Social Knowledge Networks at ITESM

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Abstract. The Social Knowledge Networks project has been defined, at Tecnológico de Monterrey, México, as a specific action for a better knowledge creation and transfer. The objective of this project is to identify and promote networks of its faculty members distributed along Mexico, and other agents, internal or external to the institution, with which they actually or potentially collaborate in different knowledge areas. A specific Model and Tool for Social Knowledge Networks based on collaboration and peer recognition relations has been developed. The objective of this document is to present some elements of the Model defined for this purpose; the process for data recollection, some of the current results, and main opportunities found.

Keywords: Knowledge Networks, Social Networks, Social Network Analysis, Social Knowledge Networks, Knowledge Hubs, Universities

1 Introduction

The Social Knowledge Network project is being developed at Tecnológico de Monterrey (ITESM), a Mexican private educational institution founded in 1943, that has 33 campuses distributed throughout the country, a Virtual University, and academic centers and international offices in México, Latin American countries, North America, Europe, and Asia [1]. Through its educational, research and development programs, Tecnológico de Monterrey includes on its Mission statement to:

- Promote the international competitiveness of business enterprises based on knowledge, innovation, technological development, and sustainable development.
- Develop business management models to compete in a global economy.
- Create, implement, and transfer business incubator models and networks, in order to contribute to the creation of enterprises.
- Collaborate in professionalizing public administration; analyze and propose public policies for Mexico's development.
- Contribute to the sustainable development of the community with innovative models and systems for its educational, social, economic and political improvement [2].

Departing from the Mission and Vision statement, three concrete strategies inspired the Social Knowledge Networks project:

- Promote and direct investigation; graduate programs towards the achievement of the Mission.
- Develop models and create networks of business incubators; and create centers for management and technology transfer to promote competitiveness….
- Establish centers for the transfer of knowledge for sustainable social development [3].

The Social Knowledge Networks Project has, as main objective, the identification of social networks based on thematic areas and different forms of knowledge relation - like intellectual production, project collaboration, and peer recognized expertise- and the promotion of knowledge communities, for a better service to the society.

To achieve this objective, a model for knowledge networks has been defined, and also a tool for information extraction from Legacy Systems, online information filling and retrieval, and real time Network Visualization. Until this moment, we have already collected information about agents, mainly faculty members of ITESM distributed in México, having collaborations mainly in six defined areas.

The objective of this document is to present some elements of the Model defined for this purpose, the process for data recollection, the current results, and main opportunities found.

2 Social Knowledge Networks Model

Social Network Analysis (SNA), as explained by J. Scott takes elements from Graph theory, Harvard Structuralists, and Structural-Functional Anthropology. A main author mentioned by him, Clyde Mitchell, sees patterns of interaction – communicational and instrumental- as the "sphere of network analysis" and the need of the study of partial networks based on abstractions around individuals or global abstractions in terms of the network relations [4]. However, a main failure of Mitchell, from Scotts' perspective, is that Mitchell's structures of institutional relations are distinguished from Networks. This difference of approaches of both authors is important for the analysis of Knowledge Networks.

Knowledge Networks have a higher level of abstraction from Social Networks, either communicational or instrumental, in Mitchell terms. A Knowledge Network formal definition depart from directed graph definition: A Graph G is a) an ordered pair of finite sets G= (V, E) where the elements of V are called Vertices or nodes, b) the elements of E are called edges or arcs, c) each edge in E joins two vertices in Vi and Vj where <V*i*, V*j*> is different from <V*j*, V*i*> [5]. In Knowledge Networks, Vertices can be concepts and agents; and Edges may be collaboration links, expert recognition and other forms of knowledge relations.

The model, described through this work, can be considered as a partial Social Network from Mitchell approach, or a subset of Knowledge Networks in a more

abstract approach. These approach Vertices, that named nodes or agents, represent people that have a specific knowledge; and the Edges, that will be called links, represent knowledge relations between the agents in terms of intellectual production, collaboration in projects, and identification of a peer as expert or knowledge having. This kind of networks will be called Social Knowledge Networks (SKN).

An objective and subjective approach is combined in terms of the explicit and/or evidences of knowledge relations, and experience recognition. The strength of the ties can be defined in terms of the level of peer recognition, codified evidences of interaction, intellectual production, etc. A level of knowledge networking can be defined as an index that combines the different forms of knowledge relations in terms of the value system previously defined.

