Individuals' Motivations to Adopt Smart Technologies for Tourism - Discrepancy Between Initial and Post Adoption

Yongda Li(✉)

School of Creative Media, City University of Hong Kong,
Kowloon Tong, Hong Kong
Yongdali2-c@cityu.edu.hk

Abstract. This study examines individuals' motivations to adopt smart technologies for tourism. We employed a case study using a qualitative approach. The results demonstrate that the factors influencing individuals' initial and post adoption differ significantly. For initial use, intrinsic motivation to know was the most important factor. Introjected regulation was the next most influential factor. Capacity-efforts belief was the most powerful amotivational factor hindering initial adoption. For the post adoption of a smart technology, the results indicates that individuals' extrinsic motivation (external regulation) was most influential, followed by intrinsic motivations (i.e., intrinsic motivation to know and intrinsic motivation toward accomplishments), which are also vital in predicting post adoption. The results suggest that users valued pleasure and satisfaction from exploring and learning to use a new technology and users were most concerned about practicality in the prolonged use. This research is a starting point for academia and industry to analyze individuals' diverse motivations regarding smart technology.

Keywords: Smart technology · Hierarchical model of intrinsic and extrinsic motivation · Technology adoption · Intrinsic motivation · Extrinsic motivation

1 Introduction

Along with the construction and development of 'smart city' [72], the term 'smart tourism' has emerged as a significant subsystem of the information network and industrial development of smart cities [1, 80]. Increasing scholarly attention has been devoted to understanding user experiences with smart technology for tourism in the fields of human computer interaction (HCI) and smart tourism. Research has conceptualized the notion of smart tourism [8, 20, 29, 47, 72], built frameworks on smart tourism [36, 58, 65, 74, 80], and explored the roles of main technology applications in smart tourism [18, 39, 78, 80]. However, most previous studies limited their view to improving travelers' experiences in the context of smart tourism. Although researchers have acknowledged that constant evaluation of users' motivations for initial and continued use (post adoption) is necessary [24, 48], little empirical research has systematically examined individuals' motivations for adopting smart technologies for tourism, which limits further development of the theories underlying user experience in

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the context of smart tourism. To fill this gap in understanding, this study addresses the following questions:

(1) What are the factors that influence individuals' initial use of smart technologies for tourism?
(2) What are the factors that influence individuals' continuance intention to use smart technologies for tourism?

To answer these questions, drawing on the Hierarchical Model of Intrinsic and Extrinsic Motivation [71], this study empirically examines an individual's diverse motivations to adopt a smart technology designed for tourism. This study contributes to research on smart tourism by analyzing users' different types of motivations for initial and post adoption of smart technology, and it reveals the significant distinctions between initial- and post-adoption motivations. For industry, this study provides meaningful insights into the design strategies of smart technology, which include an attention-grabbing interface and functions for information and entertainment.

The remainder of this paper is organized as follows. The second section includes five parts: the definition of smartness, smart technology and smart tourism, a brief review of relevant findings on user adoption of smart technology, and the theoretical background for this study. The third section provides a technical overview of the case study of smart technology. The fourth section describes the research methods, which is followed by the interview results in the fifth section. Finally, in the sixth section, we discuss the research implications of this study.

2 Literature Review and Theoretical Background

2.1 The Concept of Smartness

Smartness is a term used to describe innovative and transformative changes driven by new technologies [34]. Smart technologies aim to integrate and share real-time data for communication and collaboration, and they also use complex analytics, modeling, optimization, and visualization to make better operational decisions and implement continuous improvement [25, 32]. Table 1 summarizes the dimensions of smartness. In this study, following Rhiu et al.'s work [53], we define smartness in five dimensions: autonomy, adaptability, multi-functionality, connectivity, and personalization.

2.2 Smart Technology

Smart technology is defined as a technology with a certain degree of smartness that supports new forms of collaboration and value creation, leading to further innovation, entrepreneurship, and competitiveness [21]. As researchers have different views on the concept of smartness, the definitions of smart technology are equivocal, as shown in Table 2.

