"Networks as University Strategy: The Case of UAM"

Salvador T. Porras
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Traditionally Higher Education Institutions (HEI) in Mexico have been considered and analysed as closed systems, without major interaction or involvement with their environment, depending almost totally on government funding. Recently, global transformations in the economy have posed new challenges and opportunities for HEI, making them more vulnerable to environmental contingencies, forcing them, in certain ways, to adopt different strategies of collaboration with other organisations. Collaboration will allow HEI to survive external pressures from the environment. Different forms of collaboration could be mentioned of which forming networks is one. Working in a network implies that organisations should be willing to collaborate, commit to the relationship, trust each other, and establishing communication among participants. In this paper we present the case of a Mexican university, the Universidad Autonoma Metropolitana (UAM), in its transition towards an organisation characterised by network relationships with other organisations. We will focus on two of the elements that UAM has developed as part of its activities oriented to the establishment of organisational networks: the aspects of collaboration agreements with other organisations and the creation of the information system.

"WORK IN PROGRESS"

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Introduction

More and more often, organisations collaborate with other organisations in order to be sustainable. Husted (1994) suggest that three different kinds of organisational collaboration could develop within organisations depending on the degree of trust involved in each relationship: high-trust, low-trust and zero-trust, or opportunistic, relationship. As Newell and Swan (2000, 1288) suggest, this can give rise to particular problems at the interorganisational level, ‘because networks are not governed by traditional hierarchical relationship, critical problems surround the development and maintenance of trust and the deployment of power among members.’ Larson and Starr (1993) argue that interpersonal contact and sharing of understanding of the conduct and behaviour of participants in a relationship provides a certain minimum level of understanding, giving rise to trust and reciprocity. Larson and Starr (1993) consider that collaboration is based on previous positive experiences with partners; collaboration between competitors without previous experience could thus be very risky.

Collaboration, networks and higher education

Various elements are required for collaboration to emerge. Trust should be at the basis of any collaboration. Where trust is present, organisations are more willing to collaborate with other organisations on a reciprocal basis. Thus, one can expect organisations sharing resources and information more openly with other organisations; they will tend develop the basis of mutual understanding and goodwill of parties.

Child and Faulkner (1998) consider that "a co-operative strategy is the attempt by organisations to realise their objectives through co-operation with other organisations"

(p. 1). They posit that collaboration, as well as competition, can be more or less intense between partners.

Accordingly, Child and Faulkner's (1998) suggest that where both collaboration and competition are low it is most likely that the relationship will fail to achieve its goals or, at best, obtain poor results. This is the result of poor interaction between participants in any relationship. In the case where collaboration is low and competition is high there is an increasing risk that one of the parties will act opportunistically against the other participant in the relationship. This is the case where a powerful member dominates the relationship. Both situations manifest a poor degree of collaboration between participants and it is more likely that the relationship will terminate sooner rather than later. Where competition is low and collaboration is high, the most viable option is vertical integration, when one of the partners will integrate with the other partner through merger or acquisition. This strategy has been widely used to order relations between organisations; however, this strategy is not an option when organisations need to collaborate with other organisations. The best strategy for organisations is where both collaboration and competition are high; in such a case the major benefit is mutual learning for participants, all of which remain individual organisations collaborating in some areas of their business activities, while remaining competitors in the rest of their activities.

In collaborative interorganisational settings, trust increases where each project team is self-sufficient and includes 'outsiders' like user-representatives (Clegg *et al., 1996*). Trust increases also when the member organisations have had previous contact. When teams have a social and celebratory dimension trust levels typically increase. Also, where project participants have prior experience with relevant technology or previous co-operative programs, it increases the probability of success in any given project. Another element that has a positive effect on trust is the intensity and duration of the relationship. According to Clegg *et al.* (1996), the more long-term the relationship the greater the trust.

In this paper we centre our analysis on network forms of organisation in higher education in Mexico. Networks are one of many different types of strategies used to pursue business objectives, including strategic alliances (Harrigan, 1987), joint

ventures (Harrigan, 1988), and other forms of network organisation (Alter & Hage, 1993; Ebers, 1997; Ebers & Grandori, 1997; Ebers & Jarillo, 1997; Grandori & Soda, 1995; Jarillo, 1988; Miles & Snow, 1986; Snow, Miles & Coleman, 1992; Powell, 1987, 1991; Thorelli, 1986). However, since the 80s, the 'network' concept has become more fashionable in the social sciences in business (Jarillo & Ricart, 1987; Jarillo, 1988; Nohria, 1992).

Networks have become fashionable because they have been seen as a superior form of organisation for firms under conditions of uncertainty (Jarillo, 1988). For example, in systems and marketing (Håkansson, 1989, 1992; Forsgren *et al.*, 1995), collaboration of small-scale enterprises and or entrepreneurship (Johannisson, 1987; Larson, 1992), industrial geography (Grabher, 1995; Piore & Sabel, 1984; Putnam, 1993), collaboration in the bio-tech industry (Powell, Koput & Smith-Doerr, 1996), textile industry (Uzzi, 1996, 1997), and supplier-user relationships (Burnes & New, 1997; Provan & Gassenheimer, 1994).

Analysing the development of organisations, Castells (1996) considers that the old 'one best way' of production is being substituted for a new paradigm based on networks. He considers that "networks are the fundamental stuff of which new organisations are and will be made" (Castells, 1996:168). He notes that in an era of new information technologies, a new organisational form has emerged, the 'network enterprise'. Accordingly, a network enterprise is "that specific form of enterprise whose system of means is constituted by the intersection of segments of autonomous systems of goals" (Castells, 1996: 171).

