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Pre-trip tourism information search by smartphones and use of alternative information channels: A conceptual model

Chaang-Iuan Ho[1]*, Yu-Chun Lin[2], Yu-Lan Yuan[3] and Ming-Chih Chen[4]

*Corresponding author: Chaang-Iuan Ho, Department of Leisure Services Management, Chaoyang University of Technology, 168, Jifong E. Rd., Wufong District, Taichung 413, Taiwan
E-mail: ciho@cyut.edu.tw

Abstract: This study developed a comprehensive model of how smartphone users search for pre-trip tourism information. Important dimensions and relationships in tourism information search (TIS) behavior were studied in 21 subjects. The data collection process included semi-structured in-depth interviewing data and field observation data. The analysis revealed 10 activities characteristic of TIS behavior: internal searches, mobile searches, saving information in the smartphones, preliminary collaborative TIS, barriers to TIS, bringing mobile search to an end, summarizing information, PC Internet search, advanced collaborative TIS, and searches via editorial communications. Such data collection was not performed in isolation. Further, 20 propositions have been developed for future testing. The results suggest that pre-trip TIS appears to consist in a diversity of search patterns with the usage of multiple information sources; in addition, it is no longer individual but collaborative behavior in the context of Web 2.0. Finally, the theoretical and practical implications of the research work are discussed, and directions for future work are suggested.

ABOUT THE AUTHORS

Chaang-Iuan Ho is an associate professor in the Department of Leisure Service Management at Chaoyang University of Technology (Taiwan). Her research interests include Internet-based tourism information search, e-commerce in the tourism industry, tourist behavior, and transport/tourism studies.

Yu-Chun Lin is a clerk of Hong Hwa International Co. Ltd., Taiwan. She holds an MBA degree at Chaoyang University of Technology.

Yulan Yuan is an associate professor of Department of Tourism Management at Jinwen University of Science and Technology. Her research interests focus on the process of adoption and implementation of information and communication technology in destination marketing organizations. She also engages with the usage of bibliometric approach investigating knowledge creation and scholarly communication in tourism.

Mingchih Chen is now with Graduate Institute of Business Administration, Fu Jen Catholic University as a full professor. Her research interests include data mining, reliability and maintainability, optimization and operation research.

PUBLIC INTEREST STATEMENT

We develop a comprehensive model of how smartphone users use mobile search and a combination of information sources for pre-trip tourism information to make travel arrangements. Ten search characteristics were identified and 20 propositions were proposed for future testing. The exception of sequential information search, more information processing, and integration with different patterns of information sourcing is included in the search process. This model explains generic and common aspects of information search that can be tested with different subjects in various settings for a wider application. An example would be searching for information pertaining to durable goods such as houses and automobiles. Another example is the use of digital libraries for guidance and assistance. The ways in which information searchers interact with a complex information environment through smartphones have serious implications for retrieval, access, and information use.

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1. Introduction

For many people, the use of smartphones has changed the approach to tourism information search (TIS) and travel planning (Wang, Xiang, & Fesenmaier, 2014a). A 2013 survey by Google (2013) revealed that 49% of mobile commerce consumers searched for information items regarding travel products. Web search is a particularly complex phenomenon (Ho, Lin, & Chen, 2012; Pan & Fesenmaier, 2006), and the information need is dynamic. Use of the Web expands the needs of smartphone users and increases the way to retrieve tourism information. The search characteristics identified on the wired/PC Internet may not adequately address some critical issues.

TIS is a set of complex interactions among people and technology (Yuan, Gretzel, & Fesenmaier, 2006). Seeking recourse in a smartphone to gather, assimilate, and use information involves increasingly complex means. The Web 2.0 medium, particularly social networking sites (SNS), facilitates the use of TIS to the extent that the searches involve social and collaborative aspects rather than the interactions of a single Web user with an information environment (Di Pietro, Di Virgilio, & Pantano, 2012; Xiang & Gretzel, 2010). TIS may also be constrained by the limited information processing and storing capabilities of smartphones. Mobile search may lead its users to different behavioral patterns with regard to how they seek information (Gómez-Barroso, Bacigalupo, Nikolov, Compañó, & Feijóo, 2012).

Additionally, online TIS usually requires consultation of widely varying resources, including offline information sources (Ho et al., 2012; Xiang, Wang, O'Leary, & Fesenmaier, 2015). Some researchers argue that studies should focus on how mobile-based searchers make sense of various sources within different information environments (Gómez-Barroso et al., 2012; Okazaki & Hirose, 2009). These studies reflect the growing need to understand smartphone users in the information-seeking context. To address the gap in knowledge regarding the pre-trip TIS behavior of smartphone users, this study raised the following research questions: Do smartphone users still use the PC Internet or other media for TIS? If so, how are the multiple information channels elaborated into a search?

To answer the above questions, this study develops a new model (including the propositions) of smartphone users and applies newly explored constructs to articulate and delineate the searching attributes that describe smartphone users' TIS behavior. Instead of merely modifying the Web-based model, relevant dimensions of the issue are re-addressed. Further research work is needed for a full exploration of TIS behavior using mobile devices. Specifically, our objectives are threefold:

(1) To investigate whether the TIS characteristics of smartphone users as described in the previous literature are relevant within an mobile Internet context;

(2) To incorporate the collaborative aspects of TIS into a search process;

(3) To determine how smartphone users interact with various information media (including the mobile Internet, PC Internet, and other sources) in the search for tourism information.

This article is organized as follows: first, this study reviews the literature on the process of Internet-based TIS and online trip planning. It then describes the research approach and the field study. The proposed model and the major findings are then presented. Finally, applications of the model and directions for future research are discussed.

2. Literature review

To achieve its research purposes, this study is mainly grounded on two theoretical foundations, namely, TIS on the Internet and collaborative information search (CIS). This study conducts a

micro-level analysis of how information search activities are performed using a smartphone device interface.

