

ANALYSIS OF SCIENTIFIC PRODUCTION AT THE UNIVERSIDAD AUTÓNOMA DE TAMAULIPAS AND ASSESSMENT OF ITS IMPACT ON EDUCATIONAL QUALITY INDICATORS

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Resumen

El objetivo de este trabajo fue analizar las publicaciones en revistas internacionales de alto impacto por investigadores de la Universidad Autónoma de Tamaulipas (UAT) y analizar la relación de este indicador con la obtención de distinciones académicas y programas de posgrado. La producción científica generada por investigadores de la UAT entre los años 1989-2011 se obtuvo de la base de datos ISI Web of Knowledge. El número de publicaciones mostró asociación significativa con las distinciones recibidas de CONACYT para investigadores (Sistema Nacional de Investigadores) no así para programas académicos (Padrón Nacional de Posgrados de Calidad). Los reconocimientos de la SEP para profesores de tiempo completo (Perfil PROMEP) y Cuerpos Académicos no mostraron asociación directa con este tipo de publicaciones.

Palabras clave:

- Producción científica
- Universidad Autónoma de Tamaulipas
- Secretaría de Educación Pública
- CONACYT
- PROMEP

Abstract

Based on the scientific production from 1989 to 2011, obtained from the ISI Web of Knowledge database, this work analyzes the number of papers published in international journals by researchers from the Universidad Autónoma de Tamaulipas (UAT), thus establishing the relationship this index has with official distinctions granted to researchers and programs. The number of publications showed a significant association with the distinctions for researchers awarded by CONACYT (National System for Researchers) but not for distinctions for academic programs (National Register of Quality Programs), concomitantly, SEP's distinctions for professors (Perfil PROMEP) and for academic bodies were not found to be related to publication output.

Key words:

- Scientific papers
- Universidad Autónoma de Tamaulipas
- Secretaría de Educación Pública
- CONACYT
- PROMEP

Introduction

Public universities perform different substantive functions that include teaching (transmission of existing knowledge), basic and applied research (generation of basic or technical knowledge), human resource development, diffusion and dissemination of culture and sports activities, to name a few.

The generation of knowledge is linked to the scientific practice of researchers who are hired to perform these tasks and full-time faculty who devote some percentage of their working time to this activity, depending on the terms of their contracts. The Mexican Secretariat of Public Education (SEP) began the Faculty Improvement Program (PROMEP) in 1996, which established that Full-Time Faculty (FTF) should carry out four substantive tasks: teaching, mentoring, educational management and knowledge generation. Teachers who show they meet these four substantive activities are recognized by being awarded the appointment of a PROMEP desirable profile, which has two different levels: preferential (for faculty with a PhD) or minimal (for faculty with only Masters).

The generation and application of knowledge is assessed through the publication of scientific materials which may be conference proceedings, book chapters, books and scientific papers. PROMEP establishes different levels of scientific publications, classified as papers, papers in refereed journals and papers in indexed journals, the latter type of publications are considered the highest quality and in some areas these are the only ones deemed appropriate to be awarded the appointment (DOF, 2010).

The National Council for Science and Technology (CONACYT, acronym in Spanish) for its part, awards distinctions and economic incentives for the scientific activity of Mexican researchers, through the National System of Researchers (SNI, acronym in Spanish), created on July 26, 1984. The SNI makes an annual call for teachers and researchers working at higher education institutions, institutes and national research centers to present their scientific production to be evaluated by committees, previously defined by areas of knowledge. Among the products to be evaluated are the scientific papers. CONACYT defines a scientific paper as:

a work printed in a scientific journal or a general interest scientific publication. Journals are usually backed by a publishing house recognized as such. Indexed electronic journals are considered to be at the same level as printed journals and fall under the same quality criteria: general profile of articles published in the journal, general profile of the authors of these articles, profile of the Editorial Board, coverage, distribution and impact.