Table 1. Dimensions of smartness

Dimensions of smartness	Study
Autonomy: a technology operates in an independent and goal-directed way without interference by the user Adaptability: a technology's ability to improve the match between its function and its environment [50] Reactivity: a technology's ability to react to changes in its environment [6] Multi-functionality: a single technology fulfills multiple functions [52] Ability to cooperate: a technology can cooperate with other devices to achieve a common goal Humanlike interaction: a technology communicates and interacts with the user in a natural and human way Personality: a technology's ability to demonstrate the properties of a credible character	[54]
Fitness: a technology speeds up or improves users' routines while avoiding unnecessary work Efficiency: a technology helps users perform tasks faster or better than they can manually	[46]
Autonomy: a technology operates in an independent and goal-directed way without interference by the user Adaptability: a technology's ability to improve the match between its function and its environment [50] Multi-functionality: a single product fulfills multiple functions [52] Connectivity: a technology is connected to individual terminals, mobile devices, data centers, and local area networks based on ICT and IoT Personalization: a technology's ability to demonstrate the properties of a credible character	[53]

Table 2. Definitions of smart technology

Definition	Study
Smart technology is a term to encompass any number of different contexts where a degree of intelligence, however primitive, is embedded within an artifact	[57]
Smart technology is technology with the ability to sense changes in its circumstances and to execute measures enhancing its functionality under the new circumstances, then to offer enormous benefits in performance, efficiency, operation costs and endurance	[76]
Smart technology is not only a multifunctional but also versatile device, because it provides real-time accessibility to anyone, anytime and anything, in addition to timesaving applications	[59]
Smart technology is a self-operative and corrective system that requires little or no human interventions; smart technology has the ability to extract information from its sensors and communicate with its command and control unit or with external devices	[11]
In the context of marketing and economy, smart technology is technology with multi-functionality and high levels of connectivity, which supports new forms of collaboration and value creation that lead to innovation, entrepreneurship and competitiveness	[21]

2.3 Smart Tourism

Smart tourism refers to a platform on which information relating to tourist activities, the consumption of tourism products, and the status of tourism resources can be instantly integrated and then provided to tourists, enterprises and organizations through a variety of end-user devices [28, 80]. Smart tourism applies a new generation of information communication technology (ICT) and applications, and it provides all sorts of tourism information adequately, and in a timely manner. It brings smartness to tourism services, management, and marketing and to tourist experiences [28]. The smart tourism system applies intelligent technologies, which mainly involve the Internet of Things (IoT), cloud computing, mobile communication technology, and artificial intelligence [39, 80].

The definitions, conceptual frameworks, and technological foundations of smart tourism are summarized in Tables 3, 4, and 5, respectively. In this study, smart tourism is defined as tourism supported by the efforts of a destination (such as an airport) to use

Table 3. Definitions of smart tourism

Definition	Study
Smart tourism is a distinct step towards the progression of ICT in tourism sector in that the control and physical dimensions of the tourism are entering the digital platform field and new heights of smartness are attained in the system	[20]
Smart tourism is characterized as human-oriented, green, scientific and technological innovation	[42]
Smart tourism is to employ mobile digital connectivity to create more intelligent, meaningful and sustainable connections between tourists and their destinations, and represents wider efforts to imagine tourism as a form of deep civic engagement, and not just as a simple form of consumption	[47]
Smart tourism is based on a new generation of ICT to meet the needs of individual tourists for high-quality, satisfying services to realize the common sharing and effective use of tourism resources while promoting the integration of social resources	[80]
Smart tourism is a new form of tourism business, facing the future to serve the public, business organizations and government sections	[77]
Smart tourism is the application of networking and intelligent data mining technology applied to tourism experiences, industry development and administrative management through a systematic integration of each, consequently further developing and interacting with tourism and information resources	[64]
Smart tourism means that visitors can also offer values and can create and monitor	[8]
Smart tourism is a new generation communicational technology that combines cloud-computing, networking, the internet with personal mobile terminals (3G technology, personal digital assistant etc.) and artificial intelligence	[58]
To sum up a destination element, smart tourism is a social phenomenon arising from the addition of ICTs with the experience of tourism	[29]
Smart tourism is tourism supported by incorporated hard work at a destination to accumulate and harness the information resulting from the physical infrastructure governmental connections and social sources with the use of advanced technologies to transform the information into onsite experiences and business value-prepositions with a comprehensive focus on sustainability, efficiency and experience fortification	[72]

