THE EFFECTS OF CONTEXT AWARENESS
ON THE ADOPTION OF SPORTS TECHNOLOGIES

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THE EFFECTS OF CONTEXT AWARENESS
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DECLARATION OF ORIGINALITY

I, Yusuf Öç, certify that

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ABSTRACT

The Effects of Context Awareness on the Adoption of Sports Technologies

There is a new era of technology as a result of advancements in artificial intelligence and microsensors. Instant use of contextual data improves service customization with highly personalized feedbacks and objectives. Existing sports literature regarding sports technologies mostly aim to understand the relationship between sports technologies and sports motivation while, on the other hand, marketing and information systems literature try to explain adoption and diffusion of sports technologies with the existing frameworks. In an attempt to extend the current understanding of the intentions of using a context-aware technology from the consumer perspective, we used sports technologies as the study domain and created a new construct, named "Context Awareness," with four dimensions: tracking, coaching, sharing, and gamification. We created 16 scale items to measure the context awareness capabilities to enhance the understanding of usage drivers behind sports technologies. The purpose of this study is to understand the effects of context-aware characteristics on users' adoption together with sports motivation, sports type, and other innovation characteristics. The proposed model is empirically tested with data from 600 participants in Turkey. Partial least squares (PLS) were used for models and hypotheses testing. Context awareness is found to affect perceived innovation characteristics significantly. It is also shown that sports motivation and sports type moderates the relationships in the model.

ÖZET

Bağlam Farkındalığının Spor Teknolojilerinin Kullanımına Etkisi

Yapay zeka ve mikro sensörlerdeki gelişmeler sonucunda yeni bir teknoloji çağı başladı. Bağlamsal verilerin anında kullanılması, kişiselleştirilmiş geri bildirimleri ve hizmetlerin hedeflere göre özelleştirmesini geliştirdi. Spor teknolojilerine ilişkin mevcut spor literatürü çoğunlukla spor teknolojileri ve spor motivasyonu arasındaki ilişkiyi anlamayı amaçlarken, pazarlama ve bilgi sistemleri literatürü spor teknolojilerinin var olan modellerle benimsenmesini ve yaygınlaşmasını açıklamaya çalışmaktadır. Bağlam farkındalığı olan bir teknolojiyi kullanma niyetinin tüketici bakış açısına göre günümüzdeki anlayışını genişletmek amacıyla, spor teknolojilerini çalışma alanı olarak kullandık ve "Bağlam Farkındalığı" adında izleme, koçluk, paylaşım ve oyunlaştırma olmak üzere dört boyutlu yeni bir yapı oluşturduk. Spor teknolojilerinin arkasındaki kullanım nedenlerinin anlaşılmasını geliştirmek için bağlam farkındalığı yeteneklerini ölçmek amacıyla 16 ölçekli bir yapı oluşturduk. Bu çalışmanın amacı, bağlam farkındalığı özelliklerinin kullanıcıların spor motivasyonu, yaptıkları spor türü ve diğer inovasyon özellikleriyle birlikte teknoloji benimsenmesi üzerindeki etkilerini anlamaktır. Önerilen model, Türkiye'deki 600 katılımcıdan elde edilen veriler ile ampirik olarak test edilmiştir. Modeller ve hipotez testleri için kısmi en küçük kareler (PLS) yöntemi kullanılmıştır. Bağlam farkındalığının algılanan inovasyon özelliklerini önemli ölçüde etkilediği bulunmuştur. Ayrıca spor motivasyonunun ve spor tipinin modeldeki ilişkileri modere ettiği gösterilmiştir.

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CHAPTER 1

INTRODUCTION

If you have a body, you are an athlete.

--*Bill Bowerman*

Evolutionary evidence suggests that humans were born to run primarily for long distances (Bramble & Lieberman, 2004). Although there are no anatomical excuses for movement, 1 in 4 adults is not active enough in the world, and more than 80% of the world's young population is insufficiently physically active as stated by World Health Organization (2018). In the same study, the World Health Organization has declared insufficient physical activity to be the leading risk factors for death worldwide. It is clear that the human race does not use its full potential to move. This is one of the biggest paradoxes of human nature. There are many explanations on why don’t we move including genetic, family, neighborhood, cultural attitudes, and historical circumstances (Harvard Health Letter, 2008). The most striking part is that sport activity is self-determined process supported by external and internal factors (Luc G. Pelletier et al., 2013). Hence this is an individual level problem, and it can be worked around with individual level solutions.

It is very well known that there are countless benefits of doing regular sports activities. It gives you more energy, improves your sleep quality, decreases your stress level, boosts your mood, decreases depression, enhances memory, reduces anxiety, improves sex life, gives greater life satisfaction, increases creativity, and gives better well-being as a whole. Despite these innumerable benefits, insufficient physical activity is listed as one of the biggest potential health problems in the world.

The problem is lack of motivation. Even though being healthy and losing weight are seen as logical rewards, they do not continuously motivate people to maintain their activity behavior. Furthermore, people tend to choose to allocate their time to daily chores other than physical activity when motivation is associated with vague, medical, or intangible goals like being healthy or well-being.

In an experimental study, Segar (2015) and her colleagues split a group of breast cancer survivors into two, one group did ten weeks of exercise, and other group stayed as a control group with no exercise. After the experiment, the group that did ten weeks of exercise reported a significantly lower level of both depression and anxiety. Interestingly, when they asked whether they were still exercising or not nearly all of them answered as no. Segar (2015) astounded and noted, “If facing death and surviving serious illness aren’t motivation enough to take better care of yourself, what is?” This interesting result indicated that there is a new age of healthcare where self-management and self-regulation are crucial for improving results and decreasing costs. Nevertheless, due to intense daily life activities and many other choices, people are at the edge of self-management failure (Segar, 2015).

There is hope though. Technological advancements make it possible to track human activities, give feedback, and motivate them. Baca et al. (2009) indicated that technological developments not only facilitate size reduction of the devices but also increase their capability to transfer data. Additionally, the speed and accuracy of data processing in feedback systems are also improved thanks to the development of better and more efficient algorithms (Baca, Dabnichki, Heller, & Kornfeind, 2009). These small and portable devices with better algorithms and small processor units, measure and process vital information everywhere and every time without interrupting the users’ daily lives. Technologies mentioned above have the ability of sensing, communication, and computing skills working together. This is called as ubiquitous or pervasive computing. Especially in sports, these ubiquitous computing technologies are being widely used. Ubiquitous technologies in sports acquire, analyze, and display performance data without disturbing the athletes during activities. Sophisticated feedback systems have been developed to improve users' techniques and performance (Baca et al., 2009).

In fact, sports technologies do not only give feedback to improve performance but also motivate users in different ways. Nike is using social networks and sharing in the Nike Run Club (NRC) app to increase the motivation of the users in the activities. For instance, one can receive encouragement from friends while running. This feature is called "Cheers" and when a user is running, he hears applause over his music when friends cheer him. Users can link their Facebook accounts to add their friends and their friends might cheer them from Facebook, too. Runners get additional motivation and support with this feature. Jeanne Huang, Nike's communication director in China also shared the same opinion indicating that young Chinese are often too image-conscious to get out and run, and she said: "We need to give them an inspiration." Another account executive said, "Running does not come with spectators like basketball and football, where you can show your stuff and how cool you are." That is why Nike added such sharing features in their mobile apps in the first place (Piskorski & Johnson, 2012). Correspondingly, getting cheers while running simply gives runners more social currency (Berger, 2016). Fitbit smart wristbands and watches also give the opportunity of sharing activities with friends. Users can track their friends' activities and get notifications when a friend achieves a goal. Users can get gratifications from friends and motivated by them. Some brands position their products with the premise of increased motivation. Apple, for example, used the “Made to Motivate” slogan in the latest Apple Watch series 4 campaign (Apple, 2018b). Hence, it can be said that with the help of smart sports technologies modern people might find the sustainable motivation that has been declared lost for a long time.

Other than the support of social features, these smart technologies also use gamification characteristics to improve user performance and motivation. Apple uses three rings strategy in its smartwatch series. Three rings represent move, exercise, and stand respectively. There is one goal for the user: close all rings every day. This is one of the simplest and stickiest ways of gamification usage. Apple stated the three rings idea as “...such a simple and fun way to live a healthier day that you will want to do it all the time.” (Apple, 2018a). Challenges are another way of gamification that are used by sports technology providers. Users either challenge themselves or their friends for any activity goals to earn virtual badges and awards. Users are even motivated by just merely sharing their activities with other people. They know that their performance is being followed and this motivates them.

Major sports brands and technology companies aim to complement health and sports-oriented ubiquitous technologies into their product portfolio and invest millions of dollars in coming up with innovative products. Sports equipment with measurement chips, GPS enabled pedometer apps with heart rate tracking features, smart watches, smart wristbands, other wearable technologies, and sports Internet of Things (IoT) have been introduced the market. Most of these innovations have one thing in common, they are either mobile applications, or they have a mobile application track vital data and visualize their analysis results. Hence they are mostly hyper-connected. “

We Are Social & Hootsuite (2018) research report indicated that the number of unique mobile device users is more than 5 billion and smartphone penetration rates are increasing as well. This is another indication of why sports technologies should be in mobile devices. By the time that first iPhone was launched in 2007, there was no app market and the idea of a phone being a sports coach and motivator was far from reality. The introduction of apps is the real trigger to start the mobile revolution. Apple introduced the concept of the App Store in 2008, and app usage has been steadily growing until today. Flurry Analytics company investigated millions of apps' usage activity and prepared a report on app usage in 2013. According to the report, global app usage increased by 58% in 2015 (compared to 76% in 2014 and 103% in 2013). Among these apps "Sports" apps category grew 53% and "Health and Fitness" apps category grew 52% in the past 12 months (Statista, 2016).

From the consumer point of view, technological advancements in the sports market help them to track their sports activities more accurately, increase their sports motivation, share their sports activities, and gamify the process as well. Consumers can track their running or walking distance, amount of calories burnt, meters climbed, steps, heart rate, sleep time, sleep quality, etc. or learn a lot of technical and practical issues such as right movements for exercising right body parts by using sports technologies and related apps. Having this kind of information, people can control their sport duration, types of sports activities, eating habits, sleeping and resting times, and many more health and sport related essential daily routines. They can improve their sports performance as well. For example, tracking the heart rate is essential while walking or running because if you are around 30 years old and pass the 95-162 beats per minute during exercise than you risk your health. Besides, between 95-125 beats per minute you are burning fat, above that number you are doing a cardio activity, which means you are improving your endurance and strength (American Heart Association, 2016).

As it is seen from the above articulation, the sports technologies today are much more sophisticated than their predecessors. They track user activity and other critical physiological data. Then, they shift their role according to context. They can act like a tracker, a sports coach, a game to play, and a social sharing app or device. Hence, I named technologies, which have articulated features as context-aware technologies.

In this study, it has been observed that not all of the people doing sports are using sports technologies for tracking and learning purposes. Among the people who are using these technologies have different motivations. Consequently, this study aims to investigate the antecedents of behavioral intentions to use sports technologies. In the scope of this study "Sports Technology" concept includes the smartwatches that can be used in sports activities (e.g. Apple Watch, Samsung Gear, Garmin Fenix), smart wristbands (e.g. Fitbit, Moov Now, Garmin Vivosmart, Samsung Gear Fit, Huawei Fit, Tom Tom Smart), other device mounted sports technologies (e.g Bike Computers, Dive Computers) or other wearable technologies and mobile applications that can be used while doing sports for similar purposes such as counting calories, counting steps, and heart rate meters (e.g. Nike +, My Fitness Pal, Sworkit, Strava, Runtastic, Dietetic, Argus, Fitwell).

Sports-related apps can be classified as health and fitness apps (tracking apps, pedometers, exercise apps, etc.), sports news apps (ESPN, Yahoo sports, etc.), other sport-related apps (betting, ticketing, etc.). In this study, health and fitness apps are considered as sports apps to clarify the research scope and purpose.

CHAPTER 2

RESEARCH OBJECTIVES AND OUTLINE

Technological advancements make it possible for sports technologies to track human activities, give feedback, and motivate them (Novatchkov & Baca, 2013). They are hyper-connected and not only ubiquitously track necessary body measures but also give feedback and suggestions by using collected data (Baca et al., 2010; Lee, Kim, Ryoo, & Shin, 2016), allow instant sharing of activities, and use gamification characteristics (Apple, 2018a) to increase engagement with the help of artificial intelligence. They can identify the location and objective of the user based on previous data. They perceive and interpret human activity. In other words, they have context-aware characteristics (Dix, Finley, Abowd, & Beale, 2004).

Sports technologies are becoming widely adopted, yet challenges continue to exist in effective long-term use and adoption. Recent figures indicate that sales of fitness trackers fell by 18% in 2017; it is 23 percent lower than its highest in 2016 (Lamkin, 2018). Fitbit app, one of the leader in the market, continue to lose its active users (Fruhlinger, 2018). Lastly, IDC reports that in quarter one of 2018 worldwide shipments of wearables only grew 1.2% year-over-year, which is quite lower than the 18% year-over-year growth in the previous year (Shirer, Llamas, & Ubrani, 2018). Therefore, further attention is needed to identify what factors are affecting sports technology adoption.

A review of the literature indicates sports literature regarding sports technologies mostly aim to understand the relationship between sports technologies and sports motivation (Lyons & Swartz, 2017; M. L. Segar, 2017) while, the information systems literature tries to explain adoption and diffusion of sports technologies with the existing frameworks (Canhoto & Arp, 2017; K. J. Kim & Shin, 2016; T. Kim & Chiu, 2019; Lunney, Cunningham, & Eastin, 2016; Reyes-Mercado, 2018; Wu, Wu, & Chang, 2016). The marketing literature, on the other hand, focus on different aspects of new product diffusions such as communication strategies (López & Sicilia, 2013), influencer effects (Iyengar, Van den Bulte, & Valente, 2011; Nejad, Sherrell, & Babakus, 2014), and improved variations of the Bass Model (Ho, Li, Park, & Shen, 2012; Peers, Fok, & Franses, 2012).

The primary purpose of this research is to understand the effects of context-aware characteristics of sports technologies on users' adoption together with perceived innovation characteristics. This study utilized an extended version of the unified theory of acceptance and use of technology (UTAUT2) (Venkatesh, Thong, & Xu, 2012), which is suitable for this study context. Of particular interest is whether the sports type (Mitchell, Haskell, Snell, & Van Camp, 2005) moderates the sports technology usage or not. Our efforts on literature search revealed that the effect of sports type on sports technology usage had not been addressed before. Also, this study attempted to explore sports motivation (Luc G. Pelletier et al., 2013) influence on sports technology usage. Up until now, studies explain how sports technology usage influences sports motivation; however, this study approach the situation differently and investigate the sports motivation effects on sports technology usage. This research provides a new construct (context awareness) to the literature on adoption of new technologies and new product development. The model in this study, to the best of our knowledge, is the first study that combines marketing literature, information system literature, sports literature, and medical literature to explain the usage of sophisticated technology. The practical implication of this study is twofold. First, product managers could increase the adoption rate of new products by focusing on context-aware characteristics in their marketing communication activities. Second, sports motivation and sports type should be taken into consideration for segmentation. Different customer segments value different product features.

In this study, in-depth interviews with sports professionals and people who regularly do sports were held in order to gain information about their motives for the use of related sports technologies. These interviews and previous studies revealed that there is a gap in the literature regarding the conceptualization of the adoption and diffusion of sports technologies. In order to fill this gap, I created a new construct, named "Context Awareness", with four dimensions: tracking, coaching, sharing, and gamification. Context awareness can be defined as the understanding of where (identification of the location of a human), when (time-awareness), what (perceiving and interpreting human activity), and why people are doing what they are doing (Dix et al., 2004). I created 16 scale items to measure the context awareness capabilities to enhance the understanding of usage drivers behind sports wearables, sports apps, and other sports technologies. Content adequacy assessment with judges was carried out, and the validity and reliability of the scale items were evaluated based on the related literature (Hinkin, Tracey, & Enz, 1997).

In an attempt to extend the current understanding of the intentions of using a sports technology from the consumer viewpoint, I used the unified theory of acceptance and use of technology 2 (UTAUT2) (Venkatesh, Morris, Davis, & Davis, 2003), the sports motivation scale (L.G. Pelletier et al., 1995) and the author-generated context awareness scale. The suggested model is empirically tested with 600 data from participants in Turkey. Partial least squares (PLS) were used for model and hypotheses testing. Context awareness was found to significantly related to perceived innovation characteristics and sports motivation. It has also been shown that sports motivation and innovation characteristics have direct effects on the intention to use and usage.

Initially, the theoretical background on the diffusion of innovation, technology acceptance, involvement, and sports motivation are described in chapter 3. In chapter 4, aspects of the qualitative study that was held before the conceptualization of the model are portrayed. The qualitative study provided valuable insights into this doctoral research. Hence, based on qualitative research and literature review conceptual framework is created, and hypotheses are generated in chapter 5. Research design and methodology are carefully designed since they are critical parts of the study. In chapter 6, details of the research design and methodology are presented. Performed data analysis to test the hypotheses and obtained results are described in chapter 7. Discussion of the results based on the research performed and findings are articulated in chapter 8. Theoretical contribution and implications for practitioners are presented in chapter 9 along with future research directions and limitations of the study.