Despite this definition, which seems to include most scientific journals, there are quality criteria for evaluating the effectiveness of scientific papers, mainly based on the impact factor of the journal, and the number of citations each article has, excluding citations in thesis and self references (SNI, 2008).

Publication of the knowledge generated in journals involves demonstrating that new knowledge has been generated before peers acting as external expert evaluators. This knowledge has a different level of impact in the scientific community and humanity in general. One way of measuring it is by assessing the number of institutions interested in spreading the new knowledge, or the companies that have applied it to their processes. The impact may also be measured by counting the number of papers citing the new article over a given period of time. This is important for there is an association between the number of citations and the impact the paper had in the generation of new knowledge, establishing a quality indicator for the published paper.

This parameter for measuring the quality of an article may also be applied to assess the quality of scientific journals, by measuring the citations of articles published over a period of time. This way of assessing knowledge has led to the term "high impact scientific journals." The impact factor (IF) of scientific journals is measured mathematically by dividing the total number of citations received by papers published in that journal in that same year and the previous year by the number of articles published in the same period (Table 1). Thus, this factor determines the relevance of recently published knowledge for other researchers who are in turn publishing their new discoveries. On the whole, the IF depends on the journals, publishers, reviewers and authors, but mainly on the scientific knowledge published in scientific journals. Journals with a high impact factor are selected by the best researchers to publish their papers, reason why editors want their journals to have a high IF, and to this end they try to select scientific papers with high relevance and quality. That is why the owners of such journals try to hire, as publishers, scientists with extensive experience in the field of influence of the journal. Researchers in turn select the journals they read and the articles cited in the paper they want to publish. In this way the IF depends to a greater extent on the knowledge that is published than on any of the participants in the process. That is why new journals or publications that present delays in their release dates or a lax selection of the material they publish hardly reach an IF that would allow them to be included in the Journal of Citation Report (which publishes the IF for each journal annually).

Table 1. Example for determining the impact factor (IF) of a scientific journal in 2012

<p>Articles published in 2009 and 2010</p> <ul style="list-style-type: none"> - Number of articles published in 2009 = 148 - Number of articles published in 2010 = 152 - Total = 300 articles
<p>Cited articles in 2011</p> <ul style="list-style-type: none"> - Quotes from articles published in 2009 = 237 - Quotes from articles published in 2010 = 193 - Total articles cited = 430
<p>Cálculo: Calculation:</p> <ul style="list-style-type: none"> • IF 2012 = Citations in 2011 to articles published in 2009-2010 = 430 Total articles published in 2009-2010 = 300 • Impact Factor 2012 = 1.433
<p>Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)</p>

The system developed by the ISI is currently marketed by The Thomson Corporation (www.thomson.com) and is used worldwide. This database has been considered a valuable tool to evaluate the scientific output of individuals, journals, institutions and countries. Charlton and Andras (2008: 465) compared the type of scientific output generated in the u.s. and the uk in the area of health. Olden (2007: 370) used the Hirsch's h index as a measure for analyzing the bibliometric quality of scientific journals in the field of ecology. Ramírez de León et al. (2007: 314) evaluated the scientific production in Mexico in the area of food science and technology. The Scimago Group (2007a: 354) quantified the scientific production of Spanish universities during the 2000-2004 period. Kieling and Goncalves (2007: 177), assessed the scientific quality of the Brazilian journal of psychiatry by analyzing the number of citations received. Pulina and Francesconi (2007: 83), analyzed the scientific production of Italian researcher members of the Scientific Association of Animal Production. Zorzetto et al. (2006: 1513) evaluated the scientific output of 20 Brazilian universities in the area of health and life sciences. Bressan et al. (2005: 649) evaluated scientific production in psychiatry, psychobiology and mental health by associating it to the activity of academic programs in Brazil.

The publication of scientific papers in indexed journals with a high impact factor is an important quality parameter in the evaluation of FTF working at Mexican public universities for being awarded the recognitions by PROMEP and SNI, but also for accreditation of Academic Bodies (AB) as part of the PROMEP and the inclusion of graduate programs in the National Register of Postgraduate Quality (PNPC, acronym in Spanish) by the CONACYT. Currently, all these quality criteria are used to evaluate public universities and the scientific and technological development in the different Mexican states.

