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Scientific journals in Latin America and the Open Access (OA)

Conference given at the regional seminar ICTP-UNACH-UNESCO "Science for development" (Ciencia para el desarrollo) November 4th, 2014

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THE WHY OF THE OPEN ACCESS MOVEMENT (OA)

The Open Access movement (OA), is a movement that occurred just over 10 years ago with the signing of the first declaration in Budapest, followed in 2003 by those in Bethesda and Berlin. The emergence of this movement in Europe and North America is mainly due to the increase in the cost of research journals, which suffered the brunt of "journal aggregator" companies that began to obtain ownership of multiple journals and hence acquire control and decision over their prices. This led academics, researchers and university libraries from the first world to have problems in acquiring them, since the cost of subscriptions multiplied exponentially.

This dramatic change was the main trigger of OA. Paradoxically, academics who protested first about this situation were from North America, as they lost access to journals or were asked to choose between a few titles and to sacrifice the rest. This led to a growing number of scholars who organized around the issue and made their voices heard.

However, the OA had its genesis since before the American discontent and can be found in the work of the pioneer Paul Ginsparg (1995), who created the arXiv system in 1991. He also created another very important open access system in the United States today called Medline, focusing on medicine. Their emergence was due to the National Institutes of Health (NIH), which began publishing in open access research articles and complete research journals in order to break the monopoly of commercial companies that controlled prices. The system Medline resulted in PubMed, which is also of great value and service, providing access to a wealth of scientific information openly and for free.

Figure 1. Origins of Open Access (OA)

THE WHY OF THE OA MOVEMENT	
Genesis	Budapest 2002-Bethesda 2003-Berlin 2003
Detonator	The costs of academic journals
Trigger	Chagrin of academics
Pioneers	arXiv 1991 - Medline 1997

SCIENTIFIC JOURNALS IN LATIN AMERICA

Today, Latin America has a large publishing base, specifically for periodicals. In this respect, one can observe a division into three categories according to their nature: research, professional and technical, and dissemination. There is a total of 18, 800 titles (according to the Directory Latindex, which has the most comprehensive data base in this field); however from this vast literature there are several thousand that are no longer current.

This information about our journals was unknown 20 years ago. It was not even known what was published in each of the countries, and much less about the quality of its contents. Later on I will delve into the control process of publications in Latin America.

The problem of instability of our magazines is reflected in the facts that of the more than 18,000, only 16,000 are actively published. Of these, 1,723 are published in Mexico and 634 in Central America. Of the 634 that are published in Central America in the catalog Latindex, where only appear journals that meet

certain criteria for editorial quality, there are only 151- a very low fraction. This means that the vast majority of magazines in Central America do not meet minimum quality criteria which puts them in a very weak position by not complying with the minimum frequency for publishing, nor do they have established editorial boards or any type of arbitration system which causes the most worrying aspect of all: the quality of the content is questionable and the magazine lives in a vicious circle in which materials are not worthwhile, nobody reads them, and nobody supports them but they continue to exist.

In Mexico there are 750 titles in the Latindex catalog, the same catalog that is used as a base by several agencies including the National Council of Science and Technology (CONACyT) to decide which magazines deserve some type of additional institutional support. Thus, the journals included in the register of CONACyT are magazines that were previously recorded in the Latindex catalog.

This paper presents figures from the end of 2014, taken directly from the Latindex website. Is important to note that these figures change almost daily. Another change worth mentioning is due to the rise of digitization, there are currently 4,260 digital magazines in the 22 countries that are in the Latindex system, while 10 years ago there were only a couple dozen.

Regarding the ignorance about our own magazines that was discussed earlier, in contrast to the constant publishing in our region especially in the academic realm , a consequence is that we know little about the magazines and use them even less.

In response to this situation several important initiatives that can be framed within the Open Access movement, but are prior to the formal establishment of OA, have emerged. The first was the creation of Latindex in 1995, a Latin American magazine information system created due to the lack of information about Latin American magazines. There was only a superficial and very partial idea of publishing in the magazine world-an activity which, incidentally, should be known and appreciated as a an additional

task done by academics. This lack of recognition contributes to deepen the problems of our journals, which as was already stated are weak because most of the contributions, especially in the area of research, are submitted by authors to foreign magazines thus turning our back to our own means of publication.

Therefore as a resource that would allow us to understand a little better this panorama dichotomy of a divorce between mainstream journals published abroad and this great universe of journals published in our country, you would have to know first what you are editing and then introduce quality standards and support the publishers to improve their products. This is why Latindex was created.

In the same vein to regulate publications and give them more visibility, the SciELO system was subsequently created in Brazil. This system, now spread to several countries in the region, receives online journals in full text and provides access to them on a common platform. This procedure has become increasingly popular. There are now repositories to consult, no loose magazines, and complete collections of titles which obviously adds value to what is published.

Similarly, Redalyc was created in 2003 as a system that offered access to online journals, first in Social Sciences and Humanities. Today it has expanded its coverage from the point of view of disciplines, as well as from the geographical point of view and the services it offers. One aspect I want to emphasize is that the three initiatives (Latindex, SciElo and Redalyc) were born in the region not to emulate or imitate initiatives created elsewhere, or by any guidelines or instructions from other latitudes. They are strictly regional initiatives born in Latin America, and have even been expanded in various ways and is taken to be examples elsewhere by the success they have achieved.

Figure 2. Distribution of magazine publishing in Latin America

JOURNALS IN LATIN AMERICA & THE CARIBBEAN, CENTRAL AMERICA, AND MEXICO		
18,800	titles edited in Latin American & the Caribbean	
15,900	Are active	
	634 from Central America	**1723** from Mexico
5,080	Are in the Latindex Catalog	
	151 from Central America	**750** from Mexico
4,260	Are online magazines	
	255 from Central America	**570** from Mexico
IMPORTANT INITIATIVES OF OA		
LATINDEX 1995	SciELO 1997	Redalyc 2003

Fuente: Latindex, November 2014

MAGAZINES IN CHIAPAS

In this entity at least 22 magazines are edited according to the Latindex directory. In the tables in figures 3 and 4 various data are presented, specifically on the activity and the editorial staff of these journals based on information provided by the publishers themselves or published in the journals themselves. Of these 22 journals however, only a few are active: *Devenir, Eco-fronteras online; Espacio I+D Innovación más Desarrollo (*purely online magazine*), LiminaR, Quehacer Científico en Chiapas, Revista Paktal, Revista Tecnología digital and Staobill.*

Figure 3. Editorial Panorama in Chiapas (periodicals)

TÍTULO	STATUS	YEAR ESTABLISHED	TOPICS
Anuario IEI	Disc	1986	Anthropology, Sociology
Boca de Polén	Disc	1994	Multidisciplinary
Boletín de información. Centro de Inv. Ecol. del Sureste	Disc	1977	Ecology
Ciencia y tecnología en la frontera	Disc	2004	Local multidisciplinary studies
Cuadernos de arquitectura y urbanismo (Tuxtla Gtz)	Disc	1995	Architecture
Devenir	Active	2004	Social sciences and humanities
Ecofronteras en línea	Active	2013	Multidisciplinary
Econoticias	Disc	1977	Ecology
Espacio i+d. *Innovación más desarrollo*	Active	2012	Multidisciplinary
Fin de siglo	Disc	1994	Multidisciplinary
Lakamhá	Disc	2001	Archeology
LiminaR	Active	2003	Social sciences and humanities
Nop'Tik	Disc	1992	Linguistics, social sciences and humanities
Nuestro saber	Disc	1994	Multidisciplinary
Quehacer científico en Chiapas	Active	1998	Multidisciplinary
Revista CIHMECH	It ceased	1987	Social sciences and humanities
Revista de difusión científica-tecnológica y humanística	Disc	1990	Multidisciplinary

Revista de la Universidad Autónoma de Chiapas	Disc	1976	Multidisciplinary
Revista electrónica agroecología tropical	Disc	2002	Agronomy
Revista pakbal	Active	2002	Civil Engineering
Revista tecnología digital	Active	2011	Computer sciences, Administration, Accounting, Tourism
Staobíl lekilal ta lekil abtel	Active	2011	Computer Sciences

Fuente: Latindex, October 2014

Statistically, therefore, there is a great editorial instability: of 22 journals, only 8 are active. This problem is not unique to Chiapas, because although there are passionate people dedicated to publishing magazines, their work is not valued in general and therefore will not be supported nor taken into account in an academic evaluation.

An example of stability in Chiapas, among other publications, is the Journal *LiminaR* of the University of Science and Arts. This appears indexed in a large number of services, which not only recognizes the quality of the magazine, but also naturally helps its presence and prestige and influences those who are thinking of sending an article and looking for a place to publish to choose this magazine since being indexed ensures that the work will be publicized and therefore more appreciated.

Figura 4. Editorials and cataloging of Chiapas Journals

TITLE	EDITORIAL	INDEX/ SUMMARY IN	NAT.

Anuario IEI	UNACH, Instituto de Estudios Indígenas	Clase	DCC
Boca de polén	UNACH	Clase	TP
Boletín de información. Centro de Inv. Ecol. del Sureste	Centro de Investigaciones Ecológicas del Sureste	Periódica	TP
Ciencia y tecnología en la frontera	Consejo de Ciencia y Tecnología del Estado	Periódica, Latindex-Catálogo	DCC
Cuadernos de arquitectura y urbanismo (Tuxtla Gtz)	UNACH, Facultad de Arquitectura, Coordinación de Posgrado	Clase	TP
Devenir	UNACH, Cuerpo Académico Educación y Desarrollo Humano	Latindex-Catálogo	IC
Ecofronteras en línea	El Colegio de la Frontera Sur		DCC
Econoticias	Centro de Investigaciones Ecológicas del Sureste	Periódica	DCC
Espacio i+d. Innovación más des.	UNACH,	Latindex-Catálogo	DCC
Fin de siglo	Consejo Estatal para la Cultura y las Artes de Chiapas		DCC
Lakamhá	INAH, Museo de Sitio de Palenque		DCC
LiminaR	Univ. de Ciencias y Artes de Chiapas	Lat-Cat, CONACYT, Clase, B V CLACSO, Dialnet, e-Revistas, HAPI, Inf Acad, Redalyc, SciELO	IC
Nop'Tik	UNACH, Escuela de Lenguas Tuxtla Gutiérrez		DCC
Nuestro saber	UNACH	Clase	DCC

Quehacer científico en Chiapas	UNACH	Periódica	DCC
Revista CIHMECH	UNAM,Centro de Inv. Human. de Mesoam. y el Est. de Chiapas	Clase	DCC
Revista de difusión científica-tecnológica y humanística	Consejo Estatal de Fomento a la Inv. y Difusión de la Cultura	Periódica	DCC
Revista de la Universidad Autónoma de Chiapas	UNACH		DCC
Revista electrónica agroecología tropical	UNACH, Facultad de Ciencias Agronómicas		TP
Revista pakbal	UNACH, Facultad de Ingeniería		TP
Revista tecnología digital	Editorial Tecnológica Didáctica	Latindex-Catálogo	TP
Staobíl lekilal ta lekil abtel	UNACH, Facultad de Contaduría y Administración	Latindex-Catálogo, Clase	IC

Fuente: Latindex, October 2014

THE MEANING OF OA FOR OUR JOURNALS

Of the number of titles we have online in Latin America (4,260), 95% are free and open access. In other words, they have no reservation to share content with the general public, which contrasts with the material published in scientific journals in the United States and Europe, which are commercial magazines with usually very high costs. However this is not the tradition in Latin America, where almost all journals are and have always been freely available. The problem, however, is in access: how accessible are they really? This is a technical, as well as political and economic issue.

In the table below you can see the figures on the distribution of magazines in Latin America. Brazil is by far the country with most magazines. There are countries like Nicaragua, the Dominican Republic and Paraguay, which as official policy have all their journals open access and free to the public.

Figure 5. Distribution of journals in Latin America

of the 4,260 titles in Latin America & The Caribbean online, 94.5% are open access and free

COUNTRY	ACCESS TO JOURNALS ONLINE		TOTAL
	FREE	RESTRICTED	
Argentina	537	12	549
Bolivia	16	2	18
Brazil	1608	5	1613
Chile	333	4	337
Colombia	67	8	75
Costa Rica	141	6	147
Cuba	103	26	129
Ecuador	56	3	59
Guatemala	10	2	12
Mexico	640	126	766
Nicaragua	66	0	66
International organizations	16	0	16
Panama	10	1	11
Paraguay	14	0	14
Peru	43	1	44
Puerto Rico	40	15	55
Dominican Republic	20	0	20
Uruguay	95	13	108
Venezuela	89	1	90
Others	15	1	16

Fuente: Latindex, February 2013

WHY ARE WE INTERESTED IN OA?

Why do we care or are interested in joining this international movement of Open Access? There are several reasons: First, to take advantage of the benefits of an international movement, which means that policies and actions are taken in favor of magazines. For example, CONACyT in Mexico has ruled that those magazines that want to enter the registry and want to be supported and recognized as the best Mexican magazines have to be open access- the material that is published must be accessible to all.

What other benefits are there? They are inserted in the international context, through open access platforms. How can we insert ourselves in this international movement, not leaving behind what has to this point been our characteristics that represent comparative advantages? The region has a virtually shared common language, with the exception of Portuguese. We also have the tradition of free and open access and common problems which invites us to precisely make magazines that fulfill the function of communicating results (ours and of others) research on these common problems and in many cases is not of interest to journals published elsewhere.

We have to keep our own communication media, publishing and production. We cannot be totally dependent on what is published and what is decided to publish elsewhere. We also have a comparative advantage in that we have created systems and information services in the region that are ours, that work and are within our reach.

WHAT CHALLENGES DO MAGAZINES AND PUBLISHERS FACE?

But what are the challenges facing our magazines? First, the quality of the content. Until there is good science, there are no good

magazines- there is no point to continue insisting on the quality of journals if the contents are not worthwhile. That's one of the limiting factors- the extent of the strengthening of research capacity and knowledge generation in our universities, which are at the same time major publishers of academic journals in our countries.

Other conditions are also required, for example: institutional policies to support science and scientific publications. Their lack is reflected in the fact that the effort of publishers, authors, peer reviewers, i.e. the actors involved in the production of scientific journals, is not valued.

We have another challenge to face-the strength of the prevailing magazines from the north that not only control the market but often also the rules- they define in practice what is good science and what is a good magazine. This is a challenge we must face constructively, taking into account the maturity that has been acquired which allows us to participate in defining the criteria. Not making our criteria defined by others, but to participate in defining international standards is what we should be doing, from our own perspectives and experience.

Figure 6. Benefits of OA for the region

WHY ARE WE INTERESTED THEN IN OA?

To take advantage of the benefits of the OA movement:

- Policies & actions in favor of journals
- Insertion into the international context

Using our comparative advantages:

- The tradition of free and open access
- Common characteristics
- Cooperative initiatives in the field.

A final challenge relates to the lack of awareness to the meaning of Open Access, even within the scientific community. There is fear..... a sense of uncertainty....and this is clearly seen in Mexico during discussion of the legislative initiative on open access to scientific information which was presented in 2013 and culminated in the adoption of legal reforms in education, science and technology with line items especially dedicated to the access to scientific information.

Figure 7. Challenges for digital publishing

WHAT CHALLENGES DO JOURNALS FACE?
Weakness in our systems of scientific investigation and higher education
A lack of institutional policies that support science and scientific publications.
A dependence on the guidelines from the north.
The extensive precariousness of our journals.
Lack of awareness, fear, and incertitude of the community about OA.

Resistance to this initiative and proposed legislation came from the academic community In the respective consultation forums. Why? For all of the false dilemmas that have been created around OA. For example, it is said that OA seeks to eliminate peer review. However, there is information based on sound analysis which does see that this statement is false and misleading. There is as much rigor in the (good) refereed open access journals as in the (good) commercial mainstream journals.

A second argument is that it is not fair to give away our research abroad. On the contrary, now we are giving it away (and then having to pay for access to them) and the purpose is to make them public.

Third, it is said that open access journals are of poor quality and are not economically sustainable. However, as there are open access journals that do not have quality and are not sustainable, among those many trade magazines that besides not being open access are also poor quality nor are sustainable. It is further believed that open access has a residual presence in scientific communication, but this is no longer true. Of course at first there were numbered titles, but they are growing in number in a remarkable way. In Figure 9 we can see the development of open access that shows how the situation is changing dramatically, both in number of articles (in blue) and number of journal titles (in red).

Figure 8. Dilemmas of Open Access

THE FALSE DILEMMAS OF OA
"Open Access wants to eliminate" (peer review).
"It's not fair to give away our investigations to foreigners".
"The OA journals are of poor quality and are not economically sustainable".
"Open Access has a residual presence in the scientific community".
"The OA is a way to skip Copyright".
"Scientists are not interested nor motivated by open access".

Finally, it is said that scientists are not interested or motivated by open access. Here there is an interesting attitude from scientists, and I mean not only in our country but in general. It is a dichotomous or ambiguous attitude, one could even call it schizophrenic , because when we want to read an article and cannot access it, it is a bother. We want it to be open access. When you think of publishing, however, there are still many people who

have reserves about publishing in an open access magazine, albeit of the same quality and the same level, and prefers to go with the magazines by Elsevier, Springer, or ISI Thomson which are not even proper publishing companies but are rather aggregators/ commercial intermediaries.

Figure 9. Advances in OA

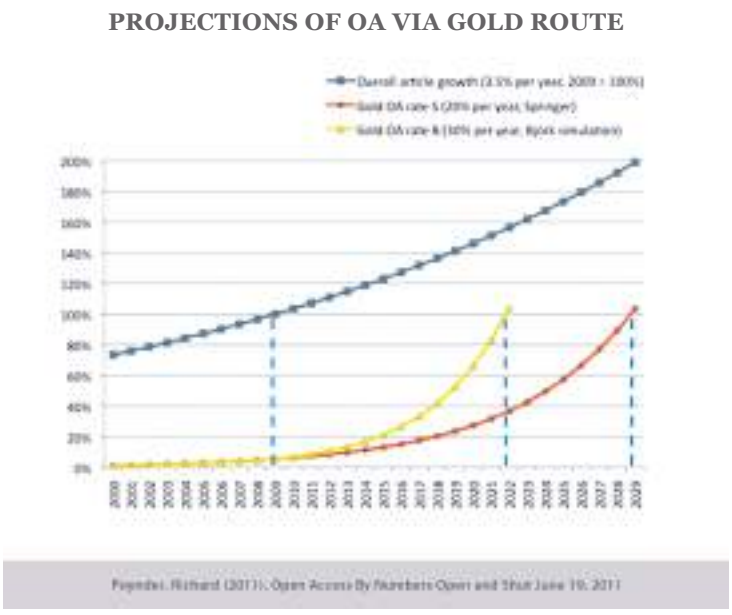
Source: Wikipedia

Figure 10. Distribution by discipline

Source: Wikipedia

In Figure 10 we can see the number of articles in open access and appreciate how this number varies by discipline. To better understand this graph, remember that the green bars represent items that are deposited in repositories, which can be for example arXiv or also the repositories in each of the disciplines. The gold bar is which benefits commercial. Aggregators, because they are changing their publishing model. Now instead of charging for the subscription to a particular journal, what they are doing is adding the option to charge for the publication of the article. Payment must be done by the author or their institution, and they aren't cheap. It can cost $ 5,000 dollars to publish an article. I think the "gold comes from the business that is done": the items are put on open access in exchange for what the authors have contributed in cash (plus all the work invested in the article itself). Frequently in addition there is an embargo period, say six months, after which the article is open access; but the deal has already been signed.

Figura 11. Projections



The golden rate is also growing significantly because commercial publishers and aggregators are reviewing their business models to jump on the bandwagon of open access and benefit from the growing importance of this movement.

A FEW STRATEGIC STEPS TOWARDS OPEN ACCESS

What can be done so that we increasingly have free and open access to the publications of all the magazines, not just a few or only journals published in Latin America? What can make this happen, and fortunately is already happening in some countries, are specific policies and mandates that give preference to encourage or require their authors and researchers in an institutional repository to publish their articles.

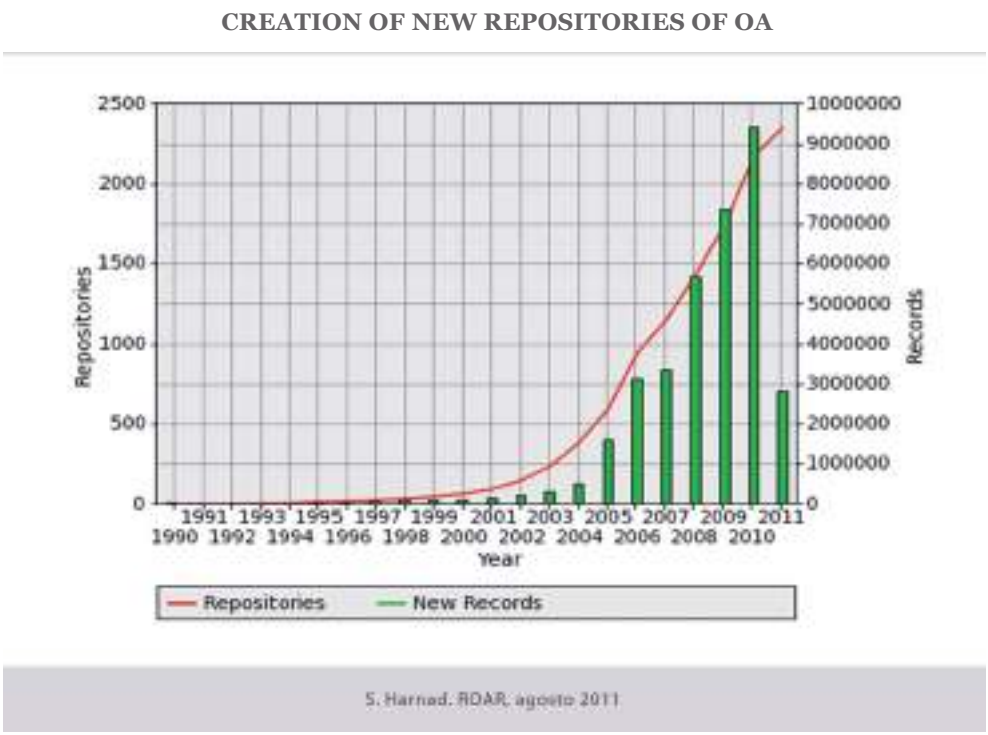
Figure 12. Policies to promote OA

As we can see in the graph, these policies and mandates and have a positive effect in many countries. In the United States the mandate issued a couple of years ago by the Office of Science and Technology of the President already has an impact on the creation of institutional repositories where authors must deposit copies of

their publications. In other countries, there are mandates at various levels: national, governmental, institutional, etc. These mandates are the ones making the open access movement spread rapidly.

This means in particular that many universities have been willing to create their own repositories. Creating repositories is also increasing rapidly. The graph in Figure 13 reaches mid-2011, but the slope continues. Just one of the articles of the new legislation in Mexico talks about the creation of a national repository which will be conducted by CONACyT. Ideally, this national repository for rests in a specialized institution or agency, discipline or field of study, created to harvesting and disseminate publications by out scientists.

Figure 13. . Institutional Repositories



Therefore it is considered important that at the institutional level we present these strategic steps to follow, and also that authors

think of using repositories to place thier material so that it is made more widely known. With that, ultimately, we hope that what have been our own magazines - always open access, always free – and the journals from the North with closed access, but are seeking the way to open – come together and form an organic system which is more coherent, more inclusive, more accessible with magazines that are not only for research but also for the dissemination of science and culture and to support professional and educational work.

Figure 14. Strategic Steps

SOME STRATEGIC STEPS
Policies of promotion
Legislation, institutional mandates, normativity
Creation of online publishers and institutional repositories

The internet and OA are not a panacea,
but they are here...
and provide valuable opportunities

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THE CHALLENGE OF COMPETITIVENESS AND SUSTAINABILITY FOR TOURIST DESTINATIONS

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Keywords: *tourism competitiveness, competitiveness models, measuring competitiveness, destination, destination management, sustainable tourism, sustainable tourism indicators.*

Since the second half of the last century, tourism has gained weight between the productive activities of countries and regions worldwide. Although traditionally economic growth has been identified with the expansion of the industry, in the last decades of the twentieth century tourism was consolidated as another productive sector, capable of generating employment and income. The characteristics of this activity allow it to develop, with more or less intensity and success, in areas excluded from the expansion of industrial activity. Moreover, it has become an opportunity for areas hit by deindustrialization and a complementary activity to rural areas and those at risk of depopulation.

Tourism has established itself as an activity of great importance internationally. According to the WTO (WTO, Tourism Highlights 2014, 2014) tourism accounts for 9% of the world´s GDP, 6% of world exports, 29% of service exports worldwide, and generates one in eleven jobs globally . In addition, growth forecasts are optimistic: it is expected to reach 1.400 million arrivals in 2020 and 1.800 million arrivals in 2030 (WTO, 1999, 2011; see Figure 1).

In a context of deep economic crisis that is affecting mainly the large regions of the world, tourism is still a growing and expanding activity. Tourist arrivals worldwide increased in 2013 by 5% over the previous year, and developed countries have grown above the world average (5.4%) and the emerging countries lower (4.5%). That is, despite the economic crisis that hit the most advanced economies the hardest, there is being recorded an increase in international tourist arrivals higher than the world average. By region, there is a notable increase in Asia and the Pacific (6.2%) and Africa (5.4%), followed by Europe (5.4%) and the Americas

(3.2%). The Middle East recorded a decrease (-0.2%) due to political instability and armed conflicts affecting some countries in the region[1]. In 2014, very positive data returned, resulting in a new record. Until October this year the number of international arrivals has increased by 5%.

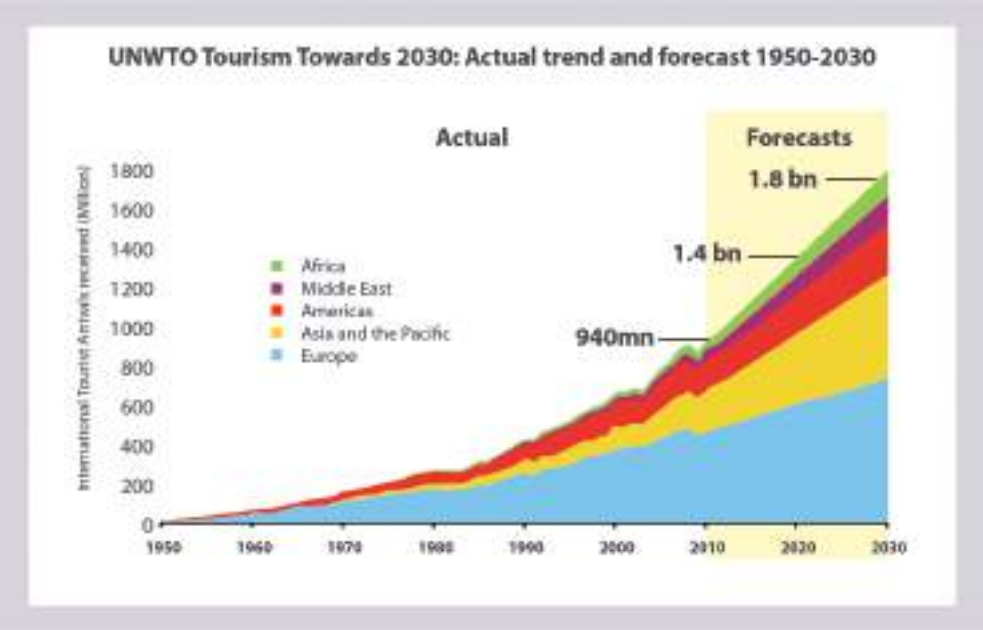
If we consider a longer period, from 2005 to 2013, we can confirm how emerging economies have increased the number of international arrivals above the world average and from advanced countries: 4.8% versus 3.8% and 3% respectively. Asia and the Pacific (6.2%) and Africa (6.1%) increased above average in this period. The remaining regions that the WTO noted grew below average were noteworthy- Europe and the Americas with the smallest increase: 2.9% for both. It is confirmed, therefore, one of the forecasts made by UNWTO for 2020 first and then for 2030: the world's leading destination, Europe, is losing market share worldwide (WTO, 1999, 2011). On the other hand, as expected, increasing the global middle class will encourage tourism growth in emerging countries.

Tourism income has shown a similar behavior. Globally, it rose 5.3% between 2012 and 2013, registering a greater increase (6%) in advanced countries and 4% in emerging countries. Regionally, behavior was very different: the largest recorded increase was in the Asia Pacific region, with 8.2%, followed by the Americas with 6.4%. Europe recorded a more moderate (3.8%) increase, while Africa and the Middle East remained down by 1.9%.

Highlighting another feature of this activity worldwide: the speed of recovery after a crisis or resilience. The impact of political and military (such as the Gulf War) crisis, terrorist attacks (like 9/|11), climatic disasters (hurricanes, floods), epidemics (such as SARs), the economic crisis ... is quickly reflected in a drop in arrivals. But the recovery of this activity is very fast.

1 http://media.unwto.org/press-release/2014-12-18/international-tourism-track-end-2014-record-numbers

Figure 1. Forecasts for growth of tourism in 2030. UNWTO



THE CONCEPT OF COMPETITIVENESS. MODELS OF COMPETITIVENESS

The reflection on competitiveness and the elements that improve a competitive position has figured prominently in economic research since the last quarter of the last century instead. Michael Porter (1980, 1990) launched a line of work and research on competitiveness that has left a mark investigation until today. Porter's work has focused mainly on industry, although some concepts have been useful also in the world of tourism. Growth and economic development of a country is determined by the microeconomic conditions. If companies are competitive, countries will be competitive.

