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Social Networks in the Technology Era: Roles of Digital Cities in Enhancing Business Networks

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ABSTRACT

A social network is a set of people, organizations, or other social entities connected by a set of social relationships, such as friendship, co-working or information exchange to augment social network. While the traditional forms of social networks are often constrained geographically, the emergence of social information infrastructures mediated by information and communication technologies provides a new way to form social networks as digital cities with potentially unlimited boundaries. With a case study, this study attempts to apply the social network concepts and design principles of digital cities to promote and structure social interaction among the users of the digital cities, to stimulate commerce and collaboration activities, to promptly disseminate linkage between discovery and societal benefits of knowledge and wealth creation, and consequently to enhance members' business networks. Advantages, design principles, and future directions of social network based digital cities will also be presented.

Keywords

Social Networks, Digital Cities, Information Cities, Business Networks

INTRODUCTION

A social network is defined as a set of people, organizations or other social entities, connected by a set of socially meaningful relationships, such as friendship, co-working or information exchange, and interactions to better achieve desired outcomes, by sharing expertise, resources, and information (O'Murchu, et.al. 2004; Kempe, et. al., 2003; Garton et.al. 1997). A social network normally provides participants with opportunities of finding social support, establishing new social or business contacts (Hogg and Adamic, 2004) for collaboration (O'Murchu, et.al. 2004), exchanging social capital including financial resources, goods or services (Garton, et.al., 1997), exploring and application of knowledge transfer (Hustad, 2004), and creating of social wealth.

A social network is an on-going revolution with a clear indication that the audiences are the participants. As illustrated in Figure 1, a social network can be contemplated to be a "web" where direct or indirect social relationships (illustrated as lines between two circles) surround the individuals (illustrated by circles). For example, individual A has a direct relationship with individual C and can establish indirect relationship with individuals D, E, and F through individual C. On the other hand, individual B has more direct relationship with other individuals and that would result in more indirect relationships among his social network. Both direct and indirect relationships enhance social integration and that provides the participants opportunities to be engaged with their peers in the network in social network ties.

Social networks can vary in terms of size and heterogeneity (Garton, et. al., 1997). Small, homogeneous networks are a characteristic of traditional work groups and village communities; they are good for conserving existing resources. Larger social networks exhibit more heterogeneity in social characteristics of the network members and more complexity in the structure of these networks (Wellman and Potter, 1997).

In the traditional forms of social networks, the participants are local people (e.g., friends, kinship, neighbors, people we come across at work or play groups, or members of face-to-face communities), the control of the network exists locally, interactions normally occur between people who physically live in the neighborhood, and services are intended to improve

the local community both socially and economically. The traditional social networks are often small in size, may exhibit homogeneity among members and nature of network, and are isolated from other networks, as shown in Figure 2.

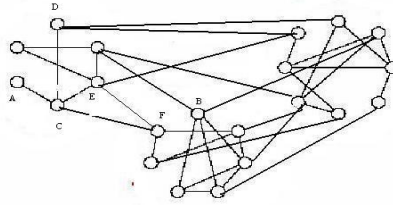


Figure 1 A Social Network is a Web of Relations

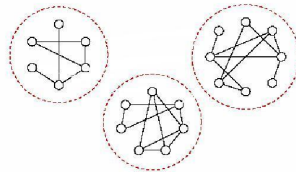


Figure 2 Traditional Social Network

As the technology advances, Kimball and Rheingold (2000) indicated that “social networks grow from personal interactions of human over time, as well as from the technological infrastructure that connects those human” and have evolved into online social networks that are mediated by the computer networks. Interactions between people that traditionally take place face to face are now conducted online using convergent synergy of web conferencing, real-time collaboration technologies, instant messaging, shared online work spaces, interactive white boards through the Internet using protocols, such as HTTP.

With elimination of physical boundaries of traditional social networks, the online social networks impart and enhance benefits of traditional social networks across time and space and accelerate and globalize the process. For example, people is able to locate and transfer information, which results in supplementing knowledge, from and to different geographical locations across the globe at any time once they start participating in the communication activities and access the network. People provide solutions to problems and people within networks can solve problems for each other. The computer-mediated social network often exhibits more heterogeneity in the social characteristics among members, has more complexity in the network structures, and is interconnected with other networks, as shown in Figure 3. The different colored nodes represent the different networks and the relations among them. The links between different colored nodes connect different networks together.