2.1. TIS on the PC/Mobile Internet

TIS behavior should be viewed as a complete process and should be analyzed from its initial search to travel decision-making. Some researchers consider Internet-based TIS from this viewpoint. Mitsche (2005) used a tourism domain-specific search engine to identify search patterns at the beginning of the information search process. Based on the cognitive information retrieval perspective and the knowledge structure of information searchers, Pan and Fesenmaier (2006) develop a mental model of online vacation planning by tourists. The model revealed that online vacation planning exhibits a hierarchical structure of episodes and the overall episode is composed of various search activities. The model also describes that the searchers use information hubs containing many links to other related websites to facilitate the navigation process. However, the interactions among search tasks are not clearly understood. Therefore, Zheng Xiang, Wober, and Fesenmaier (2008) propose a conceptual framework for system development and design. Micro-level analysis of online TIS behavior focuses on interactions between an online tourism information searcher, a search engine, and the online tourism domain.

Ho et al. (2012) considered the perspective of a tourism information searcher in their proposed model of the TIS search process by Web users. According to the conceptual framework, the temporal order of search process has four stages: the start of online searching, online searching, bringing the search to an end, and offline searching. Common elements in information-seeking experiences are prior knowledge and search experiences, online search strategies, processing and recording information, barriers to online search, reasons for ending an online search, summarizing information, exchanging information, and searching for more information through other sources. Such behavior exceeds the scope of TIS on the Internet and captures other off-line activities such as processing, using, and disseminating information. This model mainly reflects how a Web user interacts with an information environment. The proposed framework is grounded on memory and cognitive information processing theory (Gursoy & Chi, 2008). However, by revisiting this framework in view of the discrepancies in the characteristics and the interactions among specific search activities on the smartphone platform, the model may not obtain a sufficiently concise or adequate depiction of mobile-based TIS behavior. Thus, TIS itself must be re-examined, and Web users must be distinguished from smartphone users.

Compared to the Internet, which is the most widely used information source, other information sources provide more fragmented information. Studies show that the mobile Internet is not the only medium through which city tourists collaborate in the use of maps and guidebooks and mobile information systems in their traveling experiences (Brown & Chalmers, 2003); travel decisions are also made by consulting feature stories in magazines, newspapers, and television programs (Okazaki & Hirose, 2009); travel guidebooks still have a competitive advantage because they provide travelers with tangible materials (Simon Wong & Gladys Liu, 2011). These research findings indicate that editorial-style tourism information is often used by searchers and tourists even though they rely heavily on Internet-based TIS. Thus, understanding how smartphone users interact with different types of tourism information media is essential.

2.2. Collaborative tourism information search (CTIS)

Generally, information seeking is still considered an individual activity. However, social interactions occur during information-seeking activities, e.g. influencing the information needs, reformulating the query, and using the information (Hancock-Beaulieu, 1989). Studies in Library Science (e.g. Kuhlthau, 1991; Wilson, 1981) indicate that collaborative activities take place during the information search and retrieval process, which require interaction among all team members. This viewpoint is based on the user-centered paradigm, i.e. information system users seek information from various sources to satisfy their needs. For example, Hyldegård (2006) extends the Kuhlthau information search process (ISP) model to explain CIS activities in educational settings.

CIS activities may be classified as remote or co-located as well as synchronous or asynchronous (Twidale, Nichols, & Paice, 1997). Widely varying information transfer and exchange activities can be classified in terms of spatial and temporal dimensions. A simple definition of CIS is people working together to identify and to share information (Poltrock, Dumais, Fidel, Bruce, & Pejtersen, 2003). CIS activities often involve sharing of information and search results among a group as well as broadcasting information and handling search requests made by others (O'Day & Jeffries, 1993). CIS also occurs within the wider context of the group communication process, which is considered a dynamic activity of individuals working together to seek, synthesize and disseminate information (Sonnenwald & Pierce, 2000).

A TIS activity involves planning, decision-making, and anticipation of the trip with other people. The community (network of people) may act as a gateway for helping information seekers find the appropriate information repository. In this case, TIS is collaborative. However, the role of collaboration in information-seeking activities in the tourism domain is rarely discussed.

In fact, CTIS already exists when tourists gather information from family and friends, travel consultants (e.g. Snepenger & Snepenger, 1993), or travel agents (e.g. Kendall & Booms, 1989). Additionally, customers share information and opinions about a specific product, brand, or service by word-of-mouth (WOM) (Hawkins, Best, & Coney, 2004). Searching for tourism WOM information is not only an information search strategy, but also a CTIS activity. As Internet technology advances, WOM communication takes place from face-to-face contact to cyberspace, and e-WOMs have become more common than traditional WOMs. Therefore, CTIS may also refer to the active and explicit search and retrieval of tourism information by interacting with others to achieve a specific goal.

Although many studies have investigated TIS behavior of individuals, a few studies in the field of Information Science have explored CTIS behavior by developing and designing associated systems. For example, Prestipino (2004) developed a community system for supporting communication and collaboration in tourism. They found that using chat, voice, or video communication to plan search strategies enabled convenient collaboration (Talja, 2002). Tourism information searchers may collaborate for various purposes such as gathering, verifying, updating information or for sharing information, knowledge, and experience (Arif, Du, & Lee, 2012a). In another study by Arif, Du, and Lee (2012b), the most frequently used tourism keywords were used to estimate the division of search tasks and the sharing of search results during the collaborative searches. The medium used for collaboration was the phone for 71.4% of respondents, emails for 60%, and other media (face-to-face and Web inquiries) for 31%. Desirable functions of a CTIS system include synchronous/asynchronous sharing and discussion, the capability to provide a search history and feedback, chat, voice, and video call options, and searching, saving and sending options in the same window, and an organizer to support planning tips. Notably, some of these functions can be performed by smartphones.

2.3. Device-related foundations of smartphones

A smartphone is a mobile phone built on a mobile operating system. Therefore, it has more advanced computing capability and connectivity compared to a feature phone (Nusca, 2009). Their similarities include a convenient mode of communication to reach individuals and enhanced communication speed and frequency (Jelassi & Enders, 2004). Smartphones are considered individual and portable multimedia devices.

