

# **SCIENTIFIC INFORMATION**

## **CAN BE AN UNDER-USED COMMODITY:**

### **The Mexican case**

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by

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### **ABSTRACT**

Scientific and technical information (S&T) is a must for the development of any country. However, S&T information is not an easy product to digest for countries which lack scientific development. The main limitations are social barriers, such as the lack of a research culture, poor reading habits, a low level of education and poor information dissemination infra-structure. These factors inhibit S&T information use more than the economic ones in middle income countries. This paper discusses the social barriers that limit S&T information use in Mexico. Among such barriers are: nationalism, oral culture, and the non-research oriented educational system.

## 1. INTRODUCTION

Information is an objective medium to transport knowledge, rather than a physical property of matter. However, information can be acquired or transformed into knowledge only through the subjective channels of communication. Channels of communication permeate the use of information. Along with social attitudes and the previous knowledge of the author, "the recipient and any intermediaries need to be accounted for if the communication..." of information is to be optimally effective [2]. In addition, the recipient's knowledge and his social interactions delineate the way information is acquired, disseminated and used in society, such as beliefs, social customs and socioeconomic status. In this paper, information transfer and diffusion of ideas is analyzed, taking into account only social barriers which affect the use of scientific and technical (S&T) information in Mexico. The social barriers discussed are nationalism, oral culture and education, including in this section, the role that academic libraries play in the dissemination of information. The term scientific information is used in the title of the paper as a synonym of the phrase scientific and technical information.

Although information comes predominantly in print and in electronic media, it takes different formats requiring a myriad of technologies to reach potential users, such as "digitally encoded material transmitted along wires, broadcasted from ground stations or transmitted using satellites [2]." In this document, the channels of communication discussed are a) education, as an information intermediary in the S&T information cycle, and b) libraries which are regarded as centers for the diffusion of information.

## 2. ECONOMIC BARRIERS

Societies have to be open to new ideas in order to achieve socio-economic progress, a fact that becomes more important to less developed countries (LDC), since they need to close the socioeconomic gap that exists with industrialized nations. It is also recognized that scientific information has no boundaries, unlike technical information. However, there are two kinds of barriers for both types of information: economic and social [9]. The economic barriers are important in the sense that a country

with limited sources will struggle to fund public education, state universities, telecommunications and S&T information. This infrastructure limits, on the other hand, the capability of a nation to benefit from the world's scientific knowledge (See Table 1).

However, LDCs which are in the middle economic tier classified by the World Bank as middle income countries (MIC), where Mexico falls, have the economic resources to acquire S&T information. Nonetheless, most of them fail to benefit in the full sense of the world's S&T advances, due to social barriers, such as religion, management attitudes, social beliefs and a limited educational background. Mexico is no exception, as it must face most of these social barriers to fully benefit from S&T information.

Table 1

<b>ECONOMIC BARRIERS GENERATE:</b>
<ul style="list-style-type: none"> <li>- Fewer S&amp;T libraries</li> <li>- Less national academic or scientific journals</li> <li>- Lower publishing output</li> <li>- Smaller library budgets</li> <li>- Poorer telecommunication services</li> <li>- Limited social development, such as education and S&amp;T research</li> </ul>

### **3. NATIONALISM**

Mexico faces the challenge of closing the socio-economic gap with scientifically developed countries, but social attitudes like nationalism have widened this gap up to recent years. Mexico borders the US, the leading nation in S&T generation. However, Mexican nationalistic inward-looking education policies, in existence since 1910, have tended to isolate the country from international scientific activity. Universities were historically reluctant to have academic exchange agreements with their US counterparts, and the English language was seen as a change agent to alter Mexican culture. Most Mexican state universities seldom promoted student/faculty exchange with North American institutions, and English language courses were rarely part of undergraduate programs. Universities did have language centers, but they were for those students who willingly wanted to learn a

foreign language. This contrasts with the attitude in countries, like China, a communist nation, where 250 million Chinese study English, "more than the entire population of the US." [8].

It must be said, that the number of book translations in Spanish speaking countries, which is a large world community, meet to a certain degree the demand of the Mexican educational sector, but translations lag behind in at least two to five years. This translation delay obviously affects S&T education because of rapid scientific changes.

As stated, Mexican nationalism has isolated higher education from the international world, specially from the US, a policy which did not comply with Mexico's increasing trade ties with the northern neighbors. However, Mexico's new free trade policies are changing this attitude, specially with the signing of the North American Free Trade Agreement (NAFTA). Now, many universities are looking for academic liaisons with North American universities, and English is becoming part of the curricula of undergraduate studies. A couple of Mexican states are even planning to include English as a school subject in elementary level.

