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Which platform should I choose? Factors influencing consumers' channel transfer intention from web-based to mobile library service

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Abstract

Purpose – With more and more individuals relying on mobile devices to obtain information, many libraries launch mobile application to satisfy mobile users' information need. The purpose of this paper is to figure out factors influencing consumers' channel transfer intention of library service from web-based platform to mobile app.

Design/methodology/approach – A structural equation model is proposed based on categorization theory. In addition, situational contexts are taken into account to make research model more suitable for the real condition. Data collected from 319 samples are used for hypotheses examining.

Findings – The relationships between source and target (perceived differentiation including function differentiation and resource differentiation) positively affect perceived situation efficiency, which in turn shapes intention to use mobile library application. Perceived mobile library quality positively influences perceived differentiation, perceived situation efficiency and mobile library adoption intention. In summary, perceived situation efficiency is the main factor.

Practical implications – Both quality and situational factors should be taken seriously, and mobile device producers and mobile app developers should cooperate on improving the quality of mobile app. Meanwhile, it is critical to examine the relationship between web based and mobile library service in the initial or early stage of mobile library development.

Originality/value – By focussing on the impacts of the relationship between web and mobile library service and evaluation of mobile library on the adoption intention, this paper not only provides a theoretical understanding of mobile library adoption behavior but also offers practical insights to library managers and app developers for promoting such a process.

Keywords Digital libraries, Academic libraries, Information services

Paper type Research paper

1. Introduction

Mobile devices, especially smart phones, have been widely used in recent years due to their capabilities of supporting many applications. The sales of smart phones to end users reached 336 million units during the first quarter of 2015, exceeding that of PC, which are 115.7 million units (Canalys, 2015; Gartner, 2015). Ericsson also shows that

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70 percent of people will use smart phones and 80 percent of all mobile data traffic will come from smart phones by 2020 Ericsson (2015). The ever-increasing propagation of smart phones and mobile network has induced great use of mobile access. With the rise in smart phone use, People are taking advantage of being connected to data wherever they are. Mobile application (app) is the main access to mobile network. For example, about 1.6 million apps are there in the two largest stores Apple App Store and Google Play (Canalys, 2013). Moreover, the number of app users also growing fast, which may reach 4.4 billion by the end of 2017 according to Portio Research (2013). China is also a very potential country for the development of smart phones. In China, the shipments of smart phones are about 40.3 million in the April 2015, (MIIT, 2015) and the cumulative total downloads of mobile app was about 28.6 billion in the third quarter of 2014, demonstrating that the mobile app has come of age EnfoDesk (2014).

The rapid growth and use of mobile network, coupled with the development of mobile commerce, changes users' information search behavior thoroughly. Demands for mobile library services are dramatically increasing due to large user base of mobile services. Therefore, libraries explore mobile devices as a way to connect with users, creating a library application ("app") or mobile website that allows users to access library hours, view their library account or even search databases. For Instance, over 76 percent of Chinese top universities which are sponsored with "Project 985" have provided mobile library apps and want to transfer their customers from PC terminal to mobile terminal to optimize users' perceived experience. But the success in web services cannot promise the success in mobile services because there are several problems which will be generated in the channel transition process.

"Channel" is a significant concept is marketing science. With the development and popularity of web-based application, more and more people choose online business model instead of offline business model. With the convenience of mobile-based application, more and more people shift from web-based method to mobile-based method. To clarity this kind of phenomenon, scientists use the concept of "channel" to simplify it. In this research, we borrow the concept "channel" from marketing science to library science to make our research more common. In addition, "channel transfer intention" and "channel usage behavior" is also applied. If the consumer wants to shift from web-based library service to mobile-based library service, we classify it into "channel transfer intention." What's more, we classify consumers' behavior as "channel usage behavior" is they continue to use a certain kind of channel.

In fact, we notice that different from some other mobile service such as mobile purchase, mobile entertainment, mobile social interaction or mobile engagement, not all of the customers will transfer from web-based platform to mobile app when they want to use library service. And then, it would be interesting to examine the influencing factors which stimulating or blocking channel transfer intention, which is the purpose of the present study. The structure of this paper is organized as follows. The next section gives a literature review of related studies. The theoretical background of this study is described in Section 3, coupled with research model and associated hypotheses. The research methodology and analysis results are presented in Sections 4 and 5, respectively. Section 6 contains some key findings plus theoretical and practical implications. The last section gives a brief summary of the whole study.