We consider a network as “a long-term relationship between organisations as actors that share resources to achieve negotiated actions for joint objectives” (Porras, 2000). It should be a long-term relationship because it is only in the long run where organisations may know the rest of the participants in the relationship and it is when participants can have a benefit from the relationship. In the short-term not all the participants in the network may get a benefit from it. Resource sharing is vital for establishing long-term relationships. We consider that it is only when members establish a mutual sharing of resources that a network can be established.

Different researchers and entities have already proposed networks of higher education institutions. In a very influential publication Gibbons *et al*. (1994) proposed a new model for higher education which characteristics include:

- Knowledge production will be produced as a result of the interaction of many actors
- Trandisciplinary: this means that research and teaching will take place across disciplines as opposite of the current disciplinary, primarily cognitive model.
- Heterogeneous: where people having different background will participate. The current model is characterised by the existing homogeneity in its research groups.
- Non-hierarchical: based on networks of academics and strategic alliances for R&D as opposite to the current hierarchical model that tends to preserve its form.
- Socially accountable and reflexive where collaboration between practitioners will be basic for the model as opposite to the individualistic model existing.

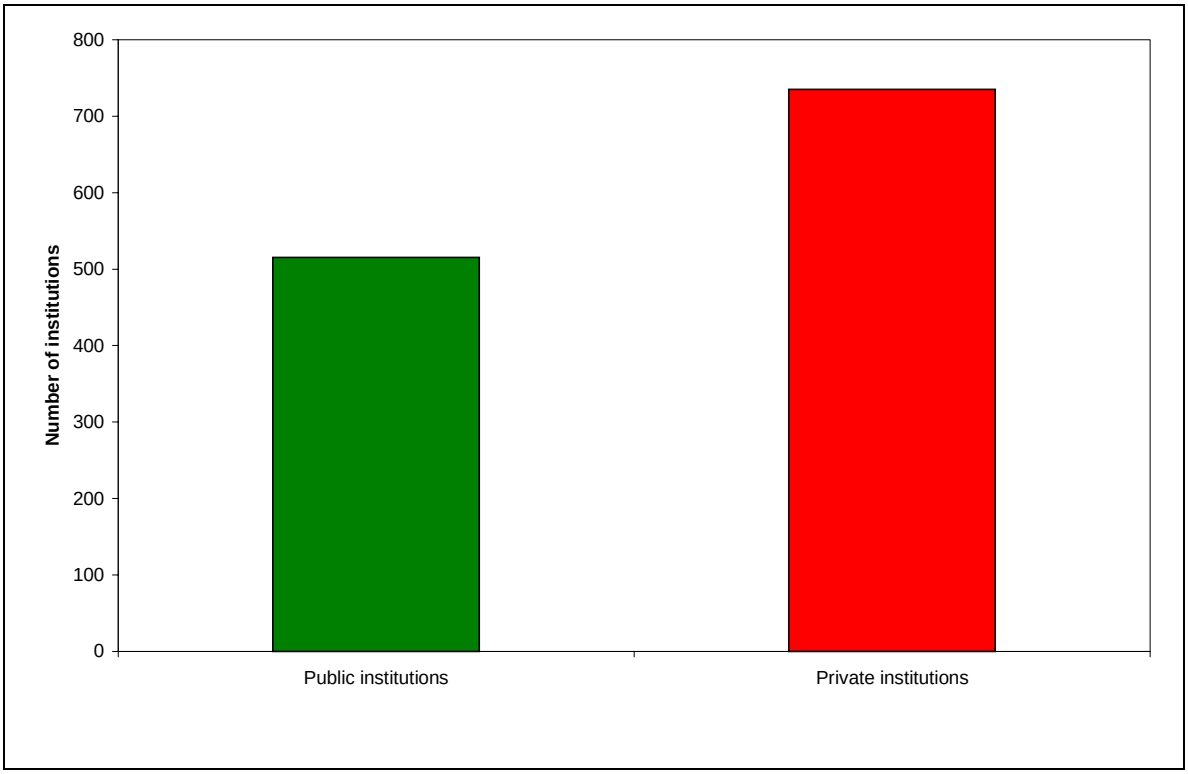
Gibbons *et al*. (1994) consider that to be competitive in a global economy, there is a growing need for new knowledge that can be easily accessed and where information technology plays an important role. The increasing costs of R&D had caused that it cannot be carried out only in-house R&D has to be conducted in different places, thus organizations have established collaborative relations with other organisations. In such conditions, organisations have to innovate constantly to be competitive. Collaboration thus, takes place in a very competitive situation combining resources and lack of resources. Those that do not have enough resources come to those that have resources in excess.

UNESCO has also proposed actions to carry on the process to transform the higher education system. The outcomes of the World Conference for Higher Education organised by UNESCO in 1998 present the challenges for higher education in the world and they suggest that higher education institutions have to establish links with private organisations to get the necessary funds to achieve their goals. It is in this context that the higher education system in Mexico is proposing its vision for the new century.

The Context of Higher Education in Mexico

The institutions of higher education in Mexico both public and private are grouped in the *Asociacion Nacional de Universidades e Instituciones de Educacion Superior* (ANUIES for its acronym in Spanish). ANUIES is the association that recommends the trends for higher education in the country. In 1999 the higher education system was formed by 1250 institutions from which 515 where public institutions and the rest private institutions (see graph 1), and the number of students enrolled for the year 1999 was 1,837,884 (ANUIES, 2000).