Special emphasis is given to intellectual production, as codified evidence of knowledge relation. The specific case co-authorship of intellectual production seems to be an important aspect for the objectivity of the knowledge networks, while "there have been few studies to date that have examined patterns of co-authorship" [6].

A main issue of the SKN model, at ITESM, was to make clear the differences respect to institutional structures, projects or committees, while Social Knowledge Networks, as social networks have "an structure and frontier that change through time as the actors are included or excluded from the net, and the activities or resources are renewed" [7].

Another important –and more difficult- differentiation in the model was respect to Knowledge Communities (KC) –like Communities of Practice-. For A*i*, to become a member of a SKN, there must be at least another A*j*, in the network, with a knowledge relation from the defined subset between them with or without a sense of group or an agreement of shared values. For a KC there can be no direct knowledge relation between the members, but still a relation between the Community as a whole and each member in terms of sense of belongs, shared values, etc.

3 Retrieval and Visualization System development

In order to support the SKN model at ITESM, a software named SIVYC was developed in PHP language over Linux Web Server. Initially, SIVYC was just a formulary to introduce data about every agent. However, the project started growing and SIVYC became more sophisticated and a Java applet called GUESS [8] was included for real time network visualization. SIVYC, still on Beta version, is functional so that possible network members or agents can be able to:

- Personalize their entry after authentication and view their personal information.
- Introduce information about collaborations with other agents, being this a key aspect for the network construction.
- Retrieve information about Agents doing and combining different kinds of queries: filters by area of interest or specific topic, Campus of belong, kind of collaboration, etc. Figures 1 and 2 show sample queries about agents of the "Regional Development" network.

- Visualize networks of collaboration. To facilitate the identification of members, we use colors that represent agents in different rectories (rectories can be groups of different campuses along the country). Figure 3 to 5 represent some examples of identified networks.

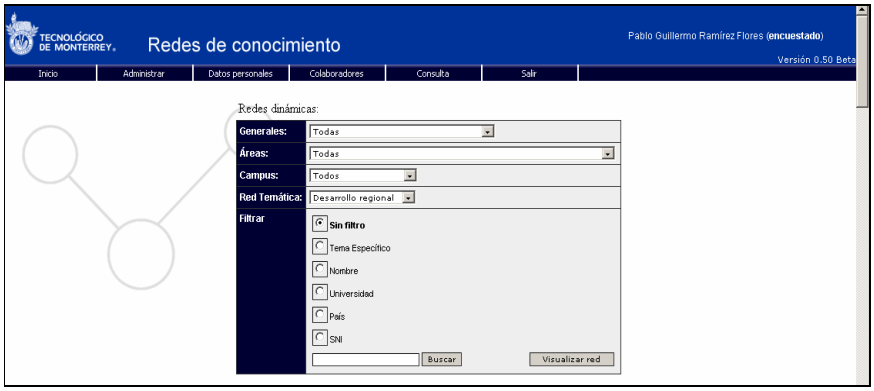
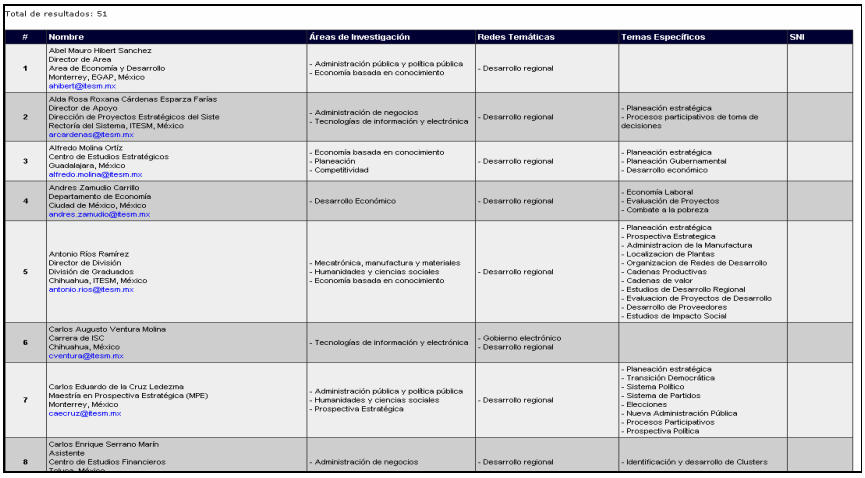


Fig. 1. Sample query interface



Total de resultados: 51

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8	Carlos Enrique Serrano Marín Asistente Centro de Estudios Financieros Toluca, México	- Administración de negocios	- Desarrollo regional	- Identificación y desarrollo de Clusters	