2. Literature review

With the proliferation of mobile devices and mobile connectivity, the popularity of the mobile app is increasing rapidly. Meanwhile, an important stream of research has

focussed particularly on the understanding of various determinants of mobile app adoption. In terms of theoretical background, technology acceptance model and unified theory of acceptance and usage of technology (UTAUT), as the classical adoption models, were widely applied to study the usage intention determinants of different end-customer mobile services (Cheng and Huang, 2013; Oliveira *et al.*, 2014). In addition, task-technology fit (TTF) which took utility of technology into consideration was also generally used in studies of technology adoption Shih and Chen (2013). With respect to influential factors of mobile service adoption behavior, both extrinsic and intrinsic motivations were examined. According to the theory of motivation, extrinsic motivation refers to satisfaction independent of the actual activity itself, and intrinsic motivation refers that the activity is valued for its own sake and appears to be self-sustained (Calder and Staw, 1975). For extrinsic motivation, perceived usefulness and social influence were widely discussed and validated (Hanafizadeh *et al.*, 2014; Morosan, 2014; Tai and Ku, 2013). And for intrinsic motivation, perceived ease of use, perceived risk and perceived trust were widely discussed and validated (Shih and Chen, 2013; Morosan, 2014; Tai and Ku, 2013). Moreover, several studies examined the control effect of demographic variables, implying that gender, age, educational level and culture were important factors to predict mobile service adoption (Chan and Chong, 2013; Chung, 2014). Various kinds of mobile services were investigated in the extant researches, such as mobile banking (Sohail and Al-Jabri, 2014), mobile ticketing (Brakewood *et al.*, 2014), mobile payment (Zhou, 2014) and so on.

Although there are a lot of studies on mobile service adoption in the previous literatures, the number of that related to mobile library services is limited. Previous relevant studies on mobile library service mostly focussed on generalized definition, such as mobile websites, SMS reference and so on (Li, 2013; Mavuso, 2012). The studies on mobile library apps concentrated either on the design (Bishop, 2012; Bishop and Bartlett, 2013; Pianos, 2012) or on the students' adoption of mobile library app (Chang, 2013). With respect to the determinants and predictors of intention to use mobile library app, Chang (2013) found that UTAUT model examined the users' behavioral intention well, and the moderating effect of TTF was also significant. In all, it is worth analyzing the factors to predict the intention to use mobile library app.

In the process of mobile adoption, the perception of web-based services is an important factor because mobile-based service can be considered as an extension of web-based service. And in the process of service extension, a customer's experience with the web-based services may affect his or her perceptions about the mobile-based counterpart. Therefore, it is necessary to study the adoption of mobile platform in web-mobile extension context. The literatures mentioned above mainly focussed on a pure mobile context. With the opening up of extended mobile channels, some scholars paid attention to mobile service adoption in multi-channel context. Based on trust transfer theory, Wang *et al.* (2013) revealed that trust in web eWOM services would positively influence trust in mobile eWOM services, which was in turn positively related to mobile eWOM services adoption. Based on categorization theory, Yang *et al.* (2014) showed that web service quality and two relation-relevant factors namely perceived integration and perceived consistency were the predictors of users' perception of mobile services). However, in the field of library service, few studies examined the factors to predict the intention to use mobile library app, especially in the multi-channel context. Furthermore, the characteristics of mobile library app are different from mobile commerce. First, generally speaking, the most important purpose of mobile library app is not to make profits, but to satisfy users' need and provide them

with better service. Hence, it is necessary to investigate users' demand for mobile service. Second, the users of academic library service including students, professors and staff are relatively constant. They not only use mobile service but also web-based service. Therefore, the emergence of mobile service must affect the web-based service, either complementary or competition. To avoid incidental channel conflict, it is also necessary to handle the relationship between web-based service and mobile service. At last, users acquire library service principally for the sake of learning, but learning needs a relatively long time to digest acquired information. In this view, users may prefer web-based platform to mobile app, which is different from mobile commerce. Therefore, contrary to mobile commerce, perceived differentiation between web-based platform and mobile app should be paid more attention in the field of library service.

The literatures reviewed suggest that it is necessary to investigate determinants of mobile library app adoption in multi-channel context. The aim of this study is to provide a comprehensive insight into mobile library app adoption in universities. In addition, we take the ubiquitous features of mobile device and mobile network into consideration which were rarely discussed in previous studies, and propose a new variable named perceived situation efficiency.

3. Theoretical background and research model

3.1 Categorization theory

In order to handle the amount and variety of information in life, categorization is adopted to recognize, differentiate and understand a new object on the basis of its similarities or dissimilarities with the corresponding old one. In other words, people naturally classify the objects and events of their world by matching the cognitive summary of their most common features with the category prototypes (Nye and Forsyth, 1991). That is the foundation of categorization theory. Categorization theory was based on cognitive economy, and was widely applied in social management, such as leadership appraisals and social identity (Chatman and Spataro, 2005; Palich *et al.*, 1992; Zdaniuk and Bobocel, 2013), which contributed to the emergence of leadership categorization theory and self-categorization theory.

