Key user roles on web-based information systems requirements

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Abstract

Purpose – To investigate the relationship between key users (defined as their influence) in “information”, “purchase”, “communication” or “entertainment” networks, and the number of elicited requirements in web-based information systems (WIS).

Design/methodology/approach – A lab experiment was designed and conducted to investigate the relationship between college students’ elicited requirements for two WIS cases and their social networks.

Findings – The individual centrality in “information” networks has a significant positive relationship with the numbers of elicited “information” requirements and total requirements; however, the individual centrality in other social networks has no significant relationship with the number of the elicited requirements.

Research limitations/implications – The requirements collected from “key users” may account for most requirements, which is similar to the results predicted by Pareto’s rule.

Practical implications – The origin of a WIS depends on a few influential users. These key users possess more power than others, and they define not only the “requirements” of the site but also its content or knowledge. The WIS designers may take advantage of this fact.

Originality/value – This paper fills the information requirement elicitation gap, while transferring the conventional IS development experiences to WIS.

Keywords Information systems, Internet, Computer networks

Paper type Research paper

1. Introduction

The impact of the world wide web on many people’s daily lives has been far-reaching and profound. This being the case, however, there is a surprising lack of studies in the literature that investigate the importance of developing web sites or web-based information systems (WIS) that meet the demands of those who use them.

A number of design methods have been proposed for developing a WIS. For example, several object-oriented methodologies have been modified for WIS development, such as the object-oriented hypermedia design model (OOHDM)

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(Schwabe and Rossi, 1995), the web site design method (WSDM) (De Troyer and Leune, 1998), scenario-based object-oriented hypermedia design methodology (Lee, 1999) and Wang and Head (2001) general model. Moreover, a number of entity-relationship methodologies variations have also been proposed, e.g., relationship management methodology (RMM) (Isakowitz et al., 1995). Modifying the software development life cycle, Sherrell and Chen (2001) proposed a W cycle of corporate web development model.

While they do shed much valuable light on WIS research, the aforementioned methods fail to address in detail the extremely important topic of user requirements analysis (RA). User RA has been usually considered from the perspective “user perspective modeling” (De Troyer and Leune, 1998). Although proxy (substitute) users or focus groups usually serve as the target of RA (Abels et al., 1998), in reality, “real” online users have only been requested to participate in WIS development on rare occasions (Fucella and Pizzolato, 1998).

RA is considered to be one of the most important phases in information systems development (ISD), and incomplete user requirements are usually the most important factors of ISD failures (The Standish Group, 1995). However, in an environment of wide internet, it is difficult to understand WIS requirements. It is not only difficult to identify users on open web sites, but it is also not possible to single out individuals on an organizational chart (Wang and Head, 2001). Based on the previous research (Yang and Tang, 2003a), the present study aims to investigate the relationships between key users and WIS requirements. The specific questions that will be addressed in this study are as follows:

1. Whether “key users” can provide more requirements?

2. If the answer of question (1) is “yes”, then, what type of relationship exists between the number of key users and the number of elicited requirements?

3. To what extent can key users “represent” the whole users in requirement analysis?

It is hoped that this study will lay a foundation for future WIS development, and thereby, offer plausible explanations for the key users’ role and value during WIS development.

2. Literature review
WIS are information systems (IS) that are based on web technology and that are likely to be integrated with conventional IS such as databases and transaction processing systems (Wang, 2001). Based on the scope of WIS applications, WIS can be classified into four kinds of systems: Intranets (supporting internal work), web presence sites (designing marketing tools to connect with consumers outside the firm), electronic commerce (EC) systems (supporting consumer interactions, such as online shopping), and a combination of internal and external systems (supporting business-to-business communication, commonly referred to as extranets) (Isakowitz et al., 1998). A WIS can also be classified according to its business functionality. For example, EC can be divided into the following six categories: business-to-business (B2B), business-to-customer (B2C), customer-to-customer (C2C), customer-to-business (C2B), non-business EC, and intra-business EC (Turban et al., 2000). Fraternali (1999) offered a comprehensive review of WIS research and tools for interested readers. From the
literature cited above, it is evident that WIS is an issue that is pertinent to both academia and practitioners. Finally, although there are various definitions of WIS, the authors of the present study refer to it as an information system that adopts web technologies with the possible goal of doing business online.

