The Electronic Library

Factors influencing the intention to use information service mashups: An empirical study of digital libraries in China

Weiwei Yan Shengli Deng Yin Zhang

Received 27 May 2015
Revised 2 August 2015
Accepted 28 September 2015

Factors influencing the intention to use information service mashups

An empirical study of digital libraries in China

Weiwei Yan and Shengli Deng
Center for the Studies of Information Resources, Wuhan University, Wuhan, China, and
Yin Zhang
School of Library and Information Science, Kent State University, Kent, Ohio, USA

Abstract

Purpose – This study aims to examine the factors influencing the adoption intention of information service mashup in digital library (DL). The study is an empirical study on DLs in China.

Design/methodology/approach – This paper employs the theory of information service mashup as its theoretical background and applies it to the field of DL to develop the measurement model which is based on technology acceptance model (TAM). A structured questionnaire was developed including the demographic information, the advantages of information service mashup in DL and the Likert evaluation of each construct. As a result, of 303 questionnaires distributed among DL users, 281 were remained as acceptable answers. The data were processed and analyzed with the aid of the SPSS 20.0 and SmartPLS 2.0.

Findings – The results show that beyond perceived usefulness and perceived ease of use, both perceived integration and perceived risk have direct impacts on user's intention to adopt information service mashup in DL. Perceived integration has the dramatic positive effects, while perceived risk negatively correlates to adoption intention. Moreover, perceived integration and individualization have positive impacts on perceived ease of use, while network externality positively influences perceived usefulness.

Originality/value – Information service mashup is still a relatively new technology in DL. There were few theoretical and empirical studies that examine the user adoption behaviour of the service. This study contributes to existing information service mashup application studies by modifying and extending TAM. The results would help the DL gain a deeper understanding of the factors affecting DL user adoption of information service mashup.

Keywords Digital libraries, China, Information service mashup, MetaLib/SFX

This research is supported in part by the Chinese National Funds of Social Science (No. 15CTQ025, No. 14BTQ044), Key Research Institutes of Philosophy and Social Science by Ministry of Education, PR China (15JJD870001), Major Projects of the National Social Science Fund, PR China (15ZDC025) and Wuhan University Academic Development Plan for Scholars after 1970s for the project of "Research on Internet User Behavior", Independent Scientific Research Project (No. 410500130) supported by the Fundamental Research Funds for the Central Universities and Luo Jia Youth Scholar of Wuhan University.

The Electronic Library
Vol. 34 No. 4, 2016
pp. 696-716

0264-0473
DOI 10.1108/EL-05-2015-0082

Paper type Research paper

Introduction

Social network tools and Web 2.0 technologies have enabled people to more easily access various information sources. A recent Pew Internet research report revealed that 72 per cent of US adults use social networks (Brenner and Smith, 2013). With the growth of information source options, one single data source cannot adapt to a user's general complex demand for information acquisition (Rahimi, 2014). Information service mashups appear to be an effective approach to address this imbalance. Information service mashups focus on integrating and processing heterogeneous resources for effective retrieval and locating related data from multiple sources. It can synthesize the new integrated information service by reusing and combining existing contents (Albinola *et al.*, 2009).

As a lightweight and flexible technology, an information service mashup makes rapid application development possible (Grammel and Storey, 2010). It not only efficiently decreases the associated application costs but also meets users' needs by incorporating services based on user preferences (Patel *et al.*, 2012). Information service mashups are widely used in enterprises for supporting business processes (De Vrieze *et al.*, 2011), as well as building graphical interfaces and collaborative working environments (Hoyer and Fischer, 2008). Meanwhile, mashups are also commonly created with social networks, such as Twitter, Facebook, Picasa and Flickr, to make user communication more convenient (Lachenmaier *et al.*, 2013; Paredes-Valverde *et al.*, 2012). In the digital library (DL) arena, besides the integration of distributed academic resources, it is common to combine social tags, comments and geographic applications with DL resources to supplement DL services (Johnston and Jensen, 2009; Wang, 2011).

Currently, over 12,000 application programming interfaces (APIs) have been shared for creating mashups on ProgrammableWeb (www.programmableweb.com), a leading mashup-sharing website. Though information service mashups have become popular, fewer than 5 per cent of them are related to the library (ProgrammableWeb, 2014), and DL mashup development remains relatively slow. In China, the mashup applications focus on information access, but lack the integrated process for diversified academic resources (Hu and Yan, 2013). However, multi-functional information processes of DL resources, such as subject navigation, conditional filtering, comprehensive statistical analysis and visualization, are all critical when utilizing a DL for supporting scientific research. Hence, factors influencing the intention of using an information service mashup in a DL, which has rarely been studied previously, need to be identified and confirmed. Based on the technology acceptance model (TAM) and previous related research, this study focuses on the characteristics of information service mashups, such as integration and interaction (Yan, 2013), and constructs a research model of users' adoption intention of information service mashups in a DL. The research model is further empirically tested and validated. The specific research questions of this study are as follows:

RQ1. What factors significantly affect users' adoption of an information service mashup in a DL? How much do these factors influence users' adoption of the information service mashup?

RQ2. Are there any interactive influences among the factors? How much do these factors influence each other?

RQ3. What should be done to advance the development of information service mashups in DLs?

Theoretical background

Mashups

Mashups were initially developed in the music field by creating a song or composition through blending two or more pre-recorded songs, usually by overlaying the vocal track of one song seamlessly over the instrumental track of another (Woodland and Klass, 2005). Currently, the word *mashup* is widely applied to web applications, allowing users to integrate products and services to create new, unique ones. The term *mashup* implies easy and fast integration that is made possible by mixing two or more different web-based data sources (Grammel and Storey, 2010; De Vrieze *et al.*, 2011). Mashups have the ability to reuse and combine data or information with an application to create and produce value-added output. They have garnered broad interest and have continued to grow in popularity (Griffin, 2008).

There are two key aspects in building a mashup application: accessing data sources to obtain unified data and building the graphical interface. The mashup tool provides generic, reusable components to engineer mashup applications (López *et al.*, 2009). It includes source adaptors for accessing a wide variety of sources, data mashup components for combining data from different sources and widgets for building the graphical interface. The graphical widgets are small, simple applications that allow the user to perform common tasks or monitor important information without launching the full application. They are designed to use XML and a scripting language, such as JavaScript, to enable developers to build small, simple and downloadable applications (De Vrieze *et al.*, 2011). In addition, the pipes and filters pattern, a key to express the data combination logic of the data sources to make up the mashup application, follows a procedural approach that lets the user implement the data combination logic (López *et al.*, 2009). With the pipes and filters pattern, the user builds the mashup application graphically by selecting, customizing and interconnecting components.

Information service mashup is a new way of building a web service by repurposing multiple existing web resources and services to provide a unique service (Paredes-Valverde *et al.*, 2012). It includes all three aspects of a typical web application (model-view-controller) with additional functionality, and supports rapid development, easy deployment and personalized settings (Kongdenfha *et al.*, 2009; Maximilien *et al.*, 2007). Based on pipeline framework, it uses Representational State Transfer (REST) protocol, which is a simpler alternative to Simple Object Access Protocol and Web Services Description Language (WSDL)-based web services, to access resources and transfer data (Paredes-Valverde *et al.*, 2012). REST is an architectural style to build scalable web services for distributed hypermedia systems. With unique identifications for resources, the operation on resources through the universal connector interface is stateless (Fielding, 2000). After combining the retrieval resources into new data objects, the widgets would be posted by feeds or other functional widgets, which are encapsulated to meet a variety of user needs. They represent application domain

functions or information specific functions and put a visual face on the underlying resources (Hoyer and Fischer, 2008).