Based on the Computers Are Social Actors paradigm, researches related to human-computer interaction (HCI) demonstrated that HCI followed the social rules and expectations of human-human interactions (Nass *et al.*, 1995; Kim *et al.*, 2013). Individuals mindlessly apply social rules to interactions with computers that exhibit anthropomorphic cues or social categories even when they recognize that they are interacting with non-human agents or machines (Kim, 2014). Thus, categorization theory is also applicable to the process of HCI, such as users' interaction with mobile app. According to categorization theory, users' impression and attitude of mobile services are influenced by their knowledge about web-based services and integrated knowledge structures in their memory. However, related study suggested that perception of extended products or services were influenced not only by the perception of associated existing products or services but also by the attitude toward the specific attributes of the extension (Yang *et al.*, 2014; Boush and Loken, 1991). Therefore, the category-based evaluation on extended products or services relies on the discrepancy level between the new object and the category stored in users' memory (Ozanne *et al.*, 1992).

The current study chooses categorization theory as the theoretical framework for three reasons. First, as the natural cognitive reaction to stimulus, categorization plays an important role in the process of our organizing and structuring the world,

recognizing and understanding the new objects encountered in everyone's daily life. Second, in the web-mobile service extension context, mobile library app shares similar user base and concept feelings. Thus, user would naturally classify them into the same category based on their similarities which is just in accordance with the basic assumption of the categorization theory. Third, compared to web-based platform, ubiquitous of mobile service enables users to access information at the point-of-need, regardless of where they are and what they are doing. The uniqueness of mobile platform also meets the necessary conditions for categorization theory.

3.2 Research model and hypotheses

3.2.1 Evaluation of target: perceived quality and perceived efficiency. With the advent of web2.0, everyone can create and consume information at the same time. The ubiquity of information has made attention scarce and valuable which gives rise to an attention economy Huberman (2013). According to attention economy, web-based service and mobile app could not attract users' attention simultaneously. Thus, web-based service and mobile app must have their own advantages. Compared to computer, mobile device is limited in storage, battery life and process speeds, but superior in localization, immediacy and customization. Studies on information search behavior found that users tried alternative internal strategies (such as characteristics of the new objects) rather than searched for more information at high discrepancy level (Ozanne *et al.*, 1992). Therefore, the characteristics of mobile app would be evaluated in the process of decision making.

Perceived quality is the global assessment of a user's judgment on the superiority or excellence of a service offering (Hwang and Kim, 2007; Song *et al.*, 2010). Furthermore, quality play an important role in the impact on adoption of information systems in the framework of Information System Success Model, including system quality and information quality (Delone and Mclean, 2003). Therefore, it is reasonable to adopt perceived mobile library quality as the antecedent variable of adoption intention. In addition, as a measurement of instrumental performance of mobile library app, perceived mobile library quality is viewed as extrinsic motivation. Moreover, the theory of motivation pointed out that extrinsic motivation was related to users' behavior (Weiner, 2010). Since mobile device is the carrier of mobile app, and mobile app is psychologically perceived as distinct source of library service, mobile library quality is measured by both hardware (mobile device) quality and software (mobile app) quality. Therefore, we hypothesize that:

H1. Perceived mobile library quality will positively influence intention to use mobile library application.

According to the Theory of Planned Behavior, intention to perform behavior is influenced not merely by attitudes toward the behavior and social norms, but also by perceived behavioral control (Ajzen, 1991). Situational characteristic was one of the components of perceived behavioral control, defined as the extent to which an individual was given control over different physical environments during a given behavior performing ((Ajzen, 2005; Orvis *et al.*, 2009). The situation of mobile app usage is almost unlimited because of the ubiquitous features of mobile device and connectivity. Thus, situational characteristic is one of unique features of mobile library app. Studies about situations focussed on location-related conditions, which were divided into the dimension of physical environments, media access and social dynamics

(Karnowski and Jandura, 2014; Zhang and Zhang, 2012). By using mobile library app, users could acquire library service anywhere and anytime so that the influence by the changes of physical environments, media access and social dynamics are reduced. Such an advantage could improve the usage efficiency of library service which is just the results that users want. Thus, perceived situation efficiency is introduced to represent situational factor in the present study. Efficiency is an economic concept to measure the maximum output from effective inputs (Picard, 1989). Perceived situation efficiency is defined as relative cost of acquiring information from mobile library app in a certain situational context (Li, 2014). Since both situational context and perceived efficiency could affect user' behavior, combined that perceived efficiency was positively related to preferred media adoption (Karnowski and Jandura, 2014; Li, 2014), we hypothesize that:

H2. Perceived situation efficiency will positively influence intention to use mobile library application.