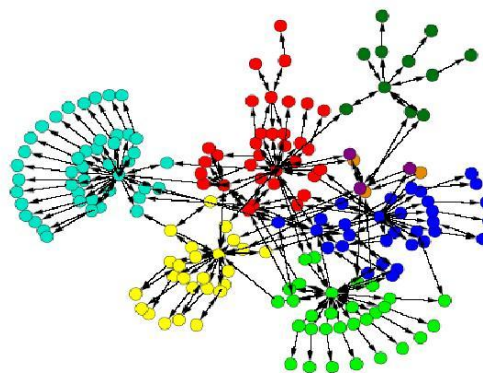


Figure 3 Computer Mediated Social Networks

In the online communities, information is transferred directly between the computers of the users connected to the network (Krishnan et al., 2004). A user can either chose to participate in the network activities or take a free ride. The problems with free riding are it causes degradation of the network performance (Krishnan et al., 2004) and it creates vulnerabilities (loss of privacy, denial of service) for a system where there is risk to individuals (Adar and Huberman, 2000). Another issue to be

considered in online networks is information credibility (Fogg and Tseng, 1999) which is to get information that is not accurate in the user's perspective. Integrity of the content design and interface design need to be considered in making the network credible (Fogg et al., 2002).

Digital Cities and Social Networks

Digital cities, often termed as virtual communities, or information cities, are cities whose administration is well advanced in the adoption and integration of new information and communication technologies into daily life at home, work, and has advanced in the adoption of the connected economy (Götzl, et.al., 2002). City of Vienna (<http://www.virtualvienna.net>) is one example that places great emphasis on the implementation of the digital technologies in its administration (Götzl, et.al. 2002). A digital city is a place where a group of people drawn together by an opportunity to share a sense of community with like-minded strangers having common interest, is a large Internet-based site offering a range of online services, including access to social environments, community services, municipal information, and e-commerce to its infohabitants (Ferguson, 2004), and is an environment of learning and innovation, on real and virtual level and is a center of knowledge, information management, technology, and innovation (Komninos, 2002). City of Kyoto (<http://www.city.kyoto.jp>) is one example where the infrastructure is built to support lifestyles and urban functions of citizens to share information, utilize citizen's wisdom and creativity to pursue alternatives and create institutions to service (Korten, 1999), implement policies along with citizens, and to make users participate in administration, which helps resolve disputes (Kollock and Smith, 1996).

A social network that utilizes information technology as described by Kimball and Rheingold (2000) can be considered as a digital city as defined by Götzl, et.al.(2002), Ferguson (2004), and Komninos (2002). Digital cities can be classified into digital government, commercial city and digital community based on ownership and scope (Lea, et. al. 2005). Digital governments are governmental owned information cities with scopes as large as an entire nation or as small as a local government. Examples of large scale digital-governments include <http://www.whitehouse.gov> for United States or http://www.canada.gc.ca/main_e.html for Canada. Commercial digital cities are owned by profit seeking companies. Large scale commercial cities, such as eBay at <http://www.ebay.com> and United Parcel Service (UPS) at <http://www.ups.com>, are often referred to as commercial or industrial portals. Digital communities are owned by non-profit organizations and communities based on predefined goals and interests with scope as large as that of global professional organizations (e.g., Association of Information Systems at <http://www.aisnet.org>) or as small as a local community cooking club.

However, one disadvantage of these digital cities is that they might decrease the social capital of a physical community. The members of these communities look for resources in the virtual network, whose scope is narrowed to a certain interest, and trade off the physical community bonds. The members thus might pass up opportunities to learn about new interests (Hales, 2000).

Social Network based Digital Cities and Business

Digital cities commonly provide both profit and nonprofit services and can enhance major social and economic advancements. These digital environments contribute to the increase of creativity and enable citizens to develop interaction and establish socio-economic forces at higher standards (Einemann and Paradiso, 2004). For example, the AOL network aids in delivering locally relevant commerce information and enhances the features such as local advertising opportunities for vertical markets (e.g., auto, real estate, employment, and health) (Ishida, 2002). Without profit services, digital cities are seldom attractive and fail to become a portal to the city. Without nonprofit services, the city may become too homogeneous as a result of pursuing economic efficiency (Ishida, 2002).

Social networks also play an important role in commerce activities and economic development. For example, the use of computer-mediated social networks provides opportunities for users to share information about the wide variety of products offered, costs or prices, and quality of the services (Adamic and Huberman, 1999; Hogg and Adamic, 2004) to increase the popularity of the business site and the services they offer. eBay is one example of digital city (virtual marketplace) where millions of users worldwide buy and sell products, discuss the products, share common interests and best practices, get help and feedback from others, and advertise the products that helps enhance reputation. This type of digital cities stimulates economy by augmenting transactions between loosely connected diverse communities of individuals and small businesses.

RESEARCH OBJECTIVES AND METHODOLOGY

Although both digital cities (Ishida, 2002, 2004; Lai, 2003; Lelis, et.al., 1999) and social networks (Adamic and Huberman, 1999) could carry out development in major social and economic facets, there is limited research in applying social network concepts to design or construct a digital city. Therefore, this study attempts to apply the social network concepts and design principles of digital cities to promote and structure social interaction among the users of the digital cities, to stimulate commerce and collaboration activities, to promptly disseminate linkage between discovery and societal benefits of

knowledge and wealth creation, and consequently to enhance their business capabilities through initial deployment of a project called Innovation Information Infrastructure (I3) funded by the National Science Foundation (NSF). Descriptions, initial design, and deployment of the project are discussed next to address how to take advantage of a digital city to move the social networks into a new technology era. Finally, future directions of social network based digital cities will also be presented.