Information service mashups could access open APIs and data sources to produce results beyond the predictions of data owners (Hoyer *et al.*, 2010). For instance, Jhingran (2006) proposed an information mashup fabric to meet the needs of situational applications and to solve the problem of augmenting structured data with unstructured information. Jung (2012) proposed a collaborative browsing system based on a semantic mashup with open APIs for supporting collaborations and knowledge sharing with other partners. Lachenmaier *et al.* (2013) presented CommunityMashup, a person-centric multi-user data integration solution for social software and similar systems, which facilitates data aggregation and filtering. Enterprise is a main application area of information service mashups. Enterprise information service mashups focus on the user interface integration (Hoyer and Fischer, 2008). For example, e-commerce enterprises combine third-party logistics service providers' tracking data with the order history on their own websites to present a single view of an order status. Other domains with mashup-based web applications include geospatial (De Longueville, 2010), education (Mason and Rennie, 2007), healthcare (Belleau *et al.*, 2008) and digital libraries (Hu and Yan, 2013; Vandenburg, 2008).

Information service mashups in digital libraries

The interconnection and accessing of heterogeneous data sources is the major issue in data source integration and has become an important field of research in DLs (Nachouki and Quafafou, 2011). An early proposed approach for data sources integration in DLs was federated database (FDB) (Sheth and Larson, 1990). A FDB is a collection of cooperative and autonomous database systems. However, FDBs focus on the constructions of databases that generally have a heavy workload. They do not help improve user experience in DLs apart from accessing data sources.

Different from FDBs, information service mashups combine pieces of functionality from several existing, heterogeneous web sources and services to provide new integrated service functionality (López *et al.*, 2009). The reusability, extensibility and dynamic nature of the information service mashup have attracted DL stakeholders and researchers, which leads to the development of the information service mashup in a DL. In addition, studies (Jung, 2012; Rosenberg *et al.*, 2008; Yan, 2013) have indicated that an information service mashup could enhance cross-system collaborations by composing the resources and services on the web. Hence, carrying out a cross-system information service mashup is not only an urgent requirement for promoting work efficiency but also an important choice for advancing the utilization of DL resources and collaborative innovation. This is especially true for DL users who concentrate on knowledge innovation and have higher requirements on sci-tech novelty retrieval, information sharing and subject literature management. Their scientific work would be more efficient with the help of an information service mashup (Engard, 2009; Hu and Yan, 2013; Li, 2009).

Research on information service mashups in DLs has mainly highlighted the integration of literature catalogue information and the extensive Web 2.0 applications. Vandenburg (2008) described a proof-of-concept web application designed to allow users to search for library materials with geographic subject headings using Google Maps as the primary interface for navigation. Shen and Du (2010) developed a mashup

application to combine a social network review site (Douban.com) and a university online public access catalogue (OPAC). Mukhopadhyay (2012) explained the way to build an open library system that uses an information mashup to achieve real-time integration of Web 2.0 objects with library services. Hu and Yan (2013) constructed a personal DL service mashup model with ConceptMaps, CiteSpace and MetaLib/SFX. Yan (2013) organized an integrated subject service in a DL based on the mashup of several functional widgets, such as a query widget, a collaboration widget and a graph widget.

With the support of the mashup studies in DLs, information service mashups have been adopted in various scenarios. For example, LibX is an open-source framework from which editions for specific libraries can be built. It offers library access through a toolbar user interface and via cues embedded into web pages, which allows users to construct direct searches against a library's OPAC and the Google search engine when browsing the web. Currently, at least 1,155 academic and public libraries have created public LibX editions (Bailey and Back, 2006; LibX, 2014). In China, the Chinese National Science Digital Library mashups use various functional widgets, such as bibliographic query and instant communication, for users to construct personal information commons and realize self-service (Liu *et al.*, 2009). Overall, information service mashups in a DL could help realize service integration, promote the ability of knowledge service and subject-oriented service and advance the development of community constructs in the DL.

MetaLib/SFX, an electronic resource portal developed by Ex Libris Group, is a commonly used approach for mashups in a DL. MetaLib integrates resources of the DL and provides a federated search system. It supports de-duplication, sorting and merging retrieval results, and some individual work, such as resource collection and personal bookshelf construction (Gerrity *et al.*, 2002). SFX, an OpenURL resolver, provides context-sensitive service for retrieval results by means of extracting OpenURL metadata of integrated resources (Wakimoto *et al.*, 2006). The SFX application is incorporated into the MetaLib application and promoted as a gateway to resources (Sutherland and Green, 2004). With the development of digital resources and web applications, MetaLib/SFX is no longer just a solution for searching multiple multi-vendor databases at one time (Sutherland and Green, 2004). It is also a comprehensive and extensible information service mashup application because users can access OPACs, full-text documents, document delivery, inter-lending services, Google Scholar and other web services according to their requirements (Haya *et al.*, 2007). Although numerous studies have explored how MetaLib/SFX works, those from the standpoint of user adoption behaviour of the information service mashup in a DL are sparse. A closer look at user adoption intention of an information service mashup and influencing factors will not only provide additional insight regarding DL user behaviours but also offer important considerations for improving the user experience with better developed information service mashups in DLs.

Factors affecting adoption behaviour

TAM is a model that has been widely used for examining and explaining the adoption intention for numerous information technologies (Sun *et al.*, 2007; Venkatesh *et al.*, 2003). In this study, TAM serves as the base model for examining the influence factors to the adoption behaviour of an information service mashup in a DL. TAM was developed in

the 1980s in light of concerns that workers were not using information technology (IT) that had been made available to them (Davis, 1989). Its originators reasoned that the key to increasing use was first to increase acceptance of IT (Davis *et al.*, 1989; Holden and Karsh, 2010). TAM reveals that the behavioural intention (BI) to use IT, namely, adoption intention (AI), is influenced by the user's attitude (ATT) toward using the IT. Attitude, in turn, has two determinants: perceived usefulness (PU) and perceived ease of use (PEOU). Additionally, PU is specified to have an independent effect on BI and PEOU has an effect on PU (Chau and Hu, 2001; Davis, 1989; Mathieson, 1991; Sjana, 1996).

TAM has gone through a number of changes according to application domains. For example, TAM2 removes the attitude construct; the unified theory of acceptance and use of technology (UTAUT) incorporates PU into a performance expectancy construct, PEOU into effort expectancy and subjective norm (SN) into social influence. Other studies supplement some system factors, individual factors and social factors to reveal the adoption behaviours of a variety of IT and Web 2.0 applications, such as DLs, e-learning, social network services, micro-blogging and mobile portal services (Kwon and Wen, 2010; Lee and Park, 2013; Park, 2009; Thong *et al.*, 2002; Zhang *et al.*, 2012). An adapted model of TAM would be a good fit in measuring the adoption behaviour of an information service mashup, which is a typical IT in a DL.

