



Research Paper

User Experience in Interaction with Digital Libraries (DLs) in Iran: Deficiencies vs Expectations in Relation with Hierarchical Value Map (HVM)

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Abstract

Background and Objectives: User experience researches defined as study users' perceptions and interactions of anticipated or intended use of a product, system, or service. Therefore, study these experiences are very important and can lead to value creation for information system stakeholders. The present study seeks to clarify deficiencies and difficulties experienced by users in interacting with the most important Digital Libraries (DLs) in Iran. Furthermore, demands and expectations of users also investigated in this research.

Methodology: The research conducted in a qualitative approach with content analysis method using MaxQDA V. 10 to investigate the experiences of 37 users of Papyrus, Pars Azarakhsh and Sana DLs. In this study, the difficulties or deficiencies and demands or expectations of users considered in relation with their Hierarchical Value Map (HVM). The sample of the study selected by snowball sampling method. Credibility of the research verified with member checking and peer debriefing methods. Finally, the content of the interview analyzed in order to identify the main concepts and related thematic categories.

Findings: Customers and their knowledge considered as one of the most important organizational assets and an essential element of competitive advantage. In fact, this knowledge gained from within and outside the organization is the core capital and critical value. This is important because the customers and their knowledge considered as one of the most important organizational assets and an essential element of competitive advantage. Customer knowledge gained from their experience in the process of using a product or service. There are variety of approaches to elicit the experience and knowledge of the customers or stakeholders which analysis of cognitive structure is one of these approaches deeply deals with the experience and knowledge of individuals. Cognitive structure encompasses users' emotions, mental images, views, beliefs and values in using a product or service. In this research Means-End Theory (MET) applied which is rarely used in information systems.

Discussion: Findings showed that the most important undesirable experiences of interacting with the DLs summarized in several dimensions: resource retrieval, display of search results, and process in searching the resources. In addition, displaying search results and search capabilities, additional features and services, linking resources to libraries were among the most important favorable experiences that users expected from DLs. The relationship between deficiencies and expectations depicted in HVM. Their values were correct selection, retrieval, and access to the full text information resources. The results of this study showed that this part of the user experience should considered by the designers of DLs in order to better design of these systems to provide more value to all stakeholders.

Introduction

Organizations today, especially those that produce products to present to their customers, are in a competitive environment. In normal and natural competitive environments, organizations are always try to gain knowledge of all those who can influence the improvement of products and services to be dynamic and resistant. In fact, this knowledge gained from within and outside the organization is the core capital and critical value. Therefore, it is important to analyze their views, behaviors and knowledge. This is important because the customers and their knowledge considered as one of the most important organizational assets and an essential element of competitive advantage. Customer knowledge gained from their experience in the process of using a product or service. Customer experience is also the result of the interaction between the organization and the customer (Shaw, 2007) and the customer's use of the product or service and the way the organization operates (Barnes, Blake, Pinder, 2009). There are variety of approaches to elicit the experience and knowledge of the customers or stakeholders. Analysis of cognitive structure is one of these approaches deeply deals with the experience and knowledge of individuals. Cognitive structure encompasses users' emotions, mental images, views, beliefs and values in using a product or service.

Literature this subject area is rich of research findings and theories emphasize acquisition and management of stakeholders' knowledge used to analyze the cognitive structure of individuals. One of the theories is Means-End Theory (MET) known as one of the behavioral analysis theories. In this theory, an exception of the cognitive structure of individuals and their understanding & behavior using a product is considered. Cognitive structure of customers, its characteristics, outcomes and values about a product considered in the context of individuals' Hierarchical Value Map (HVM). The 'means' in this theory refers to the instrumental values leads to 'terminal' values.

Although, less attention paid to the use of customer knowledge in non-profit organizations such as libraries and information centers and related services and products such as Digital Libraries (DLs). It is important to understand human interaction with these information systems to identify users' experiences gained from interacting with DLs and to elicit their Mental Models (MM). Hence, it is necessary to consider this knowledge regarding cognitive structure of users interacting DLs. This study analyzes DL users' experience to identify deficiencies and difficulties users facing in these systems or organizations. In addition, necessary solutions to eliminate these deficiencies and difficulties to improve DLs.

