state where the existence of a health and fitness mobile application is limited to being an idea. On the other hand, the Health Belief Model suggests that people are open to seeking fix and prevention measures concerning their health which in this case is obesity, notwithstanding, since my target audiences are frequent gym goers, this model is redundant because they have already taken an interest in living a healthy lifestyle. As such, I will proceed with answering the original question of whether an investment into a mobile application for health-and-fitness-oriented businesses should be the focus, by examining the Vietnamese market through the measurement of the UTAUT model.

5. Other Research

Besides the work done by Wei, J., et al. (2020), various other studies aimed at deciphering mobile app usage behavior for health and fitness purposes. This is entirely logical considering that this topic is not unique as it has been in the interest of many companies to establish a profitable and sustainable business in different markets and the platform of mobile application is not an exception. Also in the context of combating obesity, the major idea started with using a mobile application to track the weight of the user as a part of his or her weight management plan and the study behind this is the "Mobile Applications for Weight Management: Theory-Based Content Analysis" study done by Kristen M.J. Azar, Lenard I. Lesser, Brian Y. Laing, Janna Stephens, Magi S. Aurora, Lora E. Burke, and Latha P. Palaniappan (2013). This study intended to assess diet, nutrition, and anthropometric-tracking mobile applications as those that existed in the market was not living up to their expectation (Azar, et al., 2013).

Their work was founded based on theory-based content analysis as they concluded that the health-tracking mobile application of that current time was inadequate as they failed to follow any solid theoretical structure as well as display appropriate theoretical content to navigate the shift in behavioral for weight management (Azar, et al., 2013). This study, albeit that they went a different path compared to UTAUT and the HBM, also used cognitive strategies with items similar to the research design used by Wei et. al. (2020) including perceived benefits, perceived barriers, perceived risks, and self-efficacy.

There is another study on this topic that dives into the behavioral functionality of mobile applications for health purposes and it aims at explaining behavioral factor that leads people to make changes with the ultimate goal is to explore the potential that mobile application brings

about for health intervention, and the method of this research is through literature review in a standardized manner (Payne, Lister, West, & Bernhardt, 2015). Typically, smartphone owners installed 41 apps, 52% used their phones for health purposes and 19% used health apps, however, the conclusion was that only a few among thousands of applications were thoroughly verified in the intervention context (Payne, Lister, West, & Bernhardt, 2015). The Social Cognitive Theory (Bandura, 1986) was also mentioned in the research as one of the most used theoretical frameworks because self-monitoring and social support were the most dominant factors across various research, in addition to behavioral changes in application acceptability and self-efficacy factors (Payne, Lister, West, & Bernhardt, 2015).

There was also research developed by Valerie Gay and Peter Leijdekkers where the purpose was to bridge the gap between health and fitness data in mobile applications and health care for unification (Gay & Leijdekkers, 2015). Interoperability was also one of the main concentrations for developing the paper, with the help of mobile applications that act as facilitators, and in this fashion, it refers to the interchangeability of the use of data for health care (Gay & Leijdekkers, 2015). In that study by Gay and Leijdekkers (2015), the researchers utilized the Android platforms as a foundation and installed a health and fitness tracking mobile application known as myFitnessCompanion into wearable devices where information was stored on their back-end server, with the consent of the wearer for health and fitness tracking intention, the conclusion was that mobile application contributes to the facilitation of interoperability. This research amounted to great findings where the existence of mobile applications is confirmed in the context of health care and fitness monitoring.

In another original study, a research team from Michigan State University applied the UTAUT2[7] model to analyze the awareness of health and fitness mobile app users which was indicated to be more precise on assess the consumer side of the equation compared to its predecessor UTAUT (Yuan, Ma, Kanthawala, & Peng, 2015). Intriguingly, the paper was aligned with Wei et. al. (2020) on the note of research purposes, with the difference that it used UTAUT2 instead of the original UTAUT model as well as the application of Cronbach's alpha measurement model for construct validity (Cronbach & Meehl, 1955). According to the research by Yuan, et. al. (2015), UTAUT was more technological and business-oriented while its extension, the UTAUT2 model focuses more on the users by adding three more constructs which are Hedonic Motivation, Price, and Habit. These constructs are tailored toward the consumers at large as they are involved with the motivation level of the user, price value that reflects in financial status, and the habit which is influenced by self-efficacy (Venkatesh, Thong, & Xu, 2012).

One interesting finding of the study done by Venkatesh and associates on UTAUT2 is that the control factors played a significant role in mediating the connections between key

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[7] Appendix Figure 7

constructs and behavioral intention. They concluded that the constructs within the UTAUT2 model influence the behavioral intention of how consumers continued to keep using health and fitness mobile applications. Although this work applies the extended version of the UTAUT that may provide more accurate insights, in this paper, I would still proceed with the original model as the question is concerned with the organizational setting because it would be more of interest for the businesses.

6. Hypotheses Forming

The UTAUT model aims at deciphering the usage behavior of people who are accommodating to a new technology which in this case is assessing whether frequent gym-goers would adopt and continue to use health and fitness mobile applications after the pandemic has subsided and the lockdown regulation has lifted. Based on previous literature and research findings, I have chosen the UTAUT model for hypothesis testing as it is the closest match to an experimental phase before the release of an actual health and fitness mobile application. Although Usability is a better indicator to test the performance of an actual mobile application (Alturki & Gay, 2017), the main goal of this paper is to see whether consumers are ready to adopt a new technology before its release so that businesses may have a guide on their research and development strategy.

Performance Expectancy

The term Performance Expectancy is defined as the belief level of an individual in using the technology in question will aid one in obtaining a higher and positive impact on a desired goal (Venkatesh et. al., 2003). In this case, Performance Expectancy refers to the belief that using a health and fitness mobile application would improve the user's well-being condition so that he or she could reach a pre-determined goal such as staying in shape or performing better in sports. Such belief will have an impact on a user's intention to use the app. Thus, I propose the following hypothesis:

H_1: Performance Expectancy has a positive correlation with Behavioral Intention.

Effort Expectancy

Effort Expectancy can be broadly defined as the degree of comfort or satisfaction while using the aforementioned technology (Venkatesh, Morris, Davis, & Davis, 2003). For this paper, it is the simplicity and effortlessness of navigating around an app. Effort Expectancy would help measure people's willingness to use this app to pursue their fitness goals as the

lower the effort needed, the higher the Effort Expectancy. Hence, I propose the following hypothesis:

H_2: Effort Expectancy has a positive correlation with Behavioral Intention.

Social Influence

Social Influence is described as the extent to which an individual is influenced by others in deciding to use innovative technology (Venkatesh et. al., 2003). In the case of health and fitness mobile applications, Social Influence may come under various forms such as friends and family consultation, a perceived rising trend around the user, or the user in question gets affected by social media influencers, etc., which will all be considered when the user chooses to use an app to reach his or her goal. As Social Influence poses an influence on Behavioral Intention, I propose the following hypothesis:

H_3: Social Influence has a positive correlation with Behavioral Intention.

Facilitating Conditions

Facilitating Conditions, on the other hand, refers to the amount to which a person put his or her faith in an organizational and technical infrastructure that exists to assist the usage of the new technology (Venkatesh et. al., 2003). Contrary to the other three factors, Facilitating Conditions directly influence Use Behavior instead of going through Behavioral Intention. This is due to the results obtained from researching the UTAUT model which has found the consequence of the connection between Effort Expectancy and Facilitating Conditions. According to Venkatesh, et al. (2003), perceived behavioral control is substantial in both spontaneous and compulsory settings promptly following training (T1), however, the construct's influence on intention vanishes by T2, in addition to several elements being overlapped with Effort Expectancy regarding the ease of usage. In this case, the Facilitating Conditions for health and fitness mobile applications are the technology that backs up app development, mobile app creation software, UX/UI, founding companies, etc. Therefore, I propose the following hypothesis:

H_4: Facilitating Conditions have a positive correlation with Use Behavior.

Behavioral Intention

Based on the study from Venkatesh et al. (2003), Behavioral Intention is expected to have a vital positive influence on the actual usage of the new technology, especially when Facilitating Conditions and Behavioral intention to use are both direct influencing elements of Use Behavior. As such, I also propose the following hypothesis:

H_5: Behavioral Intention has a positive correlation with Use Behavior.

7. Chapter II Summary

In this chapter, I discussed several previous papers that used various methods and concepts to test their hypotheses on comparable topics of assessing the suitability of mobile applications in the health and fitness industry. I considered the Usability Model and its variance to decipher the approaches of other studies and to unravel the Health Belief Model to understand the motivation behind the pursuit of health and fitness by the public mass. I also analyzed other works that took different paths toward the same goal of examining the necessity of a health and fitness mobile application. However, among the models, I find that the UTAUT model is the closest to my research as I have not established any app yet, this means that the survey will be conducted on a hypothetical foundation without giving the participants a solid image of what a final product of health and fitness mobile application looks like.

For that, each of the UTAUT constructs is converted into statements and questions in a way that is easier for survey candidates to answer while maintaining the underlying meaning that those constructs convey. To sum up the findings from other literature, I produced my hypotheses for each of the UTAUT constructs in this paper to form a survey questionnaire which will be explained in the following chapter. I aim to illustrate the logical argument behind the creation of the survey questionnaire to demonstrate how the UTAUT model can be implemented to forecast the usage behavior of Vietnamese consumers regarding using a health and fitness mobile application.

III. Research Methodology

All research requires valid data acquisition to prove their proposed hypothesis, as such, a research methodology that is appropriate to the study that is being conducted is crucial as not only it determines the output, but it also reflects the sample size positively. There are several types of research methodology to be conducted for data collection, however, among them, two of the most frequently used methods are Quantitative and Qualitative research. By definition, quantitative research refers to the numerical assessment of measurable "quantities" and it is suitable for evaluating whether a relationship exists between two elements, or in other words, hypothesis testing (Gratton & Jones, 2010). On the other hand, qualitative research focuses more on intangible statistics to capture the meanings or qualities that are not quantifiable, for instance, feelings, thoughts, experiences, etc. (Gratton & Jones, 2010).

Since the data collected through qualitative research are non-numerical, there is a distinct discrepancy between the two approaches as qualitative data requires analysts and scientists to put meaning into them and interpret those data with words (Gratton & Jones, 2010). In this paper, I will proceed with both methods to obtain a more well-rounded observation of the Vietnamese market, considering that the survey questionnaire is not capable of ensuring 100% that the contents are being understood in full and there are bound to be errors or mistakes on the ends of both the survey conductor and the participants. Because this paper uses the UTAUT as a hypothesis testing model, it aligns with the method Venkatesh et al. (2003) used, a quantitative research methodology. And to consolidate any miscommunication that occurs during the quantitative research, I will implement qualitative research to obtain a deeper insight into the psychological process of the survey participants.

The term "construct" can be traced back to the year 1958 when it was quoted by the German physicist Werner Heisenberg in Physics and Philosophy: "…since the measuring device has been constructed by the observer, …we have to remember that what we observe is not nature in itself but nature exposed to our method of questioning" (Heisenberg, 1958). Construct validity refers to the extent to which reasonable conclusions may be drawn from a study's operationalizations to the theoretical conceptions on which those operationalizations were founded (Trochim, 2006). In terms of construct validity, the term "variable" was also brought up to introduce an entity with at least two possible outcomes that can shape a construct into a perceptible form. As such, a "construct" is an abstract, intangible, and higher-grade concept that cannot be measured or observed directly (which refers to the 'nature') (Mochon & Schwartz, 2020), while the element in question (the variables) seeks to assess the latent construct to our approach of interpretation (Agarwal, 2011).

For instance, in the Proceedings of the American Society for Information Science and Technology, the author mentioned an example that the concept of a construct can be depicted

as "hard work" which is not directly observable, while the variable "number of hours spent working on a research paper", on the other hand, appears to be perceptible through an experimental design that is based on the detectable digit variable that is the "number of hours" (Agarwal, 2011). In this paper, the five main constructs of the UTAUT will be assessed by surveying the online premise and the last construct would be measured through the evaluation of the previous five in combination with the data collected from controlling factors such as Demographical Data. Those constructs are: "Performance Expectancy", "Effort Expectancy", "Social Influence", "Facilitating Conditions", "Behavioral Intentions", and "Use Behavior".

This paper will firstly assess the proposed hypotheses by collecting primary data from Vietnamese gym enthusiasts in the form of quantitative research through a survey questionnaire that is to be sent out to reach ideally 300 candidates who frequently go to the gym and are actively looking after their health and fitness level. The survey consists of 11 questions, among them there are 4 multiple-choice questions, 4 questions with a 5-point Likert scale response, and 2 demographic questions with a question for the respondents' names. The survey questionnaire would be made on Google Forms and would be distributed through Facebook channels for a duration of approximately one month as an online survey in this case proves to be useful to reach the country in question, which is Vietnam, as well as covering the distance between the respondents and the survey conductor. The core constructs presented in the UTAUT model will be assessed in the form of a question for each of them correspondingly.

Secondly, I will incorporate qualitative research to consolidate the collected result from the quantitative research data. My goal is to deepen the understanding of the pattern that the survey candidates answer the questions. By finding the underlying pattern, the study would be more comprehensive in terms of recognizing the emotion and logical reasoning of the participants which may help identify a common logical thought process that gets generalized into the population. As such, I will proceed with interviewing 5 candidates through an online meeting platform such as Zoom, Microsoft Teams, or Google Meets, to ask the same inquiries that portray each of the constructs in the UTAUT model while including additional in-depth questions to uncover the hidden intentions as to why the candidates chose to answer in that way. Furthermore, the outcome of these interviews will be recorded and collated with the data obtained from the quantitative research to evaluate the viability of the discovered latent potential usage pattern. However, it is noteworthy that the interview will be done mostly in Vietnamese as it is the national language of Vietnam as well as it is easier to convey the meaning of the questions to the survey participants, hence, a translation for the transcript will be provided in the appendix with as close to the original intention of the constructs in the UTAUT model as possible.

1. Research Methodology for Quantitative Survey

As for the quantitative research, the type of questions that are directly related to UTAUT would be based on the model of the Likert Scale which ranges from Strongly Disagree to Strongly Agree as this provides a structure that is translatable into numerical data for evaluation (Joshi, Kale, Chandel, & Pal, 2015). Firstly, there will be a general yes or no question to assure that the responding participant is a valid candidate, for instance: "Are you currently working out at any gym?". If the respondent has never gone to a gym before, then he or she would be disqualified immediately because this paper will only be focusing on gym-goers who could use an app specifically made for fitness purposes, although this could be a drawback that would be discussed in the limitation part of this paper.

There is a major factor to note which is the study conducted by Wei et. al. (2020) where each of the UTAUT constructs is measured through various scales obtained from a wide range of previous research done by Davis, Bagozzi, and Warshaw's (1989); Kim, Horan, Gendler, and Patel (1991); Sharifi, Mahdavi, and Ebrahimi-Mameghani (2013); Wilson, K. E., Harden, S. M., Almeida, F. A., You, W., Hill, J. L., Goessl, C., and Estabrooks, P. A. (2016); Malhotra, Kim, and Agarwal (2004); Awad and Krishnan (2006). The involved factors are perceived benefits and threats of weight loss, performance expectancy, and barriers to weight loss, and one of the most crucial factors is self-efficacy (Wei, Vinnikova, Lu, & Xu, 2020). Self-efficacy is defined as the ability to take the initiative in protecting oneself from a certain threat or vision of a bad circumstance which in this case is obesity (Wilson, et al., 2016).