Research model

Perceived usefulness and perceived ease of use

Perceived usefulness and perceived ease of use are the two key constructs in TAM. Various studies have revealed the relationships among these two constructs and adoption intention (Davis *et al.*, 1989; Holden and Karsh, 2010; Van der Heijden, 2003; Venkatesh *et al.*, 2003). In the present study, as information service mashups are a new emerging technology used in DLs, its adoption intention should also be affected by perceived usefulness and perceived ease of use. To be specific, perceived usefulness should reflect the degree to which users regard an information service mashup as an effective way to improve work performance related to a DL. If users consider an information service mashup to be helpful in accessing and processing distributed resources, users' adoption intention would be enhanced. Similarly, perceived ease of use should reflect the degree to which a user regards an information service mashup in a DL as a convenient method to utilize. If users consider that an information service mashup is easy to learn and use, they would be more likely to adopt this technology. In addition, perceived ease of use has shown influence on perceived usefulness, although some studies have found the influence not to be significant (Sun *et al.*, 2007). For an information service mashup in a DL, the easier a mashup application is to use, the more value the user perceives. Hence, the following hypotheses are proposed:

H1. Perceived usefulness has a positive influence on intention to adopt an information service mashup in a DL.

H2. Perceived ease of use has a positive influence on intention to adopt an information service mashup in a DL.

H3. Perceived ease of use has a positive influence on perceived usefulness of an information service mashup in a DL.

Perceived integration

Information service mashups are an extension of service integration, which has a cross-system feature and combining nature (Yan, 2013). They follow a rapid and easy integrative approach to produce outputs by combining functionality or even data from two or more external sources (Patel *et al.*, 2012). Perceived integration reveals the integrity of content and the cooperation degree of functions to some extent (Grammel and Storey, 2010). It is a critical criterion to measure service capability of an information service mashup application in a DL (Engard, 2009). From the perspective of content, increasing perceived integration means expanding the scope of service. In other words, a mashup service includes a variety of resources to make resource retrieval and access work more convenient and efficient. From the perspective of function, increasing perceived integration implies a more holistic service, which manifests as the superiority of function selection and function composition. Through the combination and optimization of multiple information procedures, an information service mashup reduces user work and entices users to adopt (Hoyer and Fischer, 2008). Therefore, the additional following hypotheses are proposed:

H4. Perceived integration has a positive influence on perceived usefulness of an information service mashup in a DL.

H5. Perceived integration has a positive influence on perceived ease of use of an information service mashup in a DL.

H6. Perceived integration has a positive influence on intention to adopt an information service mashup in a DL.

Individualization

As individualization is usually used as a factor to measure web service quality and is proven to have a significant impact on user satisfaction (Jiao and Lei, 2008; Jing and Yin, 2011), it may also influence user experience in utilizing an information service mashup in a DL. The degree of individualization could reflect the performance of differentiated service, especially for the customization service oriented by user requirements. It could also further reveal the matching status between customization of service and users' individual needs and preferences (Schafer *et al.*, 2001). Hence, users' requirements on individualization of an information service mashup deserve attention. For an information service mashup in a DL, individualization is reflected in the customization of mashup content, composition of a mashup function and setting up of the visualization of mashup results. An information service mashup with better individualization could maintain favourable flexibility and dynamics of service, which means an information service mashup could update mashup targets according to user requirements and preferences in time. It could also improve the user experience during interactions with the mashup service. Therefore, the additional following hypotheses are proposed:

H7. Individualization has a positive influence on perceived usefulness of an information service mashup in a DL.

H8. Individualization has a positive influence on perceived ease of use of an information service mashup in a DL.

Network externality

Network externality manifests as appearances that the values of services to users increase with user population growth or the number of other compatible services (Kauffman *et al.*, 2000). In the environment of Web 2.0, the values of services and number of users are more closely related (Wang *et al.*, 2004). In addition, users usually prefer utilizing applications which have huge user bases rather than trying a whole new product because of the sense of safety that results from a collective behaviour (Lou *et al.*, 2000). Users might feel that mashups with a large user base are more useful for a variety of accessible resources and services. Meanwhile, users might receive peer support from other users in learning a DL mashup service, which could attract more new users. Furthermore, network externality has proven to have a significant impact on both perceived usefulness and perceived ease of use in research on mobile services (Deng *et al.*, 2007). Therefore, for the information service mashup in a DL, the additional following hypotheses are proposed:

H9. Network externality has a positive influence on perceived usefulness of an information service mashup in a DL.

H10. Network externality has a positive influence on perceived ease of use of an information service mashup in a DL.

Perceived risk

Most of the TAM factors, such as perceived usefulness and perceived ease of use, reflect the enabling perceptions, while the inhibiting perceptions are also critical in exploring the influencing factors of adoption intention. Perceived risk is a criterion often used in consumer behaviour analysis. It usually comprises finance risk, functional risk, time risk, psychological risk and social risk. Studies about perceived risk have found that it has an influence on users' consumer behaviour (Featherman and Pavlou, 2003). Risks not only exist in consumer behaviour but are also present in the experience of an information service, especially the adoption of a new technology such as mashup. Beemer and Gregg (2009) suggested that when the underlying data resources are available from different providers, security issues could arise. It creates security risks for both mashup users, who have to give their credentials to mashup sites, and legacy systems managers, who must open their systems to external access. The implementation of an information service mashup in a DL needs to coordinate all parties' interests and service resources, which generates risks of trust, knowledge spillover and intellectual property infringement. Meanwhile, in the process of service provision, privacy disclosure, system conflict and other functional risks might also occur. All these perceived risks would impact users' adoption behaviour of an information service mashup in a DL. Thus, the additional following hypothesis is suggested:

H11. Perceived risk has a negative influence on intention to adopt an information service mashup in a DL.

Taken together, the research model is depicted in Figure 1.

Research method

Questionnaire

Based on the research framework proposed above, a survey instrument was developed. MetaLib/SFX, a common mashup application in DLs, was chosen to measure users' adoption intention of an information service mashup in a DL. Seven latent variables are included in the research framework, each of which was measured by multiple question items. The majority of measurement items were adopted from previous studies (Table I). Adjustments were made to some items to better suit the DL context. A five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was utilized to measure each item.

Data collection

An online questionnaire was posted on SOJUMP (www.sojump.com) from 26 September to 25 October 2014. SOJUMP was selected because it is the most professional online survey site in China; users are able to design, issue and fill in the questionnaires all on the website. Participants were all DL users who were randomly invited online through the QQ app and via micro-blog. As the test run of the questionnaire determined that the completion time of the survey took at least 120 seconds, those returned responses that were finished within 120 seconds were discarded. As a result, of 303 questionnaires distributed among DL users, 281 were deemed as usable, yielding a response rate of 92.7 per cent.

Table II lists the characteristics of respondents. The sample has a relatively balanced distribution by gender, with all respondents having at least a bachelor's degree. Most respondents (86.1 per cent) are aged between 20 and 30 years, a demographic who tend to have a high acceptance ability to new services, especially to web information services (Palfrey and Gasser, 2008). The participants are mainly from academic disciplines in the humanities and social sciences (58.7 per cent) and science (26.3 per cent), with the remaining being from engineering and other disciplines.

