



# Academic and research networks management: challenges for higher education institutions in Mexico

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## Abstract

Social and economic development of countries or regions requires advances in science, technology and education. To accomplish this goal, governments have taken the decision of connecting, through the Internet, to share information to promote and enhance knowledge, and build up collaboration and synergic links among universities, organisations and institutions in order to manage knowledge efficiently.

With these assumptions, this work describes the development of academic and research networks management in higher education institutions in Mexico to promote research, innovation and education.

Concerning the research methodology, Delphi was used to gather opinions from key people; however the technique was adapted to fulfil the research design. At the beginning, there was a phase to interview experts on networks management (two Mexicans and two from other countries). On the basis of the answers, two survey instruments to investigate network management in higher education were prepared, considering variables such as leadership, planning, information and knowledge.

The interviews and 51 survey questionnaires (from 14 coordinators of network communities and 37 of their members) provided information that was analysed on a Likert Scale. The survey forms were sent by e-mail using the software denominated "onlineencuesta" to collate results and produce graphic interpretations (Online Encuestas 2014).

The results show that coordinators of academic and research networks manage their processes with effective leadership; however, long-term planning to improve projects within the networks is neglected. The same happens with the use of technology and information to innovate in network services.

From the results of the study, new lines of research could be found: new knowledge agents trends in networking, comparative studies among national and international networks, among others.

**Keywords:** Management, Academic and research networks, Innovation, Higher education institutions

## Introduction

Networks are forms of social interaction, a space of living together, and of connectivity. Networks are defined for dynamic interchanges among the human beings who form them. They can be open and horizontal systems. For Rizo 2006, quoted by Castillo (2009), p. 152, “[...] Networks are build up as a form of social organisation that allows a group of people to enhance resources and contribute to problem solution; its logical approach is not to homogenise social groups but organise a society, despite its diversity, through links among groups of interest and common preoccupations” (Hernández, 2012). Thus, networks imply a challenge to pyramidal, vertical or horizontal structures of an organisation; they foster communication and efficient work by means of information and communication technologies, (Pérez and Castañeda 2009, Steiner and Ploder 2011, Castells, 1998).

Berra (2011) points out that networks are shown as a sociotechnical system of means and content. Means consist of a transmission channel and content units. Content is the information that circulates, the relationships that are built among stakeholders and users, the nature of the relationships themselves and the resources that are interchanged (Gutiérrez, 2009). The links among people, connected to the network, vary in function of intensity, duration, frequency and content.

A network, as a sociotechnical system, Berra (2011), p. 67 has these properties: density, centrality and prestige; its features and conditions allow measurement of the value of the network.

Harasim et al. 2000, quoted by García et al. (2007), point out three basic approaches to the educational use of networks during the last three decades. The first network classrooms were created to complement traditional courses “face-to-face”. This format was implemented on several educational levels. The first network experiences occurred in high schools of Dartmouth College (USA), in 1969, the projects of the Intercultural Learning Network (ICLN; USA), in 1983; and the network Réseau d’Ateliers Pédagogique Pilote International (RAPPI; France, Canada, England and Italy), in 1983, as well (Liebowitz, 2005).

Distance education and open learning programmes also adopted a network structure to facilitate interaction among students, teachers and administrators (Valencia, 2014). Its influence has been great during the last three decades, and they have played a main role in the implantation of collaborative pedagogies in distance education. The first informatics conference systems correspond to the American Open University in 1983, and the British Open University in 1983; the latter was the first distance institution introducing such technology as a tool to complement communication between the tutor and the learner. Later, communication networks have been implanted successfully in the remaining distance universities and, nowadays, it is a tool to facilitate didactic interaction (Géant, 2012).

The third approach consists of network courses, which constitute the first experience of the present digital systems for teaching and learning (e-learning). Network courses appeared in the eighties in a specific university context,

where they function as classroom or as campus. After the initial trials with videoconferences and group work, in 1985, the Ontario Institute for Studies in Education, Canada, and the Department of Connected Education (associated to the New School for Social Research; USA) started to offer some network courses using videoconferencing as the main technological support; this would be the seed of evolution of this kind of models.

Harasim et al. 2000, quoted by García et al. (2007) introduce a last stage in the knowledge networks. In their multiple variations, knowledge networks are considered as antecedents of the present learning communities in the cyberspace.

The interest of the present paper aims at showing the relevance of the use of academic and research networks, as participants in knowledge management mediated by information and communication technologies (Bansler, 2004).

Academic networks represent a means of communication, with a complex structure Network (CODASYL, 2014); thus, its management is done by each node that allows synergy through interactions among their members, as Reynaga and Farfán 2004, quoted by C. Hernández (2013), p. 171 say: “Networks share interests, strengths and support points with the purpose of establishing a dialogue, find answers, build knowledge and join together in the search or creation of a solution concerning a subject or a problem”.