Notwithstanding, self-efficacy is deemed as always present in this study due to the continuous assumption of the Health Belief Model in the survey questionnaire because the respondents should already be holding a gym membership which illustrates that they were ready to take measures to care for their health and fitness. During the course of proving the validity of each of the constructs, the scales used by the other researchers were the foundation that let Wei et. al. (2020) measure factors such as weight loss intention, behavioral intention to use the health and fitness app, perceived health benefits as well as the associated risk/threats. However, in this study, I will proceed with the survey assuming that the Health Belief Model is always applied. This is due to the first question mentioned above in the questionnaire filtering out gym enthusiasts as potential candidates, hence, the respondents are expected to be already taking the initial step to look after their own health and fitness level.

As for the main constructs in UTAUT, regarding Performance Expectancy, it depicts the degree to which a person believes in the performance of the technology, thus, the appropriate question for this construct should tackle the aspect of mobile application performance that influences Behavioral Intention in the form of multiple choices ranging from Strongly Disagree to Strongly Agree so it would be: "You believe that by using a health and

fitness mobile application, you would achieve your goal better." with the answers based on Likert Scale. The measurement of this construct is paraphrased from the measurement made by Davis, Bagozzi, & Warshaw (1989) to fit the context of health and fitness. Although this question is a statement instead of an actual question, it serves the purpose of testing the belief of the respondent in a hypothetical sense rather than having them answer a predetermined question and this also applies to subsequent items.

Regarding Effort Expectancy, previous studies gave evidence that this factor tackles the aspect of ease of use, the question should be rephrased as a statement such as: "You find that it is easy to use such apps to help you reach your objectives.", by paraphrasing the question during the hypothesis testing of Venkatesh et. al. (2003). This is to examine the amount of effort that a prospect may exert to use a health and fitness mobile application. I anticipate that the higher the amount of effort needed, the less likely the candidate will go through with using those apps.

For Social Influence, it is believed that the social factor must be considered as an external force that subconsciously affects the person before he or she decides whether to use such an application as people are prone to imitate the environment surrounding them, and for that reason, the question for this construct would be:" If a person you know is using that app, you would use it as well.". This statement is to access the emotion of the survey participants to understand their active motifs when it comes to mirroring those who are close to them. The motivational speaker Jim Rohn has left behind a quote which is that "You're the average of the five people you spend the most time with" (Groth, 2012), and this is true in most cases for the average public mass. This means that people often mimic the actions of those they are close with and in this case, if a person has someone close to him or her that uses a mobile application for health and fitness purposes, that person would be likely to pick up the same habit.

However, in the case of Facilitating Conditions, this term can be traced back to the year of 1994 when it was first used as the defining concept that captures three separated constructs that belonged to distinguished theoretical models that are perceived behavioral control (TPBI DTPB, C-TAM-TPB), facilitating conditions (MPCU), and compatibility (IDT) (Venkatesh et. al., 2003). As such, by rephrasing the relevant question, the statement should revolve around the big picture that comprises the organizational system that supports the use of such an application including the resources to use them, the abundance of knowledge needed to use them, the compatibility involved, etc., hence: "You believe that a health and fitness mobile application would be well-received by frequent gym goers.". These questions are a precedent to determine Behavioral Intentions to use, shaping the Use Behavior. Thus, the appropriate question should be, "Do you plan to use a health and fitness mobile application in the future?".

In addition to the UTAUT constructs, the demographic data and control variables also require survey participants to answer their associated questions to obtain the necessary information. Besides the more straightforward type of control factors such as Age and Gender, for the Experience moderator, the relevant question should be: "Have you ever used similar applications before?". This question aims at gaining insights into the past usage behavior of the survey candidates to understand more about the actions for the mobile application in health and fitness that he or she would take concerning his or her answers to other questions in the part of the constructs. On that note, Voluntariness to use a mobile application would be measured through the question: "If you had tried a health and fitness mobile application before, did you try it voluntarily out of your own free will?". This is to assess the willingness of the survey participants to use health and fitness mobile applications both in the past and possibly in the future.

Based on these arguments, I have produced a survey questionnaire table that can be summed up in the following section. In the table, I added the constructs, the items that were used to perform the analysis, the questions or statements that are the measurement to be used in the analysis as well as the source from which those questions and statements originated. It is noteworthy that since those measurements were already conducted by Venkatesh and associates in their study on the UTAUT model, I will proceed to apply the same constructs measurement methodology with pertinent paraphrasing where necessary so that it fits the context of assessing the appropriateness of a health and fitness mobile application and not just any kind of technology.

2. Survey Questionnaire for Quantitative Research

Items and Constructs that are included in the questionnaire:

Construct	Item	Measurement	Source
Performance Expectancy	PE	You believe that by using a health and fitness mobile application, you would achieve your goal better.	(Venkatesh, Morris, Davis, & Davis, 2003)
Effort Expectancy	EE	You find that it is easy to use such apps to help you reach your objectives.	(Venkatesh, Morris, Davis, & Davis, 2003)
Social Influence	SI	If a person you know is using that app, you would use it as well.	(Venkatesh, Morris, Davis, & Davis, 2003)
Facilitating Conditions	FC	You believe that a health and fitness mobile application would be well-received by frequent gymgoers.	(Venkatesh, Morris, Davis, & Davis, 2003)
Behavioral Intention	BI	Do you plan to use a health and fitness mobile application in the future?	(Venkatesh, Morris, Davis, & Davis, 2003)

| Experience | EXP | Have you ever used similar applications before? | (Venkatesh, Morris, Davis, & Davis, 2003) |
| Voluntariness | VOL | If you had tried a health and fitness mobile application before, did you try it voluntarily out of your own free will? | (Venkatesh, Morris, Davis, & Davis, 2003) |

Table 1 Survey Questionnaire with Key Constructs

3. Research Methodology for Qualitative Interview

In this paper, both quantitative and qualitative research will be utilized to get the most accurate result as much as possible by having the latter compensates for the former as the quantitative research design is a closed type of survey. There is a discrepancy in the quantitative and qualitative research design in this study due to the way that the Likert Scale works which is having a survey candidate answer his or her opinion on a matter by selecting one from among their five given choices. This is beneficial in terms of statistical calculation as the choices can be translated into numbers for analysis, however, this type of study would not be able to assess the hidden motive behind the selection of the choices that those candidates made. This is where qualitative research comes into play due to this style of study possessing a more versatile approach to investigate the logical reasoning that the survey participants made during their choice selection process.

The qualitative research will comprise a survey questionnaire to be answered verbally and recorded to testifies the choices made by the interviewees. Firstly, I, as the conductor, will briefly summarize the idea behind the survey interviews and the paper as a whole. Then, I will ask for the consent of the participants regarding the data retention for analysis purposes, and after this stage, I will proceed to ask demographic questions while simultaneously collecting the necessary data on the control factors as well which are age and gender, with additional information on their location to gain a more comprehensive perspective. Post-introductory phase comes with the main component of the questionnaire which starts with the filter question similar to the quantitative survey, however, the respondent will not be eliminated on the spot if he or she does not meet the requirement which is someone who goes to the gym, own a gym membership, or work out in general. As the main focus of the qualitative research is to dive into the logical reasoning behind the answering motivation of Vietnamese consumers, diverse perspectives are preferred compared to a simplistic view on the matter from solely those who are working out intensively.

Next, I will include a question that asks about the motif of the respondent which is "What is your motivation for going to the gym or working out?". This question effectively asks for the reason that stimulates the interviewee to exercise which is also a representation of the Health Belief Model where the framework was to fight obesity. The intensiveness of the answer

in this section can potentially gauge the desire to get fit and pursue health longevity of the participants with the higher and more intensive replies suggesting a more serious resolve. This could be an initial determining factor toward the technological adoption of a health and fitness mobile application. After this stage, I will dive deeper into the experience of the interviewee by asking "Have you ever heard of or used a health and fitness mobile application before?". This question is intended to find out whether the candidates possessed prior exposure to a health and fitness mobile application, and in addition, I will ask "Which types of channels did you hear about those applications from?" to further understand the source of where the interview participants gained the insights of those mobile applications from.

Although the survey questionnaire of the quantitative research posed the freedom of asking questions in a fixed sequence it is a written survey, hence, the participants can work on their own accord to complete the questionnaire. However, that is not the case with qualitative interviews as this methodology requires verbal exchange, therefore, I have reordered the questions about the UTAUT model's constructs as well as moderators in a more reasonable manner. This is done to establish a smooth conversation flow that does not backpedal on the idea that may require the candidates to rethink and change their responses. As such, the next question in line is "In your opinion, do you think such an application is easy to use?" to assess the Effort Expectancy construct. I will pursue this issue further by adding follow-up questions such as "Why do you feel that it is easy to use such an application?" and "Compared to training without using a health and fitness mobile application, do you think that by using such an application, it would make your training easier?". These questions are created to stimulate the interviewees to imagine and think about the version of a health and fitness mobile application that they think is ideal while comparing that image to one of those of their knowledge.

Following the question about Effort Expectancy, I included the query about Voluntariness if they had used a similar application before. The question will be "Would you use a health and fitness application voluntarily or would you wait until you are forced to by your gym or someone?". At first, this question may sound abstract and controversial, however, it would pique the interest of the interview participants as well since it tackles a rather complicated issue of freedom of choice, and it makes the interviewees think about a real-life situation where such a concept is involved. Next, I will ask "In the case that you have never used a health and fitness mobile application before, if your friends or close relatives use one, would you do the same?" to find out about the propensity to use a health and fitness mobile application. This question presents two mutual conditions which are assuming that the interviewees have never heard of or used a mobile application before and to evaluate their health and fitness mobile app usage behavior based on the behavior of those who are close to them. I will then follow up with two questions "Compared to being introduced by family and friends, if you only knew about health and fitness mobile applications through the media and social networks, would you still use a similar app?" and "In your opinion, besides the 2 mentioned channels, your decision to use a health and mobile application can be influenced by what other channels, such as being introduced to an application at the gym, or at an event, or

through newsletters and emails?" to further assess the influence of family bonds and friends' advice on the app usage behavior of the interviewees.

The next question concentrates on a peculiar parameter which is the weight of the constructs. I set up the wording of the question as "What do you think could be the reasons that motivate gym-goers to use a health and fitness mobile application?" intending to obtain the inference of the interviewees on a general perspective of motivation for going to the gym, not just by themselves but by the community as a whole. Subsequently, to drive the interviewees into determining the most essential elements among those reasons, I will raise the successive question "Among them, which reason do you think is the most important?". Going back to the questions that represent the key constructs from the UTAUT model, I will continue to ask "Do you think that such an application can help gym-goers achieve their initial goals quicker or better? If so, then in what way?" to learn more about the effect of Performance Expectancy on the potential health and fitness mobile application usage behavior of interviewees. Right after, I will add the question "Why would you think of it in this sense?" to stimulate the interviewees into brainstorming the reasons behind their previous answers.

Since the Facilitating Conditions construct may get referred to as "abstract", I decided to go with a closed question, leaving the details up to the voluntariness of the participants to share their knowledge. The question will be worded as "Do you think that the infrastructure in Vietnam is sufficient to support gym-goers to use a health and fitness mobile application?". This way, the interviewees will not be pressured into sharing their opinions on the matter but rather that they will either agree or disagree with the statement within the question and voluntarily share their knowledge of the Vietnamese gym industry in general as well as the use of technology in the health and fitness sector in particular. And to conclude the interview, I will wrap the interview up with a question regarding the construct of Behavioral Intention to use technology "Are you going to use a health and fitness mobile application in the future?". Although I may not be able to provide an extensive follow-up period of observation to be ascertained that the last construct in the UTAUT model which is the Usage Behavior, however, obtaining the necessary information on Behavioral Intention and Facilitating Conditions enables me the option to use a predictive model to speculate future Usage Behavior.

4. Chapter III Summary

In this chapter, I discussed the two types of research methodologies required to consolidate a study, they are qualitative and quantitative research. Since both types have their pros and cons, I decided to proceed with both methodologies to have the strengths of one compensate for the weakness of the other. This is more crucial the larger the sample size is as a high volume of quantitative research may result in instability and produce outliers as the logical answering process of the survey respondents is not recorded. Therefore, to reveal the

underlying pattern behind the answers given by the survey candidates, I have appointed qualitative research in the form of an interview which was recorded to explore the reasoning behind the answers of the survey candidates in a more open manner where they get to share their opinions on each of the questions that represented the constructs of the UTAUT model.

I have also illustrated the connection between the constructs of the UTAUT model and analyzed the logical reasoning for the formation of the question statements, on top of that, the role of the Health Belief Model was also discussed as it is a reference concept, but it was rendered redundant due to the nature of this study. Hence, a table is formed to summarize the structure of the survey and its components. Within the table, the constructs are present as well as the items which are their names in abbreviation, in addition to the measurement for each of the constructs and the source from which the measurements were based on. Simultaneously, I have also established the necessary qualitative research script that is to be based on interviewing prospective candidates who also fall within the scope of the target audiences. At this stage, the survey questionnaire is ready to be distributed to the mentioned channels to obtain the relevant candidates as well as the qualitative interviews are ready to take place.

IV.   Data Collection & Analysis Process

1. Quantitative Data Collection Results

The quantitative survey questionnaire was sent out to reach Vietnamese targeted audiences who fall into the desired demographics of the experiment. However, it was under the ideal number of 300 responses and that could be related to the time constraints of roughly one month, as well as the motivation level of the respondents as they needed the incentive to take time filling in the form. Hence, only 103 out of 110 responses were recorded after omitting invalid answers who responded "no" to the first question that serves as a filter "Are you currently working out at any gym?". Surprisingly, there were only 16 respondents who replied: "Strongly Agree" to the first statement which links to the Performance Expectancy construct: "You believe that by using a health and fitness mobile application, you would achieve your goal better.", and three of them were below 18. This comprises only a third of the respondents who put "Agree" with two of them being below 18 and the other two being 42 and above which is an astounding number of 52 respondents. Together, these 2 groups make up 68 positive entries out of 103 valid responses which is more than 66% of the Likert Scale spectrums. The other 34% consists of 24 responses for "Neutral", 8 responses for "Disagree", and 3 responses for "Strongly Disagree".

The second statement which is tailored towards Effort Expectancy: "You find that it is easy to use such apps to help you reach your objectives." has resulted in 12 "Strongly Agree"

answers with 2 people under 18, and 31 "Agree" answers also with only 2 people below 18 and this comprises to 43 positive responses. The count for "Neutral" was unexpectedly high which is 24 responses while "Disagree" has only 8 counts and "Strongly Disagree" has only 3 counts. The respondents' answers may have been under the influence of them not having experience with a hypothetical platform which is the mobile application itself and also because the ones that were already in the market do not provide them with enough information to fortify their thought process, and this could be part of a limitation that this paper may have. This could have been the control factor that the UTAUT model has included which is the demographic element of age, gender (with names to distinguish the respondents), experience, and voluntariness.