If for the classics comparative advantages explain the differences between the degree of industrialization of the country's export capacity and ultimately economic growth, for economists of the twentieth century the growth differential is explained by

the ability of countries companies to build competitive advantage. Especially after the reflection of Porter, competitive advantage will be the subject of special attention to explaining the different economic success of countries.

In economics, competitiveness is defined as the ability to compete in markets for goods and services. It is the capacity to sustain and improve the added value or per capita income, but also to maintain or promote trade balances with the rest of the world or to attract foreign direct net investment. This ability depends largely on the ability to generate new ideas and to generate innovations in both products and processes.

Competitiveness is a relative (a country is more competitive in relation to another country) and multidimensional (multiple variables affect it) concept. It is therefore a very complex concept to analyze and measure, although there has been developed indices that measure and provide a ranking of countries based on a number of variables.

In the scheme proposed by Porter, competitiveness advances in leaps. We can distinguish several stages that mark the evolution of competitiveness of a nation:

- Step-driven by factors: the basic factors are essential and widespread source of competitive advantage.
- Step-driven by investment: the competitive advantage lies mainly in a heavy investment that allows better and more specialized factors.
- Step-driven by innovation: the sophisticated local demand, domestic rivalries and support clusters of companies generate benefits.

Innovation is therefore essential at this later stage because:

- Innovation increases productivity
- Productivity determines the standard of living of a country

- Productivity determines competitiveness

If companies are competitive, countries will be competitive. The analysis must therefore focus on business and the environment in which this takes place. It is at this level that the strategy should be designed to improve competitiveness. The companies are located in clusters, next to other competitors and others which offer services necessary for production and sales (transportation, inputs, financial advice, etc.).

In Porter's model, clusters are homogeneous geographic areas that have a very own distinct strategy with sufficient infrastructure for the entire area, and that make trade relations between them. The proximity offered by the cluster companies can create business networks that interact and strengthen ties thanks to its proximity and physical, technical, economic and social complementarity in a favorable territorial and institutional framework. The reasons why companies tend to focus on a cluster are:

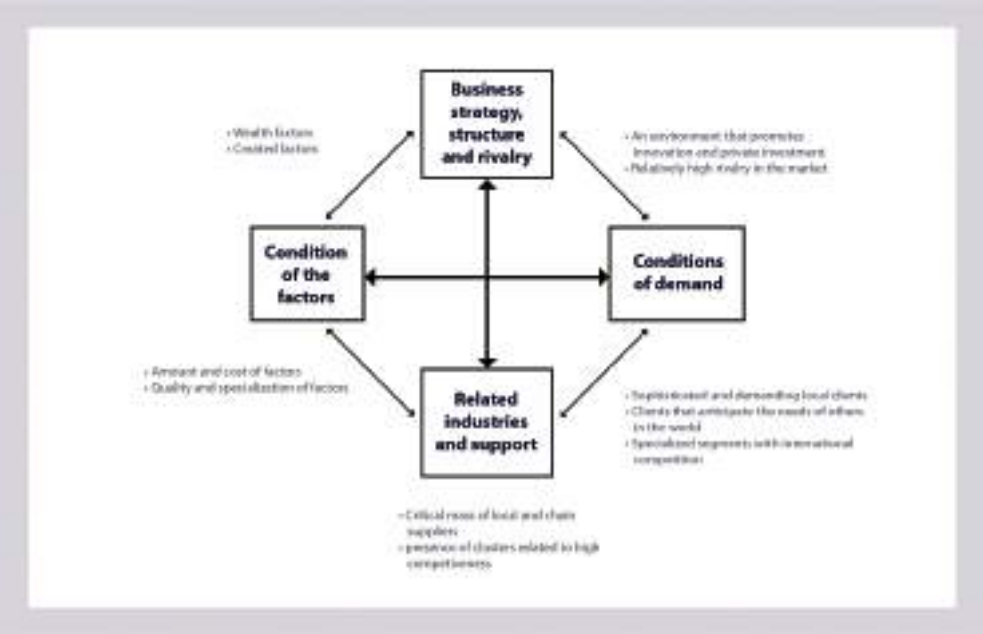
1. Access to providers, services and labor specialists
2. Information advantages
3. Flexibility and rapid change due to the extreme specialization
4. Imitation facilitates rapid adoption of innovations

From these concepts, Porter's diamond details the cluster elements and the relationships established between them (Figure 4).

- **Strategy, structure and business rivalry**: the context that gives competition incentives based on investment and the best sustained organization; strong competition between local rivals.
- **Terms of factors**: the importance of quantity and cost of inputs; their quality ; specialization of production factors.

- **Related and supporting industries**: Presence of capable local suppliers and companies in related areas; clusters instead of isolated industries.
- **Demand conditions**: sophisticated and demanding local customers; specialized segments that can be served globally; clients whose needs are anticipated to the region and other areas.

Figure 4. The Porter Diamond



These elements constitute the environment of productive activity. It is the environment that permits greater competition between companies on the one hand, and greater cooperation by others. As we mentioned, Porter's model was designed for the industry. However, some of the concepts and elements of it can be adapted and incorporated into tourism. The research on tourism competitiveness has advanced significantly. In addition, in recent decades, a repeated idea is that destinations have to take chances to be more competitive in a changing world.

Among the various proposals and models, we can highlight the model of tourism competitiveness of Crouch and Ritchie (Crouch & Ritchie, 1999; Ritchie & Crouch, 2000, 2003). This model is considered as the most comprehensive approach to tourism competitiveness, although not the only proposal or model (Mazanec, Wöber, & Zins, 2007). The model is based by distinguishing between comparative and competitive advantages while it intends to include all factors that determine the competitiveness of a tourist destination, distinguishing five major sections: qualifiers and amplifiers (location, safety, cost, dependencies, etc.), policy, planning and destination development (vision, positioning and branding, analysis, audits, etc.), destination management (organization, marketing, information and research, HR management, etc.) and resources and support factors (climate, history and culture, leisure, etc.). From this model, an initial proposal of 32 items that can be considered a first index of compound competitiveness to a destination is performed.

The model recognizes that tourism competitiveness is based on the resources endowed to the destination (comparative advantage) and the ability to develop resources (competitive advantage) (Figure 5).The model also recognizes the impact and influence of the global environment (for example: global economy, terrorism, demographic trends, etc.) and competitive circumstances of the micro-environment affecting the tourism destination. The model recognizes 36 competittiveness attributes in five grades groups. Attractors include eleven elements: natural, summit, cultural and social, general infrastructure, basic infrastructure services, tourism superstructure, access and transport facilities, tourist attitudes, price levels and costs, etc. Among the detractors of destinations are security (political instability, health, laws and regulations such as visas, etc.). These factors may act as barriers when visiting a particular destination.

Figure 5 . The Calgary Model

Ritchie and Crouch (2003)

The Ritchie and Crouch model is not the only proposal for conceptualization and management indicators of tourism competitiveness[2]. But they to introduce for the first time the main elements to consider regarding the concept of tourism competitiveness.

Why is the concept of competitiveness so important for a tourist destination? Research on tourism competitiveness will allow a better understanding of the elements that determine if a destination is more or less competitive (Crouch, 2007; Mazanec, Wöber, & Zins, 2007). More knowledge is this area can help tourist destination managers to better manage it, especially when the public-private management has become increasingly important.

[2] Mazanec, Wöber, & Zins (2007) made a revision of various proposals about competivity and destination management.

TOURISM COMPETITIVENESS AND TOURISM DESTINATION

There is still no single accepted definition of competitiveness in tourism. If we look at the definition used in economics, competitiveness can be defined as the ability to maintain and improve the added value or per capita income, but also the trade balance or even the ability to attract foreign direct net investment. It also refers to the ability to create and innovate from a more dynamic perspective[3].

To Ritchie and Crouch (2000), competitiveness can be understood as the ability of a country to create value and enhance national welfare, by managing processes and attractive advantages, aggressiveness and proximity, and integrating the relationships between them in an economic and social model.

In a narrower sense, it can be defined as the ability to respond to consumer demands, especially when these demands are consistently and significantly changing. Competition between destinations makes them have to be differentiated from each other by offering distinctive, high quality experiences (CES, 2013).

For Dupeyras and MacCallum (2013), the competitiveness of a tourist destination is the ability to optimize its attractiveness to residents and non-residents, providing quality tourism services which are innovative and attractive (for example, providing a good value or "value for money ") to consumers and gain market share in both domestic and international tourism, while ensuring that the available resources which support the development of the tourism activity are efficiently and sustainably used.

As we see there is no single definition of tourism competitiveness (CES, 2013). As Mazanec, Wöber, & Zins (2007) show , there is no broad agreement on the concept of tourism

[3] See CES (2013)

competitiveness, although they seem to have agreed on a broad interpretation as proposed by Ritchie & Crouch (2003, p. 2): "what makes a competitive tourist destination is the ability to increase tourism spending, increasingly attracting visitors while they offer memorable and rewarding experiences that are profitable for the destination, while the welfare of the residents of the destination is improved and the natural capital of destination is preserved for future generations. "

Considering these definitions and considerations, the ability of the destinations to maintain and improve the main indicators of tourism in destinations (number of tourists, tourism expenditure, etc.) depends increasingly on destination management. Destinations are facing increasing domestic and international competition, depending on the type and characteristics of each destination. The creation of the basic adequate conditions that generate unique tourism experiences are "memorable and successful"- in other words innovation is not only in the hands of private companies, but the opportunities generated in the environment where they are located.

The destinations management becomes more important in a globalized world ("think globally, act locally"). Management involves in first place knowledge, and so it is important to "know what their **internal structure and components are** because, in the extent that one place includes all of its elements (supply, demand, transportation and marketing) it acts as a small scale laboratory of the tourism system. " (González, F., 2012, p. 8)

The concept of a tourist destination as we see in the definition of the WTO approaches the concept of Porter's cluster. The homogeneity, in the case of the destination, would be related to:

- The territorial and urban model
- The economic, cultural and natural resources
- Infrastructure and environmental management
- The behavior and characteristics of supply and demand
- The inter-municipal complementarity

Thus the competitiveness of businesses is also strongly influenced by the environment: the destination. The destination is composed of a number of elements of very different natures, which include private companies and public property, natural resources, the resident population, etc. In short, the destinations are given, just as in the cluster, two major strengths: competition (rivalry) among companies that form it, and another of cooperation and collaboration.

Since the early 1990s, tourism research focused on understanding the elements and structures of competitiveness of tourism destinations. One can distinguish two main lines of research and generation of knowledge (Crouch, 2007):

1. Focused on specific elements of the tourism competitiveness: pricing, marketing, positioning, destination management systems, etc.
2. Centered in knowing and understanding competitiveness holistically.

We can also find a number of important investigations that focus on tourist destinations (USA, Las Vegas, ski resorts, etc.).

The literature on tourism competitiveness has improved the understanding of this concept from the theoretical and conceptual models applied to tourism. The different investigations have allowed progress can be made one step closer towards empirical research and analysis of tourist destinations and markets. For them it is fundamental to enhance the knowledge of the elements that promote competitiveness in the destinations, as well as their relationship or situation at different stages of development of the destinations (Dwyer and Kim 2003; Mazanec, Wöber, & Zins, 2007).

As experts note, there are still significant gaps in some aspects of tourism competitiveness, especially the assessment of the relative importance of different attributes of competitiveness. This is a vital

aspect in the management of tourist destinations if we consider that resources are scarce and should be directed towards actions that would allow further progress on competitiveness. It is also vital to advance research on the issues that affect competitiveness at different stages of development of the destination, for example what combinations of factors are most appropriate for improving competitiveness at different times of the life cycle of a destination.

MANAGEMENT OF TOURIST DESTINATIONS

The tourist destination is the appropriate level of action to adequate the tourism offer to changing consumer demands. It takes place where the tourist experience takes place; a result of a combination of public and private property; the quality of the tourism experience depends not only on what the private enterprise is able to offer (hotel, restaurant, etc.), but the environment in which the visit takes place (quality of the urban environment, safety, sanitation, information, etc.). Economic and social globalization, information technology and communication, economic and social changes, the challenges of sustainability, etc., have increased pressure on destinations. Tourism has become an industry capable of generating income and employment. For the already consolidated destinations, maintaining the activity (measured in number of tourists and / or income) is critical for profitable facilities and to continue to offer employment. For those who are still in the early stages of the life cycle (introduction, growth), they remain committed to attracting tourists as its main objective. Increasing global competition between destinations requires advance thinking on the issues that affect the management of destinations.

The management structures of destinations (Destination Management Organization or DMO) have emerged from the need to respond to the needs and requirements of the agents involved in tourism: the public sector, private sector, residents, and tourists. At

their start , DMO's often have limited and very specific functions, generally related to promotion, that continue to expand to generating product information, act as hosts to tourists, etc. (FEMP, 2006). In the present context, the DMO is acquiring more functions due to the increased international competition and complexity of a changing market and consequently, are becoming more professional. The participation of other actors besides the public sector, especially the private sector, is one of the characteristics of the destination management since late last century.

A competitive destination is an innovative destination. It is the destination where innovation takes place in tourism. The multilevel cooperation (public-private) between different agents is a vital aspect in this process. A differential fact with respect to other economic activities is the presence of a large diversity of actors (public and private institutions, educational, financial, local development agencies, etc.).With this diversity of actors and taking into account the reasons we have discussed for public intervention, it is precisely the public sector who has to take the initiative and leadership, while incorporating decisions and financing into the private sector ("**3P model-Private-Public-Partnership**).

With regard to management, experts have made several proposals for indicators. The indicators can be grouped into four categories (Dupeyras & MacCallum, 2013; p. 14):

- Indicators that measure performance and impacts: the increase in the value of tourism is important for advanced tourism economies, for what implies the maintenance of competitiveness in the global tourism market as compared to other industries. Increasing the value of tourism requires the review and collaboration across the tourism value chain, which can help overcome high fragmentation, create a better experience for the tourist and better use of existing infrastructure, staff and resources. For an indirect measurement of these issues traditional tourism indicators

can be useful that measure changes and trends in jobs, income and revenue.

- Indicators that measure the ability of a destination to offer quality and competitive tourism services: this measurement should start with the business environment and supply or production structure. As mentioned, a direct source of competitiveness for a destination is a dynamic environment for tourism businesses. Thus, this group of indicators relate to the supply side of the tourist economy.
- Attractiveness indicators of a destination: the attractiveness of a destination is a broad concept, but closely interconnected with the notion of competitiveness and quality of the tourist experience. I.e., maintaining competitiveness requires maintaining and improving the attractiveness and distinctiveness of the destination, with special emphasis on natural and cultural resources and a welcoming lifestyle.
- Indicators that describe economic opportunities and the political responses: well-designed policies to improve competitiveness and sustainability generated from dynamic environment and appropriate institutional framework. Tourism policies can help create new values that support development and develop innovative tourism services.

The introduction of indicators can help significantly in management. As we have seen, these proposals are based on theoretical models that attempt to explain tourism competitiveness. However, they are still proposals for improvement. The main criticisms of the existing systems of indicators are (Mazanec, Wöber, & Zins, 2007; Crouch, 2007):

1. Most theoretical models give little attention to the appropriate level of aggregation for the destination. The concept of the destination continues to drag a bias still very much oriented towards production.

2. From an epistemological point of view, some of the models, such as those by Ritchie and Crouch, indicate that there seems to be more efforts for defining, while before models reflected cause-effect relationships. That is, they end being just a relationship of elements that can affect competitiveness, but not determining how.
3. Tourism competitiveness models have begun to incorporate economic theories recently. For example, the theory of hedonic prices.
4. If tourism competitiveness should lead to improving the welfare and prosperity of the resident population, the debate about whether external criteria to measure the tourism competitiveness (such as market share ...) are suitable.

In short, while the theoretical frameworks and definitions of tourism competitiveness does not adequately incorporate causality and effect, the practical benefit to the management of tourist destinations is limited. They can be useful to highlight the weaknesses and strengths of a destination. We know there are a large number of factors affecting competitiveness and they are difficult to handle in management. In addition, some of these factors are the responsibility of organizations and many different players within the destination. And when you consider that it is a relative concept, it also depends on what is happening in other destinations. Nor do we have confirmation of how the different elements of tourism competitiveness may determine the destination at different stages of development. Ultimately, further progress is needed in knowledge about tourism competitiveness.

In conclusion we highlight the following (Peter, 2012):

- A more competitive tourism sector contributes to a more competitive country and reaps greater benefits for the country.

- The competitiveness of tourism destinations depends on the ability of its industry to innovate and constantly improve the quality of their products.
- Competitiveness depends heavily on the work done in local tourist destinations.
- National policies should be designed to help local tourism destinations to improve their competitiveness, creating dynamic and efficient environments.
- Continuous improvement of the tourism cluster is the source of competitive advantage in markets where competition is chosen.
- Quality and efficiency are fundamental in improving competitiveness.

THE MEASUREMENT OF COMPETITIVENESS. THE CASE OF MEXICO AND CHIAPAS

As we have seen, the reflection on the competitiveness of destinations has evolved in the definition of the elements that determines or affects competitiveness and that may be important for the management of destinations. In a study conducted in 2009, the European Union identified 5 major factors for increasing competitiveness and adapt to the environment (ECORYS, 2009): political, economic, environmental, social, technology and innovation. These factors will be different if we look at the major tourism sub-sectors: transportation, lodging, attractions, tourist, brokers, etc.

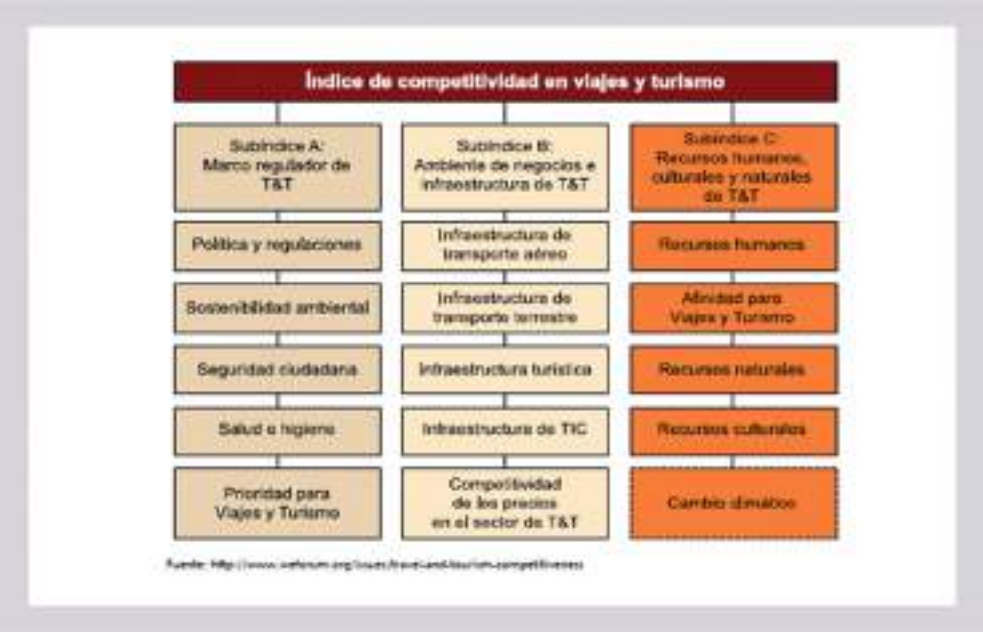
The World Economic Forum (WEF) has published the Global Competitiveness Report that evaluates the competitiveness of countries[4]. For many years this same agency has published *Travel*

[4] Since 1996 the WEF has made a study about competitiveness in collaboration with *Harvard Business School* (M. Porter) and with the *Center for International Development of Harvard University* (J. Sachs, A. Warner).

and Tourism Competitiveness Index (TTCI) every two years. The TTCI is made for a total of 140 countries, obtaining a global ranking of countries in tourism. It is calculated from 70 variables grouped into 14 columns. The 14 columns are grouped into three sub-indices that contain a broad category of key variables in determining the competitiveness of the tourism sector. TTCI index is the average of the three sub-indices (Figure 6)

1) Regulatory framework (public sector): policy and regulations; environmental sustainability; public safety; health and hygiene; priority for travel and tourism.
2) Infrastructure and industry environment: air transport infrastructure; land transport infrastructure; tourism infrastructure; ICT infrastructure; price competitiveness in the travel and tourism sector.
3) RR. HH, cultural and natural: human resources; affinity for travel and tourism; natural resources; cultural resources; climate change.

Figure 6. Competitiveness Index for Travel and Tourism (WEF)



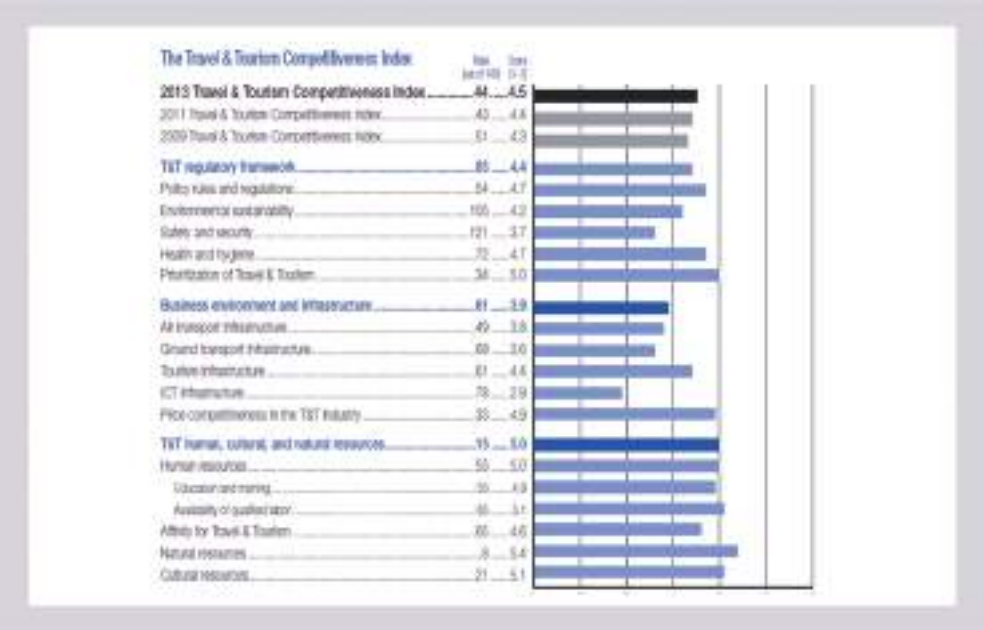
In the ranking of countries in descending competitiveness offered by the TTCI for 2013, Switzerland ranks first followed by Germany, Austria, Spain and the UK (see Figure 7). For countries on the American continent, the US ranks sixth and Canada eighth.

Figure 7. TTCI. Results for 2011 and 2013

	2013		2011
Country/ Economy	Rank/ 140	Score	Rank/ 139
Switzerland	1	5.66	1
Germany	2	5.39	2
Austria	3	5.39	4
Spain	4	5.38	8
United Kingdom	5	5.38	7
United States	6	5.32	6
France	7	5.31	3
Canada	8	5.26	9
Sweden	9	5.24	5
Singapore	10	5.23	10
Australia	11	5.17	13
New Zealand	12	5.17	19

In 2013, Mexico was ranked 44 in world rankings; one place less than the TTCI from 2011, but occupying a better position compared to that of 2009 (See Figure 8). Looking at the three sub-indices, Mexico stands out for Human, Cultural and Natural resources(position 15 in world rankings); the best position is obtained for natural resources (position 8), followed by cultural resources (position 21). At the other extreme, the sub index on the public sector shows a worse position: 83RD place in all countries in the study. Within this indicator we can find Mexico's worse position- Public Safety (121) Environmental Sustainability (105) and Health and Hygiene (72). In the third subscript occupies position 61, with a worse position in ICT Infrastructure (78), followed by the Terrestrial Infrastructure (69).

Figure 8. TTCI. Mexico. 2013



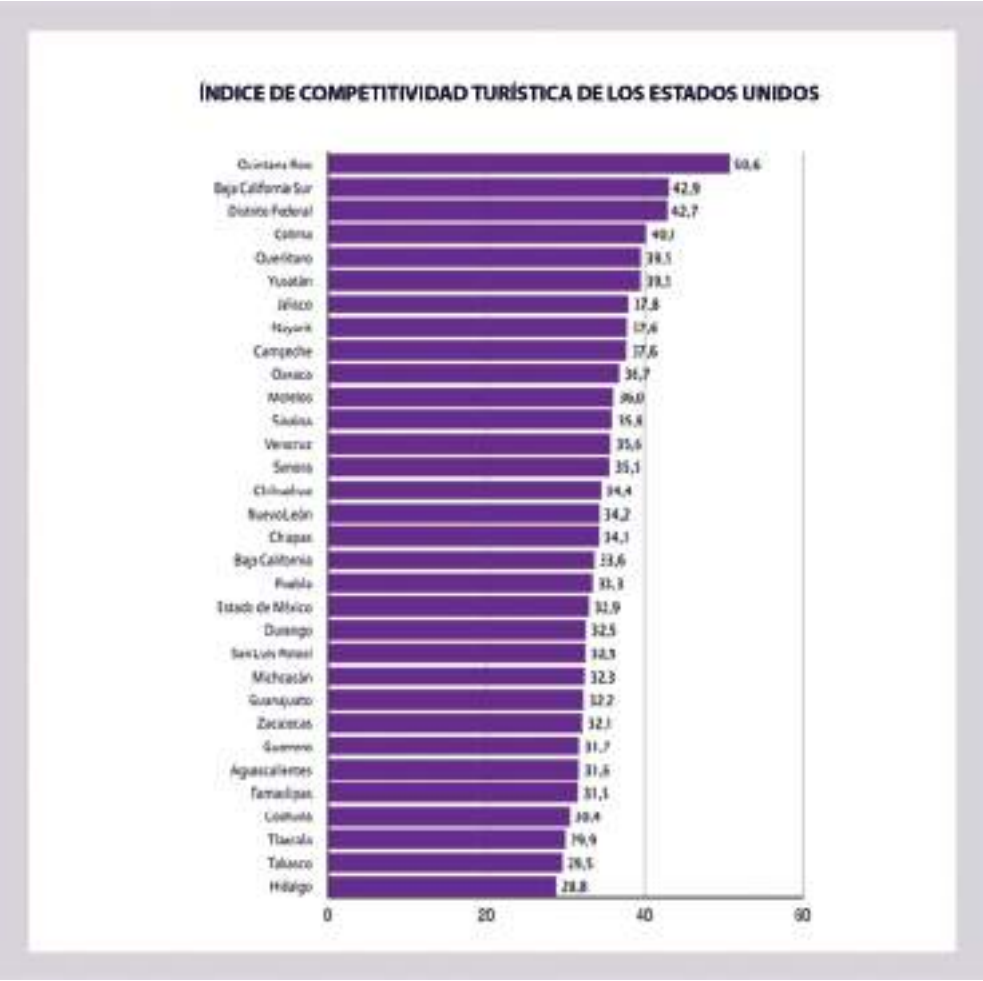
The Tecnológico de Monterey also makes a Tourism Competitiveness Index for Mexican States (ICTEM). ICTEM identifies 10 dimensions, each containing different variables:

1. Resources and cultural activity
2. Natural resources and environmental protection
3. Human resources and education indicators
4. Infrastructure and professionalization of the hotel sector
5. Flow of people and vehicles
6. Complementary services for tourism
7. Public safety and protection of the citizens
8. Profitability and economic aspects
9. Tourism Promotion
10. Participation and government efficiency

For the year 2012 (Tello Cerda, & Pardo, 2012) , the study done between the different states of Mexico establishes a ranking of states that is more or less competitive, led by Quintana Roo,

followed by Baja California Sur and Mexico DF. In the last places we find Tabasco and Hidalgo. Chiapas ranked 17 in this set of states (Figure 9).

Figure 9. ICTEM 2012. Results by States



In the case of Chiapas, we can highlight (Figure 10):

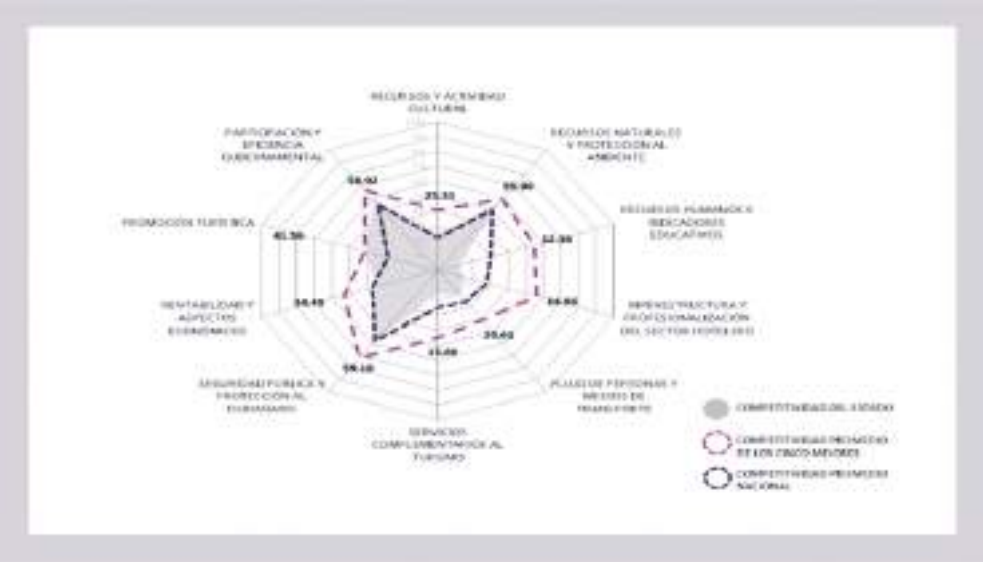
- If we focus on the different dimensions that are recognized by the ICTEM, Chiapas is above the national average and very close to the average of the top 5 states in the dimension of promotion of tourism.