CHAPTER 3

THEORETICAL BACKGROUND

When people are free to do as they please, they usually imitate each other.

-- *Eric Hoffer*

3.1 Technology adoption and diffusion

Why do people use what they use? Why some innovations are successful and the others not? What are the motives of people who adopt new products or services? Those questions have always caught the attention of academicians and practitioners over the years.

Rogers (1962) first observed the adoption of 2,4-D weed spray and other agricultural innovations among farmers and studied the reasons for the diffusion of those agricultural innovations. He then published his famous book of “Diffusion of Innovations” which contains his argument for a generalized diffusion model. First edition of the book included a meta-analysis of 405 studies on innovation diffusion. After nine years when they published the second edition with his co-author, the number of studies on innovation diffusion had already increased to 1500 (Rogers & Shoemaker, 1971). Studies were in different professions including sociology, education, communication, public health, marketing and management, geography. The interest of marketing scholars on innovation diffusion studies has been escalated after Bass (1969) study on a growth model on consumer durables. The similar rise of interest occurred in information systems studies after Davis (1986) has been introduced his Technology Acceptance Model (TAM). While Rogers (1962) uses the term adoption, Davis (1986) coined the term acceptance. Although there are two different terminologies in the literature, many scholars use both interchangeably. Many further studies have been done on both adoption and acceptance, and different models have been proposed to extend Rogers', Davis' and Bass' works. I will briefly describe the most noticeable models and their relations to each other to grasp the existing literature before proposing our model.

3.1.1 Diffusion of innovations

Everett Rogers was a researcher in rural sociology study when he first attracted to the diffusion of innovation subject. Then, he analyzed hundreds of different cases from different events and various periods. He came up with a "Five-Stage Model of Innovation-Decision Process." A simplified version of the model is illustrated in Figure 1.

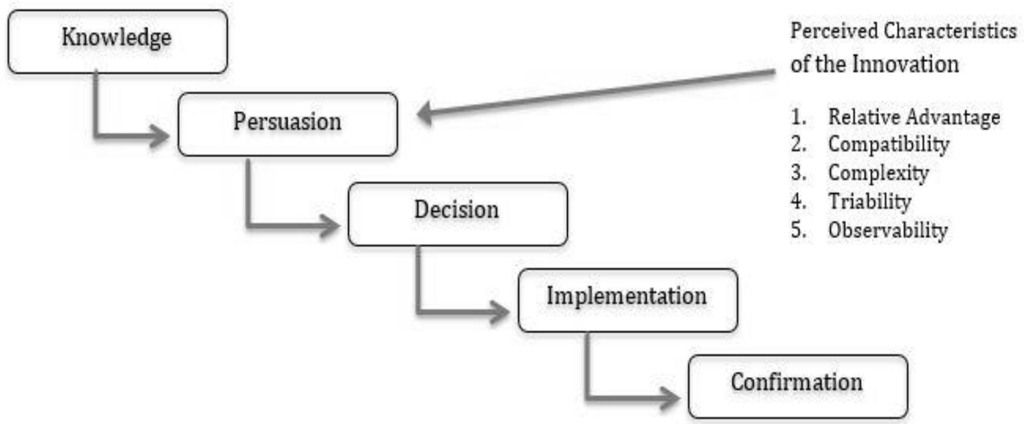

Figure 1. Rogers' innovation-decision process model.
Adapted from The diffusion of innovations 3rd edition, by E. M. Rogers, 1995, New York, NY: The Free Press.

In the innovation-decision process decision-making unit (an individual in our study) passes from first knowledge of innovation to the persuasion stage, to decision stage, to implementation of the innovation, and confirmation of the decision.
Rogers (1995) stated that there are prior conditions to knowledge stage of the process like previous practice, felt need/problems, innovativeness and norms of the social system. He also added that characteristics of the decision-making unit are affecting the knowledge stage. However, some of the mentioned items are not included in the scope of this study.

Diffusion of innovation theory provides certain attributes, which might affect the adoption intention and adoption rate of that innovation or technology. Relative advantage, compatibility, complexity, trialability, and observability are stated as perceived characteristics of the innovation. Later, Moore and Benbasat (1991) designed an instrument to measure users' perceptions of the innovation based on Rogers (1962) stated perceived characteristics, and they added two more characteristics: image and voluntariness of use. The image was a part of relative advantage in Rogers (1962), but Moore and Benbasat (1991) thought that social aspect is now more important such that it deserves to be a separate item. Triability is not used in this study because many sports technologies are mobile apps and users can easily try them before using. Voluntariness is also not used in the study since all of the sports technologies usage depends on the eagerness of the potential adopters. Mandatory usage is omitted since it is only a tiny fraction of total sports technology users' population.

Relative advantage is the dominant item to explain the technology diffusion process in many previous studies. Similarly, sports technologies are used if they provide some advantage to the user. Users are comparing new technologies with previous ones. Moore and Benbasat (1991) defined the relative advantage as "the degree to which use of an innovation is perceived as being better than its precursor." In this study, the effect of sports technologies on the sports performance of the users in sports activities is investigated. People are asked to evaluate their performances after they use the technology and compare it to their previous activity experience.

Complexity is defined as “the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 1995). Some sports technologies could be complex to use when it is compared to simple devices that are previously used for tracking purposes. Complexity increases especially when too many functions are tried to put smaller devices. Venkatesh et al. (2003) found that complexity is affected by the age and gender of the user such that old people and women find it more challenging to engage with new technologies.

Increasing social media usage in everyday life enhance image concept. As Berger (2016) indicated, we are doing what we are doing to show others how cool we are. Hence, it is impossible to evaluate the usage of new individual-level technology without an image item. Image is defined as “the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system” (Moore & Benbasat, 1991). Venkatesh et al. (2003) indicated that theory suggests women are more sensitive to other people’s opinions; thus they find other people’s opinion more important when it comes to using new technology. They also indicated that age has similar effects on acquiring new technology. Older people are more image-conscious while adopting new technology.

Rogers (1995) said that one of the reasons why people easily accept mobile phones is that they have very similar characteristics with desktop phones. People know what they do with mobile phones without further explanation because they have already used a similar version. People adopt new technologies if it complies with their current lifestyle. Hence, compatibility is defined as “the degree to which an innovation is perceived as being consistent with existing values, needs and experiences of potential adopters” (Moore & Benbasat, 1991).

Learning starts with observing. Sight is the first and one of the most reliable senses when it comes to adoption of new technologies. Hence, if the new technology is seen among the neighborhood or community, then acceptability of it is high. Observability is defined as “the degree to which the results of an innovation are visible to others.” by Rogers (1962). Later, Moore and Benbasat (1991) generated two different constructs from original observability item: result demonstrability and visibility. Result demonstrability focused on the tangibility of the results of using the innovation. Visibility stayed similar to the original observability. In other words, result demonstrability does require not only visibility but also needs communicability.

Summary of the constructs that are adopted from the studies mentioned above is presented in Table 1.

3.1.2 Technology acceptance model

Davis (1986) proposed the Technology Acceptance Model in his Ph.D. dissertation. TAM postulated that a prospective user's general attitude toward using a given system is a critical factor on actual usage. Perceived usefulness and perceived ease of use are two central beliefs that explain the attitude toward using technology. Furthermore, perceived ease of use influences perceived usefulness.

Table 1. Diffusion of Innovation Constructs and Their Definitions

Construct	**Definition**
Compatibility	"the degree to which an innovation is perceived as being consistent with existing values, needs and past experiences of potential adopters." (Rogers, 1995; Moore and Benbasat 1991)
Complexity	"the degree to which a system is perceived as relatively difficult to understand and use." (Rogers, 1995; Moore and Benbasat 1991)
Image	"the degree to which use of an innovation is perceived to enhance one's image or status in one's social system." (Moore and Benbasat 1991)
Relative Advantage	"the degree to which use of an innovation is perceived as being better than its precursor." (Moore and Benbasat, 1991)
Result Demonstrability	"tangibility of the results of using the innovation." (Moore and Benbasat, 1991)
Observability (Visibility)	"the degree to which one can see others using the system in the organization" (Rogers, 1995; Moore and Benbasat, 1991)

Design features are acting as an external variable and directly affect perceived usefulness and perceived ease of use. Figure 2 shows a simplified version of the first TAM model as proposed by Davis (1986).

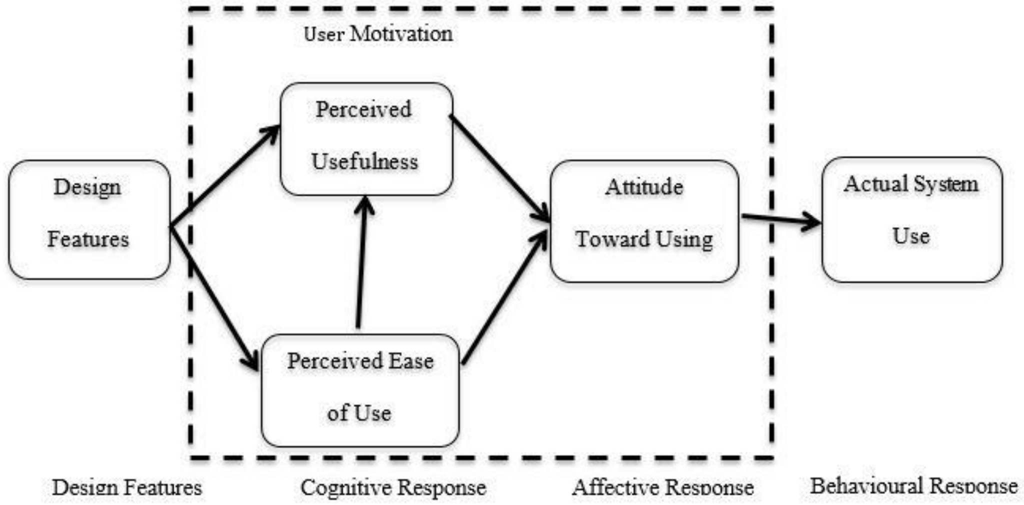

Figure 2. Technology acceptance model
Adapted from "A technology acceptance model for empirically testing new end-user information systems: Theory and results", F. Davis, 1986, Ph.D. dissertation.

In his dissertation, Davis (1986) stated that he used the Theory of Reasoned Action (TRA) as a foundation (Fishbein & Ajzen, 1975) in his model. TRA is drawn from social psychology and the hypothesis that people's beliefs direct them to constitute an attitude toward certain behaviors. Consecutively, this attitude towards a particular behavior leads to behavioral intention. Eventually, behavioral intention leads to actual behavior. Original TAM does not use the subjective norm which is included by TRA in the model, but later, Technology Acceptance Model 2 (TAM2) (Venkatesh & Davis, 2000) add this item to the model.

Davis (1986) explained the "Actual System Use" in his model as "a repeated, multiple-act behavioral criterion that is specific concerning the target (specified system), action (actual direct usage) and context (in person's job), and non-specific with respect to time frame." Attitude is "the degree of evaluative effect that an individual associate with using the target system in his or her job." Both defined components are profoundly affected by the TRA. Davis (1986) contribution to information system field especially comes from two terms he created for TAM: perceived usefulness and perceived ease of use. One might argue that perceived usefulness, and perceived ease of use are respectively similar to “Relative Advantage” and “Complexity” from Rogers (1995) diffusion of innovation, but Davis (1986) never mentioned Rogers (1962) study in his dissertation. Perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance." Moreover, perceived ease of use is defined as "the degree to which an individual believes that using a particular system would be free of physical and mental effort." After the exact definitions, it might be clear that both constructs are very similar to the diffusion of innovation constructs. Hence, it can be said that TAM is a reflection of the diffusion of innovation theory in the information system literature.

Since Davis (1986) did not state the external variables that affect the perceived ease of use and perceived usefulness in his original study, later studies attempt to extend the original model with different external variables. Davis and Venkatesh (2000) developed a theoretical extension of the Technology Acceptance Model (TAM) and tested it with longitudinal data from four different systems at four organizations. They called this new model TAM2. TAM2 used social influence and cognitive instrumental processes to elucidate perceived usefulness and usage intentions. They used result demonstrability, output quality, job relevance, image, and subjective norm as external variables which influence the perceived usefulness (Venkatesh & Davis, 2000).

3.1.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

TAM attracted much attention from the information systems scholars. An increasing number of studies with various constructs bring along confusion to the literature. Therefore, Venkatesh et al. (2003) tried to unify theories that are used in diffusion and acceptance studies. First, they reviewed the user acceptance literature and evaluated eight well-known models. Then, they compared the eight models and framed a unified model that integrates essential components of the eight models. Finally, they empirically tested and validated their unified model. Fishbein and Ajzen's (1975) theory of reasoned action, the theory of planned behavior, Davis' (1989) the famous technology acceptance model (TAM), Rogers' (1962) innovation diffusion theory, the social cognitive theory, a model combining the technology acceptance model and the theory of planned behavior, the motivational model, and the model of PC utilization. They used data from four institutions over six months. They collected data in three different points in that period. According to their study, the maximum variance explained in the eight models can only account for 53 percent of the variance in user intentions to use information technology, but their unified model outperformed them with a 69 percent of explained variance. They called their unified model, Unified Theory of Acceptance and Use of Technology (UTAUT).

Components in the UTAUT model are reasonably analogous to the TAM in a manner that external variables influence behavioral intention and it leads to the actual use behavior. External variables have also extracted the theories they have mentioned earlier in their study. The similarity of their external variables from previous studies’ constructs is shown Table 2 below.

Table 2. UTAUT Model Constructs and Previous Models' Similar Constructs Comparison

UTAUT Model	Previous Models
Performance Expectancy	Perceived Usefulness (Davis, 1986)
Effort Expectancy	Perceived Ease of Use (Davis, 1986)
Social Influence	Subjective Norm and Image (Moore & Benbasat, 1991; Venkatesh & Davis, 2000)
Facilitating Conditions	Compatibility (Rogers, 1995)

Unlike other variables in the UTAUT model, facilitating conditions has a direct effect on the actual usage of technologies. Facilitating conditions are important especially for the company level technology adoption process since the user needs help for infrastructure and training. There are also four moderating variables; age, gender, the voluntariness of use and experience in the model (Venkatesh et al., 2003). UTAUT model is a robust model for explaining technology adoption. It got much attention from academia. Many extension studies were held that is indicating room for improvement in the model. Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model was proposed to address such improvement demands (Venkatesh et al., 2012). There is no change in base constructs of the UTAUT model, but there are three new variables added to the UATUT2 model; habit, hedonic motivation and, price value. Habit is the degree which the user automatically performs activities with the new technology. Hedonic motivation is the fun or joy received from the new technology. The price value is the perceived value of the technology with respect to its cost. One of the moderating variable –

voluntariness of use, is neglected in the new model. The UTAUT2 model is presented in Figure 3.

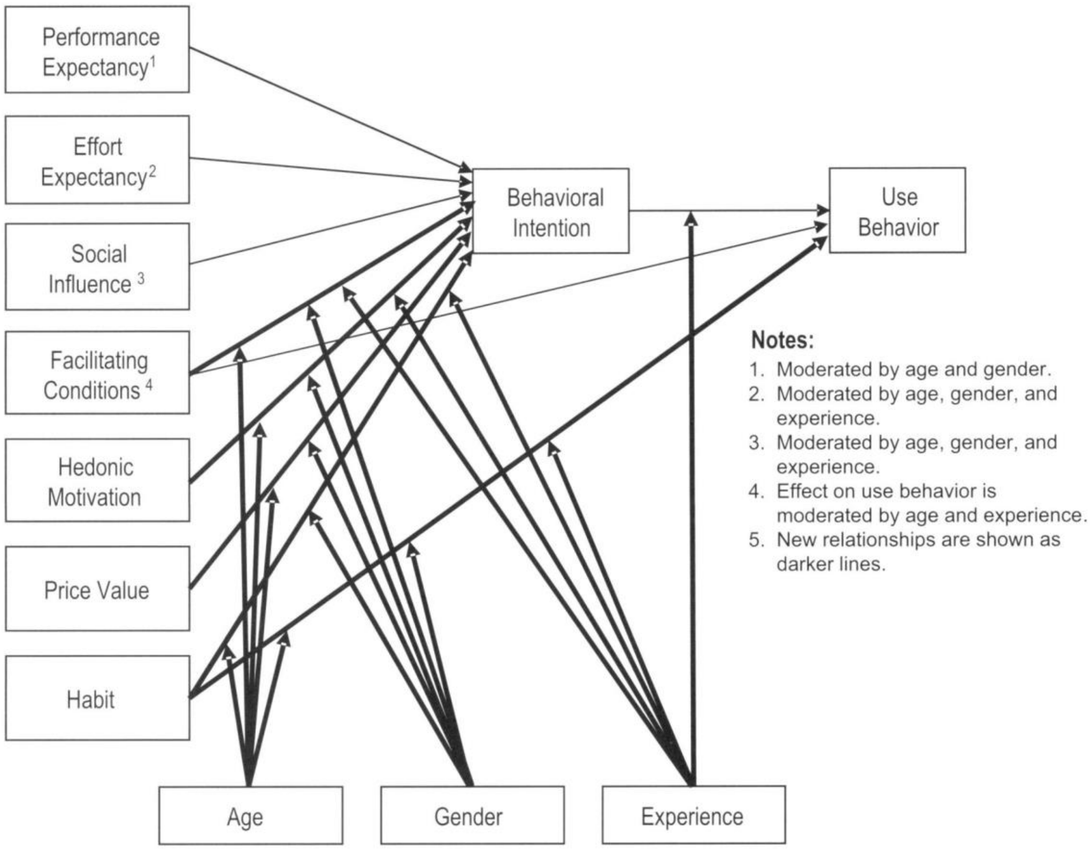

Figure 3. The UTAUT2 model
(Venkatesh et al., 2012)

The previous model focused on an organizational level system whereas in the UTAUT2 model the authors studied on an individual user level technology, mobile internet.