Data analysis

In this study, respondents were asked to select the advantages of an information service mashup in a DL after they filled in their demographic information. More than four-fifths (82.2 per cent) of the respondents agreed that the one-stop service is an obvious strength. In addition, the integrated characteristics of resources (68.3 per cent) and functions

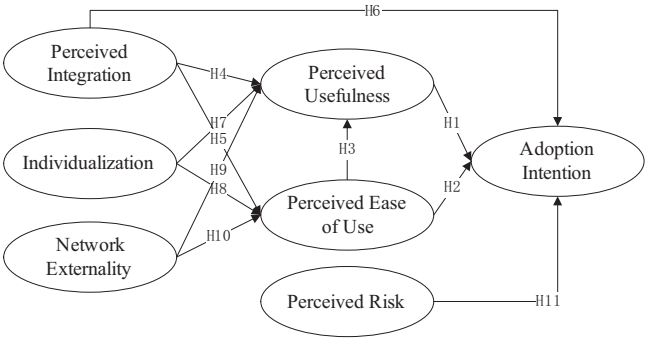

Figure 1.
The proposed research model of the adoption of DL information service mashups

Constructs		Items	Study
Perceived usefulness	PU1	Information service mashup will help me access various resources	Thong *et al.*, 2002, Bhattacherjee and Hikmet, 2007
	PU2	Information service mashup will meet my various needs of work	
	PU3	Information service mashup will make me more effective in my life	
	PU4	Overall, I find information service mashup to be useful in my life	
Perceived ease of use	PEU1	I can get information service mashup to find what I want rapidly	Van der Heijden, 2003, Bhattacherjee and Hikmet, 2007
	PEU2	I can easily become skillful at using information service mashup	
	PEU3	Learning to operate information service mashup will be easy for me	
	PEU4	Overall, information service mashup is easy to use	
Perceived integration	PI1	Information service mashup can integrate the applications that I want	Chen *et al.*, 2002
	PI2	The integrated applications collaborate with each other well	
	PI3	The mashup application can provide one-stop service	
	PI4	Overall, I find the integration effectiveness of information service mashup is obvious	
Individualization	IND1	I can customize push resources in mashup application according to individual demand	Radder and Louw, 1999, Jiao and Lei, 2008
	IND2	I can composite service in mashup application according to individual demand	
	IND3	I can set visual interface in mashup application according to individual demand	
	IND4	Overall, I find information service mashup is individualized	
Network externality	NE1	The resources which are available to mashup are abundant	Lin and Lu, 2011
	NE2	The application interfaces for mashup are abundant	
	NE3	The information service mashup applications are abundant	
	NE4	The amount of user of information service mashup is huge	
Perceived risk	PR1	Information service mashup will trigger the risks of knowledge spillover and intellectual property infringement	Featherman and Pavlou, 2003
	PR2	Information service mashup will trigger the risk of privacy disclosure	
	PR3	Information service mashup will trigger the risk of systematic conflict	
	PR4	Overall, I find information service mashup is risky	
Adoption intention	AI1	I predict I will use information service mashup in the future	Pavlou, 2003
	AI2	I intend to use information service mashup in the future	
	AI3	I plan to recommend information service mashup to others	

Table I.
Constructs and items

(56.6 per cent) also received more than half of the respondents' approval. Ease of use (42.7 per cent), service categories (31.0 per cent) and customization (25.6 per cent) of mashups were also recognized by a considerable portion of respondents. Visualization effects (14.6 per cent) and the expansion ability (10.3 per cent) of mashups were less valued compared to other advantages. The distributions of respondents' choices are shown in Figure 2.

As a second-generation structural equation modelling technique, partial least squares (PLS) can estimate the loadings of indicators on constructs and the causal relationships among constructs in multistage models (Fornell and Bookstein, 1982). Moreover, it is robust with fewer statistical identification issues and is most suitable for models with formative constructs and relatively small samples (Hair *et al.*, 2011). SmartPLS 2.0, a leading software application for PLS modelling, was used to test the research model.

The data analysis utilized a two-step approach proposed by Anderson and Gerbing (1988). The two steps are the analysis of the measurement model and the assessing of the structural model and hypotheses, which emphasize assessing reliability and validity of the measures before using the full model (Chiu *et al.*, 2006; Hair *et al.*, 1998).

Characteristics		Frequency	(%)
Gender	Male	126	44.8
	Female	155	55.2
Age (years)	18-24	133	47.3
	25-30	109	38.8
	> 30	39	13.9
Education background	Bachelor's degree	113	40.2
	Master's degree	127	45.2
	Doctoral degree	41	14.6
Academic disciplines	Humanities & Social Sciences	165	58.7
	Science	74	26.3
	Engineering	30	10.7
	Others	12	4.3

Table II.
Participant profiles

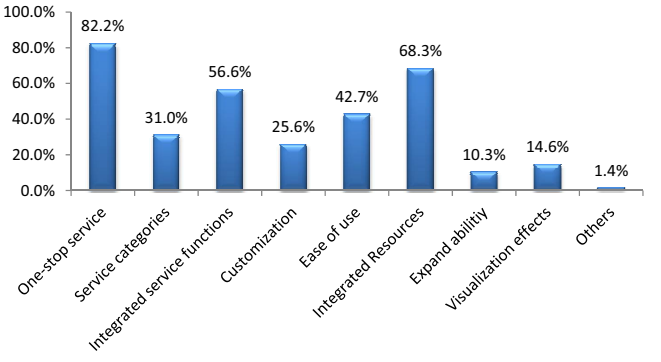

Figure 2.
Respondents' perceptions on the advantages of an information service mashup in a DL

Measurement model analysis

At this stage, the reliability and validity of the constructs were checked to ensure the appropriateness of the measurement model. Composite reliability and average variance extracted (AVE) were used to assess reliability of the measurement model. As shown in Table III, the values of Cronbach's α ranged from 0.802 to 0.892. Meanwhile, the composite reliabilities for constructs of the model varied from 0.871 to 0.913. The results of these two criteria were both highly above the suggested threshold of 0.70. Similarly, the AVE ranged from 0.628 to 0.822 (> 0.50) (Fornell, 1992). These results suggest that the measurement model has very good construct reliability (Hsu and Lin, 2008). All indicator loadings were significant and higher than 0.70, suggesting a good convergent validity of constructs (Anderson and Gerbing, 1988; Jiang *et al.*, 2002). In addition, the discriminant validity was assessed by comparing the correlations of constructs and the square roots of AVEs (Fornell and Larcker, 1981). As shown in Table IV, all correlations ranged from -0.324 to 0.557, which were significantly lower than the square roots of AVEs, suggesting that the constructs have good discriminant validity.