Private universities are also taking the lead in this change. Universities with high school level training offer bilingual programs, such as ITESM that has plans to teach 30% of undergraduate subjects in English by 1995.

Nationalism at university programs has certainly been a barrier for S&T information in Mexico since the 1910 revolution. Presently, most Mexican graduates have to make greater efforts to access scientific information, because they did not have the opportunity to learn English. This is a major limitation since most of the scientific literature is published in English. In addition, it is the common language for fields like computing, diplomacy, tourism and S&T related subjects (See Table 2).

Table 2

<b>NATIONALISM</b>
<ul style="list-style-type: none"> <li>- Nationalism considered English as a channel to alter local culture</li> <li>- Universities refused contacts with US counterparts</li> <li>- Spanish speaking countries are a large world community</li> <li>- Mexico's education relies on translation of S&amp;T publications</li> <li>- Translations lag behind at least 2-5 years</li> <li>- Most universities fail to be part of the world research stream</li> <li>- Lecturers and students fail to speak a foreign language</li> </ul>

#### **4. ORAL CULTURE**

S&T information diffusion is also limited by the oral culture of the country. The population, in general, relies more on information transmitted by pals and acquaintances, rather than on printed information. It is common to see people next to a phone book in offices asking their colleagues for unknown phone numbers, even if these colleagues are farther away than the phone directory. Another example is when people leave messages, they usually leave an oral message, instead of a written note. This oral culture is reflected in people's attitudes at academic or business sectors, where they use little printed or electronic information to make their decisions. Dialog, the major online database vendor, has only 750 customers [11], when, as stated before, 24 million Mexicans go to school [3] and there are nearly 149,192 businesses of all sizes in the country [10].

Table 3

<b>ORAL CULTURE</b>
<ul style="list-style-type: none"> <li>- Writing abilities are limited</li> <li>- Reading is also limited - 2% buy books</li> <li>- Decision making tends to be based on oral information</li> <li>- This culture limits diffusion of technical advances</li> <li>- S&amp;T printed material becomes a black box if reading is poor</li> <li>- Foreign books are expensive and difficult to acquire</li> </ul>

S&T information cannot be transmitted if the population tends to

rely on oral information sources and regards printed information as a "black box". For instance, despite the large number of Mexicans who study, there are just over 500 bookstores all over the country. [4]. It must be pointed out, however, that the average citizen has a low income and cannot afford buying national books not to mention foreign books, which are expensive and difficult to acquire (See Table 3).

## 5. THE EDUCATIONAL SYSTEM

Mexico's greatest efforts to educate its growing population dates from the 1960's. Since this period, the country has devoted between 4 to 5% of its GNP (5.3 in 1993) to fund education [7]. However, higher education has been devoted to the kind of teaching, where research has not had a proper place.

Table 4

EDUCATION BARRIERS
<ul style="list-style-type: none"> <li>- Textbook based education</li> <li>- Complementary literature is ignored</li> <li>- Students' poor reading habits</li> <li>- Professors do not do research</li> <li>- Lack command of a foreign language</li> <li>- Education basically has a training pursuit</li> <li>- Teaching is the basic priority</li> <li>- Most education officials ignore what research is</li> <li>- Ph.D. programs are just emerging</li> <li>- Engineering school are three to four decades old</li> </ul>

Lecturers have a heavy teaching load between 15-25 hours of classroom work per week, which comprises from five to six courses. Most of the teaching staff have only a bachelor's degree (See Table 4). They lack command of a foreign language and have little or no research experience. Lecturers become parrots, repeating information or knowledge generated by others, usually authors from abroad [6].

## 6. RESEARCH

Countries that produce S&T information are also more capable of using and exploiting this information, while countries with little or no research activity are less prone to benefit from S&T information [5]. Sources of scientific and technical information are research organizations and universities, an old domain of industrialized nations, and a trend partially emulated by countries like Mexico since the 17th century, where higher education really spread until the 1960's. The first technological institutes/ polytechnics were, on the other hand, founded in the late 1940's.

There are 390 [7] Mexican universities, technological institutes and other higher education institutions, with an estimated faculty of 126,000 [12]. This academic staff's endeavor is teaching but seldom research. In Mexican parlance, there is even a great difference between a lecturer and one who also does research, who is referred to as a "Lecturer-Researcher". The National System of Researchers (SNI) founded in 1985, a Mexican organization financed by the federal government to promote research through monthly salary grants to researchers according to their output, recognizes 3,959 researchers, plus 2,274 research candidates, usually young professionals in the process of studying a Ph.D. [1]. If both figures are compared to the total number of lecturers in the country there are only five SNI recognized researchers for every 1,000 university lecturers, a percentage which is rather small. Moreover, the number of Mexican researchers, as a ratio of every 10,000 people at working age, is of only nine researchers, while in the US, it is of 122 [1].