The number of scientific papers published in international journals of high impact has been employed by CONACYT as one of the quality indicators to assess the advances in national scientific capacity (CONACYT, 2008).

The Universidad Autónoma de Tamaulipas (Autonomous University of Tamaulipas, UAT) was founded in 1950 in Tampico, Tamaulipas, and decreed autonomous in 1967. It currently has a presence in 14 of the 43 municipalities of the state with 12 academic units, 11 faculties, 1 Centre of Excellence and 2 Colleges.

The UAT offers: 78 undergraduate programs, 6 professional programs and 98 associate degree programs, (12 masters, 10 doctoral and 30 majors), which recorded an enrollment of 39,769 students, of which 36,248 are at the undergraduate level.

The UAT has 2,918 teachers, of these 1,054 are FTF and 1,864 are paid on an hourly basis. 22% of FTF, have doctorate degrees, 60% have master's and 4% a specialization. Of the 907 professors with graduate degrees 477 have the PROMEP profile appointment, granted by the SEP (PROMEP UAT) and 67 are part of the National System of Researchers (CONACYT, 2011a).

The institution has 38 registered Academic Bodies, of which 11 are classified as consolidated, 13 are in the process of consolidation and 14 have been recently formed (developing). These AB's bring together 151 FTF developing 72 lines of knowledge generation, application and innovation.

Of the 98 graduate programs, 16 were registered in the CONACYT PNPC in September 2011 (one major, 12 master's and 3 doctorates). In terms of their level of development, two programs are consolidated, 3 are developing and 11 were created recently. It is important to note that there are no International Qualification programs.

Despite UAT's growing scientific activity, 15 years after the creation of the PROMEP, only 55% of FTF have been awarded the recognition and only 14% of FTF are members of the SNI, a low percentage, considering the total number of FTF with graduate degrees. It also has a small number of consolidated academic bodies (34%) and only 16.6% of the graduate programs are registered with CONACYT's PNP Both certifications are highly dependent on the scientific production of researchers, with great importance placed on the number and type of scientific publications authored by FTF. It is pertinent to point out that the authors recognize that academic production also reflects the vision and systemic development of the institution. The aim of this paper is to analyze the historical evolution of scientific publications in high impact international journals by UAT researchers, establishing their relationship with the indicators used for measuring the scientific activity of educational institutions in Mexico.

Materials and methods

Using the ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation) database as a reference the scientific output of the UAT during the period from 1989 to 2011 was analyzed.

This database does not have any specific search system that allows to search for all publications from a given institution, therefore, we tested different combinations until we found one that yielded the highest number of publications from the UAT, while eliminating the presence of other national and international institutions. The following describes the search performed in the ISI database. In the General Search Section, we conducted a search introducing a combination of parameters "tam* and mex* and uni* or uat*" in the Address field and the period "1989-2011" in the field Year published. These parameters produced a combined total of 1,584 indexed publications. Using the analysis tool provided by the same database (Analyze results), a second classification was made by selecting only the publications originating in Mexico (Country/territory), leaving only 1,354 publications. The exclusion of the works in relation to the initial search, is due to the word Mexico being present in the address, but not as the country of origin. For example, this is the case of works produced in New Mexico (USA).

The publications were analyzed according to the home institution. Several forms of referring to the institution were considered, such as: UAT, Univ Autonomous Tamaulipas, Univ Tamaulipas, Univ Auton Tamaulipas, Tamaulipas Autonomous University, and so on. The total number of scientific products reported by the database was 469. These products constituted the database used for the analysis of scientific production at the UAT in the 1989-2011 period discussed in this article.