Constructs	Cronbach's α	CR	AVE	Items	Loading	*t*-Statistics
Perceived usefulness	0.846	0.896	0.684	PU1	0.819	33.204
				PU2	0.791	29.735
				PU3	0.833	37.242
				PU4	0.863	50.708
Perceived ease of use	0.834	0.889	0.668	PEU1	0.801	30.253
				PEU2	0.788	34.191
				PEU3	0.804	36.412
				PEU4	0.873	58.344
Perceived integration	0.828	0.884	0.657	PI1	0.777	23.219
				PI2	0.787	25.288
				PI3	0.843	45.122
				PI4	0.834	38.290
Individualization	0.870	0.911	0.718	IND1	0.788	22.411
				IND2	0.866	45.514
				IND3	0.846	37.601
				IND4	0.887	58.551
Network externality	0.802	0.871	0.628	NE1	0.775	22.027
				NE2	0.843	41.768
				NE3	0.806	24.034
				NE4	0.743	16.846
Perceived risk	0.874	0.913	0.724	PR1	0.852	40.450
				PR2	0.829	23.995
				PR3	0.852	39.451
				PR4	0.871	48.238
Adoption intention	0.892	0.933	0.822	AI1	0.904	74.737
				AI2	0.912	72.012
				AI3	0.904	70.528

Table III. Reliability and convergent validity

Structural model analysis

As shown in Figure 3, the PLS results show the relationships among constructs. It shows that the relationship between perceived usefulness and adoption intention of an information mashup service in a DL ($\beta = 0.245$, $t = 4.198$), perceived ease of use and the adoption intention ($\beta = 0.220$, $t = 3.940$) and perceived ease of use and perceived usefulness ($\beta = 0.377$, $t = 6.056$) are significant. Hence, *H1* to *H3* are supported. The results also reveal that perceived integration and perceived risk have significant positive and negative influences on the adoption intention, respectively ($\beta = 0.239$, $t = 3.371$; $\beta = -0.193$, $t = 3.640$), lending support to *H6* and *H11*. Moreover, network externality is found to have a significant impact on perceived usefulness ($\beta = 0.130$, $t = 2.105$), while perceived integration and individualization do not ($\beta = 0.135$, $t = 1.581$; $\beta = 0.066$, $t = 1.234$). Therefore, *H9* is accepted, whereas *H4* and *H7* are rejected. In addition, perceived integration and individualization are associated with perceived ease of use ($\beta = 0.280$, $t = 4.784$; $\beta = 0.234$, $t = 4.219$), while network externality is not ($\beta = 0.035$, $t = 0.630$). Thus, *H5* and *H8* are accepted, whereas *H10* is rejected.

Discussion

Factors on user adoption of a digital library information service mashup (RQ1)

Through the analysis of the structural model of a DL information service mashup, the researchers found that perceived integration and perceived risk have significant direct influences on adoption intention, which supplements previously proven impacts of perceived usefulness and perceived ease of use on adoption intention. Moreover,

Variables	PU	PEU	PI	IND	NE	PR	AI
PU	**0.8269**						
PEU	0.5121	**0.8173**					
PI	0.4288	0.5151	**0.8106**				
IND	0.3003	0.3578	0.4209	**0.8475**			
NE	0.3500	0.3271	0.5565	0.3310	**0.7924**		
PR	−0.1915	−0.1949	−0.1694	−0.0576	−0.0748	**0.8509**	
AI	0.4975	0.5063	0.4901	0.2974	0.3788	−0.3235	**0.9065**

Table IV.
Discriminant validity

Note: The bold diagonal data refer to the square roots of AVE

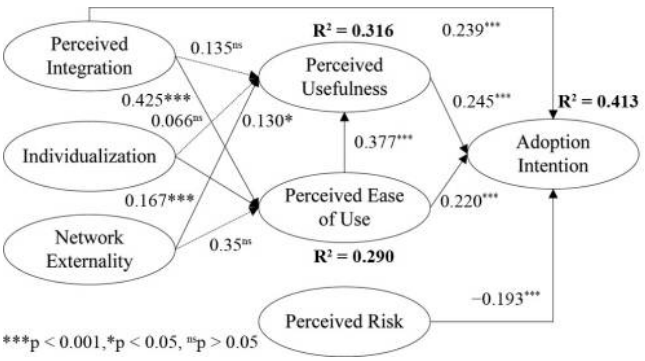

Figure 3.
PLS results

individualization and network externality have indirect impacts on adoption intention. These conclusions not only confirm the validity of using TAM as the basis of measurement model for information service mashup adoption assessment but also expand the explanation of DL information service mashup adoption.

Specifically, perceived usefulness, perceived integration and perceived ease of use are the three constructs that have the highest direct impacts on adoption intention of a DL information service mashup. As an information service technology, information service mashups in DLs are similar to other web technologies and services, such as information systems and micro-blogs. Users' adoption intentions prove to be affected by perceived usefulness and perceived ease of use. This supports the viewpoint that the success of a mashup is influenced by the benefit of what the final combination of components is able to provide (Cappiello *et al.*, 2009).

This study shows that perceived integration has a similar effect on adoption intention of the service. The reason could be that the essential characteristics of an information service mashup are the reusing and synthesizing of information components (Albinola *et al.*, 2009). Thus, users value integration when considering whether to utilize this technology, which is consistent with the standpoint that integration is a significant technical challenge encountered when developing mashups (Beemer and Gregg, 2009). In addition, a DL information service mashup could provide a one-stop service, which should be based on the integration of literature information resources and wide-ranging web academic resources. This finding is also supported by the fact that the integration of literature needs to be extended in mashup domains, as in the integration of heterogeneous data sources (Beemer and Gregg, 2009; Sneed, 2006).

Furthermore, perceived risk is an important factor that cannot be ignored. Different from other constructs, perceived risk negatively influences the adoption intention of a DL information service mashup. This result explains that an information service mashup may trigger user perception of security risks, such as intellectual property infringement, privacy disclosure and systematic conflicts (Beemer and Gregg, 2009), which would prevent users from utilizing it.

Influence among the factors (RQ2)

Besides the repeatedly verified relationship between perceived ease of use and perceived usefulness, the analysis of the information service mashup in a Chinese DL found a number of other interactive influences among the factors in the measurement model.

The result that perceived integration significantly influenced perceived ease of use proves that mashup is an efficient way to reduce work effort on information acquisition. It also supports that mashups are easily created and learned, given that they are composed of existing data (Hornung *et al.*, 2008; Huynh *et al.*, 2007). However, this study also shows that the impact of perceived integration on perceived usefulness is not significant, suggesting that user perception of integration focuses more on its convenient operation rather than its effectiveness.

In addition, the result reveals the influence of individualization on perceived ease of use. For a web service, its interactive nature allows users to receive information tailored to an individual user's interests and preferences (Ansari and Mela, 2003). Thus, because individualization facilitates novelty-seeking behaviours (Guilabert and Donthu, 2006), increasing the degree of individualization of an information service mashup, such as one for acquisition of academic resources, would help accelerate user acceptance. This result

further explains the reason that the level of customization has a positive impact on user satisfaction and enjoyment (Bright, 2014; Horan and Abhichandani, 2006). Moreover, an information service mashup is based on an encapsulation of functional widgets, which can be screened and assembled freely. It appears that individualization has a positive impact on the perceived ease of use of an information service mashup in a DL. However, the direct impact of individualization on perceived usefulness has not been confirmed, although individualization could affect perceived usefulness indirectly via perceived ease of use.