If research activity is low in academic institutions, then scientific publishing tends also to be low. Mexican contribution to journal publishing is negligible if compared to the world's output. The total output of papers published in journals scanned by the Science Citation Index numbered 1,256 in 1990 [1]. Mexico together with the 19 Spanish speaking nations of Latin America published, according to the same Index, 9,889 scientific papers which is about 1% of all the annual publications edited worldwide in 1991. However, it has to be recognized that along with Mexico, Brazil, Argentina, Chile and Paraguay contributed nearly 90% of the scientific publishing output in the region during the same year [13].

Since the faculty seldom publishes, some Mexican scientific journals struggle to find articles to keep publications running. There are just 1,084 S&T journals with the International Standard Serial Number (ISSN) in the country [1]. There are lecturers that work all their life teaching, but reach retirement without having published a single paper. This fact yields many negative consequences for the nation, where even university textbooks have to be imported from the developed world. Students are not motivated to do research since their professors ignore the methodology. They become recipients of scientific information already digested by at least two players: the textbook author and the professor [5].

Table 5

<b>BASIC FACTS OF MEXICAN S&amp;T ACTIVITIES</b>	
390 -	Higher education institutions
126,000 -	Lecturers/professors
3,959 -	SNI researchers
2,274 -	SNI junior researchers
5 -	There are 5 SNI researchers for every 1,000 lecturers
1985 -	National System of Researchers is founded
1,084 -	Total number of science and technology journals
0.35% -	GNP spent on science and technology activities
1,259 -	Papers included in the Science Citation Index in 1990

As a consequence, the lack of research at universities becomes a major barrier to the use of scientific information. Future graduates seldom have the opportunity to have access to primary information, such as research reports and scientific journals, since lecturers rarely engage in research activities. If anyone does carry out research, there is little encouragement to do it. Universities have received funds since 1990 from the Federal Government to provide economic stipends to lecturers who teach more subjects than the average. This economic reward certainly motivates professors to avoid doing research. In other words, Mexico's educational system is a major obstacle to the use and generation of scientific and technical information [3].

Government efforts to promote research with the creation of SNI, and the increased budgets of S&T activities (0.35% of GNP)



channeled through the National Council of Science and Technology [1] fail to achieve favorable results because of the present educational system (See Table 5).

## 7. ACADEMIC LIBRARIES

The country's effort to educate the population and to promote research is hindered by poor expenditure in libraries. This is due to the facts that courses are based on a single textbook, as well as the limited research activity of lecturers. Therefore, library collections, even at the university level, are integrated mostly by textbooks. In some cases, academic libraries seem to be a large reserve collection, where mostly tens of textbooks fill the shelves.

Table 6

ACADEMIC LIBRARIES
<ul style="list-style-type: none"> <li>- Collections are basically formed by textbooks</li> <li>- Complementary subject books are a second priority</li> <li>- Library budgets are limited</li> <li>- Donations are the main source of book collections</li> <li>- Subscriptions to journals are rare</li> </ul>

On the other hand, with some exceptions, libraries seldom have a regular budget, therefore, acquisitions are sporadic, and they are mainly donations. Periodicals are hard to find in most university libraries. If a country fails to have good academic library collections, it automatically denies access to the world's literature to its academic population, thus limiting the benefit that could be obtained from the scientific and technological knowledge of mankind (See Table 6).

## 8. CONCLUSIONS

Information transfer is mainly limited in Mexico by social barriers and secondarily by economic factors. The country has a middle income economy, and therefore, some resources to acquire foreign S&T information. However, social attitudes like oral tradition give less importance to printed information of all

kinds, which in turn includes S&T information. Nationalism is another social factor that has affected the use of S&T information, since the English language was seen, until recently, as a channel to alter Mexican culture. As a result, universities do not teach English as a school subject, thus limiting their graduates to have access to the international literature which is basically published in this lingua franca.

The higher educational system has also curbed the flow of S&T information. Teaching methods are based on textbooks and little importance is given to the use of complementary literature. Research has traditionally been absent from lecturers' duties. Fortunately, the new open trade economic policies of the country are now changing nationalism in regard to the teaching of the English language. The Mexican higher educational system has to train graduates in order to be capable of using S&T information. If the country reassess its educational methods, S&T information will not be an under-used commodity. Students will not only use S&T information but will potentially contribute to the generation of science and technology.

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