Literature Review

The cognitive structure & knowledge of users including their preferences, experiences and knowledge structure using information systems (Xie, 2008). It is necessary to investigate their vision and experience using a product to benefit their knowledge in product development. Understanding how stakeholders think about an information system or software can help identify their cognitive process. Understanding how users think about an information system, facilitate identification of their cognitive processes (Hunter, Caputi, Tan, 2012). On the other hand, using users' knowledge in development process of systems leads to better users' acceptance and to provide with innovative features (Sofianti, Suryadi, Govindaraju, Prihartono, 2010). Therefore, it is necessary to look at the literature about stakeholders' knowledge and experience in MM framework. Research on the subjective model and cognitive structure of information systems and library software users began with Borgman's doctoral dissertation. However, Zhang (1998) used Repertory Grid Technique (RGT) to extract and represent users' MMs and explored the search function and the influence of users' educational and professional characteristics on the use of information retrieval systems in nine selective concepts. Zhang & Chigenel (2001) studied the impact of users' characteristics on educational status, vocational status, language, academic background, and computer experience on their MMs of information retrieval systems. Not all researches in this field devoted to Information Systems (IS). For example, Felix, Hunter & Gordon (2002) emphasized on the possibility of using a RGT based on Personal Construct Theory (PCT) acknowledge the importance of users' understanding of IS in their research. Other researches focused on the MMs of users in other ISs such as DLs. Makri, Blandford, Gow, Rimmer, Warwick & Buchanan (2006) studied MM of DL users' vs MM of traditional librarians with in-depth and aloud-thinking interviews with eight students in Human & Computer Interaction (HCI) field. In addition, they studied differences on the MM of the users and the designers. Moukdad & Large (2001) investigated MM of search engine users by analyzing examples of queries, and interaction that occurred using these engines. Slone (2002) examined MM of 31 public library users using search engines and /or public directories, and explored their experiences and goals in using these systems. Using the RGT and Laddering Techniques, Crudge & Johnson (2007) explored the structures and determined the evaluation model of search engines among 10 undergraduate students at the University of Manchester's School of Information and Communication. In a usability study, Sadeh (2008) explored the experience of searching for the users in the ExLibris libraries software. Khoo & Hall (2012) also analyzed elicited mental representations of users of DLs in search section and depicted model of these representations. Wilkinson (2009) in qualitative study

examined the MM of users and designers and the framework of their information seeking behavior. In this study, information seeking behavior of MA students using Web, Google, and new systems studied; As well as MM of users and providers to understand the content of listserv software to differentiate between their mental models. They also found that the gap between the mental model of providers and users was one of the factors affecting the usability of library web products.

Method

The present study was an applied research in a qualitative method, using directed & qualitative content analysis based on Hierarchical Value Map (HVM) in Means-End Theory (MET). In MET objective and abstract characteristics, psychosocial and functional consequences, and instrumental and final values considered as categories. The unit of analysis in this study was the words and sentences used by the participants in the interviews. In addition, cognitive map analysis method used to examine HVM of the users. Hence, views, beliefs, values, attitudes, and relationships of these components examined together in the framework of a visual representation. Therefore, experiences of 37 users DLs in Iran in Payam- e Mashregh, Pars Azarakhsh and Sana systems explored and elicited. The research population consisted of individuals with relevant background (at least one year) of using DL system. The sample of the study selected by snowball sampling method. Research data gathered with recording sessions and transcription of the audio and analyzed with MaxQDA V. 10, drawn with MS Visio. Credibility of the research examined with member checking and peer debriefing methods. Finally, the content of the interview analyzed in order to identify the main concepts and related thematic categories. Research data considered with the difficulties or deficiencies experienced and the demands or expectations of users in the mentioned DL systems.