With regards to network externality, its positive impact on perceived usefulness confirms the Matthew effect (Merton, 1968) in web service. In other words, the more users and resources use mashups, the more individuals are inclined to perceive value in and to use this kind of information service technology. In fact, more accessible mashup elements make the mashup service more valuable and facilitate users in obtaining what they need more efficiently, especially from what their peers contributed and shared. In contrast, the results indicate that network externality is not associated with perceived ease of use for an information service mashup in a DL. This might be attributed to the integrated nature of an information service mashup; no matter how many functional elements are in a DL service mashup, these elements are integrated into one easily operated, customizable service. Hence, network externality does not help perceived ease of use.

Areas to advance the development of a digital library information service mashup (RQ3)

Currently, mashups can integrate available public data (e.g. web services and RSS feeds), as well as databases, data warehouses and even legacy systems (Sneed, 2006; Vancea *et al.*, 2008). With open APIs, the shared use of web resources and services becomes a trend, which advances the application of an information service mashup. However, the information service mashup in DLs is still in the early stages of development in China, as well as around the world. Hence, according to the interactive influence relationships discussed above, we may suggest some strategies for advancing the development of DL information service mashups.

For DL users, their needs mainly represent an integrated utilization of distributed academic resources. With an information service mashup, users can access information resources and comprehensively process them with simple operations. Therefore, an information service mashup in a DL, such as MetaLib/SFX, should concentrate on aggregating valuable academic resources both in databases and other functional web services related to literature screening and analysis. Moreover, given the significant effect of perceived integration on both adoption intention and perceived ease of use, enhancing integration ability of an information service mashup is one of the critical aspects to advance its development and utilization in a DL.

The current mashup elements in DLs still tend to perform literature retrieval but lack processing functions. An information service mashup should focus on offering various processing functions rather than a simple integration of distributed information, which has been relatively mature in DL cross-database searches. Therefore, deep mining and sharing literature resources within a DL or from the web is an essential way to advance an information service mashup in a DL.

Considering the customization of functions and services, individual push of resources and setting visualization effects based on user preferences could help users

master the applications easily and be in charge of their own online experience (Bright, 2014). Individualization of an information service mashup in a DL should also focus on improving ease of use, which could further promote the adoption intention.

To avoid negative effects of a DL information service mashup, its application should first set normative standards and agreements, and prevent various potential infringement risks with security techniques. Meanwhile, the compatibility and cooperativeness of functional widgets have to be ensured as well. Taking advantage of system interoperability, an information service mashup in a DL should optimize the service procedure to achieve the fluent and secure utilization of a mashup application.

Conclusion and future research

Very few previous studies have looked at information service mashups in DLs. The proposed research model in this study offers insight into the factors that are core to the characteristics of mashups, which supplement TAM in exploring the influencing factors of adoption intention. The findings show that besides perceived usefulness and perceived ease of use, both perceived integration and perceived risk have direct impacts on users' intention to adopt an information service mashup in a DL. Only secondary in significance to perceived usefulness, perceived integration has a strong positive effect on adoption intention. In contrast, perceived risk is the only factor that negatively correlates with adoption intention. The findings also reveal that perceived integration and individualization have positive impacts on perceived ease of use, while network externality positively influences perceived usefulness. Individualization and network externality also indirectly effect users' adoption intention of an information service mashup in a DL.

As an information service mashup emphasizes customization according to users' own requirements, future studies should examine the impacts of users' personal attributes and preferences. Meanwhile, an information service mashup in a DL could promote the efficiency of resource acquisition and mining. User preference of information service mashups in DLs based on the factor analysis of adoption intention is essential for developing effective services. In addition to more applications in academic fields and sustainable development of DL information service mashups, further investigation is also needed in the areas of user satisfaction, user loyalty and other user behaviour related to an information service mashup in a DL.

There are a few limitations of this study that future research may address and explore further. First, the indicators measuring adoption constructs are mainly drawn from the characteristics of mashups, especially for the perceived integration construct. Although the indicators have good reliability and validity, they need to be improved to adapt the development of mashups in future studies. Second, this study focuses on examining the factors on users' adoption intention of an information service mashup. Thus, the influences of user attributes, such as age, gender, discipline and education background, have not been explored. In addition, this paper does not fully cover various information service mashup technologies and user behaviours of using DL information service mashups. Future development could benefit from research of a wide range of DL information service mashups and associated user behaviours. Finally, this study shows the status quo of information service mashups in Chinese DLs. More research based on other DLs, particularly those in other countries, may validate and enhance the research model.

References

Albinola, M., Baresi, L., Carcano, M. and Guinea, S. (2009), "Mashlight: a lightweight mashup framework for everyone", *18th International World Wide Web Conference, Madrid, Spain (IW3C2 2009), Geneva*.

Anderson, J.C. and Gerbing, D.W. (1988), "Structural equation modeling in practice: a review and recommended two-step approach", *Psychological Bulletin*, Vol. 103 No. 3, pp. 411-423.

Ansari, A. and Mela, C.F. (2003), "E-customization", *Journal of Marketing Research*, Vol. 40 No. 2, pp. 131-145.

Bailey, A. and Back, G. (2006), "LibX-a Firefox extension for enhanced library access", *Library Hi Tech*, Vol. 24 No. 2, pp. 290-304.

Beemer, B. and Gregg, D. (2009), "Mashups: a literature review and classification framework", *Future Internet*, Vol. 1 No. 1, pp. 59-87.

Belleau, F., Nolin, M.A., Tourigny, N., Rigault, P. and Morissette, J. (2008), "Bio2RDF: towards a mashup to build bioinformatics knowledge systems", *Journal of Biomedical Informatics*, Vol. 41 No. 5, pp. 706-716.

Bhattacherjee, A. and Hikmet, N. (2007), "Physicians' resistance toward healthcare information technology: a theoretical model and empirical test", *European Journal of Information Systems*, Vol. 16 No. 6, pp. 725-737.

Brenner, J. and Smith, A. (2013), *72% of Online Adults are Social Networking Site Users*, Pew Research Center, Washington, DC, available at: www.pewinternet.org/2013/08/05/72-of-online-adults-are-social-networking-site-users/ (accessed 5 January 2015).

Bright, L.F. (2014), "Taming the information beast: content customization and its impact on media enjoyment for online consumers", *Online Journal of Communication and Media Technologies*, Vol. 4 No. 3, pp. 143-169.

Cappiello, C., Daniel, F. and Matera, M. (2009), "A quality model for mashup components", *9th Web Engineering Lecture Notes in Computer Science in San Sebastian, Spain*, Springer Verlag, Heidelberg, pp. 236-250.

Chau, P.Y.K. and Hu, P.J.H. (2001), "Information technology acceptance by individual professionals: a model comparison approach", *Decision Sciences*, Vol. 32 No. 4, pp. 699-719.

Chen, L., Gillenson, M.L. and Sherrell, D.L. (2002), "Enticing online consumers: an extended technology acceptance perspective", *Information & Management*, Vol. 39 No. 8, pp. 705-719.

Chiu, C.M., Hsu, M.H. and Wang, E.T.G. (2006), "Understanding knowledge sharing in virtual communities: an integration of social capital and social cognitive theories", *Decision Support Systems*, Vol. 42 No. 3, pp. 1872-1888.

Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340.

Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989), "User acceptance of computer technology: a comparison of two theoretical models", *Management Science*, Vol. 35 No. 8, pp. 982-1003.