There is a small margin of error, not estimated, associated with the operation of the database and how the search was executed, which results in a small number of papers published by UAT researchers not to appear among the 469 publications found in the database. Other reasons why some works produced in this period, by UAT FTF do not appear in the data obtained, would be that none of the authors declared their affiliation to the institution or the institution was not named properly and or in a different form from those considered in this study, particularly if the membership to the faculty or academic unit was mentioned, without giving credit directly to the institution as a whole. It is also important to note that given the amount of information generated, we did not analyze in detail article by article, but by the general criteria applied to obtain the selection of the 469 publications analyzed. That is why this analysis should be used as an indicator of the general trends in scientific production and not as an exact reference.

The contextualization of academic production was performed using information obtained from the records of PNC and SNI from CONACYT, and about the AB's and professors with desirable profiles from the PROMEP's office at UAT.

Results

Scientific activity at the UAT

Using the ISI Web of Knowledge database as a reference, we analyzed the scientific output associated to the UAT during the period from 1989 to 2011. In this period we recovered 469 publications in the database, of which 87.0% were scientific papers and the rest were conference abstracts (5.5%), reviews (4.1%), letters (0.3%) and others (2.1%) (Table 2).

Table 2. Scientific products published included in the ISI Web of Knowledge database by authors affiliated with the UAT from 1989 to 2011.

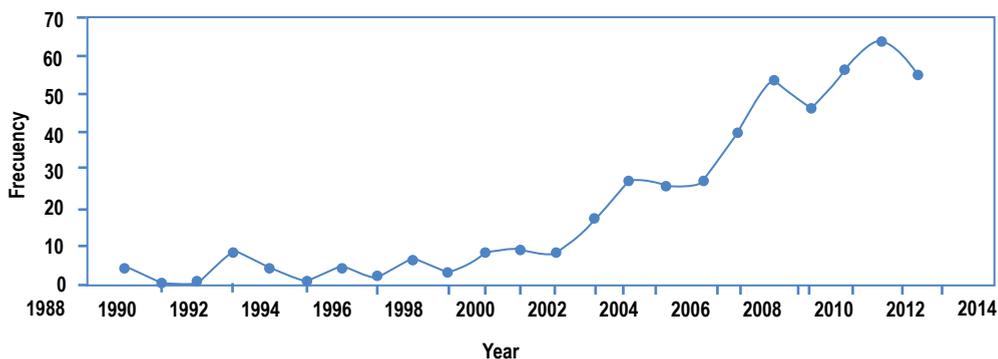
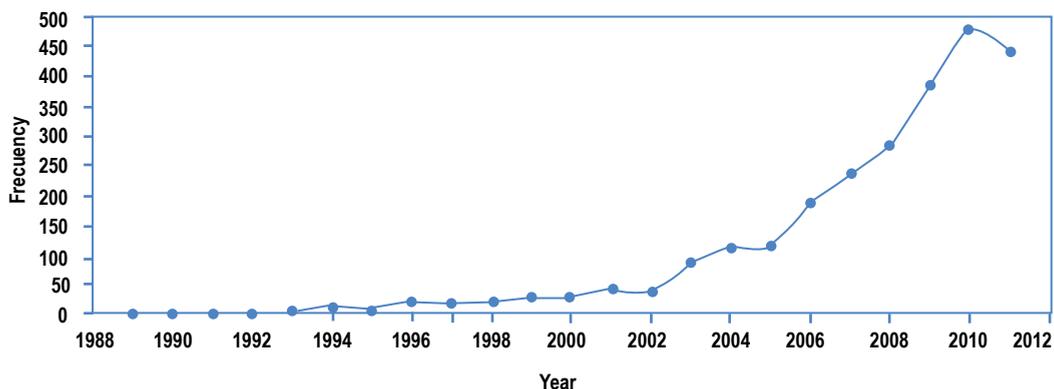
Publication Type	Scientific Products
Papers	408
Conference abstracts	26
Reviews	19
Letters	6
Comments	3
Editorial material	3
Bibliographic products	2
Book review	1
Formal correction	1

Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)

Scientific production remained low during the 1989-2001 period studied, during these thirteen years less than 10 products per year were generated in indexed journals in the ISI Web of Knowledge database (Table 1). After 2001 there is a positive trend in scientific output indicating that the coordination and planning actions taken by the institution to stimulate scientific activity have been relatively successful. In 2004, the UAT established an institutional recognition, accompanied by an economic incentive for researchers awarded the PROMEP profile recognition or those who belong to the National System of Researchers. It is also important to consider that the number of researchers has increased in the institution, either by new hirings or because staff members have obtained doctoral degrees. The scientific output of universities is related to the number of FTE, engaged in scientific activities (Scimago Group, 2007a: 354).