2.1 User requirements questions: heterogeneous and many
RA is usually a critical stage for both ISD and WIS development. Some scholars consider RA is a crucial component for WIS development and even call for a systematic and disciplined approach (Murugesan et al., 2001).

On the one hand, some researchers claim that determining systems requirements for an internet-based EC application is not different from the process of doing so for other applications (Hoffer et al., 2002). These scholars have suggested that a joint application development (JAD) session may work well enough to elicit user requirements effectively. Holck (2003) proposed four perspectives on WIS, claiming that there is no difference between traditional software development and WIS development.

On the other hand, some scholars believe that the difference between WIS development and traditional software development is significant in the development speed and the development life cycle (e.g. Fraternali, 1999; Fuccella and Pizzolato, 1998; Ginige and Murugesan, 2001; Pressman, 1998). Wang and Head (2001), for example, first made a contrast between traditional IS users and WIS users and then proposed a conceptual framework for e-tailing development. While it is beyond the scope and purpose of the present study to solve the controversy between the difference of traditional software development and WIS development, it will hopefully elucidate some of the differences between user requirements for traditional software and WIS development.

Wang and Head (2001) presented a detailed comparison between traditional IS users and WIS users. While acknowledging that all the above differences do exist, the most important differences between IS and WIS users were shown to be:

1. unknown before the early stage of system development or even unknown before system operation;
2. too heterogeneous; and
3. perhaps too many users on the WIS.

If users cannot be identified prior to the development of a WIS, then RA is extremely difficult to conduct. In some WIS, such as in intranets and extranets, most users can be recognized in advance; therefore, traditional RA methods such as interviews, surveys and focus groups can be easily applied. However, in other cases, future users and their needs may not be recognized beforehand. Thus, Yang and Tang (2003a) proposed dividing RA into three stages in order to gain a more thorough understanding of user requirements.

Gathering requirements from user representatives has long been a pivotal part of user-centered design and has, thus, been applied to the web design (Campbell, 2001; Sampson, 1998). The basic assumptions are that:

1. users can be identified at the early stage of system development;
2. user representatives are real users; and
3. a small number of users can represent the entire user population.
However, these fundamental assumptions have been questioned because:

1. some WIS users cannot be targeted appropriately before the early stage of system development;

2. user representatives who participate in the web design may not be the actual users; and

3. a sample of users may not represent the entire user population.

Accordingly, there is great value in assessing the requirement of "typical" or "influential" online users to get an accurate snapshot of the needs of the entire user population.

The present study classifies WIS usage dimensions by first addressing the two major questions of WIS users – whether or not users are "too heterogeneous" or are "too many" – and subsequently assesses the "influential" key users according to various WIS usage dimensions.

Key users may have different meanings according to their specific contexts. For example, on a commercial web site, key users may be very important customers, such as those who contribute most of the revenues of the corporation. The key users are defined in this study as influential users who may influence other users in significant WIS usage. For example, the key users may influence others in purchasing decisions, in their methods of information seeking or getting advice, in the establishment and maintenance of online interpersonal relationship with one-another, or in the way that they entertain themselves online.

2.2 The WIS usage dimensions
Compared with traditional IS users, WIS users are more diverse and heterogeneous; moreover their overall number of users can be expected to grow to a critical mass for EC success (Hagel and Armstrong, 1997). Therefore, it is crucial to classify properly users and their roles before further discussion. The present study adopts WIS classifications from Isakowitz et al. (1998), and suggests some tentative user requirements dimensions, which are most synthesized from several recent studies (Armstrong and Hagel, 1996; Korgaonkar and Wolin, 1999; Schneiderman, 1997). As web usage is associated with a variety of user motivations, it, therefore, not possible to enumerate all user needs. However, the most important motivations for WIS users are the following:

1. the acquisition of information;

2. communication;

3. exploration (e.g. surfing); and

4. the acquisition of commercial goods (Rodgers and Sheldon, 2002).