Based on the definition of efficiency, it is related to time spend and monetary cost. High quality of mobile library means high speed of access and great format of information, which will contribute to easiness to access quality and organized information that users need. Therefore, high quality of mobile library could save users' time spent in some extent. In the development of IS success model, S. Paek also pointed out that quality would positively influence perceived efficiency (Paek *et al.*, 1994). Therefore, we hypothesize that:

H3. Perceived mobile library quality will positively influence perceived situation efficiency.

3.2.2 Relationships between source and target: perceived differentiation. Categorization theory provides a framework for investigation into how users' perception of a new channel is influenced by the old channel in multi-channel context. But the influence happened only when the new target was classified into existing known category (Palich *et al.*, 1992; Zdaniuk and Bobocel, 2013). In the process of categorization, the most important issue is the discrepancy level between source and target weighted by the saliency of their common and distinctive features. Previous studies mainly focussed on the similarities between source and target. For instance, in the brand extension literature, perceived fit was adopted to measure the degree of similarity between parent brand and extended products in terms of their attributes, usage situations and target market, and was empirically examined to be positively related to the evaluation of extended products or services (Hem *et al.*, 2014; Kim and Yoonb, 2013; Park *et al.*, 1991; Zhang *et al.*, 2013); in the attribution of leadership, if a person shares the similar characteristics with observers' leadership prototype, he or she would be more favorably regarded as leader (Epitropaki *et al.*, 2013; Olivola *et al.*, 2014); in the web-mobile service transition, perceived service-platform fit positively affects intention adoption of mobile service (Lee and Chang, 2013; Yang *et al.*, 2014; Sun *et al.*, 2014).

However, it is more necessary to pay attention to discrepancy between web based and mobile platforms because the users of library service are relatively constant. At the same time, the purpose of construction of mobile library app is to meet users' need better rather than expand market shares. In the present study, we use perceived differentiation to measure the discrepancy between web based and mobile library service. And followed the definition of perceived fit, which was divided into

functional fit and image fit (Carter and Curry, 2013), perceived differentiation is conceptualized as a two-dimensional construct which contains function differentiation and resource differentiation in this study because function and resource are the main services provided by library. Function differentiation refers to the degree to which mobile library app and web-based library platform satisfy users' different needs, such as database and library catalogue searching, books returning prompt and so on. Resource differentiation is defined as the degree to which mobile library app and web-based library platform provide different information based on the same retrieval. Perceived similarity was empirically examined to be positively related to the perceptions of target (Lee and Chang, 2013). Following the same parallel, we hypothesize that:

H4. Perceived differentiation will positively influence perceived situation efficiency.

To investigate the first impression of mobile library app, perceived mobile library quality focusses on the characteristics of mobile device and mobile app, which are very different from web-based platform. In other words, system quality is the main point according to the definition in Information System Success Model (Delone and McLean, 2003). Moreover, the differentiation between mobile library app and web-based platform is caused by the hardware difference between mobile device and computer. Thus, perceived mobile library quality is helpful to improve users' perceived differentiation between mobile library app and web-based platform. Therefore, we hypothesize that:

H5. Perceived mobile library quality will positively influence perceived differentiation.

3.2.3 Structural framework. From the constructs and their relationships discussed above, we can draw the overall research framework, as shown in Figure 1. In particular, it illustrates that perceived situation efficiency and perceived mobile library quality positively influence intention to use mobile library. Moreover, perceived situation efficiency are affected by both perceived differentiation (including function and resource differentiation) and perceived mobile library quality. At the same time, perceived mobile library quality positively affects perceived differentiation.