Regarding the third statement that is corresponding to Social Influence: "If a person you know is using that app, you would use it as well", 16 out of 103 respondents recorded with "Strongly Agree" and 52 respondents out of the same pool recorded with "Agree" which combine to yield an astounding amount of 68 positive answers. On the other hand, the number of respondents who replied "Neutral" also ranged up to 24 answers while there were only 8 "Disagree" (2 among them is below 18) and 3 "Strongly Disagree". There might have been a connection between consumer behavior and a need for reassurance which in this case is "safety in number" and also "safety in close references". This means that the consumers are more likely to follow the choices similar to those that are close to them have made due to a need for making a desired impression, feel a sense of belonging, gaining affiliation and respect from others which are defined under "Social Motives" (Cavanaugh, 2016).

The fourth statement which coincides with Facilitating Conditions: "You believe that a health and fitness mobile application would be well-received by frequent gym goers", surprisingly, 16 "Strongly Agree" responses were received and 52 "Agree" responses were recorded. Coincidentally, there were also 24 "Neutral" replies received as well as 8 "Disagree" and 3 "Strongly Disagree". There might have been a certain factor in play that influences the decision of the respondents after making their choices in the third statement, however, it is not certain how precisely it affects them. On the other hand, there is also uncertainty regarding whether the respondents have enough information to agree or disagree with the statement which requires certain research beforehand.

All four statements above that represented the constructs in the UTAUT model were built up for question that tests whether "Behavioral Intention" influences the "Use Behavior" of the mobile application for health and fitness purposes. The results collected from the data were 53 positive responses and 50 negative responses, which leaves the positive responses almost equal to the negative answers. However, these results do not end the equation here as the original question of whether a mobile application for health and fitness should be developed has not been confirmed as there are still control factors to be considered.

The elements that moderate the results collected from the questionnaire are the same as those of the control factors in the UTAUT model Age, Gender, Experience, and Voluntariness of Use. Regarding the age factor, there were no data collected from gym goers who are above 57 as the sample size might not have been big enough for such outliers to come across in the survey pool. Based on the database, there were only 10 cases where the respondents were below 18, with only 3 of them being males while the other 7 were females. The young adult age group that ranges from 18-25 took the majority of the respondents with 50 answers while there were only 34 records from those that are from 26 – 41 and 9 answers from those that ranged from 42 – 57 with the higher the age, the less likely that an answer can be obtained from.

As of the current year, the generations that are most likely to have an affinity for technological adaptation are the Millennials and even more so for those who are Generation Z, which the survey is leading. In total, there were 40 responses obtained from female participants and 63 responses collected from male participants. However, by selecting the core age group of 18 – 26 as well as putting gender as a filter, the returned value obtain was that there were 36 males and 14 females who answered. Apart from Age and Gender, the other two control factors show a pattern in the selection of the survey participants. The data reported here appear to support the assumption that Voluntariness is locked behind Experience as a reply can only be deemed as valid if the person who used a similar app responded "Yes" in the survey about Experience, otherwise, it would automatically be counted as a "No", hence, it effectively created a situation where Voluntariness ≤ Experience. The same cannot be applied in a reverse relationship between Voluntariness and Experience as a person who has tried the application could have been forced to do so without wanting to in the first place. Intriguingly, the collected results display an exact amount of "Yes" and "No" answers for both factors.

2. Quantitative Data Analysis Process

After a general description of the collected results, the data will be processed through a statistical software called Stata to calculate the appropriate evaluations to support the hypothesis of this paper. The included assessments are a t-test, a chi-squared test, a correlation matrix, along with a regression analysis. In contrast to the analysis done by Venkatesh et. al. (2003) and Wei et. al. (2020), there were means to keep monitoring the participants. In the case of the original paper on the UTAUT model, the construct of Use Behavior was measured by an extended amount of time for extra observation which returns the necessary value to validate the proposed hypothesis of that construct Venkatesh et. al. (2003). As for the case of the latter paper, the participants had also stayed connected through the Boohee health and fitness mobile application and it was made with ease of use in mind, hence, allowing the team to be able to collect data from the respondents in an orderly fashion Wei et. al. (2020).

I did not have access to instruments of the same level of observation as Google Forms and Facebook offer no incentive and observational structure to follow up with the survey participants after they have filled out the questionnaire, and this means that each respondent was only recorded once with no further observation. In other words, it means that Use Behavior could not be confirmed in this paper, and as such, compared to the original UTAUT model, the second viewpoint of the framework shall be forfeited, although the Facilitating Conditions construct would still be under assessment for a comprehensive analysis. The third viewpoint of the UTAUT model which illustrates the effect of the control factors on other the influence of the key constructs on Behavioral Intention shall be named the new second viewpoint for this paper.

Branches of the UTAUT models for assessment:
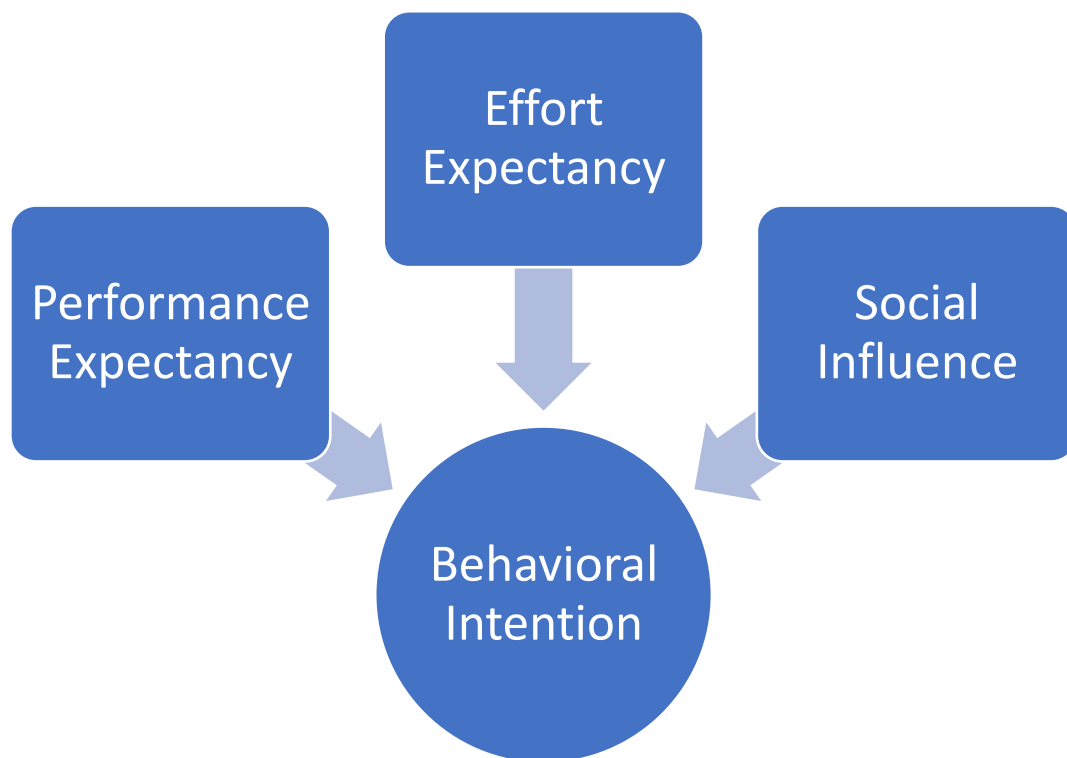
Figure 1 First viewpoint of the UTAUT model

In this first viewpoint, tests and analysis will be done on Behavioral Intention with the influence of the three key constructs: Performance Expectancy, Effort Expectancy, and Social Influence without the mediation of control variables. The purpose of this is to test the validity of the link between each construct with a Behavioral Intention to use a mobile application. The findings from the analysis of these connections will serve as a comparison baseline for further

discussion with the analysis that includes control factors. As such, the second viewpoint in this paper will be graphed as follow:
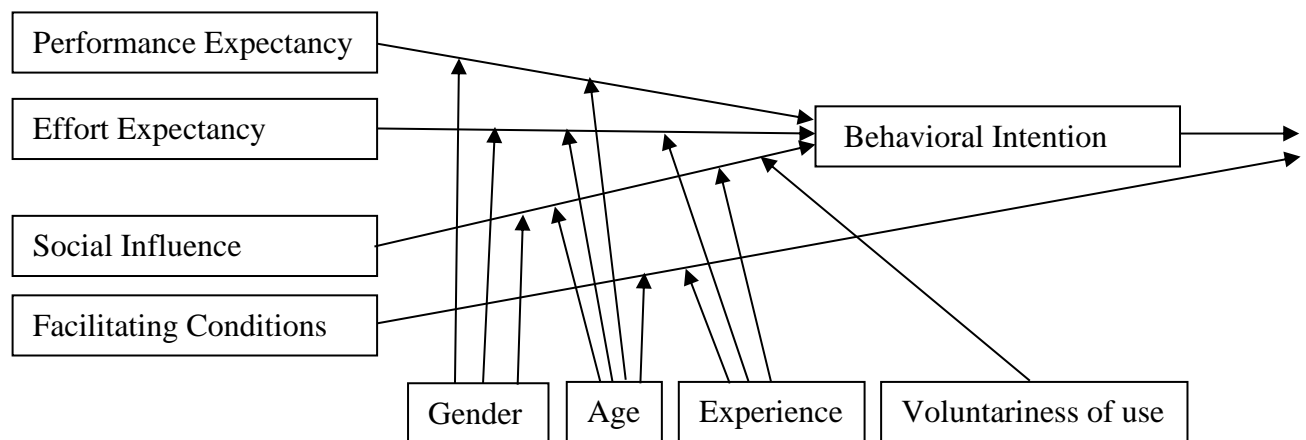
Figure 2 Second viewpoint of the UTAUT model

Due to the impossibility of keeping track of the Use Behavior construct, the UTAUT model will be remade as can be seen in Figure 2. Based on the evidence from the graph, the connection and influence between constructs remain the same as the original UTAUT model by Venkatesh et. al. (2003) while eliminating only the construct of Use Behavior from the equation, this interprets the effect of Facilitating Conditions unimportant to the model as a whole as well as it renders the hypothesis of H_4 and H_5 to be incapable of being proven. However, Facilitating Conditions still serve the purpose of forecasting future potential Use Behavior that appears in a predictive model. It is noteworthy that this could potentially alter the intended findings to answer the original question of this paper.

Being unable to measure Use Behavior is a major drawback, notwithstanding, it enables the capacity to form a predictive framework. On the note of forecasting and predicting future variables as well as a bonus to complement the analysis, I will incorporate a decision tree built from a program known as Rapid Miner through data mining techniques to further understand and recognize the patterns for possible decisions that are going to be made by prospects. In contrast to the belief that this could be a single and definite decision-making model, in reality, it is only created to be served as a reference to anticipate subsequent responses. This process alone may not be able to communicate all of the possibilities that the results may deliver, and it must be interpreted with caution because this inconsistency may be due to the decision tree being a process that is taken from a randomized smaller sample size based on the total pool of the database.

3. Qualitative Data Collection Results

After interviewing five candidates who are qualified within the scope of the target audience, I have compiled an intriguing set of data that spans several age groups as well as having the perspective of both genders in the Vietnamese health and fitness market. It is noteworthy that since the target audiences were gym-goers and those who exercise using any method available to them, the interviews were done in both Vietnamese and English depending on the language preference of the participants. All the transcripts will be provided in the appendix with translations where necessary. At first glance, the data is spread out evenly with 2 males and 3 females, ranging from the age range of 18 – 25, 26 – 42, 42 – 57, and above 57 which effectively results in a diverse set of data for analysis. The participants were able to answer all the questions included in the interview, which is beneficial for the data evaluation progress.

4. Qualitative Data Analysis Process

Qualitative research candidates:

Candidates	Age Group	Gender	Location
Mrs. Huong	42 - 57	Female	Hanoi
Mr. Chuong	Above 57	Male	Ho Chi Minh City
Mr. Nam	26 - 42	Male	Ho Chi Minh City
Ms. Lucy	18 - 25	Female	Melbourne
Ms. Linh	18 - 25	Female	Hanoi

Table 2 Qualitative Research Candidates

As previously discussed in the research methodology for qualitative research, the participants chosen were varied in terms of levels of fitness as well as their exercise habits, including those who are currently working out at a gym or at home with those who incorporate sports into their daily routine besides going to the gym, without excluding those that no longer own a gym membership. Apart from the others, only Ms. Lucy – who is a Vietnamese that is currently living overseas – the others are living in either Hanoi or Ho Chi Minh City which are the two major cities in Vietnam. This is to ensure a diverse view on this topic from Vietnamese citizens from both inside the country as well as outside of Vietnam. In general, there were several reasons for interviewees to go to the gym or work out. Among them, I have assembled a set of resemblances which is to maintain a physique, keep a healthy balance, and pursue sport-related requirements. The participants showed a relatively high interest in the topic of using technology to support their journey of staying fit and being healthy, with the usage of a mobile application being an obvious concern in their minds. Therefore, I will proceed to analyze the process of qualitative data collection and give a general review of the obtained result.

When answering the filter question which categorizes participants into a group of those who work out and those who do not, only one candidate has stopped going to the gym although they have had such an experience in the past, other participants were either working out at the gym, at home, in the park, or they incorporate sports as a part of their weekly workout as well. There were various reasons as well, one of the most common reasons is to maintain a generally healthy fitness level to live and work better without having to worry about diseases that are due to inactivity physically such as heart disease related to cardiovascular problems or obesity. Despite having such a common goal of combating obesity as the main purpose of the reasons for going to the gym, it fuels the motivation for the interviewees to go to the gym quite intensely. With such a major drive toward achieving and maintaining the physical condition of the participants, they have been looking for ways to improve their exercise and diet to optimize not only the time invested but also to reap the best possible results efficiently as much as possible.

As such, the interviewed candidates have proven to be aware of the existence of health and fitness mobile applications in the market, however, it was unclear whether they have been using the types of applications that are in line with the definition as stated in this paper which is a super app that contains both the aspects of diet planning and exercise programming (the process of forming a series of exercises to establish daily and weekly workout volume and over the span of several months or years to reach a targeted physique or performance objective). Nevertheless, the interviewees have demonstrated a general understanding of such a mobile application as well as the purpose behind the usage of those apps as well as the potential that it may bring about, although there were others do not see the point of using such an application as an absolute method to achieve a desired diet or exercise outcome (Ms. Lucy and Ms. Linh) which explains for the discontinued usage behavior or hesitation when it comes to using such a mobile application.

On a side note, for those that have experienced or have heard about a health and fitness mobile application before, it appears that they have obtained such knowledge from various sources including but not limited to social media, networking channels, advertisements, word of mouth through family, friends, colleagues, players of the same sports, etc. and the list goes on. This proves that the idea of using a health and fitness mobile application has been around for a while, although it is not made popularized on the surface, it is without a doubt a concrete option that has existed in the Vietnamese health and fitness market for a considerable time. Among the collected data only Ms. Lucy has used an application that has one of the functions similar to the health and fitness mobile application in this paper, which is nutrition planning and calorie tracking, however, she was unsupportive and hesitated about continuing the usage of such mobile applications.