Table 4. The framework of smart tourism

Framework	Study
Smart tourism has three levels: for tourists, smart tourism provides access to tourism information and promptly arranges travel plans; for managers (such as the government and tourism enterprises), smart tourism is a comprehensive and thorough system incorporating accuracy, convenience, and the ubiquity of tourism information applications by building a tourism service platform that offers visitors catering, transportation, accommodation, traveling, and shopping; from a technical perspective, smart tourism achieves highly systematic and detailed interaction between physical tourism resources and tourism information resources, thereby serving the public, enterprises and the government with a new form of tourism services for the future	[74]
The essential connotation of smart tourism is the application of intelligent technology, including ICT in a tourism industry context	[36]
Smart tourism includes three major layers: a smart information layer that collect data; a smart exchange layer that supports interconnectivity; a smart processing layer responsible for the analysis, visualization, integration, and intelligent use of data	[65]

Table 5. The technological foundation of smart tourism

Technological foundation	Study
The supporting technologies of smart tourism include cloud computing, IoT, high-speed mobile communication technology, geographic information systems, and virtual reality technology	[39]
Smart tourism uses intelligent technology to complete tourism development and management processes and to take advantage of the intelligence and information residing in the entire tourism industry	[74]
Smart tourism is customer-centered, using intelligent technology, computers, mobile devices, and intelligent terminals as the main platforms to provide intelligent service, intelligent business, intelligent management, and intelligent government affairs	[78]
Based on cloud computing technology with smart phones and intelligent terminal equipment, smart tourism can realize the collection, mining analysis, real-time transmission, and automatic induction of tourism information	[18]

advanced technologies to accumulate and harness information and social sources in order to transform this information into onsite experiences and business value propositions, with a comprehensive focus on sustainability and efficiency [72].

2.4 Previous Findings on User Adoption of Smart Technology

Users are a target group when studying smart technology [27]. Therefore, understanding factors that influence user adoption of smart technology is of interest to both researchers in various fields and the procurers of technology for large organizations

[63]. As user adoption is of great significance to the successful implementation of any new technology [63], previous research notes different system uses, including initial, continuanued (post), and extended (or deep) uses [79]. Initial use is the first-time adoption of a system [73]. Continued use refers to a user's ongoing use of an information system, reflecting a post-adoption behavior beyond initial acceptance [5, 38, 41]. Extended use, or deep use, is the extent to which a user employs different system functionalities to perform various tasks [30, 44]. To realize the benefits of an implemented system, organizations must encourage people to move beyond initial to post-adoption behaviors [38].

2.5 Theoretical Background

Intrinsic Motivation, Extrinsic Motivation and Amotivation
Motivation theorists argue that motivation formulates the mechanism of human behavior and action [81]. A person who feels no impetus to act is unmotivated and someone who is energized to work towards an end is motivated [55]. Motivation is key to understanding users' intentions and expectations regarding system use [41]. It is vital to know the level of motivation and the orientation of the motivation (i.e., what type of motivation) [55]. People's attitudes and goals lie under their actions. A complete analysis of motivation must deal with three important concepts; intrinsic motivation, extrinsic motivation, and amotivation [67]. Intrinsic motivation is at work when someone does an activity in order to obtain pleasure or satisfaction from the activity itself (see [13, 35, 67]). Extrinsic motivation can be seen when someone does something in order to achieve some separable goals, such as receiving a reward or avoiding punishment [13, 14]. Amotivation is the lack of intentionality and thus the relative absence of motivation [14, 33, 67].

Hierarchical Model of Intrinsic and Extrinsic Motivations
The concepts of intrinsic motivation, extrinsic motivation and amotivation need to be interpreted within the full range of motivational processes [68]. Vallerand et al. [69–71] posited three types of intrinsic motivation: Intrinsic Motivation (IM) to know, IM toward accomplishments and IM to experience stimulation. As proposed by Guay et al. [22], extrinsic motivation also includes three types: identified regulation, introjected regulation and external regulation. Deci and Ryan [14], Skinner [60], and Seligman [56], Pelletier et al. [51], and Stewart [62] proposed four types of amotivation: capacity-ability belief, strategy belief, capacity-effort belief, and helplessness belief. Table 6 shows the multidimensional perspective of motivation, which includes 10 motivation subscales [67, 68].