However, to maximize portability, smartphones have limited utility space and small screens (Anthony, 2012). Smartphones have limited capability to overlap or stretch multiple windows in the same screen mode and limited capability to display a full set of menu items. The small screens limit the ability to concentrate on the screen for a relatively long time. Therefore, users expect high efficiency and low cognitive loads when processing data and performing tasks on smartphones.

The different use of a PC is another rationale for the extension of the simplicity concept in a mobile interface. The clearest transition from a PC toward Web usability is a haptic interface. However, a

mouse pointing device enables more precision compared to fingertips. Another concern of smartphone users is the time and monetary costs due to the limited battery life and usage charges (Colon, 2013). Outdoor use of Web-enabled mobile handsets has many limitations, including the difficulty of reading the display in bright sunlight (Krawczyk, 2013).

When smartphone users access the mobile Internet, they have the option to use the Internet ubiquitously even while being on the move. The mobile Internet offers both IP-based and WAP-based delivery of applications (Zakas, 2013). Such services facilitate the speed and convenience of using a smartphone platform for TIS.

3. Methodology

Studies of information search phenomenon often rely on more than one data collection method, especially if the phenomenon under investigation is both complex and multi-faceted (e.g. Ho et al., 2012; Reddy & Jansen, 2008). Two methods used to collect data are on-site observation and semi-structured interviews. To investigate TIS on the smartphone platform, the study asked each participant to perform TIS. The study was performed at the discretion of the participants rather than in a laboratory in order to identify TIS activities in a realistic setting. All mobile search sessions were conducted in a completely uncontrolled environment. Additionally, participants used their own mobile devices to avoid having to learn how to use laboratory equipment and to minimize rarely used search activities.

Qualitative interviews were used to capture the complexities and nuances of what they actually do in practice, including undo moves using the smartphone as well as what they are supposed to do afterwards (through other information sources). The data collection procedure was performed as described in Ho et al. (2012). The mobile search sessions started by informing the subjects of the study purpose and instructions for completing the study. A search assignment regarding a vacation plan in the near future was given and each subject was observed throughout the information search process. The subjects were allowed to end the mobile search sessions at any time. The interviews were also videotaped to capture the interactions of the participants with the smartphone screen and to identify their mobile search activities.

The narrative descriptions and related observations of the participants yielded more than 150 pages of transcribed interviewing data and field notes for analysis. The analytical technique used in the study was grounded theory, which is increasingly used in studies of human-computer interaction (e.g. Pace, 2004; Reddy & Jansen, 2008) as well as online tourism information (e.g. Ho et al., 2012; Papathanassis & Knolle, 2011). This approach is mainly an inductive investigative process in which researchers formulate a theory regarding a phenomenon by systematically gathering and analyzing relevant data (Glaser, 1998; Glaser & Strauss, 1967; Strauss & Corbin, 1998). Grounded theory is not only effective for dealing with the complex network of concepts and relationships in human-computer systems, it also determines the flow of connected events over time. As Martin (2007) points out, grounded theory includes thick descriptions of behavior processes. These descriptions allow both emic (self) and etic (e.g. researcher) interpretations of the information searcher's lived experiences and plans. By combining both emic and etic reporting, we can obtain a deeper understanding of mobile-based TIS behavior.

The data analysis procedure was as follows. First, content analysis was used to analyze the narrative descriptions given by the participants during the interview. After comparing items extracted from the interviews, (interview-to-interview, field notes-to-field notes, and interview-to-field notes, etc.), similarities, and commonalities were identified. The data were analyzed at the paragraph, sentence, and word levels to identify categories and their properties. As initial propositions regarding the categories, and particularly, relationships between categories emerged from the data analysis, a further analysis was performed to strengthen or dismiss the initial propositions, which required a deeper literature review. In addition to effectively dealing with the complex network of concepts and relationships in human-computer systems, the procedure also determined the flow of connected

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Table 1. Profiles of the interviewees (*N* − 21)					
Variable		**Number**	**Variable**		**Number**
Gender	Male	9	Occupation	Business	3
				Service industries	11
	Female	12		Public admin.	1
Age	21–25 years old	9		Education	2
	26–30 years old	4		Military	1
	31–35 years old	2		Student	2
	36–40 years old	2		Other	1
	41–50 years old	2			
	51–60 years old	2			
Education	High school	6	Monthly income (NT dollars)	20,001 or below	2
	College degree	12		21,001–30,000	10
	Graduate school	3		31,001–40,000	3
Marital status	Married	4		41,001–50,000	2
	Single	17		51,001–60,000	2
				61,001 or above	2

events over time (Ho et al., 2012). Detailed descriptions of behavioral processes not only allowed researchers to interpret the information searchers' lived experiences within and in-between information environments, but also to identify new/different concepts and their properties from the data.

The reliability of the open coding process was checked after completing the open-coding for each transcript. After three of the interview transcripts were coded by a researcher, his renditions were then compared with our own. Intercoder reliability was measured by the formula proposed by Miles and Huberman (1994). The reliability for the first interview was 89%, which was better than the suggested criteria of 70%. The reliability rose to 92 and 94% as the procedure was repeated for the second and third transcripts, respectively. The three transcripts were coded before the checking procedure to obtain an overall consensus.

For convenience and due to time constraints, the data were collected from the sampling frame described as a purposive and snowball sample. Most "seed" informants were acquaintances of the authors, who were invited to participate in the interviews and also asked to invite their friends or colleagues. The informants were selected according to certain characteristics such as gender, age, current occupation, and their usage of the mobile Internet and experiences using TIS via smartphones. Although these subjects were purposively selected, the theoretical sampling procedure applied the concept that no additional data from additional cases should be used to develop new insights or to extend or refine the insights already gained (Taylor & Bogdan, 1998). The aim was to maximize opportunities for exploring emerging concepts. The required number of informants was not specified in advance. The data collection continued until theoretical saturation was reached. Thus, the interview process was stopped after 21 interviews. Table 1 profiles the 21 participants who contributed to data collection.