Findings

In this section, some of these experiences needed to explain more precisely including difficulties, deficiencies demands & expectations in relation with HVM cognitive map. For instance, one of the participants stated his experienced difficulties as:

“... One of the problems is the existence of half-spaces that went back to Persian scripts. For example, ‘کتابخانه ها’ [ketabkhane +halph space +ha] with half-space and with a distance ‘کتابخانه ها’ [Ketabkhaneh + space+ ha] have different results. Unfortunately, we still could not solve this. We do not know if the user is a professional typist or not ...”

He added some words to explain the need to correct this important deficiency:

“... We cannot [should not] change the Persian scripts. Finally, the [DL] system has to adapt itself to these conditions. ...”

Another participant added:

“... Sometimes the letter "ی"[y] cause the problem to produce different results. ...”

Concerning the ultimate consequence of this problem, he believed:

“... {This problem} discourages the user from searching. The user knows that we have at least one thing about the search string. However, because it searches with ‘space’ he/she does not get any results. He says to himself, ‘what is this system!?! I know there is such a thing, it doesn't work at all!’ ...”

Another user in the issue of inadequate retrieval or failure to retrieve information sources stated the problem as follows:

“... Our software has an obvious problem that many users would say. You are looking for a resource and you are sure it is in the collection. Because you had read to it before. However, this software could not find it. That is, the Farsi script and its multiple versions make it difficult for such software. Since I work in the field of linguistics, I am familiar with this subject. Once you know there is something, you go and find it any way you can. But sometimes you don't know; you think it's not existed ...”

Based on the some of the mentioned statements, these difficulties or deficiencies experienced categorized into four categories: inappropriate resource recovery, inappropriate display of search results, inappropriate process in search of resources, and other difficulties or deficiencies. It should note that these difficulties or deficiencies are part of the undesirable experiences and consequences that a person receives or perceives because of using a product or service. Of course, by removing the deficiencies these undesirable experiences in the customer value system can transformed into existing or desirable values. These deficiencies followed in Table 1.

Table 1: Difficulties or deficiencies experienced by users in DLs

#	Category	Difficulties or deficiencies	DLs							
			Azarakhsh (n=14)		Papyrus (n=9)		Sana (n=14)		Total (n=37)	
			Mean	f	Mean	f	Mean	f	Mean	f
1	Undesirable resource recovery	Not retrieving resources because of spaces in searching	0.57	8	0.33	3	0.57	8	0.51	19
2		Not retrieving information resources	0.14	2	0.22	2	0.14	2	0.16	6
3		False drop and unrelated sources	0.07	1	0.22	2	0.21	3	0.16	6
	Total		0.79	11	0.78	7	0.93	13	0.84	31
1	Undesirable display of search results	Impossible view of the all selected documents	0.07	1	0	0	0.29	4	0.14	5
2		Impossible view of the required loan information	0	0	0	0	0.21	3	0.8	3
3		Need to use scrollbar to view results	0.07	1	0	0	0.07	1	0.05	2
4		Not displaying complete full-text resource	0.07	1	0.11	1	0	0	0.05	2
5		Not providing enough details of information resources	0	0	0	0	0.14	2	0.05	2
6		Impossible comparing of search results	0	0	0	0	0.07	1	0.03	1
7		Showing limited number of search results	0	0	0.11	1	0	0	0.03	1
8		Illegible information displayed	0	0	0	0	0.07	1	0.03	1
9		Lack of proper resource sorting	0	0	0	0	0.07	1	0.03	1
	Total		0.28	4	0.22	2	0.14	13	0.51	19
1	Undesirable process of searching	Long process of searching	0.14	2	0.11	1	0.14	2	0.14	5
2		Necessity to change language while searching	0	0	0	0	0.14	2	0.11	4
3		Necessity to start searching by clicking on the Search button	0	0	0	0	0.14	2	0.05	2
	Total		0.14	2	0.11	1	0.42	6	0.30	11
1	Other deficiencies	Not presenting proper guidance	0.14	2	0.11	1	0.21	3	0.16	6
2		Hidden important capabilities	0	0	0	0	0.29	4	0.11	4
3		Complexity in user interface design	0.14	2	0	0	0.07	1	0.08	3
4		Not supporting various browsers	0.07	1	0	0	0.07	1	0.05	2
5		Some extra options	0	0	0	0	0.07	1	0.03	1
	Total		0.35	5	0.11	1	0.71	10	0.45	17