Graph 1

Scientific output annually published and citations done to the UAT works.



Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation).

To publish in high impact journals is an important indicator for entering the SNI, as well as for the registration of graduate programs in the PNPC. In the last 10 years the number of scientific products published by the UAT in high impact international journals increased from 8 to 55. While the trend is positive, the production achieved until 2011 can be considered low when taking into account that 86% (907) of the 1,054 FTF have postgraduate studies. In 2011, the university reported having 234 FTF with doctoral degrees, but only 67 FTF belonging to the SNI, none of which are level 3, only 5 FTF are level 2, 42 are level 1 and 20 are candidates (CONACYT: 2011a). The number of

graduate programs recognized by CONACYT in the PNPC is very small, only 12 current master's, 3 PhD programs and one specialization*ⁿ are recognized by the PNPC (CONACYT 2011b). The concentration of postgraduate programs by area of knowledge in the PNPC is as follows: 7 in Social Sciences, 5 in Natural Sciences, 2 in Engineering and Technology and one in Health Sciences (Table 3).

Table 3. Postgraduate Programs by Area and Level of Development.

Area	ACADEMIC UNIT	Natural and Exact Sciences		Technology and Engineering		Health Sciences	Social Sciences			Total
		ED	RC	C	RC	ED	C	ED	RC	
North	MAU REYNOSA AZTLÁN			1		1	1			3
	MAU REYNOSA RODHE				1					1
CENTRAL	F. Business and Administration							1	1	2
	AU LAW Fco. HDEZ G								2	2
	F. Science and Engineering		1		1					2
	MAU SOCIAL WORK AND HUMAN DEVELOPMENT SCIENCES								1	1
	F. Veterinary Medicine	1								1
	Institute for Applied Ecology		2							2
South	Faculty of Engineering Antonio Narro Siller		1						1	2
	Total	1	4	1	2	1	1	1	5	16
		5		3		1		7		

Source: Compiled with information obtained from: CONACYT PNPC National Register of Quality Postgraduate Programs. Current Programs 2011. Retrieved on September 2nd, 2011. From http://www.conacyt.gob.mx/Becas/Calidad/Documents/Listado_PNPC.pdf

MAU = Multidisciplinary Academic Unit

AU = Academic Unit

F = Faculty

C = Consolidated

D = Developing

RC = Recent Creation

These data show a clear association between the number of publications in high impact international journals and obtaining quality recognitions from CONACYT: for (s) researchers and the parallel quality graduate programs (PhD and Masters with a scientific research orientation), yet it does not show any association with the professionally oriented master's degrees and specialization programs. There is evidence that a greater number of graduate programs have a positive effect on the number of scientific publications (Zorzetto et al., 2006).

International scientific production has increased in recent years (Grupo Scimago, 2007b: 158), as well in Mexico, it has grown significantly rising from 3,282 papers published in high impact international journals in 1996, to 6,787 in 2005. In Mexico, in the period from 2001 to 2005 a total of 28,743 scientific articles were produced, of which 14,528 were published by UNAM featuring as the institution with the most publications. The University of Guadalajara, the Universidad Autónoma de Nuevo Leon and Universidad Autónoma de San Luis Potosi ranked eighth, ninth and tenth place with 882, 819 and 747 publications each (CONACYT, 2006). During that same period the UAT published 93 articles.