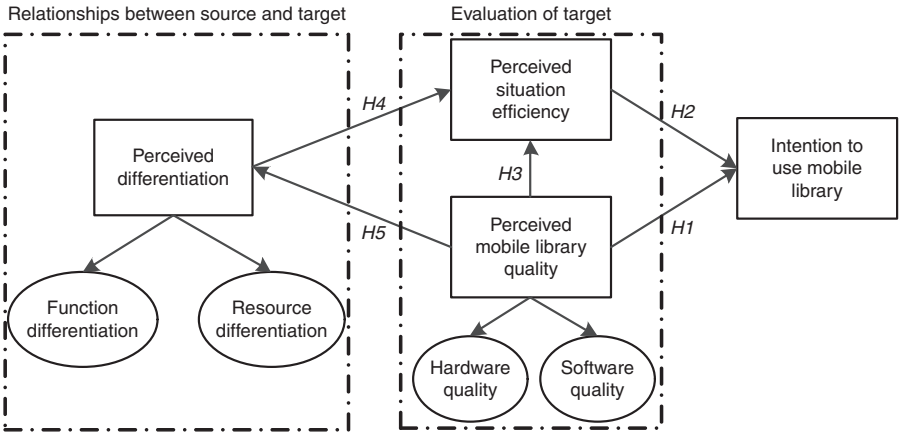

Figure 1.
Framework of the study

4. Research methodology

4.1 Measure instrument

Following the above analysis, four constructs are included in the conceptual model. All of the constructs are measured by multi-item scales adapted from prior studies with minor changes in wording in order to fit the specific research context (as shown in the Appendix). A seven-Likert scale, from strongly disagree to strongly agree, is adopted to measure the four constructs. Specially, five items on perceived differentiation were adapted from Carter and Curry (2013) to access the differentiation in function and resource between web based and mobile library service. Perceived mobile library quality was evaluated on two aspects including hardware quality and software quality. Hardware quality was measured by three items adapted from Shen *et al.* (2013b) including input function, resolution and screen size of mobile device. Software quality was measured by three items adapted from Wang *et al.* (2013) and Shen *et al.* (2013a). Three items of intention to use mobile library were adopted from Davis (1989) to assess users usage intention of mobile library apps. Perceived situation efficiency was the combination of perceived efficiency and situational context, whose items were adapted from Li (2014) and Karnowski and Jandura (2014). At last, in order to ensure the logical consistency and ease of understanding of the questionnaire, we conduct a pilot test to refine the questionnaire wording before formal data collection. On the whole, the questionnaire was unambiguous and easy to complete.

4.2 Questionnaire design and data collection method

The current study uses smart phones as the target mobile platform because smart phones are more portable than other mobile devices, and they are carried almost at all times (Sun *et al.*, 2014). Meanwhile, Chinese academic libraries are selected as a case to examine the proposed research model. And then most participants of this study are college students.

The questionnaire is divided into three major sections. The first section is an introduction of mobile library app in order to make every participant has a preliminary understanding of the research target. The second section is demographic information (gender, grade level) and general mobile usage habits (circumstance and function). The last section includes the measurement of constructs mentioned above.

Empirical data for this study were collected from both an online survey and paper-version questionnaire. Several methods were used to recruit participants. First, we sent invitation messages containing the online questionnaire URL to friends and students by instant messaging tools. Second, we searched for the potential participants in some related online communities, and sent them short messages. Third, the paper-version was distributed to students by professor after class. At last, a total of 337 surveys were returned. After eliminating 18 invalid samples, 319 valid surveys were collected.

4.3 Data analysis method

In the process of data analysis, we used a two-step method to test the model, beginning with the measurement model to test the reliability and validity of the instrument and then analyzing the structural model for hypotheses testing (Anderson and Gerbing, 1988). The measurement model describes the supposed relations of the observed variables to the underlying constructs, and the structural model presents the assumed causal relations of the estimated constructed.

The partial least squares (PLS) are selected as data analysis method in this study based on the following three points. First, the whole model of this research is lack of

solid assumptions from certain theories, which makes PLS appropriate for this study, as it emphasizes prediction rather than theory examination; second, both formative indicators and reflective indicators are included in the model of the study, so that it is proper to adopt PLS (Hair *et al.*, 2012). Third, PLS works well with small sample size, which is about ten times the largest number of structural paths directed at a particular construct in the model (Gefen *et al.*, 2000). The sample size in this study meets the necessary conditions for using PLS. SmartPLS 2.0 is used in the present study. In the process of model construction, latent variables are pictured as ellipses while observed variables are depicted as rectangles, and a single arrow pointed to the dependent variable from the independent variable as hypothesized.

5. Results

5.1 Demographic profile of respondents

Among the valid survey respondents, 145 (45.5 percent) were male and 174 (54.5 percent) were female. For education distribution, a large majority of them (97.5 percent) were undergraduate or above. In terms of their experience with the mobile network and mobile library app, around 98.4 percent of the respondents had used mobile device to surf the internet and about 41.1 percent of the respondents had used mobile library app. Moreover, 144 (45.1 percent) of the respondents used mobile device to communicate, and most of them (83.1 percent) took their leisure time to surf the mobile internet. Table I displays the demographic information in details.

As shown in Table I, surfing internet through mobile devices in the leisure time is very common among college students. Hence, college students is used to spend much of their leisure time surfing internet through mobile devices. However, the main usage of mobile app is communication, followed by reading and learning, implying that mobile app is more like tools for communication than learning. In addition, among the participants, nearly half of them downloaded and used mobile library app.

5.2 Measurement model

SEM is consisted of measurement model and structural model. The former is to assess the relationship between a latent variable and its associated observed variables by a series of indices. In the present study, we mainly examine reliability and construct validity which is composed of convergent validity and discriminant validity.

5.2.1 Reliability analysis. Reliability refers to the internal consistency of items constituting constructs. In other words, it means the degree of closeness among all items of a construct. In this study, Cronbach's α was adopted to test reliability of constructs, and the results are presented in Table II. The Cronbach's α of all constructs is above 0.7, indicating that the research constructs have good internal reliability (Chin, 1998).