Interestingly, all of the participants displayed a certain level of knowledge regarding a health and fitness mobile application, except for Ms. Lucy who has used one, the others had also known so much that they answered the question of ease of usage which represented Effort Expectancy to be simple. This is because the mobile application is often designed for commercial use and is not just limited to professional gymnastics, athletes, and competitors of all levels. As such, there is an expected level of a user interface when any health and fitness mobile application get released to the market, hence, the overall navigation of the app should not be an issue, suggesting that the user came in with prior knowledge about diet, working out, and tracking body metrics, and even if it is not, it is still learnable information. The interviewees have illustrated their understanding of the ease of use of such mobile applications so much that they were able to explain in detail the reason that made them so confident in using those applications although this paper did not specify any particular app. In addition, most of them agreed with the statement that using a health and fitness mobile application would make it easier for the users to pursue their training and dieting objectives compared to pursuing those goals without assistance from those mobile applications.

As a general rule, most of the participants were active seekers of ways to achieve their goals, thus, they weigh freedom of choice highly. The majority of participants responded that they would use a health and fitness mobile application voluntarily, except for a candidate who is more passive and laid back when it comes to using those mobile applications and would only do so if requested by a personal trainer. As such, it can be assumed that voluntariness plays a role in determining the intention to use a technology from the consumer perspective as those who are not actively willing to seek actions on their end tend to skip that technology entirely and only wait to be left by chance of encountering someone who pushes them to use that technology.

Similar to the previous questions, the Social Influence construct appears to play a significant role in determining the Behavioral Intention to use technology as most of the interviewees responded that they would use a health and fitness mobile application if those that are close to them also use one. Moreover, they also added that they would use it regardless of whether their family and friends have introduced those mobile apps to them or not. Since it is in human nature to avoid exclusion due to the fear of being left out, people tend to imitate others, especially those around them (Dahl, 2013). However, the Social Influence at hand does not just limit to those who are close to the participants because when they are asked if they would use health and fitness mobile applications if they had only known about them through channels other than their family and friends, they would still agree to try using those mobile apps. This suggests that the motivation for seeking a way to achieve their fitness goal may triumph over the Social Influence element regarding its effect on the Behavioral Intention to use.

However, when I went in-depth and investigated the likelihood of such mobile applications adoption when the interviewees are confronted by other means, such as through their gyms, events, or newsletter and emails, which are all social factors, the responses included a well-received attitude for the first three scenarios while the last situation is tricky. It tackles a different problem which revolves around the controversy of privacy and by advertising a health and fitness mobile application through emails, it may take a contrasted effect and drive the receivers away instead of gaining more of them. Thus, as a side note, marketers of these mobile apps should avoid using emails as an advertisement channel, especially for cold leads where people are yet to be "warmed up" to the idea of having a health and fitness mobile application to track their progress in the gym. This point is made known by Mrs. Huong and is also mentioned by Mr. Chuong and Mr. Nam, indicating that those who are in the age group of 26 – 42 and above tend to be more alert when it comes to privacy, whereas this issue is overlooked by Ms. Linh and Ms. Lucy due to their exposure to the social media and influencers which makes them believe in the recommendation made from the social networks more than the others.

Besides asking for the motivation of the participants at the beginning of each of the interviews, I have also put another question to ask for the opinion of the participants regarding their impression of other people's motivation that they think others would have to use a health and fitness mobile application to achieve their objective. This process effectively pushes the participants to make a critical judgment of the choices that they have selected in the beginning because they are made aware of others who might be taking the same options that they have. This means that the participants had to put themselves in the shoes of others to figure out what other factors that could lead to the motivation behind the drive to use those mobile applications for attaining their fitness goals. Three out of five participants gave logical reasonings regarding the possible motivation of others which are convenience, effectiveness, and usefulness whereas the other two did not give any reason. However, among the given reasons, all participants chose different answers for the most important motivation among those that they have named.

After the question that aimed at deciphering the construct's weight above, I implemented a question that represents the Performance Expectancy construct of the UTAUT model by asking the opinion of the participants if they think that a health and fitness mobile application would help them get better results quicker. The interviewees who are supportive of the idea of using such apps to achieve their goals wholeheartedly agreed with the statement within the question that I gave them. However, what I did not anticipate was that both Ms. Lucy and Ms. Linh who were unenthusiastic regarding using a health and fitness mobile application displayed positive and encouraging behavior toward that idea for those who want to use them despite not using those applications themselves. It signifies a high level of awareness regarding the benefits that those applications yield, if non-users are conscious of such benefits from Performance Expectancy, those who want to use those mobile applications are strikingly likely to adopt them to reach their ambitions which is to either stay healthy (Mr. Chuong and Mrs. Huong) or pursue a sport-related goal (Mr. Nam).

Regarding the question of Facilitating Conditions which is lodged under the context of the infrastructure of Vietnam, all interviewees believed that Vietnam has more than enough resources to support the usage of health and fitness mobile applications due to several factors. One of them is the most obvious in terms of daily habits and economic level, which is the ownership of smart devices with 4G connection including smartphones, tablets, smartwatches, and many others. According to all the participants in this qualitative research, since the average income of the Vietnamese people has increased over the past decade, more people are owning smart devices and it has become a modern norm to expect everyone to have them in possession. Moreover, Mrs. Huong has emphasized that gyms nowadays are equipped with Wi-Fi, so app access is not an issue. On top of that, even if the Wi-Fi does not operate in certain gyms, people are still presented with the option to switch on the 4G connection on their devices.

All the questions before Behavioral Intention to use a health and mobile application are to establish a foundation to assess the final question of whether the interviewees would choose to use such a mobile application in the future. Besides Ms. Lucy who has used a similar app before but decided to discontinue using them, Mrs. Huong stated that she would not use those apps if they were not translated into Vietnamese which prompts the issue of languages that the fitness applications in Vietnam are facing right now since the majority of those applications are in English and other languages. On the note of Mr. Chuong and Mr. Nam, although they have not used a health and fitness mobile application before, during the interview, I found out that they are extremely eager to use an all-in-one application that is defined in this paper. However, the case is different with Ms. Linh, even though she has not used one of those mobile applications before, she declared that they are not up to the task of providing the necessary motivation in her expectation. She argued that a mobile application can only serve so much as an assistance tool, without the necessary self-efficacy factor such as clear goals and a strong will that makes up a driving force, a person can just switch off the notification or delete that application and they are back to square one. As such, she is not fond of the idea of adopting one for her future exercise and diet planning.

5. Chapter Summary

In this chapter, I have discussed the results of both the quantitative and qualitative research on a general term. Each of the constructs of the UTAUT model as well as the moderators were assessed according to their questions and statements in the questionnaire as well as in the interviews. The process of each methodology was explained in detail regarding their evaluation criteria. I have noticed that there are several differences between Quantitative and Qualitative Data that make up for what the other lacks and vice versa. Quantitative research used a closed-question style of the survey to force the respondents into answering based on a set of given choices which is the Likert Scale, this is efficient macro-wise, but it lacks the valuable information that these candidates may have had to share. This weakness is covered by

Qualitative research where the emotions and opinions of the interviewees are displayed to reach a more in-depth level of wisdom as they are aware of the health and fitness industry in Vietnam, considering that they are also knowledgeable about their fitness goals.

Based on the evidence from both research methodologies, I have found inconsistencies between both styles of research as their results are relatively in contrast to each other. And with this data process framework laid out, I will proceed to evaluate the collected quantitative data using statistical methods as mentioned, combined with analyzing the qualitative data by reviewing the answers of each of the interview participants, then I will add an analysis for both the quantitative research and the qualitative research and include a combined discussion, followed by clarifying the limitations, and finally wrap this paper up with a conclusion.

V.   Results, Analysis, and Discussion

1. Results of the Quantitative Survey:

After the quantitative survey period, there were 103 responses data collected with 10 participants who were below 18, a dominating number of 50 participants were from 18 to 25 years old, while there were 34 records from the age of 26 to 41, with only 9 data from those who are 42 to 57, and none were recorded from the age group of 57 and above. It is understandable for the majority of the survey data to be attained from the younger side who are more exposed to social media than adults and senior citizens. Moreover, it is already an uncommon occurrence for the elderly from 57 and above to go to the gym, but to respond to a survey regarding the use of technology in a gym will require a much larger sample size to acquire the relevant survey candidate.

Regarding genders, there were 63 male and 40 female participants which indicates that the survey was male-dominant although it does not mean that only males are interested in this idea of health and fitness mobile applications. It could mean that by chance, this survey was not come across by the same amount of respondents in the given survey distribution time frame, and the number is expected to be shifted the larger the sample size is. The data are presented in the following table:

Age Groups	Quantity		Total Responses
Below 18	10		103
18 - 25	50		

26 - 41	34		
42 - 57	9		
Above 57	0		
Gender	Quantity		Total Responses
Male	63		103
Female	40		

Table 3 Age Groups and Genders
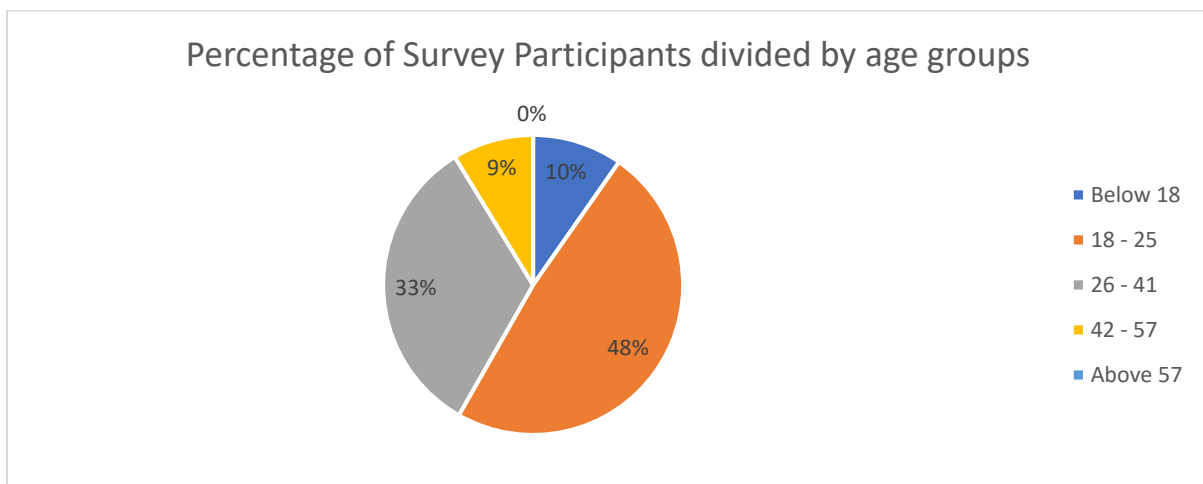
Figure 3 Percentage of Survey Participants divided by age groups.

Figure 3 demonstrated the age groups into five categories from Below 18 up to over 57. Based on the pie chart, the age group of 18 – 25 has the highest volume and took over 48% of the total responses, with the age group of 26 – 41 sitting in the second place at 33% of the total records, followed by those who are below 18 at 10% and the elderly from 42 – 57 at 9%. Since there was no data from those who are above 57 years old, the pie chart omitted the portion of that age group and left out the 0% outside of the graph.

Figure 4 Percentage of Survey Participants divided by gender.

As previously discussed, this survey was male-dominant, hence, they took up 61% of the total survey, leaving only 39% to be female participants. Besides age and gender, there were two other moderators which are Experience and Voluntariness control variables that were nested into the questions in the survey.

Experience	Quantity
Yes	53
No	50
Voluntariness	Quantity
Yes	53
No	50

Table 4 Experience and Voluntariness

Interestingly, Experience and Voluntariness shared the same amount of candidates who answered "Yes" and "No" to the relevant questions. With 53 replies of "Yes" and 50 replies of "No", both Experience and Voluntariness showed a sign of codependency. In other words, if a survey candidate answers positively to the question of Voluntariness, that person had most likely answered "Yes" to the question of Experience as well, and since one needs to have experienced a sensation before assessing if that experience were voluntary or not, from a logical viewpoint. However, it does not work the other way around since a survey candidate may have experienced a health and fitness mobile application without their freedom of choice, either that

he or she was forced by the close ones or the gym. Therefore, this relationship is not absolute codependency but rather one-way in the order from Voluntariness to Experience.
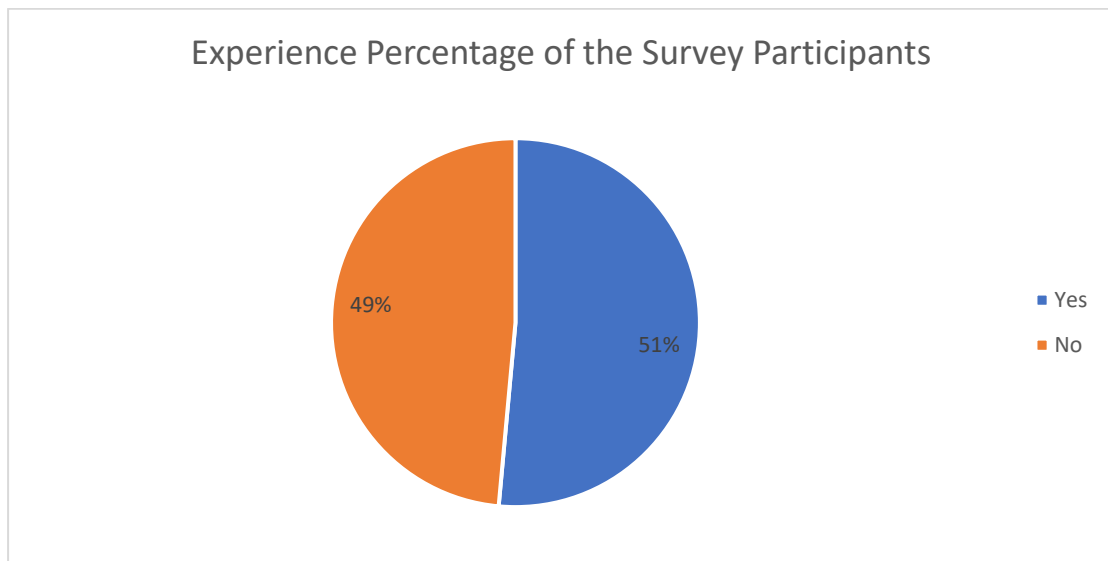
Figure 5 Experience Percentage of the Survey Participants
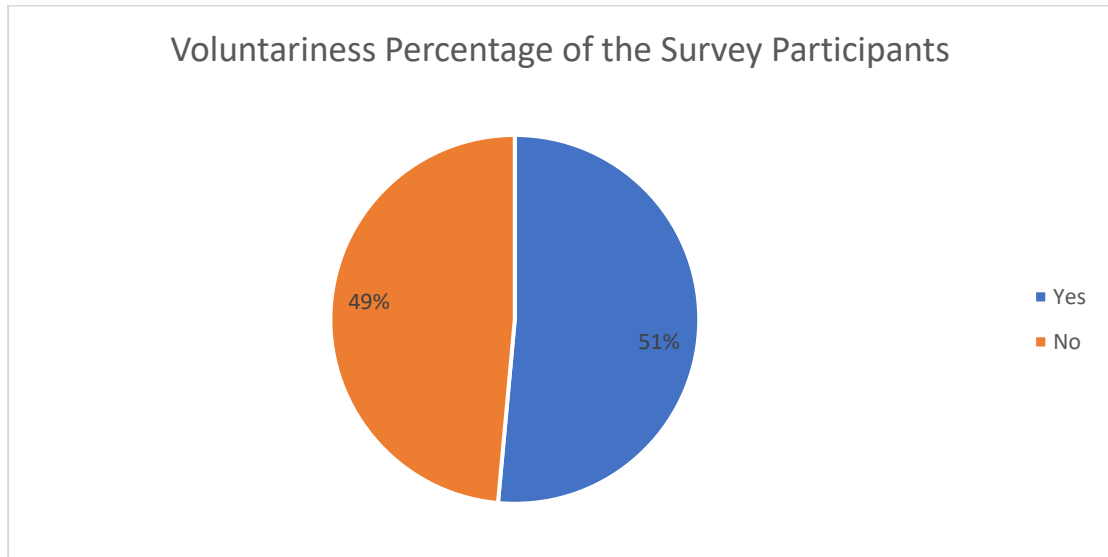
Figure 6 Voluntariness Percentage of the Survey Participants