Exploration is related with play, and some researchers contend that playfulness has a significant effect on www usage (Atkinson and Kydd, 1997). Therefore, this study adopts playfulness or entertainment as a dimension for WIS use. As a starting point for discussion, the user characteristics and their accompanied requirements in different WIS applications are listed below.

As shown in Table I, a majority of users in intranets are employees in an organization; thus users could be identified prior to the early stage of system development. Generally
<table>
<thead>
<tr>
<th>Main user role</th>
<th>User characteristics</th>
<th>Identity</th>
<th>Information</th>
<th>User requirements dimension</th>
<th>Playfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranet</td>
<td>Employee</td>
<td>Low</td>
<td>Always</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Web presence</td>
<td>Visitors, customers</td>
<td>Expected high</td>
<td>Seldom</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>EC</td>
<td>Customers</td>
<td>Expected high</td>
<td>Sometimes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Extranet</td>
<td>Mixed</td>
<td>Low</td>
<td>Often</td>
<td>Yes</td>
<td>Sometimes yes</td>
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</table>

**Source:** This research
speaking, in comparison to the other WIS users, the intranet-user growth rate is low due to the fact that its growth is dependent upon the organizational overall human-power growth rate. As for web presence and EC, most users are customers who cannot be specifically identified beforehand in general and whose identities can often only be inferred from how they choose to register themselves online. Thus, whereas marketing research may identify the market segment and identify potential customers, the real customers cannot be known until the web sites are actually open for business. One of the critical conditions for a successful business is when customers and visitors are expected to grow at a high rate in order to form a critical mass (Hagel and Armstrong, 1997). Extranets are mainly created for B2B transactions; therefore, users are either on the inside or on the outside of an organization. Therefore, most users within the related organizations can be identified in advance, and some of the business partner users can be reached prior to the early stage of system development. But this type of user growth rate is often limited since business partners are corporations, which, obviously, cannot increase in number as rapidly as can its consumers.

One of the most important user requirements is “information” gathering and sharing; therefore, information content, the user’s navigation processes and data filtering capabilities are prime system concerns. For users within an organization, how to create, gain access to and distribute knowledge is a prodigious challenge. Knowledge management is no longer a slogan, but rather a practical and integral part of knowledge management systems (Alavi and Leidner, 2001); WIS providing a reasonable platform for these systems. In other words, organizational memory and critical information should be appropriately coded, stored, retrieved and utilized in order to realize the optimal value of its knowledge assets (Soliman and Youssef, 2003; Wild et al., 2002).

“Relationship” or “communication” requirements are important not only in the work place but also for users’ personal purposes. Meeting communication requirements may range from simple communication facilities, such as e-mail or electronic forums to sophisticated community-building facilities. Through an investigation of several communities, Preece (1998) suggested that online communities should provide users with a climate of trust, equality and empathy; furthermore, these aspects should be combined in the design stage. Stanojevska-Slabeva (2002) emphasized specifically the social aspect of the internet and proposed a community-oriented design of internet platforms. The implications of the aforementioned studies imply that communication with the users; and the relationship between online users are the two paramount user needs that contribute significantly to increases to users’ satisfaction levels.

“Transaction” is the main function for e-commerce and online communities commercial web sites (Hagel and Armstrong, 1997; Kogarokkar and Wolin, 1999; Rodgers and Sheldon, 2002). Consequential customer requirements, such as privacy concerns, trust, and convenience should be taken into consideration. Moreover, since intranets or web presence are not for transaction purposes, there is no need to include this dimension for analysis in this type of situations.

With the exception of studies conducted on e-commerce sites or virtual communities, “playfulness” or “fantasies” are two topics that have received scant attention in the literature (Armstrong and Hagel, 1996). Recent empirical studies have confirmed that playfulness, or enjoyment, is a key dimension of web design quality (Liu et al., 2001; Van der Heijden, 2003). Some scholars, such as Agarwal and Karahanna (2000), regard playfulness as an individual trait related to cognitive
2.3 The problem of finding key users
Identifying key users is especially important for WIS requirements elicitation because users cannot be identified during a new web site development (Rahardja, 1999), might be too many to be taken care of, or may be too diverse to be analyzed. A number of previous studies proposed to place emphasis on user requirements by means of focus groups (Abels et al., 1998), derived user requirements (Artz, 1996), or usability methods (Campbell, 2001) for web applications. However, to the best of our knowledge, no previous study has elaborated on the methods employed for identifying a handful of important users, which is identified as “key users” in the study. Borrowing from the social network analysis (SNA) perspective of online users, this study examined carefully the relationship between key users and their requirements.