- It is also noted that the value in the dimension of human resources and education indicators are below the national average.

To conclude, and as a result of exercise in the ICTEM of 2012, some key principles that were identified that they tourist destinations must follow if your goal is to become more competitive:

- put the environment and the concept of sustainability as priorities,
- make tourism a key sector,
- improve and create more distribution and arrival channels, and
- create and foster a dynamic private sector.

Figure 11. Results ICTEM for Chiapas



TOURISM SUSTAINABILITY

Competitiveness and sustainability are the two ultimate goals of tourism policies developed since the last decades of the last century (Peter, 2012a, 2012b). Tourism competitiveness is closely related to sustainability as the quality of tourist destinations is strongly influenced by their natural environment and the integration of the local community (EU, 2013).

It is not easy to define sustainability. From the proposal made by the Brundtland report, sustainable development would be one that meets the needs of the present without compromising those of future generations. But this definition, although politically correct is not very operative.

Sustainability covers a very diverse set of issues such as the responsible use of resources, consideration of the impacts of the activities carried on tourism (positive and negative impacts), the type of energy used, protection of the natural and cultural heritage, the type of jobs created, etc.

Therefore, we must consider the concept of sustainable development as a set of theoretical contributions of pre-paradigmatic character in a still open scientific research field. The scientific community is still far from defining with consensus and total clarity on what is meant by sustainable development. The increase in inequality in the world, the persistence of hunger and poverty, and the challenges posed by climate change put pressure to advance on a proper definition of sustainability. In any case, sustainability should not be a cosmetic correction of the paradigm of indefinite growth, but its replacement by a different definition, more in tune with the times and new needs.

From a critical perspective, sustainable development is considered by this critical current as a "strategy of makeup" (*greenwashing*) consisting of covering with green the same paradigm of industrialization, competitiveness, unlimited growth (in production, the economy in general , and benefits

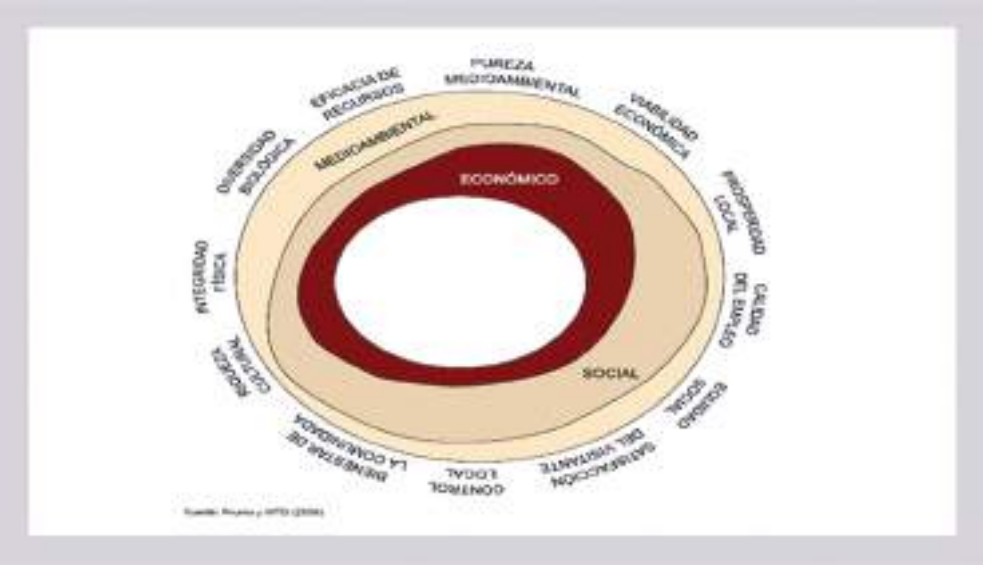
in particular) and imposition of economic models and Western consumer policy on development in order to continue in the same pathway; the pathway is considered by itself essentially unsustainable (Pons, 2013).

From a technical perspective, academics have focused the debate and research in the definition of concepts that make up the various aspects of sustainable development. Scientific progress requires measurement, data and the elaboration of indicators of evolution. For them, in a similar manner we have seen for competitiveness, their work on the concept of sustainability leads to the idea of their use for management.

The conceptual model distinguishes three main dimensions:

- Economic sustainability
- Environmental sustainability
- Sociocultural sustainability

The WTO defines concrete objectives and pillars of sustainability (Figure 12):



The responsibility of governments is critical to create an environment conducive to the balanced development of the activity. The presence of important public goods in tourism (beaches, natural resources, landscapes, etc.) requires that public sector in involved in preservation as much as possible the elements that have favored the development of the activity, because they are the guarantee that such activity is maintained over time. Thus, public policy, especially tourism policy, is a key instrument in the process of the development of sustainable tourism.

The development of indicators answers the need for references and standards, to make comparisons with other locations to assist in the process of sustainable tourism development. In other words, to have selected information that is regularly used to guide the management of the destinations and to help reduce future risks to the destination and the tourism activity that occurs there.

The indicators can measure:

- Changes in tourist structures and internal factors
- Changes in external factors affecting tourism
- Impact of tourism

In the context of sustainable tourism development, the **indicators** are a chronological series of strategic information for the sustainability of a destination, its assets and ultimately, the future of the tourism sector. In Figure 13 we have a proposal of sustainability indicators from the WTO (WTO, 1999, 2005).

Figura 13. Sustainability indicators. OMT

INDICADOR	MEDIDAS ESPECIFICAS
Protección del Sitio	Categoría de la protección del sitio según el índice de la UICN

Presión (Sobre el sitio)	Número de turistas que visitan el sitio(por año/mes máximo)
Intensidad de uso	Intensidad de uso en alta temporada (persona/hectárea)
Impacto Social	Ratio entre turistas y residentes (alta temporada y exceso de tiempo)
Control de Desarrollo	Existencia de procedimientos de revisión ambiental o controles formales del desarrollo del sitio y densidades de uso
Gestión de desechos	Porcentajes de aguas residuales del sitio ereceptor del tratamiento (Entre otros indicadores adicionales pueden incluirse los límites estructurales de la capacidad infraestructural del sitio, como el suministro de agua)
Proceso de Planificación	Existencia de plan regional organizado para la región destino turístico (con inclusión de los componentes turísticos)
Ecosistemas críticos	Número de especies raras en peligro
Satisfacción del Turista	Nivel de satisfacción de los visitantes (basado en encuestas)
Satisfacción de la Población Local	Nivel de satisfacción de los residentes (basado en encuestas)
Contribución del Turismo a la Economía Local	proporción de la actividad económica local generada únicamente por el turísmo
ÍNDICES COMPUESTOS	
Capacidad turística	Medida compuesta de alarma temprana de factores clave que afectan a la capacidad del sitio para soportar diferentes niveles de turismo

Presión sobre el sitio	Medida compuesta de los niveles de impacto sobre el sitio (sus atributos naturales y culturales debido al turismo y otras presiones acumilativas del sector)
Atracción	Evaluación cuantitativa de los atributos del sitio que lo hacen atractivo para el turismo y que pueden cambiar con el tiempo

Several initiatives are trying to guide actions to determine the sustainability or good practices on the road to sustainability of tourist destinations. In recent decades, we have witnessed the attempt to consolidate "sustainable" or "green" certifications. Certifications certainly help guide actions and to reward good practices, but should be globally accepted and controlled by a recognized and international organization. One of these initiatives is called the **Global Criteria for Sustainable Tourism**[5]. These criteria are an effort to standardize as far as possible, the performance in tourism destinations which aims to achieve sustainability. They can therefore be regarded as minimum standards that address any tourism organization wishing to be sustainable should aspire to achieve. The Global Sustainable Tourism Council (GSTC) emphasizes that these criteria are part of the response of the tourism community to achieve some of the Millennium Development Goals of the United Nations[6] .

[5] These criteria are administered by the Global Counsel of Sustainable Tourism (GCST) that is formed of a number of important organizations that are involved in tourism activities, like the WTO, destination management organisms, etc.

[6] These criteria are oriented towards the eradication of extreme poverty and hunger, the gender equality, and environmental sustainability including climate change

These Global Criteria for Sustainable Tourism identify four groups of indicators:

1. Demonstrate an effective & sustainable management
2. Maximize social and economic benefits for the local community and minimize negative impacts
3. Maximize benefits to communities, visitors and cultural heritage and minimize negative impacts
4. Maximize benefits to the environment and minimize negative impacts

But in conclusion, we can say that:

1. There does not exist a universal formula of sustainable tourism , aspects such as the maturity of the destination or tourism product, its stage of economic development, sociocultural phenomenon, perception of sustainability, the geographical nature of the destination, etc., make it impossible to reproduce a single model of sustainable tourism.
2. The measure of sustainability in tourism destinations is poorly underdeveloped. The series of homogeneous and comparative data on the ability of tourism to generate positive and negative effects are still incipient. Progress in this field requires special attention to the system of indicators of sustainability.

CONCLUSIONS

As we have seen, tourism continues to establish itself as an industry with great potential for the growth and development of countries. The following are highlights of the main features of this activity in recent years:

- Growing importance of tourism as an economic sector worldwide
- Expansion of tourism to all world regions, although the weight and pace are different
- Optimistic outlook for the coming decades; UNWTO forecasts point to a continued growth through 2030, reaching 1.8 billion international arrivals
- Emerging countries progressively gain an international market share
- Extraordinary resilience of tourism after crises (9/11, SARS, etc.)

Competitiveness and sustainability are the two main objectives of tourism policy. In other words, the public sector intervention in the tourism market. As we have seen throughout this work, there has been a significant effort of definition and conceptualization of both concepts. However, we cannot say that there is a widely accepted definition or that both concepts are fully defined so that they can serve in the management of tourist destinations.

The need to change before greater international competition, rapid changes in the profile and demands of tourists, advances in information technology and communications, changes that cause climate change, etc., make it increasingly more necessary to adopt decisions in one's destiny. The management of these tourist areas require standards and references to guide action.

Competitiveness research has generated measurement indices which incorporate a large number of variables. In the case of sustainability, proposals for indicators are advancing for destinations in such a way that they can become a useful & defined concept in the management of destinations.

Both concepts continue to set different trajectories in research. There has not been an effort to try to reconcile the two. The trend toward improved management of destinations requires that both concepts can be reconciled within innovative management schemes.

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A SUSTAINABLE HOUSE AND ASSOCIATED APPROPRIATE TECHNOLOGY TO REDUCE POVERTY, ELEVATE THE LEVEL OF LIFE OF INDIGENOUS COMMUNITIES, AND CONSERVE THE ENVIRONMENT IN MEXICO

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ABSTRACT

The Earth is currently experiencing climatic instability. Data from temperature and precipitation anomalies prove it. The most accepted hypothesis by the international scientific community is that this instability is caused mainly by anthropogenic effects. According to this hypothesis mankind is issuing more and more greenhouse gases though the consumption of fossil fuels since the Industrial Revolution. These gases are causing changes in the temperature and average precipitation over large regions of the planet, which in turn is causing changes in the hydrological cycle. Under this hypothesis, there is currently an analysis of the potential impact of these climatic alterations of the environment and its relation to man, especially in areas discussed where natural resources such as water are scarce. However, these studies should also develop in area in the world where besides the potential threat to natural resources there is a need to provide and preserve vital resources like water and forests. This is the case of thousands of poor communities around the world, especially indigenous communities. It is important to emphasize that these communities lack decent housing, cement floors, electricity, drainage, and medical services –in general, inadequate means to live decently. This paper describes a project called "Sustainable House" (SH), which seeks to dignify life in the poor, especially indigenous, communities in Mexico. In addition to saving energy , avoids the emission of greenhouse gases into the atmosphere (the SH does not use fossil fuels), it preserves natural resources such as water, soil, and air while raising the standard of living of its inhabitants. The SH includes nearly a dozen "Appropriate technologies" (AT) for efficient water use and conservation of the environment, and was designed based on the experience gained with the Rainwater Collector (*Colector de Agua de Lluvia-CALL*, in Spanish) built in 1999 in the indigenous community of Yalentay in the municipality of Zinacantán in the Highlands Chiapas. The SH can be adobe, brick, or concrete block depending on the material avail-

able in the area. It was designed in a modular manner, considering the Tzotzil indigenous cosmogony of the Highlands of Chiapas. It consists of two or three bedrooms (depending on number of family members); living room; an ecological bathroom, kitchen with stove and ecological water tank (one part in the kitchen and another part in the courtyard), and the entrance porch. The construction surface can be adjusted to 50 m 2 minimum to comply with the Rules of Operation of Rural Housing, for fiscal year 2014 of the Ministry of Territorial and Urban Agrarian Development (SEDATU, 2014) program. The technologies in this sustainable home are: a). Home Rainwater Collector (*Colector de Agua de Lluvia Domicillario*-CALLD) with attached filter, b). Ecological bathroom (does not use water), c). Bici-pump (a system that only uses mechanical energy of pedaling a bicycle to raise water from the water tank to the roof water tank), d). Ecological sink (clean soapy water and oil for reuse), e). Ecological stove (saves fuel and prevents smoke pollution in the home), f). . Intermittent irrigation system (saves up to 50% of water for irrigation of vegetables and flowers) The SH also includes: antibacterial reinforced floor, three kits of photovoltaic solar panels for electricity supply in areas where it is necessary, efficient light bulbs, low consumption toilets in the case of wet composting toilets, and low flow shower and faucets. This year the first functional sustainable house in an indigenous communities in Mexico will be built, which will be donated to a family of 10 people. This family was selected by the community according to their criteria and customs.

Keywords: *Sustainable House, alternative technologies, rainwater.*

Thousands of indigenous communities in the world live in conditions of poverty. During the meeting of indigenous peoples and health in 1993 in Winnipeg Canada, it was recognized that America's communities are still living under precarious conditions (Torres et al., 2003) and hundreds of them are without adequate housing and drinking water. Regarding the issue of housing in general, 20 years ago the Economic Commission for Latin America (ECLAC) estimated the lack in housing in Latin America (A L) at 27.9 million homes. Adopting an average of five people per room, we can come to the conclusion that 140 million Latin Americans are living in poor housing or are homeless. An estimated total of 270 million Latin Americans are poorly housed or homeless. This problem has currently worsened. The quantitative and qualitative housing deficit affects more than half of the households in Latin America. To absorb it would be necessary to build or improve 53.6 million units (Salas, 2002). Living conditions are also typically worse in rural areas.

On the other hand, the supply of drinking water to small rural communities is a problem that Latin American countries have been unsuccessful at resolving. According Gelles (2002), Gentes (2002) and Guevara et al., (2002) cited by Peña (2004) argue that studies of the Water Law and Indigenous Rights (WALIR) program indicate that water rights are linked to the right to land, and is one of the great challenges that indigenous peoples face in America. It is a key issue for the management of this resource in the sub-continent. In the case of the American Continent in which more than 40 million indigenous people live, most have high mortality rates due to preventable causes such as water-related diseases, and have an overall decrease in life expectancy at birth. This demonstrates to a degree the disparities between indigenous people on this continent in relation to other social groups (Torres et al., 2003).

Mexico is not isolated from that reality. Indigenous communities in Mexico live in precarious conditions in education, housing and basic health services. Thousands of families live in

overcrowded conditions and many others lack even the most basic amenities such as potable water. In 1995, it was estimated that of the 803 municipalities with more than a 70% indigenous population, 44% had living conditions classified as highly marginalized (INI, 1993, 1999). With slightly more than ten million people spread across the country (INEGI, 2000), indigenous communities in Mexico have existed for hundreds of years in unsanitary conditions, lacking basic infrastructure to live in dignity. Thousands live in extreme poverty and with communication problems to the world outside of their communities. In Mexico, more than 72 languages other than Spanish are spoken, which represents a difficulty, especially for adults, in terms of communication and their civil rights. Mexico's indigenous population is concentrated mainly in the states of central and southern Mexico. The states of the Mexican Republic with the largest indigenous populations are Oaxaca with more than a million and a half people, Chiapas, also with more than one million and a half inhabitants; Veracruz, Yucatán, State of Mexico and Puebla, with around 900,000 Indigenous people. The states of Hidalgo, Guerrero, Quintana Roo, San Luis Potosí and Tabasco also have large indigenous populations. In the Federal District (DF) there are 333,000 people of indigenous origin; making DF the urban are area with the highest concentration of indigenous people in Mexico (Peña, 2005).

On the other hand in the north of the country, for example Sonora, there is a large population of Yaquis and Mayos. The Tarahumara live in Chihuahua and Coahuila, which also has a small Kickapoo group (Peña 2005). In 27% of 2443 municipalities in Mexico contain 40% of the indigenous population, the vast majority living in very poor and unhealthy conditions such as those already stated - lack of water and decent housing. The potable water supply (a basic right of any individual) is still a utopia in thousands of rural communities in the country which also face additional major shortcomings. Thousands of indigenous live in extreme poverty. Regarding the poverty level, a study conducted in 1994 in four Latin

American countries (Bolivia, Guatemala, Mexico and Peru), Mexico showed that 81% of indigenous people lived below the poverty line (with income below two dollars a day). According to this investigation, in municipalities with a population less than 10% indigenous, the poor represented 18% of the population. In those that were between 10 and 40% indigenous, the poverty rate increased to 46%, and in municipalities with more than a 70% indigenous population, poverty affected 80% of the population. The level of education had a similar contrast: the average years of schooling was seven years in municipalities with a 10% indigenous population, and decreased to 3.5 years of schooling in municipalities with a more than 40% indigenous population (Psacharopoulos et al 1994).

In Mexico according to official estimates, 42% of indigenous households lacked piped water in 2000 and 70% had no sanitation. This partly explains the resurgence of diseases such as cholera and typhoid which persist in these regions (Peña, 2005). Mexico continues to record, particularly in rural areas, high rates of infectious diseases whose transmission is associated with the lack of potable water or the consumption of contaminated water. For example, in the case of diarrhea the Ministry of Health and Welfare established a report that this disease is a leading cause of death among indigenous groups, with a rate three times higher than the national (SSA-INI, 1992). On the other hand, in the case of Chiapas there are at least three municipalities with endemic trachoma, a disease caused by the bacterium Chlamydia trachomatis that according to the World Health Organization cited by SS (2010), states that there are almost seven million blind people in the world by this disease. Trachoma is endemic in 56 countries, not only in Africa, Middle East and Australia, but also in parts of Asia, Latin America and Western Pacific. Nearly 84 million people have active trachoma, and 7.6 million have trichiasis (S S, 2010). In the case of Chiapas, this disease is spread by unsanitary conditions normally associated with traditional customs and a lack of water. In an interview done by the newspaper La Jornada, there are about 5000 indigenous

Tseltales that live in communities with extreme poverty in the municipalities of Oxchuc, San Juan Cancuc, Tenejapa, Huixtán and Chanal which have trachoma (La Jornada, 2012). In another study by Cisneros et al (2013) in the Tseltal community of Chaonil in the town of Oxchuc Chiapas, it was found that in all age groups which were studied there was a high prevalence of trachoma. They are all potential sources of infection. It was concluded that "physical and close" contact is decisive and necessary to acquire the infection in places where government programs to address trachoma are weak, short term and poorly executed.

APPROPRIATE TECHNOLOGY PROJECTS DONE IN INDIGENOUS COMMUNITIES BY THE RESEARCH CENTER OF THE SCHOOL OF ENGINEERING OF THE UNACH

According to the National Institute of Geography, Statistics, and Data (*Instituto Nacional de Geografía Estadística e Informática* -INEGI, 2010) records from the last census of 2010 indicate that there are 192, 244 localities in the country of which 3,653 were urban and 188,591 rural[1], the latter with a total population of 26,062,076 inhabitants (Table 1).

The rural population of the country represents about 23% of the total population (these data have not undergone substantial changes to date). Most of these rural communities have houses without cement floors and problems with water supply, especially those with less than 1000 inhabitants. The problems are magnified in communities with populations of no more than 500 less than 100 inhabitants. In the case of Chiapas, according to official data from the National Water Commission (Comisión Nacional de Agua-CONAGUA,2009) there is full coverage of potable water for 89.9%

[1] INEGI those considered rural population under 2500 inhabitants

of the population and a coverage of treated wastewater of 47.2% . Other sources indicate that 41% of the population lacks piped potable water and 55.7% lacks sewage connections (It is difficult to precisely quantify the amounts, which is why the sources have different data, as can be seen in Table 2).

Table 1. Number of urban and rural locations in Mexico (INEGI, 2010).

SIZE OF LOCATION	NATIONAL		CHIAPAS	
	Localities	Population	Locality	Population
Total	**192 244**	**112 336 538**	**20 047**	**4 796 580**
From 1 a 499 inhabitants	182 335	10 622 618	18 160	1 061 545
From 1 to 2,499 inhabitants	188 591	26 062 076	19 886	2 460 645
From 2,500 to 14,999 inhabitants	3 076	16 064 124	140	748 266
From 15,000 to 49,999 inhabitants	384	10 559 634	20	594 776

Table 2. Coverage of basic public services, dirt floors and overcrowded housing

HOUSING, 1995	CHIAPAS
Drainage	42.66%
Potable or piped water	42.09%
Electricity	34.92%
Overcrowding	74.07%
Dirt floors	50.9%

Clearly, the data in Table 2 are multiplied by the poverty of hundreds of communities in this entity. Therefore under these circumstances the Zapatista movement called forth for the need to dignify indigenous societies through public services that every Mexican citizen has the right to enjoy. In this historical context, through the Mexican Institute of Water Technology (IMTA) and the Food Agricultural Organization (FAO) a technical delegation traveled to Chiapas was organized in 1995 to analyze the problems of indigenous communities in relation to water supply. The first meeting was held in the library of the Faculty of Engineering of the UNACH with a group of international, national and regional experts who analyzed the problems related to the theme of water and indigenous communities. From this meeting a small research group gave rise to a line of work in the IMTA on "Alternative Hydraulic Technologies " whose first product was the publication of a book entitled "Alternative Hydraulic Technologies: Technical Selection Guide" (T*ecnologías Alternativas en Hidráulica: Guía técnica para la selección*, Mundo et. al, 1997) that the institute published and distributed to various institutions in the country[2].

In this manner, motivated by this work starting from the ideas proposed in the before mentioned book, a research project analyzing the intent or ability to *collect water from fog* to supply drinking water was derived for small rural communities of the Highlands of Chiapas, taking advantage of low cloud banks (fog) that occur in that region. Two experimental models were built called *fog water collectors* (*Colectores de Agua de Niebla* -CAN), one of them in the indigenous community of Chainatic the Highlands of Chiapas (photo 1) and the other near the Llano San Juan airport in the municipality of Ocozoc uautla (Photo 2).

[2] In the following years, supported by the work, publications and projects done by this small group of investigators and due to the awakening interest in this sector, the IMTA created the Sub Coordination of Appropriate and Industrial Technologies.

Photo 1. CAN experiment in Chainatic, Chiapas.

Photo 2. CAN experiment outside of the Llano San Juan Airport, Ocozocuautla, Chiapas

It was concluded that due to the low presence of fog banks in the study sites (compared to coastal fogs) and the short duration of the event, it was not possible in practice to obtain good results (Mundo et., al 1998). So the project was moved to the small fishing community of Punta Baja, in the Baja California coastal region of Mexico, where CAN fulfilled its objective. The average volume of fog water collection in Punta Baja was significantly higher than the volumes collected in Chiapas.

However, there is still pending a search for viable and economic alternatives to provide drinking water with unconventional technologies to small rural communities in Chiapas. For these reasons we continue with the research to provide water to these communities despite adverse technical conditions, among the most relevant are: scattered villages situated in locations with difficult access due to irregular topography, remote communities without significant surface water (rivers, streams) or natural reservoirs (lakes, ponds) and few springs with minimum flows. Thus, in this search and based on the book published in 1997, the Rainwater Collection System (*Sistema de Colección de Agua de Lluvia* -CALL) was designed, which under a tripartite agreement between the Mexican Institute of Water Technology, the Spanish Agency for International Cooperation (which granted the financial resources for construction) and the Faculty of Engineering at the U NACH advised and guided the construction of a CALL system in Yalentay (photo 3), which in 2010 was awarded the World Prize of Engineering "Best Practices" by the United Nations (UN) and the Government of the United Arab Emirates city of Dubai.

Photo 3. Rainwater Collector, Yalentay, Zinacantán, Chiapas

Basics design aspects of CALL. In order to build a rainwater collection system described herein, it is necessary to consider the following studies: topography, soil mechanics, hydrology, hydraulics, structural design, construction, social issues and social framework for the transfer of the system (Mundo, et al., 1999). *The topography* determines the flatness of the terrain and its profiles, in order to estimate the cuts and plot the ground storage tank construction site, while studies of the soils provides two basic data. First, the resilience of the soil to the design of the type of footings that will support the columns and the structure of the collection roof; and secondly the type of soil and its infiltration capacity (in some cases this test is performed with a double ring infiltrometer). If the infiltration rate exceeds the allowed limit, the base of the tank will have to be covered with a synthetic rubber geo-membrane or thermoplastic polymer obtained by the polymerization of ethylene. For their part, the hydrological studies are essential to meet the intensities of rainfall in the area and the average annual precipitation. Rain intensities associated with

several return periods will enable a good design of the system of channels and determine the capacity and size of the CALL filters, so that the construction of the IDT curves are necessary. The annual average rainfall is used to size the storage tank volume which is a function of daily demand, population and storage time estimated with a volume version of the equation of conservation of mass:

$$V=f(v_m.P.ta)$$

Where:

V = Total storage volume in m^3

vm = Average volume delivered to each person each day (l / person / d)

P = Total number of people to supply

ta = Time that the water will remain stored (d)

The known maximum storage volume and with the data of average annual precipitation (it is important that this value is the standard according to the criteria of the World Meteorological Organization) can estimate the area (A) of collection required, taking into account a security coefficient of 20%, therefore:

$$A=f[V/(Px0.80)]$$

Where:

A = Surface of roof collector (m^2)

V = VTotal storage volume in m^3

P = Total number of people to supply

On the other hand, once flow rates for different return periods are obtained, uniform flow equations for prismatic channels will allow to design the dimensions of the gutters. For the case described here, gutters with a slope of z = 0 and less than 1%, are

considered. Therefore, by using the Robert Manning equation the dimensions of the gutters (hydraulic area and wetted perimeter) will depend on the estimated flow according to RTD curves, the roughness of the material (n) of said channel and slope (S):

$$R_h=[v.n/ (S^{1/2})]^{3/2}$$

Where:

v = average flow in the prismatic channel (ms^{-1})
n = Manning rigidity (dimensionless)
Rh = Hydraulic radius (m)
S = Slope of the prismatic channel (dimensionless)

For his part the *structural* design defines the dimensions and spacing of the collector roof beams (*fink* type structure) as well as the number and size of the support columns. If the area is seismic and high wind speeds are present, it is necessary to consider to review the design for earthquakes and wind. The construction aspects are important because they can meet the requirements of design, quality of materials and compliance with corresponding regulations. Finally the *social aspects* and *transfer scheme* should be considered before construction of CALL and must be executed by a team of experts in sociology and communication to ensure the transfer of the system and make users take ownership of the project[3].

This project generated multiple benefits to the community, raising the standard of living of its inhabitants. Among the most

3 The Yalentay project was achieved through excellent planning. All of the specifications of design and programming were achieved through the support of specialists, included experts in structures, hydrology, sociology and communication. In this manner, after more than 10 years the CALL continues to successfully function. It has resisted earthquakes, the largest of which was 5.5 on the Richter scale. But the most important is that it continues being useful in a society where for hundreds of years had lacked potable water

relevant results were: a) The reduction of diarrheal diseases, b) The decrease in skin diseases, c).Children consume drinking water at school that comes straight from the CALL, d). There is less absenteeism by decreasing the water-related diseases, e). Women do not have to walk miles away on a steep topography to get water, most often of poor quality s, f). It strengthened the community actions by establishing the first " indigenous hydraulic committee " in Chiapas in that community (referred to small rural communities under 1,000 inhabitants), raising it to the rank of a "hierarchical responsibility" for two years the responsibility of distributing water through the CALL (this role is equivalent to the responsibility of "ecclesiastic steward", a charge sought by various community members for the social distinction that this role carries, g) A generation of trust between the community and the researchers, and as a consequence opened the (previously denied) possibility to continue executing projects in Yalentay.