3.2 Motivation

There are countless benefits of doing sports activities on a regular basis including better fitness, better self-esteem, and reduced chronic diseases. Even though many people know the benefits of consistent sports activities, most of them stop their participation in a short-term period. The main problem is sustainable motivation. Because of that, there have been a great number of researches conducted on motivation in sport to understand the motives behind continuing or quitting sports participation (Luc G. Pelletier et al., 2013). People get motivated quickly but keeping that motivation in more extended periods is most of the time troublesome. That is why insufficient physical activity listed as one of the biggest potential health problems in the world. Figure 4 below shows the search interest over time for the term “fitness” in all over the world. It is effortless to observe the seasonal peaks in every year. In every January people search fitness related keywords on Google because New Year’s Eve people motivate themselves to have a better physique and healthy body.

Figure 4. Search interest in fitness-related keywords between 2008-2018 (Google Trends, 2018)

Even though having a better physique and healthy body seems to be the right motivation, it does not sustainably motivate people. Scholars studied sports motivation with using Self-Determination Theory (SDT) as a foundation. SDT hypothesized competence, autonomy, and relatedness as three inherent psychological needs which when fulfilled generate improved self-motivation and mental health and when dissatisfied lead to weakened motivation and well-being (Ryan & Deci, 2000).

Pelletier et al. (1995) used SDT and adapted it to the sports environment; they called it Sports Motivation Scale (SMS). Later in 2013 they revised it together with original SDT scholars and proposed a better scale Sports Motivation Scale 2 (SMS II) (Luc G. Pelletier et al., 2013). In this study to measure sports motivation of participants SMS II scales are used.

Some other studies included sports involvement in the acceptance model of sports apps (Ha, Kang, & Ha, 2015). Involvement is “evoked by a particular stimulus or situation and has driven properties. Its consequences are types of searching, information processing, and decision making” (Laurent & Kapferer, 1985, p. 49). In sports, context involvement is defined as “the perceived interest in and personal importance of sport to an individual” (Shank & Beasley, 1998). In their studies, McGehee et al. (2003) and Bennett et al. (2009) found that high levels of involvement triggered more detail search activities thus spending more time gathering information. Therefore, they believe that sports involvement facilitates to adopt a sports app related to his/her involved sports activity. In our study, I am using sports motivation construct instead of sports involvement construct because it is more activity oriented. Previous studies that used involvement constructs do not only focus on physical sports activities, but they focus more on sports fan behavior.

3.3 Sports type

There are several sports type classification based on empirical data such as team sports and individual sports; or indoor sports or outdoor sports. A broader and systematic classification based on cardiovascular activity is developed by Mitchell et al. (2005). They created nine clusters of sports type based on the dynamic and static components of the sports. Their original clustering is presented in Figure 5.

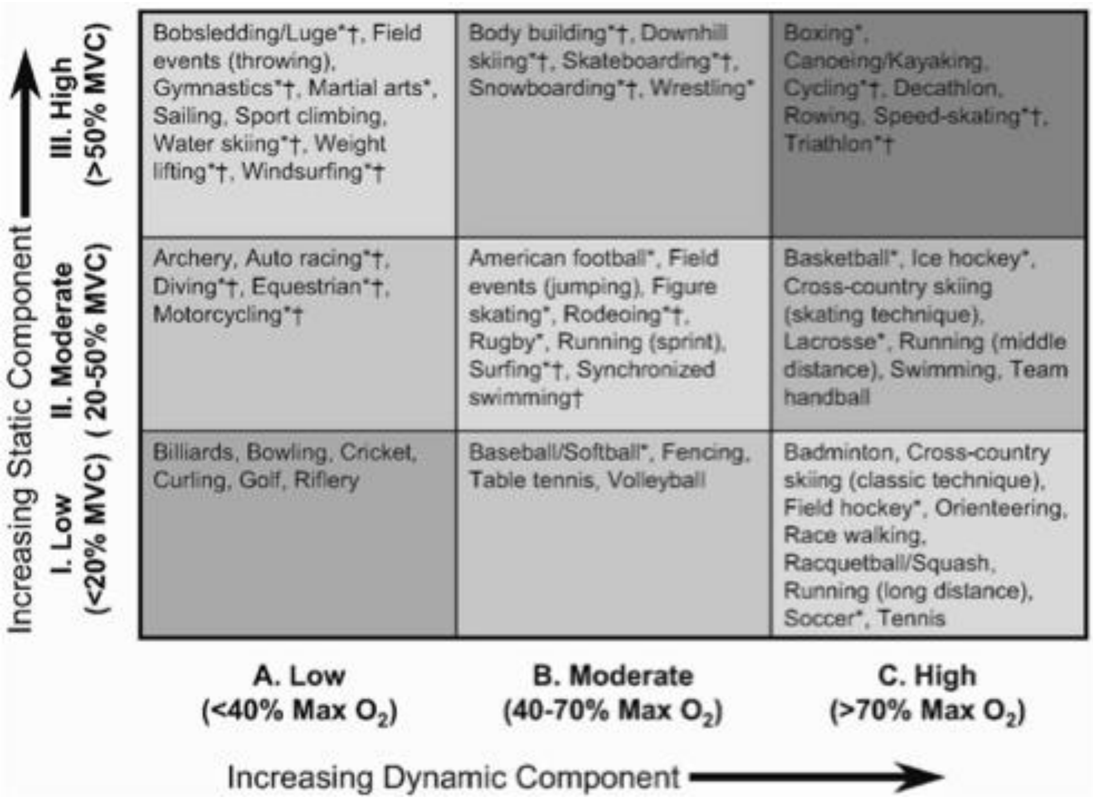

Figure 5. Classification of sports
(Mitchell et al., 2005)

In this study, I simplified their 9 clusters into 2 for the sake of parsimony: dynamic sports and non-dynamic sports. Sports that require more cardiovascular activity such as football, basketball, and running fall into this category; whereas yoga, pilates, and golf fall into the non-dynamic category. The dynamic and non-dynamic sports included in the scope of this study are presented in Table 3. As for our knowledge, no previous study looked for the impact of sports type on sports technology adoption.

Table 3. Dynamic and Non-Dynamic Sports

Dynamic Sports	Non-dynamic Sports
Badminton/Squash/Tenis	Crossfit
Basketball	Fitness
Cycling	Golf
Football	Kickboks/Karate/Judo/Muaythai
Running	Pilates
Swimming	Powerlifting/Weightlifting
Triathlon	Walking
Volleyball	Yoga

CHAPTER 4

QUALITATIVE STUDY AND INSTRUMENT DEVELOPMENT

4.1 Qualitative study

Qualitative studies provide valuable insights into consumers' opinions and experiences. Padgett (2016) describes a justification for the use of qualitative interviewing to provide the groundwork for quantitative studies. Conducting exploratory qualitative research before generating scale items for questionnaires can enhance the quality of the overall research. Analysis of the interview data can help the better design of survey items. (Rowan & Wulff, 2007; Weiss, 1995)

The in-depth interviews carried out for this study were designed as two stages. In the first stage, three sports professionals were interviewed to get expert opinions, and in the second stage, a broader purposive sample of twelve people who regularly do sports activities was interviewed.

Three people (one female, two male) from three different sports domain were interviewed for the first stage. One of the experts was an experienced Pilates instructor, the second one is the certified CrossFit trainer, and the last one was a Fitness trainer and instructor in the Turkish Body Building Federation. Ages of the professionals were between 25 - 45 and the mean interview duration was 45 minutes. The objective of the expert opinion interviews was mainly to confirm the importance of the study; hence a more inductive approach was used.

The second phase of the in-depth interviews was conducted with seven female and five male participants who were between 18 to 35 years old. Participants who were actively performing sports activities for at least one hour a week over more than one year period, and using at least one sports technology were selected for the second stage based on the purposive sampling approach. Interview questions were designed to enable respondents to open up his or her opinions and develop new topics around the subjects. I implemented guided questions to derive interpretations instead of direct information. The questions were specific, but I slightly changed them according to the direction of the interview to intensify the conversation and probing for further clarification.

I recorded the audios of all the conversations then transcribed the meaningful phrases from recordings and interviewer's notes. Refined transcriptions were coded by using the "Descriptive Coding" technique. For example, in one of the in-depth interviews, an amateur triathlon sportsman said, “Without data how can I measure my performance? That is why I need these gears in my sports activities. Sometimes, if I forget to wear my smartwatch, I do not do sports.” I coded this phrase as "Tracking Performance." Another interviewee living in Turkey indicated that he sometimes walks in his home to close his rings since he does not want to stay behind his friend who lives in the USA. I coded this phrase as “Gamification.” He added that competition with his fellows is one of the main reasons he is using his smart wristband and its associated app. One of the participants pointed out that “I have been using my smartwatch for three years but I only really started using after one of my friends, and I shared our activities. Now, I am trying to keep up with her since this is always the topic we talk about lately.” Sharing his activity with his friend is the main reason for this participant to use sports technology. This feature allows us to code this item as “Sharing.” Lastly, data-oriented technologies with the help of improving artificial intelligence give users recommendations, reminders and tips for their activities. A university student mentioned, “I simply love when my smartwatch warns me to stand up. I feel like someone cares about me." I coded similar comments as "Coaching." Those remarks made us realize that accumulating such specifications of sports technologies under the performance expectancy is not academically satisfactory.

After the coding, I grouped the codes and created categories. Insights from in-depth interviews provided valuable information about the experience, opinions, and expectations about sports technologies. In-depth interviews helped us to create a new construct to explain better the adoption process that is not present in the relevant literature.

4.2 Context awareness instrument development

Everett Rogers (1995, p. 15) said, "It should not be assumed, as it sometimes has been in the past, that all innovations are equivalent units of analysis. This assumption is a gross oversimplification. "

Product-related variables were used in innovation diffusion studies to some extent Harmancioglu et al. (2009), but there is a gap in the literature regarding the conceptualization of the adoption and diffusion of new sports technology products. They are extraordinarily user-oriented and dynamic: they utilize users' contextual data including location, heart rate, pace, and speed. I named these features of sports technology as "Context-Aware" characteristics.

Context awareness can be defined as the understanding of where (identification of the location), when (time-awareness), what (perceiving and interpreting human activity), and why people are doing what they are doing (Dix et al., 2004). The qualitative study I held and previous literature helped us to identify and define four dimensions of context awareness by which each sports technology in our data set could be assessed which are: tracking, coaching, sharing, and gamification. These four characteristics are not mutually exclusive; one sports technology may possess multiple elements; technological advancements encourage extensive use of all four attributes.

4.2.1 Context awareness

As it will be mentioned in detail in the next chapter, in-depth interviews with sports professionals and people who regularly do sports were held in order to gain information about their motives for the use of associated sports technologies. These interviews revealed that there is a gap in the literature regarding the conceptualization of the adoption and diffusion of sports technologies. This is mainly due to the unique characteristic of sports technologies. They are extraordinarily user-oriented and dynamic. That means they need user data including location, heart rate, movement data like pace, speed, etc. to work properly. In other words, they need the context of the user to act on it. In order to fill this gap, I created a new construct, named "Context Awareness," with four dimensions: tracking, coaching, sharing, and gamification.

Definition of context is a controversial subject. Bazire and Brézillon (2005) articulated this issue and concluded that it is hard to find a relevant definition of satiating in any field. They stated that it is problematic to clarify whether context a frame for a given object or a set of elements that have any influence on the object. Furthermore, they said in psychology commonly studied a task is a person doing a task in a given situation hence which context is relevant for their study: the context of the person, the context of the task, context of the interaction or context of the situation? Even the start and end of a context is problematic as they indicated.

On the other hand, computer science literature is more explicit on the definition of context and context-awareness. Context and context-awareness have been being studied in computer science literature with the emergence of various mobile computing technologies at the beginning of the 90s. The primary purpose of those studies was to support computer usage in a different physical environment effectively (Schmidt, Beigl, & Gellersen, 1999). Advancements of microprocessors and sensor technologies boost context-aware technologies. Context awareness is defined as the understanding of where (identification of the location of a human), when (time-awareness), what (perceiving and interpreting human activity), and why people are doing what they are doing (Dix, 2009). Context-aware technologies first gather information on the user's physical, informational, social or emotional condition with the help of advanced sensor technologies. Secondly, analyze the data, either by separately or by combining it with other previously or simultaneously collected data. After that, they carry out some action based on the analysis and repeat the process from the first step with some adjustments stemmed from previous iterations (Abowd, Dey, Orr, & Brotherton, 1998). In other words, context-aware technologies try to use data of a user's physical, social, informational and emotional situation as input to adjust the performance of their analytical outcomes.

Based on our analysis, I identified four dimensions of context-awareness in sports technologies: tracking, coaching, sharing, and gamification.

4.2.1.1 Tracking

Sports technologies use context-aware computing mainly to collect data on an individual's location, heart rate, pace, and speed. Some other sport-specific technologies try to collect different data that is needed for that specific sport. Cycling computers collect cadence data and altitude, which are critical for cyclist performance. New generation smart watches and wristbands try to understand the style of the swimmer via stroke recognition. Diving watches and computers are also widely used among divers because of the safety issues it is almost compulsory for diving activities. Diving sports technologies mainly provide depth data that is critical for mandatory decompression stops. Basically data is vital for sports performance. In one of the in-depth interviews, an amateur triathlon sportsman indicated, "Without data how can I measure my performance? That is why I need these gears in my sports activities." Hence, tracking of essential data for sports activities is the main features of sports technologies.

Most of those technologies use ubiquitous computing. Ubiquitous computing often confused or restricted to mobile computing but it is more. Mobile computing and intelligent environments are two pillars of ubiquitous computing when they are used together; ubiquitous computing is comprehended (Yoon & Kim, 2007). Users need to see the processed information, not the raw data that is why intelligent systems are necessary for the process. Graphs, charts and other visual representations are used in sports technologies for users to see the data easily while they are doing activities.

Hence I defined the context-aware tracking as the ability of sports technology to track one or more following features: heart rate, distance, pace, speed, style, altitude, and depth, etc. for sports activities and provide instantaneous access to these data for user to follow.

4.2.1.2 Coaching

It is important to do sports activities correctly; otherwise severe injuries and health problems might occur. Experts like trainers, coaches, and physiotherapist help people to adjust and correct their exercise execution, prevent injuries and health threats. Furthermore, they give feedbacks, motivate people and improve their overall exercise and training performance. As a matter of fact, the individual they are assisting determines their roles. Their motives are preventing injuries and possible health threats if they see one. Then they are more performance oriented if they see the potential with the patient or the customer. They help to improve joint mobility if the problem is an inability to move the desired extremities of the body. They are acting more like a motivator if the athlete is in need of motivation. Hence they are shifting their roles depending on the context.

There are many problems with working with an expert. First, they are costly if the assistance is frequently needed such as twice a week or three times a week. Second, their availability is not always aligned with yours; hence arrangements may be problematic. Last but not least, they are not available anytime anywhere you exercise because they are human. Development of sports technologies as it is defined in this study’s context has made it possible for people to carry their coach anytime anywhere. Most of the sports technologies have the ability to provide feedback to the user, give reminders regarding their activities, and motivate them to reach their goals as coaches and trainers do. One might argue they are not replacements of real trainers or coaches but increasing artificial intelligence capabilities of the software and continuous advancements in hardware as Gordon Earle Moore predicted might close the gap in the future (G. E. Moore, 1965). The recent launch of Apple watches series 4 is an excellent example of how these technologies evolve so quickly.

Hence, I defined the context-aware coaching as the ability of sports technology to have one or more of the following characteristics: activity suggestions, stand up reminders, move notifications, nutritional notifications, motivational reminders and feedbacks based on your goals.