We took this approach for the following reasons: First, most requirement elicitation methods focus primarily on information seeking or general navigation analysis. By applying SNA on the data, other dimensions, such as communication, social, emotional support needs, could also be identified. Identifying social leaders can help elicit their comments, which may enhance the system design on the social/communicational functions, interface or other design qualities.

Secondly, sometimes the users of a WIS are fairly divergent. It is not easy to conduct a requirement analysis with a great many users not to mention others who might be “potential users”. Only a limited number of users, usually ranging from five to fifteen users, are valuable for reliability tests (Campbell, 2001; Nielsen, 1993). The same rule holds true for RA.

Thirdly, the users themselves are the important resources for a WIS, not only for their contributions to the site’s content but also for their potential purchasing power. Web users are valuable in that their comments and responses could be systematically and effectively used in system analysis.

Fourthly, SNA is useful in identifying information-related roles such as gatekeepers, opinion leaders and boundary spanners in an organization. It can be used to understand the patterns of collaboration of online community members, and key community members can be spotted, accordingly. Therefore, a system’s SNA may be useful for locating appropriate users during system analysis and improving ISD (Loughman et al., 2000).

SNA a social science method that is extremely popular in CMC studies, can be used to draw on and measure relationships and flows between people, groups, or organizations. The nodes in the network are the people and groups, while the links show relationships or flows between the nodes (Wasserman and Faust, 1994; Wellman,
Online users can be depicted as nodes in a network, and the rationale of this analysis is that the respective position an actor occupies in the overall group ultimately determines the extent to which he/she can access the shared resources or information in the network. Therefore, an actor’s embeddedness in a social network has important implications for many of the outcomes of the overall network. An online user, for example, who is central in an information network – that is a user who has many direct contacts and who gives or receives information from other users – is likely to be regarded as more powerful and prestigious than more marginal participants in the network.

The notion of embeddedness used in the present study relies on a measure of the concept of “closeness”. Closeness centrality measures can be conceptualized as the “ease of access to others” (Baldwin et al., 1997). An individual who is maximally close would have direct relationships with all of the other members of the network. In an information network, the closest information would be from a friend directly, the next closest relation would be from a “friend-of-a-friend”, and so on. Closeness centrality was adopted in this study since it is conceptualized as the ease of access to other members for a group.

Social networks that are constructed from particular types of relationships, such as advice, friendship, communication and adversarial networks, have been explored in various studies (Baldwin et al., 1997; Ibarra and Andrews, 1993). Four subsets of relationships: information, communication, transaction and entertainment networks have been shown to be particularly important for WIS users. These four networks and their implications for online users’ requirements are discussed below.

3. Research hypotheses
Information gathering and sharing is essential within an organization as well as for WIS users (Borgatti and Cross, 2003). Information networks are naturally formed for a WIS, in that some users possess information that is unavailable but valuable to others. While the information is processed in the minds of individuals, it is personalized information that is related to facts, procedures, concepts, interpretations, ideas, observations, and judgments that are termed knowledge (Alavi and Leidner, 2001). In other words to say, users usually exchange information/knowledge and have substantial interactions over the internet (Cross et al., 2001). Highly central individuals in information are better able to gain direct access to information, and validate the information that flows through informal networks because they are, by definition, relatively close to many other network actors and can thus avoid the noise introduced as information is passed from actor to actor. Highly central individuals in an information network are thus more influential in the gathering and dissemination of information/knowledge. Therefore, they may be more knowledgeable about the corresponding requirements, such as how to get appropriate information, during WIS development.

H1. Individual centrality in an information network is positively associated with both the number of elicited information-related requirements and that of the total requirements.