De Longueville, B. (2010), "Community-based geoportals: the next generation? Concepts and methods for the geospatial Web 2.0 computers", *Environment and Urban Systems*, Vol. 34 No. 4, pp. 299-308.

De Vrieze, P., Xu, L., Bouguettaya, A., Yang, J. and Chen, J. (2011), "Building enterprise mashups", *Future Generation Computer Systems*, Vol. 27 No. 5, pp. 637-642.

Deng, Z.H., Lu, Y.B. and Zhang, J.L. (2007), "Study of individual consumer behaviors in SMS by using TAM and network externality theory", *Chinese Journal of Management*, Vol. 4 No. 2, pp. 216-221.

Engard, N.C. (2009), *Library Mashups: Exploring New Ways to Deliver*, Information Today, New York, NY.

Featherman, M.S. and Pavlou, P.A. (2003), "Predicting e-services adoption: a perceived risk facets perspective", *International Journal of Human-Computer Studies*, Vol. 59 No. 4, pp. 451-474.

Fielding, R.T. (2000), "Architectural styles and the design of network-based software architectures", *Doctoral dissertation*, University of California, Irvine, CA.

Fornell, C. (1992), "A national customer satisfaction barometer: the Swedish experience", *The Journal of Marketing*, Vol. 56 No. 1, pp. 6-21.

Fornell, C. and Bookstein, F.L. (1982), "Two structural equation models LISREL and PLS applied to consumer exit-voice theory", *Journal of Marketing Research*, Vol. 19 No. 4, pp. 440-452.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Gerrity, B., Lyman, T. and Tallent, E. (2002), "Blurring services and resources: Boston College's implementation of MetaLib and SFX", *Reference Services Review*, Vol. 30 No. 3, pp. 229-241.

Grammel, L. and Storey, M.A. (2010), "A survey of mashup development environments", in Chignell, M., Cordy, J., Ng, J. and Yesha, Y. (Eds), *The Smart Internet: Current Research and Future Applications*, Springer Verlag, Heidelberg, pp. 137-151.

Griffin, E. (2008), *Foundations of Popfly: Rapid Mashup Development*, Springer-Verlag, New York, NY.

Guilabert, M.B. and Donthu, N. (2006), "Mass customisation and consumer behaviour: the development of a scale to measure customer customisation sensitivity", *International Journal of Mass Customisation*, Vol. 1 No. 2, pp. 166-175.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998), *Multivariate Data Analysis*, 5th ed., Prentice-Hall, Upper Saddle River, NJ.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011), "PLS-SEM: indeed a silver bullet", *The Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-152.

Haya, G., Nygren, E. and Widmark, W. (2007), "MetaLib and Google Scholar: a user study", *Online Information Review*, Vol. 31 No. 3, pp. 365-375.

Holden, R.J. and Karsh, B.T. (2010), "The technology acceptance model: its past and its future in health care", *Journal of Biomedical Informatics*, Vol. 43 No. 1, pp. 159-172.

Horan, T.A. and Abhichandani, T. (2006), "Evaluating user satisfaction in an e-government initiative: results of structural equation modeling and focus group discussions", *Journal of Information Technology Management*, Vol. 17 No. 4, pp. 33-44.

Hornung, T., Simon, K. and Lausen, G. (2008), "Mashing up the deep web", *4th International Conference on Web Information Systems and Technologies*, *Funchal, Portugal*, Institute for Systems and Technologies of Information, Control and Communication, Setúbal, pp. 58-66.

Hoyer, V. and Fischer, M. (2008), "Market overview of enterprise mashup tools", *6th International Conference on Service-Oriented Computing*, *Sydney, Australia*, Springer Verlag, Heidelberg, pp. 708-721.

Hoyer, V., Stanoevska-Slabeva, K. and Vom Brocke, J. (2010), "On the contribution of reference modeling for organizing enterprise mashup environments", *Business Process Management Workshops*, *Ulm, Germany*, Springer Verlag, Heidelberg, pp. 695-706.

Hsu, C.L. and Lin, J.C.C. (2008), "Acceptance of blog usage: the roles of technology acceptance, social influence and knowledge sharing motivation", *Information & Management*, Vol. 45 No. 1, pp. 65-74.

Hu, C.P. and Yan, W.W. (2013), "Personal digital library service mashup for scientific research", *Journal of Library Science in China*, Vol. 39 No. 4, pp. 93-101.

Huynh, D., Miller, R. and Karger, D. (2007), "Potluck: data mash-up tool for casual users", *International Conference on World Wide Web, Alberta, Canada*, *Elsevier, Amsterdam*, pp. 737-746.

Jhingran, A. (2006), "Enterprise information mashups: integrating information, simply", *Proceedings of the 32nd International Conference on Very Large Data Bases*, *Seoul, Korea*, Association for Computing Machinery, New York, NY, pp. 3-4.

Jiang, J.J., Klein, G. and Carr, C.L. (2002), "Measuring information system service quality: SERVQUAL from the other side", *MIS Quarterly*, Vol. 26 No. 2, pp. 145-166.

Jiao, Y.Y. and Lei, X. (2008), "Establishment and survey analysis of a consumer satisfaction-based evaluation model for network information service quality", *Library and Information Service (in China)*, Vol. 52 No. 2, pp. 81-84.

Jing, J.P. and Yin, Y.X. (2011), "Analysis on mechanism of influencing factors for information service in knowledge portal", *Information Science (in China)*, Vol. 29 No. 10, pp. 1488-1493.

Johnston, L.R. and Jensen, K.L. (2009), "Maphappy: a user-centered interface to library map collections via a Google maps 'mashup'", *Journal of Map & Geography Libraries*, Vol. 5 No. 2, pp. 114-130.

Jung, J.J. (2012), "Collaborative browsing system based on semantic mashup with open APIs", *Expert Systems with Applications*, Vol. 39 No. 8, pp. 6897-6902.

Kauffman, R.J., McAndrews, J. and Wang, Y.M. (2000), "Opening the 'black box' of network externalities in network adoption", *Information Systems Research*, Vol. 11 No. 1, pp. 61-82.

Kongdenfha, W., Benatallah, B., Vayssière, J., Saint-Paul, R. and Casati, F. (2009), "Rapid development of spreadsheet-based web mashups", *Proceedings of the 18th International Conference on World Wide Web*, *Madrid, Spain*, Association for Computing Machinery, New York, NY, pp. 851-860.

Kwon, O. and Wen, Y. (2010), "An empirical study of the factors affecting social network service use", *Computers in Human Behavior*, Vol. 26 No. 2, pp. 254-263.

Lachenmaier, P., Ott, F. and Koch, M. (2013), "Model-driven development of a person-centric mashup for social software", *Social Network Analysis and Mining*, Vol. 3 No. 2, pp. 193-207.

Lee, J. and Park, M.C. (2013), "Factors affecting the smartphone users to use the mobile portal services focusing on Korean mobile portals", *Information Systems and e-Business Management*, Vol. 11 No. 2, pp. 235-252.

LibX (2014), "LibX-a browser plugin for libraries", available at: http://old.libx.org (accessed 12 December 2014).

Li, L. (2009), "Mashup application based on library information service", *Researches in Library Science (in China)*, Vol. 28 No. 4, pp. 68-70.