4.2.1.3 Sharing

Why do we share? The question is bothering many minds. Berger (2013) termed social currency as one of the reasons for people to share. Social currency is used for attaining positive impressions among friends, families, and colleagues. Berger said "Most people would rather look smart than dumb, rich than poor, and cool than geeky. Just like the clothes we wear and the cars we drive, what we talk about influences how others see us." In this case, people want to show their sports activity to others and be seen as fit and healthy. He also said emotions are important for us to share; in other words, "When we care, we share." Some emotions increase our desire to share some others not. (Berger, 2016) Sports activities are mostly challenging and fun; both feelings increase our instinctive desire to share. When we achieve something hard, we want to show this to our social circle to prove we can do it. Also, when we enjoy something again, we want to share this to people around us because it will generate a shared memory.

Many sports technologies allow sharing user's activity information as well as follow other friends' activities. Sharing is not only sharing of activity data but also a user can share an event, create a challenge or plan an event with a friend in some technologies. Sharing of accomplishments, earned badges and rewards is also common among this kind of technologies. Sports technology users share those activities and other things without an effort, technology itself share the information based on the context of the user with related parties in a periodical manner. In other words, you do not need to share every time you earn a badge; it automatically notifies others.

Many sports activities are team activities. Teams are small communities whose members' numbers are changing between 11 and 30 including substitute players, coaches and support staff. Other individual sports like running, cycling, etc. also increasingly done by together in community environments. The community has been found to be an important factor on perceived usefulness in adoption behavior (Koch & Toker, 2011). Major brands are creating events to create communities (Nike+ Run Club, Adidas Park Run) around those sports activities to provide a sense of community. Sense of community is defined as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (Mcmillan & Chavis, 1986). As it is seen from the definition to become a community, members should share many feelings and faith. Sense of community theory proposed four dimensions that a community must have; membership, influence, integration, and fulfillment of needs; and shared an emotional connection. In this study, shared emotional connection is the most important characteristics of community theory. Team or community members want to share their activities with each other tribute to that shared emotional connection. Also sharing of the activity will strengthen the community feeling because the activity itself is the community's core feature.

Sharing behavior depends on the person and the activity itself sometimes. One of the interviewees stated that he is not sharing his activity when he is diving because diving itself is a group activity and you already shared the experience with your friends. However, he still indicated that he is using his diving app to keep his diving records. That later comments also an indication of activity sharing. In fact, interviewee displays his activity info to other people who are not present in the activity site and diving community worldwide as a proof of his diving. Qualitative evidence showed that sharing is an important factor in the adoption and diffusion of sports technologies, but it has not been empirically tested yet. Hence, in this study, I defined the context-aware sharing as features that allow you to share your activity data with other people, keep track of your friends' activities and data, communicate with others, create chat groups, and set up joint activities with your friends.

4.2.1.4 Gamification

Perceived usefulness and relative advantage constructs were dominant in previous acceptance studies for explaining usage behavior of innovations. Both constructs are representing the benefits of using a particular innovation to become better in the desired situation, work or activity. Holbrook and Hirschman (1982) stated that Bettman's (1979) commonly used the "information processing model" explains consumption activities that are done with logical and rational decisions. However, they elaborated that not all consumption activities are done with logical, rational decisions but also some of are done with a steady flow of fantasies, feelings, and fun. They proposed a model called “experiential view” for consumption activities that are done with a mainly subjective state of consciousness. Various symbolic meanings, hedonic responses, and esthetic criteria affect the consumption decision in the “experiential view.” As it is mentioned above, UTAUT2 model also uses hedonic motivation also known as perceived enjoyment in other studies as a predictor of usage intention (Venkatesh et al., 2012).

Sports technologies have some characteristics such as progress bars, virtual badges, virtual awards, and the opportunity to create challenges with friends. Those characteristics are not used only for perceived enjoyment. They meant something more. They are used for helping people to achieve their goals, motivate them to stay on track. User experience and user interface designs are arranged to create those characteristics. As it is stated earlier, the behavior of one of the interviewees who sometimes walks in his home to close his rings since he does not want to stay behind his friend who lives in the USA is merely illustrating the power of gamification with user experience tool and challenge motivation. Hence, in this study, I used “Gamification” instead of hedonic motivation to cover such perceived characteristics of sports technologies.

Burke (2014) discussed that there is no single gamification definition accepted by the majority. However, he favors the Gartner Inc.’s definition of “the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals.” This definition is comprehensive and applicable to this study. According to Burke (2014), the critical elements in the definition are game mechanics, experience design, digital engagement, motivation, and goal achievement. Game mechanics explains the usage of components such as points, badges, and leaderboards that are usual for every game. Many sports technologies include those elements and more. Storyline, game experience, and game environment represent the experience design. In other words, the gamified elements make you feel like you are in a game process. The whole process digitally engages you to the technology you interact with such as smartphones, wearables or other digital devices. The purpose of gamification is to motivate people to alter their behaviors or develop skills such as they achieve their goals.

Hereafter, features those allow you to earn points and badges from your activities, point tables and ability to create a competitive environment with your friends or other people for your activities will be known as gamification.

4.2.2. Validity and reliability checks

I created 16 scale items to measure the context awareness capabilities to enhance the understanding of usage drivers behind sports technologies. Content adequacy assessment with judges was carried out, and the validity and reliability of the scale items were evaluated based on the related literature (Hinkin et al., 1997). To evaluate the four context-aware characteristics, I surveyed seven academic experts in marketing, economics and information systems. I asked them to assign each survey item to the most suitable characteristics according to their judgment. One of the items had a high rate of conflict, at 60%, and because of that dropped from the study. Every other item-specific average indicated that at least 6 of the seven judges agreed that the expected classifications were applicable, with an average agreement of 90%.

Following this procedure, 16 survey items were used to measure context-aware characteristics.

The survey items used in each context-aware characteristics are listed in Table 4. Face validity of the items is assured by the judges. Exploratory factor analysis is conducted to calculate validity scores of the items and constructs. Table 5 presents the correlated uniqueness measures (Campbell & Fiske, 1959) assessing discriminant validity of the context-aware characteristics classification. All of the cross-correlations, presented at the left-hand side of the table, are less than .07 which means that there is no significant shared variance between the factors (Hair, Black, Babin, & Anderson, 2010). The average factor loadings (path coefficients) for each context-aware characteristics are reported on the right-hand side of Table 4. Higher factor loadings indicate better convergent validity (Liaukonyte, Teixeira, & Wilbur, 2014). All average factor loadings are quite high that shows excellent convergent validity.

Lastly, I check the reliability score of each context-aware characteristics. Reliability scores indicate the consistency of the errors and variance in a single factor. If there is an error term that is not related to the construct, then the reliability score is lower. I used Cronbach's alpha to compute the reliability of each factor. Cronbach's alpha score is between 0 and 1. Cronbach's alpha should be higher than 0.7 to show the reliability of the construct. A higher score means a more reliable construct. Factors with higher items tend to have a high reliability score. While some certain items like “Actual Usage” have two items, each factor should have at least three items to grant acceptable reliability. (Gaskin, 2018; Hair et al., 2010). Reliability scores for each context-aware factor are presented in Table 6.

Table 4. Context-Aware Characteristics Survey Items

Characteristic	Items
Tracking	My sports technology tracks my performances in my activities and shows me. My sports technology measures the activity data that I need (pulse, distance, depth, speed, pace, cadence, etc.). The data measured by my sports technology is current enough to meet my needs in my activities. My sports technology presents the measured data in a format that I can easily understand.
Sharing	I think my sports technology has enough capabilities to allow me to follow my friends' activities. My sports technology allows me to share information about my activities with my friends. I think that my sports technology has enough social features (sharing, following, etc.) that use my activity information. There are enough features (group chat, activity planning, etc.) that I can communicate with my friends in my sports technology.
Coaching	My sports technology provides useful tips and advice for my activities. My sports technology coaches me to do my activities. I am motivated by my sports technology to perform my activities. My sports technology helps me reach my goals.
Gamification	My sports technology has gamification features (virtual badges, scoreboard, prizes, etc.) related to my activities. My sports technology allows me to reach my goals in a fun way. I think my sports technology has some features that enable me to compete with my friends. I think there are some features in my sports technology that make me feel like I am playing games.

Table 5. Correlations across Context-Aware Characteristics

	Correlations across Context-Aware Characteristics				
	Tracking	Coaching	Sharing	Gamification	Average Factor Loadings
Tracking	1				0.795
Coaching	0.486	1			0.798
Sharing	0.525	0.491	1		0.715
Gamification	0.431	0.591	0.567	1	0.727

Table 6. Reliability Statistics for Context-Aware Characteristics

	Reliability Statistics	
	Cronbach's Alpha	N of Items
Tracking	0.847	4
Coaching	0.866	4
Sharing	0.867	4
Gamification	0.877	4

CHAPTER 5

CONCEPTUAL FRAMEWORK AND HYPOTHESIS

5.1 Context aware characteristics and perceived innovation characteristics

5.1.1. Tracking

Tracking is the main context-aware characteristics of sports technologies. The user often thinks that the only advantage of sports technologies is tracking ability. Other context-aware technologies are also using the data that is provided by tracking capability of the technologies.

The following hypotheses concerning the context-aware tracking will be confirmed if mentioned perceived innovation characteristics can be explained through the context-aware tracking:

H1: Tracking has a positive impact on perceived performance expectancy of a sports technology.

H2: Tracking has a positive impact on perceived effort expectancy of a sports technology.

H3: Tracking has a positive impact on the perceived hedonic motivation of using a sports technology.

H4: Habit mediates the relationship between tracking and intention to use of a sports technology.

5.1.2. Coaching

The main functionality of most of the sports technologies is giving feedbacks, activity suggestions, stand up reminders, move notifications, nutritional notifications, motivational reminders and feedbacks based on user goals. Some of the devices automatically detect the activity and the type of activity of the user. Some technologies even detect the swimming style and analyze users' swing speed in tennis (Apple, 2018b).

There are several studies in the literature showing that sports technologies are good coaches in a variety of sports activities from Golf (Ghasemzadeh, Loseu, & Jafari, 2009) to Fitness (Novatchkov & Baca, 2013).

The following hypotheses concerning the context-aware coaching will be confirmed if mentioned perceived innovation characteristics can actually be explained through the context-aware coaching:

H5: Coaching has a positive impact on perceived performance expectancy of a sports technology.

H6: Coaching has a positive impact on the perceived hedonic motivation of a using sports technology.

H7: Coaching has a positive impact on perceived habitual use of a sports technology.

5.1.3. Sharing

One of the interviewee in our qualitative study, who lost almost 30 kg after using his Fitbit wrist band, stated that observing his friends achieving their goals motivate him to accomplish his goals too. That sharing behavior provides him a sustainable motivation tool. He enjoys to challenge and to be challenged by his friends via his sports technology. There are several constructs like subjective norm (Fishbein & Ajzen, 1975), image (G. Moore & Benbasat, 1991), social factors (Thompson, Higgins, & Howell, 1991) and social influence (Venkatesh et al., 2003, 2012) in the technology acceptance and innovation diffusion literature. All of them mainly focus on how other people in the community affect the users' perception of technology adoption. I focused on the other side of social interaction: sharing. I think that sharing features of the sports technologies positively affect social influence hence behavioral intention to use.

The following hypotheses concerning the context-aware sharing will be confirmed if perceived habitual use and social influence can actually be explained through the context-aware sharing:

H8: Sharing has a positive impact on the perceived social influence of a sports technology.

5.1.4. Gamification

Previous studies mostly focus on the perceived usefulness (Fred D. Davis, 1989) and perceived relative advantage (Venkatesh et al., 2003, 2012) of the technologies. I am articulating that characteristics that create a relative advantage for the users are different for each technology. As Holbrook and Hirschman (1982) criticized Bettman's (1979) "information processing model" that favors logical and rational decisions on user behavior, I suggest that gamification features of sports technologies are strong determinants of adoption behavior.

The following hypotheses concerning the context-aware gamification will be confirmed if perceived habitual use and hedonic motivation can be explained through our analysis:

H9: Gamification has a positive impact on perceived performance expectancy of a sports technology.

H10: Gamification has a positive impact on the effort expectancy of a sports technology.

H11: Gamification has a positive impact on perceived social influence of a sports technology.

H12: Gamification has a positive impact on perceived habitual use of a sports technology.

H13: Gamification has a positive impact on the perceived hedonic motivation of using sports technology.

5.2 Perceived innovation characteristics and intention to use

Moore and Benbasat (1991) designed an instrument for measuring users' perceptions of the innovation based on Rogers' (1962) perceived innovation characteristics: relative advantage, compatibility, complexity, trialability, and observability, and they added two more characteristics: image and voluntariness of use.

Davis's (1986) the famous Technology Acceptance Model (TAM) postulated that a prospective user's overall attitude regarding using a given system is a vital element on actual system use. Later studies attempt to extend the original TAM model with different external variables such as perceived health-related outcomes of sports technologies (Lunney et al., 2016), technology readiness of the users (T. Kim

& Chiu, 2019) and other psychological determinants including affective quality, mobility and availability (K. J. Kim & Shin, 2016).

Venkatesh et al. (2003) tried to unify theories that are in diffusion and acceptance studies. They framed a unified model that integrates essential components of eight well-known models in the literature, which is named as “Unified Theory of Acceptance and Use of Technology (UTAUT)” (Venkatesh & Davis, 2000; Venkatesh et al., 2003). Performance expectancy, effort expectancy, social influence, and facilitating conditions components in the UTAUT model are relatively analogous to the TAM in a manner that external variables influence behavioral intention and this, in turn, leads to usage. In 2012, UTAUT2 model was proposed to adopt the changing technology features of innovations (Venkatesh et al., 2012). The foundation of the UTAUT2 is the same as the original UTAUT, with the addition of three more influential variables: hedonic motivation, price value, and habit. There are several studies in the literature that used different constructs from the UTAUT model to explain the adoption of sports technologies. Wu et al. (2016), used a combination of the TAM, innovation diffusion theory, and the UTAUT to explain smartwatch adoption. They found that attitude is a significant mediator and ease of use is not a significant construct in the model, which were contradictory results when compared with the previous studies. Reyes-Mercado (2018) used the UTAUT model and compared adopters and non-adopters’ adoption behavior with the PLS technique. He found that performance expectancy and effort expectancy have significant direct effects on use and intention to use for adopters; whereas non-adopters track different paths to intention to use over performance expectancy, effort expectancy or facilitating conditions.

Previously mentioned studies tried to build a generalized adoption model whereas (Canhoto & Arp, 2017) in their qualitative research studied the characteristics of the device, the context, and the user for the adoption and the continued use of sports technologies. They found that factors that are influencing adoption differ from the factors affecting continue to use. For example, the ability to collect activity data is crucial for adoption, whereas portability is important for continued use.

The following hypotheses concerning the UTAUT2 model will be confirmed if sports technology adoption can be explained through the UTAUT2 framework:

H14: Performance expectancy will have positive effects on behavioral intentions to use sports technologies.

H15: Effort expectancy will have positive effects on behavioral intentions to use sports technologies.

H16: The social influence will have positive effects on behavioral intentions to use sports technologies.

H17: Hedonic motivations will have positive effects on behavioral intentions to use sports technologies.

H18: Habit will have positive effects on behavioral intentions to use sports technologies.

H19: Behavioral intention to use of a sports technology has direct effect on actual use behavior.

Price value constructs from the UTAUT2 model is dropped from the scope of this study since our sports technology definition includes both free and paid products and apps.

5.3 Role of sports motivation as a moderator variable

There has been a great number of research conducted on motivation in sports to understand the motives behind continuing or quitting sports participation (L.G. Pelletier et al., 1995; Luc G. Pelletier et al., 2013). Scholars studied sports motivation in using the Self-Determination Theory (SDT) as a foundation (Ryan & Deci, 2000). The SDT hypothesized competence, autonomy, and relatedness as three inherent psychological needs which when fulfilled generate improved self-motivation and mental health and when dissatisfied lead to weakened motivation and well-being. Pelletier et al. (1995) adapted the SDT to the sports environment and created the Sports Motivation Scale (SMS). Later in 2013, they revised it together with the original SDT scholars and proposed a better scale, SMS II (Luc G. Pelletier et al., 2013).

Segar (2017) argued that fitness trackers were not enough for sustainable motivation if they used alone. She noted that for some users, fitness trackers might even reduce the motivation as doing sports becomes a chore rather than a fun activity. Lyons and Swartz (2017) also stayed cautious about only using sports technologies for motivation. They indicated that it is important to support sports technology usage with other intervention techniques. They also suggested that different sports technologies might be suitable for different lifestyles and personalities.

In line with these findings, sports motivation is included as a moderating variable in our research model.

5.4 Role of sports type as a moderating variable

Our insights from qualitative research convince us that there is a behavioral difference between people who are doing dynamic sports and non-dynamic sports. I think that there will be a significant difference between groups, especially in perceived social influence. I believe that when compared with non-dynamic sports doers, people who are doing dynamic sports are more performance oriented and less effected from social influence

In addition to the theoretical relationships among the primary constructs, each direct effect is tested for moderation by sports type, to give a more detailed assessment of the behaviors of consumers.