It is well known that functional communications networks are important to employees of effective organizations; this maxim also applies to the users of WIS. Communication
networks are different from information networks in that communication networks usually include emotional support, rather than simply instrumental purposes (Preece, 1998). Highly central figures in a communication network can exert their influence by listening empathically to others’ painful experiences or by giving advice to those who need it. Since highly central users in a communication network communicate frequently with other users, they might be more aware of the system’s corresponding communication requirements.

H2. Individual centrality in a communication network is positively associated with both the number of elicited communication-related requirements and that of the total requirements.

Transaction networks refer to the “advice network for online transaction”, specifically. Customers may obtain advice from others for purchasing decisions easily over the internet and thus the transaction networks may significantly affect customers’ purchase intentions. Online forum has been used and managed to allow all involved users to exchange their procurement-related experiences (Hsieh et al., 2002). Highly central individuals in a transaction advice network means that they can easily get access to others’ advice or give their own advice, thus they might be more sensitive on the product, price, and online transactions. Central persons on advice network for transaction thus are more knowledgeable about how to search for advice from reliable source, and they might be keener on the corresponding requirements for online transaction.

H3. Individual centrality in a transaction network is positively associated with both the number of elicited transaction-related requirements and that of the total requirements.

Entertainment is a major motivator for those who participate in online community. Similarly, playfulness is also an important characteristic related to the quality of a WIS. Many online users, especially those who play online games, usually form an informal network to exchange entertainment-related knowledge and skills (Choi and Kim, 2004). Highly central individuals in an entertainment network are thus more knowledgeable about the characteristics related with the playfulness of a WIS, and they might be keener on the corresponding requirements for entertainment.

H4. Individual centrality in an entertainment network is positively associated with both the number of elicited entertainment-related requirements and that of the total requirements.

4. Research method
The research is divided into two phases. The first phase set out to elicit students’ requirements, and the second phase measured students’ social networks and their perceptions of all the requirements gathered on the first phase.

4.1 Study materials
The inherent assumption in this study was that key users were aware of different dimensions of requirements and could recall the requirements of those dimensions. While, it is ideal to devise four typical WIS (information, relationship, transaction and entertainment), and elicit users’ requirements accordingly, four web sites were found to
be too laborious for both the researchers and the students. Thus, only two imaginary cases were designed in the study, one represented a typical EC web site and the other represented relationship maintenance site: Classmate Net, which is more familiar and practical for students.

Case I: E-Store.

A computer vendor in Taipei is attempting to extend his sales by opening an electronics store to sell computers peripherals in order to meet the pressing demands of the highly competitive industry. The owner of the store asks you to create an online shopping system whereby customers can do their shopping from home via computer. As the first step, you must develop a set of requirements to guide the design and development of this shopping system. What information system requirements would the web site need? Please write as much as possible.

Case II: Classmate Net.

If you were building a web site for your own class for communication, information or even entertainment, you would need to create a set of requirements for the web site development. What information system requirements would the web site need? Please write as much as possible.

4.2 Phase I

A total of 142 students were registered in an undergraduate requisite course, systems analysis and design (SA&D). It was announced that if students participated in the study, they could earn extra credits; probably due to this bonus encouragement, all of the students in the class participated. During phase I, students were given the cases provided in above and requested to write as many important information system requirements as they could imagine. No given template was given to restrict their imagination. Most students finished this task and turned in their requirements within approximately 30 minute. As some of the students in the course were non-MIS majors and graduates (n = 27), they were not deemed appropriate for “Classmate Net” analysis because they formed special cliques in the SA&D class and could not develop quality social relations with the MIS undergraduates. In addition, six students either did not submit their responses or their responses were found to be incomplete. Thus, there were 109 valid samples (43 females and 66 males), 77 percent of the whole sample population.

4.2.1 Requirements classification and summation. After gathering all of the student requirements, researchers began to classify and summarize them. Although Browne and Rogich (2001) proposed a “generic requirements classification” in terms of goal, process, task and information levels to make comparison between research outcomes easier, their classification scheme was not adopted since the purpose of the study was to gather information on requirements in other dimensions. Our classification scheme was described briefly as follows:

- **Information.** These requirements include the data to be delivered to end users and the language and formats used in “displayed information” to end users (Byrd *et al.*, 1992).