Lin, K.Y. and Lu, H.P. (2011), "Why people use social networking sites: an empirical study integrating network externalities and motivation theory", *Computers in Human Behavior*, Vol. 27 No. 3, pp. 1152-1161.

Liu, F., Li, C.W. and Wang, F. (2009), "Study on widgets for mashup", *New Technology of Library and Information Service (in China)*, Vol. 25 No. 12, pp. 7-11.

López, J., Bellas, F., Pan, A. and Montoto, P. (2009), "A component-based approach for engineering enterprise mashups", *International Conference on Web Engineering, San Sebastian, Spain*, Springer Verlag, Heidelberg, pp. 30-44.

Lou, H., Luo, W. and Strong, D. (2000), "Perceived critical mass effect on groupware acceptance", *European Journal of Information Systems*, Vol. 9 No. 2, pp. 91-103.

Mason, R. and Rennie, F. (2007), "Using Web 2.0 for learning in the community", *The Internet and Higher Education*, Vol. 10 No. 3, pp. 196-203.

Mathieson, K. (1991), "Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior", *Information Systems Research*, Vol. 2 No. 3, pp. 173-191.

Maximilien, E.M., Wilkinson, H., Desai, N. and Tai, S. (2007), "A domain-specific language for web APIs and services mashups", *International Conference on Service-Oriented Computing, Vienna, Austria*, Springer Verlag, Heidelberg, pp. 13-26.

Merton, R.K. (1968), "The Matthew effect in science", *Science*, Vol. 159 No. 3810, pp. 56-63.

Mukhopadhyay, P. (2012), "Marching with mashup: application of information mashup for developing open library system", *Challenges in Library Management System, Jadavpur, Kolkata*, Indian Association for the Cultivation of Science, Kolkata, pp. 39-47.

Nachouki, G. and Quafafou, M. (2011), "Mashup web data sources and services based on semantic queries", *Information Systems*, Vol. 36 No. 2, pp. 151-173.

Palfrey, J. and Gasser, U. (2008), *Born Digital: Understanding the First Generation of Digital Natives*, Basic Books, New York, NY.

Paredes-Valverde, M.A., Alor-Hernández, G., RodríguezGonzález, A. and Hernández-Chan, G. (2012), "Developing social networks mashups: an overview of rest-based APIs", *Procedia Technology*, Vol. 3 No. 5, pp. 205-213.

Park, S.Y. (2009), "An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning", *Educational Technology & Society*, Vol. 12 No. 3, pp. 150-162.

Patel, A., Seyfi, A., Taghavi, M., Wills, C., Na, L., Latih, R. and Misra, S. (2012), "A comparative study of agile, component-based, aspect-oriented and mashup software development methods", *Tehnicki Vjesnik*, Vol. 19 No. 1, pp. 175-189.

Pavlou, P.A. (2003), "Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model", *International Journal of Electronic Commerce*, Vol. 7 No. 3, pp. 101-134.

ProgrammableWeb (2014), available at: www.programmableweb.com (accessed 18 December 2014).

Radder, L. and Louw, L. (1999), "Mass customization and mass production", *The TQM Magazine*, Vol. 11 No. 1, pp. 35-40.

Rahimi, H.M. (2014), "Social network improvement utilizing information fusion", *Switzerland Research Park Journal*, Vol. 103 No. 1, pp. 751-770.

Rosenberg, F., Curbera, F., Duftler, M.J. and Khalaf, R. (2008), "Composing restful services and collaborative workflows: a lightweight approach", *IEEE Internet Computing*, Vol. 12 No. 5, pp. 24-31.

Schafer, J.B., Konstan, J.A. and Riedl, J. (2001), "E-commerce recommendation applications", in Kohavi, R. and Provost, F. (Ed.), *Data Mining and Knowledge Discovery*, Springer, New York, NY, pp. 115-153.

Shen, K.L. and Du, J. (2010), "Using mashup to improve library service ability: take the combination of Douban and Nanjing university library", *New Technology of Library and Information Service (in China)*, Vol. 26 No. 10, pp. 87-90.

Sheth, A.P. and Larson, J.A. (1990), "Federated database systems for managing distributed heterogeneous and autonomous databases", *ACM Computing Surveys (CSUR)*, Vol. 22 No. 3, pp. 183-236.

Sjana, B. (1996), "Empirical evaluation of the revised technology acceptance model", *Management Science*, Vol. 42 No. 1, pp. 85-92.

Sneed, H. (2006), "Integrating legacy software into a service oriented architecture", *Proceedings of the Conference on Software Maintenance and Reengineering, Bari, Italy*, IEEE, Piscataway, NJ, pp. 3-14.

Sun, J.J., Cheng, Y. and Ke, Q. (2007), "Advances of research on technology acceptance model", *Information Science (in China)*, Vol. 25 No. 8, pp. 1121-1127.

Sutherland, A. and Green, P. (2004), "An OpenURL resolver (SFX) in action: the answer to a librarian's prayer or a burden for technical services", *The 12th Biennial Conference of the Victorian Association for Library Automation, Melbourne, Australia*.

Thong, J.Y.L., Hong, W.Y. and Tam, K.Y. (2002), "Understanding user acceptance of digital libraries: what are the roles of interface characteristics, organizational context, and individual differences?", *International Journal of Human-Computer Studies*, Vol. 57 No. 3, pp. 215-242.

Van der Heijden, H. (2003), "Factors influencing the usage of websites: the case of a generic portal in The Netherlands", *Information & Management*, Vol. 40 No. 6, pp. 541-549.

Vancea, A., Grossniklaus, M. and Norrie, M. (2008), "Database-driven web mashups", *International Conference on Web Engineering, Yorktown Heights, NY, IEEE, Piscataway, NJ*, pp. 162-174.

Vandenburg, M. (2008), "Using Google Maps as an interface for the library catalogue", *Library Hi Tech*, Vol. 26 No. 1, pp. 33-40.

Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: toward a unified view", *MIS Quarterly*, Vol. 27 No. 3, pp. 425-478.

Wakimoto, J.C., Walker, D.S. and Dabbour, K.S. (2006), "The myths and realities of SFX in academic libraries", *The Journal of Academic Librarianship*, Vol. 32 No. 2, pp. 127-136.

Wang, C.C., Hsu, Y. and Fang, W. (2004), "Acceptance of technology with network externalities: an empirical study of Internet instant messaging services", *Journal of Information Technology Theory and Application*, Vol. 6 No. 4, pp. 15-28.

Wang, W.J. (2011), "Research on the crossover service of library based on mashup technology", *Library and Information Service (in China)*, Vol. 55 No. 7, pp. 68-71, p. 133.

Woodland, M., and Klass, D. (2005), *Podcast Solutions: The Complete Guide to Podcasting*, Friendsoft, New York, NY.

Yan, L. (2013), "Subject service organizing of the digital library based on mashup", *Library Tribune (in China)*, Vol. 33 No. 4, pp. 98-103.

Zhang, Z., Sun, H. and Du, H. (2012), "An empirical research of effects of realness on microblogging intention model", *Advances in Multimedia, Software Engineering and Computing, Wuhan*, Springer Verlag, Heidelberg, pp. 515-520.

Corresponding author
Shengli Deng can be contacted at: victorydc@sina.com