Among these deficiencies, not retrieving resources because of spaces in searching was the most frequent category. In addition, some of the deficiencies such as not retrieving information sources, false drop and irrelevant resources, long process search process, and not presenting proper guidance stated at least once in all DLs and more than half of the stated to not retrieve resources because of spaces in searching. Furthermore, a large proportion of the deficiencies experienced fall into the category of undesirable information resource recovery. In the next section, DL users' expectations discussed. Findings showed that five categories including search results display capabilities, search capabilities, additional features and services, linking resources and libraries, and other desires and expectations explored. It should be noted that these expectations are part of the desirable experiences and consequences that they wish to experience using a digital library. These experiences are part of the customer value system that embodies his or her desired values. The demands and expectations of users listed in Table 2.

In this Table, the most frequent expectations was the search results display category. Furthermore, we can relate expected capabilities to the Hierarchical Value Map (HVM) or cognitive mapping of DL users. As stated Rajabali Beglou (2015) HVM or cognitive map is used to extract the characteristics, outcomes and values desired for a product or service and HVM is based on the MET contains chains of relationships (Reynolds & Olson, 2001) among mentioned categories. In the first and lower ring of this chain, attributes fall into abstract and objective categories. Objective attribute defined as the external aspects of a product or service that individuals interact or deal with. In this study, objective attributes described as capabilities, features, and options in DLs. In the second ring of the chain, consequences divided into psychosocial-social and functional categories. Psychosocial-social consequences include feelings and considerations an individual experiences. Functional implications also refer to the practical benefits and executive outcomes of a product or service. At the top of the chain are values. Values defined as beliefs individuals hold about themselves and includes instrumental and terminal values. In the personal experiences of individuals, there are instrumental values meet lower needs than terminal values (Jones, Ross, Lynam, Perez & Leitch, 2011). These values lead to terminal values at the highest level of the HVM. The basis of MET is based on the relationship between the instrumental and terminal values. Taking the mental model of individuals as a cognitive representation of the external reality provides experience or perception in the lives of individuals a basis for decision-making (Spicer, 2000). In addition, in MET these values direct individuals' behavior and provides a framework for a deeper understanding of the reasons for doing their daily duties (Reynolds & Olson, 2001). Therefore, MM of DL users' form the cognitive structure, underlies their experience organization and can link this cognitive structure to the cognitive maps they experience using this system.

Table 2: Expectations of Users from DLs

	Category	Expectations	DLs							
			Azarakhsh (n=14)		Papyrus (n=9)		Sana (n=14)		Total (n=37)	
			Mean	f	Mean	f	Mean	f	Mean	f
1	Search results display capabilities	Offer similar and related resources	2	0.14	1	0.11	2	0.14	5	0.14
2		Visual resolution of important information	2	0.14	0	0	1	0.07	3	0.08
3		View search results on a separate page	1	0.07	0	0	0	0	1	0.03
4		Presenting newer versions of the resources	0	0	0	0	1	0.07	1	0.03
5		view more resources at the bottom of search results	1	0.07	0	0	0	0	1	0.03
6		Display resource place in initial search results	1	0.07	0	0	0	0	1	0.03
	Total		0	0	0	0	0	0	0	
1	Search capabilities	Refine and suggest search phrases	4	0.29	0	0	2	0.14	6	0.16
2		Use of Boolean operators	1	0.07	1	0.11	0	0	2	0.05
3		Searchable overview of library classification	1	0.07	0	0	0	0	1	0.03
4		Federated search	0	0	0	0	1	0.07	1	0.03
5		Smarter search	1	0.07	0	0	0	0	1	0.03
	Total		7	0.50	1	0.11	3	0.21	11	0.30
1	Additional features and services	Sending notification	1	0.07	1	0.11	2	0.14	4	0.11
2		Order documents	1	0.07	0	0	1	0.07	2	0.05
3		Login with guest	1	0.07	0	0	0	0	1	0.03
4		Manage citations in system	1	0.07	0	0	0	0	1	0.03
5		FAQ	0	0	0	0	1	0.07	1	0.03
6		Virtual reference` `	0	0	1	0.11	0	0	1	0.03
7		Visual thesaurus	0	0	1	0.11	0	0	1	0.03
	Total		4	0.29	3	0.33	4	0.29	11	0.30
1	Other demands and expectations	Link to other systems and libraries	4	0.29	0	0	4	0.29	8	0.22
2		Implementation of FRBR	1	0.07	0	0	0	0	1	0.03
3		Link to Wikipedia	1	0.07	0	0	0	0	1	0.03
	Total		6	0.43	0	0	4	0.29	10	0.27
	Other demands and expectations	Resolution of capability and options	2	0.14	0	0	1	0.07	3	0.08
		More user friendly interface	0	0	0	0	2	0.14	2	0.05
		Tab based DLs' sections	1	0.07	0	0	0	0	1	0.03
		Index content by search engines (Google)	1	0.07	0	0	0	0	1	0.03
	Total		0	0	0	0	0	0	0	