PROJECT DESCRIPTION

Business success is positively correlated with the opportunity to mobilize and direct resources (e.g., human, financial, physical and/or intangible/intellectual resources) into businesses and that are highly correlated to the strength of an entrepreneur's social network. Benefits of having strong social network include opportunities of finding social support, establishing new social or business contacts for collaboration (Hogg and Adamic, 2004; O'Murchu, et.al. 2004), exchanging social capital including financial resources, goods or services (Garton, et.al., 1997), and exploring and applying knowledge transfer (Hustad, 2004). Therefore, it is important for an entrepreneur to be strongly tied with his communicators in his/her social network in order to establish and maintain connectivity to acquire resources needed for his/her business success. There must be a continuum of ties for the exchange of information with the members of the network depending on which the medium of communication and interaction is chosen (Haythornthwaite, 1999).

However, the process of establishing and maintaining a strong social network is time consuming and effort intensive through a traditional social network process. Therefore, Innovation Information Infrastructure (I3) proposed to develop a social network based digital city prototype for entrepreneurs who need to obtain access to critical technology and business assets to address his/her social network issues by monitoring, assessing and reporting on the social network factors and their correlation to innovation success by network participants. The objectives of the I3 project include

- § Making information available to others to share/exchange resources, learn best practices or propose new projects
- § Engage individuals, groups and communities to participate in the social network activities (e.g., exchange of information, resources, or knowledge)
- § Generation, collection and correlation of social network data (e.g., degree, centrality, density, redundancy, etc)
- § Providing a framework for timely communication and distribution of experiences, contextual information, and expert insight to stimulate knowledge creation (Davenport and Prusak, 1998).

The use of digital city concepts to build the proposed social network provides the following capabilities in addition to those provided by the traditional social networks:

- § **Information Integration:** Digital city could handle information and sensitive real-time sensory data (secure and access controlled data) more effectively and efficiently than the traditional social network. Examples of such data may include bus schedules (location and route data for every few minutes), traffic status, weather condition, and live videos (Ishida, 2000).
- § **Flexibility:** The digital cities are very flexible and allow the users to participate in them as they aspire to, allowing them to create their ideal environment (Ishida, 2002) and the flexibility is necessary to survive in a business environment as changes come faster in such an environment.
- § **Dissemination Activities:** Knowledge, experience and best practices can spread through multiple communication media (e.g., virtual working groups, exhibitions, publications, websites, training courses as well as a virtual discussion forum) (Götzl, et.al., 2002) The communication through these media can be either synchronous (online) or asynchronous (offline).

INITIAL DEPLOYMENT

Although types and focus of services may vary greatly based on the objectives and natures of a digital city, services provided by digital cities often include content services/information dissemination, communication and social services, and commerce/business transaction services, as shown in Figure 4 (Lea, et. al. 2005). The initial deployment of the project incorporates social network concepts to address these three basic types of services. Complexity of services increases as content services move from providing static content to advanced knowledge search and representation, allowing the structuring of knowledge (e.g., using XML markup or similar) to make knowledge more accessible in the knowledge repositories (Helms et al. 2004) , as communication and social services shift from providing email service to providing advanced collaboration tools, as commerce/business transactions services changes from having an online presence to providing B2C (Business to Consumer) and B2B (business to business) functions. To keep project manageable under time constraint, the focus of the initial deployment is to provide more advance content services while maintaining basic features in

the areas of communication/social services and commerce/business activities. Although initial deployment includes modules from both the user side and the administrator side, the user side functionality is the focus of this paper.

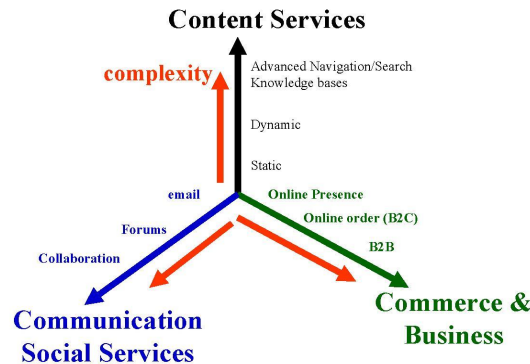


Figure 4 Common Digital City Services

User Management

A list of success factors for digital cities is provided by Leimester et al. (2004). One of factors to success of any digital city is capturing user *profiles and preferences* to facilitate collaborative environments in digital cities, to give the user a sense of belongingness in the digital community (Ferguson, et. al., 2004), and to generate content and new knowledge (which is to be done by the member of the network) (Leimester et al., 2004). User profile was created through an initial registration process based on business rules provided in Table 1 (detailed registration questionnaires are available upon request) and can be updated after registration.

