The Effect of Context-Awareness on New Product Diffusions

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Abstract:

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. Current literature lacks to incorporate the adoption of context-aware innovations. 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. The purpose of this study is to understand the effects of context-aware characteristics on users' adoption together with sports motivation and other innovation characteristics. The proposed model is empirically tested and findings reveal that the context-aware characteristics have a significant direct effect on the new product diffusions.

1. Introduction

Evolutionary evidence suggests that humans were born to run especially for long distances (Bramble & Lieberman, 2004). Although there are no anatomical excuses for movement, 1 in 4 adult in the world is not active enough, and more than 80% of the world's adolescent population is insufficiently physically active as stated by World Health Organization (2018). Recent studies agree that sports activity is a self-determined process supported by external and internal factors (e.g., Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013). Self-management and self-regulation are crucial for better results. Nevertheless, due to intense daily life activities and many other choices, people are at the edge of self-management failure (M. Segar, 2015).

Technological advancements make it possible for sports technologies to track human activities, give feedback, and motivate them. They are hyper-connected and not only ubiquitously track important body measures but also give feedback and suggestions by using collected data, allow instant sharing of activities, and use gamification characteristics to increase engagement with the help of artificial intelligence. Sports technologies are becoming widely adopted, yet challenges continue to exist in effective long-term use and adoption.

The existing 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 try to explain adoption and diffusion of sports technologies with the existing frameworks (Canhoto & Arp, 2017; Lunney, Cunningham, & Eastin, 2016; Reyes-Mercado, 2018). 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).

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 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, we created a new construct, named "Context Awareness," with four dimensions: tracking, coaching, sharing, and gamification. The purpose of this research is to understand the effects of context-aware characteristics of sports technologies on users' adoption together with sports motivation and perceived innovation characteristics.

2. Literature

2.1. Adoption and Diffusion

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

Rogers (1962) published his famous book of "Diffusion of Innovations" in which he presented a generalized diffusion model. The interest of marketing scholars on innovation diffusion studies has escalated after Bass (1969) study on a growth model on consumer durables. A similar rise of interest occurred in information systems studies after Davis (1986) has introduced his Technology Acceptance Model (TAM). While Rogers (1962) uses the term "Adoption," Davis (1986) coined the term "Acceptance." Although these two terminologies still prevail in the literature, both terms refer to the consumers' usage of innovations.

Bass (1969) proposed that consumer's initial purchase of a new product is highly dependent on the number of previous buyers. He used innovative and imitative behavior in his model to predict sales of an innovation.

Moore and Benbasat (1991) designed an instrument to measure 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 potential user's overall attitude toward using a given system is a critical factor of whether or not he uses it. Later studies attempt to extend the original TAM model with different external variables.

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, Morris, Davis, & Davis, 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 adapt 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. Effort expectancy, social influence, facilitating conditions, and price value constructs from the UTAUT2 model is used in this study.

2.2. Sports Motivation

There are countless benefits of doing regular sports activities. Despite these well-documented benefits, insufficient physical activity is one of the most significant potential health problems in the world. The problem is the lack of continuous motivation. There have been a significant number of studies conducted on motivation in sports to understand the motives behind continuing or quitting sports participation (Pelletier et al., 1995; Pelletier et al., 2013).

Even though having a better physique and healthy body seems to be good motivations, they do not sustainably motivate people. Scholars studied sports motivation by using the Self-Determination Theory (SDT) as a foundation (Ryan & Deci, 2000). The SDT hypothesized competence, autonomy, and relatedness as three inherent psychological needs. Pelletier et al. (1995) adapted the SDT to the sports environment and created the Sports Motivation Scale (SMS) then revised it together with the original SDT scholars and proposed SMS II (Pelletier et al., 2013). In this study, to measure sports motivation of participants the SMS II scale is used.

2. Theoretical Model

Product-related variables were used in innovation diffusion studies to some extent (Harmancioglu, Droge, & Calantone, 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. In order to fill this gap, we 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), when (time-awareness), what (perceiving and interpreting human activity), and why people are doing what they are doing (Dix, Finley, Abowd, & Beale, 2004).

The purpose of this research is to understand the effects of context-aware characteristics of sports technologies on users' adoption together with sports motivation and perceived innovation characteristics. Effort expectancy, social influence, facilitating conditions, and

price value (Venkatesh et al., 2012) are used as perceived innovation characteristics, which influence attitude toward using a sports technology. Sports motivation (Pelletier et al., 2013) is also modeled as a predictor of intention to use of sports technology. The conceptual research model is shown in Figure 1.
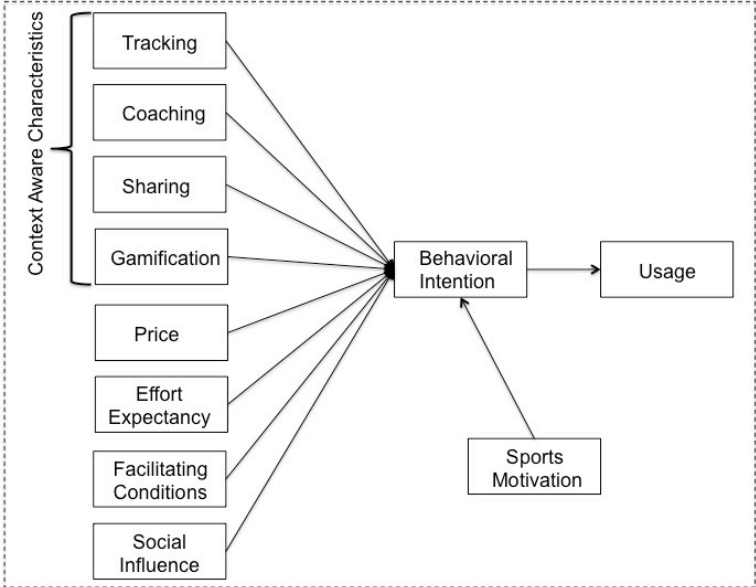