In relation to SEP's recognition, the PROMEP profile appointment does not show to have any relation with publication in high impact international journals, as was observed in regard to SNI membership. It is interesting to analyze the fact that the UAT has 907 FTF with graduate degrees (234 PhDs, 630 Master's degrees and 43 with specialization), of these only 477 FTF have been awarded the PROMEP recognition, which entails meeting four fundamental functions: teaching, mentoring, administration and application/generation of knowledge. However, this large number of appointed FTE, is not reflected in the number of publications in high impact scientific journals. It is also worth noting that although 477 FTF have been awarded the PROMEP, only 151 are registered as forming part of an Academic Body, and of these, only 45 have been recognized as Consolidated Academic Bodies.

The ISI Web of Knowledge classifies publications by areas of knowledge. Articles published by the UAT cover 58 fields of knowledge included in this database (Table 4). Knowledge areas which have generated more publications are Food Science and Technology (71), Agriculture (69), Veterinary Science (44), Engineering (34), and Chemistry (31). Social disciplines present a lower number of publications: Psychology (22) and Behavioral Sciences (11). There is a correlation between the areas of study with more publications and the Lines of Knowledge Generation of nine of the eleven Consolidated Academic Bodies (CAB) at the UAT (Table 5), for example, food science and technology, agriculture in its different classifications, entomology, biotechnology and applied microbiology, as well as the areas of health and medicine. The language selected for publishing was English (413), followed by Spanish (56). There are no publications in any other language. Here it is important to note the lack of publications in the areas of Education and Architecture although there are CAB's registered in both (3 members each, one of the bodies has a doctoral candidate and the other is a level 1 SNI researcher).

Table 4. Main areas of knowledge for registered publications.

Areas of knowledge	Scientific products
Food science and technology	71
Agriculture	69
Veterinary Science	44
Engineering	34
Chemistry	31
Biotechnology and Applied Microbiology	23
Ecology and Environmental Sciences	22
Psychology	22
General medicine	17
Marine and Freshwater Biology	17
Entomology	16
Endocrinology / Metabolism	14
Fishing	14
Parasitology	12
Behavioral Sciences	11
Biochemistry, molecular biology	11
Computer Science	11
Plant Science	11
Reproductive Biology	11
Biodiversity conservation	10
Emergency Medicine	9
Immunology	9
Mathematics	9
Zoology	8
Inherited Genetics	7

Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)

Table 5. Publication Disciplines and Consolidated Academic Bodies Knowledge Generation and Application Lines.

Academic Unit	Name of the Academic Body	Lines of Knowledge Application and Generation	Main Publishing Disciplines
MAU REYNOSA AZTLÁN	Food and Nutrition	Use of Fishery Resources. Agricultural Biotechnology Resource Utilization. Food Safety. Nutrition	Food Technology (71)
MAU REYNOSA AZTLÁN	Health	Basic, clinical and epidemiological research of chronic illnesses.	General Medicine (17)
MAU REYNOSA RHODE	Electronic Engineering	Linear and nonlinear control systems. Opto-electronic and wireless communication systems.	Engineering (34)
Faculty of Engineering and Science *	Applied Entomology	Taxonomy of hymenoptera. Economic entomology	Entomology (16)
Faculty of Engineering and Science	Management, Conservation and Improvement of Plant Genetic Resources	Conservation and improvement of plant genetic resources. Design and analysis of agricultural experiments. Stress physiology. Plant Physiology.	Agriculture, Dairy and Animal Sciences (69)
Faculty of Engineering and Science	Breeding, Biotechnology and Food Systems	Improving productivity in livestock production systems. Feeding systems and management of forage resources in the tropics. Reproduction biotechnology and genomics.	Biotechnology and Applied Microbiology (23)
Faculty of Engineering and Science	Dynamics and environmental conservation	Dynamics of chemicals in the environment. Evaluation, control and prevention of environmental degradation. Biotechnology.	Ecology and Environmental Sciences (22).
MAU SCIENCE, EDUCATION AND HUMANITIES	Politics, Administration and Management Education	Policy, planning and management of higher education. HE and work	
Faculty of Veterinary Medicine	Aquaculture	Diagnosis, patho-physiology and prevention of disease in aquatic organisms. Analysis and evaluation of key performance parameters of production processes in aquatic organisms.	Veterinary Sciences (44).
Faculty of Engineering "Arturo Narro Siller"	Integrated Coastal Zone Development	Dynamic coastal processes. Coastal development planning.	Marine and Freshwater Biology (17).
Faculty of Architecture, Design and Planning	Sustainable Building Design	Sustainable Design Sustainable Building	