With this community welcome and support, works continues on appropriate projects to conserve soil, air, water, atmosphere and forest, with the idea of converting into a model community, understood as: "... a place where due to its easy accessibility, acceptance of the community to develop projects and its proximity to the city (San Cristobal de Las Casas), you can plan, develop, execute and transfer projects of appropriate technology for the conservation of natural resources and diminish poverty, dignifying the individual and social being, with the goal that students, engineers, researchers and decision makers in the public and private sectors could see or develop specific practices with projects, for their promotion or transfer to other latitudes".[4]

4 Internet links (SCHRT, 2005a y SCHRT, 2005b) : https://www.youtube.com/watch?v=zeIT2L0bEqQ, http://www.youtube.com/watch?v=POSHGLwNPNo, http://www.youtube.com/watch?v=hxs3ledKHgw, http://www.youtube.com/watch?v=dNhkPW2nYOU, where you can see the use of the CALL in Yalentay and the religious festival for the water in the Zinacantanian town. The following link describes the sustainable house in an interview which is mentioned in this document: https://www.youtube.com/watch?v=37lj7wURCSg

THE SUSTAINABLE HOME

Sustainability. It is a definition created to promote the maintaining of balance in the relationship between humans and the environment. It tries to promote economic development without damaging the dynamics of the environment, using scientific and technological breakthroughs from society. Sustainability intends to meet the needs of the current generation of humans using natural resources provided by the Earth without sacrificing the future capabilities of the next generations. It is a concept that is still not completed. It is promoted by the Mexican State as a political action, as a *slogan* for its social promotion and individual or group interests, but without positive results in practice. Society "waits" for sustainable action by the state in a passive and irresponsible manner, because individually and as a whole is not fully aware of the magnitude of the problem. On the other hand there is the science and technology that is blamed for its "actions and consequences" on the environment. It is neither science nor technology to blame, nor the economy or politics. They are not because none of them, from the point of view of the theory of knowledge, are subjects but rather objects. The subject is active, the object is passive. In the social becoming a group of men (subjects) develop science and technology (objects) and others choose to apply it. The man (subject "I") may decide, can trigger, therefore is responsible, alone or in small groups because their actions plunders the environment without preserving it. It is man with his unethical actions, in his economic efforts or zone of comfort who has not found the necessary balance between desires and conservation of the nature that surrounds him, and that provides life: water, air, soil, food, and material goods.

Therefore, the concept of sustainability must be rethought- not as a concept that only a evokes a multiplicity of processes that compose it- leaving only the social and political as imaginary concepts. Sustainability must be restated as a "measurable action",

as a new way of thinking rooted from childhood in formal and non-formal education (civics). But mainly it must be restated as a new form of behaving, where the relations of its three main entities- environment, society and economy- have measurable and practical effects. The bad individual or group actions that have negative results with nature, rural or urban areas, must be restituted and / or restored by the "actors of such action." These actions must have political, economic or social consequences, with the pedestal body and Adjudicating of the facts, independent of the state, constituted by civil society, supported by the laws for the preservation of the natural environment, where even the lack of promoting sustainability by the state is evaluated and judged by the citizen committees.

In this manner, politicians, scientists, technicians have roles to play with ethics and responsibility in relation to the environment. It is crucial that the state not only increase the budget for research on these issues but promotes the preparation and formal awareness of citizens from childhood. On its part, universities and research centers should increase its research and technological development in environmental topics for conservation and restoration. Within the jurisdiction of Earth Sciences and associated technological fields, it is necessary to turn our eyes towards poor rural communities, especially indigenous communities, worldwide to address and rethink these issues: modeling climate to analyze the impacts on the hydrological cycle under various climate change scenarios; develop techniques for downscaling to model climate at regional or local levels; develop and implement methods to provide potable water to rural communities; develop methods to purify water without the use of fossil fuels; implement methods to save and preserve water resources; develop new methods to clean wastewater using eco -technologies; develop methods and technologies for the conservation of forests, rivers, streams, and springs; implement methods for soil conservation and maintain air quality; implementing economic methods to

bring electricity to rural communities with "clean technologies"; develop new models of sustainable housing that also contemplate the architectural design for the weather and local environment, use of space, thermal building materials that are economic and resistant and equipped with technologies that allow better use of water, air, soil and the natural environment .

In this context and through taking up this set of ideas, a sustainable house was designed with the idea of transferring it to the indigenous community of Yalentay. Thus, the Research Center of the School of Engineering of the UNACH with the support of an architect and alumni from this university, have integrated the experience gained in the CALL- taking into consideration customs, values and indigenous cosmogony- to propose a "SH" associated with nearly a dozen AT's, based on four elements: water, soil, fire and air[5]. Therefore based on their cosmogony, one of the first factors taken into account in the design project of the SH and AT's was the soil. For these reasons the design of the SH was adapted and the AT's to the average space (ground) that a normally large indigenous family for accommodation. Another was adapting to their requirements according to their customs. For example, they are not interested in Western vision of a "big" house, because the ground is communal-it belongs to everyone. In their words: "... the tiny earth if of the community, of men, and the smallest is of the dead. The largest land (the majority), is the forest where the air that gives life comes from, the firewood for heating the home; this, the largest land, also belongs to corn from where the family exists. " The soil gives them the sense of belonging "... it is my land, it is everyone's, it is my heritage, I am from here, here were born my grandparents and my parents and here I will die." Soil is fundamental in its cosmic vision. In this small area it is necessary to

[5] The sustainable house has a patent pending with registry number MX/a/2014/004491 with the Mexican Institute of Industrial Property (*Instituto Mexicano de Propiedad Industrial* -IMPI).

shelter them with dignity, helping them to improve and maintain their health. In the same "ground" there is also a healthy relationship that determines the family morbidity: a firm anti-bacterial floor means less biological vectors that generate diseases with that combined with the biological vectors found in water are the major causes of illness and death in these communities.

Moreover its relationship with water is basic not only to eradicate certain diseases of poverty such as dermatitis, diarrhea, trachoma, or to raise their standard of living, but also for its religious character shown in syncretic acts every April 15, when the whole community participates in the water festival in the CALL and executes the cleaning of the holy wells, acts of pre-Hispanic origin for "vo"[6] honoring Tlaloc mixed with the liturgy in honor of Christ. This link with water is achieved in the SH through four associated AT's, one of which is a replica of CALL but now in a house called the CALLD, which can store more than 35,000 liters of water if the design requires. The three other appropriate technologies are: a tank with a laminated siphon for irrigation, an ecological sink, and the bike-pump. The SH also has a system called an intermittent irrigation siphon tank used for growing flowers and vegetables that saves 50 out of every 100 liters of water used. The ecological sink is made of several deposits made from brick that cleans the soap or oil from domestic water for re-use. Finally, the bike-pump is a device composed of a stationary bike attached to a horizontal pump "charm" that raises the water from the rain water collector and sends it to the elevated water tank.

Moreover, in indigenous cosmogony fire (represented by the Sun) is one of their most important gods, who every morning peeks over the mountains in the dawn and then emerges victorious in its struggle against death (represented by darkness), soaring through the sky to complete its cycle-circular- just like the

[5] "Water" in tzotzil zinacanteco.

indigenous cosmogony. The ground fire "detached" from the sun, provides hot food, cooks the food that gives life, represents the "home", in the center of which the family is based. It is a source of light and heat, which in high and mountainous areas serves to shelter the family from the intense cold. The ecological stove (ES) is the metaphor of this myth. . The ES is the source of heat in the SH and is the means to cook food. The ES has a chimney to evacuate smoke for the SH and thus helps reduce respiratory illness in the family. The ES also contributes to forest conservation by efficiently using firewood. The SH obtained a "Global Energy Award 2013" in May of 2013, one of the most prestigious awards in environmental issues in the world awarded by the "Energy Globe" foundation based in Austria. The following is a brief description of the technologies associated with the SH.

Figure 1. View of sustainable house

Household rain water collector (CALLD). The CALLD is a circular tank, made of reinforced cappuccino brick with electro – welded metal mesh, plastered inside and outside. It has a filter that cleans the water of impurities and where you can chlorinate if necessary (Figure 2). It is economical because the cost is equivalent to $ 0.10 USD per liter and tanks over 35, 000 liters can be built. It competes with the cost of companies that sell plastic tanks (PVC or HDPE), but the CALLD is outstanding for its durability

and storage capacity. The laws of design are the same design as the CALL (equations 1-3).

Photo 4. CALLD in Yalentay, Chiapas

Hydraulic ram pump (HRP). The HRP operates continuously for 24 hours using only hydropower. It is powered by a natural or artificial drop of at least 1 meter high. There must be a constant flow of the supply source, which can be a stream, river, small dam or tank. The recommended minimum flow of the source must be 2 l/sec and the minimum hydraulic load should be 1 m high. If the minimum height between the source and the entrance to the HRP is 1 m, it can push water up to 10 m in height.

Foto 5. Hydraulic ram pump, Research Center, School of Engineering

The bike-pump (BP). The BP operates with the simple pedaling of a stationary bike that converts mechanical energy into hydraulic energy. The operating range of the BP (Figure 6) is up to a 8m depth in the suction and up to 20m high in the discharge. The pumping rate can be from 0.8 l/s for 1m of elevation with a 1 inch hose, up to 0.2 l/s to 20m in height.

Photo 6. Bike pump in Yalentay

Gravel and sand quick filters (GSF). GSF's are used for the treatment of turbid water, with sediment or suspended particles in suspension and that generally have no prior coagulation and sedimentation. They are used to clean water before sending it to a reservoir. It consists of an upper layer of 40 cm sand sifted through No 8 and 16 mesh. Below this layer a layer of 40 cm gravel is placed ½ of Θ and finished with a bottom layer of 40 cm of gravel ¾ ¨ of Θ. In the inter-face layer of mesh is placed a layer of screen with a smaller diameter than the upper particles to avoid heterogeneity in the filter layers.

Photo 7. Sand and gravel filters in Yalentay

Slow home filter (SHF). The SHF consists of a vertical 200 liter plastic container, with an upper layer of prepared sand 60 cm thick placed between the mesh openings of 0. 42 and 1. 19 or 1. 41 mm, with an effective size ranging from 0. 50 and 0. 60 mm and a coefficient of uniformity of less than 1.5. Below the sand layer should be placed a layer of 40 cm of charcoal, prepared between the Tyler series meshes with openings of 0.59 and 1.68 to 2. 00mm, with an effective size ranging from 0.80, one 10mm and a coefficient of uniformity less than 1.5. A drain is located under the charcoal layer, which serves as a collector of filtered water, connected in turn to a faucet.

Ecological Bathroom (EB). The EB has two brick structures with reinforced mesh. The first is a septic tank for the sedimentation of solids; the second consists of two chambers formed by an anaerobic filter followed by a filter of graded materials. The anaerobic filter is filled with plastic rings (PET) which serve to distribute the water evenly and that the bacteria feed on contaminants in the water. The second chamber is formed by layers of graded materials (sand, pea gravel, gravel and round stones) placed in that order (from top to bottom).

Figure 2. Homemade filter

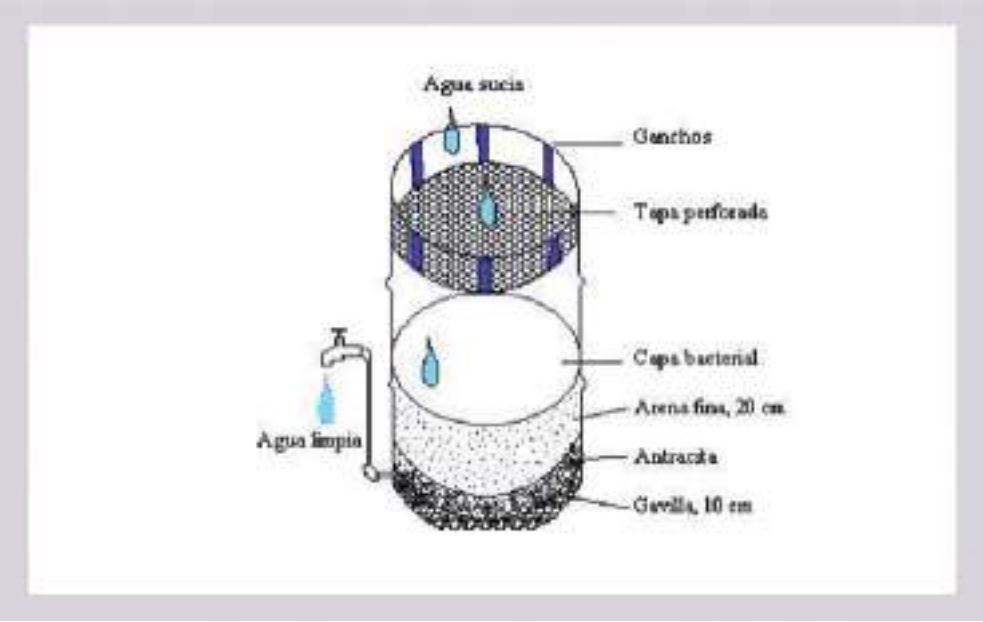

Photo 8. Ecological Bath in Yalenyay, Chiapas

Ecological sink (ES). The ES is an appropriate technology that is used to treat through a biological system using water from the laundry, dishes and washing hands. The ES is a five-chamber structure of brick with reinforced mesh: 1. A grease trap with a drain colander to trap solids; 2. Two sealed chambers for anaerobic treatment of rings from plastic bottles (PET), to increase the area available for the development of bacteria and; 3. Two chambers with graded materials. Next to the first chamber is located the laundry area (photo 9).

Photo 9. ES in Yalentay Chiapas

Tank with laminated siphon (TLS). The TLS is a hydraulic structure (tank) used to supply water intermittently to agricultural parcels (up to one hectare) small home gardens. This system has a discharge tube in the shape of a laminated siphon, which can save large amounts of water (up to 50 out of every 100 liters used) compared to continuous surface irrigation. The fundamental equation governing its intermittency for a constant flow input is:

$$Q_s > Q_e$$

Donde:

Qs = Inflow (l/s)
Qs = Outflow (l/s)

Photo 10. Laminate siphon tank

Ecological stove (ES). The EE is a small rural stove or fireplace made of brick that has a "furnace" at atmospheric pressure whose energy source is the internal combustion of wood. The upper surface of the ES is constituted by a metal plate of 10 gauge steel (40.5 cm wide by 61 cm long) that is used for cooking or heating food. The ES saves a lot of wood and prevents pollution inside the home by removing smoke through a metal chimney (photo 11).

Foto 11. Estufa ecológica en Yalentay, Chiapas.

CONCLUSIONS

Thousands of indigenous communities in Latin America and Mexico are living in poverty. They lack basic public services such as water, sewage, electricity, health services and decent homes. This paper presented a sustainable house and a set of appropriate technologies for poor communities that permit them to dignify their life and live decently. One of these technologies (which was also the solid precedent for future developments) is the rainwater collector built in the indigenous community of Yalentay in Zinacatán, Chiapas. Built in 1999, it has produced many benefits regarding health, dignity and community social relations. From this point it is planned to constitute this population as a model community, where they have developed and in this case validated nearly a dozen suitable appropriate technologies for the provision of potable water- raising the standard of living of its inhabitants and conserve the natural environment such as soil, air, water and

forest. From these projects have developed the idea of designing and building a sustainable house that saves energy, prevents the emission of greenhouse gases into the atmosphere and conserves natural resources. The sustainable house was designed incorporating elements of the customs and indigenous beliefs based on the four elements: soil, water, fire and air. The sustainable house can be built of adobe, brick, or cement block depending on the material available in the area. It was designed in modular form and is composed of: Two or three bedrooms (depending on number of family members); living room; ecological bathroom; ecological kitchen with stove and water tank (a part in the kitchen and elsewhere in the courtyard), and an entrance porch. The construction surface can be up to 50 m 2 . The sustainable technologies in the home are: a). Household rainwater collector(CALLD) with attached filter, b). Ecological bathroom (does not use water), c). Bike-pump (system that uses only the mechanical energy of pedaling a bicycle to raise water from the CALLD water tank calld), d). Ecological sink (cleans soapy water and oil for reuse), e). Ecological stove (saves fuel and prevents smoke pollution in the house), f). Intermittent irrigation system (saves up to 50% of water for irrigation of vegetables and flowers). The SH also includes: anti-bacterial solid floor; 3 kits for supplying photovoltaic power in areas where needed via solar panels; fluorescent lighting, low consumption toilets in the case of wet composting toilets, and shower and kitchen sink with water-saving devices. The SH obtained the “Global Energy Award 2013”in May 2013 awarded by the “Energy Globe” foundation based on Austria. This year it plans to build the first functional sustainable house in indigenous communities in Mexico, which will be donated to a family of 10 people. This family was selected by the community according to their criteria and customs.

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THE REGIME OF PATENTS AND TECHNOLOGICAL INVENTIONS OF UNIVERSITIES IN MEXICO.

A historical review between 1940 and 1970

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ABSTRAC

Between 1940 and 1970, Mexico recorded the highest economic growth rate in the last century. This growth was supported mainly by the establishment of a series of protectionist economic policies known as *industrialization in substitution of importation* (*Industrialización por Sustitución de Importaciones* - ISI) directed by the Mexican government. During this period of activity of patenting biotechnological inventions, one of its most accelerated dynamics was also recorded. In this context, this work presents a historical review of the experience of university patenting during this period, characterizing the technological results and its relationship with economic activity.

Keywords: *Industrial Property Law, Patents, economic incentives, technological areas, ISI.*

Mexico experienced a rapid industrial expansion and modernization between 1940 and 1970. This industrialization process was accompanied by a significant dynamic of a creation and adoption of technologies. One of the components of technological progress was the patenting activity of technological inventions. This activity recorded one of its highest levels and pace. However patenting activity by educational organizations was quite low. A certain level of patenting observed came from foreign universities which took advantage of existing economic conditions in the country. By contrast, patent registration by national organizations, public and private higher education was practically zero.

Two elements considered in this paper are the basis of the explanation for such behavior. On the one hand, patenting activity of foreign educational organizations responded to changes in relative prices that came with the growth of domestic economic activity and changes in the industrial production system. In other words, foreign educational organizations were encouraged to obtain patents in Mexico in response to favorable economic conditions that the country offered for both exploitation and for territorial marketing of their products or patented technological processes. In principle this logic should also expect the development of native economic or social agents of a growing country. It is can be endogenously assumed that a nation that records high growth can have a greater amount of resources for research and development efforts, training of senior researchers and others, and for developing their own technological capabilities for the production and dissemination of useful industrial technological knowledge. However, the absence of patenting activity of Mexican higher education organizations challenges such explanations, which is why we try to explore other elements. Although there are important factors such as the ignorance of the benefits of patenting, insufficient or absent university-industry relationships; inadequate or absent financial programs to support research and development of technologies; or, the priorities of educational organizations other than the

generation of technological knowledge activities such as teaching or scientific research; are commonly used to explain the low level of patenting of such organizations. In this paper we propose that an essential element that significantly conditioned the results of patenting shown by the Mexican higher education sector was the kind of incentives shaped by the particular nature and operation of the patent regime prevailing during the period under study. Instead of economic incentives resulting from the expansion and modernization of the industrial sector and the growth rate of the economy as a whole, were the foundation that incited the interest of Mexican educational organizations in producing technologies and to obtain patents - incentives that were established by the patent regime that determined, impeded and delayed their propensity to patent, missing an historic opportunity which is part of the process of industrialization. Therefore, we consider that virtually no patent registration by the Mexican educational organizations was more a problem of rule structure, organization and coordination, than changes in relative prices resulting from amendments to the conditions of the industry and markets.

To these ends, development work is divided into the following parts. Secondly, the different legal provisions of the current patent law are reviewed during the period of this study. While they are general, they may have affected the low propensity for Mexican educational organizations to patent. Thirdly, the results of the historical experience of university patenting and their relationship with economic activity are also presented. Finally, some conclusions are presented.

THE PATENTING OF THE HIGHEREDUCATION SYSTEM IN MEXICO

Incentives for patenting under the Industrial Property Law

One of the essential elements to explain the behavior of patenting activity in Mexico can be found in the prevailing incentives established by the Industrial Property Act of 1943 (hereinafter called the LPI- *Ley de Propiedad Industrial*) during the period of rapid industrialization. Although the entire regulatory framework of the legislation was in character and application generalized for all those interested in obtaining patents, some provisions of the statute could particularly affect the propensity of patenting by higher education organizations, specifically those in Mexico. In general, regulatory elements or vector incentives that probably affected the performance of educational organizations were: a) Provisions on the ownership of the property rights of patents, b) criteria for the exploitation of the patent and distribution of costs and benefits among holders or between them and the inventors should it correspond to different people c) general provisions on the design and operational rules within educational organizations for the purpose of transferring and commercializing the patented technology information.

Ownership. The LPI generally established that the ownership of a patent was by whomever had requested and obtained a patent for by their own account or through a representative or alternatively by a successor (arts. 9, 15 and 35). The title of a patent could therefore correspond to an individual inventor, a group of inventors, a company or a national or foreign combination that were duly accredited by the Mexican authorities. In the case of the education sector, this implied several provisions according to the laws. One way was that the patentee could be only one academic or set of researchers that on their own registered and protected the results of their research even if such activities were carried out within an

> educational organization. Another possibility was that higher education organizations possessed ownership of the patents. In this manner a university could register under its own title the results of a researcher or investigator with whom they have a working relationship only when they had seceded all rights on an invention. Finally ,an educational organization could share ownership with another similar agency, with one or a variety of companies, with one or more public or private centers of investigation, or with a government agency as a result of joint efforts in research programs.

The problem with this particular design of the patent law of 1943 was that it did not lay down special provisions on arrangements for the allocation of property rights under the formulas of shared ownership. This implied that both negotiation and agreement on the allocation of ownership of a patent was in private practice between the parties. This posed no difficulty if private agreements resulted from a convergence of interests and cooperation between the actors involved. However, when incentives for the right to ownership of patents of each stakeholder were not aligned, such as in the case of efforts in shared research, the asymmetric bargaining power of each contracting party could generate an increase in conflicts and to high negotiation costs, opening the way to contractual opportunism which resulted in barriers or lack of interest in research and technological development and patenting in educational organizations, acts that became linked to other organizations or internally with fellow academic staff. Since the LPI did not establish provisions or criteria to resolve the problem of assigning ownership in the event of a conflict of interest, this lack of definition discouraged and hindered cooperation between those involved, affecting the performance of educational organizations, especially Mexican organizations that were framed in such a way that their institutional environment discouraged the investment in

technological activities, or otherwise choose not to devote efforts to patenting their technological results.

> **Exploitation benefits and costs.** The patentee had the right and obligation to use or exploit the patent on their own account or for third parties, but if it did not comply with the obligation of exploitation their rights were restricted (art s. 41 and 42). Therefore, the exploitation in an academic environment could be performed by an individual researcher, an educational agency, or an educational organization and a company, or a combination of all of them. Just as in the case of ownership, the patent law of 1943 lacked specifications or provisions about the forms of participation or collaboration in the direct or indirect exploitation of products or patented technological processes. For example the statute does not generally nor specifically define rights and responsibilities of use by partners: who can carry out the use of rights, how these rights and mechanisms could be exercised and controlled for the rendition of results. The benefits and costs of individual exploitation of a patent were reserved exclusively with its owner.

While the LPI established the right of the inventor to have his name in the title of a patent, it was independent of the ownership and rights or obligations, benefits and costs that this involved. The problem again was that patent law did not establish any precept about the distribution of benefits in the case of exploitation of a patent whose ownership was shared. In the case of the education sector there weren't provisions on the proportion or percentage of profits that corresponded to each researcher, the university, research center, company, government agency, etc. that was co-owner of a patent for its exploitation. Similarly, there did not exist provisions for a special form of benefit sharing arising from the exploitation patented results obtained from joint research between

different organizations, for example between a university and a company, but the ownership of the patent only corresponded to one of them. That's to say, whether this form of collaboration came to be under the regime of the prevailing patents, the patent holder was the only one able to appropriate the total profits obtained from the exploitation of the property, which largely discouraged processes of inter-agency cooperation on technological research with industrial applications when there was no mutual interest.

In an equal or more complex manner, but also not taking the patent system into account, was the situation on the distribution of benefits within a subordinate employment relationship where an academic or research group produced patented technological results but whose titles were patented and in the hands of the educational organization. In neither case the LPI established precepts to rate inventions made within a framework of wage labor within a university, national technological institute, public research center, etc.,. The legislation did not understand provisions on the amount, rate or mode of participation of academic inventors in profits from exploitation. Compensatory mechanisms were also not established regarding their wage payments as prizes, bonuses, commodities, etc. Likewise it did not include provisions that complement the basic social aspects of subordinate employment relations that resulted from the inventive activity.[1] Finally, the patent regime lacked provisions that would allow Mexican educational organizations, with reference to the above provisions, to establish policies within their organizational structure or profit sharing programs and benefits that were harmonious with the efforts and personal goals of their areas of research.[2]

[1] It wasn't until 1976 with the reform of patent law of 1943 that there was introduce an amendment that established that inventions developed from work activities should be established and organized under the Federal Labor Law. For some questions about academic labor relationships in technological research see Kurczyn and Villanueva (2009).

[2] In order to make a comparison with some recent experiences in other countries see OECD (2003); González-Albo and Zulueta (2007); Nezu (2007).

In any of the above mentioned conditions the limitations of the LPI in providing institutional mechanisms for benefit sharing between owners or between patent holders and partners, formed incentives that hindered progress in the production of patented technologies. In the case of Mexican universities where much of the research conducted was understandably within their organization, the absence or inadequacy of the patent regimen to define or delineate certain criteria on modes of appropriation of profits, distribution, amounts, proportions on profits or income and academic staff perceptions for maintaining a working relationship with any of these organizations, led researchers to be more interested in devoting efforts to activities other than technological applied research and basic research, teaching, etc., in response to other incentives provided by the academic environment. Given the uncertainty in obtaining benefits different from academic recognition, it is likely that even a researcher who is dedicated and obtained technological results with industrial patentable value would prefer to make public the results of their research by other means than patenting- through publications in books, journals, newsletters, etc. of academic prestige[3]. According to this institutional weakness demonstrated by the patent law, it is reasonable to assume that the established incentives contribute to restrict and discourage production processes of patentable knowledge and hamper the propensity to patent by Mexican higher education organizations.

Another basic element in shaping incentives which particularly affects the propensity to patent is the cost of patenting. According to the patent law the costs per request and obtain a title is borne by the interested party. However, in similar manner as with benefits, there are not established provisions for allocating the cost in the case that a shared title is sought or under a subordinate employment relationship. The LPI also did not define

[3] Jensen & Thursby (2004); and Baldini (2006) formally model this type of behavior within educational organizations.

exemption or preferential treatment in charging fees for higher education organizations, so under no modality could it be exempted from payment or received subsidized payments for soliciting, reviewing, obtaining and maintaining patents. The uncertainty in the distribution of the costs of patenting and the absence of a regime of favorable rates to the national education sector meant that were specific factors that had a negligible influence on the propensity to patent in Mexican educational organizations.[4]

Transfer of technology. The law of national patents granted the patent owner the power to transfer their rights in whole or in part to others of good legal standing. Both cessation (total transfer of the patent) and licensing (partial transfer) are regulated following Mexican civil law. However, similarly to what is known to occur regarding the benefits of direct exploitation of a patent, the legal standards do not include specific mechanisms for the distribution of profits or perceptions (royalties, bonuses, etc.) between the various participants when a license agreement is made. The patent regime does not offer criteria that would allow educational organizations to make their own decisions about marketing of the ownership of their patentable results, portfolio of patents, licensing arrangements and schemes of participation of costs and benefits. Similarly the LPI does not set guidelines or criteria, although they are general, contribute to the constitution (design & operation) of technological transfer offices through which educational organizations present and reference their processes, policies or internal regulations on decisions to patent technological research results product of the efforts of its research staff; the alternatives of exploitation of patents

[4] A recent example of rules regarding costs of submission of patents can be found in González-Albo & Zulueta (2007).

on their own; the conditions and licensing arrangements of patented technology; and the distribution of costs and benefits among academic staff and educational institutions. In a broader sense the LPI was also not an important instrument of technological policy since it does not consider in its precepts criteria that contribute to the creation or strengthening of forms of relationship building between the education sector, private business sector and the government. Thus the institutional framework of patent law or provides for a very restrictive environment for the commercialization possibilities obtained by Mexican educational organizations, which reduced the propensity to patent when considering obstacles erected against technological invention.

Activity of patenting for higher education organizations in Mexico during the ISI

Patenting activity recorded by the education sector during the rapid industrialization period covers patents owned by national higher education organizations -such as universities, technical institutes and other public and private education institutions- as the number of patents granted to local or foreign higher educational organizations . The level of patenting registered by both groups is presented in Table 1.

Table 1. Patents given to higher education organizations between 1940-1970

Period	Total	Mexican	Foreign
1940 - 1950	9	0	9
1951 - 1960	5	0	5

1961 - 1970	35	1	34
1940 - 1970	49	1	48

Source: Own data based on the Industrial Property Gazette. IMPI. Various years

It is noteworthy see in Table 1 that the total patents granted in Mexico accounted for virtually all educational organizations abroad. Only one patent was granted to a Mexican university, the University of Guanajuato, in the final phase (1969) of the long period. Of the 48 patents given to the foreign education sector, 41 were given to different public and private American universities (86%). Five patents were registered by an Australian public university representing 10% ,and the remaining two patents belonged respectively to a Canadian and Israeli university (4%). Highlighting the predominance of the most active patenting American universities were the Foundation of Indiana University with 7 patents, The Regency at the University of Minnesota with 6 patents, and Ohio State University with 5 patents. However the Australian National University was also one of the most interested in protecting their inventions through patents in Mexico with five titles (see complete list of universities in Table 2 at the end of the text). During the first two decades of university patenting activity , there was low but relatively stable activity. It was in the last decade of the period when a great number, 35 of 49 university patents, were granted -contributing to 71% of all registered patents. Since virtually all patent registration was made by foreign universities, it is assumed that the trend throughout the period responded to the high growth rate of the economy that encouraged these educational organizations to obtain patents in the country. In the period of 1960-1970 , during which the highest level of educational organizations patents were registered,

the Mexican economy achieved an average growth rate of 7.1%- a rate rarely seen in other periods of national economic history.

In contrast, the meager patenting activity of Mexican educational organizations didn't seem to correspond to the expected rationality that high economic growth will encourage the propensity to patent. The national academic sector was prompted to devote efforts in the production of valuable industrial and commercial technologies protected by patents seizing the opportunities and benefits that the historical opportunity of intense industrialization and economic expansion offered. This apparent contradiction in the substantive economic logic of educational organizations is cleared when we consider the nature of the Industrial Property Act 1943 and the incentives that framed the patenting decisions of these organizations. The almost zero effort to patent by Mexican universities and educational institutes was due to obstacles and limitations set by absent and insufficient design of institutional framework and no changes in relative prices encountered with a protectionist regime of national industrialization. We consider the adverse valuation that the national education sector made regarding incentives of the patent law exceeded the expectations of benefits that could be offered to industries and emerging markets during the ISI period given the uncertainty introduced by the lack of definitions and deficits within the patent law as noted in the previous section.