There exist organisations that manage academic networks: The Unesco Networks Programme, established in 1992, the Unitwin (Twinning and University Networking), a link to research, formation and development of programmes in all competence spheres of UNESCO, through the construction of university networks to foster cooperation among universities through knowledge transfer (APAN, 2012).

Unesco Chair and Unitwin networks have established new teaching programmes through research and reflection, fostering the enrichment of present university programmes and respect for cultural diversity (Red Clara, 2012). Today, there exist 715 Unesco Chairs and 69 Unitwin networks in more than 839 institutions in 131 countries (Unesco, 2011).

Another network with an international scope is RedClara (Cooperación Latino-Americana de Redes Avanzadas), a Latin American collaboration system mediated by telecommunication advanced networks for research, innovation and education (RedCLARA, 2014). Among the countries that are members of RedClara, there is CUDI (Cooperación Universitaria para el Desarrollo de Internet / University Cooperation for the Development of Internet); this network belongs to Mexico (CUDI, 2013).

CUDI 2009 is under construction; it is a social association without profit that manages the National Network for Education and Research (RENEI-Red Nacional de Educación e Investigación) to promote Mexican development and increase synergy among its members. Its mission and vision are:

- Mission: “To manage, promote and develop the National Network for Research and Education (RNIE) in Mexico and increase synergy among its members”. Additionally, it is connected with its international peers, aiming at

increasing the quality of their offer and profit by the collaborative opportunities of internationalisation (CUDI, 2014).

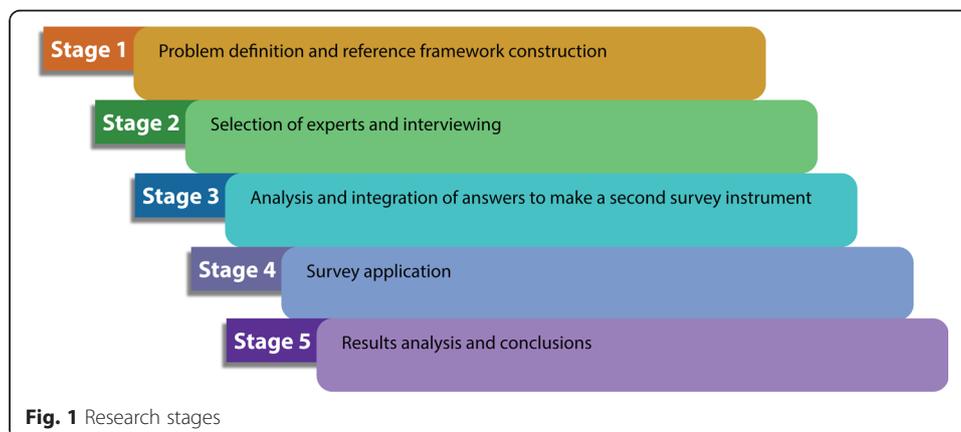
- Vision: “Become the world leader in the use, innovation and research of applications and services of the National Network for Education and Research in Mexico, through collaboration among its members and with the support of information and communication technologies.” (CUDI, 2014).

This study was designed in five stages, which are fully detailed later. It has a non-experimental design, because information about the existing situation inside the academic and research networks of a higher education institution in Mexico was gathered; because CUDI is a more consolidated network, it was used as the sample.

International and national websites of academic and research networks were examined; thus, this study becomes exploratory. It has a descriptive design because it aims to investigate the incidence of modalities or levels of the coordinators in the CUDI communities. In this mixed-methods approach, interviews with experts were conducted and open questions were designed for the network members (qualitative feature). Moreover, an instrument based on the document called Self-evaluation of Educational Centres for Quality Management was used. Instruments for self-evaluation in Educational Centres (SEP, 2007) and the information in the answers from the instrument related to a Likert Scale were organised in order to make graphic representations (quantitative features).

### Research stages

For this research, a variant of the Delphi method was used; this method is supported by experts’ opinion in two instances. The questions were designed to explore the present situation about the management of academic and research networks in higher education institutions. The experts oriented the methodological design Fig. 1.



### Stage 1. Problem definition and reference framework construction

In the first stage, based on the study of primary and secondary sources about academic and research networks in higher education institutions, the problem, the objectives and the research questions were defined. International education networks were also explored (mainly Europe, Asia and America) and Mexican networks (Conacyt, ANUIES, CUDI, UNAM e IPN) were also explored. The objective of the research was defined as *to describe how academic and research networks in Mexico have been managed*.