Within the survey, there was a part to identify the importance of each of the UTAUT constructs based on the Likert Scale, and among those 103 responses, Performance Expectancy has the highest amount of respondents who replied "Agree" and is seconded by Facilitating Conditions for 43 responses with a close competition with Social Influence at 40 responses for "Agree". Both Social Influence and Facilitating Conditions tied out at 29 "Neutral" and "Strongly Agree" responses while Effort Expectancy received an unexpected number of 41 responses for "Neutral". On top of that, there is another outlier in the data as well which is Facilitating Conditions receiving 0 "Disagree" whereas this construct had 2 "Strongly Disagree" answers. The data are shown in the following table:

Questions	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total Responses
You believe that by using a health and fitness mobile application, you would achieve your goal better	PE	3	8	24	52	16	103
You find that it is easy to use such apps to help you reach your objectives	EE	8	11	41	31	12	103
If a person you know is using that app, you would use it as well	SI	1	4	29	40	29	103
You believe that a health and fitness mobile application would be well-received by frequent gym-goers	FC	2	0	29	43	29	103

Table 5 UTAUT Constructs on Likert Scale collected from the Quantitative Survey

Table 4 depicted the key constructs of the UTAUT model under the wording of agreement statements instead of just pure questions and compiled from the method of the Likert Scale. Those who answered "Agree" to the statement of Performance Expectancy accounted for roughly half of the responses, this means that there is a general tendency of the survey candidates to find that it is highly likely for Performance Expectancy to be important towards their technological adoption which in this case is a health and fitness mobile application. However, there were still 24 "Neutral" responses, higher than the 16 "Strongly Agree" responses, indicating that a majority of the sample size was not sure about the influence of Performance Expectancy, and this is to be expected since the premise of this paper was based on a yet-to-be-existed mobile application. Notwithstanding, both the feedback for "Disagree" and "Strongly Disagree" were in single digits with 8 and 3 respectively.

However, the case was different for Effort Expectancy where there were a relatively high number of 41 "Neutral" responses, more than the number of 31 "Agree" replies. This could mean that the respondents were uncertain about the expected effort needed to operate an application. The other options were comparatively low with "Strongly Agree" having 12 responses, "Disagree" getting 11 responses, and "Strongly Disagree" obtaining only 8 responses. Social Influence, on the other hand, returned an interesting record of 40 "Agree" replies while "Strongly Agree" and "Neutral" both were registered with 29 entries. This suggests a fairly strong recognition of the social factor in play where humans tend to flock and imitate the actions of those who are close to them (Dahl, 2013). Among the 103 responses, only 1 respondent chose "Strongly Disagree" and 4 others chose "Disagree" for this particular statement.

Coincidentally, the number of those who answered "Neutral" and "Strongly Agree" to the statement representing Facilitating Conditions is similar to the number of those who selected those choices for the statement of Social Influence which are 29. Nonetheless, the recorded figure for "Agree" was slightly higher at 43 replies whereas only 2 survey candidates selected "Strongly Disagree" for this statement, and interestingly, there was no record for the choice of "Disagree". This could be explained in the sense that the Vietnamese consumer believed in the capability of the infrastructure of the economy of their home country in the current era. Nonetheless, this suggests that they have faith in the technological advancement of the country that they are living in to be capable of being the distribution and nurturing channel for a health and fitness mobile application.

These figures below put the distribution of the UTAUT model's constructs into perspective, to enable a more comprehensive view of the big picture:
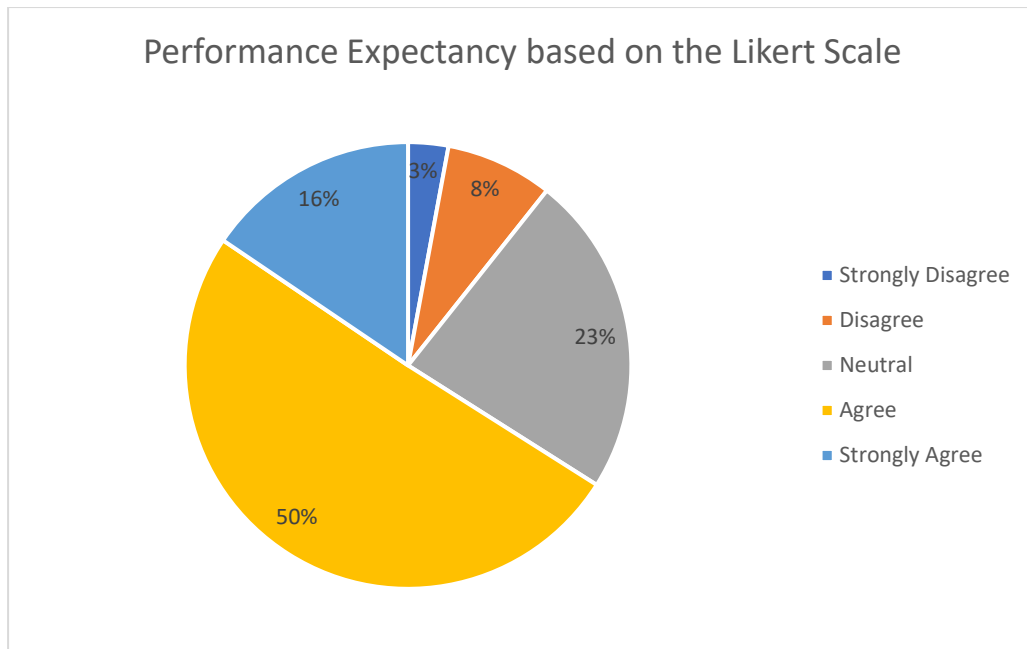
Figure 7 Performance Expectancy based on the Likert Scale
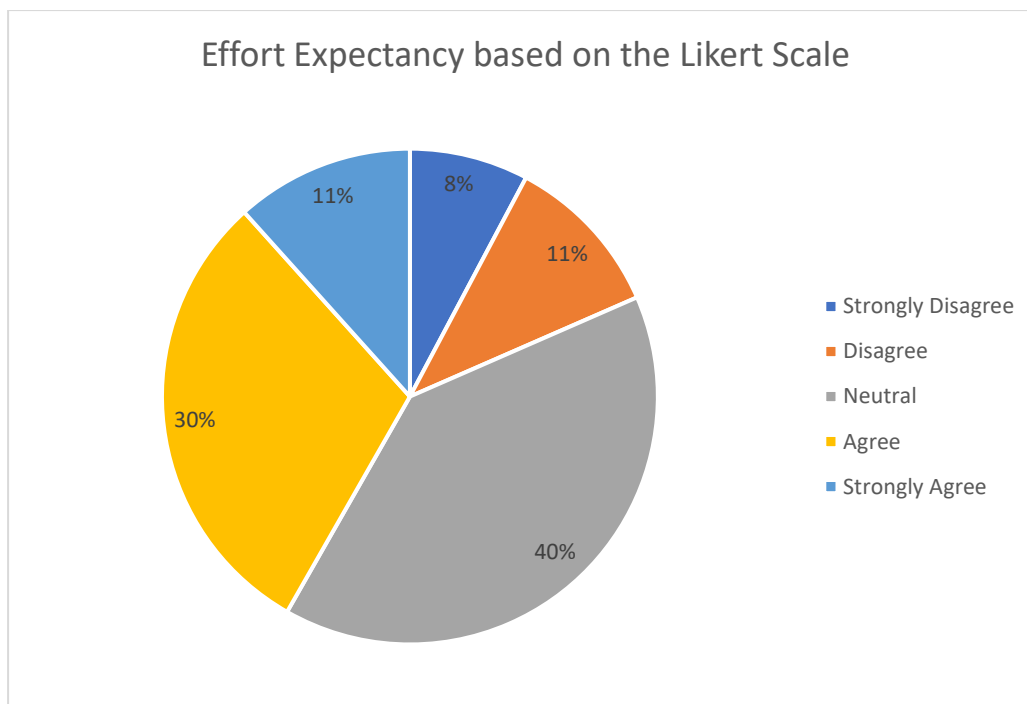
Figure 8 Effort Expectancy based on the Likert Scale
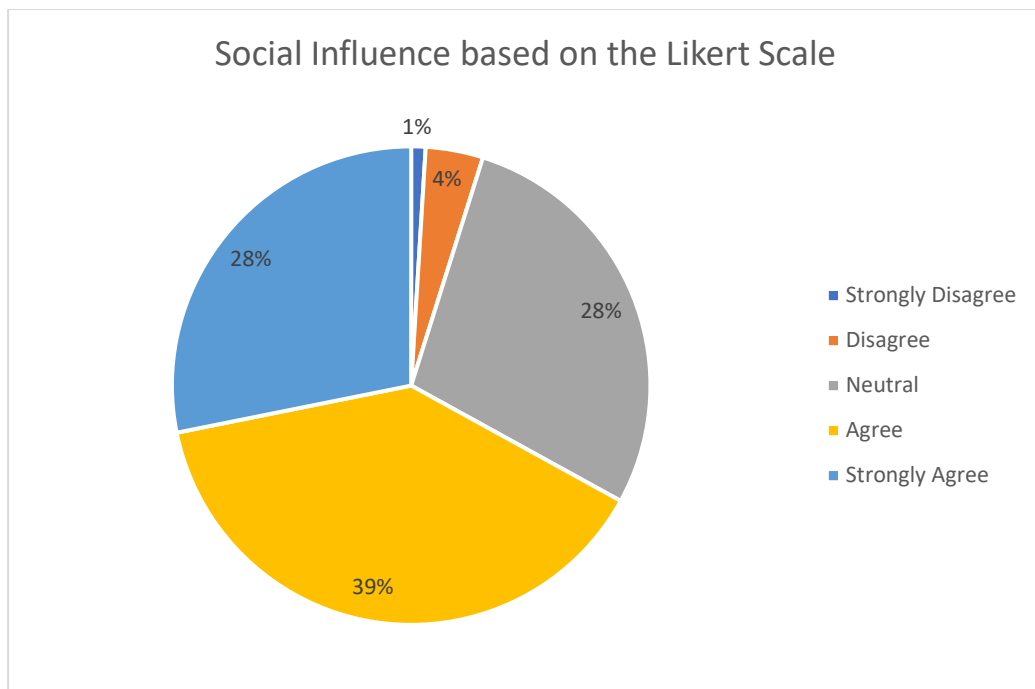
Figure 9 Social Influence based on the Likert Scale
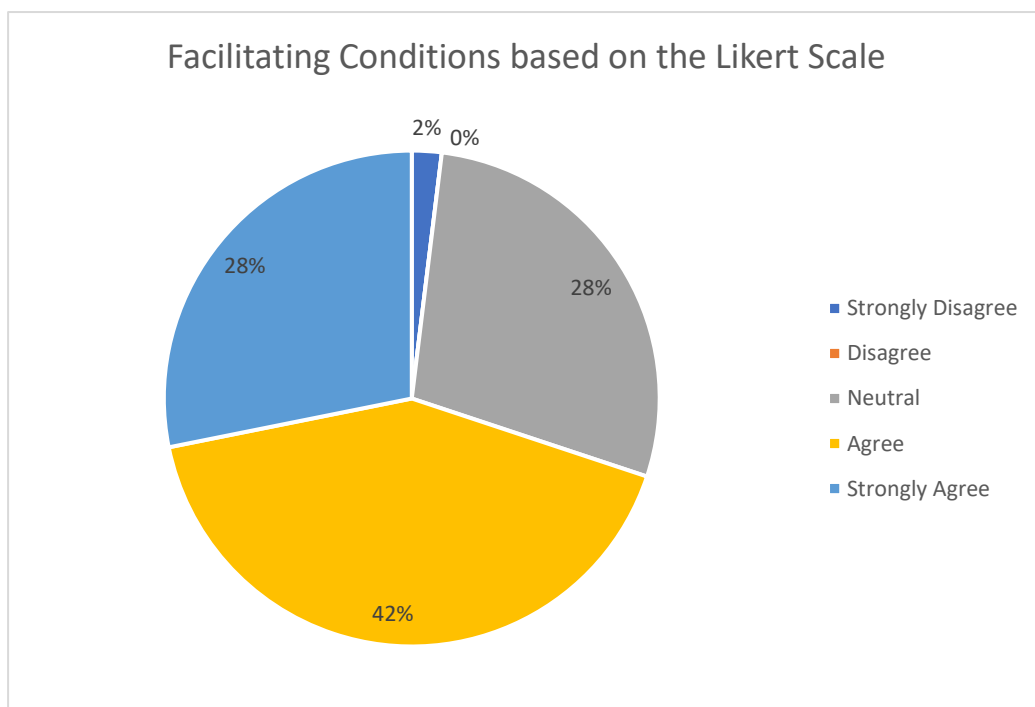
Figure 10 Facilitating Conditions based on the Likert Scale

Regarding the quantitative methodology, the collected result at first glance seems to be neutral in terms of answering the business question of whether a health and fitness mobile app is a profitable or sustainable business to invest in since there was an almost equal outcome in

terms of positive and negative responses to the actual intention to use the health and fitness mobile application. Nevertheless, there are variables to be considered within the UTAUT paradigm such as deciphering how demographic control factors affect the decision-making process of the respondents or finding the underlying meaning and patterns of the collected data to analyze the combination of construct that leads to the highest chance of a respondent giving a positive answer on his or her intention to use a health and fitness mobile application (Venkatesh, Morris, Davis, & Davis, 2003). The previous study of Venkatesh et. al. (2003) has shown that control factors are present to mediate the connection between key constructs and each of the elements acts as a different interference to those connections.