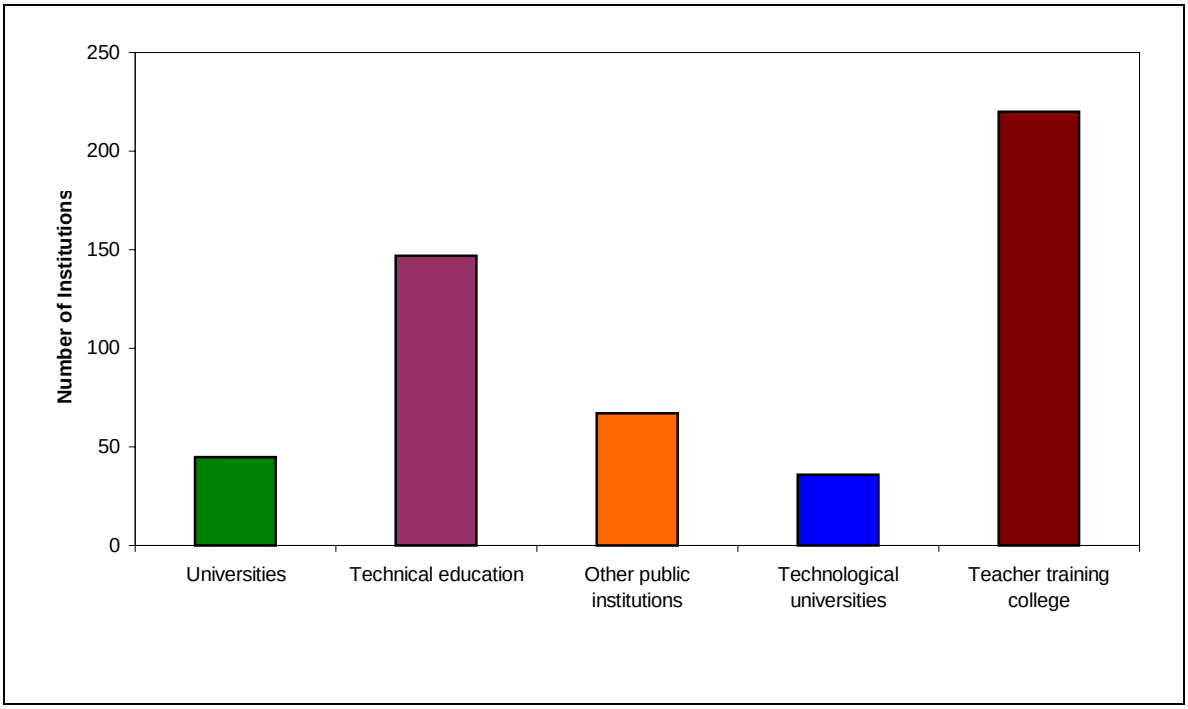
Graphic 1 Number of Higher Education Institutions in Mexico by type of ownership



Public HEI integrate diverse subsystems including: 45 public universities; 147 institutions of technological education; 67 public institutions that are part of the Ministry of Education and other Ministries; 36 technological universities[1], created by the Mexican government early 90s, and 220 technical teaching colleges (see Graphic 2).

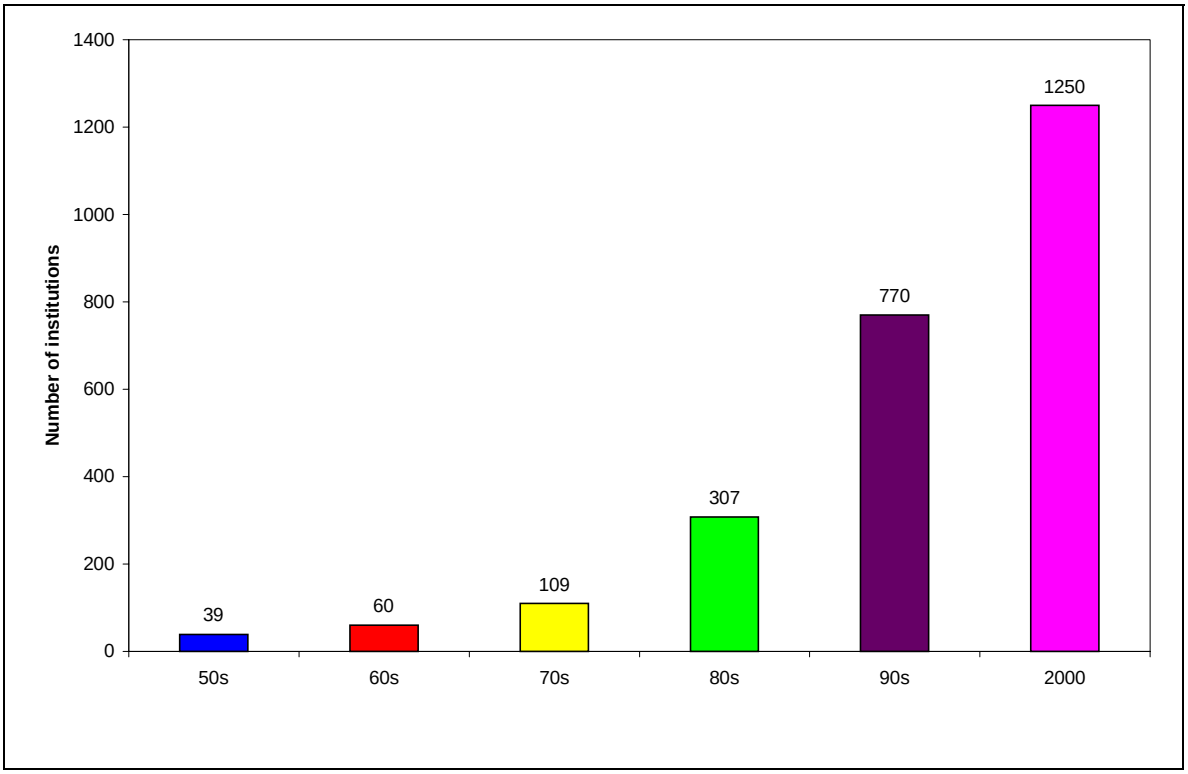
[1] In 2000, the number of technical universities increased to 38 institutions (ANUIES, 2000)