Characteristics of university patenting activity

The registered patents by educational organizations represented different patterns of innovative activity. Reorganizing the patents regarding its technological classification, using the International Patent Classification (IPC), we can examine the characteristics of academic technology research as shown in Table 3.

Table 3. Patents given to universities for technological areas

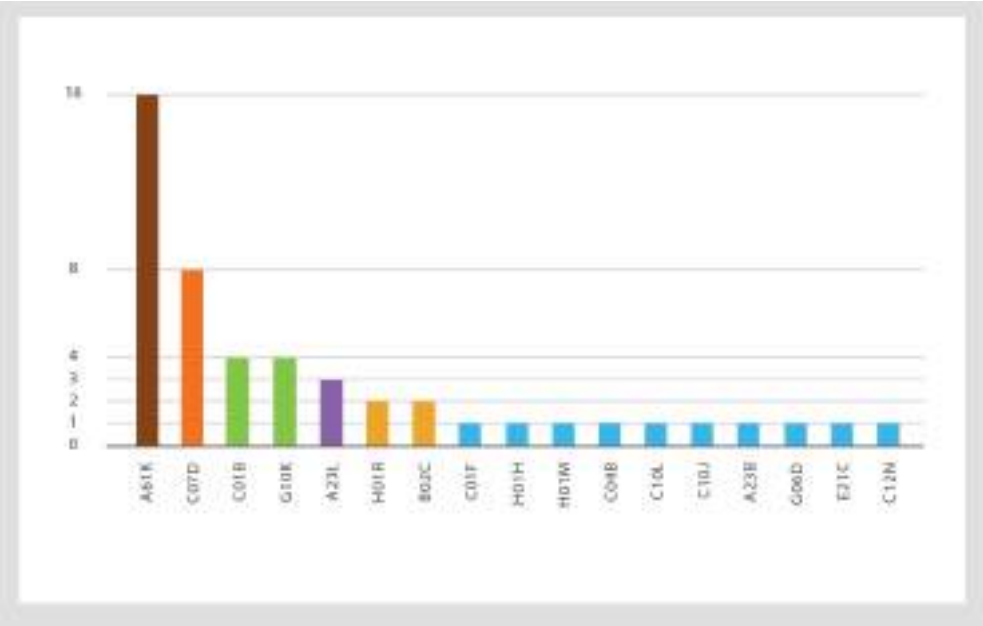
CIP CODE		A	B	C	E	G	H
Period	Total	articles of use and consumption	Diverse Industrial Techniques-Transport	Chemistry & Metallurgy	Fixed Construction	Physics	Electricity
1940 - 1950	9	5		2			2
1951 - 1960	5	2	1	2			
1961 - 1970	35	13	1	13	1	5	2
Totales	49	20	2	17	1	5	4

Source: Own data based on the Industrial Property Gazette. IMPI. Various years

In Table 3 we see that university patenting activity was accentuated in the protection of technological areas that satisfy human needs or assets and consumption (Section A of the IPC). The number of patents granted in this field accounted for 41% of all patents granted to the education sector within the country. Followed in importance by the technological field related to chemistry and metallurgy where 17 patents representing 35% participation in the record. In reviewing the records included in the CIP for technological subclasses, the following features of academic patenting activity are displayed.[5]

[5] The CIP is a system of cataloging patents used by the World Organization of Industrial Property in accord with the Strasburg Accord of 1971. The structure of the classification is basically made up of Sections, Subsections, Classes, Subclasses, Groups & Subgroups. The most desegregated level presented here is Subclass, shown in Figure 1. In table 4 a description of the subclasses that were examined are presented.

Figure 1. Mexico. Principal areas of knowledge of university patents, 1940-1970.



Source: Own data based on the Industrial Property Gazette. IMPI. Various years

In chart 1 we identified that between 1940 and 1970 patents were recorded primarily in technology fields related to health and healing. As shown in A61K and C07D subclasses and to a lesser extent G10K and C01B subclasses, patenting activity focused on the generation of products or processes for medical, dental and sanitation (pink bar) and heterocyclic compounds were a result of organic chemistry and with various industrial applications including pharmaceuticals (orange bar); and also in those inorganic chemical compounds with certain pharmaceutical and healthcare applications such as halogens, percompounds or peroxides, and different sound generating devices (green bars). Together these four subclasses covered 32 of the 49 total patents, representing 65% of total patenting activity in the education sector. The remaining patents also included a variety of related chemical sector innovations; with the development of innovations in machinery,

equipment and tools; the food sector and a record pf related non-metallic mineral alloys (See Table 4 at the end of the text list of subclasses used herein). As noted, 86% of registered patents were owned by U.S. universities. Of the 41 patents of this group, 12 had represented the class A61K of the 16 granted to the entire foreign university sector. Five patents belonged to the class C07D of the 8 in total, while the 4 patents for G10K and C01B classes respectively were all owned by U.S. universities. Due to the size of the sample it cannot be confirmed that American universities observed a pattern of specialization or mastery of the technological sectors of Mexican technological development, however the concentration of patenting these technologies allows us to assume that economic conditions in these sectors were very important for the educational organizations of our northern neighbor.

In order to see if this behavior was related to the economic activity in the country for industrial expansion under the ISI regime, technological fields are grouped based on their equivalence to sectors of economic activity.[6]

As shown in Table 5 economic activity for the chemical industry was more related to patenting activity. Thirty-two (65% of total) of patents granted to foreign universities including the only national patent filed by a Mexican university, Universidad de Guanajuato, corresponded with the development of innovative activities within that industry. Between 1950 and 1970 the chemical industry recorded a high growth rate of 12% on average each year, much higher than in the economy as a whole (6.5%) and product manufacturing (8%). In terms of participation in the value of total manufacturing output, this industry reached an average of 11% over the long term. Due to its dynamism an important share of production was in charge of foreign transnational companies. In terms of value of production of the chemical industry as a whole,

[6] In order to establish relationships between technological subclases of the CIP and economic sublcasses we employ a table in accordance to one presented by Schmoch et. al. (2003).

the participation of foreign private sector increased from 58% in 1962 to 67% in 1970, registering an average annual growth rate of 12.9%. As a result of this performance, the rate of return on foreign direct investment (FDI) increased from 14.4% to 19.2% between 1960 and 1970 (Sepúlveda and Chumacero, 1973). The very favorable results recorded in the national chemical industry during the ISI- high rate of output growth, high return and the significant presence of foreign firms of mostly American origin with universities from the same source could be linked- were important incentives for U.S. educational organizations and others in the propensity to patent proprietary technologies in Mexico.

Table 5. Mexico. University patents & industry-technology relationship

Technological-Industrial Sector	Number of patents	%
Food	4	
A. Food, drink, & tobacco industry	**4**	**8**
Pharmaceutical products	25	
Basic Chemistry	6	
Petroleum based products	1	
B. Chemical industry	**32**	**65**
Nonmetallic minerals	1	
C. Non-Metallic mineral products industry	**1**	**2**
Specific purpose machines	2	
Tooled machines	1	
Office equipment	1	
Electrical equipment	4	
Batteries, storage systems	1	
Electric accessories and controls	3	
D. Machine & Equipment industry	**12**	**25**
Total A+B+C+D	**49**	**100**

Source: Own data from the Industrial Property Gazette. IMPI. Various years; table in agreement with technological & economic subclasses

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In particular, the chemical industry corresponding to the pharmaceutical industry was the most watched patenting activity relationship. Twenty-five of the 49 total patents granted to universities related to this industry, which accounted for just over half of all patents granted (51%). The pharmaceutical industry recorded a significant growth throughout the long period due to the economic and social policy undertaken by the Mexican government since the early forties of the last century.

With regard to social policy, between 1942 and 1943 the Mexican Social Security Institute (IMSS) was created and the Ministry of Health and Welfare (SSA) was reformed. Later in the sixties, the Institute for Social Security and Services for State Workers (ISSSTE) and the General Directorates of Military and Navy Social Security were established. Also during this stage other special health schemes for state enterprises such as Railways, Federal Electricity Commission (CFE) or *Petroleos Mexicanos* (PEMEX) was formed. All of these were part of a public health program aimed at increasing the coverage of medical services provided to the population. This system or social health sector included the acquisition of huge batches of drugs from pharmaceutical companies granted for free to the beneficiaries of each scheme of therapeutic care (Bernal, 1980). This was a major boost to the internal market for the pharmaceutical industry that pushed mainly foreign companies to become established in the country and to participate in productive activities which allowed universities of the same origin to undertake patenting and innovation efforts to directly or indirectly participate in various numbers of businesses.

The policy of import substitution was very important for the development of the pharmaceutical industry. By applying tariff barriers, subsidies and exemptions, the government formed a series of incentives for production of in country and semi-finished drugs, which resulted in the establishment and progress of a growing number of companies and chemical-pharmaceutical laboratories.[7] Between 1940-1949 18 pharmaceutical companies were established in the country, 48 of 1950-1969 and 73 in 1960-1969, much of which was transnational (Soria, 1980). The expansion of the aggregate production of the pharmaceutical sector registered a rapid pace during the decades of the fifties

[7] Before the measures enacted in the 1940's, almost all of the total demand for medicine was covered by imports (Molina, 1980).

and sixties, reaching annual rates of 11 and 10% respectively. The added value of pharmaceutical products of 284 million pesos registered in 1950, went to 781 million in 1960 and 2 billion in 1970. [8] Much of the pharmaceutical market by the end of ISI process was in the hands of transnational corporations. By 1969, the top 35 companies operating in the country were all foreign, and captured 65% of product value with a little over 3 billion pesos at the time (Soria, 1980). Given the dynamic and profitable behavior described by the industry and the role of the foreign sector, it is feasible to assume that this had a major effect on the concentration of granted patents in this sector by foreign universities. In other words, educational organizations from abroad observed it convenient or of interest to register Mexican patents due to dynamic markets reflecting the domestic pharmaceutical industry, regardless of the recesses that the operation of the system of Mexican patents could signify. It was also significant that an important part of the foreign private sector participation in the pharmaceutical industry was of U.S. origin. Of the total of the 30 most important businesses, 16 were recognized as under American control or ownership (Wionczek, et. at ., 1988). Therefore it is not difficult to explain under these conditions the business technological predominance of the U.S., with the fact that 18 of 25 patents related to innovations in pharmaceutical industry corresponded to American universities.

Other economic sectors which registered significant dynamism was the producer of capital goods, particularly the industrial production of machinery, equipment and electrical products. Here 8 out of 12 university patents registered were linked to this branch of economic activity (see Table 5 above). Between 1950 and 1970, the GDP of the machinery and electrical equipment industry registered an average growth rate of 13% per year with

[8] Constant Pesos of 1960 according to INEGI (2009).

a share of total capital goods of 34%. Like the pharmaceutical industry, a significant share in the value of production in the industry corresponded to foreign investment. In 1962 foreign companies registered a rate of 58.3% in the total value of the industry and by 1970 it reached 79.3%. The performance of the external sector was very dynamic, with a 15% annual average growth rate in production, surpassing the growth rate of the industry as a whole (13%). The benefits in this industry were very profitable for foreign investors. In 1960, the rate of return showed 13% and for 1970 rose significantly to 29.3% (Sepúlveda and Chumacero, 1973). Although there is no data to show us the behavior of the machinery and electrical equipment production industry disaggregated at country level, Sepulveda and Chumacero (1973) however propose that the participation of U.S. companies in this industry became very important. So it is not difficult to have expected that the 8 total patents related to this industry were owned by American universities following the pattern of behavior shown by the national companies in Mexican markets. Given the prevailing conditions, in particular in the previously revised sectors of chemical, pharmaceutical and electrical products, the major expectation of profits that were made and the large presence of foreign (mainly American) investment at end of the period (1960-1970), we can assert that university patenting activity abroad and especially the propensity to patent by American universities, responded to the high economic incentives offered by the Mexican industrial performance.

Moreover, for a better understanding of the limitations of the system of national patents to encourage Mexican university technological development, it would be appropriate to include a review of experiences of patenting of educational organizations in other countries, such as those in the North Atlantic and Europe. Although at this time making a comparison is beyond the scope of this document due to limited available information and space, we can, however, make some brief remarks known about the

case of patenting educational organizations in the United States. According to Mowery and Sampat (2000) the behavior of the American university patenting over the last century responded more to political factors and financial incentives (federal public funds) than the incentives provided by the national system of patents. But this does not mean that U.S. patent policy was not present in discussions on the definition and scope of such intellectual property rights in education. As Metlay (2006) notes, there was intense public and private debate on these issues before and after World War II, in which the resolution of the federal government was to leave the final decisions regarding the allocation and exercise of patent rights to the educational organizations or other related agencies at least until the early l960s. But this didn't mean that in all of the cases over the period educational organizations or the entities created to manage patenting regulated processes with complete autonomy. As evidence, a report from the National Academy of Sciences (1962), design patent policy within educational organizations in several cases was formulated through consensus decisions of their governing boards, but also in other cases the institutional design was established based or reference to specific laws prevailing in the states or prescribed by state agencies under its control or jurisdiction. This implies, among other things, that while the American national patent regime did not directly influence the design of politics or American university patenting behavior, based on the specific points we have described here regarding the patent law: a) ownership, b) benefits and costs of exploitation c) benefits and costs of technology transfer, technological work related to specific institutional environments played a key role in framing patenting policy within each university correspondingly, promoting a wide variety of modalities (guidelines and scope) in the organization and administration of patentable technological developments and patenting activity. In contrast, due to the absence of such situations, there was virtually null

development of patented technological activities of Mexican educational organizations.

CONCLUSIONS

The limited patenting activity of educational organizations as a whole does not allow for rigorous identification or tracing of specific trends of technological change in Mexico. However, it reveals that the high incentives offered with the policy of industrial protectionism was a factor in the propensity to patent, especially for foreign (and particularly for American) public and private universities. The national education system otherwise did not respond to these opportunities. Among other factors, ceteris paribus , due to the design and absent and/or insufficient Mexican patent regime that did not orient itself to operate, promote or facilitate technological exchange processes in the educational setting, but even hampered venting of the results of activities of invention and innovation of all Mexican educational organizations, before the gaps and uncertainty that they suffered and were configured by such an institutional environment. This aspect of institutional weakness of the patent regime subtracted economic potential performance from educational organizations, because although the major universities in the country at the time such as the UNAM, IPN or ITESM performed a certain level of effort in activities and technological developments for industrial use, such efforts or investments did not result in patent rights with marketing possibilities and in principle to obtain their own benefits, thereby wasting a historic opportunity offered by a favorable economic scenario of expansion and industrial modernization.

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MECHANICAL CHARACTERIZATION OF ADOBE BRICKS USED IN THE REGION OF TUXTLA GUTIERREZ, MEXICO

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ABSTRACT

This paper presents the results of a series tests for the mechanical characterization of adobe mud used in the region of Tuxtla Gutierrez. The tests were carried out in the Materials Laboratory of the School of Engineering of the Autonomous University of Chiapas during the second half of 2008. The following features for adobe bricks were studied: volumetric weight, compressive and flexural strength. Compression tests were also done on stacks built with individual pieces and clay mortar specimens used to join these pieces. The test material was obtained directly from manufacturers in the urban area of América Libre, in the municipality of Chiapa de Corzo. A comparison between the results that were obtained and the recommendations that are followed in other countries for construction with adobe was performed.

Keywords: *adobe, testing, masonry, mechanical characterization, regulations.*

Adobe is a cheap building material made from sand, clay, sand and water, to which you would normally add fiber or organic material, usually straw (or other vegetable fibers such as grass or manure). It is prepared in a traditional way, molded into a brick and allowed to dry in the sun. It is known to be a material used since ancient times (from 8000 years B.C., Houben and Guillaud, 1994), and allows for the construction of very durable structures. Many constructions made with this material continue to exist, which are among the oldest in the world. Moreover, 30% of the world population lives in clay buildings, and about 50% of the population of developing countries, including most of the rural population and at least 20% of urban and suburban population, live in clay houses (Houben and Guillard 1994).

Adobe buildings are masonry walls (usually without reinforcement) made from raw bricks (manufactured locally) and generally joined with mud mortar. They are structures that do not involve specialized technicians, which is why they are known as "undirected" or "without technical supervision".

Traditional adobe buildings respond very poorly to seismic shocks. These structures lack ductility and are therefore very fragile, resulting in sudden failure under seismic loading. Poor seismic performance of these constructions is due to the weight of the structures, their low strength and brittle behavior (Blondet et al., 2004, 2011). Seismic vulnerability is very high- class A (European Macro seismic Scale -EMS).

Much of this type of construction is in areas of moderate to high seismic activity, and is particularly susceptible to severe structural damage and even collapse when an earthquake occurs, even after shaking with intensity of grade VIII (EMS). For this intensity, typical damage in these constructions is represented by large cracks and disintegration in walls, separation of walls in the corners, between roofs and bearing walls. In many cases this leads to partial and total collapse. In addition, the percentage of partial collapse in constructions is very high (40-60%) and total collapse is significant (5-15%). For earthquakes with an intensely grade of IX (EMS), the percentage

of adobe buildings with total collapse is particularly high (> 50%). This damage causes severe and lethal injury to its residents and generates a lot of debris, which hampers and slows the rescue of victims.

In Mexico the majority of most humble dwellings were built with adobe, which is why its use has been associated with low quality construction. In the headlong rush to take advantage of modern materials and construction methods coupled with aggressive advertising campaigns of cement companies in the middle of the last century, its use has been slowly disappearing.

Currently adobe is still being used in Chiapas as a building material, either for dwellings in small communities or for mixed-use buildings in rural populations. Adobe is used since it is an inexpensive, readily available material which is used by the self-builder, and at the same time reduces construction time. It also has a high thermal inertia due to the thickness required to build with it, which serves as an internal temperature regulator-it retains coolness in summer and warmth in winter.

While this material is still appealing, there are not enough studies on the mechanic characterization of adobe to allow for adequate levels of security in these types of constructions. To date there have been no studies conducted in Chiapas which are conducive to know the mechanical characteristics of adobe, and there is a lack of building codes for designing structures based on this construction system.

BACKGROUND

The study and research of adobe mud buildings is important for understanding the evolution of building systems based on soil, and to predict the structural behavior of these systems and propose solutions to the problems of low-income housing distributed throughout Chiapas. No studies have been conducted in Chiapas on the behavior of adobe manufactured in this state. In 2008, as a first step towards the mechanical characterization of adobe, the Faculty of Engineering

UNACH carried out a testing campaign which main objectives were to evaluate the compressive strength and flexibility of this material. The tested parts were obtained directly from the manufacturers of the urban area of *America Libre*, in the municipality of *Chiapa de Corzo*. The volumetric weight of each block was also obtained and compression tests were performed on parts built with adobe and united with mud mortar.

METHODOLOGY

The characteristics of resistance to compression and flexibility of the adobe pieces were determined, and the results were statistically processed in order to obtain representative values of compressive force and flexibility for this building material. The tests were carried out using a 100-ton universal press. Average volumetric weight of the test pieces and compression tests were performed on three pieces formed by adobe columns. A total of 10 pieces were tested for compression, 10 for flexion, and 10 stacks.Figure 1 some of the tested specimens are shown. The tests were performed according to the protocol specified in the Complementary Technical Norms for Design and Construction of Masonry Structures (*Normas Técnicas Complementarias para Diseño y Construcción de Estructuras de Mampostería* 2004) and the Regulations of the Secretary of Communications and Transportation (*Normativa de la Secretaría de Comunicaciones y Transportes*, 2000 and 2005). It is worth mentioning that these regulations were used because a clear procedure for testing adobe masonry is not available in Mexico. Laboratory work was performed according to the following steps:

1. Weight by volume: each of the pieces was weighed in order to record their weight (see Figure 2). An average of the weight of the 50 tested pieces was made.

2. Preparation of the samples: because adobe cannot be coated with a thin layer of plaster and sand for testing compression, rubber foam was used in order to have better distribution of the compression force on the adobe pieces (see Figure 3).
3. Resistance to compression: compression was applied to each adobe piece until reaching failure, and its value was registered. (see Figure 3).
4. Resistance to flexion: each piece was subjected to a state of flexion and a value was registered at the point of failure (see Figure 4).
5. Resistance to compression of columns: a total of 10 stacks using 3 pieces of adobe for each were built. A compression force was applied and a value was registered for the failure of each stacks (see Figure 5).
6. Resistance to compression of mortar between the parts used to build the stacks (see Figure 6). Three examples were prepared with dimensions of 5 × 5 × 5 cm.

Figure 1. Typical adobe bricks from the municipality of Chiapa de Corzo (Ovando Ruíz de la Cruz and Castellanos, 2010)

Figure 2. Obtaining the weight of each of the parts of tested adobe
(Ovando Ruíz de la Cruz and Castellanos, 2010)

Figure 3. Compression test of the adobe parts
(Ovando Ruíz de la Cruz and Castellanos, 2010)

Figure 4. Flexion test on pieces adobe
(Ovando de la Cruz y Ruíz Castellanos, 2010)

Figure 5. Compression test of adobe stacks
(Ovando de la Cruz y Ruíz Castellanos, 2010)

Figure 6. Compression test on clay mortar specimens
(Ovando de la Cruz y Ruíz Castellanos, 2010)

RESULTS AND DISCUSSION

Average volumetric weight of the adobe pieces

The 50 pieces which were tested had an average volumetric weight of 23.20 kg, and the average size of the pieces was 48.65 × 28.54 × 9.19 cm. Thus, an average volumetric weight of 1817.26 kg / m^3 was obtained. In the consulted literature, it is mentioned that the average weight of a piece of adobe should be 1600 kg / m^3 (Cemex, 2005). It was deduced that follows that the tested adobe has a quite reasonable volumetric weight for the Mexican environment and meets the requirements of national construction.

Compression test of adobe pieces

10 pieces of adobe were randomly selected and subjected to compression using a universal press with a capacity of 100 tons. The amount of pressure at the time of failure for each piece was recorded. With this data the compressive strength was calculated by dividing the value of the maximum load on the piece between its gross area. Table 1 shows the results of the 10 tests.

Table 1. Compression tests on adobe bricks

PIECE	AXIAL FORCE (KG)	GROSS AREA (CM^2)	COMPRESSIVE STRENGTH (KG / CM^2)
1	40 000.00	1435.50	27.86
2	28 000.00	1411.20	19.84
3	38 000.00	1396.50	27.21
4	28 000.00	1377.40	20.33
5	33 000.00	1372.80	24.04
6	38 000.00	1406.30	27.02
7	40 500.00	1396.50	29.00
8	41 500.00	1342.32	30.92
9	33 000.00	1421.00	23.22
10	30 500.00	1376.90	22.15
	Average		25.16
	Standard deviation		3.59
	Variation Coefficient		0.14

The resistance of the design to compression was obtained by the following expression that appears in section 2.1.2 of the NTCDCM-2004:

$$f_p^* = \frac{\overline{f_p}}{1 + 2.5C_p}$$

In the equation (1) f_p represents the average compressive strength tests obtained from the 10 parts that were tested (25.16 kg / cm²);C_p is the coefficient of variation, 0.14, that is found at the end of Table 1. Thus, using equation (1) resulted in a value of f_p^* equal to 18.64 kg / cm². Rotondaro and Patrone (2009) report that good adobe, with a volumetric weight of 1800 kg / m³ or more, must resist axial compression at least 1.6 MPa (16.31 kg / cm²). It was concluded that the test pieces meet internationally accepted minimum recommendations for compressive strength.

Flexion test of the adobe pieces

10 pieces of randomly chosen adobe pieces were tested for flexion according to the protocol indicated by the SCT regulations (2000 and 2005). The pieces were arranged as shown in Figure 4 , and an axial load was exerted until the material ruptured. Table 2 shows the results of this test. The value of flexion resistance indicated in the sixth column was obtained by applying the following expression (SCT, 2000 and 2005):

$$R = \frac{3}{2}\frac{PL}{bd^2}$$

Table 2. Flexion test of the adobe bricks

PIECE	AXIAL FORCE (KG)	L (cm)	w (cm)	d (cm)	R (kg / cm^2)
1	75.00	32.00	29.00	9.00	1.53
2	125.00	32.00	28.50	9.00	2.60
3	112.50	32.00	28.70	9.00	2.32
4	137.50	32.00	28.30	9.00	2.88
5	125.00	32.00	29.00	9.10	2.50
6	100.00	32.00	28.80	9.20	1.97
7	75.00	32.00	29.00	8.80	1.60
8	75.00	32.00	28.50	9.90	1.29
9	150.00	32.00	28.50	10.50	2.29
10	100.00	32.00	28.50	8.90	2.13
		Average			2.11
		Standard deviation			0.48
		Variation Coefficient			0.23

The average flexion was 2.11 kg / cm^2 as shown in the table above. Oscar Hernández et al. (1981) report an acceptable value of flexion resistance of 3 kg / cm^2 for adobe. It was concluded that the tested material had a lower resistance to flexion to what has been obtained in other studies.

Compression test of adobe stacks

Stacks were made using 30 pieces of adobe, with 3 pieces used for each stack, obtaining a total of 10 stacks. The mortar was allowed to dry for a week. These specimens were subjected to a compressive load until achieving the rupture of the material (see Figure 5). Table 3 shows the results obtained in this test.

Table 3. Compression test of adobe stacks

PILA	FUERZA AXIAL (KG)	A1 (cm^2)	A2 (cm^2)	A3 (cm^2)	Aprom (cm^2)	σ (kg/cm^2)
1	10 000.00	1421.00	1376.16	1435.50	1410.89	7.09
2	10 500.00	1392.00	1358.40	1411.20	1387.20	7.57
3	9 250.00	1339.20	1373.34	1344.00	1352.18	6.84
4	9 750.00	1406.30	1396.80	1445.50	1416.20	6.88
5	9 250.00	1421.00	1372.00	1406.50	1399.83	6.61
6	9 000.00	1360.80	1362.85	1358.00	1360.55	6.61
7	8 500.00	1344.00	1372.00	1372.00	1362.67	6.24
8	9 000.00	1368.00	1382.25	1344.00	1364.75	6.59
9	7 750.00	1360.80	1421.00	1412.30	1398.03	5.54
10	8 000.00	1392.00	1382.25	1396.50	1390.25	5.75
		Media				6.57
		Desviación estándar				0.57
		Coeficiente de variación				0.09

In the above table, A 1, A 2 and A 3 refer to the gross area of each of the pieces that each stack was constructed. In the sixth column, the average of these three areas is shown (A avg). The seventh column refers to the tensile strength to compressive load (σ) of each stack. The resistance of the design to compression was obtained by equation (1), therefore, considering the average value of 6.57 kg / cm^2 and the coefficient variation of 0.57, there was compressive design strength of 5.36 kg / cm^2. Oscar Hernández et al. (1981) report an acceptable value for compressive strength for low walls of adobe at 6.00 kg / cm^2. Given the paucity of literature on the subject, this data was adopted as reference of the test on the stacks. Thus, it is concluded that resistance to compression of this design is slightly below what is recommended by Oscar Hernandez et al (1981).

Compression test of adobe mortar

Compression tests were performed on 3 examples of clay mortar which was used to join the adobe pieces to form the stacks. The same material that comprised the adobe bricks was used in its preparation. The dimensions of these specimens were 5 × 5 × 5 cm. After 11 days of drying, the clay specimens were tested for compression (see Figure 6). The results of these tests are summarized in Table 4.

Table 4. Compression test of adobe mortar

SAMPLE	Axial force (kg)	L1 (cm)	L2 (cm)	A (cm2)	σ (kg/cm^2)
1	650.00	4.50	4.60	20.70	31.40
2	725.00	4.50	4.50	20.25	35.80
3	650.00	4.50	4.60	20.70	31.40
		Average			32.87
		Standard Deviation			2.07
		Variation Coefficient			0.06

In Table 4, L 1 and L 2 are the dimensions of the sides of the cube face that receive the compressive force. The area shown in the fifth column is obtained by multiplying L 1 × L 2. In the sixth column, the axial stress (σ) is shown, for which the break occurred in the specimen sample. As in the previous cases of compression tests, the design strength of the tested compression set was obtained by equation (1).Thus, considering the average value of 32.87 kg / cm² and the variation coefficient of 0.06, there is a resistance to compression of this design of 28.58 kg / cm². No references to the desirable clay mortar strength were found. The use

of mortar arises from the need to fill the gaps between the pieces and to provide adhesion and continuity. Given that the stacks that were tested show a design compression strength less than that recommended in other studies, it is concluded that mortar that was tested did not improve the compression behavior of the stacks. Further studies should be conducted to find the optimal ratio of a mortar that achieves desirable design strengths in compression.

Comparison with regulations and practices of other countries

Currently New Zealand, The United States and Peru have official standards for adobe construction. Multidisciplinary teams from Mexico, Colombia, El Salvador and Ecuador are preparing standards for construction with this material. In this section the standards and recommendations used in Peru and Ecuador for the construction of adobe mud are succinctly demonstrated and are compared with this case study. The cases of Peru and Ecuador are considered because they are countries with similar construction practices to those applied in Mexico, and in which there is already an effort to standardize the construction of such buildings (Castillo et Al, 2009). The following are the highlights of this comparison.