-
- (1) **User:** A User is any general user of the system. A user can be either an **authorized member** or a **Non-authorized member**
 - (2) An authorized member:
 - is a **Business Owner** or an **Individual**
 - has one main **Occupation**
 - is classified into one of six **Ethnic Groups** (African American, Asian American, Hispanic, Native American/Alaskan Native, White, Others).
 - is classified into one of seven **Employment Categories** (University, Government, Large company, Small business, Self-employed, non-profit organization, Unemployed, Student)
 - has **Highest Education Level**, degree area, and degree granted institute
 - has his/her **Annual Income Level in one of ranges provided**
 - has zero or many **Expertise Areas**
 - chooses one **Privacy Preference Level** (no confidentiality, partial confidentiality, complete confidentiality)
 - works for zero or many non-Profit Organizations or businesses.
 - manages zero or many innovation resources: **Human resource, Financial resource, Space resource, Intangible resource, Equipment resource**
 - can be a contact person for no or many companies
 - can be assigned as a member of system administrators.
 - (3) A **Business or a Non-profit Organization** has zero or one contact person
 - (4) A **Business Owner** owns at least one business or non-profit organization
 - (5) A **Business**
 - is owned by at least one person
 - employs zero or many employees (i.e., some small companies may just have owners)
 - is classified as a **Profit-Small Business** or a **Profit-Large Business**
 - is classified into one of **NAICS** code
 - has annual revenue level in one of the ranges provided
 - is classified into one of the **Innovation stages**: Basic research, Proof of concept, Early stage development, Product development, Production & marketing
 - (6) A non-Profit Organization employs zero or many individuals
 - (7) A Non-Profit organization is classified into one of non-profit types: government, foundation, university, or institution
-

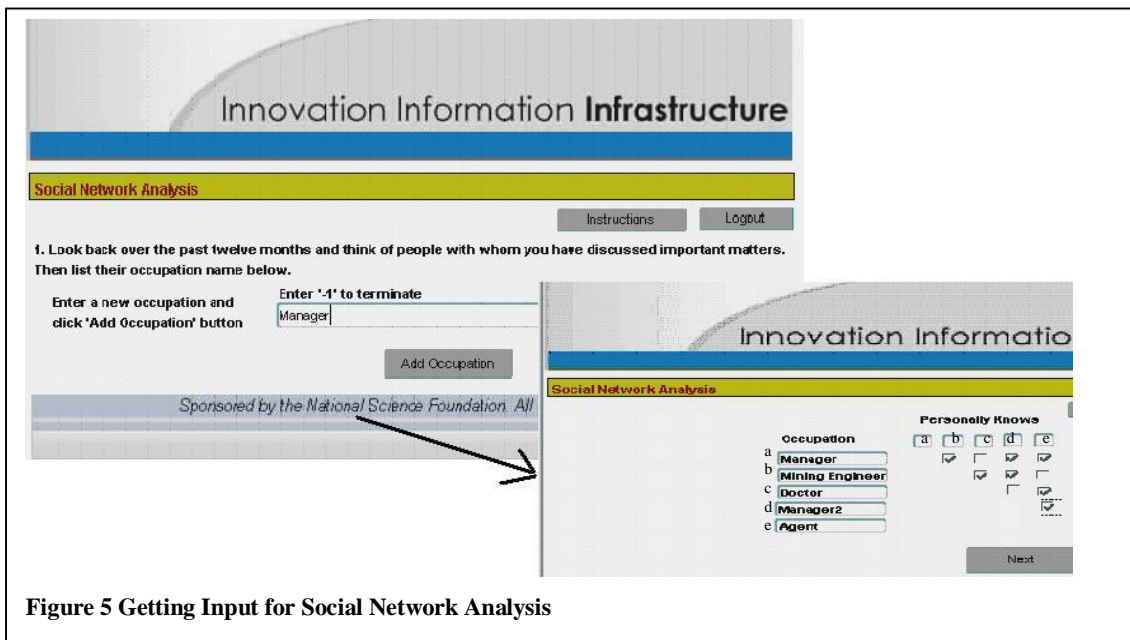
Table 1 Business Rule for Creating User Profiles

Representing Properties of Social Networks

A social network participant is often termed as an actor. The basic properties of social networks include the size, density, degree, reachability (Hanneman, 2001), connectivity (Stocker et.al, 2001), and multiplexity (Emirbayer and Goodwin 1994). Size of the network is indexed by counting the number of nodes in the network (Stocker et.al, 2001). Density is the ‘extent to which everyone of ego’s contacts know each other’ (Mitchell, 1969) or ‘the ratio of the number of ties actually observed to the number theoretically possible’ (Granovetter 1976; Niemeijer, 1973); Density decreases as the groups get bigger or as the size increases. The number of connections a participant has is the degree of the network (Hanneman, 2001). The sum of connections from the participant to others is the out-degree, which tells how influential a participant may be. In-degree specifies the number of other actors that send information to the target actor. An actor is ‘reachable’ by another if there are a set of connections that can be traced from the source to the target actor regardless of how many of them are there between (Hanneman, 2001). Connectivity is the number of connections per node (Stocker et.al, 2001). Multiplexity (repeated links) is the existence of two or more types of relations linking actors (Emirbayer and Goodwin, 1994), or ‘the degree to which relations between participants include overlapping institutional spheres. For instance, individuals who are work associates may also be linked by family ties, political affiliations, or club memberships’ (Portes, 1995).