- **Communication.** Requirements that cover all the functions and activities that may maintain or foster the interpersonal communications. For example, sending a birthday message or e-card may fulfill this goal.
• **Transaction.** Requirements that contain the process or information that is necessary to complete a business transaction. Selling used goods or providing backorder function are typical transaction requirements.

• **Entertainment.** Requirements that provide users with amusement and enjoyment. MP3 downloads and online games belong to this type.

• **System.** Requirements that are systems constraints and implementation considerations, such as hard disk capacity, network capacity or database backup.

One of the researchers tabulated all the requirements. When there was uncertainty regarding the classification of requirements, another researcher, who was blind to the study, was invited to solve the dispute. To estimate inter-rater reliability, 20 student’s answers were randomly selected and their listing requirements were counted by two researchers independently. The inter-rater reliability was found to be 0.82, implying that the requirements classification counts have fairly reliable estimates.

4.3 **Phase II**

After gathering all of the participants’ requirements during the first phase, the researchers distributed an online questionnaire to measure:

(1) individual’s centrality index;

(2) their perceptions of the two web site orientations; and

(3) their ratings on the importance of each requirement.

4.3.1 **Measurement of network centrality.** Four items were designed to measure network centrality; each item was intended to measure the “key” users in an imagined situation. Students were asked to select up to three students to whom they “listened” the most. The measurement of network variables was adapted from prior research (Baldwin et al., 1997; Yang and Tang, 2003b). The four items were as follows:

(1) Many people have had the experience of purchasing a computer or computer peripherals (if you do not, please use your imagination). If you intended to buy a computer or computer peripherals, whose opinion in your class would you take as reference?

(2) Whenever you are not in a good mood, to whom in the class do you express your feelings?

(3) Generally speaking, if we were to have a final exam tomorrow, which, member of the class do think would have the most exam-related information that would help you?

(4) If the summer vacation was approaching and we were making plans for a class excursion, whose opinion in your class would you value the most as reference?

The underlying objectives of the above four social network questions were to measure each student’s perceived influence upon the social networks on overall transactions, communication styles, information access and distribution and types and styles of entertainment. These influential students were assumed to be “key” users for e-store and Classmate Net. The index used in this study is closeness, which measures
independence from the control of others. A popular social network software program, UCINET 5, was used to analyze the social network data (Borgatti et al., 1999).

4.3.2 Perception of website orientation. The questionnaire contained four questions that measured the extent to which (ranging from 1 to 7) respondents agreed that this type of website (e-store or Classmate Net) would work for their “information”, “communication”, “transaction”, and “entertainment” needs, respectively. In other words, the purpose of this type of questions was to measure the respondent’s perception of website orientation.

4.3.3 Rating on requirement importance. All requirements collected from phase I were then presented in the online survey. The importance of each requirement was rated on a seven-point Likert scale ranging from 1 (very unimportant), 4 (unknown or unclear), to 7 (very important).

5. Results and discussions

5.1 Basic statistics
The requirements collected from phase I were described as follows. A total of 83 requirements were elicited from e-store, and 66 requirements from Classmate Net. Of all the 83 requirements from e-store, 66 percent were classified as “information” requirements, 24 percent “transaction” requirements, and 9.6 percent “system” requirements. No “communication” and “entertainment” requirements were elicited for e-store. Of all the 66 requirements garnered from Classmate Net, 56 percent were grouped as “information”, 22.7 percent as “communication”, and 15.5 percent as “system”. Only 1.5 percent were classified as “transaction” and 4.55 percent as “entertainment” requirements.

The results indicated that a majority of requirements for both e-store and Classmate Net were related to the access and sharing of information. “Information” access seems to have become the most important motivation for WIS usages. On the other hand, the apparent motivations, “communication” and “transaction” requirements, regressed to secondary importance in Classmate Net and e-store, respectively. Finally, “system” requirements accounted for nearly 10 percent of all of the total requirements, which implied that MIS students might take the necessary hardware and software constraints into consideration when developing a website.