As mention earlier, some of the most important features users expected in relation to the HVM can examined as follows (see Figure 1). These expected features (Table 2) affected by all the information systems considered in this study and due to their frequency in these IS consider as the most important expected attributes.

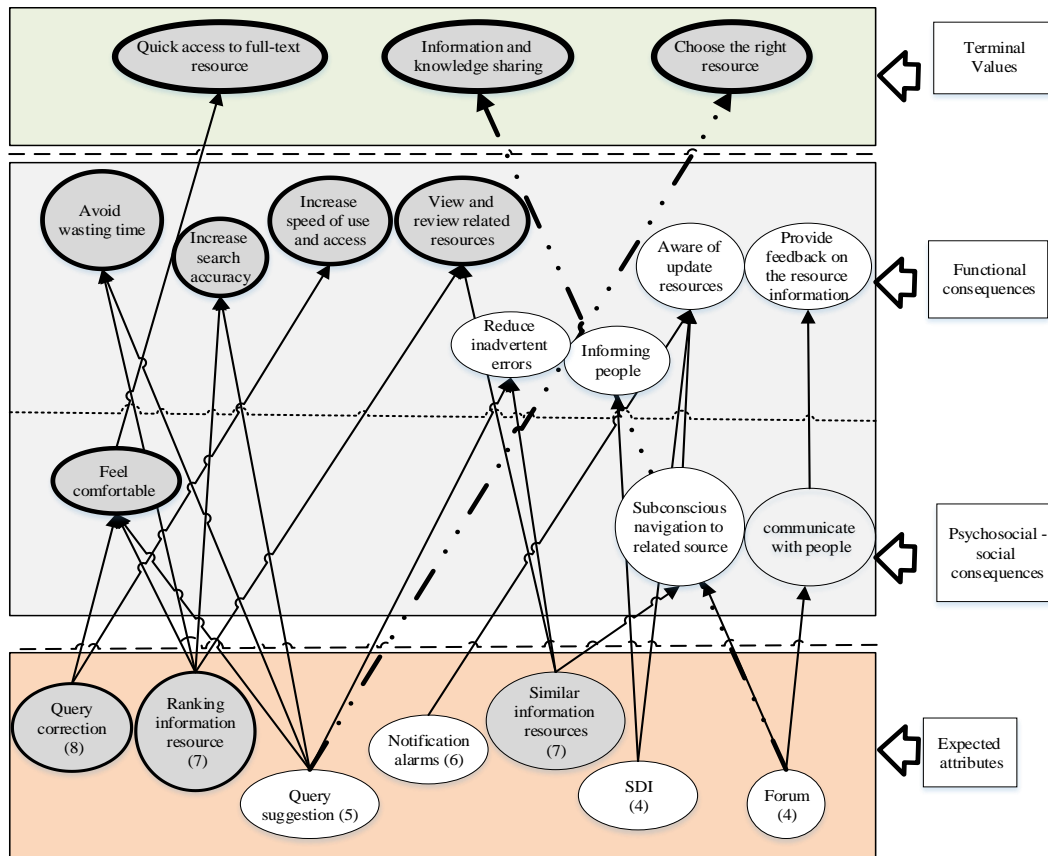


Diagram 1: Relationship among the most important attributes users expected in their HVM