3 Technical Overview of Chigoo Trolley

Chigoo's iFLYMATE is a service platform (Fig. 1a, b) that collects data and provides information to travelers. This platform circles the airport service data center and is based on the IoT and cloud computing. It develops public airport services and

Table 6. Multidimensional motivation subscales

Category	Motivation	Description
Intrinsic motivation (IM)	IM to know	Engaging with the technology for the pleasure/satisfaction that one experiences while learning, exploring, or trying to understand something new (e.g., technological functions for searching travel information and news)
	IM toward accomplishments	Engaging with the technology for pleasure/satisfaction while attempting to reach goals or accomplish or create something new
	IM to experience stimulation	Engaging with the technology to experience pleasure associated mainly with one's senses (e.g., sensory and aesthetic pleasure)
Extrinsic motivation (EM)	External regulation	Behavior is regulated through external means, such as rewards and constraints (e.g., users must use the technology due to constraints related to Wi-Fi usage, phone chargers and airport navigation)
	Introjected regulation	Individuals replace the external source of control (e.g., others' opinions/feelings) with an internal source (user's attitude) and impose pressure on themselves to use a technology for others' sakes
	Identified regulation	Users highly value certain behaviors; they will use the technology even if the process of using the technology is not in itself pleasant
Amotivation	Capacity-ability belief	Users believe that they lack the ability to use the technology (e.g., they are unfamiliar with the new technology)
	Strategy belief	Users believe that the functions of the new technology will not meet their needs
	Capacity-efforts belief	Users believe that using the technology is too demanding, so they do not want to expend the effort necessary to engage with the technology
	Helplessness belief	Users believe that using the technology is inconsequential due to its complexity or poor functionality

value-added advertisements at the airport. CTrolley (Fig. 2), which works based on Chigoo's iFLYMATE platform is a multi-functional smart technology with a high level of connectivity. CTrolley is available to users after they scan their boarding passes on the touch screen, which means that Ctrolley is smart only when the iFLYMATE system adapts itself to users' needs.

CTrolley includes to the five dimensions of smartness: autonomy (cTrolley itself can mine and analyze data after passengers' scanned their boarding passes), adaptability (the setup of cTrolley's wireless access points and power stations can freely upgrade to conform to existing airport infrastructures and are optional if airports have plans for their own wireless internet infrastructure upgrades), multi-functionality

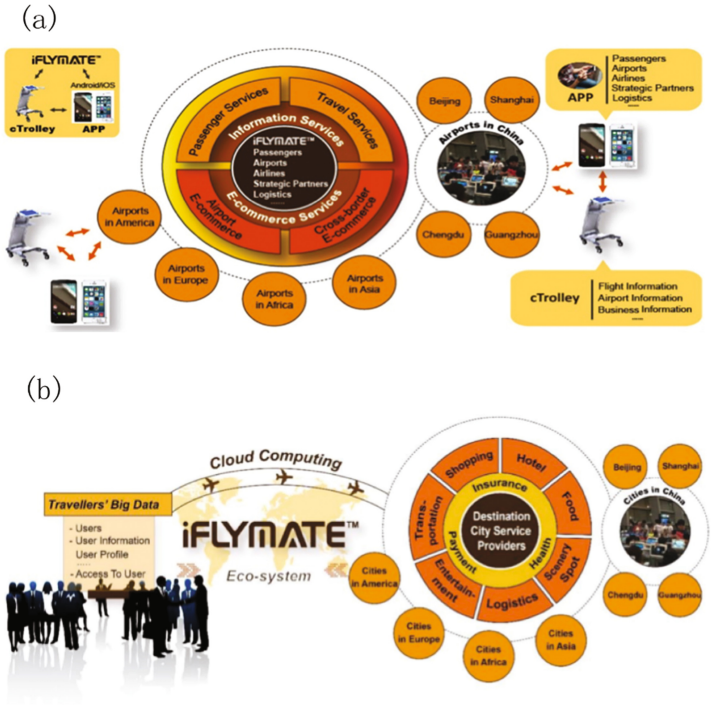

Fig. 1. Operation process of cTrolley (provided by Chigoo Company) (http://www.chigoo.net/goodsen.html).