Figure 1. The Research Model

3.1. Tracking

Sports technologies use context-aware computing mainly to collect data on the individual's location, heart rate, pace, and speed. Some other sport-specific technologies collect sport specific data that is needed for that sport. For example, cyclists care not only about the bike speed to assess their performance but also measure their cadence with sensors on pedals. Data is essential for sports performance. Users need to see the processed information rather than 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 easily see and evaluate the performance data while they are doing activities.

Hence, we defined the context-aware tracking as an ability of sports technology to track one or more following parameters: heart rate, distance, pace, speed, cadence, style, altitude, and depth for sports activities and provide instant access to these data for users to follow.

3.2. Coaching

It is crucial to do sports activities safely otherwise severe injuries, and health problems might occur. Personal trainers, coaches, and physiotherapists help people to adjust and correct

their exercise practice, prevent injuries, and health threats. Furthermore, they give feedback and motivate people to improve their overall exercise and training performance.

Advancements in sports technologies as it is defined in this study's context have made it possible for people to carry their coach with them anytime, anywhere. Most sports technologies can provide feedback to users, push reminders regarding their activities, and motivate them to reach their goals as coaches and trainers do.

There are many 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). Hence, we 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 feedback based on users' goals.

3.3. Sharing

Why do we share? Berger (2013) termed social currency as one of the reasons for people to share. Social currency is used for attaining positive impressions among friends, family, and colleagues. Sports activities are mostly challenging and fun. Both feelings increase our instinctive desire to share. When we achieve something hard, we want to show our achievement in our social circle.

Sharing in sports technologies is not only sharing of activity data but also sharing an event, a challenge or a plan with a friend. Sharing of accomplishments such as earned badges and rewards are common in this kind of technologies. Nike is using social networks and sharing in the Nike Run Club (NRC) app to increase the motivation of the users in sports activities.

Qualitative evidence showed that sharing is an essential factor on adoption and diffusion of sports technologies, but it has not been empirically tested yet. Hence, in this study, we defined the context-aware sharing as features that allow users to share activity data with other people, keep track of friends' activities and data, communicate with others, create chat groups, and set up joint activities with friends.

3.4. 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) criticized that Bettman's (1979) the commonly used "information processing model" which explains that consumption activities are done with logical and rational decisions. They proposed a model called "experiential view" for consumption activities that are carried out with a steady flow of fantasies, feelings, and fun.

Sports technologies have some characteristics such as progress bars, virtual badges, virtual awards, or opportunity to create challenges with friends. These characteristics are meant more than just perceived enjoyment. 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. 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, which is one of the simplest and stickiest example 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, 2018).

There is no single gamification definition accepted by the majority (Burke, 2014). In this study, we follow Gartner Inc.'s definition of "the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals". Gamification features allow users to earn points and badges from activities and the ability to create a competitive environment with their friends or other people.

4. Methodology

In-depth interviews with end-users and sports professionals were conducted as a part of the qualitative analysis of the study. In-depth interviews provided valuable insights about the experience, opinions, and expectations about sports technologies. For example, 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 revealed its importance.

In-depth interviews helped us to create a new construct to better explain the adoption process that is not present in the relevant literature. We created 17 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, Tracey, & Enz, 1997). A survey was prepared with the perceived innovation characteristics scale items

(Rogers, 1995; Venkatesh et al., 2012) sports motivation scale items (Pelletier et al., 2013) from the existing literature together with author-generated context awareness scale items to measure the relationship quantitatively in the conceptual model. Definition of sports technology in this study context and pictures of some relevant sports technologies were presented to survey participants. 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.

A broad, random sample of sports technology users (n = 600) was surveyed to implement the research analysis. Data were collected with a mobile platform named Twentify that is similar to the Amazon Mechanical Turk. The sample contained 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.

5. Results and Discussion

The suggested model was empirically tested with data from participants in Turkey. Partial least squares (PLS) regression was used for models and hypotheses testing. Context awareness has a significant direct effect on the behavioral intention to use. People who favor context-aware characteristics of the technology have a higher behavioral intention to use. Sports motivation also has a significant direct effect on the intention to use such that people who have higher intrinsic sports motivation have more positive intentions towards using the sports technology. Price value, facilitating conditions, and social influence factors also have significant positive relations with the behavioral intention to use. Only effort expectancy has a significant negative relationship with the dependent variable as expected.

This research provides important contributions to the literature on innovation diffusion and new product development. 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 construct. Practical implication of this study is twofold: firms first could boost the user adoption through implementing highly targeted customization of very personal data combined with the artificial intelligence in their products, and secondly product managers could increase the adoption rate of the new products by focusing on context-aware characteristics in their marketing communication activities.

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