4. Research findings

Figure 1 shows how the findings were used to develop a conceptual framework. In total, 10 major behavioral characteristics that subsumed the important features were identified and 20 propositions were developed for future testing. The next two sub-sections discuss a group of related concepts and propositions from the framework: mobile-based TIS characteristics and multiple tourism information sources elaborated on mobile Internet.

Figure 1. Conceptual framework of smartphone users' pre-trip TIS behavior.
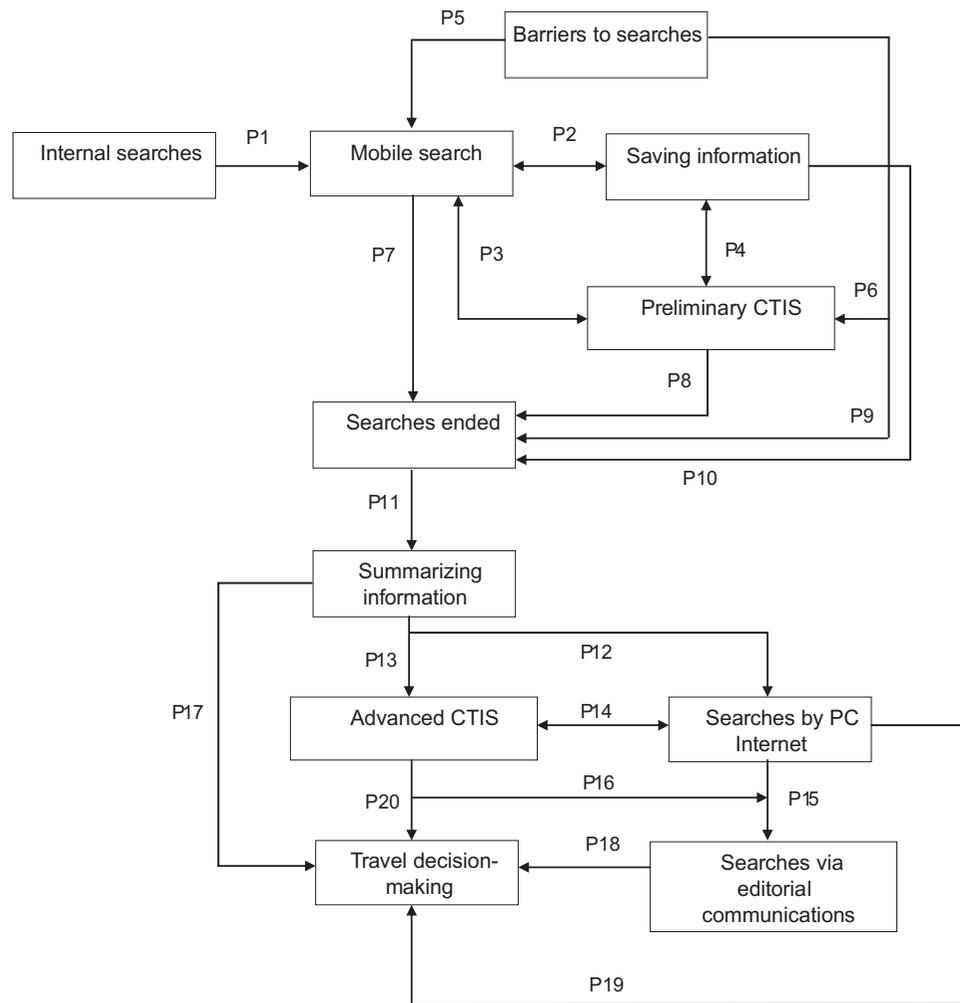
4.1. Pre-trip TIS activities characteristic of smartphone users

The 10 major TIS activities performed with smartphones were (1) internal searches, (2) mobile search individually, (3) preliminary CTIS, (4) saving information in the smartphones, (5) barriers to mobile search, (6) bringing mobile search to an end, (7) summarizing information by using smartphones, (8) searches by PC Internet, (9) advanced CTIS, and (10) searches involving editorial communications. These search characteristics and their properties are presented below.

(1) Internal searches

The data revealed that mobile search was almost identical to that of Web users (Ho et al., 2012). The data indicated that smartphone users initiated TIS by recalling web pages, URL, bookmarks, and email memos in previous searches. These data-sets were conveniently stored in mobile handsets for users engaging in internal and new searches. Mediators of travel experiences also include photo and video (Tussyadiah & Fesenmaier, 2009). These media are important for TIS because they provide the opportunity re-experiencing the past and stimulate the desire to re-visit a destination. The following comments from those interviewed described their initiation of mobile searching based on their past successful experiences:

Informant No. 4:   I generally referred to my previous search results when starting a search. Just like copying the past experience to a new search …

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Informant No. 9: ...The memories still existed as long as I had ever been there. Once I had the information I needed, I immediately recalled visiting those hotels and shops.

Informant No. 21: I followed what I knew already to find out the information and to see whether anything new or interesting was obtained.

(2) Mobile search individually

The seven mobile search strategies most commonly used by individuals smartphone users are using search engines, using keywords, using bookmarks, browsing web pages, comparing search results, using e-WOMs, and other approaches. The approaches used to access the Internet by mobile devices were generally similar to those used to access the Internet by PCs (Ho et al., 2012). The search strategies can also affect the amount of information obtained and the amount of efforts spent on making search queries.

(a) Using search engines

Most of the informants started searches with their favorite search engine (either Yahoo or Google). Loyal use of a search engine can also contribute to the selection of a mobile handset with a specific operating system. Simultaneous use of multiple search engines is rare. This search action slightly differed from that for the PC Internet (Ho et al., 2012). Some informants clicked the items on the hotlist, i.e. the most frequently viewed subjects or advertisements. The interviewees described several examples of such experiences:

Informant No. 3: I used Yahoo more often because it became a habit.