Following four questions are designed to capture an individual’s social network properties and are implemented as shown in Figure 5:

1. Most people occasionally discuss important matters with other people. Look back over the past twelve months and think of people with whom you have discussed important matters. Then, list their occupations in the space provided and use the appropriate boxes to indicate who personally knows whom within your list.
2. Consider the people you communicate with to get your work done in your occupation. Look back over the past twelve months and think of people with whom you have communicated to get your work done. Then, list their occupations in the space provided and use the appropriate boxes to indicate who personally knows whom within your list.
3. Now consider an entrepreneurial venture or business start-up. Look forward over the next twelve months and consider people you personally know who would be influential for obtaining the resources, opening doors for financing, support, and “making it happen”. Then, list their occupations in the space provided and use the appropriate boxes to indicate who personally knows whom within your list.
4. Who are the people with whom you spend time after working hours or socialize with informally? Look back over the last twelve months and think of these people. Then, list their occupations in the space provided and use the appropriate boxes to indicate who personally knows whom within your list.



Once user provides information for each of the three questions, the parameters of density, redundancy and effective network size will be automatically calculated and presented to the user, as shown in Figure 6.

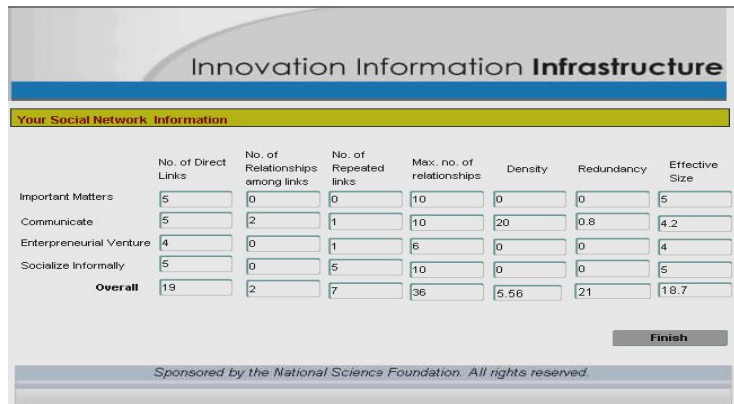


Figure 6 Social Network Analysis

Content Services: Facilitating resources needed for business growth

Access to sources of resources through person-to-person social networking has a high opportunity cost in terms of time and effort. On the other hand, digital societies often augment their features to facilitate communication between people in the scope of resource exchange (Akahani, et. al, 2000). Creating, authoring, publishing, and navigation functions are crucial for delivering services to infohabitants of digital cities (Ferguson, et. al., 2004).

One of the major content services provided by the I3 project is the access to a variety of resources needed for business growth. Critical resources identified by a panel of experts include human, financial, physical (equipment and space), and intangible/intellectual resources. The proposed digital city provides more complex content service, as defined by Lea, et. al. (2005), to facilitate access of resources with advanced navigational/search capabilities, information retrieval, and means of obtaining resources. Both the Administrator and the user can search for the resources. The Administrator will have the privilege to view information on resources for all users and edit/delete any user’s resource entries. However, a user can only add, modify or delete his/her own resource entries, as shown in Figure 7. Once the user registers as a member, he or she can maintain his/her resources in the resource management screen where the user is allowed to search and view the resources posted by the other and contact user for obtaining resources of interests, as illustrated in Figure 8.