(the functions of cTrolley include multiple languages, indoor navigation, real time flight status, boarding guidance and reminders, entertainment, free Wi-Fi hotspots, phone chargers, etc.), connectivity (cTrolley is connected to the airport service data center and is based on the IoT and cloud computing), personalization (cTrolley can automatically log users into their personal accounts after they have scanned their boarding passes and serve travelers based on their previous preferences recorded in its system).

4 Methods

We employed a smart technology case study using a qualitative approach to conduct an exploratory research on user adoption of smart technology for tourism. The threefold methodology included document analysis, in-depth and sequential interview [43] with purposive sampling, and post hoc analysis based on summaries of the interview content. The case study was conducted in Guangzhou Baiyun International Airport. First, documentation of cTrolley's operational process and outlook was examined in order to identify the practical processes underpinning the technological solution and its use [48]. Second, as suggested in sequential interview guidelines [43], we did not set a specific

Fig. 2. CTrolley touch screen view (provided by Chigoo Company) (http://www.chigoo.net/goodsen.html).

number of interviewees prior to data collection; instead, we conducted interviews until we reached an information saturation point. The first interview yielded a set of findings and a set of questions that informed the next interviews; when an interview provided little new or surprising information, then saturation had been reached, and we ended the interview process [61]. Third, we examined and analyzed the results based on the content of the interviews and on observation.

5 Results

Our interview questions were semi-structured. We asked interviewees two main questions: "What motivated you to use cTrolley the first time?" and "What motivated you to continue to use cTrolley in the departure lounge?" Different types of motivation were identified based on the interviewees'. Interviews were conducted from 11:00 AM to 5:00 PM for three days, and the interview targets were passengers using cTrolley in the departure lounge. Our information reached saturation with forty-fifth interviewee. We invited 52 people to be interviewed, and 45 agreed to participate. The interviewees included 17 females and 28 males. Fifty-three percent of the interviewees were between the ages of 18 and 30, 22% were aged 30–40, 11% were under 18, and 13% were over 40. Fifty-eight percent of the interviewees were business travelers and 42% were traveling for leisure. Figure 3 shows the frequency of occurrence.

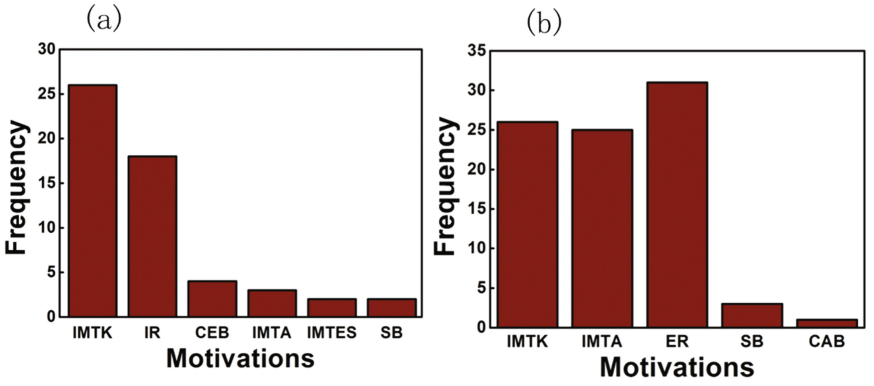

Fig. 3. Occurrence frequency of motivation subscales for initial use. (a) Motivation for initial adoption. IMTK: IM to know, IR: Introjected regulation, CEB: Capacity-efforts belief, IMTES: IM to experience stimulation, IMTA: IM toward accomplishments, SB: Strategy belief. (b) Motivation for post adoption. Occurrence frequency of motivation subscales for continuance intention (ER: External regulation, IMTK: IM to know, IMTA: IM toward accomplishments, SB: Strategy belief, CAB: Capacity-ability belief).