Peruvian regulations

Peru is the only country in the Pacific Ring of Fire which has an official technical standard for adobe construction. The National Institute of Research and Standardization of Housing (*Instituto Nacional de Investigación y Normalización de la Vivienda* - ININVI) of Peru published the Design Standards for Adobe in 1987. Its second edition is currently in use, which was approved

in 1999 by the Ministry of Transport, Communications, Housing and Construction of Peru (MTC, 2000).

This document details the conditions that the different components of the housing need to comply in order to ensure stability with respect to stress, especially regarding earthquakes. The basic condition is that the adobe walls are load bearing, and structurally there are no other load bearing elements on the walls.

The rules indicate that the resistance to compression is determined by testing carved cubes whose edge has the smallest dimension of the adobe. A value of resistance (f_o , force of permissible compression) is calculated based on the cross sectional area. This value will be exceeded by 80% of the test pieces. The minimum number of parts to be tested shall be six (6) and must be completely dry. The value of f_o should not be less than 12 kg / cm².

The compressive strength of adobe stacks may be determined by:

1. Tests stacks with the materials and technology used in construction. They are composed by a number of whole adobes necessary to obtain a slenderness coefficient (height / thickness) of three (3).
2. The minimum number of adobes should be four (4) and the thickness of the joints 2 cm. The drying time of the mortar of the stacks should be 30 days and the number of the test stacks is three (3).

This regulation does not say anything about flexion of the test pieces of adobe or the compressive strength of the clay mortar.

In the tests described in previous sections, 10 pieces of adobe were tested, whereby the recommendation of Peruvian legislation to study a minimum of 6 pieces per lot is met. The average resistance obtained was 18.64 kg / cm² , a value that exceeds the resistance requirement f_o= 12 kg / cm², as outlined in this regulation for individual pieces of adobe.

In addition, 10 stacks were studied which were built with three parts joined with a clay mortar, leaving a thickness of about 2 cm in the joints (see Figure 4). The design strength of compression in these stacks was 5.36 kg / cm², a value above that recommended by the Peruvian legislation (f_m= 2kg / cm², the value to be exceeded by 2 out of 3 test stacks) for this type of testing (MTC, 2000).

It should be noted that not all of the requirements demanded by these recommendations were followed. Peruvian regulations suggest using four pieces for building stacks, while in this case 3 were used. Similarly, the drying time for the mortar was lower (7 days) to that indicated (30 days) in the regulations. This point should be considered for improving the compression behavior of test stacks.

It should be mentioned that the mortar with which the parts are joined to form the stacks was developed using the same material that made up the adobe bricks. This material was screened in No. 4 mesh (as recommended by the local building practice) and mixed with water to a paste consistency optimal for use as mortar. The Peruvian regulations indications for masonry joints in adobe buildings were not used- proportion cement-thick sand mortar for type I (between 1:5 and 1:10). Nor were there adjustments for the recommendations for type II mortar (based on soil with straw). The results show that additional materials should be included in the mixture, such as cement, gravel and straw, to improve their behavior under compression . The proportions that should be used to optimize this resistance should be subject to further studies.

Overall, despite that the formalities of Peruvian regulations were not met, the tested masonry had good compression behavior even higher than required by this standard.

Recommendations from Ecuador

In Ecuador, the following criteria for adobe clay masonry are used not as a rule but as an "adequate" building practice (Cevallos Salas, 2002):

1. The adobe bricks will be made with soils which granulometry has a sand content between 50 and 60% and the rest between fine silts and clays.
2. The allowable compression force will be f_0 = 10 kg / cm ^{2}.
3. Mortars are manufactured with compatible materials with adobe and its quality should never be less than the pieces being used.

It may be noted that these recommendations only consider basics aspects of adobe resistance. Nothing is indicated regarding the protocol for testing pieces of adobe built in stacks with this material or for samples of mortar used to join the pieces. Also the statistical interpretation of the results of these tests is not mentioned. An interesting approach is that it suggests the desirable characteristics of the granulometry of the soil that is used to make the adobe bricks.

As noted above, the average strength of test pieces was 18.64 kg / cm^2, a result which is above Ecuadorian recommendations f_0= 10 kg / cm^2. Thus it is considered that the test pieces exceed Ecuadorian guidelines.

In contrast, the recommendation of the granulometry that the adobe soil should have was not observed. Where this material is obtained (urban area of America Libre of Chiapa de Corzo), manufacturers do not usually take into consideration the detail of the granulometry of their products. In any case, they are careful that no stones or plant material enter their adobe bricks. This is an area to consider in future trials of adobe.

With regards to mortar, the Ecuador recommendations do not indicate a minimum resistance or drying time in order to reach optimum strength. In this sense, since the tested mortar was made of the same material used for the adobe bricks, it was deemed to comply with than these recommendations.

It can be concluded that although not all of the criteria recommended by the constructive practice of Ecuador are met, the tested material meets the basic recommendations.

CONCLUSIONS

The most relevant results of a campaign of experimental tests conducted in 2008 on adobe bricks manufactured in urban area of America Libre in municipality of Chiapa de Corzo have been presented. The tests were performed according to the protocol for compression tests established by the Technical Standards for the Design and Construction of Masonry Structures (2004) and the provisions established in the Regulations of the Secretary of Communications and Transportation (2000 and 2005).

Despite the high brittleness of the material that was tested, the results are encouraging since most tests of the adobe showed similar behaviors to those recommended in other projects. The volumetric weight obtained in the corresponding test was a pretty fair value for the requirements of national construction. Similarly, in the compression test of adobe pieces, an average compressive design strength that meets the minimum recommendations for compression resistance accepted in other countries was reached. It cannot be said the same for the flexion resistance of the test pieces that obtained a value of 2.11 kg / cm², which is less than 3 kg / cm² suggested by other researchers. Moreover, in the compression test in adobe stacks had results that are slightly below those reported by Oscar Hernandez et al (1981). Finally, in the mortar tests, average compressive design strength of 28.58 kg / cm² was

recorded. There are not sufficient references of similar tests to be able to analyze this result. However, it can be inferred that the mortar that was tested did not improve compression behavior of the stacks. Comparison of the results described in these tests, contrary to what the Peruvian and Ecuadorian regulations recommend, shows that despite the lack of an adequate quality control adobe manufactured in the region of Tuxtla Gutiérrez have mechanical properties suitable for good mechanical behavior.

Since in Chiapas there are still historic buildings built with adobe, and that this material is still used in rural areas for low-cost mass housing, most of our attention should focus on its mechanical characterization, thus preserving the aesthetic and cultural values and historical, traditional architecture patrimony of raw earth, as well as for the protection of the physical integrity of the inhabitants of adobe houses.

It is recommended that a standard is established or adopted, so that a formal document is available with the main purpose of providing guidelines for seismically safe adobe buildings that primarily benefit the most marginalized sector of the population.

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TAX INSPECTION PROCEDURE

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ABSTRAC

This article evaluates and studies the inspection process with special emphasis on the issue of discretion and decision making that outline the powers of the Tax Administration. The latter, within diverse options established within the standards, opts for the best in order to make the best options available in order to obtain the tax debt or fiscal credit which is the obligation of the taxpayer. The standards that allow for the functioning of the taxes have to rely on legal concepts and discretionary powers, which enable it to act in one way or another depending on the circumstances.

Keywords: *Administration, tax, tax inspection, procedures, powers.*

DISCRETION IN THE WAYS AND FORMS OF THE INITIATION OF THE PROCEDURE INSPECTOR

The Administration, in order to meet the goals of the State, performs many acts of verification and investigation of taxes as described in Article 42 of the Tax Code of the Federation. In this sense, the law confers inspectors discretionary action regarding taxpayers obligations. Such acts must be issued in accordance with the general interest. Regarding the issue of acts of administrative authority the legality principle applies, that in accordance with Article 16 of the Federal Constitution provides that "no one may be molested in his person, family, home, papers, positions, except pursuant to a written order of a competent authority that provides grounds and legal motive procedural cause." That is, the initiation of inspections is a discretionary decision (Arrioja, 2005) and therefore must have a motivation and reasonable grounds that are not arbitrary.

In this sense, the procedure is initiated ex officio, (Quintana, 1997) since "The state cannot expect all contributors to express in good faith operative events that give rise to obligations in their charge, but rather, in view of its need to obtain revenue to carry out its purposes, develops a research activity through its administrative bodies to determine the operative events that have not been disclosed ".

However, problems arise when action creates an administrative decision affecting the taxpayer (Romero, 2012). That is, the Administration decides on the initiation of inspections based on the judgment of opportunity and always considers that there is evidence or likelihood of fraud. This is due to the great mass of taxpayers that the state has to check regarding the veracity of their statements. (Jiménez, 1993) states that "a factor that explains and constrains the behavior of the taxpayer regarding taxes in our country is ignorance, lack of knowledge and in some

cases illiteracy ... Moreover, every day there is an increase in the degree of complexity and technicalities of the tax system. "

In this sense the Administration has an important planning function. At this stage is when "activities whose implementation is deemed necessary are anticipated, methods are devised to carry out and identify the necessary means to facilitate decision-making." However, for Mabarak (2007) "it is necessary that this power is better regulated in the laws that allow its exercise, to avoid abuse and misuse of power that far from benefiting taxpayers complicate their situation illegally." Thus, the tax authorities have been attributed the discretion to formulate plans and inspection programs to prevent fraud and tax evasion, all in accordance with the public interest (Orena, 2006),also citing the limits of those powers, constitutional guarantees, and principles of legal certainty, equality and proportionality.

Common forms of initiation of the inspector procedure laid down in Article 134 of the Tax Code of the Federation indicate modes of inspector initiation procedures by personal notification or by certified mail, by mail or telegram, by courts, by edicts , and by instruction. In this regard, Article 14 of the Constitution requires that any act of disenfranchisement meets *the essential procedural formalities*. In addition to this, in report number 849/78 from November 1978, the Supreme Court of Justice of the Nation points out the essential formalities of any procedure and highlights as a first step to inform the concerned party on the initiation of the procedure, which translates always as a notification and leaves the party in a position to prepare his defense.

In other words, the taxpayer must have knowledge as to how the proceedings will take place in a duly reasonable and informed manner. Otherwise the interested individual rights are violated and judicial protection proceeds to be granted (Mancheco, 2009). However, Article 49 Section II of the Tax Code of the Federation does not provide for the delivery of pre-inspection visit subpoena, since " for the visitors to present themselves to the place where

the diligence should occur, they will deliver the verification order to the one being visited, his legal representative, manager or whoever is present at the place being visited, indistinctly, and such person shall be given an explanation of the inspection visit".

That is, the initiation of inspections takes place without notice when there is danger that the one being visited is absent or could perform maneuvers to prevent the onset or development of the due diligence. In this regard, the Judicial Weekly of the Federation (1999) of the Supreme Court of Justice of the Nation states: "Article 16 of the Constitution does not establish a requirement for home visits or inspections if they are preceded by a subpoena, rather they are issued in writing by a competent authority in the place to be inspected is expressed and the person in it is addressed, as well as the subject that the visit is pursuing, providing a detailed affidavit to that effect".

DISCRETION AT THE START OF A HOME INSPECTION VISIT

Based on Article 16 of the Constitution, the Tax Code of the Federation (Article 42, Section III) empowers the Secretariat of Finance and Public Credit to practice visits to taxpayers, solidarity or responsible third parties related to them and review their accounting, real estate and goods. Thus, the practice of a home visit must be the result of a written order by a tax authority[1] , to proceed immediately with the visit.

If a written copy of act is not given to the person being visited, the visit itself is constitutionally flawed and therefore has no legal value, resulting in violation of Article 16 of the Constitution. Consider Arrioja (2005) who states that the Government must

[1] The order written by the tax authority must contain certain prescribed formatilties from articles 38 & 43 of the Federal Tax Code.

find and sanction "the true evaders, but also while avoiding injustice, threats, and the intimidation that sometimes tends to be truly grotesque and particularly abusive. The abuse of power never helps strengthen public awareness and respect for the authorities".

Article 44, section II of the Tax Code of the Federation notes that prior to the summons and once the day has arrived and the time determined for the visit and his representative was not found at the location, the visit will begin with whomever is in the place that is being visited. This action exists because it cannot be admitted that the subject evades the action of the Treasury, with the attitude of not confronting the fiscal visit. However, with the same rule there are discretionary aspects which empower the inspection to proceed to insure accounting, when there is danger that the one being visited is absent or able to perform maneuvers to prevent the onset or development of the visit.

In connection with the examination of the accounts, there is a risk of misuse of power by the users because they are left with discretionary power to consider cases in which such risks exist. This discretion often jeopardizes the good relations that should exist between authorities and taxpayers, because users sometimes misuse these powers and proceed to securing the property although there is no proof or evidence that should motivate them to do so.

Locations for conducting home inspection visits

In order to verify, investigate and audit taxpayers, taxpaying institutions and those relevant to tax credit, the Tax Administration conducts exercises designed to verify and determine unpaid taxes or missing tax credits. Among its main objectives and powers is to work with other tax authorities in the fight against tax fraud (Valdez, 2009). The specific location stated in the tax law as to

where a home visit should take place is enveloped in discretion when considering various cases. The provisions are manifested in article 43 of the Tax Code of the Federation, which states that: In the visit order, in addition to the requirements of Article 38 of this Code, it should specify: "The place or places where the visit must be made. The increased number of places to visit shall be notified to those who are visited. " This leads to the conclusion that the discretion to choose the place or places or increasing the number of home inspections is deposited exclusively and unilaterally in the hands of the Tax Administration.

The places that must be applied by a single home visit are usually the aforementioned offices and other establishments and places where the business is located, or where activities or goods subject to taxation are exploited. The entry of officials in places of inspection, which does not necessarily have to be established and registered offices, may be in different places determined by the Tax Administration Service. The Tax Administration has discretion to practice any inspection activity, especially for recognizing offices, goods, facilities and holdings, by means of whatever actions are deemed necessary and related; and to provide for the application of a method of derivation of tax liability [2] .

This is done with the purpose of making affordable tax credit to those it is due. The implementation of home visits is therefore subject to the administrative discretion of the Tax Administration Service. The enforcement officers, in exercising their functions, should be considered agents of the tax authority, have the powers of authorities and can enforce administrative or criminal liability, as well as to those who oppose, resistant or in contempt thereof.

2 Responsibility could arise in subsidiary or joint manner, where the responsible prosecutors are individuals or legal entities established by law in certain circumstances, and they are required to meet tax obligations which initially were not theirs but the principal debtors.

The administrative authorization prior to entry into a residence

The sixteenth paragraph of Article 16 of the Constitution empowers the administrative authority to implement visits to taxpayers. In practice, the acts of the Tax Administration are issued and executed without prior judicial authorization. That is, the aforementioned constitutional article entitles the Tax Administration to conduct home inspection. This action, which takes place at the home of taxpayer, must observe two formalities. The first is that the act must be issued by the competent authority and second, which usually is not seen in the home visit, is the presentation of the foundation and motivation of said act.

Searches and home visits are different. The first is applied by the commission of a criminal act or criminally liable offense, and results in the apprehension of persons or confiscation of objects that lead to the commission of a crime. The second is applied by the exposure of evidence of tax liability. The home inspection visit, according to Article 16 of the Constitution, should also be subject to the formalities prescribed in searches.

In order for an administrative act not to be unconstitutional, it must be founded and motivated, and therefore provides the criterion upheld by the Judicial Power of the Federation, Appeal under review 8280/67. The reasoning is that there is a rule applicable to the case and that the motivation is in that case under special circumstances, are obvious and have particular reasons or immediate causes that must be taken into consideration for the issuance of the act and that there remains a connection between the detached circumstances and applicable law.

Article 16 does not mention a formality but rather refers to all constitutional formalities prescribed for searches. Among them, the guarantee of inviolability of the home is protected by the Constitution, and for exceptions this inviolability can only be admitted by order of a judicial authority. This has caused several

controversies and doctrinal positions, but the Supreme Court of Justice of the Nation has not clarified such controversies.

The court only establishes the requirements that must completed in the reports that are prepared for the occasion of the home visit, and in order to have real legal support it must meet the requirements of Article 16 of the Constitution. That is, acts that have been made in the presence of two witnesses who are proposed by the on being inspected, or in his absence or refusal, designated by the tax authority.

With the above, the omission or absence of a real application of the formal requirements laid down in Article 16 of the Constitution is deducted in the development of inspection visits. This results in the Tax Code of the Federation gives the tax authorities an initial procedure that may violate the guarantee of inviolability of the home. In addition, the tax law does not distinguish between offices and private homes. Unlike Article 18 of the Spanish Constitution which guarantees the inviolability of the home and provides that entrance to it can only be by the court or by consent of the owner, except in the case of a flagrant crime. This is also established in Article 113 of the Tax Code. In our Mexican law, a legal jewel is found (an appeal trial) against the abuse of power or violation of rights.

The secondary law, or the Tax Code of the Federation in Articles 85 and 86, gives tax authorities the discretion to conduct inspections and enter the inspected home. In case of opposition to the home visit, they can impose financial penalties to those being reviewed, in addition to tax offenses that may arise. In another sense it is tolerated that visits occur, given the principle of enforceability which supposedly covers the act of domiciliary visit by the Administration, but the principle contains in itself administrative discretion-unlike in the Spanish Tax Administration, it is not conferred the power to enter the constitutionally protected house, except in established cases and which should consequently meet constitutional requirements.

The days and business hours for inspection home visit

The temporal scope on tax audits also has certain indeterminate findings, especially when referring to specific days and times in which to practice. The discretion of the Tax Administration is notorious as to when certain days and business hours should be noted. The above is to review the effectiveness and enforceability of the act of the home visit itself, but also for administrative discretion giving a sense of vulnerability to those being visited.

The legal uncertainty promoted by the vagueness and indeterminacy of the concepts derived from Article 13 of the Tax Code of the Federation are purely discretional, since "The tax authorities, regarding the practice of home visits, administrative enforcement proceedings, notification and provisional seizures, may enable legal holidays when the person who is to practice the visit performs activities for which they must pay contributions on non-working days or hours. A visit that began in working hours and days can continue on non-working days or hours. " Also, section IV of Article 44 gives authority to the Tax Administration to implement measures related to holidays and restart others that were suspended, subverting to the right to legal security of the constitutionally administered supervision.

The tax authorities have the discretion to extend the number of places where that may use discretion for home visits and to increase the number of visits applied to taxpayers. Added to this is the time domain- the prerogative to have after hours of work, which usually develops within the administrative offices. This, by a mirroring effect, leads the inspector to endless problems resulting from labor charges for overtime payments to employees, as well as subtracting and diverting attention from the company, focusing on the visit or visits to which the taxpayer is subject, suffering a detriment in productivity and business growth.

Early termination of the home inspection visit

Within this mode of termination of the home visit are some discretionary aspects mentioned in Article 47 of the CFF "The provisions of this paragraph shall not apply where it appears to the tax authorities that the information provided in the terms of Article 52-A of this Code by the public accountant who has been advised is not sufficient to meet the fiscal situation of the taxpayer " which, gives the tax authorities of personal judgment about the fiscal situation of the taxpayer.

These personal prosecutions by tax authorities have no parameter or legal guidelines prescribed by law that can be adjusted and generate motivations on no real or legal basis. With the anterior, the Tax Administration has discretionary aspects as manager of the tax credit. Even in the event that the one who is visited presents financial statements audited by an authorized accountant, or in the event that a delay has occurred in the presentation of documents or time restricted decisions requiring a public accountant, tax authorities have the power to continue the home visit and raise a conclusive certificate about the new reality. This represents a disproportionality and legal disadvantage in relations between the tax authorities and taxpayers.

FINAL ACT

Article 46 of the Tax Code of the Federation clearly establishes the rules that tax representatives must follow during the course of a home visitation. It also points out the different types of records that may arise and various legal statements for the taxpayer, such as: partial reports, final reports and additional reports. Partial minutes are kept for the inspection visit which reflect circumstances, acts or omissions of the Tax Authorities for the taxpayer- considering (DE LA GARZA, 2006) that "... partial

or supplementary proceedings can be reported in which facts, omissions or circumstances of a specific nature, or knowledge that occurs during the development of a visit or after it has finished are stated ".

The final report is one that is made at the end of the home visit and where the results are stated. That is, the final report is the final step in a home visit. Within it can be found compliance or otherwise regarding tax liability, which is determined and compiled to regularize the fiscal status.

Additional records are made after the realization of the final report, and are made when the authority finds some areas, events or situations that were not reviewed or audited by the visitors and merit inspection in order to regularize the tax situation of the taxpayer. However, if new tax measures arise it will be necessary for the authority to issue new clearly marked orders; otherwise it violates Article 16 of the Constitution since it involves the exercise of powers of verification, inspection and inquiry in home visits.

Consequently the lack of signature on any of the pages invalidates the act since it did not fulfill the requirement by law. It should be stressed that that the faculty enjoyed by visitors to make assessments of the above documents and assessments of taxpayers situations. Likewise, in home visits there is also the discretion enjoyed by the visitors, with regard to early conclusion of a home visit.

Judicial review of administrative discretion

The control of the legality of discretionary acts of the administration is done through the courts. In accordance with Article 104 of the Constitution, the judicial authorities are responsible for settling disputes between the governed and the Treasury. Notwithstanding, Article 125 of the Tax Code of the Federation states: "The applicant may choose to challenge an act through

the use of revocation or promote directly against that measure, a judgment in the Federal Court of Fiscal and Administrative Justice". In the same vein (Fix Zamudio 1972) states that it is important that the legality of the acts of the administration is controlled through administrative remedies, since this resource is a repressive process that provides the one being managed direct legal means of protection of their rights.

Thus, the Administration should support their action against individuals on the legality of their actions, otherwise a violation of the rights of the citizens originates- for violating the law or lack of application of the due provision, whose resolution can only be known in the courts. Article 103 Section I of the Federal Constitution states: "The courts of the Federation shall settle any dispute arising: I. laws or acts of authority that violate individual rights". The Constitution provides for the protection of the rights and legitimate interests of citizens without, in any case, may occur helplessness.

In accordance with Articles 103 and 107 of the Constitution which deduces the prohibition of arbitrariness of public authorities to establish that the courts control the actions of the Administration, and that this acts in accordance with the general interest. Thus, Article 107 Section V of the Constitution provides: The appeal against final judgments or awards and resolutions until the end of the trial, whether the violation is discussed during the procedure or sentence are promoted to the corresponding Circuit Court under the division of powers established by the Organic Law of Judicial Power of the Federation in the following cases: b) In administrative matters, when requested by private individuals, bring to an end judgments and decisions handed down by administrative or judicial tribunals not serviceable to any recourse, trial or ordinary means of legal defense".

In accordance with the rule of law, the administrative act must be controlled jurisdictionally, verifying that the acts issued by the government meet the general interest. The importance of

constitutional tax principles of legality and legal certainty for all acts of authority, administrative or judicial, requires the Federal Constitution.

The principle of legal certainty in its negative aspect is reflected in the prohibition of arbitrariness, preventing the Administration discretion to decide on the issues that must be established by law. Thus, legal certainty is manifested as the substance of various public rights enforceable and payable to the State and its authorities.

The principle of legality -in its two aspects: policy and application- should be inferred from the joint interpretation of the second paragraph of Article 14 of the Constitution "No one shall be deprived of life, liberty or property, possessions or rights without a trial before previously established courts in which due process is observed and in accordance with the laws issued before the fact ". The law allows the constitutional defense to be performed when there are constitutional violations. In this sense, the rule of law limits the administrative action of the law. Thus, the first paragraph of Article 16 of the Constitution "No one shall be molested in his person, family, home, papers or possessions, except by written order of a competent authority that provides grounds and legal procedural cause"- these principles will be applicable to both the administrative procedure and administrative acts that comprise it.

The First Appellate Court on Administrative Matters of the First Circuit (Judicial Weekly of the Federation [SJF] 1917, p.64) has argued that Article 14 of the Constitution protects the right to a hearing held by citizens, arguing that: "When the payment of a tax depends on assessments, appraisals, exercising the discretion of authorities, or generally any element that the legislature has not given and must determine the tax authority in accordance with the precise and specific guidelines that indicate that legislature, while not excessive or discretionary, nor its unilateral administrative will, in these cases, the obligation to contribute to

public expenditure, is no longer entirely determined by the law itself, and the authorities must respect the guarantee to a hearing.

As there is no legal basis for the authorities to exercise economic and coercive power to all legislative control, setting taxes in an amount not derived from a single legal text, but must come specified by an act of the tax authority. "The taxpayer has the opportunity to inconformity, and to appeal the act issued by the Administration. In this regard the (Supreme Court of Justice of the Nation [SJF] T. XXIX, p.669) states that "the administrative authorities have no powers other than those expressly granted to them by law, and when they dictate a determination that is not properly grounded and motivated by any law, it must be deemed as a violation of the guarantees contained in Article 16 of the Constitution".

Article 16 of the Constitution provides assurances to foundation and motivation, preventing individuals from being defenseless. Motivation is required by that article and expressed in the (Bulletin of jurisprudential Information [BIJ], 1963, p. 417) "externalize relative considerations to the circumstances of facts that the authority made to establish the suitability of concrete legal case to a hypothetical scenario".

The principles of legality and legal certainty demand that the administrative authorities comply with the requirements at the moment of interfering with an nuisance act by authorities. That is, the resolutions issued by the Administration must be properly grounded and motivated, noting the legal rules and assumptions that are found in the special law, resulting in the match between the circumstances of the case and the legal foundation.

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COFFEE PRODUCTION IN MEXICO: WINDOW OF OPPORTUNITY FOR THE AGRICULTURAL SECTOR IN CHIAPAS

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ABSTRAC

The role of government programs that support the coffee sector of Mexico with direct support to farmers' income is a measure of appropriate policy which covers the difference between costs and total revenues of coffee farming. The state of Chiapas has the necessary conditions to cope and compete in an international market, however, the absence of economic policy tools that integrate risk and uncertainty does not allow for short-term increase in the incomes of small farmers.

Actions tend to generate stability in the production of coffee is represented by the Productive Coffee Development Program, which has generated productive activities among small producers that induce productivity and the incorporation of organic crops. This paper analyzes the conditions of production and the market in the domestic and international contexts of the coffee sector. It also describes and identifies the importance of the state of Chiapas in trade integration processes. Finally, government action was taken during the period 2007-2013 through the *Procampo* Production Program and the Productive Coffee Development component.

Keywords: *Chiapas, coffee, productivity, producer, organic.*

Coffee is considered one of the most important raw materials that are are followed in the global economy. Thus, for many of the least developed countries, coffee exports represent a fundamental part of their foreign exchange earnings-in some cases over 80% (Banking Association of Guatemala, 2012).

Coffee production has a high economic and social value, and the activity plays an important environmental role, since its production is conducted under systems that maintain an almost permanent plant cover on the soil, thus reducing erosion problems. The combination of economic, social and environmental benefits that coffee cultivation makes it necessary that the agents involved in the sector promote the necessary incentives to support competitiveness and economic growth of the grain.

Coffee provides ideal conditions for international cooperation between producing and consuming countries, which secures an adequate remuneration for producers while providing consumers quality coffee at affordable prices (Barrera, Parra, Herrera, Jarquín & Pohlan ensures , 2004). The imbalance between supply and demand has traditionally affected the coffee trade, and correcting this imbalance is a constant goal in forums of international cooperation. Currently, there is an export market with a highly differentiated dynamic, where there are high exports of robust and natural coffee with a sharp decline in exports of washed Arabica. The main conclusions of international meetings are limited to establishing a system of information exchange between countries to identify opportunities and actions to improve current and future conditions of the international coffee market (Barrera, Parra, Herrera, Jarquín & Pohlan, 2004).

In addition, producers face a window of opportunity before the growth of global coffee consumption. According to Euromonitor International, the total and *per capita* consumption of coffee has increased since 2005, and is expected to continue to grow until 2015. Thus, in 2005 the consumption was 2.0 million bags of green coffee [1] , in 2010 it was 2.7 million, and it

is estimated that in 2015 the category will represent 3.6 million bags. Moreover, *per capita* consumption in 2005 and 2010 stood at 1.16 and 1.43 kg, respectively, and it is expected that 2015 consumption will stand at 1.85 kilograms.

The global coffee consumption will not only continue to grow at annual rates of 2.5%, but could even overcome supply in 2014, with an average of more than 145 million bags (La Patria, 2013).

There are about 75 million potential consumers each year, which are demanding at least three million additional bags. This is during a lower global production, especially caused by drought problems that are currently recorded in Brazil, the largest producer in the world (La Patria, 2013).

The purpose of this document is to describe the state of global and domestic production of coffee, and recognize that the state of Chiapas has important elements and variables that can enhance the coffee sector in the region. Additionally, the tool of the component to promote the production of coffee is presented as the linchpin and motivator for productive activities among small producers.

WORLD COFFEE PRODUCTION

The average world production of green coffee in the 2000-2012 period was 7 million 964 thousand tons. Of this amount, 75 percent was contributed by the ten major producing countries. Brazil ranks first in reporting 30.5 percent of total production, followed by Viet Nam, Indonesia and Colombia with a contribution of 12.4, 8.1 and 7.8 percent of world production, respectively. India and Mexico rank fifth in representing 3.5 percent of world coffee supply.

[1] The unit of measure of 60 kilograms of green coffee per bag is considered.

Based on Table 1, in the period 2000-2012 Mexico had an average production of 282 000 569 tons of green coffee. However, an Average Annual Growth Rate (AAGR) of -2.61 percent was recorded, unlike its main competitors who presented a positive AAGR.