5.5 Preliminary research model

The purpose of this research is to understand the effects of context-aware characteristics of sports technologies on users' adoption together with sports motivation, sports type, and perceived innovation characteristics. Performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation and habit (Venkatesh et al., 2012) are used as perceived innovation characteristics, which act as a mediator between context-aware characteristics and behavioral intention to use. Sports motivation (Pelletier et al., 2013) and sports type (Mitchell et al., 2005) are also modeled as grouping variables. The conceptual research model is shown in Figure 6.

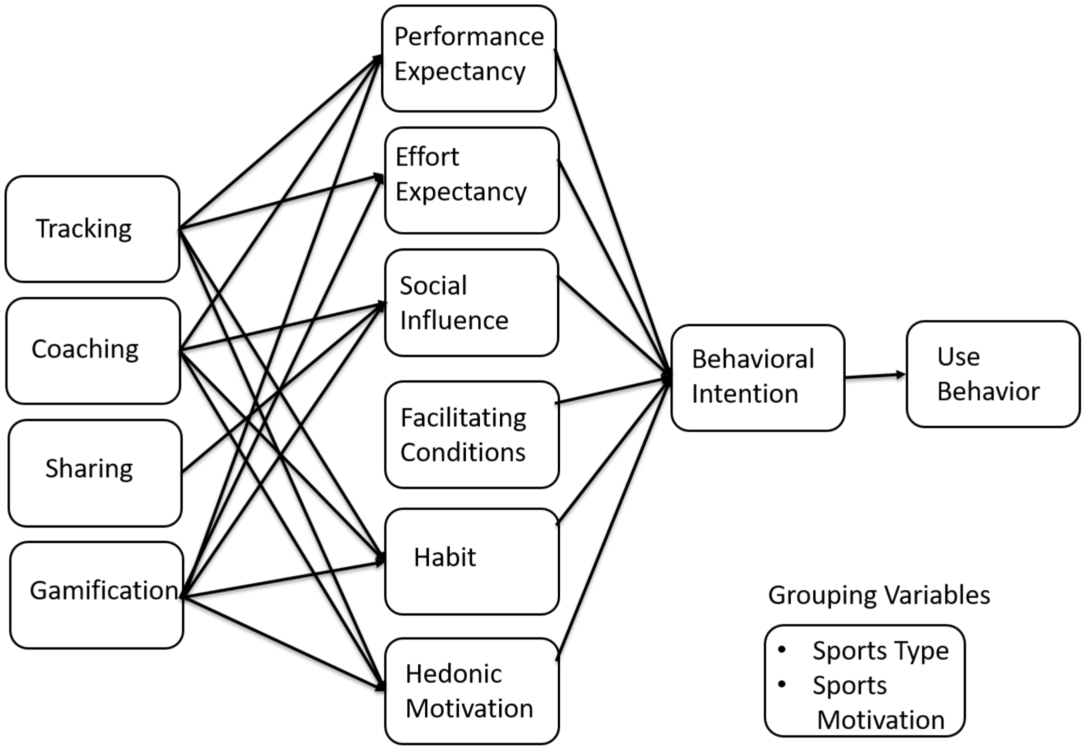

Figure 6. The preliminary research model

CHAPTER 6

RESEARCH DESIGN AND METHODOLOGY

6.1 Questionnaire design

A survey is prepared with the perceived innovation characteristics scale items from the UTAUT2 model (Venkatesh et al., 2012), second version of sports motivation scale items (SMS2) (Luc G. Pelletier et al., 2013) from the existing literature together with author-generated context awareness scale items to quantitatively measure the relationship in the conceptual model.

The 40 items in the questionnaire survey were adapted from the literature, and each item was delicately rearticulated for the sports technology context then translated to Turkish. Author-generated six teen context-aware scale items were already created in Turkish. Pre-tests and pilot tests were conducted with a sample of university students before a full-scale implementation to update any misunderstanding or inconsistencies in wording that might be stemmed from translations. There were 71 were items in the overall questionnaire including demographic and screening questions. There were demographic questions including gender, age, household income, and education. Gender was denoted with a dichotomous variable, 0 (female) and 1 (male). Age was assessed with five categories: (1) 15-18 years old, (2) 19-24 years old, (3) 25-35 years old, (4) 36-45 years old and (5) 45 or older. Household income was measured with five intervals: (1) Less than 2500 TL, (2) 2500 TL – 5000 TL, (3) 5000 TL – 7500 TL, (4) 7500 TL – 10000 TL, (5) More than 10000 TL. Education was measured with four categories

(1) Less than secondary school, (2) High school, (3) University, (4) Master degree and more.

The data collection period was 25 days, from April 1st, 2019, to April 25th, 2019. Definition of sports technologies in this study context and pictures of some relevant sports technologies were presented to survey participants. Respondents location at city and town level were collected from their mobile app. There are two screening questions: sports type performed and frequency of sports activities. People who are not doing any sports activities were not included in the sample. English version of the survey items are presented in Appendix A, and the Turkish version is presented in Appendix B.

6.2 Sampling and data collection procedures

The suggested model was empirically tested with data from participants in Turkey. The study was carried out with a heterogenous purposive sample of 600 men and women between 18-50 ages, from different income and education levels who are regularly doing sports and using sports technologies. Data was collected using a mobile platform in Turkey (Twentify) that is similar to the Amazon Mechanical Turk. Participants were notified about the survey, and they saw the amount of monetary reward they would get if they complete the survey. Participation in the survey was voluntary. The sample was including people practicing various sports types to eliminate the possibility of having a single dominant sports type in the sample, which could hinder the generalizability of our results. The survey was sent to people who are doing a relevant sports activity based on the user data of online platform. Participants were first filtered with two screening questions which were asking their sports activity participation and sports type. Based on the answer of these two questions eligible respondents were allowed to continue the rest of the survey.

The first subgroup (n=244) for sampling was people who are doing a dynamic sports activity such as running, walking, football, and the second subgroup (n=356) was people who are regularly doing a static sports activity such as yoga, pilates, weightlifting. Detailed frequency of the sports types is indicated in Table 7.

Table 7. Sports Type Frequencies

Sports Type	Dynamic Sports	Frequency	Non-dynamic Sports	Frequency
	Tenis	4	Crossfit	4
	Basketball	22	Fitness	144
	Cycling	30	Golf/Archery	4
	Football	80	Martial Arts	16
	Running	76	Pilates	38
	Swimming	20	Weightlifting	6
	Triathlon	4	Walking	138
	Volleyball	8	Yoga	6
Total		244		356

In the sample group, 130 respondents were not a user of the sports technologies but had knowledge about them. Rest of the sample were the people who use different sports technologies. A pie chart is provided in Figure 7 to illustrate the proportion of the respondents using a different kind of sports technologies. There also several detailed descriptive statistics of the overall sample at Appendix C including age, gender, income, education, usage frequency, location, socioeconomic status, sports technology usage frequency, weekly average time spent on sports technologies.

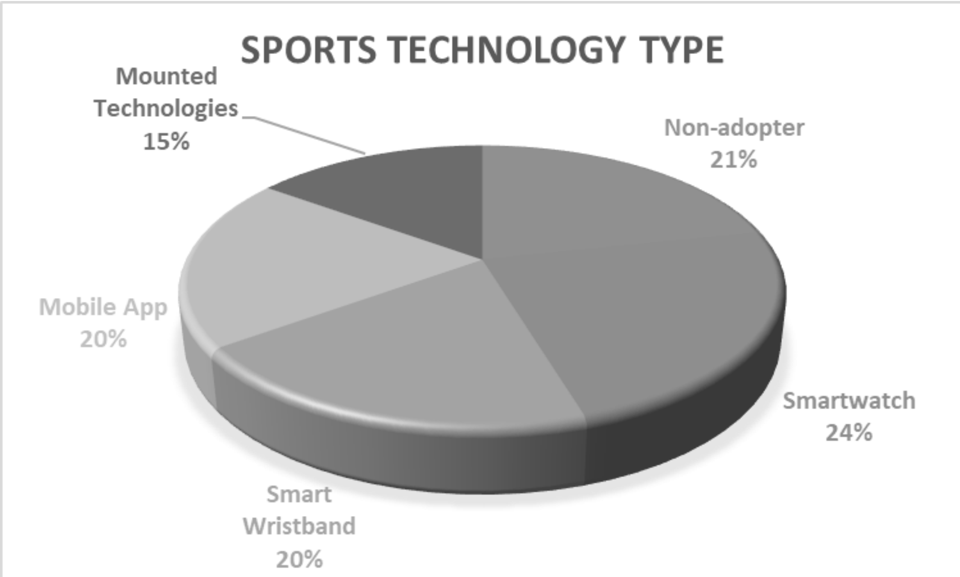

Figure 7. Sports technology types used by respondents

6.3 Methodology

Partial least squares structural equation modeling (PLS-SEM) was used for models and hypotheses testing via SmartPLS v. 3.2.8. (Ringle, Wende, & Becker, 2015). PLS-SEM method is one of the rising method adopted by information systems and marketing scholars due to its strong features for theory testing (Bentler & Huang, 2014; Hair, Hult, Ringle, & Sarstedt, 2017). PLS-SEM is used for evaluating the UTAUT model and monitoring the validity, reliability and internal consistency of the scale items in the measurement model. SmartPLS has an option named consistent PLS (PLSc) which is a modified version of regular PLS (T. Kim & Chiu, 2019; Wu et al., 2016). PLSc delivers an improvement for the path coefficients and correlations between constructs when PLS-SEM is utilized for reflective constructs. A Monte Carlo simulation study performed by Dijkstra and Henseler (2015) revealed that the bias of PLSc factor estimates is as good as the covariance-based structural equation model (CB-SEM). Furthermore, the outcomes of the same study displayed that PLSc has benefits when it is used with non-normal data. The consistent PLS is indicated as to be more suitable for theory testing. Since our study is an extended version of the UTAUT2 model, the PLSc is judged to be a proper method to test the relationship between the constructs in the model. Hair et al. (2017) articulated that if there are violations with regard to the normality of the data or minimum sample size, then PLS-SEM is better than CB-SEM.

CHAPTER 7

DATA ANALYSIS AND RESULTS

Data screening operations were performed prior to factor analysis and structural model assessment. Normality, collinearity and outlier issues were addressed in the data screening part. There was no missing data in the sample hence I did not address that. Linearity and homoscedasticity are not obligatory for the PLS-SEM analysis, and they are not investigated for the scope of the analysis. Afterward, I performed data analysis in three parts. In the first part, I conducted factor analysis, checked validity and reliability of the scale items. Based on the Hair et al. (2017) recommendations, I assessed the internal reliability of each construct, indicator reliabilities, convergent and discriminant validities. In the second part, I evaluated the structural model by checking collinearity between latent constructs, R^2 values of endogenous latent variables, and the statistical significance of path loadings. In the last part, I performed two partial least squares – multi group analysis (PLS-MGA) to look for any differences between different groups (Kim & Chiu, 2019). The first, PLS-MGA analysis was carried out to explore differences between the dynamic and non-dynamic sports groups; second PLS-MGA was implemented to investigate the differences between intrinsically motivated and extrinsically motivated people.

7.1 Data screening

7.1.1 Outliers

There was no missing data since the respondents were required to answer all questions to get the monetary reward. Obligations might create a bias and respondents might answer with extreme values to finish the questionnaire early. We conducted outlier analysis to find out if there are any extreme cases in the sample. We calculated the z-score of all items and look for the scores which are higher than ±3.29 which is the default value used by SPSS software in outlier analysis. Hair et al. (2010) suggested the cutoff point of ±4 for large samples, but we used SPSS default value of ±3.29 to be on the safe side. There were 18 items excluded from the analysis after the outlier detection and the rest of the analysis was done with 582 observations. Full z-score of the items are included in the Appendix D.

7.1.2 Collinearity and common method bias

Collinearity or multicollinearity is the phenomena that explained variance in our dependent variables, and independent variables are overlapping. It is not desired and sometimes it also evaluated as an indication of common method bias. We assess collinearity with the variance inflation factor (VIF). If VIF values are greater than 3.3, it is an indication of collinearity and common method bias at some degree (Kock, 2015). In another study, collinearity threshold is set at VIF value of 10 (O'brien, 2007). Overall, VIF value greater than 3.3 is not desired, and if it is more than 10, there is a serious collinearity problem in the model. Inner and outer VIF values are listed in Appendix E. Results indicated that there is not a problem on collinearity in our model.

Common method bias is also assessed by Harman’s single factor test. Variance explained by a single factor is expected to be less than 50% (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). All items were forced into a single item and variance explained by this single item was compared to cut off point. The single factor was responsible for the 37.3% of total variance in the overall model and it is in the acceptable limit.

7.1.3 Normality

Normality is not required for PLS-SEM analysis. Hair et al. (2017) indicated that normal distributions are wanted when working covariance-based SEM; however, since PLS-SEM is a nonparametric statistical approach, it normally dictates no assumption about the normal data distribution. Nonetheless, it is suggested to prove that data is not exceedingly non-normal since extreme non-normal data could be problematic in the evaluation of statistical significance. Extreme non-normal data can distort the standard errors acquired from bootstrapping that can decrease the chance of some relationships to be calculated as significant (Dijkstra & Henseler, 2015; Hair et al., 2017). The Kolmogorov-Smirnov and Shapiro-Wilks tests are devised to assess normality by comparing the data with a normally distributed data that has the same mean and standard deviation with the sample data. It is generally done by grouping the original sample with age or other used demographic variables. It is suggested that both test methods are not enough to test whether the data is extremely non-normal or not since both methods only point out if the null hypothesis or normal distribution should be rejected or not. This approach would be limited to understand if the data is highly non-normal. That is why researchers are advised to look at the skewness and kurtosis. Skewness indicates the degree of distribution’s symmetry and kurtosis shows whether the distribution is mostly at the center or not. Desirable values for both measures are around zero; however, values much less than -1 or much greater than +1 might indicate extreme non-normality (Hair et al., 2010, 2017). In this study, extreme non-normality was not seen in the sample. Detailed normal distribution values were presented in Appendix F.

7.2 Exploratory factor analysis

Exploratory factor analysis is a good method to reduce dimension before theory testing (Reio & Shuck, 2015). We used principal component analysis extraction method and Promax rotation with Kaiser normalization. There were seven iterations for a rotation to be converged. Exploratory factor analysis results were displayed in Appendix G.

Two items of facilitating conditions load on effort expectancy hence dropped from the construct. There were two items remained for facilitating conditions and one of them has a loading score of 0.458 which is less than the suggested level of 0.5. We keep the facilitating conditions items to further test with the confirmatory factor analysis, reliability, and validity test before dropping out from the overall model. Rest of the constructs was shows high loading scores.

7.3 Confirmatory factor analysis

Exploratory factor analysis is an investigative method and most of the time researchers have knowledge of how many factors would be obtained after the analysis. Even SPSS used an option that enables researchers to enter the number of factors before analysis. On the other hand, the confirmatory factor analysis permits testing and verifying the indicators of a reflective factor (Hair et al., 2010, 2017; Sarstedt & Mooi, 2014). Figure 8 shows the visual diagram of the structural model. Bootstrapping analysis with factor option was held for confirmatory factor analysis in SmartPLS software. Reliability and validity score of each item in the model, as well as interaction with the constructs, were assessed with confirmatory factor analysis.

7.3.1 Model fit

Model fit measures are not suitable for PLS-SEM analysis since most of the model fit measures are calculated based on the covariance matrix. As it is mentioned earlier, PLS-SEM is variance-based method. Still, some of the researchers find it useful to mention model fit criteria for PLS-SEM. SmartPLS software calculates some of the model fit measures including SRMR, NFI, d_ULS, d_G, and Chi-Square. The threshold for SRMR is reported to be below 0.8 and NFI is expected to be greater than 0.9. Rest of the model fit criteria is not commonly used among researchers and need further clarification to be used as model fit indicators (Gaskin, 2018; Ringle et al., 2015). SRMR value of the estimated model is in the desired range. NFI is less than expected but it is close to cut off point.