Graphic 2 Number of Public Institutions in Mexico by type of structure



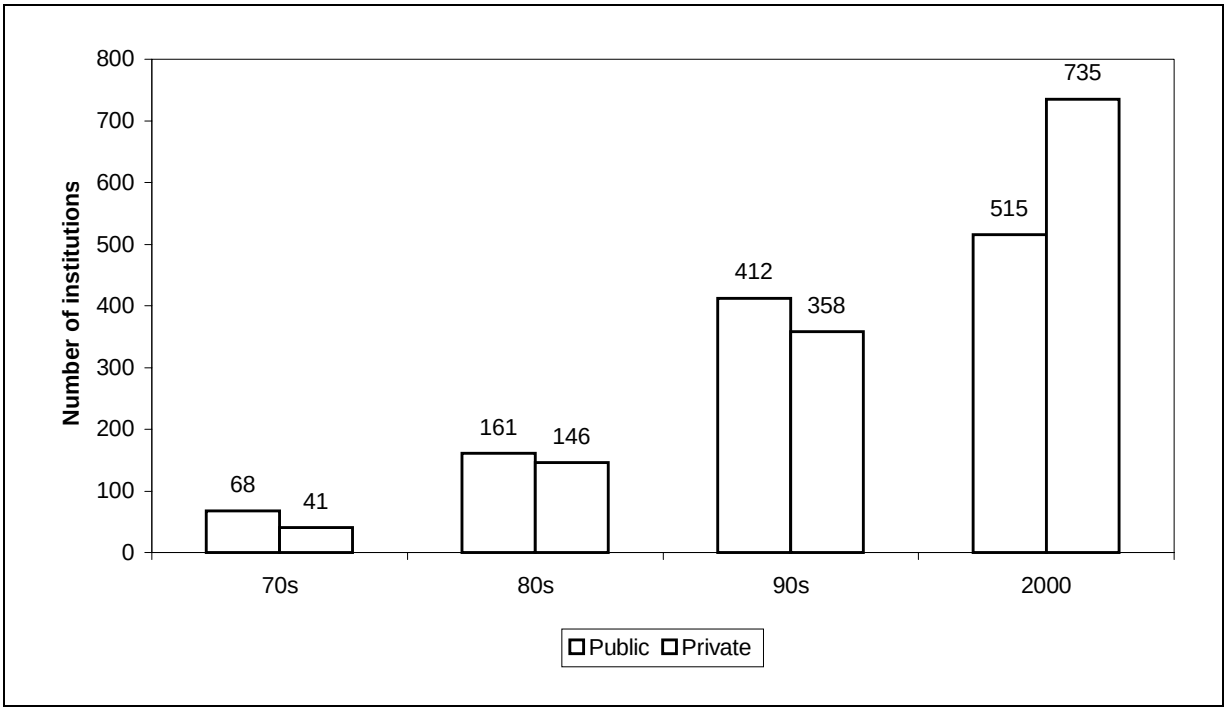
The evolution of higher education institutions in Mexico shows a growing pattern passing from 39 in the 50s to 1250 at the end of the 90s (see Graphic 3). From the decade of the seventies to the decade of the eighties the number of higher institutions almost triplicated passing from 109 to 307. During such a period the Mexican government promoted the formation of institutions aiming to descentralise the largest university The Universidad Nacional Autonoma de Mexico (UNAM for its acronym in Spanish).

Graphic 3 Evolution on the number of higher education institutions in Mexico



Comparing the number of private and public HEIs, one can appreciate that it was during the decade of the nineties when the number of private institutions became more important in number than public institutions (see Graphic 4).

Graphic 4 Evolution of public and private HEI in Mexico



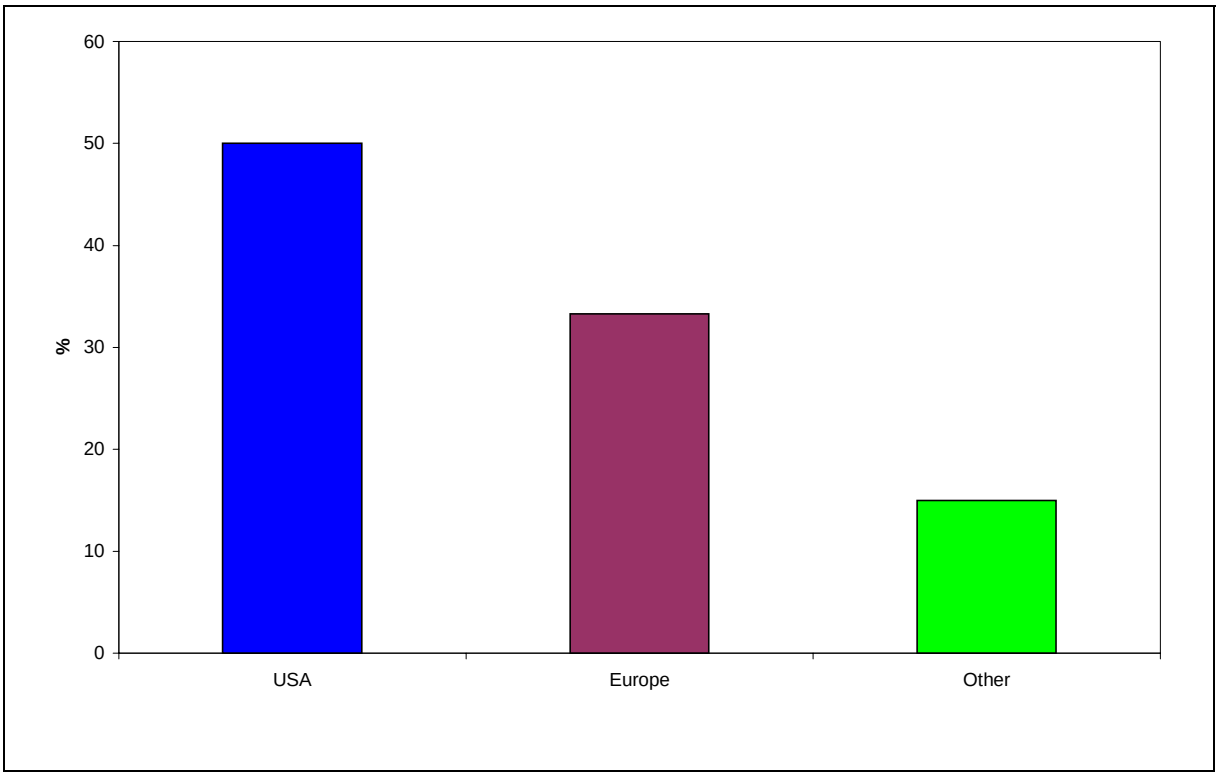
Based on the UNESCO 1998 World Conference on Higher Education, ANUIES published early 2000 the "Strategic Lines for the Development of Higher Education in the XXI Century" in which, the higher education system for the year 2020 is proposed. In such a system, higher education institutions (HEI) would be characterised by being oriented towards the establishment of collaborative agreements under the form of network with diverse national and international institutions.