5.2.2 Convergent validity. Convergent validity indicates the degree to which the measures of a construct that are theoretically related, are also related in reality. It should come up to three criteria using the measurement model: first, the loadings of measurement items on the variables through CFA are greater than 0.70; second, the associated average variance extracted (AVE) of measures is greater than 0.50; and finally, the associated composite reliability (CR) of measures is greater than 0.70 (Fornell and Larcker, 1981).

The data from Table II shows that the loadings of measurements range from 0.83 to 0.97, which are all over 0.70. In addition, both the associated AVE and CR exceed the recommended thresholds. Therefore, we can come to the conclusion that every measure scale has a high convergent validity.

Measures	Items	Frequency	Ratio
Gender	Male	145	0.45
	Female	174	0.55
Education background	Junior college or less	8	0.03
	Undergraduate	192	0.60
	Master	107	0.34
	PHD	12	0.04
Mobile Network	Yes	314	0.98
	No	5	0.02
Scene of mobile Internet usage	Leisure time	265	0.83
	Self-regulated learning	48	0.15
	Class	6	0.02
Function of mobile application	Game and entertainment	69	0.22
	Reading and learning	73	0.23
	Business financial management	6	0.02
	Communication	144	0.45
	Service of life	17	0.05
	Others	10	0.03
Mobile library application	Yes	131	0.41
	No	188	0.59

Table I.
Demographic profile of respondents

5.2.3 Discriminant validity. Discriminant validity indicates the extent to which a given latent variable is different from other latent variables. If the square root of AVE is greater than the correlation between that construct and all other constructs, the discriminant validity of the measurements is satisfactory (Fornell and Larcker, 1981). Table III displays the correlation matrix of the constructs and their square root of AVE value which is presented on the diagonal. The results imply that every construct has higher correlation with itself, indicating satisfactory discriminant validity.

5.3 Structural model

The structural model is to examine the linear relation between exogenous latent variable and endogenous latent variable. The path significance levels were estimated by using a bootstrap with 500 resamples. The R^2 criteria were used to assess the predictive capacity of the structural model. Examination of R^2 shows that the model explains perceived situation efficiency and intention to use mobile library. The results of the analysis are depicted in Figure 2, which displays the overall explanatory power and the estimated path coefficients.

Variables	Items	Loadings	Cronbach's α	AVE	CR
Function differentiation	FD1	0.92	0.83	0.86	0.92
	FD2	0.93			
Resource differentiation	RD1	0.89	0.87	0.80	0.92
	RD2	0.96			
	RD3	0.88			
Hardware quality	HQ1	0.86	0.81	0.72	0.89
	HQ2	0.87			
	HQ3	0.83			
Software quality	SQ1	0.89	0.85	0.77	0.91
	SQ2	0.89			
	SQ3	0.87			
Perceived situation efficiency	PSE1	0.85	0.85	0.77	0.91
	PSE2	0.90			
	PSE3	0.88			
Intention to use mobile library	INT1	0.92	0.90	0.84	0.94
	INT2	0.92			
	INT3	0.97			

Table II.
Psychometric properties of measures

	FD	RD	HQ	SQ	PSE	INT
FD	0.93					
RD	0.48	0.89				
HQ	0.31	0.13	0.85			
SQ	0.33	0.11	0.61	0.88		
PSE	0.33	0.17	0.58	0.64	0.88	
INT	0.27	0.08	0.41	0.47	0.62	0.92