Table 1. Main green coffee producing countries, 2000-2012 (Thousands of tons)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average 2000-20012	AAGR %
Brazil	1,904	1,820	2,650	1,987	2,466	2,140	2,573	2,249	2,797	2,440	2,907	2,700	3,038	**2,436.2**	3.97
Indonesia	803	841	700	794	914	831	985	1,251	1,056	1,058	1,106	1,277	1,292	**993.7**	4.05
Colombia	555	569	682	664	647	640	682	676	698	683	684	639	657	**652.0**	1.42
Mexico	637	656	697	694	674	667	725	757	689	469	535	469	465	**626.7**	-2.60
Ivory Coast	292	301	301	275	271	276	274	288	262	262	290	302	314	**285.2**	0.61
Vietnam	338	303	313	311	312	294	280	269	260	264	245	237	246	**283.6**	-2.61
Ethiopia	312	276	222	244	250	248	235	244	248	249	248	243	248	**251.3**	-1.90
India	192	196	213	203	231	189	273	226	274	243	265	332	303	**242.5**	3.90
Peru	230	157	160	126	156	172	241	273	260	265	371	377	276	**236.7**	1.52
Uganda	193	206	173	175	185	191	214	236	241	231	229	282	300	**220.7**	3.73

Source: Based on data from the Food and Agriculture Organization, FAO. Consulted: April, 2014.

Internationally, the production figures for 2013-14 crop will depend on the involvement of drought in the next harvest in Vietnam, and the production volume in Central America, damaged due to drought and the presence of rust.

According to an analysis by the National Coordination of Coffee Organizations (CONOC) for the 2013-14 coffee cycle, production is emerging a little lower than consumption unlike in the 2012-13 cycle, where an approximate harvest was estimated of 6 million bags more higher than consumption.

The agency notes that according to a report from Bank Rabobank, the 2013-14 cycle of world production of coffee could be a million bags less than consumption. Production in Central America and Mexico could be affected by rust by about 3.3 million bags.

Table 2. Area harvested worldwide of green coffee, 2000-2012 (Thousands of hectares)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average 2000-20012	AAGR %
Brazil	2,268	2,336	2,371	2,396	2,368	2,326	2,312	2,264	2,222	2,136	2,160	2,149	2,120	**2,263.6**	-0.56
Indonesia	1,261	1,313	1,372	1,382	1,304	1,255	1,309	1,296	1,295	1,266	1,268	1,293	1,234	**1,296.0**	-0.17
Colombia	675	705	711	721	771	807	786	798	733	765	778	739	778	**751.3**	1.18
Mexico	701	747	725	743	761	762	763	772	767	766	741	688	695	**740.9**	-0.07
Ivory Coast	829	602	455	410	740	719	748	777	650	623	450	153	160	**562.8**	-12.81
Vietnam	477	474	493	481	479	484	483	489	500	507	512	544	574	**499.7**	1.56
Ethiopia	250	244	218	232	260	261	295	407	391	395	499	516	529	**346.0**	6.43
India	308	314	321	321	325	333	341	343	345	351	356	360	369	**337.4**	1.49
Peru	264	274	287	292	295	302	321	324	333	343	350	367	312	**312.7**	1.39
Uganda	301	264	218	264	264	263	220	285	345	320	270	320	310	**280.3**	0.24

Source: Based on data from the Food and Agriculture Organization, FAO. Consulted: April, 2014.

Following Table 2 we can see that the global area harvested for green coffee in the world in the period 2000-12 averaged 10 million 497 thousand hectares, of which nearly half are concentrated in Brazil (21.6%), Indonesia (12.4%) , Colombia (7.2%) and Mexico (7.0%). However, these countries with the exception of Colombia have lost the ability to incorporate a greater number of hectares for rice production, which is shown by the negative AAGR during the period 2000-2012.

According to Table 3, the average global yields of coffee stood at 691 kilograms per hectare (kg / ha). Significant highlights include Belize (2,312 Kg / Ha), Vietnam (1,977 Kg / Ha), Tonga (1,961 Kg / Ha), Sierra Leone (1,897 kg / ha) and China (1,801 Kg / Ha).

Table 3. Yield of green coffee, 2000-2012
(Kilograms / hectare)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average 2000-20012	AAGR %
Vietnam	1,683	1,775	1,420	1,652	1,907	1,718	2,039	2,559	2,111	2,085	2,160	2,347	2,250	**1,977**	2.45
Brazil	839	779	1,118	830	1,041	920	1,113	993	1,259	1,143	1,346	1,257	1,433	**1,082**	4.56
Guatemala	1,143	1,010	905	990	1,010	1,002	947	980	995	993	995	972	992	**995**	-1.17
Honduras	917	949	845	767	783	799	855	989	996	953	849	1,066	1,128	**915**	1.74
India	947	959	938	859	832	826	803	840	761	748	815	838	852	**847**	-0.88
Colombia	943	931	981	962	874	827	923	949	940	612	688	634	597	**836**	-3.74
Peru	725	716	740	696	784	626	850	697	821	711	757	903	971	**769**	2.47
Ethiopia	920	645	734	543	600	657	818	672	665	672	743	730	521	**686**	-4.62
Indonesia	440	433	497	480	496	510	521	522	539	539	539	494	533	**503**	1.61
Mexico	482	405	432	418	411	386	366	348	340	345	331	344	354	**382**	-2.54

Source: Based on data from the United Nations Food and Agriculture Organization, FAO. Consulted: April, 2014.

In the case of major coffee producers in the world, Mexico is the least positioned in the list of countries presented above in performance, averaging a production of 382 Kg / Ha-In other words, eighty percent below the average world production. In addition, the AAGR indicates a negative trend in production acreage.

NATIONAL COFFEE PRODUCTION

Coffee is one of the most important tropical crops not only for the 56 producing countries of the Third World, but for the United States, Europe and Japan which consume 80% of the coffee produced worldwide (Moguel & Toledo, 1996).

Based on the record of National Register of Coffee Production (*Padrón Nacional Cafetalero* -PNC), coffee cultivation in Mexico takes place in 12 states, 404 municipalities, and 4,572 localities by 510,544 producers in 675,258 hectares (AMECAFE-SIAP).

Coffee production is grouped into four regions (SIAP, 2014):

- Gulf slope: composed of the states of San Luis Potosi , Hidalgo, Puebla, Mexico, and Veracruz.
- Pacific slope: belonging to the states of Colima, Guerrero, Jalisco, Nayarit and part of Oaxaca.
- Soconusco region: comprising a large proportion of the state of Chiapas, noted for the production of organic coffee, which is in high demand in the North American and European markets.
- North Central región of Chiapas.

Coffee cultivation is practiced at altitudes ranging from 300 to almost 2000 meters above sea level in areas that exhibit a variety of climates, soil and vegetation types. However, the most suitable elevation for coffee production is between 600 and 1200 m, in mainly semi-arid areas located right on the border between tropical and temperate ecological regions (CIMAT, 2006).

40% of land planted with coffee corresponds to high and medium (humid tropical) forests, 23% pine and oak forests, 21% low tropical deciduous forests and 15% high mountain cloud forest. This means that from a biological point of view, the coffee regions in Mexico are among the richest and most diverse in flora and fauna (Bartra, 2006).

Based on Table 4, coffee production is concentrated in the states of Chiapas, Veracruz, Puebla and Oaxaca representing 94% of total production, 85% of the harvest area and 83% of producers. Production is primarily small landholders, with about 90% of farmers having plots smaller than five hectares. Approximately 80% of coffee production is destined for export markets. In good years, foreign exchange earnings generated by coffee sales are about $800 million dollars, second only to oil exports (Bartra, 2006).

Table 4. Indicators of coffee cherry production and GCE by state, 2012 cycle.

Entity	Production (Tons)	Yield (Tons/Ha)	Production value (Thousands of Pesos)	Production GCE (Tons)	Production GCE (Bags of 60 Kg)
Chiapas	532,582.79	2.09	3,481,899,684.22	98,048.49	1,634,141.53
Veracruz	369,455.21	2.65	2,584,749,838.42	68,016.70	1,133,611.74
Puebla	202,947.48	3.43	1,564,469,924.11	37,362.63	622,710.52
Oaxaca	117,439.81	0.94	440,579,491.44	21,620.67	360,344.48
Guerrero	48,447.37	1.03	186,851,849.40	8,919.16	148,652.68
Hidalgo	32,880.30	1.25	212,070,140.00	6,053.26	100,887.72
San Luis Potosi	11,829.87	0.70	18,784,136.00	2,177.88	36,297.98
Nayarit	10,785.20	0.58	90,265,603.59	1,985.56	33,092.59
Jalisco	5,311.38	1.33	33,419,020.20	977.83	16,297.08
Colima	2,043.58	0.82	16,366,251.20	376.22	6,270.38
Tabasco	953.68	0.92	7,131,360.75	175.57	2,926.21
Querétaro	108.00	0.40	972,000.00	19.88	331.38
National	1,336,882.11	1.92	8,647,580,349.05	242,510.41	4,041,840.25

Source: Based on data from SIAP. **Note:** GCE refers to "green coffee equivalent" to its calculation is considered that 1 kg of coffee cherries is equal to 0.1841 kg of green coffee**.**

Chiapas is the leading producer of coffee, and also has a yield per hectare higher than the world average. Its conditions in this area are similar to countries like Vietnam and China. During the 2012

growing season, it had a production of 532,000 tons of coffee cherries, equivalent to 1 million 634 thousand bags of green coffee which resulted in the generation of 40% of the value of coffee production in the country. Chiapas, Veracruz and Puebla jointly accounted for 88% of the value of coffee production in 2012. It is also important to note that Veracruz and Puebla have a high yield in tons per hectare, which is mainly due to the effect of the coffee plot renovation program.

The sector has great advantages in product marketing because there is a very limited use of hybrid varieties and use of agrochemicals-factors that are of international interest due to the global trend of consuming healthy foods. It can be argued that coffee production in Mexico is virtually artisanal, and a significant percentage of producers are principally indigenous (ASERCA, 2013).

According to Table 5, the states of Chiapas, Oaxaca and Veracruz are the states with the largest number of producers, which as a whole make up 74% of farmers who grow the grain, with Chiapas having the largest number of producers at approximately 36%. In the same manner, the state has a third of the land area dedicated to coffee growing in the country.

Chiapas has the highest proportion of hectares devoted to growing coffee, and represents 36% of the national total followed by Veracruz and Oaxaca, with 20 and 19% respectively.

Table 5. Characteristics of coffee production in Mexico, 2010

Entity	Number of producers	Plots (Number)	Surface area (Ha)	Men (Number)	Women (Number)
Chiapas	183,761	198,320	241,876	148,916	34,733
Oaxaca	103,052	146,134	128,802	62,854	39,991
Veracruz	90,248	137,704	138,427	64,190	26,011
Puebla	48,215	66,166	67,137	32,632	15,555
Guerrero	22,699	29,867	39,507	12,616	10,045
Hidalgo	35,379	46,635	23,925	25,702	9,667

Nayarit	5,327	9,415	16,402	4,108	1,199
San Luis Potosi	18,048	29,115	14,001	13,524	4,504
Jalisco	1,413	1,785	2,656	1,018	394
Colima	863	1,169	1,304	671	186
Querétaro	312	413	222	203	109
Tabasco	1,227	1,398	1,000	1,078	149

Source: Mexican Association of the Coffee Production Chain, A.C. (AMECAFE)

In addition, 41% of men and 24% of women dedicated to coffee production are concentrated in the state of Chiapas. This indicates that a significant portion of the workforce in this sector is directly associated with the province with the highest coffee production in the country.

Chiapas is the world's largest producer of organic coffee. 18 million tons per year are produced by more than 60,000 producers, of whom one third are indigenous and peasant women who grow coffee plants under the shade of native trees without using agrochemicals to avoid contaminating the soil (Marshall, 2011).

Chiapas is a state with a long tradition in the cultivation and marketing of coffee. The variety of coffee most produced in the state (just as in the rest of the country) is "Arabica". "Robust" coffee is another species that is commercially produced in the world and is used mostly in the soluble coffee industry (Barrera & Vine).

Organic coffee is defined as the product obtained through a production process where agrochemicals are replaced by organic elements, and involves practices to prevent soil erosion, improve soil fertility, maintain biodiversity, rejuvenate plantations and use an integrated management agro-ecosystem to control weeds, pests and diseases. It also involves rigorous implementation of the tasks of harvesting, processing, storage and transport in order to obtain a high quality product (Trápaga and Torres, 1994).

PRODUCTIVE DEVELOPMENT PROGRAM COFFEE

The commercialization policies for grains and oil seed have sought, in first place, to adapt to new conditions generated by the national openness to international markets, and as a second purpose to respond to the demands of some of the country's producers (Riedemann, 2007).

The Procampo Production Program of 2013 included a component that allowed grants that went directly to income to support coffee producers based on the productivity of the land, and through actions sought to stimulate agro cultural activities in coffee plantations to continuously improve the competitiveness founded in yield per hectare and sales volumes. Furthermore, the promotion of organic farming was considered, and was supported with additional resources to farms whose production was certified or had some other sustainable certification.

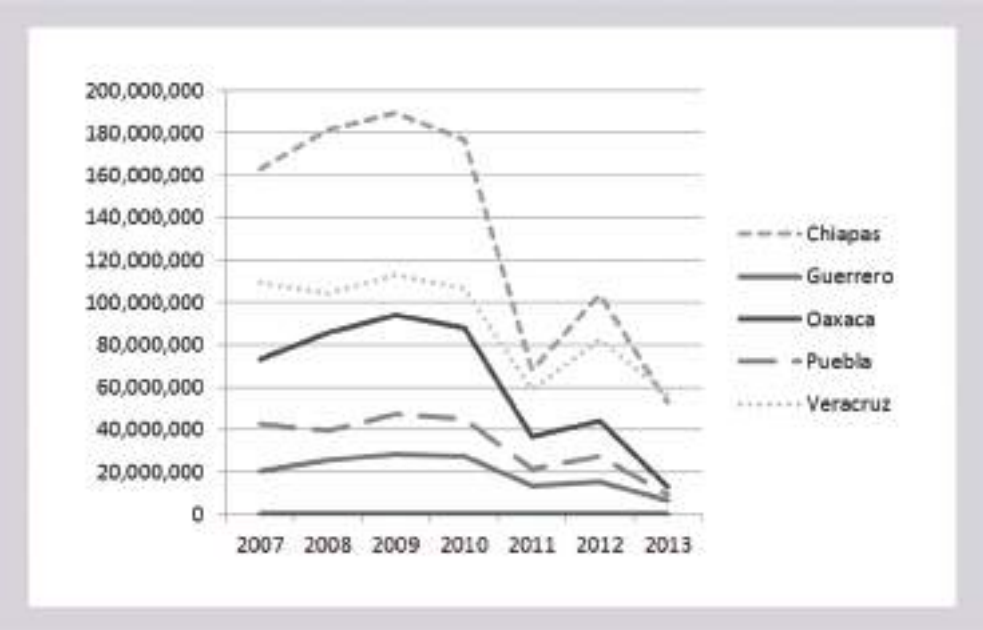
The objective of this program was to increase the capitalization of the economic units of coffee production, allowing an increase in production volume per hectare and promote commercialization. The target population considered legally constituted individuals or entities, registered in the National Coffee Production Registry (PNC) , producers with direct marketing activities, registered and / or validated in the Information System of National Coffee Production (SICN), located in the 12 states with the highest coffee economic activity, which are: Chiapas, Colima, Guerrero, Hidalgo, Jalisco, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosí, Tabasco and Veracruz. Additionally, sustainable coffee producers were sought. In this case, they had to present and individual or group certificate issued by a certification company.

The distribution of the financial support considered surface area (30%) and productivity (70%), and in cases of certified organic production an additional (40%) of support was considered. The area subject to the benefits had a threshold of 10 hectares,

while support for integrated productivity was considered up to 10 quintals[2] yield per hectare.

Following the information in Chart 1, the evolution of the program budget presented a significant weakening in recent years. The main producing states have experienced a negative annual average rate of growth with the most relevant cases being Oaxaca and Puebla, which presented during the period 2007-2013 a rate of -22 and -25 percent, respectively. Meanwhile, Chiapas and Guerrero have had a weakened budget during the same period of -17 percent. Veracruz experienced a decline of -10 percent rate of budget growth.

Graph 1. Evolution of the budget for the Productive Coffee Development Program, 2007-2013 (In current pesos)



Source: Based on data from the Procampo Productive Program, 2013

[2] Un quintal (Qq) de café equivale a 57.5 kilogramos de café pergamino (46 kilogramos de café oro).

According to Table 6, the other coffee producing states have been subject to this dynamic budget loss, with Queretaro and Tabasco not receiving support by the program during 2013.

Table 6. Evolution of the amounts allocated by state Productive Coffee Development Program, in current Pesos

Entity	2007	2008	2009	2010	2011	2012	2013
Chiapas	162,816,740	181,562,919	189,527,424	176,726,967	68,351,783	103,874,139	52,918,412
Colima	906,593	560,677	1,061,838	1,106,875	409,824	524,660	277,550
Guerrero	20,714,923	25,611,743	28,407,998	27,590,988	13,471,513	15,389,488	6,602,806
Hidalgo	9,042,172	2,539,379	3,741,113	3,836,899	2,314,653	2,760,214	211,637
Jalisco	181,788	219,189	1,143,530	1,183,095	62,192	177,839	57,697
Nayarit	12,143,894	13,105,081	17,733,563	17,097,670	7,558,563	10,841,986	4,662,686
Oaxaca	73,220,460	85,720,354	93,890,889	88,164,244	36,850,474	44,298,043	12,913,369
Puebla	42,743,506	39,290,134	47,209,350	44,835,253	21,288,719	27,282,588	9,518,108
Querétaro	69,600	1,150	1,000	950	3,571	3,399	0
San Luis Potosi	4,287,025	6,103,960	7,038,938	7,187,544	3,043,898	2,774,643	676,049
Tabasco	316,150	650	650	617	0	0	0
Veracruz	109,560,620	104,351,305	112,896,271	106,398,874	58,729,796	82,499,481	56,376,159
TOTAL	436,003,471	459,066,541	502,652,564	474,129,976	212,084,986	290,426,480	144,214,473

Source: Based on data from the Procampo Productive Program, 2013

Table 7. Characteristics of the beneficiaries of the Productive Development Program Coffee, 2013

State	Beneficiaries (Number)	Amount (Current Pesos)	Hectares
Chiapas	22,750	52,918,412	44,771
Colima	153	277,550	317
Guerrero	4,287	6,602,806	9,133
Hidalgo	275	211,637	268
Jalisco	27	57,697	62
Nayarit	1,212	4,662,686	5,167
Oaxaca	6,582	12,913,369	16,105
Puebla	4,212	9,518,108	9,268
San Luis Potosí	794	676,049	1,003
Veracruz	25,239	56,376,159	46,676
TOTAL	**65,531**	**144,214,473**	**132,770**

Source: Based on data from the Procampo Productive Program, 2013.

Basing the information in Table 7, the state of Chiapas has 35% of the total program beneficiaries who were given about 53 million pesos, representing an average of $ 1,181 pesos per hectare.

According to Lopez and Caamal (2007), in Chiapas the total costs to maintain one hectare of conventional coffee are on average $ 9,443.40 pesos. Of this amount, nearly 72.6% were spent on the payment of wages, while the rest was for the use of fertilizers. The average yield per hectare was 10 quintals per hectare, so that the average income stood at $ 9,200 pesos per hectare. In other words, revenues were lower than costs.

Therefore, the support provided by the program can cover in the majority of cases the difference between revenue and total

costs. However, this situation is conditioned by the structure of prices and future demands of the grain. Despite envisioning a horizon of a high demand for coffee in the national and global markets, it is important to incorporate policy tools which cover risks and uncertainty.

CONCLUSIONS

The state of Chiapas presents an important opportunity to continue as a leading producer of coffee in Mexico, and has yield levels per hectare that allow for the incorporation into international markets, coupled with the production of organic coffee which must have additional alternatives to conventional certification as is the case with participatory certification. The incorporation of a greater number of hectares to organic coffee production should be a priority action for the government and social movements.

The State as a whole must orchestrate a series of sectorial policy measures to enable the sector to maintain its average annual growth rates. Chiapas should also be consolidated with a central element or "cluster" of coffee farming in the country. To this end, institutions and programs should direct their efforts to consolidate certification processes that allow small producers into global agricultural food chains.

According to Silva (2006), the production costs of conventional coffee are lower compared to organic coffee, primarily due to the fact that the there is a greater amount of labor for the maintenance of an organic coffee plantation, and secondly, by the amount of organic fertilizer used- resulting in a higher purchase price. However, the price premiums achieved by organic coffee compared to those of conventional coffee, together with the prices or "prize" that is given to belonging to the Fair Trade system, allow organic producers to stay in the market for this product

worldwide, absorbing the high costs generated during maintenance of the coffee plantations.

The profitability of organic coffee producers is superior by far to conventional coffee, which is also reflected in increased responsiveness by organic producers against possible misfortunes, because their income reduces the impacts of their costs giving greater stability in the coffee market compared to conventional coffee producers.

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ACADEMIC

PAPERS

DATABASE MANAGEMENT WITH POSTGRESQL LABORATORY 2. APPLICATION OF RESTRICTIONS

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In this second installment of the series of Database Administration (DBA) labs, we show how restrictions apply to fields in a database table. The labs are designed to provide the concepts and skills necessary to know in detail the system, and the functions "copy and paste" offered by the Windows operating system is used to reduce the effort of the reader in preparing the work environment and in solving problems. In the section called "additional work" it is required that the reader apply the experience gained in solving problems related to the central theme of the laboratory. The section of basic concepts shows the command syntax and provides some explanations of their use. This material is taken from the users manual for the PostgreSQL system ,which is available on the official website of the tool. In some cases it has been taken from the official site in Spanish. The basic concepts are applied around a project called "ACME University", which is the product of the author's imagination, as well as the practical solution for the problems that are presented. The books are available in the reference section, and serve as reference to support some of the concepts that are applied in the practice of troubleshooting database administration.

These laboratories have been prepared in order to create practical experience for students in the Database Administration course of the undergraduate program in Computer Systems offered in the School of Public Accounting (SPA) Campus IV of the Autonomous University of Chiapas (UNACH) . The SPA has at least 14 years of experience in using PostgreSQL in classrooms, for research projects and in systems that have been implemented to automate the daily activities of the SPA. As a result of this academic and industrial experience, these laboratories have been developed and are used in classrooms to train our students. We have found that students are motivated to study when these abstract ideas are defined in the exercises , although that will be the subject of another article to be published in this journal.

It has also been reported that they are a resource for graduates who are currently working in the business sector.

As it was previously mentioned, the tool features characteristics and standard programming languages that proprietary systems offer, so that examples can easily be applied to other database systems on the market, or can be referred to when applying the concepts to industrial projects . They can also serve as reference for Computer Science professionals.

OBJECTIVE

The reader will learn to restrict the fields of a database using the commands SQL has for this purpose in the management of the PostgreSQL database system.

PREREQUISITES

It is expected that the reader has previous experience in the use and conversion of Entity-Relationship (ER) diagrams-theme associated with the Database Design issues which are not covered in this document. It is also expected that the user has basic knowledge of the SQL programming language.

You must install the PostgreSQL database version 9.3 on the Windows operating system, and verify the requirements for installation on the official website of the tool: www. postgresql. org. The system can be downloaded from the website:

http://www.enterprisedb.com/products-services-training/pgdownload#windows

If you have any questions regarding PostgreSQL, I recommend you visit the official site: http://www.postgresql.org

PARTS OF THIS LABORATORY

1. Project to develop
2. Basic concepts
3. Preparation of the work environment
4. Problem solving
5. Additional work
6. References

I. Project to develop

The exercise to be performed is a project that describes the problem of a company dedicated to providing educational services: After reading the text a ER diagram is generated with the solution to this problem, it continues with the creation of the population tables and tables, in order to finally work with user and group permissions.

ACME University Project

In UACME, two types of courses in the special summer period are offered, when summer and extracurricular courses are offered. The first are classes for a regular student pursuing a degree in this period. You are allowed to advance up to two subjects, while the latter are special training courses that are offered to regular students or external professionals.

Teachers of UACME are the only ones who are allowed to teach these courses, which receive an additional payment that should be paid according to a tab that indicates the cost according to the academic level of the teacher. Payment is generated from the beginning of the course and only once check is allowed to be issued for each course. In addition, students must additionally pay the cost per semester to attend the course.

UACME has two departments involved in the administration of the courses:

A) Department of Administration (DA) and B) Department of School Control (DSC). With regards to the DA, they make payment to teachers and manage the payment of students fees. The DA is managed by PA (Public Accountant) Avila and is assisted by Mr. Cancino. While the DSC is directed by Mr. Barroso and assisted by Ms. Tirado, Ms. Martinez, Ms. Aquino and Ms. Ramos. It is here where the courses that are going to be taught in the semester are decided, who will the teachers be who imparts the courses, and where student applications are accepted. A special case is that of the professors, since the DA is who can modify their biweekly salary, while the DSC cannot even see the payroll. A curious situation is that the DSC is who accepts the teachers and logs into the system, but it is the DA where the salary is captured. It is important to the UACME that this policy is applied to the letter, which is implemented directly on the DB. The following describes in detail the tables to which personnel have access to.

Tables that are allowed access to the staff by the Administrative Secretary:

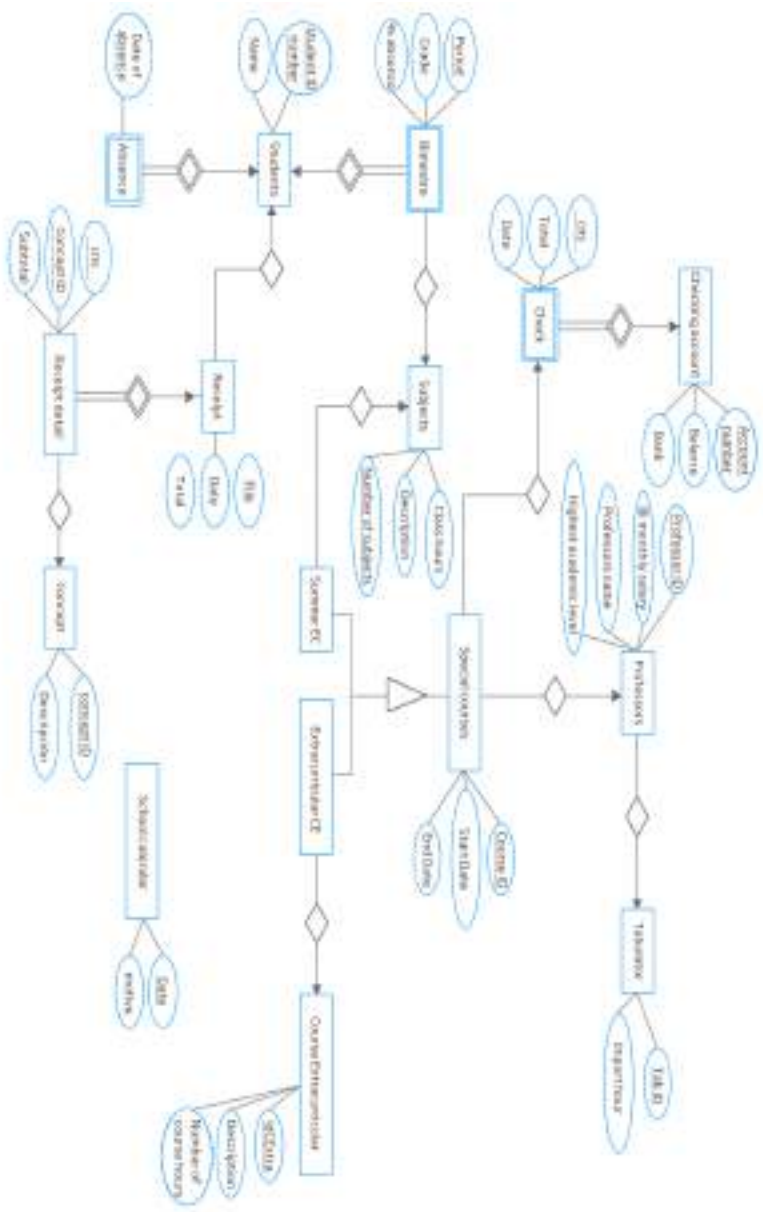
Checking account, Checks, Tabulator, Teachers, Concept, Receipt, and detailed receipt.

In special cases this department can access the tables of Special Courses, Special Summer Courses, Extracurricular Special Courses, Extracurricular Courses, and courses. It is explicitly prohibited to modify any field or record.

Tables that are allowed access to the School Secretarial staff:

Special courses, extracurricular courses, courses, Summer EC, Extracurricula EC, students, bimester, abscences, school calendar.

Figure 1. Diagram E/ R which solves the above problem.



II. Basic concepts

Here is a modified version of the PostgreSQL user manual which gives an explanation of the use and syntax of the commands used in this laboratory. To see the official manual in English visit the official website on the Internet: www.postgresql.org

Restrictions (CONSTRAINTS)
These allow for the restricted use of the data, thereby to help prevent invalid data entering into the database. Defining a data type for a column is a restriction. For example,when a column that has a restriction of a type DATE, the column validates dates.

USE OF NOT NULL
The NOT NULL constraint prevents NULL values in the columns. Inserting a NULL value or an INSERT could gather a NULL column 2, causing an INSERT fault.

UNIQUE
The UNIQUE constraint prevents duplicate values that are stored in the same column. CREATE TABLE displays the name of the unique index created. If a UNIQUE constraint had multiple fields, you must separate the UNIQUE with a line to specify the columns that make up the constraint.

PRIMARY KEY
A primary key indicates that a column or group of columns can be used as a unique identifier of rows in the table. (This is a direct consequence of the definition of a primary key. Note that a unique constraint by itself does not provide a unique identifier because it does not exclude null values).

When you add a primary key, you automatically create a unique *btree* index on a column or group of columns used in the primary key.