The establishment of networks will replace the traditional 'going alone' strategy for a more competitive strategy aiming to make a better use of the existing resources, considering the comparative and competitive advantages of the institutions.

ANUIES posits that the benefits of collaboration for HEI include: updating of programmes, innovation in the teaching process, students' stage in the industry, creation of new sources of funding, introduction of new careers and/or research fields, and in general the greater presence of the institution in its community (ANUIES, 2000). The benefits for production organisations include: innovation in processes and products, cost reduction, sales increase, and new export markets (ANUIES, 2000).

International collaboration is also important for ANUIES. Traditionally Mexican HEI have established links with American universities. Recent figures (ANUIES, 2000) show that approximately 50% of institutions collaborate with American institutions; one third of them collaborate with European organisations (UK, France and Spain basically) and 15% of them establish collaborative agreements with Latin American institutions (see Graphic 5). American universities are also the major recipients of Mexican postgraduate students, followed by UK, Spain, France and Canada.

Graphic 5 International Collaboration of Mexican HEI.



The case of UAM

The *Universidad Autonoma Metropolitana* (UAM) was established in Mexico City in 1973 (UAM, 1992). UAM integrates three different and independent Units (campuses): Azcapotzalco, Iztapalapa and Xochimilco. Each Unit is in charge of their own programs, the development of research projects and the diffusion of research results. UAM has a Rector General that coordinates the activities of the whole

university. According to Luna (1997), UAM is the second largest university in Mexico.

As a public university UAM receives most of its budget from public funding and the interaction with particulars has always been difficult basically due to the opposition of the academic community to establish such kind of links. However, the globalisation of the economy has forced UAM to promote collaboration in two different levels, internally, supporting relationships within its Units, and externally, endorsing collaborative agreements with other organisations. Collaboration within the UAM takes place in different ways, been the most important the PhD program on Economics that is coordinated by all three Units. However, in our paper we will focus on UAM external relations, in particular we will concentrate in two areas that have been having greater importance for UAM authorities: collaborative agreements with other organisations and the information system.

Collaboration between UAM and other organisations

Traditionally UAM has not been linked to private funding, however, at the end of the decade of the eighties that UAM started to establish closer relationships with private sector. The first agreement with a private organisation was signed in 1988 after a series of contacts that started early 80s (Luna, 1997). Currently, UAM receives a considerable amount of private funding from divers organizations. The following table presents UAM's most important funding organisations.

National Public Funding Organisations	National Private Funding Organisations	International Funding Organisations
• Banco de México • Bolsa Mexicana de Valores • Comision Nacional de Valores • Consejo Nacional de Ciencia y Tecnología • Consejo Nacional para la Cultura y las Artes • Departamento del Distrito Federal • Instituto de Investigaciones Electricas • Instituto Mexicano del Petroleo • Instituto Nacional de Ecología	• Agua Sistemas • Asociación de Empresarios de Iztapalapa • Banco del Atlántico • Celanese Mexicana • Cooperativa Pascual • Condumex • Cydsa • Embotelladora Mexicana • Fundación Bancomer • Gohner de México • lndustrializadora de Leche El Sauz • Industrializadora de Leche La Caperucita • Laboratorios Columbia	• Agencia Japonesa de Cooperación Internacional • Banco Centroamericano de Integración Económica • Banco Interamericano de Desarrollo • Consejo Británico • Fundación Ford • Fundación Friederich Ebert • Fundación Hewlett Packard • Fundación Internacional para la Ciencia • Fundación Rockefeller • Fundación W. K. Keilogg • Fundación William and Flora Hewlett

• Petroleos Mexicanos • Secretaria de Desarrollo Social • Secretaria de Educación Publica • Secretaria de Relaciones Exteriores • Secretaria del Medio Ambiente, Recursos Naturales y Pesca • Secretaria del Trabajo y Previsión Social • Sistema de Transporte Colectivo Metropolitano	• Laboratorios Imperiales • Nacobre • Negromex • Panificadora Bimbo • Productos Marinela • Resistol • Richardson Vicks • Schrader Bellows Parker	• Instituto Francés de América Latina • Instituto Francés de Investigación Científica para el Desarrollo • Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura Organización de los Estados Americanos • Servicio Canadiense para la Vida Salvaje

Since then, UAM has been active in obtaining external support. It is in this way that external funding has passed from $202,000 for 1994; $40,000,000 for 1995 and $115 million pesos for 1999 (UAM, 1999). It is important to mention that such amounts does not consider inflation and devaluations, but in any case they show and important path to the opening of the university to private funding.