Among the 3 major aspects of the UTAUT model as stated previously (Pan & Gao, 2021), Performance Expectancy, Effort Expectancy, and Social Influence are the direct influencers of Behavioral Intention to use, however, Gender and Age mediate the influence of Performance Expectancy on Behavioral Intention; those two control factors along with Experience, intervene the influence of Effort Expectancy of Behavioral Intention; and the impact of Social Influence on Behavioral Intention is under the intercedence of the four control factors simultaneously. On that note, while Usage Behavior is under the influence of Behavioral Intention and Facilitating Conditions, the latter is intervened by Age and Experience (Venkatesh et. al., 2003). To start, a simple summary of the collected data shows a general view of each of the constructs within the UTAUT model and four control factors included in the survey by converting respondents' answers into numerical values for data computation. Note: For clarity purposes, the numbers will be rounded up to the nearest 3 digits after the decimal point.

6. Quantitative Research Analysis:

Statistical Summary:

```
. summarize

    Variable │       Obs        Mean    Std. Dev.       Min        Max
─────────────┼───────────────────────────────────────────────────────
          PE │       103    3.679612    .9310925         1          5
          EE │       103    3.271845    1.058987         1          5
          SI │       103    3.893204    .8956608         1          5
          FC │       103    3.941748    .8612035         1          5
         EXP │       103    .5145631    .5022318         0          1
─────────────┼───────────────────────────────────────────────────────
          BI │       103    .7572816    .4308227         0          1
         VOL │       103    .5145631    .5022318         0          1
      Gender │       103    .6116505     .489758         0          1
         Age │       103    2.407767    .7851176         1          4
```

Table 6 Statistical Summary with Means and, Standard Deviation

As the table shows, the four constructs of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC) have the same minimum and maximum values while the situation is similar to Behavioral Intention (BI), Experience (EXP), Voluntariness (VOL), and Gender. This is because the four constructs' survey items are based on the Likert Scale which explains the range from 1 – 5 with 1 for Strongly Disagree, 2 for Disagree, 3 for Neutral, 4 for Agree, and 5 for Strongly Agree, whereas BI, IU, and VOL, are Yes or No questions that return 1 or 0, respectively. For Gender, I assigned 0 to female and 1 to male to convert a categorical variable into a numerical one for quantification purposes. On the note of numerical conversion, the survey included five age groups ranging from below 18 to over 57, however, as there was no record of a respondent who is over 57, the last group is omitted from the data pool and only four age groups were observed.

Although the four constructs were under the same Likert Scale, Performance Expectancy had a mean of 3.68 with a standard deviation of 0.931 while Effort Expectancy appears to be more neutral with a mean of 3.272 and a standard deviation of 1.059. On the other hand, the number is more skewed between Social Influence and Facilitating Condition where their means are 3.893 and 3.942 with a standard deviation of 0.896 and 0.861, respectively. The table shows that among the four constructs, Facilitating Conditions has the highest mean which suggests that the majority of the respondents lean toward answering "Agree" on the Likert scale to the statement associated with Facilitating Conditions. Whereas Effort Expectancy holds its place as the construct with the highest standard deviation which indicates that the data collected are more spread out than the rest.

Overall, based on the evidence from the collected data, Performance Expectancy, Social Influence, and Facilitating Conditions lean more toward having respondents answer "Agree" to their corresponding statements in the questionnaire while Effort Expectancy is more likely to receive a "Neutral" for an answer. However, despite having a mean closer to 3, the standard deviation of Effort Expectancy goes up to 1.059 which means there could have been outliers who answered either 1 or 5 due to how wide of a range the plot data was. After the four key constructs, except for the age group factor, the rest of the data were collected in the format of "Yes" or "No" answers, hence, it established a binary number system where the data were labeled as 0 for "No" and 1 for "Yes". This enables a simpler assessment of the data for computation with more clarity. On that note, the mean of Behavioral Intention is 0.757 with a standard deviation of 0.431, this suggests that there is a slight incline toward the side of respondents saying "Yes" to their intention to use, with a standard deviation lower than 0.5 indicating that there are more positive answers than negative ones.

Nonetheless, in the case of Experience and Voluntariness, they had similar statistics with their means at 0.515 and standard deviation at 0.502, and these numbers imply two aspects, the first being that they do not fluctuate substantially and the second being that those who have experience with using a mobile application for health and fitness purpose before are entirely based of their will without being coerced into using an app due to gym policies. These two control factors are previously discussed to be sharing a one-way relationship where survey participants who answered "Yes" to the statement of Voluntariness of use are bound by the obligation of answering "Yes" as well to Experience because logically, a person can only proceed to answer subsequent question or statement if he or she tried the mobile application beforehand. Thus, the data gathered here could have been due to the wording and the limited structure of a closed-end statement in the form of a "Yes or "No" answer that may have hindered the possibility of having the candidates give a detailed response.

Nevertheless, this relationship does not work the other way around as the respondents are still exposed to involuntariness while using the health and fitness mobile application and they are not immune to such elements even if they had experience in using them. Because in this manner, it may invoke a situation where the gym that this candidate went to had forced him or her to use a mobile application to access the gym facilities and if not then they could have lost their privileges as a gym member, and this could not be ruled out despite how unlikely it may be.

Occurrence of the Gender and Age Factors:

Gender	Freq.	Percent	Cum.
0	40	38.83	38.83
1	63	61.17	100.00
Total	103	100.00	

-> tabulation of Age

Age	Freq.	Percent	Cum.
1	10	9.71	9.71
2	50	48.54	58.25
3	34	33.01	91.26
4	9	8.74	100.00
Total	103	100.00	

Table 7 Frequency of Gender and Age Factors

These two tables represent the frequency of Gender and Age within the survey questionnaire of this paper. There was a record of 40 female and 63 male participants as 0 is assigned to female respondents and 1 is assigned to male respondents and they made up 38.83% and 61.17% respectively. This means that the participants were mostly male gym enthusiasts, however, the interesting part was the ratio of both genders 6:4 in favor of males is still an unexpected finding because I expected lesser female respondents to an online survey. Regardless, the crucial factor is that there was a general abundance mixture which enables a broader view for hypothesis generalization.

Regarding the Age factor, there were 4 age groups with the first being 18 and below, the second being 18 – 25, the third 3 being 26 – 41, and the fourth being 42 – 57. Originally, there was supposed to be a fifth age group, but no records were found with the age group of 57 and over. This could be due to the influence of the newer generation who are more familiar with modern technology than those precedents, hence, explaining the mode of the graph as it

was especially with the case of the second group. Respectively, the percentage was 9.71%, 48.54%, 33.01%, and 8.74% for age groups from 1 to 4.

Based on the evidence from the recorded data, half of the participants fall into the second age group while most of the rest were from the third age group. It could have been due to how well-received the technological element as well as interest in the research exercise that led the second age group to find this survey more often than the other parties. Those belong to the first group, they are Generation Z who appears to have the most access to the Internet and social media nowadays, namely TikTok (Oktarini, Dewi, Putra, Ataupah, & Oktarini, 2022). However, it could have been due to the lack of quality content that they tend not to search for gym-related topics, hence, explaining the low count of responses from the first age group.

Notwithstanding, this is not to rule out the possibility of those of the first age group finding themselves lacking the necessary motivation to fill out the survey as their span of attention could have been elsewhere. Other than that, what is striking in this table is the steady decline in responses from age group two to age group four as there were fewer older survey candidates and there were absolutely zero records for those who belonged to age group five which is above 57 years old. Understandably, the elderly may commonly avoid going to the gym due to their health circumstances in old age, thus, only four age groups were recorded in the survey database.

T-test of each construct with Behavioral Intention:

```
. ttest PE == BI, unpaired

Two-sample t test with equal variances
```

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
PE	103	3.679612	.0917433	.9310925	3.497639 3.861584
BI	103	.7572816	.0424502	.4308227	.6730817 .8414814
combined	206	2.218447	.1138284	1.633745	1.994022 2.442871
diff		2.92233	.1010883		2.723018 3.121642

```
    diff = mean(PE) - mean(BI)                                t =  28.9087
Ho: diff = 0                              degrees of freedom =      204

    Ha: diff < 0                 Ha: diff != 0                  Ha: diff > 0
 Pr(T < t) = 1.0000       Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Table 8 T-test of Performance Expectancy with Behavioral Intention

To assess the influence of Performance Expectancy on Behavioral Intention, I used a two-sample t-test with a confidence interval of 95% to prove my hypothesis. The reason behind the test choice is that, unlike a paired t-test, a two-sample t-test amplifies the independence of the two variables, and since Performance Expectancy was measured on a Likert Scale and Behavioral Intention was measured using a "Yes" or "No" question, this means both of these structures were statistically independent. This also applies to subsequent t-tests of Effort Expectancy and Social Influence, both with Behavioral Intention.

Based on the summary, the mean and standard deviation stays the same, with a difference in the mean by 2.922. The standard error for each construct was relatively low at 0.092 and 0.042 for Performance Expectancy and Behavioral Intention, respectively. The degrees of freedom are 204 by combining both observations, each at 103 entries, and minus by 2. The obtained t-value is 28.909 which is considerably high compared to the other outcome collected in the t-tests of the three constructs with Behavioral Intention.

```
. ttest EE == BI, unpaired

Two-sample t test with equal variances
```

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
EE	103	3.271845	.1043451	1.058987	3.064877	3.478813
BI	103	.7572816	.0424502	.4308227	.6730817	.8414814
combined	206	2.014563	.1042498	1.496266	1.809024	2.220102
diff		2.514563	.1126496		2.292456	2.73667

```
    diff = mean(EE) - mean(BI)                              t =  22.3220
Ho: diff = 0                            degrees of freedom =      204

    Ha: diff < 0                 Ha: diff != 0                  Ha: diff > 0
 Pr(T < t) = 1.0000       Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Table 9 T-test of Effort Expectancy with Behavioral Intention

In the case of assessing the influence of Effort Expectancy on Behavioral Intention, both their mean and standard deviation remains unchanged from the data of the statistical summary. The standard error was 0.104 while Behavioral Intention was 0.042, this marks Effort Expectancy as the construct that has the highest recorded standard error among the four. The difference between the means of both constructs is 2.515. The obtained t-value is 22.322, compared to the other constructs, Effort Expectancy possesses the lowest t-value among them. Thus, this implies that Effort Expectancy may not pose much of an impact on the decision-making process at the stage of Behavioral Intention. In other words, it means that although it supports hypothesis H_2, it may not be able to contribute significantly.

```
. ttest SI == BI, unpaired

Two-sample t test with equal variances
```

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
SI	103	3.893204	.0882521	.8956608	3.718156	4.068251
BI	103	.7572816	.0424502	.4308227	.6730817	.8414814
combined	206	2.325243	.1199108	1.721044	2.088826	2.561659
diff		3.135922	.0979308		2.942836	3.329009

```
    diff = mean(SI) - mean(BI)                                    t =  32.0218
Ho: diff = 0                                  degrees of freedom =      204

    Ha: diff < 0                 Ha: diff != 0                   Ha: diff > 0
 Pr(T < t) = 1.0000       Pr(|T| > |t|) = 0.0000         Pr(T > t) = 0.0000
```

Table 10 T-test of Social Influence with Behavioral Intention

Again, the mean and standard deviation of each construct remains the same with the statistical summary, with a standard error as low as 0.088 and 0.431 respectively for Social Influence and Behavioral Intention. The difference in means of Social Influence and Behavioral Intention is 3.136, higher than the average of the three t-tests. However, contrary to my expectation, the t-value obtained from the t-test of Social Influence has an astounding figure of t = 32.022 which indicates a significant impact of Social Influence on Behavioral Intention. Notwithstanding, the t-tests alone of each of the constructs only partially support hypothesis H_3.

Correlation Analysis:

```
. correlate BI PE EE SI
(obs=103)
```

	BI	PE	EE	SI
BI	1.0000			
PE	0.7574	1.0000		
EE	0.4469	0.6261	1.0000	
SI	0.5165	0.6522	0.5064	1.0000

Table 11 Correlation Table

The evidence from the table suggests that there are positive correlations between the four constructs. Although each of the constructs may potentially support one another and establishes a correlation matrix together, in this paper, I will not discuss how Performance Expectancy, Effort Expectancy, and Social Influence affect each other due to the UTAUT model showing no connection between such influences. Thus, I will ignore any results other than those that are related to Behavioral Intention.

On the other hand, The correlation score of Behavioral Intention with Performance Expectancy, Effort Expectancy, and Social Influence in this order is 0.757, 0.447, and 0.517. At first glance, it was within my expectation that they have positive correlations, hence, this finding supports the hypotheses of H_1, H_2, and H_3. However, the t-value and the correlation table alone may not be enough to prove a hypothesis, I will proceed to analyze the linear regression of Performance Expectancy, Effort Expectancy, and Social Influence with Behavioral Intention as the dependent variable.

Regression Analysis:

The first regression analysis

```
. regress BI PE EE SI
```

Source	SS	df	MS			
				Number of obs	=	103
				F(3, 99)	=	44.87
Model	10.9088292	3	3.63627642	Prob > F	=	0.0000
Residual	8.02320959	99	.081042521	R-squared	=	0.5762
				Adj R-squared	=	0.5634
Total	18.9320388	102	.185608224	Root MSE	=	.28468

BI	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
PE	.3511839	.0447852	7.84	0.000	.2623202	.4400475
EE	-.0214668	.0346162	-0.62	0.537	-.0901529	.0472193
SI	.0232151	.0420982	0.55	0.583	-.0603169	.1067471
_cons	-.5550838	.1328764	-4.18	0.000	-.8187394	-.2914281

Table 12 Linear Regression of Behavioral Intention

The first regression analysis is done with Behavioral Intention as the dependent variable while Performance Expectancy, Effort Expectancy, and Social Influence are defined as independent variables. Whilst the second, third, fourth, and fifth regression analyses are

tailored toward each of the constructs in the UTAUT model which are Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, each of those constructs becomes the dependent variable of their regression table, respectively.

In addition, control factors are present to mediate the influence of each construct with Gender and Age mediating Performance Expectancy; Gender, Age, and Experience mediating Effort Expectancy; Gender, Age, Experience, and Voluntariness of use mediating Social Influence; Age and Experience meditate Facilitating Conditions (Venkatesh et. al., 2003). This is because Behavioral Intention is straightforwardly affected by the three aforementioned key constructs which are Performance Expectancy, Effort Expectancy, and Social Influence whereas Use Behavior is only determined by Behavioral Intention and Facilitating Conditions (Pan & Gao, 2021). However, since Use Behavior is removed from this study, the regression analysis will stop after analyzing Facilitating Conditions and leave the sequence measurement for the predictive model. The objective of regression analysis is to establish a mathematical model that can precisely forecast the values of the dependent variable based on the values of the independent variables. Within the regression analysis, the beta coefficient serves as the standardized regression coefficient or the strength and direction of the relationship between two variables.