Fig. 2. Sample query results about “Regional Development” network Agents

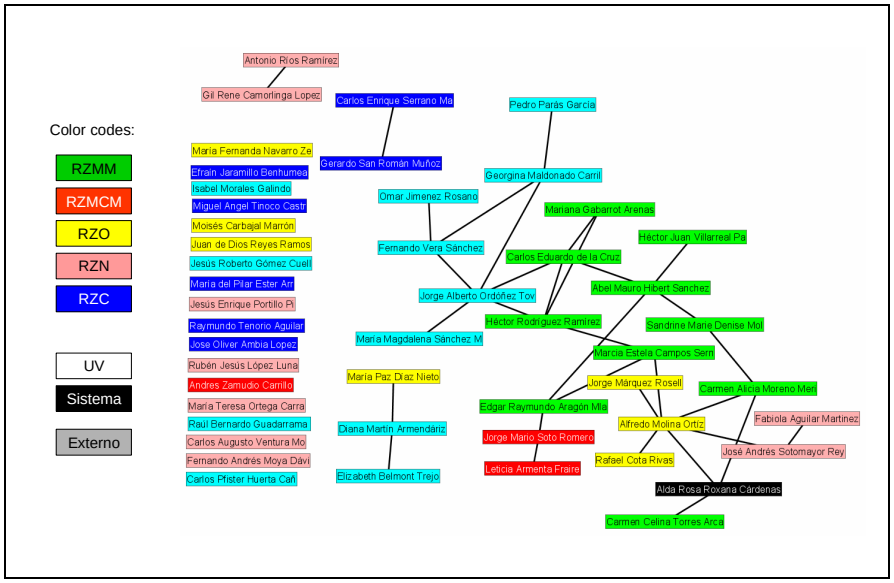

Fig. 3. Regional Development ITESM Collaboration Network including Color Codes

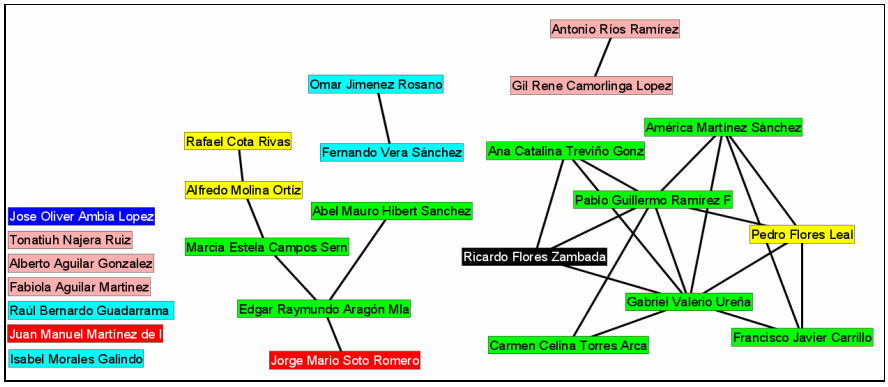

Fig. 4. Knowledge Economy ITESM Collaboration Network

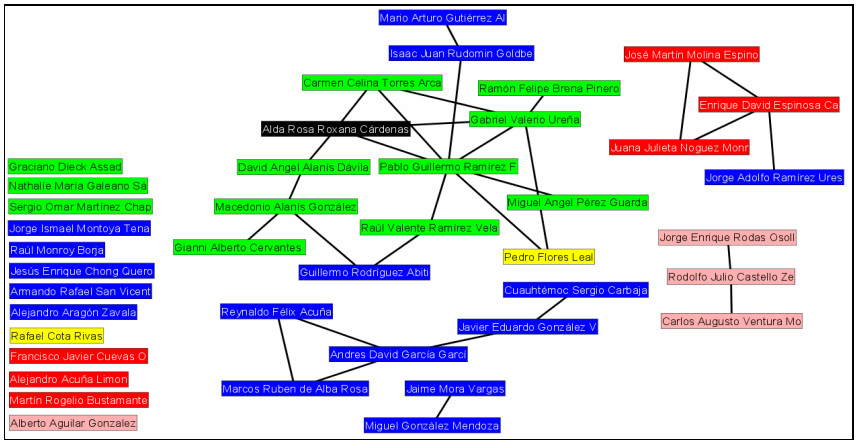

Fig. 5. Information Technologies ITESM Collaboration Network

4 Initial phases for information collection

For the construction of the networks, some initial agents were identified and were asked for research information and peers with which they have collaborated or identified as experts in the field. During the first phases of the project there were “two forces” for Networks identification.