At the teaching level, UAM has also diverse collaborative agreements allowing academic staff and students to be involved with international institutions. Currently, from the 51 postgraduate programs that UAM teaches, nine of them are establish in collaboration with overseas universities (UAM, 1999).

Information System

The development and penetration of Information Technologies (IT)[2] has certainly contributed towards the capacity for interaction between small and medium-sized businesses as well as with large companies. (Castells, 1996)

Following Castells (1996), the impact that those technologies have had in organisations is due to the features that constitute the paradigm of Information Technologies that has the following characteristics: their raw material is information itself, this is a fundamental part of any process –individual or collective- that has allowed them to have a great effect and penetration in all organisations. Another

[2] Information technologies can be defined as the mixture between telecommunications, computer science and electronics. This new field of knowledge involves everything that has to do with hardware, software and the exchange of digital information. The object of these tools is being able to create, process and transmit information, aimed at better decision making. (Nora, 1997 y Castels,1996).

important factor is the disposition of the information network[3] these technologies use as a structure for their interconnection; with the use of information technologies of recent appearance this type of configuration can be installed in any type of process and organisation. The adaptive capability and flexibility that can be obtained with these kind of developments, which allows joining dynamic organisations that change according to their own needs as adjustments, innovations and alternative products (that can be modified and used as the company decides) appear, is also noteworthy. The last characteristic refers to the concurrence of specific technologies in a system that is becoming more and more integrated so that telecommunications, microelectronics and computers are now integrated into Information Systems.

The progress in Wide Area Networks (WAN) also allowed for the surge of totally interactive information processes for management, production and distribution, giving place to the simultaneous collaboration between several institutions, firms or organisations. In fact, interconnection is the new form of global economy competition.

Due to the fact that today information has become an essential administrative resource, Information Systems (IS) are of such relevance in any organisation that they affect all levels of activity including operational, production and management (Kendall, 1977). They also represent an important factor in organisation's operational effectiveness, as well as in employee productivity and client services. Information Systems are the source for data and support; they are indispensable for efficient decision-making and can become an important ingredient in the development of competitive products and services, generating strategic advantages in the market (Senn, 1990).

An IS can be defined as a group of people, procedures and resources that gather, transmit and spread information in an organisation. Nowadays, they use resources such as hardware, software and personnel to introduce, process, obtain, store and

[3] A network can be defined as the interconnection between two or more computer equipments, enabling users to communicate and exchange information and share resources. A Local Area Network (LAN) is that in which computers are plugged into directly, normally by means of a cable. When one

control activities that transform the initial data into productive information. In an IS, the main resources needed for carrying out the data processing activities for the information systems are data, hardware, software and personnel (Lucas, 1990).

The development and application of this type of system in organisations such as Universities has become necessary to be competitive. ANUIES considered also the importance of such systems that, pointed out the creation of the *Sistema de Información Nacional* (National Information System NIS)[4] as one of the programs for the *Sistema Nacional de Educación Superior* (National System for Higher Education) (ANUIES, 2000).

NIS' objective is to "provide those decision makers and studies performers in the field of higher education in Mexico with an efficient mean to support their tasks, through an authentic National Information System for Higher Education (SNIES for its acronym is Spanish) that arranges for the necessary qualitative and quantitative information, and for it to be trustworthy, solid and up to date" (ANUIES, 2000). For 2002, public universities are expected to put their integral information systems into operation, within the framework of PRONAD (*Programa de Normalización Administrativa*; Program for Administrative Normalization) and by the year 2006, IES will have integral information systems that will allow for the comparison between institutional indicators and information of common interest such as facts about the graduates, faculty, administrative personnel, etc.

ANUIES's strategies include the support of institutions towards the integration, development, consolidation and -if that is the case- towards the creation of their own information systems. It will focus its efforts specifically on the improvement of statistics at an institutional level, promoting the development of computerized systems and telecommunications and establishing training programs for personnel in charge of handling and analysing such information.

LAN is connected to others, a Wide Area Network (WAN) is created. Most of these extended area networks are joined by means of telephone lines and satellite links. (McLeod, 2000)

[4] Which does not yet exist because all facts related to the IES are gathered from different sources such as the ANUIES, the SEP, CONACYT, INEGI, and IES itself.

Evidently, part of these system's objectives is that they be open and work in the global telecommunications networks so that this type of information technology can be properly exploited and for IES to have a stronger interrelation.

The UAM has slowly but surely been growing in the development of its own Information Systems as well as in the consolidation of its computer infrastructure. Without a doubt, this last is due to the progress in telecommunication networks, which has also pushed the development of computer applications and has increased communication within the company and especially towards the outside.

The appearance of Internet has greatly contributed towards the opening of all organisations and the University is no exception. At the beginning of the 1980's the first wide network, denominated TeleUAM, was established. It was used mainly for administrative processes and research projects. By the end of the decade, local networks were built for each Unit in order to share computer resources with each other and with the rector's office.

At the beginning of the nineties, UAM got connected to the Internet and the local networks, as well as TeleUAM, began to grow in such a way that early November 2000 UAM had to be enlarged in order to effectively handle the more than 6000 nodes TeleUAM has currently.