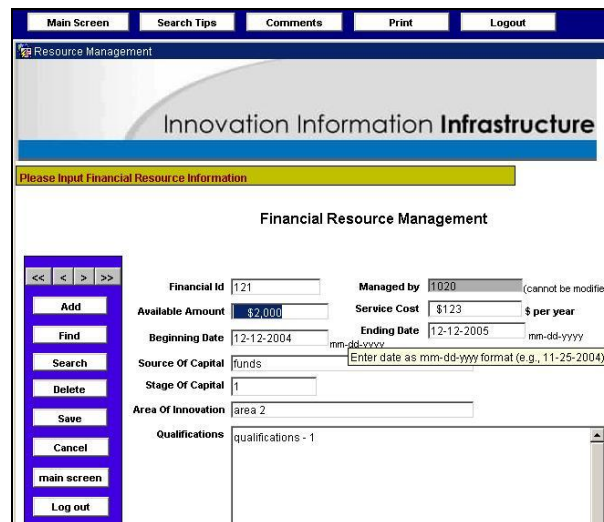


Figure 7 Resource Management

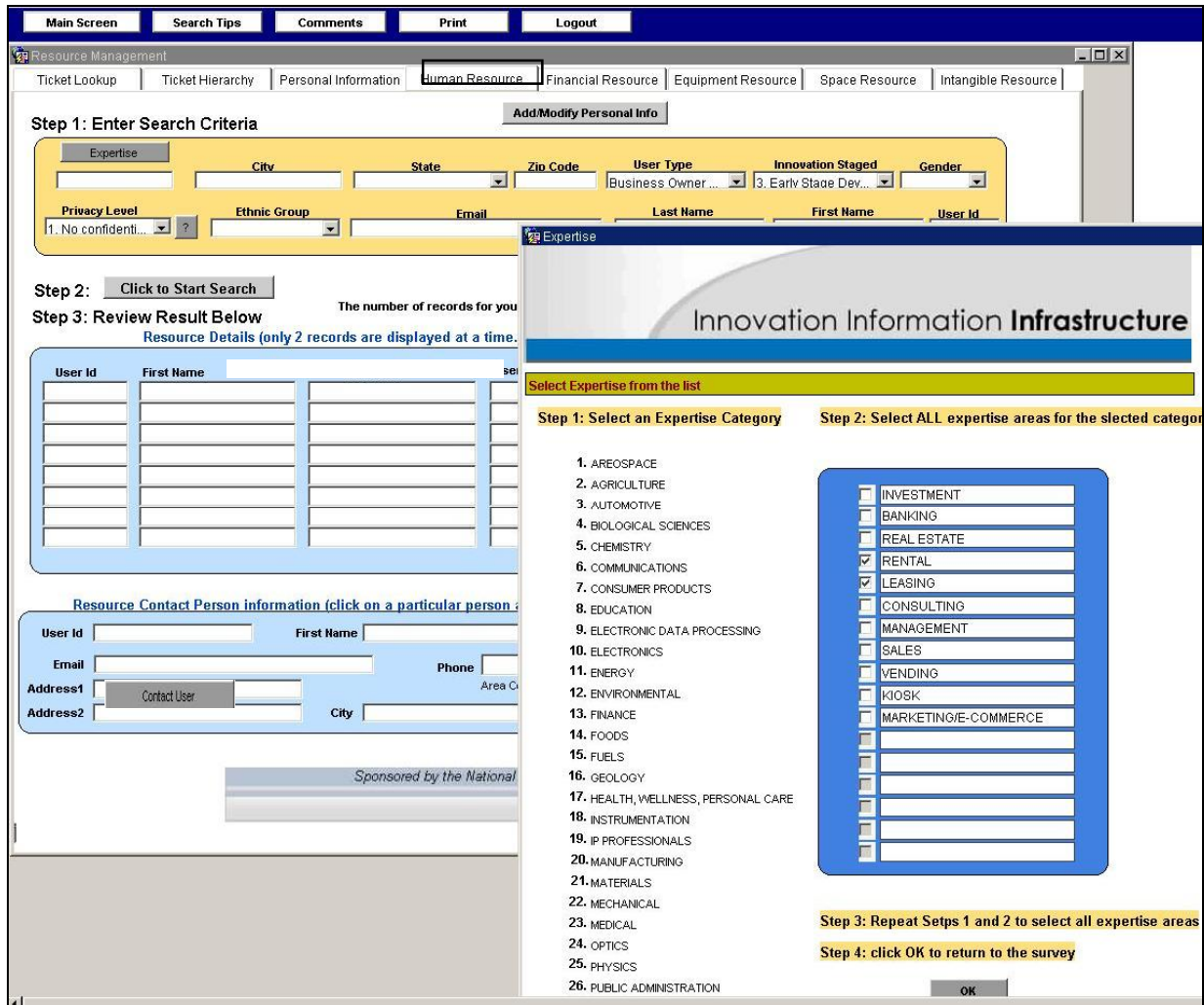


Figure 8 Accesses to Critical Resources

Communication and Social Services

Important features of a digital city are to support communication and collaboration among large groups of people over computer networks (Erickson, Kellogg, 2000) and to encourage the participation of the key players of the digital city based on the cooperation and the information transfer (Götzl, et.al., 2002). These digital cities provide a framework for knowledge exchange between members seeking information on other members' expertise and experience in order to implement their own innovative plans without running into risks otherwise entailed (Götzl, et.al., 2002). The following communication and social services are provided during the initial deployment of the project:

1. Contacting Resource Providers

After performing search, users can contact the resource provider via email to obtain resources, as shown in Figure 9. All email contacts are tracked and will be used to monitor changes in social network parameters and network evolution of users. The system administrator can view all the request contact messages, but users can only view and reply to the messages received in their accounts.