Table III.
Correlation matrix of the constructs

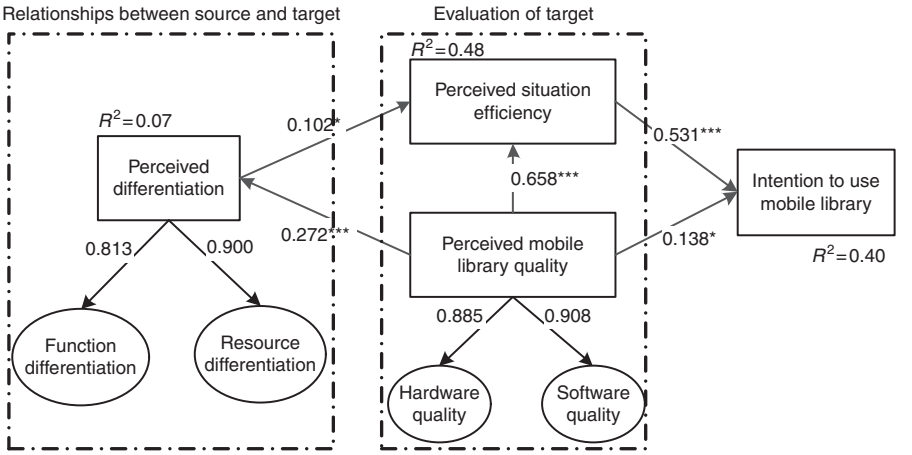

Figure 2.
Results of the research model

Notes: *$p<0.05$; **$p<0.01$; ***$p<0.001$

The results illustrate that the exogenous variables explain 7 percent of the variance in perceived differentiation, 48 percent of the variance in perceived situation efficiency and 40 percent of variance in intention to use mobile library. All of the structural paths are statistically significant. The results also demonstrate that the impact of perceived mobile library quality on perceived situation efficiency is greater than the impact of perceived differentiation, but both of them are significant with path coefficients of 0.658 and 0.102, respectively (*H3* and *H4* are supported). Moreover, perceived mobile library quality is significantly related to perceived differentiation, with a path coefficient of 0.272 (*H5* is supported). Perceived situation efficiency and perceived mobile library quality are statistically significant in explaining adoption intention of mobile library with path coefficients of 0.133 and 0.530, respectively (*H1* and *H2* are supported). The results also show that perceived situation efficiency is more important in explaining adoption intention. In addition, perceived differentiation and perceived mobile library quality are multi-dimensional constructs, and the path coefficients mean factor loadings.

6. Discussion

6.1 Interpretation of results

This study investigates the determinants to predict mobile library app adoption in the context of web-mobile extension. The current study provides several important findings. First, perceived situation efficiency and perceived mobile library quality positively affect intention to use mobile library, demonstrating that both quality and situation efficiency are necessary to satisfy library users' needs in mobile era. Specially, the estimated coefficients and significance levels of perceived situation efficiency are relatively stronger than those of perceived mobile library quality, which highlights the importance of situation efficiency for determining user intention to use mobile library. In addition, the current study also finds that perceived mobile library quality has a strong impact on perceived situation efficiency. This finding further strengthens the important role of situational factors in shaping users' behavior toward mobile library service. In mobile era, the situational context of users is always changing, so it becomes very important to satisfy their efficiency needs in different situational contexts.

Second, the present study also finds that users' perceived differentiation between web based and mobile library service in terms of function differentiation and resource differentiation positively influences their perception of situation efficiency. The present study points out that the theory of categorization is appropriate to be used in a dual-channel environment. The results suggest that the difference of function and resource of mobile library service make it more efficient than web-based library service in terms of different situation contexts. Distinguished features should be designed in the mobile library app because such differential operation can facilitate the process of web-mobile service extension in certain degree. However, the results also demonstrate that both the significance and path coefficient of perceived mobile library quality are greater than that of perceived differentiation in predicting perceived situation efficiency. Therefore, library managers who want to promote their mobile app should pay more attention to mobile library quality, especially software quality. Mobile library app should be developed to accommodate to different types of mobile devices.

Third, perceived mobile library quality positively influences perceived differentiation, demonstrating that which kind of services would be provided by mobile app should accommodate to the characteristics of mobile device. In addition, software quality and resource differentiation perform better in explaining perceived mobile library quality and perceived differentiation, respectively.

6.2 Implications

6.2.1 Theoretical implications. This study offers a few interesting contributions to literature. First, the present study extends the categorization theory from mobile commerce to mobile library in a multi-channel context, and perceived differentiation is tested instead of perceived consistency. Previous studies applied categorization theory to explain the category-based consumer behavior mainly in the area of management and economic (Zdaniuk and Bobocel, 2013; Yang *et al.*, 2014). As academic library is a non-profit organization, the purpose of mobile library construction is not to extend market, but to satisfy the demands of users, which determines the current research point is different from the previous researches in essence. With more and more individuals relying on mobile devices, the transition from web to mobile platform has become a trend for most of web services, including non-profit organizations such as library. For the sake of particularity of them, it is necessary to expand categorization theory to these fields, and explore users' additional demands in the emerging web-mobile service extension context compared to the web-based context.

Second, the present study mobile library app adoption from a cross-environment perspective by considering evaluation of target and the relationship between source and target. Our empirical study demonstrates that the relationship between source and target can affect certain evaluation of target, while certain evaluation of target can also affect the relationship between source and target. Therefore, it is important to identify and realize the factor which is concerned by users. The current study thus enriches the innovation adoption literature by providing a holistic insight into the evaluation and use of mobile library.

Third, in previous studies, the ubiquitous characteristic of mobile devices have been mentioned to analyze the power of mobile word-of-mouth (Shen *et al.*, 2013a, b). The current study concentrates on the benefits from the ubiquitous characteristics of mobile devices, and its impact on adoption intention, which can be adopted by future research to investigate user behavior in mobile context. In addition, this study adds users' situation efficiency to predict mobile service adoption in a multi-channel context.