Diagram 1 illustrates the relationship among expected attributes with psychosocial-social and functional consequences, as well as their terminal values. The numbers in the ellipse refers to the frequency of expected attributes. In this diagram, some of the expected features such as query correction, ranking information resources and similar information resources suggestions presented in a distinct color. The links and relationships that lead to these expected attributes lead to psychosocial-social and functional consequences received the most attention. In other words, these expected attributes lead to consequences and values that more frequently stated by users. In addition, some links highlighted in bold with a dotted line .These arrows represent a direct link among some of the expected attributes and the terminal values without any particular consequence.

These expected attributes are forum and query suggestion, which lead to the terminal values of information and knowledge sharing and choose the right information resource. The direct link among these expected attributes and the values indicate the importance of these features in the users' HVM. In other words, if forum and query suggestion attribute implemented in DLs, it can directly create terminal values for users. On the contrary, the difficulties experienced by users in interaction with DLs can illustrated in the HVM (see Diagram 2).

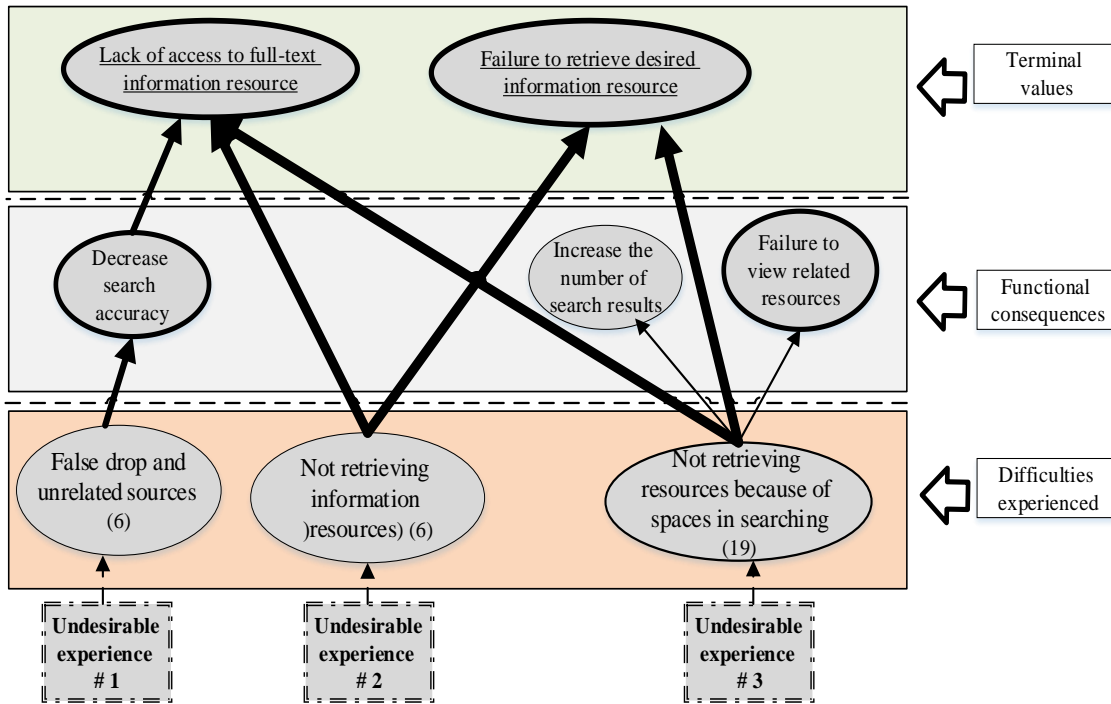


Diagram 2: Relationship among the difficulties or deficiencies experienced by users with their HVM