A table can have at most one primary key. (There may be any number of unique and not-null constraints, which are functionally the same, but only one can be identified as a primary key).The theory of relational databases dictates that every table must have a primary key. This rule is not enforced by PostgreSQL, but it is better to follow.

Foreign Key / References (Foreign Key / Reference)

A foreign key constraint specifies that the values in a column (or group of columns) must match the values in a column in another column. We say this maintains the referential integrity between two related tables.

RESTRICT and CASCADING DELETES are two of the most common options. RESTRICT prevents deletion of a referenced row. NO ACTION means that if there are still reference rows when it is checked, it produces an error. This is the default behavior if nothing is specified. (The difference in substance between these two choices is that NO ACTION allows the validation to be deferred until later in the transaction, while RESTRICT does not). CASCADE specifies that when a referenced row is deleted, the referenced rows should be deleted automatically as well. There are two other options: SET NULL and SET DEFAULT. These cause the columns referenced in the referenced rows to be initialized with null or default values, respectively, when the referenced row is deleted. Note that they do not prevent you from observing any restrictions. For example, if a specific action SET DEFAULT but the default does not satisfy the foreign key constraint, the operation will fail.

Analogous to ON DELETE there is also ON UPDATE which is invoked when a referenced column is changed (updated). The possible actions are the same. In this case CASCADE means that the updated columns of referenced values must be copied to the referenced items.

Normally, a referenced record need not satisfy the foreign key constraint if any of the referenced columns is zero. If the coincidence of zero is added to the declaration of foreign key, a line of reference escapes satisfying the restriction only if all referenced columns are null (so a mixture of null values and non-zero ensures a failed MATCH FULL restriction). If you do not want reference lines to avoid meeting the foreign key constraint, declare columns referenced as non-existent.

A foreign key of referenced columns form either a primary key or form a unique constraint. This means that the referenced columns always have an index (the underlying primary key or a unique constraint); In this manner you can check whether a referenced row that has a match is efficient. Since deleting a row in a referenced table or updating a row in a referenced table requires searching the referenced table by matching rows with the old value, it is almost always a good idea to index the referenced columns. Since this is not always necessary there are many options available such as indexing. The declaration of a foreign key constraint does not automatically create an index of the referenced columns.

Changing the primary key

If a foreign key constraint references a row as its primary key, and the row of the primary key is updated or deleted, then the default action of the foreign key is to restrict the operation. Foreign key options ON UPDATE and ON DELETE, however, allow you to take a different action.

The ON UPDATE and ON DELETE options can have the following:

- UPDATE CASCADE updates the primary key of all columns referenced by it.
- DELETE of the primary key causes the elimination of all primary key rows that are references for it.

- UPDATE and DELETE SET NULL to the row of a primary key causes the primary key placed as a NULL.
- The NO ACTION is the action by omission.

The action of foreign key gives you great flexibility in how to control how the primary key changes affect foreign key rows.

Multi-columns in Primary Keys and Foreign Keys

To specify a multi-column primary key, you need to write a separate PRIMARY KEY command in the CREATE TABLE statement. A multi-column foreign key has the same requirements, so it is necessary to write the FOREIGN KEY command separately.

Handling null values in foreign keys

A NULL value cannot reference a primary key. A single column foreign key is NULL or matches a primary key. In a multi-column foreign key, sometimes only part of the foreign key can be NULL. The default behavior allows some columns in a multi-Foreign Key column be NULL and others not be NOT NULL.

Using MATCH FULL in a multi-column foreign key constraint requires that all the key columns are NULL or all columns are not NULL.

First, the tables are used to show that the default allows that a foreign key column must be set to NULL. Then the *matchtest* table is created with the option of restricting the foreign key MATCH FULL. MATCH FULL; allows all keys to be placed in NULL, but requires only a NULL is established in some multi-column key values.

Frequently checking the foreign key

By default, foreign key constraints are checked after each INSERT, UPDATE, and DELETE query. So, if you perform a complex modification, the foreign key constraint must be validated at all times.

CHECK

The CHECK constraint enforces the values of the restricted columns. This way the restriction can restrict a column, for example; for a set of values, only positive numbers or reasonable data. By default, CHECK allows NULL values.

Referential integrity rule

When a column is defined as a foreign key, the table rows in that column can contain either the null (no value) or a value that exists in another table, an error would be assigned to a resident population that is not in the populations table. That is what is called referential integrity and consists of what the other data is referencing (foreign keys) must be correct. Referential integrity makes the management system of the database ensure that there are no foreign key values that are not in the main table. The following demonstrates the statement:

> «If a tuple in table A has attributes (a1 ... an) that reference the primary key of another tuple in table B, these attributes have null values, or values (v1 ... vn) corresponding to a specific key B tuple».

It is implemented in SQL using the command references when it deals with a primary key of a single attribute or Foreign Key when there is a primary key for more than one attribute.

III. PREPARATION OF THE WORKING ENVIRONMENT

To apply the concepts described in this laboratory is necessary to have databases in which restrictions apply that are required by the project. One of the additional activities that the reader must make is to integrate the concepts explained in Lab 1 and 2 into a single database in order to gain practical experience. So in

this laboratory we use a new database, different from that used in the “Laboratory 1. Control of Users”.

Creating Tables

The tables found in this section were created by applying the conversion rules to the E-R model as related to the E-R diagram in section 1. This lab does not attempt to explain those rules.

Schemes for the E-R diagram of ACME University:

The names of the fields in some cases were changed with respect to the ER diagram based on sizes of the name, but the concepts are the same.

CheckingAccount (naccount, balance, bank)
Check (nacount, cns, total, date);
Tab (idtab, amount, hour);
Teachers (idteacher, idtab, name, maximum, salary);
SpecialCourses(idcourse, idteacher, cns, fini, ffin);
ExtracurricularClasses(idextra, decextra, ncoursehours);
Subject (nsub, des,coursehour);
ECSummer (idcourse, nsub);
ECExtracurricular (idcourse, idextra);
Students (tuition, name);
Bimester (tuition, period, nsub, rate, faults);
Abscences (registration, date);
Concept (idconcept, desconcept);
Receipt (folio, registration, daterec, totalrec);
ReceiptDetail (folio, cns, idconcept, subtotal);
SchoolCalendar (date, reason);

3.1 Policies to implement boards ER diagram of ACME University

Following is a summary of the policies to be implemented and tables that will be affected. The purpose of this summary is to have a complete picture of restrictions that apply to the database.

The following commands for the creation of tables and insertion of data must be executed using the postgres user (default user) and must change until it is explicitly indicated. Note that unlike the first laboratory, this table creation contains more code restrictions, and because the use of restraints the statement of the tables is more detailed. The guidelines for creating these restrictions are developed from the policies outlined by the company.

- No attribute which is itself a primary key or is part of a primary key can accept null values.

- When a master record receipts is deleted, all records relating to the receipt detail table should automatically be erased.

- When a checking account is deleted, all records related to the checking table should automatically be erased.

- When you delete a record in the table *SpecialCourses*, any related record in specialized tables and *ECExtracurricular* and *CESummer* should automatically be erased.

- NULL VALUES ARE NOT ALLOWED on the following fields in each table (primary keys are restricted in the first guideline):

  CheckingAccount (bank)
  Tab (amounthour);

Teachers (name, maximum);
Subject (des,coursehours);
Students (name);
Concept (desconcept);
SchoolCalendar (reason);

- NOT ALLOWED VALUES LESS OR EQUAL TO ZERO on the following fields in the tables below:

Check (total);
Tab (amounthour);
Teachers (salary);
Receipt (totalrec);
ReceiptDetail (subtotal);

- The date of issuance of the check can only be today or earlier, but never later than the date of the system.

3.2 Solution to the problems

We now move from the policies to the necessary commands in PostgreSQL that provide solutions to the problems that are presented. This proposal requires that the database is reconfigured. In order to visualize the detail in these changes, we suggest that you compare it with what was created in Lab 1. The changes that you discover are the restrictions that are being implemented in the database.

To comply with company policies, the tables are rebuilt on a new database that we call UACMEREST. Copy and paste the tables below in the new database, remember to use the postgres user in all cases. Finally, insert the data that is provided to verify that the restrictions that are suggested are covered by the new definition of the tables.

```
- Creating the database UACMEREST
create database uacmerest;
- Switch from the BD default to the ACME (in PSQL)
\ C uacmerest
--Creation of the tables
- The primary key cannot accept null values
CREATE TABLE checkingaccount(
naccount integer NOT NULL,
numeric balance (7.2),
bank varchar NOT NULL,
CONSTRAINT checkingaccount _ pkey PRIMARY KEY
(naccount)
);
- The primary key cannot accept null values
– The total field must be greater or equal to zero
- When Checking Account registry is deleted ...
- All checks from the account are deleted
CREATE TABLE check (
naccount integer NOT NULL,
cns integer NOT NULL,
Total numeric (10,2) CONSTRAINT amount _ invalid
CHECK (total> 0),
date CONSTRAINT date _ invalid CHECK (date <now
()),
CONSTRAINT Check _ pkey PRIMARY KEY (naccount, cns)
CONSTRAINT Check _ naccount _ fkey FOREIGN KEY
(naccount)
REFERENCES checkingaccount (naccount) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE CASCADE
);
- The primary key cannot accept null values
– The amounthour field must be greater or equal to
zero
CREATE TABLE tab (
idtab integer NOT NULL,
amounthour varchar NOT NULL CONSTRAINT CHECK
amounthour _ invalid (amounthour> 0),
CONSTRAINT Tabulador _ pkey PRIMARY KEY (idtab)
);
- The primary key cannot accept null values
– The salary field must be greater or equal to zero
```

```
- When a record of the tab table is deleted the
associated records are deleted in
- The teachers table
CREATE TABLE teachers (
idteacher integer NOT NULL,
idtab integer,
name varchar NOT NULL,
maximum varchar NOT NULL,
double precision salary CONSTRAINT salary _ invalid
CHECK (salary> 0),
CONSTRAINT teachers _ pkey PRIMARY KEY (idteacher)
CONSTRAINT teachers _ idtab _ fkey FOREIGN KEY
(idtab)
REFERENCES tab (idtab) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION
);
- The primary key cannot accept null values
CREATE TABLE specialcourses (
idcourse integer NOT NULL,
idteacher integer,
fini varchar,
ffin varchar,
naccount integer,
cns integer,
CONSTRAINT specialcourses _ pkey PRIMARY KEY
(idcourse)
CONSTRAINT specialcourses _ naccount _ fkey FOREIGN
KEY (naccount, cns)
REFERENCES check (naccount, cns) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION
);
- The primary key cannot accept null values
CREATE TABLE extracurricularcourses(
idextra integer NOT NULL,
decextra text,
ncoursehours integer,
CONSTRAINT extracurricularcourses _ pkey PRIMARY
KEY (idextra)
);
CREATE TABLE subjects (
nmat integer NOT NULL,
```

```
des varchar NOT NULL,
coursehours integer NOT NULL,
CONSTRAINT subjects _ pkey PRIMARY KEY (nmat)
);
CREATE TABLE ecsummer (
idcourse integer NOT NULL,
nsub integer,
CONSTRAINT Ecsummer _ pkey PRIMARY KEY (idcourse)
CONSTRAINT Ecsummer _ nsub _ fkey FOREIGN KEY
(nsub)
REFERENCES subjects (nsub) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE CASCADE
);
CREATE TABLE ecextracurricular(
idcourse integer NOT NULL,
idextra integer,
CONSTRAINT Ecextracurricular _ pkey PRIMARY KEY
(idcourse)
CONSTRAINT Ecextracurricular _ idextra _ fkey
FOREIGN KEY (idextra)
REFERENCES extracurricularclasses(idextra) MATCH
SIMPLE
ON UPDATE NO ACTION ON DELETE CASCADE
);
CREATE TABLE students (
enrollment integer NOT NULL,
name varchar NOT NULL,
CONSTRAINT students _ pkey PRIMARY KEY (enrollment)
);
CREATE TABLE bimester (
period integer NOT NULL,
enrollment integer NOT NULL,
nmat integer,
integer grade,
absences double precision,
CONSTRAINT Bimester _ pkey PRIMARY KEY (enrollment,
period)
CONSTRAINT Bimestre _ enrollment _ fkey FOREIGN KEY
(enrollment)
REFERENCES students (nmat) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION
```

```
CONSTRAINT Bimestre _ enrollment _ fkey1 FOREIGN KEY
(enrollment)
REFERENCES students (enrollment) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION
);
CREATE TABLE faults (
date varchar NOT NULL,
integer enrollment,
CONSTRAINT absences _ pkey PRIMARY KEY (date)
CONSTRAINT absences _ enrollment _ fkey FOREIGN KEY
(enrollment)
REFERENCES students (enrollment) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION
);
CREATE TABLE concept (
idconcept integer NOT NULL,
desconcept varchar NOT NULL,
Concept _ pkey CONSTRAINT PRIMARY KEY (idconcept)
);
CREATE TABLE receipt (
Folio integer NOT NULL,
integer enrollment,
daterec varchar,
totalrec double precision CONSTRAINT totalrec _
invalid CHECK (totalrec> 0),
CONSTRAINT Receipt _ pkey PRIMARY KEY (folio)
CONSTRAINT Receipt _ enrollment _ fkey FOREIGN KEY
(enrollment)
REFERENCES students (enrollment) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION
);
CREATE TABLE receiptdetail(
cns integer NOT NULL,
idconcept integer,
Folio integer NOT NULL,
subtotal double precision CONSTRAINT subtotal _
invalid CHECK (subtotal> 0),
CONSTRAINT Receiptdetail _ pkey PRIMARY KEY (folio,
cns)
CONSTRAINT Receiptdetail _ folio _ fkey FOREIGN KEY
(folio)
```

```
REFERENCES receipt (folio) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE NO ACTION,
CONSTRAINT Receiptdetail _ idconcept _ fkey FOREIGN
KEY (idconcept)
REFERENCES concept (idconcept) MATCH SIMPLE
ON UPDATE NO ACTION ON DELETE CASCADE
);
CREATE TABLE schoolcalendar(
date varchar NOT NULL,
reason varchar NOT NULL,
CONSTRAINT schoolcalendar _ pkey PRIMARY KEY (date)
);
```

Inserting data for some newly constructed tables

```
insert into CheckingAccount values (2.9000,
'HSBC');
insert into CheckingAccount values (3,60, 'HSBC');
insert into CheckingAccount values (4,10, 'HSBC');
insert into CheckingAccount values (5.1000,
'HSBC');
insert into CheckingAccount values (6200, 'HSBC');
insert into Check values (1,10,200, '2008-02-01');
insert into Check values (2,10,575.20, '2008-02-01');
insert into Check values (2,20,20, '2008-02-01');
insert into Check values (3,10,600, '2007-02-01');
insert into Check values (4,10,800, '2007-02-01');
insert into Check values (5,10,100, '2007-02-01');
insert into Check values (6,10,300, '2007-02-01');
insert into Tab values (10,100);
insert into Tab values (20,200);
insert into Tab values (30,300);
insert into Tab values (40,400);
insert into Tab values (50,500);
insert into Tab values (60,600);
insert into Tab values (70,700);
insert into Teachers values (1,40, 'Robert',
'Masters', 15000);
insert into Teachers values (2,70, 'Carlos',
'Doctorate', 25000);
```

```
insert into Teachers values (3,20, 'Luis',
'Bachelors', 6000);
insert into Teachers values (4,30, 'Yunuan',
'Masters', 12000);
insert into Teachers values (5,10, 'Julio',
'Bachelors', 4500);
insert into Teachers values (6,20, 'Samuel',
'Bachelors', 5500);
insert into SpecialClasses values
(1,1,1,20070204,20050204);
insert into SpecialClasses values
(2,2,2,20070204,20050204);
insert into SpecialClasses values
(3,3,3,20070204,20050204);
insert into SpecialClasses values
(4,4,4,20070204,20050204);
insert into SpecialClasses values
(5,5,5,20070204,20050204);
insert into ExtracurricularClasses values (1,
'admin', 204);
insert into ExtracurricularClasses values (2,
'design', 204);
insert into ExtracurricularClasses values (3,
'bdd', 204);
insert into ExtracurricularClasses values (4,
'java', 204);
insert into Subject values (1, 'admin bdd', 204);
insert into Subject values (2, 'networks', 204);
insert into Subject values (3, 'networks 2', 204);
insert into Subject values (4, 'admin bdd', 204);
```

The data inserted only serve to demonstrate the function of access privileges. It is up to the user to insert data in other tables to show that access rules are functional for each user.

Deleting tables

If you need to delete tables, this is the order in which they must be deleted since the strict application of referential integrity can cause problems in the deletion process.

```
drop table SchoolCalendar;
drop table ReceiptDetail;
drop table Receipt;
drop table Concept;
drop table Absences;
drop table Bimester;
drop table Students ;
drop table ECExtracurricular;
drop table ECSummer;
drop table Subjects;
drop table ExtracurricularCourses;
drop table SpecialCourses;
drop table Teachers;
drop table Tab;
drop table Check;
drop table CheckingAccount;
```

Checking tables with restrictions

After constructing the tables, you must validate that the restrictions work properly. Since some involve dates and the time is unknown when this laboratory practice will take place, you must capture the date as necessary.

- Try to insert the next row in the checks table.
  `insert into Check values (6,10,0, '2/1/2014');`

  Are you allowed to execute the operation? Explain what happened.

- Remove the checking account no. 6
  `Delete from CheckingAccount where naccount = 6;`

  Did it work? Now verify what happened with check 10 that was inserted in the previous step. Explain.

- Insert the next register in the concept table:
  `Insert into concept values (1);`

Did it work? Explain in detail.

- Try to insert the next record in the checks table.
  insert into Check values (6,10,10, <date after the day on which it runs>);

  For example, if today is February 19, 2008, use February 21 as a later date.

  Did it work? Explain in detail.

V. ADDITIONAL WORK

The following issues are unresolved, so it is necessary to apply your experience that you have acquired to solve them.

1. Using different users, verify that you are able to make the movements according to the privilege assigned to each of the tables.
2. Build the missing rule for school group on the view ViewSchoolTeachers, build the rule for when the user wants to delete the register of the teacher Luis.
3. Add additional restrictions. Use the following policy: The manager responsible for capturing the special courses is assigned to the administrative department (any user), but those who will assign teachers will be the school department. Build the view and the rule will regulate this insertion of data.
    - The insertion of data into the table for SpecialClasses and the specialized tables to engage the DA, with the teacher field in zeros or referencing a special register (for example, an invalid teacher) of the Teachers table.

- The modification of the tables SpecialClases to assign a teacher that will affect the DCE.

4. Explain the reasons why the instructions for users Barroso and Avila make mistakes or function properly.
5. Integrate the concepts explained in Laboratories 1 and 2 of this series into a single database. Tips: Destroy the UACME data base, apply the concepts from Lab 2 and then apply the user access privileges.

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BOOK REVIEW:

"MODELO DE ALFABETIZACIÓN DIGITAL PARA PROFESORES UNIVERSITARIOS" (MODEL OF DIGITAL LITERACY FOR UNIVERSITY PROFESSORS) BY REBECA GARZÓN CLEMENTE

Nancy Leticia Hernández Reyes

The text which I refer to in this paper is the result of a thorough analysis that addresses two issues that arose at different times; one in the nineteenth century, which can be considered part of late modernity that fails to reach the time of humanity: the model of a modern university; another, the world of technology. So pervasive that it integrates, more every time, all aspects of human life. University and technology are the subjects that catch the author in a process of reflection and action on the necessary training of university teachers to meet the challenges that they face in this world dominated by information and communication.

The function of educational policies with respect to the ongoing evaluation of the quality of services, universities in Mexico have made efforts to their attention. However, the author poses the essential argument that this will not be possible until there are not approved and integrated standards into a National System of Higher Education, which will equate information on the quality levels that are reached.

One of the educational agents who become relevant in assessing quality in universities is the teacher who, according to a rigorous diagnosis with teachers from the Autonomous University of Chiapas presented by the author, can be found a positive attitude by part of them regarding the use of technology. However, there are great contrasts between this attitude and the actual use of technology, as it was found that there is a minimum active application for teaching. The study amply demonstrates the need to address teacher training in technology, specifically in the development of teaching strategies based on ICT, and more, in creating learning environments that represent real challenges to student's knowledge.

The analysis is based on the diagnosis that was made, which leads the author to the creation of a model based mainly on Digital Literacy that focuses on four key areas: institutional governance, technological infrastructure, the university curriculum, and teachers and their training. These axes have a close relationship

and correlation with each other and educational processes in the training of professionals. This may mean for universities in Mexico and Latin America –due to the similar context of these institutions-a turning point for bridging the gap between teaching practice and global context that surrounds university students .

The book provides in turn, important theoretical referents; the first is a comprehensive treatment of the concepts that give foundation to the work that is presented: a metamorphosis of the concept of literacy in education mediated by technology, as regarded by the author; and the evolution of ICT in this area This makes it an obligatory reading for current educators and those interested in enabling technology as a facilitator of formative processes at all levels of the education system.

As an addition to all of the advantages offered by the book, the work is prefaced in a brief but masterly manner by Joaquín García Carrasco, professor at the University of Salamanca, Spain, who accompanied the author on the winding road taken by this subject which is quite interesting and undeniably present.

CULTURAL

BRIEFS

BOOK REVIEW:

"THE POEMS OF OBLIQUE SOUL" BY VICENTE CERVERA SALINAS

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L'anima obliqua (2008) is the Italian version of *The Oblique Soul*, a volume of poems by Vicente Cervera Salinas[1]. The fact of calling this group of forty poems with a geometric adjective, so infrequently referred to with the soul, is one of the most abstract and complex words in the language and certainly among the major strengths of this book as well as the name of the four chapters in which it is structured: Oblique, Grammar, Captive & Panoptica- all intellective words, almost technical terms, that organize and designate a powerful artistic discourse.

In this manner, the universal spirit, the mystic soul, is associated with a rational word, belonging to the Euclidean, rather than the poetic, universe. This substantive charges a higher weight due to the adjective that qualifies it, and so it is the content-always a mixture of abstraction and concreteness, of notions and meanings applied to everyday life: In "Children to come" reads: "You're not / more who you were. They will mother warm seas / emblazoned, confused cities / languages . You are no longer / who said, 'at once'. You've patronized stations, mouths of / subway, postcards ... "(p. 104). After the almost vague mention of the stations, crossing and shooting, they can be both seasons of the year as much as the aforementioned moving train, comes one of the iconic images of the latest poetry: the subway, the mouth that is lowered to the underworld of modernity, at least since 1922 when The Waste Land appeared by T.S. Eliot.

The meeting of abstraction and concreteness in The Oblique Soul leads to paradoxes such as the auction of the first poem: "Cliffs appear in the / plain. I'm the dodging and twisting route

[1] The cover of the graphic artist Miliani Fabriano reproduces the image of the painting "The Tree of Crows," by the German Romantic painter Caspar David Friedrich, whose original is in the Musée du Louvre in Paris. This volume of verses of Cervera Salinas is an edition by Levante Editiri - Bari, Volume No. 58-59 of the collection *I Quaderni di Abanico* , directed by Lucia and Emilio Coco. It takes a critical text of Gabrielle Morelli. The translation is by Elsa Rovidone. The original texts in Spanish are cited that go at the end of the volume, immediately followed with each verse separated by a slash. At the end there is a bio-bibliographic profile of the author, his *Traiettoria poetica e professionale*. The original book, with a foreword by Antonio Cillóniz, appeared by the Editorial Verbum (Madrid, 2003).

/ in the immaculate flat. The biased / direction of every line. Soul / oblique who loves, at last, righteousness" (p. 103).[2] The terms used in this passage can reveal a bit of the intention of the book: *obliquus*, Latin adjective indicating that a line - or a plane- is biased of the horizontal line. You can cut a plane- or a line- forming an angle that is never straight, as reported by the *Diccionario de la Real Academia Española*. In this initial paradox, the soul occupies in space an oblique and biased position, but it "loves, at last, righteousness." It is offset from the horizontal line, determined to go against the current; a soul in rebellion that argues, ignores normality, praises and fears the daily grind; It is not resigned to the sheepfold, to the cage of convention. In "A lack dismissed" (P 118) states: "Do not suffer by their absence / When the other does not want to answer, / It is the same if you stay in / a lunar ocean, or by your side ..." an idealized always fleeting presence, shadow, image, fiction, as in the sonnet by Sor Juana Ines de la Cruz (1972: 143) where only the fantasy of a lover can imprison the elusive loved one.

The poem "The Train Stop" (p. 104), especially in the verses "permanent maze / we pity in your gloomy restlessness / Minotaur stripped of his temple / and converted in the procession of the routine, / without offering and without ritual nothing waits ... ", he evokes the always remembered poem "In a Station of the Metro" by Ezra Pound (1978: 29) as the couplet:"The apparition of these faces in the crowd / Petals on a wet branch, black ".

"Deposits" (pp. 109-110) extols rest, resting, "Maybe resembling the ideal." Contrary to the romantic vision of travel and movement, sedentary lifestyle is seen and perceived as the natural state of body and psyche in their exercise for reflection and writing.

[1] The poems are quoted in Spanish as they appear, as stated, at the end of the Italian edition.

In Oblique Soul there are speculations, conjectures, experiences, analysis, bitter revelation -as in all knowledge. The aforementioned poem "Train stop" (p. 104) and "Downstairs" (p. 105) show an Orpheus looking for Eurydice in the depths, and suggests a descent to the underworld. In the latter, it reads: "They have left / counting, to be measured / Immaculate; when looking at /the abyss, they see the other home / to come, which is already being / from above, on the steps / without stealth ".

A voice from the past runs through the book, echoes from afar, and reading some poems from the Greek Constantine Cavafis , where memory revives the charm and the object contemplated brings the time that is gone. Revelation is convened; then called Epiphany,just as in the poem "The three temptations" (pp 119-120.) in which the poetic subject suddenly discovers at a party whose guests in a subtle way exclude or marginalize it: "The suspicion / that laughter is perceived / surprise and drunkenness / undisclosed, when the wet / joy and tempts us to become / in the troupe of a banquet / to which we were invited / careless an without a hug".

A poem bordering on fetishism, "The Yellow Shoes" (pp. 106-107), is a good example of the accuracy to name objects associated with a function or extravagance: "hypnotized a desire / stripped of troubles: cheerful, / Pure. Neither the blue boots, and / airy open breasted / in leather. Sublimated / the graceful rhythm of the claque / counterdance of the patent leather, the arabesque / ankled flamenco. Solace of the / rogue, brilliant clown shelter / Achilles heel of the gold dandy / damasked ". And in "The three temptations" mentioned above, the section "Captive" (pp. 118-124), offers a kind of postmodern version of Lucifer, who "no longer looks for idolatry. / It confuses us to rid ourselves of the gifts / that are housed seasoned with time. / Heirs of their haste, we despise /the banquet of a friend to believe / that is far, and we forget those other sheets / lie ahead and that, soft, cover /the nudity that humbles us".

The poems of the Oblique Soul presents arguments based on images which are always full of meaning and symbols, mythological and historical allusions-and even the theological, as in "The moral kinetics" (p. 108), which leverages words of Christian symbolism such as Golgotha, cross, thorns. The exposed facts pass through the reflective screen in a seemingly impersonal tone, which are in reality rich and suggestive, calculated through the mastery of the techniques of verse, such as the use of enjambment and rhythm. Gabrielle Morelli (2008: 11-12), quoting Antonio Cillóniz (2003: 10), says that in the poetry of Cervera there exists correspondence between artistic license and his vision of the world, which is proof of the fragmentation of verse, the pause that registers syntactic breathing, a pause "not used in place of rhyme but rather as a place of inflection of thought and expression, which leads to suspense and surprise at the phonetic, syntactic and semantic dissociation that occurs".

It is true. Vicente Cervera Salinas is a writer who surprises, not only by the link between text and reader, but also with the verses he has said out loud, as when he uttered in chorus with his students "Everness" by Jorge Luis Borges, in a time when nobody expected; or when one opens another book of the same Vicente Cervera Salinas (2011), Escalada y otros poemas, and you find the poem that Jose Emilio Pacheco wrote as a prologue.

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BOOK REVIEW:

"BALLET BONAMPAK AND CHIAPAS FESTIVAL"

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José Luis Zebadúa Maza, son of Doña Beatriz Maza, who is a Bonampak ballet enthusiast, is currently the producer of the show and has put it within reach of everyone its memoirs that since its founding have been so rewarding for its members. The book reports its discovery on February 9, 1946, when Carlos Frey, accompanied by the Lacandons Pepe Chambor, Ka'Yun Carranza, Acacio Kin Chang and Kin Obregón came to the archaeological site of Bonampak- a Classic Period Maya site. Its rise was recorded between 650 and 850. Its fame is due to the murals that are located in one of the buildings known as the Temple of Murals, a building with three rooms completely painted from the Classic Period.

In August of 1951, Pedro Alvarado Lang, a prominent member of the Athenaeum of Science and Arts of Chiapas, announced the argument for the Bonampak Ballet which was inspired by its paintings, with the support of the governor Francisco José Grajales who authorized the construction of Bonampak outdoor theater where the Bonampak ballet premiered. The composer Luis Sandi was instructed to create the music which was played by the National Symphony Orchestra and recorded by the RCA Victor Company of New York.

In the Bonampak Ballet, the characters in the famous murals of the ancient Maya city are presented through modern dance. The presentation of this ballet became a tradition in Tuxtla Gutierrez, which from 1953 was directed by choreographer Beatriz Maza Solis. The book is available online at:

http://www.conecultachiapas.gob.mx/publicaciones/?t-tulos-recientes:el-ballet-bonampak-y-la-fiesta-chiapaneca