In the table, each construct has its coefficient with Behavioral Intention as the dependent variable. Performance Expectancy and Social Influence both have a positive coefficient relationship with Behavioral Intention with a beta coefficient (β) score of $\beta = 0.351$ and $\beta = 0.023$, respectively. A beta coefficient of 0 indicates no relationship between the independent variable and the dependent variable, while a beta coefficient of 1 indicates a perfect positive relationship and a beta coefficient of -1 indicates a perfect negative relationship. In the case of Effort Expectancy, it has a negative coefficient relationship instead which indicates a reversed flow of connection, for instance, in this case, if Effort Expectancy increases, Behavioral Intention would decrease, though by not a large margin as it has a beta score of $\beta = -0.021$. This finding is interesting as those who find it easier to navigate around a mobile application are usually more interested in using those apps than others, but the t-test has also proven Effort Expectancy to have a minor impact on Behavioral Intention to use a health and fitness mobile application.

On the other hand, Social Influence has a positive beta coefficient score of $\beta = 0.023$ and this supports the findings of the t-test of this construct and endorses the influence of this construct on Behavioral Intention, though, not by a large margin. However, the case is different with Performance Expectancy because, at a beta coefficient score of $\beta = 0.351$, it holds a certain impact on Behavioral Intention to use a health and fitness mobile application. Regarding the standard error, it is a measure of the accuracy of the projected coefficients of the regression equation with the higher the standard error, the worse the precision of the coefficient is, or in other words, the signal-to-noise ratio.

In this case, the standard error is relatively low, with the results of 0.045, 0.035, and 0.042 for Performance Expectancy, Effort Expectancy, and Social Influence, in that order. The reported R-squared is 0.5762 with an adjusted R-squared of 0.5634 which indicates a positive relationship as well as a higher-than-average fitting of the model of the data as both numbers were close to each other while being over 0.5 on a spectrum from 0 to 1, with 0 suggesting that none of the variations in the dependent variable is explained by the independent variables, while an R-squared value of 1 signals that all of the variations in the dependent variable is made clear by the independent variables.

In combining with the beta coefficient scores of $\beta = 0.351$ and $t = 28.909$ from the t-test of Performance Expectancy, with a positive relationship, the higher the level of Performance Expectancy, the higher the level of Behavioral Intention to use a health and fitness mobile application as well. Or in other words, it is safe to declare that Performance Expectancy has a positive influence on the Behavioral Intention construct. Therefore, it justifies hypothesis H_1 of enabling a positive correlation between Performance Expectancy and Behavioral Intention. However, with a beta coefficient score of $\beta = -0.021$ and $t = 22.322$, it suggests that Effort Expectancy has a negative influence on Behavioral Intention, and as such, it rejects hypothesis H_2.

In the case of Social Influence, it has a beta coefficient score of $\beta = 0.023$ and $t = 32.022$ which is contradicting as the beta score was low while the t-value was the highest among the three assessed constructs with Behavioral Intention. Regardless, it still means that this finding provides evidence to support hypothesis H_3. However, these data are collected without consideration for a controlling factor. Therefore, I will add a linear regression for each of those control elements relevant to each construct as indicated in the re-drawn UTAUT model of this paper.

The second regression analysis

```
. regress PE Gender Age
```

Source	SS	df	MS		Number of obs	=	103
					F(2, 100)	=	4.46
Model	7.23599248	2	3.61799624		Prob > F	=	0.0140
Residual	81.191192	100	.81191192		R-squared	=	0.0818
					Adj R-squared	=	0.0635
Total	88.4271845	102	.866933181		Root MSE	=	.90106

PE	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Gender	.2688781	.1822701	1.48	0.143	-.0927405	.6304968
Age	-.3005402	.1137005	-2.64	0.010	-.5261187	-.0749617
_cons	4.238783	.3053173	13.88	0.000	3.633042	4.844524

Table 13 Linear Regression of Performance Expectancy

The second regression analysis shall be done on the construct of Performance Expectancy with the control factors of Gender and Age acting as independent variables to mediate the influence of this construct towards Behavioral Intention to use. The beta coefficient score is $\beta = 0.269$ for Gender and $\beta = -0.301$ for Age. This is logical considering that the older age group tends to have a lesser impact on the adoption choice of technology and the rate of responses decreases the older the age group gets. Regarding Gender, a beta coefficient score of $\beta = 0.269$ means that there is still a positive relationship between Performance Expectancy and Gender although not much considering the whole spectrum of Beta Coefficient to range from -1 to 1.

The respective t-values are 1.48 and -2.64 with a p-value of 0.143 and 0.010 for Gender and Age. The R-squared value is 0.082 with an adjusted R-squared of 0.064, with a confidence interval of -0.093 to 0.630 for Gender and a confidence interval of -0.526 to -0.075 for Age. As such, Gender has a positive relationship with Performance Expectancy while Age tends to lead a negative one and thus, candidates who have higher Age tend to rank lower in the levels of Performance Expectancy, diminishing its impact on Behavioral Intention while Gender has an impact on the influence of Performance Expectancy toward Behavioral Intention to use a health and fitness mobile application, though not by a large margin it serves as a control variable. Moreover, since the p-value of Gender is higher than 0.05 at 0.143, it is statistically insignificant while the p-value of Age is lower than 0.05, so much at 0.010 that it is highly statistically significant.

The third regression analysis

```
. regress EE EXP Gender Age

      Source |       SS           df       MS            Number of obs   =       103
-------------+----------------------------------         F(3, 99)        =      6.65
       Model |  19.1932072          3  6.39773574         Prob > F        =    0.0004
    Residual |  95.1951423         99  .961567094         R-squared       =    0.1678
-------------+----------------------------------         Adj R-squared   =    0.1426
       Total |   114.38835        102  1.12145441         Root MSE        =     .9806

------------------------------------------------------------------------------
          EE |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         EXP |   .6000364   .2081409     2.88   0.005     .1870398    1.013033
      Gender |   .3184951   .2044675     1.56   0.123    -.0872128     .724203
         Age |  -.2046562   .1298803    -1.58   0.118    -.4623669    .0530546
       _cons |   3.261045   .3740556     8.72   0.000     2.518837    4.003252
------------------------------------------------------------------------------
```

Table 14 Linear Regression of Effort Expectancy

The third regression analysis revolves around the interference of Gender, Age, and Experience on Effort Expectancy. This construct is affected by Experience at a beta score of $\beta = 0.6$ indicating a positive relationship with Effort Expectancy where it is slightly higher than half of the times which indicates that those with experience are more likely to possess enough tolerance for the amount of effort that is required to use a health and fitness mobile application. Gender also has a positive relation with Effort Expectancy in this regression analysis at $\beta = 0.318$ while Age, again, was reported to be in a negative relationship with Effort Expectancy by being at $\beta = -0.205$. Their standard deviation along with Experience is 0.208, 0.204, and 0.130 for Experience, Gender, and Age which results in the ratio of t-values at 2.99, 1.56, and -1.58 in the same order.

The R-squared of this analysis is 0.168 while its adjusted R-squared is 0.143. The t-values of the three control factors are in the order of Experience, Gender, and Age at 2.88, 1.56, and -1.58 which leave them with a p-value of 0.005, 0.123, and 0.118. Apart from Experience whose p-value suggests it to be statistically significant (p-value < 0.05), the other two control factors prove to be statistically insignificant due to their p-values being higher than 0.05. Therefore, it can be concluded that Experience affects the influence of Effort Expectancy on Behavioral Intention to use a health and fitness mobile application the most out of the three control variables while Gender does not affect much, and Age may even have a negative effect due to its negative results reported in the analysis table.

The fourth regression analysis

```
. regress SI EXP Gender Age VOL
note: VOL omitted because of collinearity
```

Source	SS	df	MS			
Model	19.3669369	3	6.45564563			
Residual	62.4583058	99	.630891978			
Total	81.8252427	102	.802208262			

Number of obs	=	103
F(3, 99)	=	10.23
Prob > F	=	0.0000
R-squared	=	0.2367
Adj R-squared	=	0.2136
Root MSE	=	.79429

SI	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
EXP	.7969338	.1685952	4.73	0.000	.4624044	1.131463
Gender	-.0633642	.1656197	-0.38	0.703	-.3919896	.2652612
Age	-.1300669	.1052037	-1.24	0.219	-.3388139	.0786801
VOL	0	(omitted)				
_cons	3.835059	.3029869	12.66	0.000	3.233867	4.43625

Table 15 Linear Regression of Social Influence

The fourth regression analysis is done on the impact of the Social Influence factor on the Behavioral Intention construct through the mediation of Experience, Gender, Age, and Voluntariness to use. Before I start analyzing the numbers, it is important to note that in this evaluation, Experience and Voluntariness control variables shared the same statistics as previously explained in the earlier section regarding how survey participants answered the same for these two factors. Hence, it clarified how Voluntariness is omitted in this regression analysis because it has the same results as Experience.

Based on the evidence from the table, the obtained beta coefficient score in the mentioned order is $\beta = 0.797$, $\beta = -0.063$, and $\beta = -0.130$, with a standard error of 0.169, 0.166, and 0.105, and these numbers lead to a t-value of 4.73, -0.38, and -1.24 for Experience (which is equal to Voluntariness), Gender, and Age. These figures return p-values of 0.000, 0.703, and 0.219 in that same order and they specify that Experience and Voluntariness are statistically significant ($\beta = 0.797$ which is high, and a p-value = 0.000) whereas Gender and Age are statistically insignificant due to their p-values > 0.05. The conclusion that can be drawn from this observation is that Experience and Voluntariness impact the effect of Social Influence on Behavioral Intention to use a health and fitness mobile application.

The fifth regression analysis

```
. regress FC EXP Age

      Source |       SS           df       MS         Number of obs   =       103
-------------+----------------------------------       F(2, 100)       =     16.99
       Model |  19.1847948         2    9.5923974      Prob > F        =    0.0000
    Residual |  56.4656906       100    .564656906     R-squared       =    0.2536
-------------+----------------------------------       Adj R-squared   =    0.2387
       Total |  75.6504854       102    .741671426     Root MSE        =    .75144

------------------------------------------------------------------------------
          FC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         EXP |   .8304175   .1547342     5.37   0.000     .5234292    1.137406
         Age |  -.0622021   .0989819    -0.63   0.531    -.2585794    .1341752
       _cons |   3.664214   .2820944    12.99   0.000     3.104546    4.223881
------------------------------------------------------------------------------
```

Table 16 Linear Regression of Facilitating Conditions

Regarding Facilitating Conditions, although it is no longer relevant to the model for analyzing its impact on Use Behavior as explained previously, it still serves as a reference to the predictive model which will be discussed right after. The fifth regression analysis this time will evaluate the effect of Age and Experience control factors on Facilitating Conditions. Firstly, the beta coefficient score of Experience is $\beta = 0.830$ while the beta coefficient score of Age is -0.062. Once again, the Age factor attained a negative relationship with one of the constructs in the UTAUT model while Experience has a high coefficient with Facilitating Conditions. Their standard error in that order is 0.155 and 0.099, resulting in t-values of 5.37 and -0.63 respectively. This leads to a p-value of 0.000 and 0.531, and as such, this indicates that the influence of Experience is statistically significant on Facilitating Conditions while the case is in contrast to Age which is statistically insignificant toward mediating Facilitating Conditions. From this evidence, I would like to conclude that Experience impacts greatly the influence of Facilitating Conditions toward Behavioral Intention to use a health and fitness mobile application, whilst Age does not play any significant role in interfering with that influence.

These regression analyses have revealed the impact of the control variables on the key constructs of the re-drawn UTAUT model of this study. Since that model is incomplete, I propose the following predictive model to amend the missing construct of Use Behavior in the form of a decision tree to predict the prospective usage behavior of potential users. This method is to gain a reference of how well a statistical model may turn out to be, while at the same time aiming at answering the original question of whether a mobile application is necessary for health and fitness businesses.
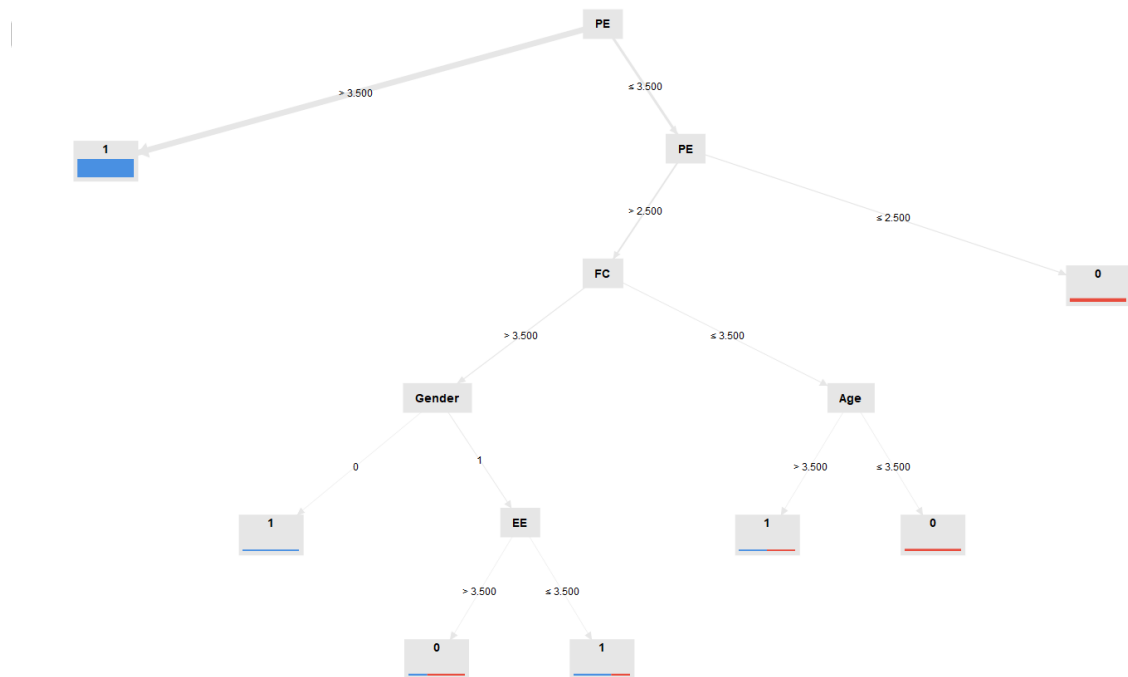
Predictive Model:

Decision Tree:

Figure 11 Decision Tree

Originally, the UTAUT model possesses three viewpoints, the first being Performance Expectancy, Effort Expectancy, and Social Influence influencing Behavioral Intention to use; the second viewpoint is Behavioral Intention along with Facilitating Conditions influence the Usage Behavior of the technology users; and the third viewpoint is that four control variables mediate the influential movement of the model as a whole, with each factor impacting accordingly (Pan & Gao, 2021). However, that model is disrupted in this study due to the inability to track the Usage Behavior of the survey participants post-completion of the questionnaire. Therefore, the decision tree is created to support and simulate the decision-making process to determine the Usage Behavior of those respondents and potential prospects. The decision tree is made of a core path which is a "tree" in the decision-making process with various "leaves" indicating different branches depending on the statistical value of each branch.