Informant No. 6: I changed the search engines during the search process. The change was one by one.

Informant No. 19: I clicked the items in the "hot" list on the home page of Yahoo.

(b) Using keywords

Instead of using a single-word query, the informants often used a multi-word expression or a phrase to describe their TIS needs. They started with keywords for a given topic. As reported by Zheng Xiang et al. (2008), search queries were often initially expressed in broad terms and then refined and narrowed by using words presented in the web pages. Consider the following comments from Interviews 16 and 17:

Informant No. 16: I directly keyed in the word or phrase representing what I would like to look for.

Informant No. 17: I typed the name of the destination and then clicked each query on the web page.

(c) Using bookmarks

Some informants bookmarked the URLs of useful websites or web pages. Since the sites may also have been habitually visited sites or landmark websites, they started the searches by typing the URLs directly to access the target sites or used the bookmarks to go to the web pages. For example, interviewees 1 and 12 said:

Informant No. 1: If the information was useful, I would bookmark the URL in my smartphone. Once I needed to search for information, I clicked the URL directly to link the target website.

Informant No. 12: I often found my bookmarks which I had used to save some information. I then chose an appropriate one to click on a website.

(d) Browsing web pages

The informants performed several actions commonly observed in Web users (Ho et al., 2012), including exploring, scrolling, or scanning a web page before taking further action, navigating backwards and forwards, and finally selecting a document for review. Due to the small screen size, however, participants often searched pages near the home pages instead of searching at deep levels. Some participants performed visual searches by reviewing the photos rather than reading the text on the web page. Generally, smartphone users were quicker than Web users in deciding whether the website was relevant and in moving from one site to another. The following descriptions represented some examples of the comments made by those interviewed.

Informant No. 5: *I conducted a brief review of the Web page content.*

Informant No. 20: *If necessary, I would click the links connected to other websites or web pages.*

(e) Comparing search results

Likewise, the actions often identified by the informants included navigating backwards and forwards or backtracking to specific web pages (Ho et al., 2012). The discrepancy resulted from the small screen size, which limited the capability to stretch or display a full set of menu items to compare or evaluate the search results. The information obtained in the searches was then used in subsequent searches. Consider the following descriptions of the search process described by several interviewees:

Informant No. 13: *I used portal websites to request the result pages. …… I also made comparisons among several service companies based on their prices, and found out which one was less expensive.*

Informant No. 4: *Several web browser windows were open in parallel for comparison purposes. For example, while considering a B&B service, a single personal review was insufficient. Multiple online reviews were used.*

(f) Seeking e-WOM

Online WOMs can be conveyed by using Facebook, Twitter or travel blogs (Sotiriadis & van Zyl, 2013). Some informants stated that they searched for tourism information by reviewing opinions, claims or recommendations on the official cooperative websites or on private blogs. Similarly, Minazzi and Mauri (2015) reported that user-generated content (UGC) was the most frequently accessed source of information in the pre-trip stage. The following comment from Interview 14 illustrated the use of SNS:

Informant No. 14: *I would visit personal blogs to search for reviews or recommendations.*

(g) Other strategies

Another strategy applied by the informants was to use customized Apps as shortcuts to the smartphone interface. Some informants used various travel-and-tourism related Apps in their mobile devices to start their TIS activities. Dickinson et al. (2014) argued that these Apps can facilitate travel by enabling collaborative and dynamic travel decisions. One example of user experience with an app is given by Interviewee 2.

Informant No. 2: *I often used APPs on my smartphone. The software was like a tour guide that provided functions such as recommending restaurants.*

The above search approaches used on smartphones were almost identical to those used on the PCs. Despite their overall similarity, smartphone users tended to achieve fast and preliminary TIS on an individual basis. Generally, several search strategies were used simultaneously (i.e. each search strategy was combined with other search strategies); the informants rarely used a single search strategy during the process.

(3) Preliminary CTIS

The survey results indicated that preliminary collaboration in the tourism context mainly focused on gathering information (raising questions and seeking responses from the WWW), obtaining information (asking travel companions whether they had found anything of interest or which was useful), sharing search results (search strategies and search experiences), sharing information (search history, successful queries, and passing on interesting/useful items), updating information (emailing memos, posting the information on Facebook), and verifying information (communicating and sharing personal opinions). The collaborators included acquaintances, strangers who had or had not been to the travel destination, and travel companions.

These CTIS activities included synchronous and asynchronous sharing, interacting in real time, seeking feedback, searching for and sending messages. Except for the co-located collaborators, most participants stated that they used voice calls, emails, web inquiries as well as social media tools (including Facebook and LINE) to complete the CTIS tasks. For potential travelers, information shared on social media sites is an important source of information for making travel decisions (Kang & Schuett, 2013). Social media also affects the travel planning process (Leung, Law, van Hoof, & Buhalis, 2013). For examples of participants with such experiences, consider the following cases from several of those interviewed:

Informant No. 5:   *I forwarded the information obtained to my friend to review it.*

Informant No. 21:   *I posted the information obtained on my Facebook page and waited for the opinions of my friends.*

Informant No. 12:   *I e-mailed what I found to my friend and asked him to give me what he had already looked for.*

(4) Saving information in the smartphones

The collaborative search actions were performed after the obtained information was saved. Actions taken by the informants included writing down the URLs, cloning the web pages, saving the links or web pages as bookmarks, and sharing the useful information by directly forwarding it to the collaborators. *The following descriptions represented some examples of the smartphone users' experiences.*

Informant No. 14:   *I would make copies of the information and store it in the "notebook" on my smartphone …*

Informant No. 17:   *I always bookmarked useful websites.*

Informant No. 7:   *If I liked the visited website, I would take a photo to save it as a file.*

(5) Barriers to mobile search

Disturbances encountered during a search process were divided into three categories: website content, mobile Internet connection, and mobile appliance. As reported previously by Ho et al. (2012), most of the unexpected situations were associated with connected websites, including the web pages that required updating, the removal of the result pages, unsatisfactory search results, and many advertisements on the web page. Smartphone users reported many more inconveniences, including: slow Internet speed when using websites and failure to link web pages. The research findings of Stienmetz, Levy, and Boo (2013) justify the experiences of some interviewees. The search obstacles related to mobile handset features were small screen size and limited battery life. Such search obstacles caused the participants to feel depressed or stressed during the mobile search.