Diagram 2 illustrates relationship among deficiencies experienced by users with their functional consequences, as well as their terminal values. The numbers inside the ellipse indicate the frequency of difficulties or deficiencies experienced by users. This diagram attempts to point out the real difficulties or deficiencies experienced by users. Therefore, it is inverted consequences and values in the HVM to reflect the true consequences and values prevents from users. In other words, Diagram 1 provide basis for HVM related to users' expectations whereas in the Diagram 2, the difficulties or deficiencies experienced inverted or reversed to the users' HVM.

To simplify the description of these difficulties, three kind of the difficulties experienced by users presented in this chart under the names of experience numbers one, two and three. As noted earlier in Table 2, difficulties or deficiencies more likely attributed to undesirable resource recovery. Hence, the difficulties experienced in this category not retrieving resources because of spaces in searching (experience # 1), not retrieving information resources (experience # 2), and false drop and unrelated sources (Experience # 3) presented in relation with users' HVM. As noted earlier, the most frequent difficulty stated by users was "not retrieving resources because of spaces in searching" (experience # 1). This deficiencies in addition to leading to some functional consequences, such as "missing relevant resources" and "increasing the number of search results" directly leads to a failed experience for these beneficiaries, resulting in "failure to find the desired information resource". A similar example of this deficiency occurs with the second experience in DLs and not retrieval of resources prevents users from achieving their terminal values. The deficiencies mentioned significant because they undoubtedly undermine the fundamental (terminal) value of a user and should considered in order to compensation. In other words, although the MMs and cognitive map of the users tend to achieve terminal values, these difficulties or deficiencies act as a barrier to achieving these values. In addition, in false drop and unrelated sources, users face the direct consequence of the "reduced search accuracy" functionality, which ultimately results in the "lack of access to full-text information resource" which is an inappropriate experience.

Conclusion

Based on the findings of Rajabali Beglou (2015) research, in order to create value for DLs users in Iran, three components of “exploring resource”, “right information source selection” and “accessibility” are needed. These values are part of the users’ value system in relation to DLs and without them value creation is impossible. However, achieving these values is not always possible and users face difficulties and challenges. These difficulties or challenges may include not providing the facilities and conditions needed to form values or because of the gap between the existing or desired values for users. In addition, dissatisfaction can arise if the value system of the users not properly matched with existing values with their desirable values. The data in Table 1 showed that some of the difficulties or deficiencies experienced by the users were very common. Diagram 2 delineated the link between the difficulties or deficiencies experienced by users with the HVM. The difficulty or deficiencies that not allow to the creation of values such as “retrieval of desired information resources’ and fail to the “fast access to information resources”. The aforementioned values considered as “desirable values” in the user value system, which focus on the desires and expectations the users. Table 2. Presents users’ expectations of DLs indicated that the “refine and suggest queries” was one of the most frequent desires. This demand may influenced by the experience of using other information systems such as search engines and databases. Figure 1 illustrates the link between the expected attributes of the users to some of the most important consequences of DLs. In other words, this expectation in the HVM of the users led to important and overwhelming consequences that show its importance. Therefore, it concluded that some of these expectations have a more prominent place in the value system of the users, which need attention of the designers.

Monitoring beneficiaries’ viewpoints can implemented by "user interest" and “expert” groups which, help developing appropriate and purposeful products, as well as extract and gather user insights and identify their difficulties, deficiencies, demands and expectations. These groups, which are typically involved in the process of business product development, offer useful insights for improving and promoting these products. However, the formation of special user interest groups in each of these special groups can provide knowledge needed for the purposeful development of DLs. For example, expert groups of professionals, which may include librarians, professionals, and interested in libraries and information centers provide good context for transferring users' knowledge and experiences of the librarians to the designers. This enables IS design based on a hierarchical value system of beneficiaries and to provide services that are more appropriate to end users.

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Conflict of interest:

No conflict of interests has been reported by the author.

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