The results demonstrate that the factors influencing initial and post adoption for a smart technology differ significantly. The results show that IM to know was the most important factor for initial adoption, whereas introjected regulation (extrinsic motivation) was found to be the second most-influential factor. The most powerful amotivaitonal factor for initial use was capacity-efforts belief.

Interviewee No. 32 said: "I haven't seen a trolley with a touch screen in the airport before, so I think this is a very interesting smart technology. I want to know what functions it has and I want to explore it. So I am using it."

Interviewee No. 10 said: "At first I simply wanted to put my luggage on this trolley, but then I noticed the touch screen on it. I'm curious about this new technology, so I try it."

Interviewee No. 1 said: "My kids are interested in this smart technology. They told me they wanted to play with it, so I took this cTrolley with me."

Interviewee No. 4 said: "I noticed that others are using the cTrolley, so I took one."

Interviewee No. 16 said: "I have never used such a thing before, and I don't want to waste my time and efforts to trying it."

The results (Fig. 3b) also indicate that individuals' external regulation (extrinsic motivation) might significantly influence individuals' post adoption. The results show that IM to know and IM towards accomplishments (intrinsic motivation) played important roles in explaining continued use. The results suggest that users value pleasure and satisfaction from exploring and accomplishing new things. The most influential amotivational factor for post adoption was found to be strategy belief.

Interviewee No. 40 said: "I keep using it because I need it to charge my phone. I also need the free Wi-Fi"

Interviewee No. 21 said, "I found out that the cTrolley has a navigation function. I always get lost in the airport, so now I always take a cTrolley so I can use the GPS."

Interviewee No. 7 said, "I use the smart trolley to play games and watch movies while I am waiting for my airplane. It is a good way to kill time. And I was happy to find that there are various kinds of games and movies on it. Also, I want to know my departure information, and this trolley can give me a voice reminder of my departure information at any time. That's really practical."

Interviewee No. 19 said, "My phone is totally enough for me. My phone has more functions than this trolley has. And my phone can do everything that this trolley can, so why should I use this technology?"

The results reveal that users are concerned about practicality when adopting a new smart technology, and this factor was the most important one determining long-term use; the smart technology's practical functions include search functions for departure and destination information, news and airport navigation, etc.

6 Discussion

This study investigates factors that influence users' adoption of smart technology for tourism. The study revealed the different types of motivation behind user behaviors based on multidimensional motivation subscales [67]. Our study shows that the motivation subscales differ significantly from initial use to post-adoption. Intrinsic motivation, extrinsic motivation, and amotivation all influence user adoption of the technology.

This study is the first step in analyzing users' different types of motivations for initial use and post-adoption behavior with smart technology. We have specifically examined various dimensions of user motivation. This gives us a better understanding of users' motivations for adopting smart technology. Conceptually, the distinction between initial and post adoption is clarified by analyzing users motivation separately. Aside from IM to know, external regulation has the strongest influence on initial use and post adoption behavior, which indicates the external control or social pressure on user's adoption of smart technology. Furthermore, our study highlight that amotivation should not be ignored when understanding user adoption of smart technology.

We want to pinpoint several design strategies based on our research. First, since IM to know and introjected regulation have the strongest influence on initial use, the initial appearance of smart technology outlook should grab the attention of potential users. External regulation has the strong influence on post-adoption behavior and can even affect users who were amotivated for the first use. Therefore, more steady functions as free Wi-Fi, phone charger should be developed. IM to know and IM toward accomplishments are also very important, so information and entertainment are important functions.

6.1 Limitations

This research has two limitations. First, our data may lack diversity because the interviews were conducted in one location and all interviewees were Chinese. Second, our results only present 8 motivation subscales out of 10 proposed by Vallerand [68]. Identified regulation and helplessness beliefs did not appear in the interviews, indicating future research needs to further examine the diverse individual motivations for adopting a new smart technology in different contexts.

Both practitioners and researchers are increasingly interest in understanding why people adopt smart technologies in order to design and evaluate technology [15]. Future research should better clarify the distinction between the three intrinsic motivation subscales. Amotivation subscales should also be considered when evaluating the factors influencing technology adoption. Furthermore, in order to make full use of the multidimensional perspective of motivation, a more diverse set of subjects should be examined.

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