5.2 Individual centrality vs elicited requirements
The relationship between the value of individual centrality (normalized closeness) and the number of individuals’ elicited requirements was measured via Pearson correlation coefficients. In both cases, only “information” centrality was significantly ($p < 0.05$) positively related to the number of elicited “information” requirements ($r = 0.22$ in e-store and $r = 0.18$ in Classmate Net). In addition, “information” centrality was significantly positively associated with overall elicited requirements ($r = 0.22$ and $r = 0.19$ with $p < 0.05$ in two cases, respectively). The results supported only $H1$. In other words, those who are higher in “information” centrality, may produce more information-related requirements.

Another significant negative correlation existed between “communication” centrality and system requirements in e-store with $r = -0.2$. This can probably be explained by the fact that if a person is central in “communication”, or more relation-oriented, he/she might pay less attention to more technical questions.
The reasons that \( H2 \) to \( H4 \) were not supported could be explained as follows:

First, each WIS should have its main purposes to satisfy different needs. As shown in Figure 1, the average perceptions of each website orientation vary drastically with different dimensions. It seems that a website like e-store is expected to satisfy both “information” and “transaction” needs; however, Classmate Net is expected to support both “information” and “communication” needs. “Entertainment” is not the main purpose for either e-store or Classmate Net (with the average rating of 4, meaning unknown or unclear). “Information” requirements seem to be fundamental for all WIS. Since information requirements are primary concerns, the effect for the “key communication persons” in the Classmate Net might be decreased. Likewise, the effect for those “key purchase persons” in e-store might be diluted as well.

Secondly, all of the participants in this study are not real users. The “key purchase persons”, who are technical experts with computers or computer peripherals, may be not accustomed to surfing the internet. Moreover, they might gather purchase information on the internet, but not necessarily be the online customers. These factors made the results complex.

Third, there are several difficulties in requirements determination. Four classes of requirements difficulties are known to exist:

1. constraints on humans as information processors;
2. the variety and complexity of requirements;
3. communication problems; and
4. the unwillingness of users to provide requirements (Browne and Ramesh, 2002).

In this study, users were motivated to give their requirements because they received extra credit in the course if they did so. However, other difficulties in requirements determination might also influence the research results; some students, for example, did not participate in this study willingly and some might have misunderstood the task requirements.

<table>
<thead>
<tr>
<th>Case I: E-Store</th>
</tr>
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<tbody>
<tr>
<td>A computer vendor in Taipei is attempting to extend his sales by opening an electronics store to sell computers and computer peripherals in order to meet the pressing demands of the highly competitive industry. The owner of the store asks you to create an online shopping system whereby customers can do their shopping from home via computer. As the first step, you must develop a set of requirements to guide the design and development of this shopping system. What information system requirements would the Web site need? Please write as much as possible.</td>
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</tr>
</tbody>
</table>

Figure 1.
Predicted user requirements
5.3 The relationship between key users and elicited requirements

It would be interesting to delineate the relationship between key users and their elicited requirements. The results were analyzed only for key users in "information" networks since only the value of "information" centrality was correlated significantly with the number of elicited requirements. The value of individual information centrality raw data in Classmate Net and e-store were sorted, and the corresponding accumulated numbers of requirements were tabulated accordingly.

As shown in Figure 2, there is an interesting relationship between the percentage of total requirements and the percentage of users. While 10 percent of the key users generated 60 percent of the total requirements, 20 percent of the users could offer approximate 80 percent of the total requirements. However, a slight difference was also detected between user responses in Classmate Net and e-store. The user requirements of e-store (83 items in total) were more diverse than those of Classmate Net (66 items). The ratio of accumulated requirements of e-store was less than that of Classmate Net. On the whole, the 20:80 ratio still holds, which is similar to the famous Pareto’s rule. Pareto’s rule states that a small number of causes is responsible for a large percentage of the effect, in a ratio of about 20:80 (Hafner, 2001). For the effective use of resources, the manager’s challenge is to distinguish the correct 20 percent from the trivial many. By the same consideration, for the effective IS requirements, the WIS developer’s challenge is to distinguish the key users from the silent majority.