Informant No. 1:   *What bothered me while searching for tourism information? I found the information provided by the website was out-of-date.*

Informant No. 13:   *I could not just put up with the web pages with text only (without photos). Although the description in the text was helpful and important, I felt it necessary to have figures for a better understanding.*

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Informant No. 3: *Advertisements were often merged. And then, ... the information on the Web pages did not meet my expectations. In particular, the headline was attractive, but the content differed from the topic.*

Informant No. 11: *The mobile Internet connection was relatively slow, and sometimes it was difficult to link them. Thus, I had to switch to the other site.*

Informant No. 10: *I had sore eyes after looking at the screen for a while.*

Informant No. 8: *The problems of using a smartphone to search for tourism information were the short battery life, insufficient information, and the low reliability of the smartphone.*

(6) Bringing mobile search to an end

Most web users reported that their one-spot Internet search stopped when they obtained the information they required or when they found that the desired information was unavailable (Ho et al., 2012). Likewise, the informants cited similar reasons for quitting a mobile search. However, due to the limited functionality of their mobile devices, they had difficulty in further using the obtained information. The small screen size and limited battery life of smartphones were additional reasons cited for stopping searches. Furthermore, some informants ended their mobile searches simply because they had to attend to other personal affairs.

(7) Summarizing information by using smartphones

After completing their mobile searches, the informants summarized the information they obtained. Typical actions were reviewing the overall content, deleting redundant or useless information, and preserving what they really wanted. This suggests that the informants obtained further reviews and evaluations. Consider the following comments from several interviewees:

Informant No. 4: *At the end of an mobile search by a smartphone, I would write down the wanted information (by hand) into my (paper) notebook, and then summarize it to find what I wanted most.*

Informant No. 19: *I would take time to classify the search results that had already been saved as bookmarks.*

(8) Searches by PC Internet

Some participants reported that they used their mobile search and/or preliminary CTIS results for further Internet searches by PCs. They often revisited pages obtained in earlier searches or reviewed their search history to double check searches or to make relevant judgments. They would then backtrack to specific web pages. They reactivated another search whenever an advanced search needed to be performed. The participants indicated that their navigation behavior when using the PC for Internet search was usually goal-directed. In contrast, smartphones were mainly used for browsing the Internet. Their instrumental navigation strategies were intentional and selective and apparently reflected the purposive exposure to specific information content.

The informants also reported that they kept several web browser windows open in parallel when using a PC for Internet searches. These search activities involved information multitasking such as comparing tourism products or comparing information (Spink, Danby, Mallan, & Butler, 2010). The multiple search tasks and switching between tasks implied that the participants reviewed and evaluated the information found by these search activities.

The participants indicated that PCs were essential for compiling and editing the obtained information. They then classified the detailed information according to their needs. A major convenience of using PCs was the capability to print the documents. Consider the following comments from some Interviews:

Informant No. 2:   *Apart from using a smartphone, I would use a computer for searching. The computer connected with the website more quickly. For me, it was more convenient to use a PC to find the information I needed.*

Informant No. 5:   *After searching for tourism information with my smartphone, I would further search for more information using the PC. Because of the large screen size, using PC reduced strain on my eyes.*

Informant No. 13:   *I use my smartphone for a general search of tourism information. I then double check the information on my PC.*

Informant No. 4:   *I would convert what I had already found into the save the information on my computer and print it out on paper.*

(9) Advanced CTIS

Important TIS processes include judgment and sense making such as assessing the natural beauty of a place and taking a decision regarding whether or not to go on a certain trip. Conversations with others may also provide information that can be used to improve the effectiveness of CTIS. Interviews with the informants indicated that advanced CTIS mainly focuses on further communication and discussions with travel companions by evaluating and filtering the information found either synchronously or asynchronously.

Advanced CTIS activities also included seeking personal recommendations from acquaintances (friends, colleagues, or relatives) and asking them how to make the trips. The information sources were also expanded by asking travel intermediaries (e.g. travel agents) to perform a search, provide information, or obtain additional information from travel-related service providers (e.g. resorts, hotels, and so on).

Nevertheless, our research finding is similar to past research by Ho et al. (2012), who reported that Web users exchange/share information and perform offline searches for information through other auxiliary channels. In the collaboration process, preliminary and advanced CTIS were interrelated, echoing the two processes of CIS&R proposed by Hansen and Järvelin (2005). The research results are also consistent with those presented by Sigala (2010, 2012), who reported that trip planning has evolved from an individual to a collaborative process and group decision-making. The following descriptions represented some examples of the comments made by those interviewees.