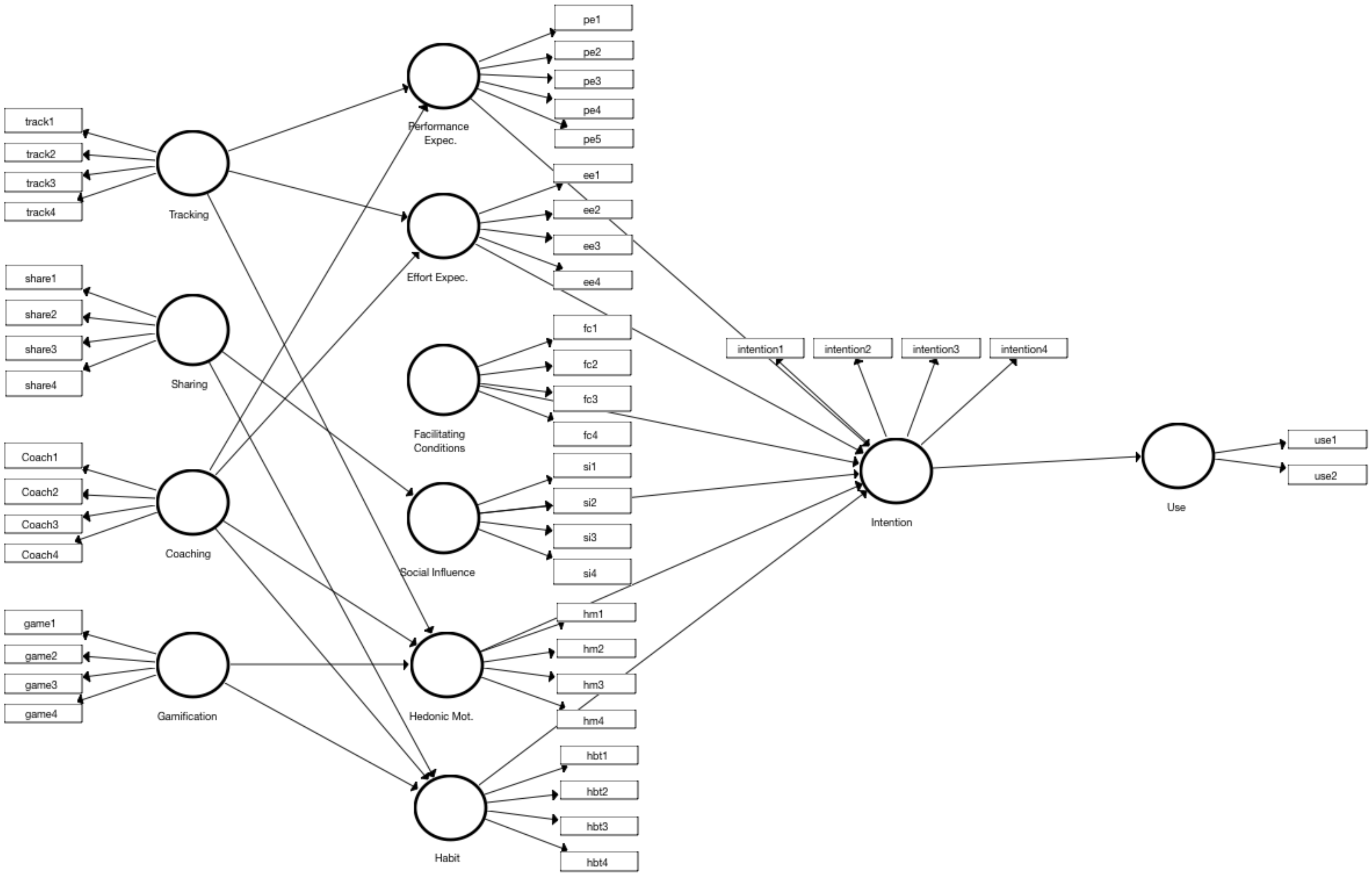

Figure 8. Structural model

Table 8. Model Fit Measure of Factor Model

	Saturated Model	Estimated Model
SRMR	0.043	0.078
d_ULS	1.952	6.279
d_G	0.876	1.100
Chi-Square	2,635.267	3,197.664
NFI	0.854	0.823

7.3.2 Internal reliabilities

I evaluated Cronbach's alpha scores for each latent construct in the model to assess internal reliabilities. Suggested Cronbach's alpha score to judge the reliability of the constructs is 0.8. All items except facilitating conditions (0.726) and tracking (0.781) are well over 0.8. I addressed these problems by looking at the loadings of the scale items to each construct. There are four facilitating conditions scale items, and all of them were below the 0.7 threshold level. I did not do anything about the reliability of the facilitating conditions and looked at the other analysis. I suspected that there could be more problems with this latent variable and investigated the discriminant validity before making any decision. There are also four tracking scale items, and I only delete the item with the low loading since its Cronbach's alpha score is not so much below the acceptable level. New Cronbach's alpha score of tracking was 0.8, which is acceptable. Cronbach's alpha and Rho_A values are in Appendix D.

7.3.3 Convergent validity

There are three criteria that should be met to confirm convergent validity: factor loadings should be higher than 0.5 (Bagozzi & Yi, 1988), the AVE score of every construct in the model should be higher than 0.5, and composite reliability of all constructs should be greater than 0.7 (Bagozzi & Yi, 2012; Fornell & Larcker, 1981; Shook, Ketchen, Hult, & Kacmar, 2004; Wu et al., 2016). The detailed scores of each item are listed in the Appendix D table. The AVE score of facilitating conditions is 0.405, much below the acceptable limit. Rest of the items in the model are showing great performance in terms of convergent validity.

7.3.4 Discriminant validity

There are two ways of validating discriminant validity: square root of AVE values should be greater than the R square values, or item loadings of a construct should be greater than the cross-loadings of items of other constructs (Fornell & Larcker, 1981). There are problems with facilitating conditions' cross-loadings such that they have high cross-loadings with several other factors like effort expectancy and gamification. I also looked at the Heterotrait-Monotrait Ratio (HTMT) for constructs, and they are all below the one, which is the acceptable limit. Discriminant validity scores of the items are presented in Appendix D.

Facilitating condition has obtained good measures neither from exploratory tests nor confirmatory analysis. Its cross-loadings with other factors were also above suggested cut off values. Hence I decided to take this construct out of our model and continue with a revised model that is presented in Figure 9.

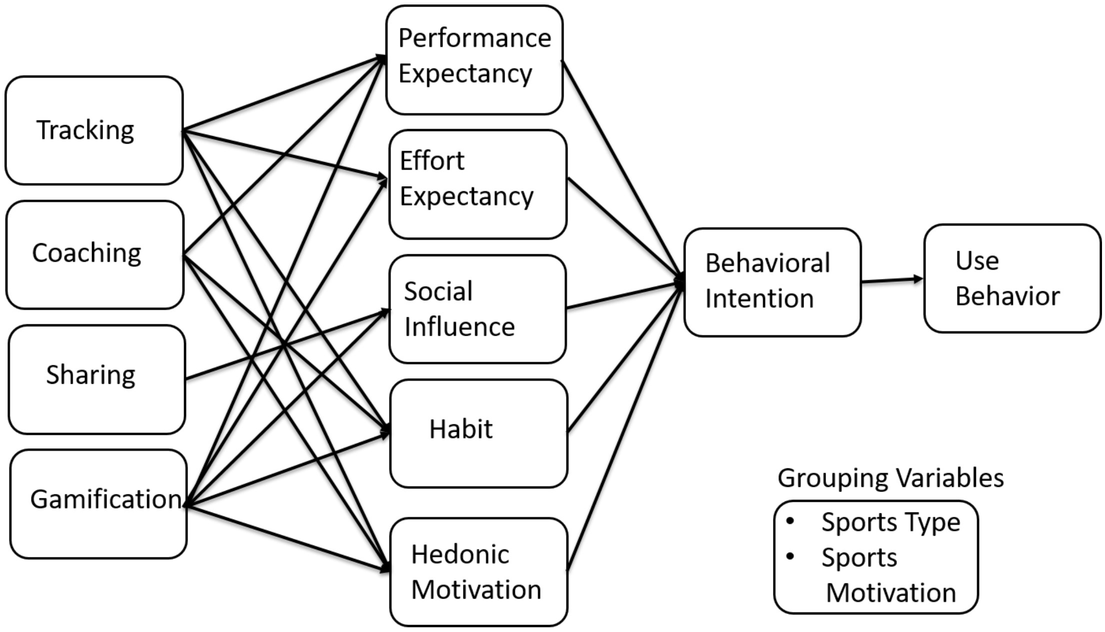

Figure 9. Final model after data screening and factor analysis

7.4 Structural model assessment and hypothesis testing

I tested our causal model with PLS-SEM after the reliability and validity results were proven to be in the acceptable range. I used PLS bootstrapping procedure with 1,000 subsamples and 95% confidence interval level to indicate that hypotheses are supported which means in any relationship t-statistics should be greater than 1.96 or p-value should be less than 0.05. I looked at the direct relationships in the first step. Afterward, mediation and moderation effects were also calculated. Results of the direct effects are listed in Table 9. All direct hypotheses were supported except social intention effect on intention. I summarize the results of the hypotheses in Table 10 to better present the analysis outcomes.

The latest model after reliability and validity corrections had an improved model fit values including a better SRMR and NFI. Table 11 presents the model fit assessments.

Table 9. Path Coefficients and P-values of Hypothesized Relationships

	Path Coefficients	P Values
tracking -> effort	0.502	0.000
tracking -> habit	0.216	0.000
tracking -> hedonic	0.336	0.000
tracking -> performance	0.313	0.000
coaching -> habit	0.175	0.004
coaching -> hedonic	0.192	0.000
coaching -> performance	0.290	0.000
coaching -> social	0.100	0.045
sharing -> social	0.315	0.000
gamification -> effort	0.205	0.000
gamification -> habit	0.339	0.000
gamification -> hedonic	0.259	0.000
gamification -> performance	0.223	0.000
gamification -> social	0.292	0.000
performance -> intention	0.150	0.013
effort -> intention	0.184	0.000
social -> intention	0.045	0.253
habit -> intention	0.259	0.000
hedonic -> intention	0.153	0.011
intention -> use	0.290	0.000

Table 10. Hypotheses Testing Summary

No	Hypotheses	Results
H1	Tracking has a positive impact on perceived performance expectancy of a sports technology.	Supported
H2	Tracking has a positive impact on perceived effort expectancy of a sports technology.	Supported
H3	Tracking has a positive impact on the perceived hedonic motivation of using a sports technology.	Supported
H4	Habit mediates the relationship between tracking and intention to use sports technology.	Supported
H5	Coaching has a positive impact on perceived performance expectancy of a sports technology.	Supported
H6	Coaching has a positive impact on the perceived hedonic motivation of a using sports technology.	Supported
H7	Coaching has a positive impact on perceived habitual use of a sports technology.	Supported
H8	Sharing has a positive impact on the perceived social influence of sports technology.	Supported
H9	Gamification has a positive impact on perceived performance expectancy of a sports technology.	Supported
H10	Gamification has a positive impact on the effort expectancy of a sports technology.	Supported
H11	Gamification has a positive impact on perceived social influence of a sports technology.	Supported
H12	Gamification has a positive impact on perceived habitual use of a sports technology.	Supported
H13	Gamification has a positive impact on the perceived hedonic motivation of using sports technology.	Supported
H14	Performance expectancy will have positive effects on behavioral intentions to use sports technologies.	Supported
H15	Effort expectancy will have positive effects on behavioral intentions to use sports technologies.	Supported
H16	The social influence will have positive effects on behavioral intentions to use sports technologies.	Not Supported
H17	Hedonic motivations will have positive effects on behavioral intentions to use sports technologies.	Supported
H18	Habit will have positive effects on behavioral intentions to use sports technologies.	Supported
H19	Behavioral intention to use of a sports technology has a direct effect on actual use behavior.	Supported

Table 11. Model Fit Measures of the Research Model

	Saturated Model	Estimated Model
SRMR	0.045	0.068
d_ULS	1.708	3.938
d_G	0.801	0.936
Chi-Square	2,377.141	2,721.992
NFI	0.852	0.830

7.4.1 Moderation effects

I performed a partial least square-multi group analysis (PLS-MGA) to control whether or not any path loadings difference exists between groups. PLS-MGA is used for comparing each group's statistical scores with the other one for the same parameter. Comparing different groups gives valuable insights into different group's behaviors, and it is advantageous both academically and practically (Hair et al., 2010; Ringle et al., 2015). According to PLS-MGA analysis, if the p-values of path estimates differences are higher than 0.95 or lower than 0.05, it means there is a statistically significant difference between groups (Dijkstra & Henseler, 2015).

7.4.1.1 Sport motivation

Coaching effect on habit was not significant for extrinsically motivated people whereas it was found to be significant for intrinsically motivated people. On the other hand, the coaching effect on hedonic motivation and gamification effect on performance expectancy was found to be significant for extrinsically motivated people but not for the intrinsically motivated people. Effort expectancy, hedonic motivation, social influence, and performance expectancy effects on intention to use path coefficients were found to be significant for extrinsically motivated people but not for intrinsically motivated people. Table 12 shows the path coefficients and p-values of the two groups. However, PLS-MGA analysis could not find any statistically significant difference between subject groups according to its methodology.

Table 12. Moderation Effect of Sports Motivation

	Extrinsic		Intrinsic	
	Path Coefficients	p-Values	Path Coefficients	p-Values
coaching -> habit	0.132	0.128	0.209	0.007
coaching -> hedonic	0.266	0.000	0.097	0.245
effort -> intention	0.163	0.012	0.142	0.062
gamification -> performance	0.312	0.000	0.142	0.061
hedonic -> intention	0.174	0.021	0.087	0.314
performance -> intention	0.169	0.013	0.071	0.485
social -> intention	0.140	0.047	0.005	0.933

7.4.1.2 Sports type

Effort expectancy effect on intention was found to be significant for people who are doing a dynamic sports activity whereas, for the non-dynamics sports people it was found to be not significant. Similarly, gamification had a positive significant direct effect on habit; but the relationship was not significant for non-dynamic sports doers. On the other hand, the habit effect on the intention to use was found to be significant for non-dynamic sports people but not for dynamic ones. Table 13 shows the path coefficients and p-values of the two groups. However, PLS-MGA analysis could not find any statistically significant difference between subject groups according to its methodology.

Table 13. Moderation Effect of Sports Type

	Dynamic		Non-dynamic	
	Path Coefficients	p-Values	Path Coefficients	p-Values
Effort Expec. -> Intention	0.252	0.021	0.032	0.775
Gamification -> Habit	0.312	0.006	0.139	0.241
Habit -> Intention	0.118	0.182	0.415	0.008

CHAPTER 8

DISCUSSION OF RESULTS

This study focused on sports technologies because of their state of the art features. Sports technologies are using users' dynamic states as the input of their algorithms supported by artificial intelligence and provide valuable outcomes. Our aim was providing empirical evidence that existing technology acceptance literature can be improved to explain context-aware technologies. Our results showed that context-aware characteristics explain the drivers behind UTAUT2 constructs. Sports motivation and sports type are also moderate the certain relationships in the model.

8.1 Perceived innovation characteristics and behavioral intention to use

Performance expectancy or relative advantage constructs constitute the majority of explanation power in previous acceptance models (Fred D. Davis, 1989; Venkatesh et al., 2003). Reyes-Mercado (2018) also found that performance expectancy significantly loads to behavioral intention to use of fitness wearable. On the other hand, Wu et al. (2016) indicated that relative advantage affects attitude towards using smartwatch, but it didn't significantly affect behavioral intention to use. Our findings showed that performance expectancy is still one of the important factors for behavioral intention to use a sports technology.

Facilitating conditions were problematic in factor analysis; hence I dropped it from the model. Literature also indicated that compatibility or facilitating conditions constructs are more suitable for the company level technology adoption process (Venkatesh et al., 2012). Wu et al. (2016) also shared that compatibility was not found to be significant antecedents of intention to use. Reyes-Mercado (2018) found that facilitating conditions had an effect on the intention to use for non-adopters of the fitness trackers; whereas it had a direct effect on actual use behavior for adopters of the technology.

Ease of use or effort expectancy found to be not a significant indicator of intention to use in Wu et al. (2016) study and authors argued that this was mainly because ease of is a firm level acceptance construct. Reyes-Mercado (2018) and (Kim & Shin, 2016) found that effort expectancy and ease of use had a direct positive effect on the intention to use. Our study is also consistent with the later studies, and our findings also revealed that effort expectancy is an important construct to explain intention to use of a sports technology.

As Lunney et al. (2016) suggested, I looked at the relationship between habit and intention to use and found that there is a significant relationship between them. Habit is especially important for intrinsically motivated, dynamic sports doers.

Canhoto and Arp (2017) indicated that hedonic features of a sports technology are important for the user. Our findings also supported their claim. I found that there is a direct positive relationship between hedonic motivation and behavioral intention to use.

All our hypotheses were supported, but social influence effect on behavioral intention to use did not. The relationship between social influence and the behavioral intention to use was also found to be not significant in Reyes-Mercado (2018) study. Reyes-Mercado stated that while quantitative data did not support the significance of the relationship between social influence and behavioral intention to use; his qualitative study supported that social influence is the significant antecedent of behavioral intention for a 26 percent of the people in his sample. I also believe that social influence items may not be working in different cultures. Reyes-Mercado (2018) collected data in Mexico, and I collected data in Turkey; whereas Wu et al. (2016) collected data in Taiwan. Social influence was not supported in two former countries, but it was supported in the latter country. Interestingly, later study indicates that there is a negative relationship between social influence and intention to use.

8.2 Context-aware characteristics and perceived innovation characteristics

The default feature for sports technology is tracking. If you cannot track accurately, you cannot perform other activities. That is why tracking, in our study, was found to be the strongest indicator for performance expectancy and effort. Loadings were 0.313 and 0.502 respectively. Tracking also had a direct effect on habit and hedonic motivation. Tracking had a mediated effect on behavioral intention to use through effort expectancy, habit, and performance.