The advantages that come with this kind of technology, such as cost reduction, more efficient forms of operation, easy distribution of information, e-mail, immediate communication with other colleagues, etc. have greatly benefited, reinforced and rocketed the links outside the UAM. The University hasn't stopped investing in resources for the enlargement of its internal network, enabling communication within and outside of the institution to be carried out through these processes more and more each day.

According to its own needs and depending on its own hardware, software economic and human resources, each Unit has decided to create its own Information System. It has also given it the necessary maintenance and has upgraded and renewed it. Most of the Information Systems that have been developed are oriented mainly towards the

coordination and organisation of each Unit. But also carry out other functions within each Unit and, in particular, some academics develop their own systems that comply with very specific functions.

Thus, for example, the Iztapalapa campus has:

- Its own Administrative Control System that is in charge of handling administrative documents and data pertaining to budget control (that may be programmed) originating from the inside as well as from outside (CONACYT). This system processes information related to budget control, cashier, supplies, sponsor agreements, warehouse and document management (notes, invoices, requisitions, etc.)[5].
- An Information System for the Library. Its main objective is to run the Library in regards to the processes and administrative services pertaining this Unit's material. [6]
- A System for School Control that carries out every process related to student's academic history, Teaching/Learning programs and study programs for undergraduate and graduate courses. All management of school processes such as first time enrolment; enrolment, subject changes, roll reports, deed reports, etc. are carried out through this system.
- A set of Documentation Centres***:*** *Centro de Documentación Económica y Financiera sobre Norteamérica (CEDEFNA), Centro de Estadística y Documentación Electoral (CEDE), Centro de Documentación de Literatura Hispanoamericana "Alfonso Reyes", Centro de Información en Filosofía latinoamericana e Ibérica, Red de Información Rural, Centro de Documentación de Ecosistemas litorales Mexicanos, etc.* Their objective is to build a nucleus of documental material related to a specific subject so that those interested can consult them. Most of these information centers constitute an effort by groups of teachers from the same Unit and, in some cases like the *CEDE*, by other institutions of higher learning -both foreign and domestic- like the University of California at San Diego, *UAEM*, *Colegio de Michoacán*, *Fondo Nuevo Milenio*,

[5] Information provided by the Coordination for Administrative Services and the Computer Services Coordination.

Instituto Mora, *Tribunal Electoral del Poder Judicial de la Federación*, *ITAM*, *Colegio de México*, and by government entities such as political parties, other electoral entities and Non-Governmental Organisations.

Within UAM, the most important information system is the ***Sistema de Información Integral de la Universidad Autónoma Metropolitana*** **SIIUAM** (UAM's Integral Information System) which main objective is to meet all UAM information requirements. The system is integrated by four subsystems:[7]

- School Administration
- Financial Resources
- Human Resources
- Academic Administration

The School Administration subsystem was totally finished in October 1998 and works based on the information supplied by the Information Systems of each Unit. The main duties of the system include:

- Carrying-out the registration process of new applicants in a secure manner (registration with photographs)
- Enrolment process/on-line enrolment, indicating the amount due
- Enrolment process/ by automatic on-line assignation (Xochimilco)
- Enrolment process/Graduate School
- Term statistics
- Modifications to the study programs at any given moment
- Generating a certificate of every student history
- Automatic student drop-out process (regulation)
- Several records reports
- Interfacing with other modules: foreign languages, computer lab, social service, kiosks, etc.
- High-level security due to user control, registration of movements made by users, registration and reports of access to systems and movements made by users

[6] Information provided by the Chief Project at the Coordination for Document services.

The subsystem for Financial Resources (97% developed) also uses information supplied by every Unit and carries-out these tasks:

- Control of all the information that has to do with the budget, considering all organic levels of responsibility including specific projects. This information is sorted out into the four institutional programs and by budget estimates, according to the University's programmatic structure.
- Registration and application of assigned budget
- It controls the figures of adjustments, transference, engagements, acquisitions, orders, entry notes, exit vouchers, policies, etc.
- Unification of bookkeeping and budget items
- Daily financial reports
- It insures the timely and correct fulfilment of the institution's financial obligations

The Human Resources subsystem (68% developed) carries out these tasks:

- It generates information on the posts and the budget they require
- Decentralization of procedures
- It generates the registration of each employee's history (which allows for the generation and completion of procedures for obtaining leaves of absence, sabbaticals, settlements, recognition of seniority, etc.)
- Develops projections about the behaviour of earnings and deductions
- Controls movements of active personnel (transactions)
- Controls permits, leaves of absence and sabbaticals
- Integrates all movements that originate payment (pay sheet)
- Controls all scholarships and academic stimuli
- Controls employee benefits and services
- Verifies and certifies worker related certificates
- Generates administrative stimuli
- Provides reports and statistics

The Academic Administration subsystem is the least developed (around 27%) and its purpose is:

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[7] Information provided by UAM deputy-director, Administrative Computer Sciences

- To handle information related to academic personnel (courses taught, grants, etc.)
- To support the commission's report for assigning productivity points to faculty members (seeking promotion, scholarships for the support of permanence, stimuli for teaching and research, stimuli for outstanding academic career)

The object of this System has been to unify all the information generated by each Unit for a better processing management of all of the institution's needs. It has constituted an enormous effort due to the multiplicity of forms and data generated. However, at this time the SIIUAM works on-line from every Unit and consultations and reports can be made immediately from anywhere inside the University. We have set the medium-term goal of completing all the modules that the subsystems are missing as well as operating through an Intranet.

The least developed module is Academic Administration. It will be created based on Web technology so that, by means of hypertext and the University network, the caption, processes, consultations and reports will be simple and will serve as a support tool for administrative personnel and teachers.