Informant No. 9:   *After summarizing the tourism information I collected, I posted it on Facebook so that my friends could evaluate the travel itinerary.*

Informant No. 14:   *I learned about the destination by asking friends who had been ther.*

Informant No. 15:   *After doing my own search, I consulted a travel agent.*

(10) Searches involving editorial communications

While the Internet (either mobile or wire-based) is now an important platform for TIS, some participants indicated that they still rely on editorial communications such as guidebooks/brochures, advertisements or feature articles in newspapers/magazines, TV programs or travel exhibitions. These findings are consistent with a report that Finnish leisure travelers use multiple information sources to make purchasing decisions (Bjork & Kauppinen-Raisanen, 2015). Whereas Web users turn to offline information sources as opposed to only using the Internet (Ho et al., 2012), smartphone users make decisions based on information in feature stories in magazines, newspapers, and television (Okazaki & Hirose, 2009). Examples of related comments were the following:

Informant No. 2:   *... I used these search methods on the Mobile Internet. In addition, I would look for travel magazines for more information.*

Informant No. 9:   *For further searches, I would use other information channels such as travel exhibitions, travel magazines, and some TV programs. They provided a different format of tourism information.*

Informant No. 20:   *I would go to the bookstore to look for more information from the travel books. I then compared the information obtained online with the book content.*

The research findings highlight several important features of pre-trip TIS behavior by smartphone users. First, the search strategies applied when using the mobile Internet for TIS were very similar to those applied when using the PC Internet for TIS. However, the search strategies slightly differed. For example, the web pages that users viewed with their smartphones rarely included in-depth evaluations and comparisons. Different browsing strategies were used. For example, searchers also tended to explore and scan web pages rather than reviewing a document thoroughly. Secondly, the smartphone was not only the primary platform for individual TIS, it also played an important supporting role in collaborative TIS in terms of seeking, saving, sharing information, and communication/discussions. In the mobile Internet environment, TIS comprises more than just search and more than the interactions between a single smartphone user and a device. Finally, smartphone users typically use multiple information channels for TIS. Many resources involve not only the usage of the Internet (mobile and wire-based), but also editorial communications.

4.2. Pre-trip TIS behavioral model of smartphone users

Figure 1 outlines what, when, and how TIS activities pertain to trip planning by smartphone users. The boxes represent the search characteristics, and the arrows represent the grounded theory propositions. The box at the tail of an arrow indicates an influence or driver of the box at the head. The search characteristics, which are presented in temporal order, show the order of relationship that lead to travel decision-making.

The search characteristics and their relationships, including some that either did not feature in the work of Ho et al. (2012) or emerged from dimensions described by the latter, may be regarded as new insights into the TIS behavior of smartphone users: preliminary CTIS, advanced CTIS, searches using PC Internet, and searches involving editorial communications. Other search characteristics are identical to the dimensions of the Web users' model; however, they occur in a different context and apparently differ: mobile search, barriers to mobile searches, and reasons for ending mobile searches. The propositions of the conceptual model are summarized below.

Proposition 1 (P1) is the knowledge based on how travel experiences and search experiences affect individual smartphone user framing of mobile search. That is, smartphone users engage in internal search to determine the best way to start a new search. Previous success in a search is assumed to guide the completion of a new search task.

Proposition 2 (P2) is that the mobile searches correspond to the saving of obtained information. The reciprocal influences between these two search behavioral features (saving and not saving) indicate that saving information corresponds to continuous mobile searches.

Propositions 3 & 4 (P3 & P4) are that preliminary CTIS is performed after a certain duration of mobile search activities. It denotes the transition from individual search behavior to collaborative search behavior. Smartphone users generally search for tourism information individually. Once they have obtained information and/or saved it, however, they turn to collaborative TIS, which may be synchronous or asynchronous. They might pass or post messages to collaborators or contact collaborators immediately to discuss the messages. The reciprocal effects between these two search features indicate that the information collected from collaborative searches is also stored.

Propositions 5 & 6 (P5 & P6) are that unexpected barriers encountered by smartphone users affect their individual or collaborative mobile searches.

According to Propositions 7, 8, 9 & 10 (P7, P8, P9 & P10), individual or collaborative TIS activities were performed continuously but ultimately ended for various reasons.

Proposition 11 (P11) is that the mobile search ends with the smartphone users summarizing the information obtained.

Proposition 12 (P12) is that smartphone users used the PC Internet for further searches based on their preliminary mobile search results. This suggests that TIS is a time-consuming task because of its iterative nature.

Propositions 13 & 14 (P13 & P14) are that smartphone users perform subsequent search tasks and advanced CTIS while finishing PC Internet searches. The CTIS activities would be performed based on the previous mobile-based search results as well.

Propositions 15 & 16 (P15 & P16) are that smartphone users prefer using other editorial channels to search for additional information. That is, the non-mobile searches were performed while the advanced CTIS and searches using the PC Internet were being achieved.

Propositions 17, 18, P19 & P20 (P17, P18, P19 & P20) are that searchers ultimately use different information sources and different amounts of information to make their travel-related decisions.

Figure 1 presents a comprehensive model of pre-trip information search by smartphone users. The upper half indicates TIS activities performed using smartphones. Smartphones are viewed as individual and portable computers in a mobile use context, and almost all the search tasks can be performed by mobile devices. Ubiquitous communication also facilitates more active search behavior compared to Web-based search behavior. The bottom half illustrates that the mobile Internet, PC Internet, and editorial communications have been interwoven into TIS, which shows that individuals uses mobile search and a combination of information sources to make travel arrangements (Lamsfus, Wang, Alzua-Sorzabal, & Xiang, 2014; Xiang et al., 2015).

Our research findings reveal that pre-trip TIS in the ICT era is still an ongoing or specific problem-solving process that occurs before the travel decision is made (Sharifpour, Walters, Ritchie, & Winter, 2014; Wang, et al., 2014b). In contrast with descriptions of the search process in previous studies (e.g. Bieger & Laesser, 2004; Choi, Lehto, Morrison, & Jang, 2012), this study found that, which the exception of sequential information search, the search process involves more information processing and integration with different patterns of information sources. Further, the search feature of the preliminary CTIS distinguishes individual forms of search behavior from collaboration, and further elucidates pre-trip TIS.

However, the search characteristics were not shared by all searchers. Since each participant performed recent TIS searches in different situations, not all of them had an equal opportunity to encounter all of the search activities in Figure 1. Table 2 shows the search patterns (i.e. sub-models of the search process) identified in this study. Interestingly, the number in each pattern represents the number of participants whose search experiences provided empirical indicators for that particular search pattern. The number cannot be used to claim that one pattern is more important (or dominant) than another.