5.4 Representativeness of the key users

Another important question regarding key users is whether key users’ opinions are typical or not. In our attempts to answer this question, the data collected on phase II were analyzed as described below.

The null hypothesis was that importance ratings on requirements from key users were not different from the remaining users. The population for Classmate Net was known (the population is the number of the students in the class), yet the population for e-store was unknown. A series of two-tailed t-tests of mean difference was adopted for e-store, yet a sequence of two-tailed z-tests was used for Classmate Net in top 5, top 10,
top 15, top 20 and top 25 key users, respectively. These top key users were those who ranked higher on closeness centrality in information networks of WIS usage.

The results were surprising in that of the total of 83 requirement items of e-store, there were no significant ($p < 0.05$) differences found between the ratings of top 5 key users and the remaining users. However, significant differences were detected for the top 10 (eight items had significant difference), top 15 (four items), top 20 (six items) and top 25 (five items) key users. Similar results were obtained for Classmate Net. Among all 66 requirement items, one significant difference was detected on the importance of item rating between top 5 key users and all other students; however, there were 12 differences for the top 10 key users, 14 for the top 15 key users, 4 for the top 20 key users, but none for the top 25 key users. The implications of the results are that:

1. a handful of central online users may be typical user representatives, despite the fact that the size of user representatives is not certain;
2. 20 percent of the users (25 in this study) of the entire population may reflect typical user requirements; and
3. user representativeness may be a function of user numbers.

6. Conclusions and suggestions

In sum, the current study empirically demonstrated that key users, those who were defined via SNA, might be valuable for WIS development. Key users in information/knowledge access and sharing might generate more information-related requirements and total requirements, and most of their perceptions toward requirements were found to be typical.

Information seeking and knowledge sharing are the two most important requirements for WIS users. As Borgatti and Cross (2003) contend, information seeking is a function of:

1. knowing what that person knows;
2. valuing what that person knows;
3. being able to gain timely access to that person’s thinking; and
4. perceiving that seeking information from that person would not be too costly.

Our research shows that “key users” are at the hub of a WIS, in that they may generate more requirements than the others and know “what the people know”. Therefore, “key users” are important not only for requirements elicitation but also for knowledge management in an organization.

The results could be explained in terms of Foucault’s power/knowledge analysis (Smart, 1995).

Similar to Foucault’s analysis of the origin of a clinic, the origin of a WIS depends on an influential few users. These key users possess more power than others, and they define not only the “requirements” of the site but also its content or knowledge. It is the “powerful few” who decide not only the information/knowledge use and reuse but also the distribution and access to information/knowledge. These powerful users may influence others mainly in the seeking of information and knowledge use; however the other dimensions (communication, purchasing and entertainment) are not significant.
In other words, our study results are in support of Foucault's view: even on the internet power is prior to knowledge.

In addition, some useful managerial implications can be obtained as follows:

1. Given the variety and heterogeneity of WIS users, SNA may be used as a simple and practical method to pinpoint a handful of key users. The size of key user representatives in a social network, ranging from 5 to 25, might be adequate.

2. Key users may be helpful not only to elicit information requirements, but also to serve as opinion leaders, who are also valuable for marketing.

3. A small number of key users may produce most of system's important requirements. Therefore, it is not necessary to invite all users to assist in WIS development.

4. Information/knowledge gathering and access are the most important requirements for a WIS; therefore, key users in information/knowledge access may be those that are most essential in the long run.

There are also some weaknesses in this study:

1. some moderator variables, for example, such as demographic variables and user involvement, were not considered;

2. The sample used for this study was garnered from students only and not actual internet WIS users; and

3. the web sites visited by the participants are simulated cases.

Despite these potential shortcomings, however, the results of this study might lay a foundation for further investigation into online requirement analysis. It is the author's hope that future studies on this topic: focus on the "real" WIS and online users; explore the relationships between key user roles in different WIS and their elicited requirements; and investigate how to utilize several channels; e.g. forum, BBS, online survey, to conduct requirement analysis effectively and efficiently.

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