The development of SIIUAM is in accordance with the politics proposed by ANUIES, and surely, the information generated in every one of the modules will form a part of the *Sistema Nacional de Información* since it deals with relevant facts for those who make decisions and will help those who wish to carry out studies in the field of Higher Education. It is also an efficient method for implementing all negotiations within the University, under the lineaments established by PRONAD.

Regarding the relationship of the IS and their links with other institutions, there now exists a project called Internet 2 that has joined several institutions like Universities, Government Offices and private companies in order to develop technology and advanced network applications. This project began in 1996 with a network of 34 Universities in the U.S. and now has 150 Universities from that country collaborating with government and industry, thus conforming the University Corporation for Advanced Internet Development (UCAID).

In Mexico, the question of creating a network similar to UCAID was posed. It would have the objective of promoting and coordinating the development and broadcasting of advanced technology applications for computer and telecommunication networks in Mexico, focusing on scientific and educational development. In 1999 the University Corporation for the Development of Internet (CUDI) or Internet2, was made official[8]. It is formed by:

ACADEMIC ASSOCIATES	**AFFILIATES**	**INSTITUTIONAL ASSOCIATES**
• Universidad Autónoma Metropolitana (UAM) • Instituto Politécnico Nacional (IPN) • Universidad Nacional Autónoma de México (UNAM) • Universidad de Guadalajara (UDG) • Instituto Tecnológico de Estudios Superiores de Monterrey (ITESM) • Universidad de la Américas Puebla (UDLAP) • CONACYT • COMISION FEDERAL DE TELECOMUNICA-CIONES	▪ Centro de Investigación Científica de Educación Superior de Ensenada (CICESE) ▪ Instituto Tecnológico Autónomo de México (ITAM) ▪ Universidad Anáhuac del Sur (UAS) ▪ Universidad Autónoma de Chihuahua (UACH) ▪ Universidad Autónoma de Coahuila (UACoah) ▪ Universidad Autónoma de Colima (UACol) ▪ Universidad Autónoma de Tamaulipas (UAT) ▪ Universidad del Valle de México (UVM) ▪ Universidad Iberoamericana (UIA) ▪ Universidad Tecnológica de México (UTM)	▪ TELMEX ▪ Asociación Hispanoaméricana de Centros de Investigación y Empresas de Telecomunicaciones (AHICIET) of Spain

The advantages of this project include:

- Great Band Width
- Quality of Service
- Priority for Video Transference
- Multicast Transmission
- Low Latency/Low Jitter
- Higher Security, Privacy and Reliability

Some of the applications that can be developed in Internet 2 include:

- Distant education
- Digital libraries
- Tele-medicine
- Supercomputing
- Geographical Information Systems
- Weather Prediction Systems

[8] Information provided by the Administrative Computer Sciences Department, UAM

Some of the examples of these applications include:

- **Distributed Nano Manipulator** developed by the University of North Carolina
- **Regional Prediction System** developed by the University of Oklahoma
- **Massively parallel interactive rendering environment (human body interactive looks)** developed by the Centre for Supercomputers of San Diego
- **Distributed process for geographic information analysis** developed by the Massachusetts Institute of Technology
- **Reovirus simulation** by virtual reality through the web, developed by the University of Calgary
- **Distributed processing laboratory** in University of Cincinnati

With projects such as Internet 2, UAM's links towards the outside gain potential. However, the computer network and telecommunications fields are scarcely exploited by the University. With theses types of technologies a great amount of multidisciplinary projects will be established with colleagues from other countries, long-distance education programs, teleconferences (already available), distance techniques and practices, etc.

Conclusions

Mexican higher education institutions have been working as closed systems without having contact with their environment. Recently some of the largest organizations have started opening their doors to private funding. In this paper we reviewed the public policy of higher education in Mexico through ANUIES, and in particular we presented the case of the Universidad Autonoma Metropolitana.

It was only in 2000 when ANUIES presented a set of guidelines aiming to promote collaboration in higher education institutions, both national and international. The induction of collaboration in higher education in Mexico is very recent and according to the plans presented for ANUIES, the initial outcomes of the guidelines are expected by the end of 2002 and the final results for 2020.

However, the level of development of the different institutions that form the Higher Education System in Mexico have made the process difficult. While some of the largest institutions have already links and establish collaboration with other institutions, and have developed information systems in place, their exist other institutions that are starting to know the idea of collaboration and networking.

The lack of understanding of the benefits and commitments of collaboration has not yet been clear for HEI. A lot of effort has to be put in order to take advantage of the resources already existing and to face the challenges of the new competition.

In the case of UAM, there are some agreements within Units, however the level of achievement is very poor compared to the potentialities existing in each campus. Authorities have to promote closer relationships between academic and student corps to achieve greater levels of collaboration.

If it is true that the University as a whole and within every Unit is open to other institutions by means of agreements, the work carried out in the field of Computer Sciences has been conducted internally.

Regarding the relationship between the IS and the outside world, there is still plenty to be done since up till now the University only has an information Web Page. This means that no operations or transactions can be made and no questions can be asked through the Internet.

Because at this day and age many of the efforts towards the development of IS are individual (carried out by each Unit) it is necessary for the University to establish general outlines for the creation of new Information Systems. This will benefit their management, coordination and control. Then, every process carried out by students, faculty members, administrative personnel and authorities will be easier, immediate and cost effective.

As stated in the article, every organisation requires IS nowadays because they can be of support for the analysis and development of decision-making models, for the execution of computerized processes, as a way of making external and internal

communication easier, for the sale of goods and/or services, etc. From any point of view, information is tightly bound with management because it directly influences all activities within an organisation, including productive and operational ones, as well as those pertaining the administrative offices.

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