The first force can be called “institutional”, with resources for the identification of members of previously defined interest topics, and with some restrictions for its inclusion in those nets. The problem of the knowledge taxonomy, with this approach, was to define one that could make sense to future members, although there was an open field for specific interest areas.

The second force, more oriented to a living system, was to invite the ITESM community members to participate in identifying their interest areas and peers and let the network to grow itself. The first force helped to work fast in the member and kinds of relation identification, but it may exclude natural members of those nets. The second, slower on its growth may help to identify knowledge networks that emerge from the system dynamics. This second approach gives more emphasis to the open field and needs more effort to deduce the taxonomy that is also emerging.

Lazer explains that “the dominant way to measure relations in social network analysis (SNA) is still based on self-report data” [9] and how in the following years there will be an important change in this, by the actual state of Information Technologies. There has been an important effort to extract information from Legacy systems. However, those systems do not use to have information about collaboration, so the agents need to fill most of their information with the respective accuracy problems. Intelligent Technologies may play a key role in the identification of relation information or the deduction from legacy systems; specifically for “(1) the link

between different types of interaction behaviors and self-reported relations, and (2) the interaction between the two" [9].

5 Conclusions

This project is just the beginning of an important effort in identifying the institutional capabilities and enabling the knowledge flow and transfer inside and outside ITESM. There have been some advances mainly for the Biotechnology, Mechatronics, and Regional Development Networks. Being the last, the one that shows more richness on its content, but still cannot be fully representative of the Network and the Model because of special institutional interventions that were done for it, and because there are members that have not responded yet. Anyway, this network is illustrative about the kind of effort it is needed to promote the already identified networks, and to identify new ones.

There are important issues to solve respect to the knowledge areas' taxonomy in both the inductive and deductive approaches, and there is still much work to do in the actual and future knowledge links identification and validation; as well as identifying the better way to measure the level of *networking* in terms of knowledge.

Also other cultural aspects need to be solved, from the perspective of the authorities, in terms of the kind of interventions that enable or not innovation; and from the perspective of the possible network members, in terms of the many learning and project opportunities that can arise if they participate in the network construction.

We strongly believe that Universities may play a key role as hubs for innovation networks in a similar way that is represented by Dhanaraj and Parkhe [10] for firms. But for this "External Engagement" an "Internal Transformation" is required in the context of the Knowledge Economy [11], and Social Knowledge Networks research and development, in and between Universities, are an important step.

References

1. Tecnológico de Monterrey. Retrieved December 23, 2006 from http://cmportal.itesm.mx/wps/portal/english
2. ITESM 2015 Mission. Retrieved December 23 2006, from http://www.itesm.mx/2015/english/mission.html
3. ITESM 2015 Strategies. Retrieved December 23, 2006 from http://www.itesm.mx/2015/english/strategies.html
4. Scott, J.: Social Network Analysis. A handbook. 2nd Ed. Sage Publications, Ltd, .London (2006)
5. Sahni, S.: Concepts in discrete mathematics. 2nd. Edition. The Carnegie Mellon Publishing Company, North Oaks, Minnesota (1985)
6. Barabasi, A.L. ; Jeong, H. ; Neda, Z. Ravasz, E.; Schubert, A. and Vicsek, T.: Evolution of the social network of scientific collaborations. Physica A 311, (3-4)

(2002) 590-614. Retrieved October 9, 2006 from http://xxx.lanl.gov/abs/cond-mat/0104162
7. Swan, William; Langford, Nigel; Watson, Ian y Varey, Richard J.: "Viewing the corporate community as a knowledge network", Corporate Communications: An International Journal., Vol. 5, No. 2 (2000) 97-106.
8. Adar, E. GUESS: A Language and Interface for Graph Exploration. Retrieved October 10, 2006 from http://graphexploration.cond.org/documentation.html.
9. Lazer, D.: Complexity and Social Networks Blog of the Institute for Quantitative Social Science and the Program on Networked Governance, Harvard University, February 20, 2006
10. Dhanaraj, Ch. & Parkhe, A.: rchestrating Innovation Networks. Academy of Management Journal, Vol. 31, No. 3 (2006) 659-669. Retrieved July 26, 2006 from EBSCO Database.
11. Harloe, M. and Perry, B.: Rethinking or Hollowing out the University? External Engagement and Internal Transformation in the Knowledge Economy. Higher Education Management and Policy. Vol. 17, No. 2 (2005) OECD