Many sports technologies provide users to have some gamified characteristics such as progress bars, virtual badges, virtual awards, or the opportunity challenge with friends. These characteristics are meant more than just perceived enjoyment (Wu et al., 2016). They are used for helping people to achieve their goals and motivating them to stay on track. User interfaces and user experience are designed to enhance these features in sports technologies. Our findings showed that gamification features of sports technologies do not only affect performance expectancy but also effort expectancy, social influence, habit, and hedonic motivation. Apple’s usage of three rings strategy in its smartwatch series is also a good example that is supporting our findings. Three rings show the objectives of the day in a very simple and fun way. The goal for the user is clear: closing all rings every day. Closing rings gives pleasure to the user, and it improves hedonic motivation. Users want to close the rings every day which leads to habit. When you close the rings, it is also shared with your friends which affects social influence (Apple, 2018a).

At the beginning of the study, I thought that sharing would be one of the key features of sports technology because it also enables social activity. Especially, strong findings in qualitative study increase our expectation but sharing feature only had a significant impact on social influence (0.313). Sharing did not have an indirect effect on intention either.

Sports literature focused on the usage of sports technologies as a transition tool that enables people to improve their intrinsic motivation. Our findings revealed that coaching characteristic of sports technologies indeed help people to improve their habitual sports behavior. Coaching feature would help people to increase their sports performance and constitute habit. It is interesting that coaching also had an effect on social influence. Sports technologies remind people to stand up or close their activity rings during their daily life, this triggers the conversation in the user's social environment, and social influence is generated. Image and visibility (Moore & Benbasat, 1991) constructs were also used in literature because of similar reasons. People see and learn the usage of technologies from their social networks. Coaching characteristic makes people to check devices more often that triggers other people to wonder what is happening.

8.3 Sports motivation and sports type as moderators

This study also showed that there are different groups of people in the market that has different motivations to use sports technologies. People who have extrinsic motivation found social influence as an important characteristic of sports technology whereas intrinsically motivated people do not care about it too much. Gamification is important criteria to evaluate performance expectancy for extrinsically motivated people but not for the other group. Detailed results were shared in Table 12, but the critical part is sports motivation is important factor to group sports technology users.

Sports type has never been studied in the acceptance studies to the best of our knowledge. Our results supported the effect of sports type on different group behavior. I adopted the sports classification approach from a medical study (Mitchell et al., 2005) and tested it in the information systems domain. I found that people who are doing dynamic sports activities which require more cardiovascular activity have different motivations to use sports technologies when they compared to non-dynamics sports performers.

CHAPTER 9

CONCLUSION AND IMPLICATIONS

9.1 Academic and practical implications

Our study contributes to the literature on the diffusion and adoption of sports technologies. I created a new construct to better explain the drivers behind the adoption of sports technologies. Context-aware characteristics can be used as an extension of existing technology acceptance (TAM) (Davis, 1989; Venkatesh, V., & Davis, 2000) and unified technology acceptance and use of technology (UTAUT) models (Venkatesh et al., 2003, 2012). Use of context-aware characteristics increases the adoption rate of the new products. For highly sophisticated technologies, specific context-aware characteristics are better at explaining the intention to use than the previously proposed relative advantage or performance expectancy based models. Our context-aware characteristics measurement items could be used for other high tech products which are available in the market like Amazon Echo or future technologies which have not been introduced to the market yet.

There is also a practical implication of this study. Firms could lift user adoption through implementing highly targeted customization of personal data combined with artificial intelligence in their products. Data generated by sports technologies are highly specific. Sports technologies do not only track body activities but also understand the location, enable the user to share image and data. There are some problems stated in the literature and reported by users with context-aware technologies on activity recognition and data collection accuracy (Abowd et al., 1998). One of the interviewees stated that his smartwatch could not recognize her twist activity in the gym. Similar claims made in online forums about the accuracy problems of the smartwatches and wristbands, which are the most popular sports technologies. One of the main reason for that kind of inaccuracy is stemmed from the single sensor devices. It is hard to track the movement of the upper body with wrist located sensor technologies. Tracking technologies that are located in different parts of the body including ankle, torso or hip can be better at activity recognition compared to wrist located technologies (Gjoreski, Gjoreski, Luštrek, & Gams, 2016). Even though the performance of sports technologies is better if they located in different parts of the body, it is hard for individuals to carry them at those points in their daily lives. That is why the majority of sports technologies are wrist located. On the other hand, professionals may use more performance-oriented products. Since in this study effect of tracking on performance expectancy is high, manufacturers should increase their effort to improve the accuracy of tracking measurements.

Lastly, product managers should take different user groups into consideration while designing sports technologies. Our study revealed that there are different groups based on sports motivation and sports activities. Marketers should also communicate right context-aware characteristics to the right group in their promotional activities.

9.2 Limitations and future research

I used one of the latest technology acceptance model the UTAUT2 model and modified it according to sports technology concept. Original UTAUT2 model includes price, which is the perceived cost of the technology, but I didn't include it to our model since our sports technology scope includes both free and paid tools. Future studies could study the possible differences in acceptance behavior of the free and paid sports technologies with a model that incorporates the context-aware characteristics items.

There are some culture-related differences in sport participation and involvement. For example, Chinese people viewed running as boring or punishment whereas in the US it is one of the major recreational activity (Piskorski, 2012). Our face to face interviews revealed that women generally do not run in their small hometowns, but they run in metropolitan neighborhoods. Along with these insights; Straub, Keil & Brenner (1997) stated that it is important to know whether TAM applies in other cultures because apps are not local but rather global in a sports context. Culture effects adoption of sports apps directly and indirectly. A cultural difference is strong when it comes to community participation. Some cultures value individualism more than collectivism; hence effect of sense of community on adoption behavior is affected by the cultural environment.

Furthermore, culture affects innovation characteristics like image, complexity, relative advantage, compatibility and observability. In some cultures, image is more significant when it comes to utilizing something new. In this study effect of cultural differences on the adoption of sports technologies is neglected. It could be used as the main construct for another study.

APPENDIX A

SURVEY ITEMS IN ENGLISH

Performance Expectancy	Using sports technologies enables me to accomplish sports activities more quickly.
	Using sports technologies improves the quality of sports activities I do.
	Using sports technologies gives me greater control over my sports activities.
	Using sports technologies makes it easier to do my sports activities.
	Overall, I find using sports technologies useful in my sports activities.
Effort Expectancy	My interaction with sports technologies is clear and understandable.
	I believe that it is easy to get sports technologies to do what I want it to do.
	Overall, I believe that sports technologies are easy to use.
	It is easy to become skillful at using sports technologies.
Social Influence	People who are important to me think that I should use sports technologies.
	People who influence my behavior think that I should use sports technologies.
	People whose opinions that I value prefer that I use sports technologies.
	People in my social circle think that I should use sports technologies.
Facilitating Conditions	I have the resources necessary to use sports technologies.
	I have the necessary knowledge to use sports technologies.
	Sports technologies are compatible with other technologies I use.
	I can get help from others when I have difficulties using sports technologies.
Hedonic Motivation	Using sports technologies is fun.
	Using sports technologies is enjoyable.
	Using sports technologies very entertaining.
	Using sports technologies gives me pleasure.

Habit	The use of sports technologies has become a habit for me.
	I am addicted to using sports technologies.
	I must use sports technologies.
	I don't want to do sports without my sports technology.
Sports Motivation	Because people around me reward me when I do
	Because it gives me pleasure to learn more about my sport.
	Because I would feel bad about myself if I did not take the time to do it.
	Because practicing sports reflects the essence of who I am.
	Because through sport, I am living in line with my deepest principles.
	Because I think others would disapprove of me if I did not.
	Because it is very interesting to learn how I can improve.
	Because it is one of the best ways I have chosen to develop other aspects of myself.
	Because I have chosen this sport as a way to develop myself.
	Because I feel better about myself when I do.
	Because I find it enjoyable to discover new performance strategies.
	Because I would not feel worthwhile if I did not.
	Because participating in sport is an integral part of my life.
	Because people I care about would be upset with me if I didn’t.
	Because I found it is a good way to develop aspects of myself that I value.
Tracking	My ST tracks my performances in my activities and shows me.
	My ST measures the activity data that I need (pulse, distance, depth, speed, pace, cadence, etc.).
	The data measured by my sports technology is current enough to meet my needs in my activities.
	My sports technology presents the measured data in a format that I can easily understand.
Sharing	I think my ST has enough capabilities to allow me to follow my friends' activities.
	My ST allows me to share information about my activities with my friends.
	I think that my ST has enough social features (sharing, following, etc.) that use my activity information.

	There are enough features (group chat, activity planning, etc.) that I can communicate with my friends in my ST.
Coaching	My ST provides useful tips and advice for my activities.
	My ST coaches me to do my activities.
	I am motivated by my ST to perform my activities.
	My ST helps me reach my goals.
Gamification	My ST has gamification features (virtual badges, scoreboard, prizes, etc.) related to my activities.
	My ST allows me to reach my goals in a fun way.
	I think my ST has some features that enable me to compete with my friends.
	I think there are some features in my ST that make me feel like I am playing games.
	I think there are some features in my ST that make me feel like I am playing games.
Intention to Use	I intend to start using or continue to use sports technologies.
	I will probably use or continue to use sports technologies.
	I'm going to use sports technologies often in the future.
	I also recommend others to use sports technologies.
Usage	How many hours do you use sports technologies in each week?
	How often do you use sports technologies in your sports activities?

APPENDIX B

SURVEY ITEMS IN TURKISH

Performans Beklentisi	Kullandığım spor teknolojisi spor aktivitelerimi daha hızlı tamamlamama yardımcı oluyor.
	Kullandığım spor teknolojisi spor aktivitelerimin kalitesini arttırıyor.
	Spor teknolojisi kullanmak spor aktivitelerim üzerinde bana daha fazla kontrol sağlıyor
	Spor teknolojisi kullanmak spor aktivitelerimi yönetmeyi kolaylaştırıyor
	Genel olarak, spor aktivitelerimde spor teknolojisi kullanmayı avantajlı buluyorum
Efor Beklentisi	Spor teknolojisi ile etkileşimim açık ve anlaşılırdır
	Spor teknolojilerini kullanmayı öğrenmek benim için kolaydır
	Genel olarak, spor teknolojimin kullanımının kolay olduğuna inanıyorum
	Spor teknolojimi kullanmakta uzmanlaşmam kolay oldu.
Sosyal Etki	Benim için önemli bir çok kişi spor teknolojileri kullanmam gerektiğini düşünüyor.
	Fikirlerine önem verdiğim bir çok kişi spor teknolojileri kullanmam gerektiğini düşünüyor.
	Çevremdeki insanlar spor teknolojileri kullanmamı bekliyor.
	Beğendiğim insanlar spor teknolojisi kullanmam gerektiğini düşünüyor.
Kolaylaştıran Durumlar	Spor teknolojisi kullanmak için gerekli ön bilgim vardır.
	Spor teknolojim kullandığım diğer teknolojilerimle (Telefon, bilgisayar vb.) uyumludur.
	Eğer spor teknolojimi kullanmakla ilgili bir sorun yaşarsam başkalarından yardım alabilirim.
	Kullandığım spor teknolojisi yaptığım spor ile uyumludur.
Hedonik Motivasyon	Spor teknolojisi kullanmak eğlencelidir.
	Spor teknolojimi kullanırken keyif alıyorum.
	Spor teknolojimi kullanırken sıkılmıyorum.
	Spor teknolojimi kullanmak zevklidir.

Alışkanlık	Spor teknolojisi kullanmak benim için bir alışkanlık oldu.
	Spor teknolojimi kullanmaya çok düşkünüm.
	Spor teknolojisi spor aktivitelerimin vazgeçilmez bir parçası oldu.
	Spor teknolojim olmadan spor yapmak istemiyorum.
Spor Motivasyonu	Çünkü etrafımdaki insanlar spor yaptığım zaman beni takdir ediyorlar.
	Çünkü yaptığım spor hakkında daha fazla şey öğrenmek bana zevk veriyor.
	Çünkü spor yapmak için zaman ayırmazsam kendimi kötü hissederim.
	Çünkü spor yapmak benim kişiliğimin bir parçasıdır.
	Çünkü spor yoluyla, en temel ilkelerim doğrultusunda yaşıyorum.
	Çünkü spor yapmasaydım bence etrafımdakiler bunu doğru bulmazdı.
	Çünkü spor yaparken kendimi nasıl geliştirebileceğimi keşfetmek beni çok mutlu ediyor.
	Çünkü bu sporu kendimi geliştirmenin bir yolu olarak seçtim.
	Çünkü spor yapmak diğer yönlerimi geliştirmek için seçtiğim en iyi yollardan biri.
	Çünkü spor yaptığımda kendimi daha iyi hissediyorum.
	Çünkü yeni performans stratejileri keşfetmeyi keyifli buluyorum.
	Çünkü spor yapmazsam kendimi değerli hissetmem.
	Çünkü spor yapmak hayatımın vazgeçilmez bir parçası.
	Çünkü spor yapmasam önemsediğim insanlar hayal kırıklığına uğrarlar.
	Çünkü spor yapmak değerli bulduğum yönlerimi geliştirmek için iyi bir yol.
Ölçümleme	Spor teknolojim aktivitelerimde performansımı takip eder ve bana gösterir.
	Spor teknolojim ihtiyaç duyduğum aktivite verilerini (Nabız, mesafe, derinlik, hız, tempo, güç vb.) ölçümler.
	Spor teknolojimin ölçümlediği veriler aktivitelerimde ihtiyacımı karşılayacak kadar günceldir.
	Spor teknolojimin ölçümlediği verileri kolayca anlayabileceğim formatta sunar.
Paylaşma	Spor teknolojimde arkadaşlarımın aktivitelerini takip edebileceğim yeterince özellik olduğunu düşünüyorum.
	Spor teknolojim aktivitelerim ile ilgili istediğim bilgileri arkadaşlarımla paylaşmama imkan sağlar.
	Spor teknolojimin aktivite bilgilerimi kullanan yeterince sosyal özellikleri (paylaşım, takip vb.) olduğunu düşünüyorum.

	Spor teknolojimde arkadaşlarımla topluca iletişim sağlayabileceğim yeterince özellik (grup chat, aktive oluşturma vb.) vardır.
Koçluk	Spor teknolojim aktivitelerim için kullanışlı ipuçları ve tavsiyeler verir.
	Spor teknolojim aktivitelerimi gerçekleştirmem için bana koçluk yapar.
	Aktivitelerimi gerçekleştirmem için spor teknolojim tarafından motive edilirim.
	Spor teknolojim hedeflerime ulaşmam için bana yardım eder.
Oyunlaştırma	Spor teknolojimin aktivitelerim ile alakalı oyunlaştırma özellikleri (sanal rozetler, puan tablosu, ödüller vb.) vardır.
	Spor teknolojim hedeflerime eğlenceli bir şekilde ulaşmamı sağlar.
	Spor teknolojimde arkadaşlarımla yarışabileceğim özellikler olduğunu düşünüyorum.
	Spor teknolojimde oyun oynar gibi hissettiğim özellikler olduğunu düşünüyorum.
Kullanma Niyeti	Spor teknolojilerini kullanma veya kullanmaya devam etmeye niyetim var.
	Büyük bir ihtimalle spor teknolojilerini kullanacağım ya da kullanmaya devam edeceğim.
	Gelecekte sık sık spor teknolojisi kullanacağım.
	Başkalarına da spor teknolojilerini kullanmalarını tavsiye ederim.
Kullanma	Spor yaparken spor teknolojilerini ne sıklıkla kullanıyorsunuz?
	Spor yaparken haftada ortalama kaç saat spor teknolojisi kullanıyorsunuz?