These patterns reveal differences in how searches were performed. While using a smartphone as an information search appliance, some searchers reveal individual search behavior: a smartphone acting as a PC without making use of its functionality to communicate with others. That is, preliminary CTIS is not performed on the mobile Internet (Patterns E, F, & G). Patterns B, C, & D indicate that

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Table 2. Search patterns of the interviewees							
	Characteristics						
Pattern	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Internal searches	✓	✓	✓	✓	✓	✓	✓
Mobile searches	✓	✓	✓	✓	✓	✓	✓
Saving information	✓	✓	✓	✓	✓	✓	✓
Barriers to searches	✓	✓	✓	✓	✓	✓	✓
Preliminary CTIS	✓	✓	✓	✓			
Searches ended	✓	✓	✓	✓	✓	✓	✓
Summarizing information	✓	✓	✓	✓	✓	✓	✓
Advanced CTIS	✓	✓	✓	✓	✓	✓	
Searches by PC Internet	✓	✓					
Searches by editorial communications	✓		✓			✓	
No. of searchers	3	6	3	4	3	1	1

tourism information channels are interplayed; however, the information channels are not employed as a whole. The search patterns imply a dependency on mobile search of Internet sources, reduced use of other editorial information sources, and the combined use of PC Internet search and mobile search.

5. Conclusions

This study develops a conceptual model of how smartphone users engage in pre-trip TIS activities. The model comprehensively answers the research question of how smartphones are used for TIS. Explanations for how and why certain events occur are grounded on the data rather than deduced from the literature. The overall search process holds promise for capturing transitions from one-step to another and pre-trip TIS tasks are not performed in isolation. Some search characteristics may be considered insightful; others exceed the context but shed new light on the dimensions of the Web users' model (Ho et al., 2012). The contribution of this study is the improved understanding of how smartphone users engage in complex search-related and collaborative tasks/activities as a means to approaching their travel decision-making.

5.1. Theoretical implications

According to Brown (1991), a general model of information-seeking behavior must consider varying patterns of interaction among individuals as well as varying patterns of behavior by a single individual. The diverse TIS patterns revealed by this study accommodate the associated search behavior of different searchers, travel products/services, and situational factors (Eichhorn, Miller, Michopoulou, & Buhalis, 2008; Jun, Vogt, & MacKay, 2010), mobile searches with a combination of information sources (Okazaki & Hirose, 2009; Xiang et al., 2015), and the information needs, and concerns in the different TIS phases (e.g. pre-purchase or en-route search) (Lamsfus et al., 2014; Wang et al., 2014b). Researchers may examine the components of the model systematically. Further replication or verification in similar environments or with different subjects in various settings would contribute to the knowledge of search behavior.

Although the findings are drawn from a specific domain, this model explains generic and common aspects of information search that can be tested for goodness of fit in different subjects and settings for broader application beyond the original setting. An example would be searching for information pertaining to durable goods such as houses or automobiles. Another example is the use of digital libraries for guidance and assistance in a more complex information environment. The ways in which information seekers interact with a digital library through smartphones have important implications for retrieval, access, and information use.

5.2. Practical implications

This exploratory study captures important aspects of pre-trip TIS through the mobile Internet, the PC Internet, and other information media. The research results are consistent with the report by Okazaki and Hirose (2009) that the cross-media promotions and campaigns using smartphones will be an important strategy for travel-related industries. The mobile Internet is mainly used as a medium for communication and interaction. The design standards of mobile appliances and software need further development to support a more sophisticated role. The current design principles apparently ignore the needs of the whole person, and our research findings may contribute to the development of such multidimensional design principles.

Additionally, the use of apps has increased at all stages of tourism consumption (Höpken, Fuchs, Zanker, & Beer, 2010). More apps are expected to emerge into travel decision-making. Designers of software and related mobile services can use the findings of this research when designing mechanism for integrating information search and access, which would facilitate the improvement of tools and smartphone interface for TIS.

According to Shah (2010), a new paradigm of system design is needed to support social aspect of information search instead of supporting individual search activities. This proposed model provides guidelines for designing functions and services to support various aspects of CIS&R for smartphone users. The model has great potential for improving effectiveness of information search through the re-use of earlier searches; this is one mechanism for adding value to the hardware and software of smartphones.

5.3. Limitations and suggestions for future research

Notably, given the small scale of the study, the analytical results must be interpreted cautiously. The resulting model is an integrated set of propositions, and grounded concepts are suggested, but not proven. Additionally, this study did not investigate the relative frequency of the search characteristics and activities. It remains to be determined whether these findings reflect the TIS behavior of smartphone users in general. In future studies, we will generalize the theory to a wider population by testing the model with empirical data. As suggested by Zins (2007), longitudinal panel studies are needed for further elucidation of various facets of the TIS process. Further studies may reveal other more important search actions.

The proposed TIS behavioral model describes the early stage of a travel decision-making process. According to Hyde (2008) and Sigala (2012), further research is needed for an improved understanding of how information search (including CTIS and collaborative trip planning) is performed in complex real-world situations. Finally, the TIS behavior analyzed in this study was goal-directed and was not mainly for the purpose of entertainment. Further studies are needed to identify behavioral differences in online TIS (Dickinger & Stangl, 2012).

Author details
Chaang-Iuan Ho[1]
E-mail: ciho@cyut.edu.tw
Yu-Chun Lin[2]
E-mail: uniquelove@gmail.com
Yu-Lan Yuan[3]
E-mail: yoyo@just.edu.tw
ORCID ID: http://orcid.org/0000-0002-3520-3479
Ming-Chih Chen[4]
E-mail: 081438@mail.fju.edu.tw
[1] Department of Leisure Services Management, Chaoyang University of Technology, 168, Jifong E. Rd., Wufong District, Taichung 413, Taiwan.
[2] Hong Hwa International Co. Ltd., Taichung, Taiwan.
[3] Department of Travel Management, JinWen University of Science and Technology, New Taipei, Taiwan.
[4] Graduate Institute of Business Administration, Fu Jen Catholic University, New Taipei, Taiwan.

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