### Stage 2. Selection of experts and interviewing

To build up a context for the development of the academic and research networks, two interviews were performed on two axis: questions about experience in working with a network or a specific academic community and questions about management of academic and/or research networks. The interviewed experts were two members of the academic staff from Mexico (from Instituto Politécnico Nacional and Guadalajara University); additionally, two members of the academic staff from Italy and Colombia were interviewed.

Interviews were transcribed for the analysis and the text was uploaded to Atlas Ti software. In general terms, a network or relationships among the most important concepts concerning academic and research management in higher education institutions was obtained.

According to the interviews, it is noted that management, knowledge, research and education have an interrelation in academic and research networks, always mediated by information and communication technologies, as shown in Table 1.

In Table 1, it is observed that there exist common concepts; the people interviewed refer more frequently to concepts such as: projects, shared leadership, synergy, human resources, creativity,

**Table 1** Frequency of key concepts in the interviews

Dimension	Key word	Repetitions in the interviews	Category
General terms in network activity	Knowledge and acknowledgment	4	Participation
	Regulations	2	Planning
	Financial support	3	Planning
	Participation	4	Collaboration
Shared	Projects	4	Planning
	Shared leadership	3	Leadership
	Synergy	4	Collaboration
	Technology	4	Technology
	Human resources	3	Collaboration
	National and international collaboration	2	Collaboration
	Creativity	3	Strategy
Network or specific community	Support	4	Planning and participation
	Groups	4	Collaboration
	Flexibility	3	Planning
	Work with teachers	4	Collaboration
	Institutional support	4	Planning
	System change	2	Planning



**Table 2** Items for the survey instrument for coordinators and representative members of CUDI (Continued)

	How often do you use collaborative spaces in CUDI? Which of these services do you use in CUDI?	
General	Which obstacles have you found concerning management in your community? What do you propose to overcome them? How can science and technology be articulated through work in academic networks? How can innovation be promoted through work in a network?	Survey with CNC open questions

Note: Definitions are from Secretaría de Educación Pública (SEP, 2007)

support, national and international collaboration. On the other side, the most frequent key words concerning academic and research networks are: knowledge and acknowledgement, regulations, financing and participation. Concerning the work inside a network or specific community, groups, flexibility, work with teachers, institutional support and system change stand out.

**Stage 3. Analysis and integration of answers to make a second survey instrument**

Based on the answers from the interviews, information was gathered, analysed and the software used was onlineencuestas (Online Encuestas, 2014), organised in a frequency table, which allowed the design of two survey instruments with the following characteristics Tables 2 and 3:

**Stage 4. Sample and survey instruments application**

As it has been said, this work aims to inquire about the way academic and research networks are managed. Because CUDI is the association in charge of the management of the most networks in Mexico, it was taken as a reference point to make the survey designed in stage 3; that is why it is important to be more specific about the roles of representative members of higher education institutions who belong to CUDI, as well as the responsibilities of community coordinators.

- Representative Members with CUDI Membership have the responsibility of performing collaboration actions established between the network and the institutions.
- Community coordinators are in charge of promoting development of applications to be used in the network with similar telematics, such as aerospace, astronomy, earth

**Table 3** Characteristics of the survey instrument

Addressed to:	Representative Members of Higher Education Institutions in CUDI	CUDI Communities coordinators
Population (HEI)	266	17
Types of items	7 multiple options (Likert Scale) & 1 open question	17 multiple option (Likert Scale) & 3 open questions
Study variables	Information and knowledge	Leadership, planning, information and knowledge
Software	Onlineencuestas.com	Online Encuestas.com

sciences, digital libraries, accounting and business, education, renewable energies, science teaching, socio-environmental studies, engineering, mathematics and health.

The survey instrument was uploaded to an URL, available in Online Encuesta software (Online Encuestas, 2014); two instruments were sent via email to CUDI community coordinators and to the institutions with a CUDI membership. It is important to note that this network is organised through committees; among them, one in charge of memberships, another one for applications and fund grant, and another one in charge of the network development.

### **Stage 5. Results analysis**

Online Encuesta.com generates statistical data, graphs and shows the information in a spreadsheet; in order to organise data, a congruence matrix was elaborated; this fact facilitated the creation of graphics to illustrate the results.

From the 17 CUDI communities, only 14 coordinators (82 %) answered the survey instrument. With regard to the representativeness of the sample of CUDI members, it is noted that 230 survey instruments were sent and only 37 (16 %) answered; because of the number of responses received, it is observed that community coordinators are more committed than representative members.

To compare information in the answers, more relevant results about the research variables: leadership, planning, information and knowledge are presented.