APPENDIX C

DESCRIPTIVE STATISTICS

Table C1. Districts Statistics

DISTRICTS	Frequency	Percentage
South East Region (n=28)	28	4.7%
Marmara Region (n=236)	237	39.5%
Central Anatolia Region (n=130)	130	21.7%
Aegean Region (n=60)	60	10.0%
Black Sea Region (n=44)	44	7.3%
Mediterranean Region (n=73)	73	12.2%
East Anatolia Region (n=26)	26	4.3%
No Response	2	0.3%

Table C2. Age Groups Statistics

Age Groups	Frequency	Percentage
15-18 years old	10	1.7%
19-24 years old	163	27.2%
25-35 years old	318	53.0%
36-45 years old	84	14.0%
45 or older	25	4.2%

Table C3. Socioeconomic Status Statistics

Socioeconomic Status	Frequency	Percentage
A	113	18.8%
B	150	25.0%
C	310	51.7%
D	16	2.7%
E	1	0.2%
No Match	10	1.7%

Table C4. Sports Technology Type Statistics

Sports Technology Type	Frequency	Percentage
Non-adopter	130	21.7%
Smartwatch	142	23.7%
Smart Wristband	118	19.7%
Mobile App	120	20.0%
Mounted Technologies	90	15.0%

Table C5. Usage Frequency

Usage Frequency	Frequency	Percentage
Rarely	180	38.3%
Sometimes	72	15.3%
Always	98	20.9%
Frequently	120	25.5%

Table C6. Weekly Average Time Spent

Usage Weekly Average Time Spent	Frequency	Percentage
Less than 1 hour	186	39.6%
1-3 hours	100	21.3%
3-5 hours	70	14.9%
5-7 hours	32	6.8%
7 hours or more	82	17.4%

Table C7. Education Statistics

Education	Frequency	Percentage
Secondary school and below	28	4.7%
High school	184	30.7%
University	328	54.7%
Masters or more	60	10.0%

Table C8. Income Statistics

Income	Frequency	Percentage
Less than 2500 TL	110	18.3%
Between 2501 TL -5000 TL	236	39.3%
Between 5001 TL - 7500 TL	132	22.0%
Between 7501 TL - 10.000 TL	42	7.0%
10.001 TL and more	32	5.3%
Do not want to disclose	48	8.0%

Table C9. Weekly Average Sports Duration

Sports Duration (Weekly Average)	Frequency	Percentage
30 minutes to 1 hour	84	14.0%
1-3 hours	134	22.3%
3-5 hours	152	25.3%
5-7 hours	108	18.0%
7 hours or more	122	20.3%

APPENDIX D

CONSTRUCT RELIABILITY AND VALIDITY SCORES

Table D1. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
coaching	0.827	0.829	0.828	0.547
effort	0.845	0.846	0.843	0.574
facilitating	0.726	0.735	0.730	0.405
gamification	0.813	0.817	0.814	0.523
habit	0.899	0.907	0.900	0.695
hedonic	0.904	0.905	0.904	0.702
intention	0.893	0.893	0.893	0.675
performance	0.856	0.856	0.855	0.542
sharing	0.869	0.869	0.869	0.624
social	0.915	0.918	0.915	0.729
tracking	0.781	0.781	0.781	0.471

Table D2. Fornell-Larcker Criterion

	coaching	effort	gamification	habit	hedonic	intention	performance	sharing	social	tracking
coaching	0.740									
effort	0.579	0.757								
gamification	0.785	0.520	0.723							
habit	0.597	0.553	0.639	0.834						
hedonic	0.637	0.693	0.620	0.681	0.838					
intention	0.531	0.587	0.441	0.618	0.600	0.822				
performance	0.727	0.721	0.658	0.644	0.749	0.607	0.736			
sharing	0.560	0.429	0.712	0.479	0.383	0.408	0.404	0.790		
social	0.503	0.399	0.630	0.691	0.390	0.433	0.485	0.599	0.854	
tracking	0.711	0.731	0.568	0.559	0.667	0.713	0.708	0.506	0.376	0.687

Table D3. Heterotrait-Monotrait Ratio

	coaching	effort	gamification	habit	hedonic	intention	performance	sharing	social	tracking
coaching										
effort	0.575									
gamification	0.784	0.516								
habit	0.600	0.545	0.642							
hedonic	0.638	0.693	0.619	0.676						
intention	0.533	0.586	0.440	0.616	0.599					
performance	0.726	0.715	0.654	0.640	0.749	0.605				
sharing	0.563	0.426	0.721	0.483	0.383	0.408	0.403			
social	0.502	0.392	0.634	0.696	0.389	0.432	0.482	0.600		
tracking	0.713	0.727	0.566	0.557	0.668	0.713	0.707	0.503	0.373	

Table D4. Cross Loadings

	coaching	effort	facilitating	gamification	habit	hedonic	intention	performance	sharing	social	tracking
coaching1	0.705	0.408	0.569	0.510	0.435	0.431	0.391	0.467	0.420	0.310	0.532
coaching2	0.760	0.418	0.503	0.612	0.464	0.478	0.408	0.559	0.436	0.401	0.518
coaching3	0.742	0.394	0.447	0.641	0.476	0.459	0.371	0.529	0.441	0.441	0.480
coaching4	0.750	0.490	0.499	0.556	0.395	0.516	0.403	0.592	0.362	0.331	0.577
effort1	0.532	0.829	0.650	0.460	0.494	0.515	0.453	0.634	0.375	0.388	0.616
effort2	0.409	0.742	0.698	0.351	0.385	0.558	0.446	0.532	0.285	0.234	0.571
effort3	0.414	0.726	0.681	0.391	0.364	0.523	0.422	0.533	0.304	0.276	0.505
effort4	0.388	0.728	0.677	0.367	0.422	0.508	0.459	0.475	0.333	0.300	0.517
facilitating1	0.370	0.661	0.642	0.388	0.442	0.475	0.424	0.452	0.302	0.323	0.499
facilitating2	0.471	0.587	0.649	0.433	0.444	0.448	0.420	0.469	0.345	0.324	0.495
facilitating3	0.399	0.399	0.555	0.346	0.398	0.436	0.348	0.358	0.380	0.402	0.387
facilitating4	0.489	0.602	0.692	0.418	0.475	0.625	0.418	0.529	0.273	0.276	0.553

gamification1	0.533	0.361	0.423	0.677	0.433	0.412	0.304	0.428	0.471	0.429	0.412
gamification2	0.673	0.434	0.476	0.784	0.499	0.550	0.370	0.562	0.400	0.422	0.503
gamification3	0.493	0.330	0.421	0.688	0.422	0.367	0.288	0.403	0.690	0.468	0.348
gamification4	0.560	0.372	0.484	0.739	0.489	0.455	0.307	0.498	0.518	0.508	0.372
habit1	0.524	0.539	0.658	0.530	0.901	0.668	0.579	0.605	0.376	0.545	0.518
habit2	0.476	0.439	0.563	0.542	0.834	0.570	0.540	0.525	0.428	0.577	0.467
habit3	0.538	0.501	0.625	0.556	0.878	0.593	0.523	0.572	0.391	0.606	0.493
habit4	0.453	0.343	0.442	0.504	0.709	0.415	0.406	0.429	0.410	0.584	0.372
hedonic1	0.514	0.542	0.654	0.538	0.522	0.796	0.458	0.582	0.321	0.292	0.528
hedonic2	0.530	0.605	0.662	0.513	0.561	0.846	0.540	0.634	0.296	0.325	0.576
hedonic3	0.545	0.575	0.677	0.508	0.596	0.847	0.488	0.632	0.332	0.332	0.575
hedonic4	0.545	0.599	0.636	0.522	0.600	0.859	0.522	0.661	0.338	0.357	0.558
intention1	0.425	0.471	0.508	0.362	0.498	0.478	0.799	0.490	0.351	0.351	0.531
intention2	0.413	0.517	0.534	0.345	0.511	0.520	0.832	0.507	0.324	0.361	0.592

intention3	0.434	0.474	0.518	0.343	0.521	0.505	0.818	0.511	0.330	0.322	0.585
intention4	0.475	0.466	0.524	0.397	0.501	0.469	0.837	0.486	0.338	0.388	0.634
performance1	0.585	0.500	0.495	0.584	0.502	0.470	0.402	0.743	0.377	0.422	0.487
performance2	0.575	0.557	0.547	0.511	0.490	0.535	0.450	0.765	0.345	0.398	0.525
performance3	0.531	0.529	0.539	0.431	0.442	0.593	0.454	0.729	0.276	0.298	0.558
performance4	0.483	0.504	0.506	0.436	0.425	0.537	0.410	0.676	0.230	0.305	0.472
performance5	0.500	0.560	0.546	0.454	0.504	0.623	0.513	0.764	0.254	0.354	0.560
sharing1	0.438	0.329	0.373	0.563	0.391	0.266	0.328	0.314	0.793	0.485	0.458
sharing2	0.444	0.414	0.449	0.533	0.361	0.372	0.352	0.326	0.813	0.441	0.425
sharing3	0.420	0.334	0.412	0.543	0.379	0.315	0.317	0.345	0.783	0.462	0.398
sharing4	0.471	0.276	0.359	0.612	0.380	0.257	0.291	0.291	0.768	0.506	0.314
social1	0.446	0.402	0.468	0.542	0.615	0.350	0.389	0.430	0.547	0.904	0.370
social2	0.453	0.377	0.478	0.545	0.608	0.381	0.381	0.455	0.510	0.897	0.338
social3	0.398	0.267	0.405	0.532	0.581	0.301	0.355	0.385	0.478	0.804	0.298

social4	0.418	0.305	0.398	0.535	0.552	0.296	0.353	0.381	0.510	0.806	0.271
tracking1	0.487	0.503	0.540	0.371	0.353	0.478	0.560	0.492	0.248	0.244	0.685
tracking2	0.465	0.471	0.504	0.367	0.367	0.499	0.519	0.512	0.272	0.230	0.673
tracking3	0.487	0.477	0.509	0.468	0.415	0.400	0.442	0.471	0.460	0.321	0.693
tracking4	0.515	0.556	0.546	0.351	0.399	0.457	0.439	0.471	0.405	0.236	0.694

APPENDIX E

COLLINEARITY AND COMMON METHOD BIAS EVALUATION RESULTS

Table E1. Outer VIF Values

	VIF
coaching1	1.480
coaching2	2.480
coaching3	2.201
coaching4	1.636
effort1	1.592
effort2	2.178
effort3	2.179
effort4	1.810
gamification1	1.528
gamification2	1.778
gamification3	1.572
gamification4	2.021
habit1	2.559
habit2	3.342
habit3	3.314
habit4	1.939
hedonic1	2.402
hedonic2	2.952
hedonic3	2.504

hedonic4	2.968
intention1	2.892
intention2	3.579
intention3	2.517
intention4	1.851
performance1	1.782
performance2	1.948
performance3	1.966
performance4	1.906
performance5	1.946
sharing1	2.048
sharing2	2.110
sharing3	2.341
sharing4	1.971
social1	3.024
social2	3.524
social3	3.069
social4	3.073
tracking1	1.617
tracking2	1.734
tracking3	1.587
tracking4	1.468

Table E2. Harman's Single Factor Test

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.331	37.393	37.393	15.331	37.393	37.393
2	3.417	8.334	45.727			
3	2.025	4.939	50.666			
4	1.885	4.599	55.264			
5	1.522	3.712	58.976			
6	1.354	3.303	62.279			
7	1.117	2.725	65.004			
8	1.033	2.521	67.524			
9	0.940	2.294	69.818			
10	0.838	2.045	71.863			
11	0.679	1.656	73.519			
12	0.654	1.595	75.114			
13	0.635	1.549	76.663			
14	0.620	1.513	78.176			
15	0.547	1.333	79.509			
16	0.531	1.294	80.803			
17	0.520	1.267	82.070			
18	0.502	1.224	83.294			

19	0.471	1.148	84.442			
20	0.458	1.116	85.558			
21	0.436	1.063	86.621			
22	0.429	1.046	87.667			
23	0.386	0.942	88.609			
24	0.375	0.915	89.524			
25	0.356	0.869	90.393			
26	0.343	0.837	91.230			
27	0.335	0.816	92.046			
28	0.326	0.794	92.841			
29	0.303	0.740	93.580			
30	0.292	0.711	94.292			
31	0.277	0.675	94.967			
32	0.261	0.636	95.603			
33	0.258	0.630	96.233			
34	0.250	0.610	96.843			
35	0.232	0.565	97.408			
36	0.203	0.496	97.904			
37	0.200	0.487	98.390			
38	0.192	0.469	98.860			
39	0.172	0.420	99.280			
40	0.162	0.395	99.675			
41	0.133	0.325	100.000			

APPENDIX F

NORMAL DISTRIBUTION MEASURES

	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
intention1	3	0	4.392	4	1	5	0.63	0.815	-0.746
intention2	4	0	4.361	4	2	5	0.632	0.009	-0.593
intention3	5	0	4.309	4	2	5	0.666	-0.084	-0.588
intention4	6	0	4.321	4	2	5	0.616	-0.42	-0.378
tracking1	7	0	4.527	5	3	5	0.548	-0.781	-0.579
tracking2	8	0	4.536	5	3	5	0.538	-0.91	-0.541
tracking3	9	0	4.194	4	2	5	0.649	0.443	-0.479
tracking4	10	0	4.28	4	1	5	0.639	0.337	-0.484
sharing1	11	0	3.746	4	1	5	0.931	-0.318	-0.409

	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
sharing2	12	0	3.971	4	1	5	0.798	0.376	-0.578
sharing3	13	0	3.936	4	1	5	0.834	0.366	-0.629
sharing4	14	0	3.545	4	1	5	1	-0.618	-0.201
coaching1	15	0	4.117	4	1	5	0.713	2.132	-0.943
coaching2	16	0	4.129	4	2	5	0.717	0.635	-0.672
coaching3	17	0	4.065	4	1	5	0.841	0.918	-0.924
coaching4	18	0	4.301	4	2	5	0.684	1.149	-0.885
gamification1	19	0	4.033	4	1	5	0.912	0.167	-0.8
gamification2	20	0	4.119	4	1	5	0.805	0.958	-0.893
gamification3	21	0	3.84	4	1	5	0.931	0.252	-0.677
gamification4	22	0	3.847	4	1	5	0.936	0.223	-0.714
performance1	23	0	4.144	4	1	5	0.753	1.472	-0.947

	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
performance2	24	0	4.251	4	1	5	0.673	1.522	-0.823
performance3	25	0	4.383	4	2	5	0.6	-0.387	-0.451
performance4	26	0	4.407	4	2	5	0.59	0.245	-0.568
performance5	27	0	4.375	4	2	5	0.59	-0.391	-0.386
effort1	28	0	4.196	4	2	5	0.639	0.221	-0.396
effort2	29	0	4.364	4	2	5	0.61	-0.143	-0.493
effort3	30	0	4.33	4	2	5	0.604	-0.134	-0.401
effort4	31	0	4.165	4	1	5	0.728	0.937	-0.774
social1	32	0	3.727	4	1	5	1.005	-0.32	-0.583
social2	33	0	3.713	4	1	5	0.999	-0.427	-0.489
social3	34	0	3.411	4	1	5	1.127	-0.782	-0.308
social4	35	0	3.558	4	1	5	1.073	-0.677	-0.382

	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
hedonic1	36	0	4.356	4	2	5	0.633	0.436	-0.666
hedonic2	37	0	4.368	4	2	5	0.6	0.445	-0.558
hedonic3	38	0	4.363	4	1	5	0.601	0.747	-0.552
hedonic4	39	0	4.376	4	3	5	0.61	-0.658	-0.429
habit1	40	0	4.077	4	2	5	0.773	0.165	-0.627
habit2	41	0	3.883	4	1	5	0.914	0.272	-0.728
habit3	42	0	3.964	4	1	5	0.903	0.732	-0.898
habit4	43	0	3.515	4	1	5	1.107	-0.535	-0.473
external1	44	0	3.454	4	1	5	1.223	-0.931	-0.443
intrinsic1	45	0	4.227	4	1	5	0.739	2.119	-1.131
introjected1	46	0	4.119	4	1	5	0.832	0.531	-0.853
integrated1	47	0	4.101	4	1	5	0.815	0.41	-0.76

	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
integrated2	48	0	4.033	4	1	5	0.848	0.389	-0.757
external2	49	0	3.046	3	1	5	1.269	-1.18	0.059
intrinsic2	50	0	4.304	4	2	5	0.636	0.744	-0.643
identified1	51	0	4.211	4	1	5	0.719	1.564	-0.951
identified2	52	0	4.196	4	1	5	0.75	1.381	-0.95
introjected2	53	0	4.469	5	1	5	0.602	1.646	-0.947
intrinsic3	54	0	4.271	4	1	5	0.707	1.58	-0.939
introjected3	55	0	3.433	4	1	5	1.22	-0.941	-0.367
integrated3	56	0	4.05	4	1	5	0.833	0.837	-0.863
external3	57	0	2.905	3	1	5	1.315	-1.193	0.193
identified3	58	0	4.132	4	1	5	0.742	1.533	-0.925

APPENDIX G

EXPLORATORY FACTOR ANALYSIS

Constructs	Scale Items	Factor Loadings
Context-Aware Sharing	sharing3	0.874
	sharing2	0.836
	sharing1	0.824
	sharing4	0.748
Context-Aware Coaching	coaching2	0.888
	coaching3	0.815
	coaching4	0.71
	coaching1	0.679
Context-Aware Tracking	tracking2	0.886
	tracking1	0.814
	tracking3	0.679
	tracking4	0.533
Context-Aware Gamification	gamification4	0.782
	gamification2	0.725
	gamification1	0.642
	gamification3	0.549
Effort Expectancy	effort4	0.885
	effort3	0.884
	effort2	0.838
	effort1	0.563
Social Influence	social4	0.879
	social3	0.847
	social2	0.838
	social1	0.778
Hedonic Motivation	hedonic2	0.813
	hedonic1	0.812
	hedonic4	0.804
	hedonic3	0.735
Performance Expectancy	performance1	0.848
	performance4	0.806
	performance3	0.802
	performance2	0.773

	performance5	0.587
Behavioral Intention	intention2	0.913
	intention1	0.902
	intention3	0.857
	intention4	0.743
Habit	habit2	0.893
	habit4	0.85
	habit3	0.832
	habit1	0.674
Facilitating Condition	facilitating3	0.89
	facilitating4	0.458

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