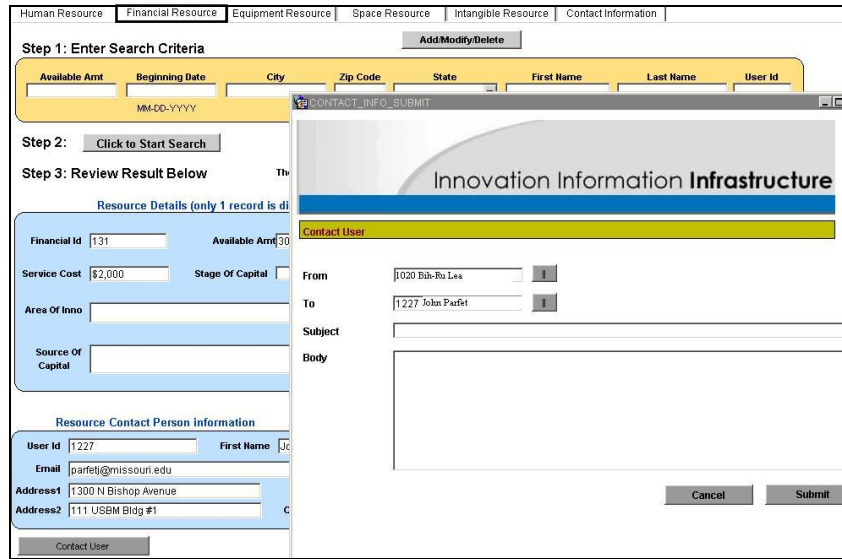


Figure 9 Contacting Users for Obtaining Resources

2. Request for Services

A user can create **Member Request for Service tickets** that have properties described in Table 2.

-
- (1) A Member Request for Service (*case*) must be made by one and only one Authorized member.
 - § A *case* can have no or many milestones.
 - § A given **Milestone** is made for one and only one case
 - § A *case* is assigned to one **Case Manager** but need not be assigned at any given time (e.g., after creation but before assignment). A *Case* can be assigned to more than one case manager at different stages.
 - § A Case Manager can manage zero or many Member Request for Service (*case*)
 - (2) A case is fulfilled by zero or many **Service Sessions**.
 - (3) A Case Manager can render zero or many **Service Sessions**.
 - (4) A given Service Session
 - § is conducted for one and only one case.
 - § is rendered by one and only one Case Manager.
 - § issues at least one **Resource Request (Service Ticket)**
 - § needs to specify one of seven **Contact methods** (Client Site, Center Site, Telephone, Conference, Email, Snail Mail, or Web Site)
 - § is classified into one of five **Session types** (Initial, follow-up, Close-out, Administrative, Information transfer)
 - (5) A Service Ticket
 - § can request zero or many resources (Human resource, Financial resource, Space resource, Intangible resource, Equipment resource).
 - § is issued by one and only one service session.
 - (6) A Human Resource, Financial resource, Space resource, Intangible resource or an Equipment resource can be requested by zero or many Service Ticket.
-

Table 2 Properties of a Member Request for Service

Once a case is created, the user can search, delete, or modify a Member Request for Service tickets, as shown in Figure 10 and Figure 11. Furthermore, the User can view the request details (Request information, Service session, Milestones) in a hierarchical tree format, as shown in Figure 12.

Ticket Lookup	Ticket Hierarchy	Personal Information	Human Resource	Financial Resource	Equipment Resource	Space Resource	Intangible
---------------	------------------	----------------------	----------------	--------------------	--------------------	----------------	------------

Add/Modify/Delete

Your User id is: 1020

Step 1: Enter Search Criteria

Request Id:	Request Desc:	Request Status:	Contact Method:	Expected Resp Time:	Starting Date:
<input type="text"/>	<input type="text"/>	In progress	<input type="text"/>	<input type="text"/> weeks	MM-DD-YYYY

Step 2:

Step 3: Review Result Below The number of records for your query: << < > >>

Resource Details (only 1 record is displayed at a time. Use the navigation buttons above to view additional records.)

Request Id	116	Starting Date	02-27-2005	Ending Date		Expected Resp Time	<input type="text" value="2"/> weeks
Contact Method	Client Site			Innovation Stage			
Request Desc	Find financial support of \$20,000 to start a supply chain simulation mode			Based On	No	(0=yes 1=no)	
Request Status	In Progress			Searched Already	Yes	Found Match No	
Action Notes				Referable	Yes	Shared Info Yes	
				Search Result Notes			

Figure 10 Search Existing Member Request for Service Tickets

Main Screen	Search Tips	Comments	Print	Logout
-------------	-------------	----------	-------	--------

Resource Management

Innovation Information Infracore

Please Input Ticket Information

Your user id is: 1020 cannot be modified

Your request id is: 116

<< < > >>

Add

Find

Search

Delete

Save

Cancel

main screen

Log out

Describe your request

What is the contact method for the request?

Did you search I3/web already?

Did you find any matched resources yet?

Enter your search result notes

Is this request a follow-up of a previous request?

When in weeks you need response from case manager? weeks

Can this request be referred to a case manager for services?

Is the information shared?