Concerning leadership, the coordinators state that they promote teachers' participation and that they also encourage a quality and collaboration culture ("always", 40 %, "almost always", 60 %). Because of this, it is observed that CUDI communities coordinators encourage leadership. The same happens with fostering network work culture ("almost always", 45 % and "almost never", 22 %); in the same sense, it is basic to strengthen a network work culture in all dimensions; that is to say, with teachers, researchers, students and the external community in order to develop efficient links and consolidate projects.

In terms of planning, there exist several opportunity areas for coordinators; they point out that they do not always aim their objectives at improvement of network work and that it is necessary to establish procedures to guarantee clarity and effectiveness in the network. In relation to resources and means granted to perform the activities, 43 % point out that "almost always" they do that and 57 % "almost never" do the same. It is also observed that less than 50 % of the CUDI communities project a network work culture in the network, and they do not always guarantee clarity and effectiveness in their work; thus a common effort is required to consolidate guidelines and objectives within the networks.

In relation to information and knowledge, it is observed that 50 % "almost never" get internal and external information about academic and research activities to publish them in the network; notwithstanding, coordinators point out that 43 % "almost always" use information and technology to innovate services in a network, while 57 % point out that they "almost never" do that. It is also noted that coordinators do have the ideal information to broadcast it and work with it in the network; however, this process is likely to be carried out in a poorly planned manner because the percentage for planning is low.

It is also important to make it clear that some coordinators enhance the development of research, innovation and education through leadership, information and knowledge; however, it is necessary to reinforce planning and "assure" its accomplishment.

To find out whether the representative members of higher education institutions know about the activities and benefits of their membership to a network, specifically CUDI, the main points arising in the survey are discussed.

One hundred percent of the representative members answered that they do know about the existence of CUDI, which was a favourable aspect for network development.

Eighty percent of the members know about functions and authority in the network, while 20 % do not; this information suggests that most institutions know the objectives, aims and resources granted to them by the network.

Thirty four percent of the members “totally agree” and 26 % “agree” that they know of the benefits granted by CUDI (to the institution or university); in contrast, 40 % point out they have “partial” knowledge.

The most frequent services used in the network are videoconference (60 %) followed by international collaboration projects (25 %) and real time applications such as IPv4, IPv6 and Multicast (5 %), while 10 % do not know about such services.

## Conclusions

Today, due to the accelerated technological advance, there are many networks of different kinds (Incera, 2007). Networks are spaces of a great opportunity because they favour learning and generation of self-organisation processes to share visions and commitments about a defined topic. They allow the establishment of links of different kinds among their members and from there, social relationships and consolidation of projects are constructed.

The preparation of academic and research networks implies collaborative work from the university community, so as to create work and cooperation links among peers to fulfil institutional objectives. In order to achieve this, it is necessary to manage processes within academic networks and foster the development of research, innovation and education, under an efficient administration that makes it possible to reach these objectives in an effective way.

Management, knowledge, research and educational proposals are interrelated in the academic and research networks, always through information and information technologies. In the case of CUDI, the learning management system, Sakai, is the main delivery platform, and it provides links to digital repositories that include collections of index journals, dissertations, learning objects, among others. Institutions or organisations that belong to CUDI can be education oriented or they can be enterprises interested in enhancing research, innovation and education.

As it has already been said, CUDI is an association that manages academic and research networks for higher education institutions, and in doing so, it has several strengths; however it has not yet gained an efficient leadership to establish a trend among higher education institutions in Mexico, and it also needs to promote national and international impact. On the basis of the survey responses, it is observed that communities coordinators are more committed than the representative members.

The study found the main strengths and limits of the academic and research network work in the participating universities include:

Strengths:

- Graduate and research projects management is permitted.

- Diversity of ideas in the academic communities is enhanced.
- Innovation, research, cooperative models of knowledge production and forms of socialisation are allowed.
- Knowledge production and creativity are facilitated.
- Different technologies, which can be shared, are promoted.
- Networks can be useful to overcome the social and digital gap.

#### Limitations:

- Because networks can broadcast information of different kinds, its truthfulness and reliability are doubtful.
- The diversity of software does not allow all the users' computers to have the same functionality in the network.
- It can generate social and spatial discrimination,
- It can generate a digital gap that may prevent access to goods and services offered by the networks among developed or underdeveloped countries (Wang, 2013).
- There could arise power groups of several types.

Academic and research networks are an option to promote collaborative work among higher education institutions; but, in Mexico, they present deficiencies in their operation; this fact is a limitation for this proposal. It is necessary to design management models that make it possible for their efficient operation to achieve their aims that, despite their clarity in the origin and organization of the networks, are not achieved totally. It is urgent that the institutions themselves promote discussion spaces to guarantee the development and permanence of such networks.

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