In this model, the chosen factors are the ones who have the most impact on the outcome of participants who answered "Yes" to their Behavioral Intention to use a health and fitness mobile application and decide to stay with it over a duration of time which translate into their Usage Behavior. It starts with Performance Expectancy where there were two paths, one with

a score of more than 3.5 while the other is less than or equal to 3.5 on the Likert Scale. This means that those who answered "Agree" and "Strongly Agree" to the statement of Performance Expectancy in the questionnaire are more likely to use a health and fitness mobile application after completing the survey. For those who fall into the second pathway, they are revisited with the same measure of Performance Expectancy, however, this time the score is lowered to 2.5 but the catch is that those who registered a score of 2.5 or lower, or in other words, those who selected "Neutral", "Disagree", and "Strongly Disagree" in the statement of Performance Expectancy, would automatically default to "No" which means they would not choose to use that mobile application post-survey. Thus, the pathway takes a turn and goes with the function of $3.5 \geq$ [Usage Behavior in question] > 2.5.

Intriguingly, the second criterion after Performance Expectancy would be Facilitating Conditions where the assessment score is once again 3.5. In this case, a score higher than 3.5, which translates into the participants choosing "Agree" and "Strongly Agree" in the statement part of Facilitating Conditions in the survey, would lead to the evaluation of the Gender factor whereas the score equal to or lower than 3.5, meaning the participants chose "Neutral", "Disagree", and "Strongly Disagree" would redirect the tree line to the Age criteria. For when Facilitating Conditions record a score of 3.5 or lower than that then the Age factor would be considered, and the assessment would be based on the age groups. What stands out is that if the participants score higher than 3.5, or in other words, belong to the age group between 3 and 4 (26 – 41 and 42 – 57) they have a 50% chance to pick up on using the health and fitness mobile application, while having a score equal to or lower than 3.5 indicating that if the candidates belong to the age of 25 and below, they would not use the app entirely, and this is interesting since it goes against my initial expectation of the Generation Z and the Millennials.

Besides the Age factor, on the other part of the branch, when Facilitating Conditions registered a score higher than 3.5, the consideration regarding the Gender factor would then divide into 0 or 1, also known as female or male, and unexpectedly, if the respondents are female, they would 100% use the mobile application, whereas, in the case of male participants, it leads to another criterion which is Effort Expectancy. This is where the regression analysis of the re-drawn UTAUT model shows its impact because male participants who had a score of 3.5 or higher, which indicates that they selected "Agree" and "Strongly Agree" to the statement of Effort Expectancy in the survey questionnaire, would be more likely to say no to using a health and fitness mobile application, with a little portion saying "Yes".

On the other hand, if the score of the Effort Expectancy recorded to be equal to or lower than 3.5, suggesting the fact the participants chose "Neutral", "Disagree", and "Strongly Disagree" to the statement of Effort Expectancy in the survey questionnaire, then they are more likely to use a health and fitness mobile application, with only a few refusing to use it. This model is supposed to wrap up the decision-making process of what could have been of the Use Behavior construct, notwithstanding, this single decision tree does not set in stone a single

model for the population as a whole since it should only treat the collected data as a sample pool, hence, various decision tree should have been implemented into a random forest consisting of a wide range of decision trees to gain multitude insights into a predictive model with multiple viewpoints. Thus, I have created an accuracy assessment table through the confusion matrix of the Performance Vector to reinforce the classification model which is the decision tree above.

accuracy: 91.45% +/- 11.44% (micro average: 91.26%)

	true 1	true 0	class precision
pred. 1	74	5	93.67%
pred. 0	4	20	83.33%
class recall	94.87%	80.00%	

Figure 12 Performance Vector

What can be seen in this table is the accuracy of the decision tree that I have drafted which is an accuracy of 91.45%. The table divides the data into four categories where the prediction there are only two possible outcomes for each prediction: true positive (TP), true negative (TN), false positive (FP), and false negative (FN):

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP)	False Negative (FN)
Actual Negative	False Positive (FP)	True Negative (TN)

Figure 13 Confusion Matrix

In the matrix, TP represents the number of correctly predicted positives, TN represents the number of correctly predicted negatives, FP represents the number of false positives (i.e., those predicted are positive but are negative) and FN represents the number of false negatives (i.e., cases that were predicted to be negative but were positive). In this case, the performance vector returns a true positive of 74%, and a false negative of 4%, while it gives a false positive of 5% and a true negative of 20% (not to be confused with Figure 5 Confusion Matrix since the location of prediction and actual results are swapped). This is to recognize the Error Type 1 and Type 2 of a statistical model as an error type 1 indicates a false positive when the null hypothesis is rejected even though it is true, and an error type 2 suggests a false negative when the null hypothesis is not rejected even though it is false. As such, there were only 5% of the

predictive model returns an error type 1 while only 4% of the predictive model returns an error type 2.

7. Discussion

Overall, both research methodologies have their advantages and disadvantages that are in contrast to each other. The Quantitative research methodology aids in reaching out to a substantial number of candidates to obtain the most answers within a limited time frame and to bridge the distance between the conductor and the respondents. The larger the pool of candidates, the higher the chance to obtain a more accurate assessment of a hypothesis. Notwithstanding, the strength of such a methodology is also a weakness in another way due to the calculous nature of the technique which requires data to be transfigured from categorical variables into measurable information. As such, it limits the type of questions that can be put on the survey questionnaire, and it often ignores the emotions as well as the logical reasoning behind those answers since they can only select among a few given choices. I adopted the Qualitative Research Methodology to offset this flaw by interviewing several candidates, who are also aware of the topic, to gain more insights into their personal experience with a health and fitness mobile application as well as to gain access to their line of reasoning for the given choices.

These methodologies fused to paint a bigger picture to see the health and fitness in the Vietnamese market as a whole. However, it is noteworthy that the data collected for each of the constructs from the UTAUT model in both manners were contradicting each other. Regarding the qualitative interviews, it can be due to the small amount of sample size that results in encountering outliers by pure chance. In that sense, the outcome of the quantitative survey should not be marked as invalid just because the qualitative research stumbled across outliers early on. Performance Expectancy and Social Influence still play a major role in both methodologies. Apart from that, the Effort Expectancy that the quantitative survey analyzed is in a negative relationship with Behavioral Intention to use a health and mobile application, that construct is weighed heavily on the table for determining the Behavioral Intention based on the qualitative interview result. Facilitating Conditions remain an influential construct, but it does not interfere with the Behavioral Intention to use those mobile applications since it only serves as an enabler for this technology to function and Vietnam is already at a developing point where almost everyone owns at least a smartphone.

The Experience moderators were not as significant in the qualitative interviews compared to how they were in the quantitative survey. Interviewees were able to go through with the research by using their knowledge on the matter despite having no prior experience in utilizing a health and fitness mobile application. Voluntariness to use this technology on the other hand, was a dependent factor on Experience in the quantitative survey due to the nature

of the question flow that required the participants to possess certain experience before they can select an answer for Voluntariness. This was not the case with the qualitative interviews as I got to hear more about the two factors involved with the answer to Voluntariness to use a health and fitness mobile application which is the nature of the participants. For those who are more active, they tend to use modern technology voluntarily whereas those that are more passive usually let others decide if they need to use this technology or not, as in the case of Ms. Lucy and Ms. Linh. Regarding Age and Gender, both of these moderators tend to be lacking in presence since they are demographic factors, some might argue that the actual influencers of these elements are mindsets and the environment where they grew up from. On top of that, the answers for each of the construct in the UTAUT model for both research methodologies were at variance with each other from the viewpoints of age and gender such as when the quantitative survey states that those from 18 – 25 years old are acquainted with modern technology, but the interviewees from the qualitative research data refused to use a health and fitness mobile application despite the findings from the quantitative survey.

Notwithstanding, both research methodologies point toward the same outcome which is that a majority of the Vietnamese who go to the gym or work out in any approach are ready to adopt a health and fitness mobile application to assist their journey in achieving a desired fitness target. The participants in the survey as well as the interviews have demonstrated a distinct awareness of the need for such mobile apps and the benefits that they bring about, even for those who do not plan on using those apps. This is a strong indicator that the technology acceptance of the Vietnamese consumers is high and an investment into a health and fitness mobile application is bound to yield a reasonable amount of attention that can be generated into a considerable amount of income with the application of the Freemium model. In addition, this signals managers at small-to-medium companies to exercise Technological Acceptance, assimilate Innovation Adoption, and incorporate Change Management to oversee a new project that involves administering a new application of strategic pathway toward mobile applications development instead of just using a website to host the main product of the company and instead, enables an earlier shift in the brand development.

2. Limitations and Conclusion

1. Limitations:

The purpose of this paper is to answer the question of whether a company should invest its resources into developing a health and fitness mobile application to keep up with the trend of working out flexibly. It does not stop at just investing in gyms and conventional channels such as websites or social media, but it also establishes a reliable platform that gym enthusiasts can turn to in time of need which is a mobile application right on their smart devices that are almost always accessible. Regardless, every study has its limitation, and this paper is not an

exemption. Firstly, as indicated in the filter question of the quantitative survey, it crosses out those who replied "no" to the question of whether the participant in the survey is owning a membership at any gym, and as such, for those who exercise at home and do not go to the gym, they survey might have filtered out a valuable source of information. Although the goal is for businesses to decide if investing in a health and fitness mobile application is viable, this loophole in the study may prove to be flawed when a substantial portion of potential prospects gets left out of the equation.

Moreover, by adhering to the research methodology of previous work on the UTAUT model, this paper neglected an important part of human lives in the controlling element of the demographic factor, which is the financial side that appears to be significant in the UTAUT2 (the construct of Price Value) and other models, on top of distinguishing their living regions within the border of Vietnam. The survey was also lacking when the occupation and marital status of the respondents were not recorded as online surveys might prove to be limited in gathering personal information and having people with sufficient motivation to fill them. This is a significant drawback to an online survey as it cannot cover all the information needed while it also cannot provide enough incentive for the survey participants, and this was signified in the journal article written by Dr. Chittaranjan Andrade where he discussed both the advantages and disadvantages of using online surveys as a research methodology. In his paper, he explained that online surveys hold the power of convenience as well as reach and creation where they can be formed quickly using software and appropriate online tools while distributing them to the mass through the Internet (Andrade, 2020). However, despite how popular this method is, since it can spread far from the experiment conduction site, the information received may not be able to be verified as not all respondents are honest or have the incentive to go through with the whole survey (Andrade, 2020). One thing to note is that when people are asked to fill out a survey, they are often found with a lack of motivation to see the survey through to the end.

In addition to the known limitation posed by online surveys, the study done by this paper was not based on any "well-known" mobile application but rather a standalone questionnaire, hence, it is possible that the respondents were presented with a vague idea about the final product which is a mobile application tailored for those to frequently go to the gym and they do not have a clear picture in mind about what can such an application do. This is a different approach from the work done by Wei, J., et al. (2020) where their survey was published in conjunction with a health and fitness management mobile application called "Boohee". In that sense, the respondents who were involved in the survey were given a clear image of what a health and fitness mobile app could do, and it could have greatly influenced the final results.

Regarding clarity, since the survey is done in Vietnamese, there is a possibility that the translation did not convey accurately the intention behind the questions and statements. This is

due to language and cultural differences that the wording of the survey questionnaire may stray off or differs in meaning or even paint a distinguished picture instead of conveying the original belief of the constructs (Harkness, Pennell, & Schoua-Glusberg, 2004). Another major factor that may impact the result of the findings of this paper is that Usage Behavior was not measured. In the research of the UTAUT model done by Venkatesh et. al. (2003), all constructs were measured with an addition of further observation done on survey participants for an extended period to assess Usage Behavior, however, it was not the case in this paper because Google Forms and Facebook, which are online platforms for the distribution of the survey questionnaire of this paper, do not possess the capacity to follow up with respondents after each survey form being filled and completed. Thus, a significant factor of actual health and fitness mobile app usage was left out of the equation, possibly leading to results inaccuracy.

On another hand, although this fact is not part of the current set of problems, it should still be taken into consideration as a potential factor that hinders future health and fitness mobile app development which is the matter of privacy. Many scholars hold the view that mobile applications are the root cause of various privacy problems where data tracking was deemed unethical and a form of privacy breach whereas the originally intended idea was for good faith to keep the app up to date with the health and fitness status of the user, hence, a policy that asks for the consent of the users should be implemented to overcome such a shortcoming (Rowan & Dehlinger, 2014). Despite not being a direct cause that can potentially restrict the development of a health and fitness mobile application, this is a significant limitation to take into account when investing in any application.

2. Conclusion:

This study aims at analyzing the important data of the Vietnamese market relevant to the health and fitness sector to answer the question regarding the necessity of a mobile application dedicated to health and fitness that businesses should adopt, especially for startups and small-to-medium enterprises. During the course of the analysis, many findings may benefit the decision-makers as well as the business managers in choosing the optimal management methods to keep up with the market. There were also some management concepts involved which are Technology Acceptance, Innovation Adoption, and Change Management. Although the full potential of the UTAUT model that this paper adopted has not been evaluated due to the absence of the Usage Behavior key construct which requires tracking over an extended period, there were substantial findings through the calculation of t-test, regression analysis, correlation table, etc. that may support businesses in making their decisions.

In addition, this study included a predictive model in the form of a decision tree to simulate the potential of the Usage Behavior to make up for the missing link of the UTAUT model and this decision serves as a reference to prospects who are more likely to adopt a health

and fitness mobile application. Thus, bridging the crucial construct gap within the incomplete theoretical model. The findings of this paper may contribute significantly to the strategy of a company as a change in the strategic direction of a company may result in massive changes over time and even alter how a company has always been operating. Take the example of large corporates and other unicorn startups, even those that have made a disruption in the past such as Uber, Grab (those in the taxi industry), Deliveroo, Doordash (those in the food delivery industry), or even Amazon, AliExpress (those in the e-commerce industry), etc., they have caused enormous changes not only in how a company operates but also the industry as a whole. As such, Change Management is an essential concept in managing a business, especially when it comes to adopting new technology to gain better results. Technical solutions are hard to copy and are usually a hassle to handle in any business, and by making use of such a difficult area, a company may establish a significant competitive advantage to stay in the market.

The location is also important because lies at the heart of Southeast Asia, Vietnam is one of the most exciting developing markets to explore, and choosing the correct way to invest early means the more rewarding the return on investment will be while minimizing alteration costs as much as possible. With this reasoning in mind, the study in this paper aimed at delivering the most accurate predictive model of the mobile application market in the health and fitness sector, and as such, along with the evidence from both research methodologies, I conclude that the health and fitness sector in Vietnam is a valuable industry to invest and small to medium companies should not avoid going all-in for developing a super mobile application dedicated to health and fitness that combines diet planning, training programming, and body metrics tracking. Notwithstanding, there are still several limitations that this paper faces and also it should only be used as a reference and not be taken as an absolute truth. But this also means that future research may use this paper as one of the foundation studies to further explore the mobile application industry as well as the Vietnamese market. I have achieved my goal of being able to study this topic in-depth and I can conclude that by investing in a health and fitness mobile application in the earlier stage, companies may experience a surge in usage rate as Vietnamese consumers are increasingly more open to adopting new technology.

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