Figure 11 Add, delete, or modify Member Request for Service Tickets

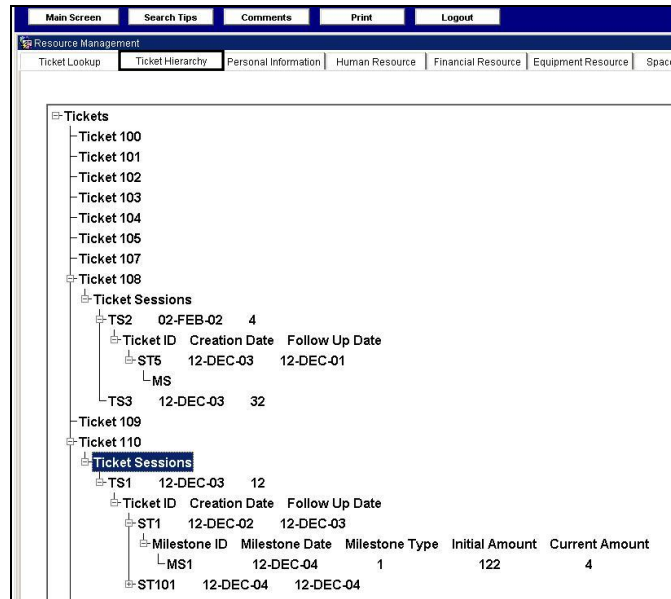


Figure 12 Viewing Status of Member Request for Service Tickets in Hierarchy Tree Form

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

Social Networks can enhance social and economic advancements. The digital cities utilize new information and communication technologies to provide an arena where people in different communities can interact and share knowledge, experiences and mutual interests. This study documents design and initial deployment of a digital city based on social network concepts to promote and structure social interaction among the users, to stimulate commerce and collaboration activities, to create the linkage between discovery and societal benefits, and consequently to enhance business networks.

Several design principles were used to encourage active user participations. Privacy is an important issue in today’s ‘network societies’ (Oostveen and Besselaar 2004) and confidentiality of information should be sustained in digital cities interested in fostering intimacy between the entrepreneurs in a business network environment (Strahilevitz, 2005). I3 project provides option to the user to choose between three different levels of confidentiality of personal information, as listed in Table 3, to restrict the members of the network from discovering the personal information of members who wish to conceal their personal information.

No confidentiality.

Both the authorized member and other members and resource providers know the identity (name and email) of one another. Information is published to all parties.

Partial confidentiality.

The authorized member does not know the identity of the other members/resource providers. If contact is requested, the providers will be given the choice whether or not to provide contact information.

Complete confidentiality.

Neither party knows the identity of the other party. The innovation network provides for masking the identity of both parties until a higher level of confidentiality is required to establish the social capital to consummate the transactions.

Table 3 I3 Confidentiality Settings

Credibility issue of interface design can be overcome by considering the usability principles. Usability assures that the users can perform tasks and interact easily (Girgensohn and Lee, 2002) while the learnability measures that the ease with which a system can be learned (Preece, et. al., 2002). Hints are included for every task/function to be done and help function is included in all the screens in I3 to ensure the search/navigation feature is easy to use and learn. Safety is another usability goal which protects the user from undesirable situations (Preece, et. al., 2002). Including alerts or confirmations for important actions as well as system backup are implemented by the I3 as a few ways to ensure the user does not lose any information accidentally. The usability test is currently conducted with real users and results will be used to modify and enhance the design in the future. Issue of content integration and credibility is addressed by using the data mining and text mining

techniques (that filters out fake documents) to a certain extent is currently under development and will be included in I3 in the future.

Maximizing collaboration can provide means to proactively and successfully meet the needs of the members and that helps in attaining their objectives by involving a wide spectrum of representatives from the entrepreneurial community. It also encourages the active participation of the members which is otherwise a difficult process (Lackney, A.L., 2003). The problem of free riding can be overcome by providing incentives (Krishnan et al., (2004) and sanctions for non-participation (Ginsburg and Kambil, 1999). Incentives provided for active participants can be anything like awarding them faster download times, and granting a wider view of the network (Kamvar et al.) or recognition in broadcast mails (McKenzie and Lee, 1998) and so on. In the initial implementation stage, I3 provides different means (i.e., email, contact information, content services, etc.) for collaborations and responds quickly to member requests through case managers to motivate active member participations.

Although major functions needed to establish and maintain one's social network are implemented, several essential functions are yet to be developed to improve efficiency and effectiveness of the proposed social network based information city. Personalization and intelligent interaction between the digital city and users based user profiles are still challenges. Forum, chat rooms, and other collaboration tools need to be developed to provide better participation and collaboration among users. Business and transaction services are yet to be provided. To promote active member participations, text mining and data mining techniques are currently investigated and applied to enhance the response time, successful rate, and tracking feature of the case management system. Furthermore, tools that can be used to track and report social network parameters and evolution over time are yet to be developed.

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