6.2.2 Practical implications. This study also offers several practical implications. First, library service providers should pay close attention to both quality and situational factors, because both of them significantly affect users' behavioral intention, especially situation efficiency. Quality is the basic condition of a system, but the results show that efficiency improvement is more important. In other words, library service providers should ensure that their users can quickly receive information they want in a mobile situation.

Second, mobile device producers and mobile app developers should cooperate on improving the quality of mobile app, because results in our study imply that both hardware quality and software quality are important components of the whole system. The most important thing is compatibility of mobile app with mobile type, and the content of mobile services should be suitable, because of the limitation of mobile and users' time.

Third, library service providers should be aware of the critical role of the relationship between source and target because findings in our study indicate that perceived differentiation including function differentiation and resource differentiation between web based and mobile library services significantly affect perceived situation efficiency of mobile library app. Therefore, mobile library app developers should attempt to enhance both function differentiation and resource differentiation between

web based and mobile library services. The running speed of mobile device is far inferior to the computer due to the limitation of mobile device and mobile network, so mobile library app developers should focus on core functional design to reduce unnecessary modules.

6.3 Limitations and future research directions

Like all other empirical studies, the current study suffers from some limitations. First, the participants of this study are from China, and the example in questionnaire is also in Chinese context. Caution is required in any effort to generalize our findings to other cultural contexts. Since the development of mobile internet and the habits of using library service vary with countries, factors influencing users' extension or adoption decisions in regard to users' environment may not be the same, or the degree of influence may differ. Future researches can test and compare our findings among users from different countries.

Second, some participants of this study have not used mobile library app before, which may lead to biases against the results. However, it is not a serious limitation because the central issue of this study is intention adoption which concentrates on the first usage. Moreover, a simple introduction of mobile library app is included in the questionnaire and the items adopted in this study do not need participants to have insight into mobile library app.

Third, according to the theory of motivation, behavior intention is determined by both extrinsic and intrinsic motivations (Davis *et al.*, 1992). In this study, we have not included the intrinsic factors such as perceived ease of use due to the features of research object. Mobile library app is more like means for learning, so that extrinsic motivations seems more important in some extant. Future researches may test and compare the impact of these two motivations on intention adoption.

Finally, the R^2 of perceived differentiation is very small, implying that perceived mobile library quality is not enough to predict perceived differentiation, and other factors should be discussed in the future research. In addition, perceived situation efficiency is a little abstract as a factor to predict intention to use mobile library app. In the future researches, we can provide deeper insight by including situation category. For instance, it would be interesting to analyze how users' perceived efficiency of mobile library app varies between leisure time and self-regulated learning.

7. Conclusion

Using the categorization theory as the theoretical framework, the present study examined users' intention to use mobile library app in a web-mobile extension context by focussing on the impacts of the relationship between web and mobile library service and evaluation of mobile library on the adoption intention. Specially, from a mobile perspective, the results indicated that the relationship-relevant factor namely perceived differentiation, significantly affect users' perception of mobile library situation efficiency, which in turn shapes mobile library adoption behavior. In addition, perceived mobile library quality positively influences perceived differentiation, perceived situation efficiency and mobile library adoption intention. Thus, this study not only provides a theoretical understanding of mobile library adoption behavior in the web-mobile extension context but also offers practical insights to library managers and app developers for promoting such a process.

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Appendix. Constructs and measurement items

Function differentiation:

- FC1: Web-based platform and mobile app are functionally different for library services.
- FC2: Web-based platform and mobile app offer different services for library services.

Resource differentiation:

- RC1: For information services, information provided by web-based platform and mobile app are different.
- RC2: For information services, web-based platform and mobile app are different in resource richness.
- RC3: For information services, web-based platform and mobile app are different in information searching results.

Hardware quality (Shen *et al.*, 2013a, b):

- HQ1: The input function of my mobile device is convenient for using mobile library app.
- HQ2: The resolution of my mobile device is high enough to use mobile library app.
- HQ3: The screen size of my mobile device presents no difficulty in using mobile library app.

Software quality (Wang *et al.*, 2013):

- SQ1: The content provided by mobile library app is well formatted.
- SQ2: The content provided by mobile library app is well laid out.
- SQ3: The content provided by mobile library app is clearly presented on the screen.

Perceived situation efficiency (Li, 2014; Karnowski and Jandura, 2014):

- PSE1: Mobile library app can provide services according to my environments.
- PSE2: For my environment, my interaction with mobile library app is convenient.
- PSE3: For my environment, it is easy for me to find get information I want from mobile library app.

Intention to use mobile library (Davis, 1989):

- INT1: I intend to use mobile library app in the future.
- INT2: I expect that I would use mobile library app in the future.
- INT3: I plan to use mobile library app in the future.

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