Sources: Compiled from information obtained from: the PROMEP (Faculty Improvement Program). [http / www.promep.sep.gob.mx](http://www.promep.sep.gob.mx). Retrieved on June 27th, 2011, ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation).
MAU = Multidisciplinary Academic Unit

The UAT collaborates with different national and international research groups located in 33 countries (Table 6). The main of which are the United States, Spain and Canada. Credits for papers published were shared with 349 national and international institutions (Table 7). The international institutions with more collaboration registered include the University of Santiago de Compostela, Oklahoma, Oregon State University and the University of Prince Edward Island. Among the national institutions featured on the list are UNAM, Universidad Autónoma de Nuevo Leon, Universidad Autónoma

Table 6. Publication credit partners main countries of origin.

Countries with which there is collaboration	Scientific products
United States	136
Spain	123
Canada	23
Netherlands	11
South Africa	10
England	7
France	6
Russia	6
Germany	4
Italy	4
Uruguay	4

Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)

Table 7. Main institutions with which publication credits were shared.

Name of the Institution	Scientific Products
Universidad Santiago de Compostela	48
Universidad Nacional Autónoma de México	30
Oklahoma State University	26
Instituto Politécnico Nacional	22
Oregon State University	17
Universidad Autónoma de Nuevo León	21
Universidad Autónoma Metropolitana, at Xochimilco and Iztapalapa	19
Universidad Autónoma de Baja California	17
CSIC UCLM JCCM	11
University of Prince Edward Island	11
University of Texas	11
Universidad Utrecht	11
Universidad de Vigo	10
INAOE	9
Universidad de Petroria	9
Universidad Guadalajara	8
Colegio de Postgraduados	7
Rutgers State University	7

Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)

Metropolitana at Xochimilco and Iztapalapa and the Universidad Autónoma de Baja California.

The scientific output of the UAT has been diverse, researchers selected 260 different high-impact international journals for the publication of new knowledge. Table 8 lists the 25 journals in which researchers published more frequently. These journals account for only 144 of the 469 articles published from 1989-2011, accounting for close to 31% of the total, which provides an idea of the large scatter selection of scientific journals. The main journals selected were the following: Journal of Dairy Science (13), Journal of Applied Animal Research, (9), Resuscitación (9), Food Hydrocolloids (7), Journal of Food Engineering (7), Journal of Food Science (7), Food Chemistry (6), Hormones and Behavior (6).

Table 8. Main journals selected by UAT researchers and their collaborators.

Journal	Scientific Products
Journal of Dairy Science	13
Resuscitation	9
Journal of Applied Animal Research	9
Food Hydrocolloids	7
Journal of Food Engineering	7
Journal of Food Science	7
Food Chemistry	6
Hormones and Behavior	6
JOURNAL OF ANIMAL AND VETERINARY ADVANCES	6
Tropical Animal Health and Production	6
AEU-International Journal of Electronics and Communications	5
Agrociencia	5
Bioresource Technology	5
FLORIDA ENTOMOLOGIST	5
Food Technology and Biotechnology	5
Journal of Animal Science	5
Southwestern Naturalist	5
Veterinary Parasitology	5
Abstracts of Papers of the American Chemical Society	4
Animal Reproduction Science	4
Atmosfera	4
Ciencia y Tecnología Alimentaria	4
Developmental Psychobiolog	4
Foodborne Pathogens and Disease	4
Interciencia	4
Total	144*

* Includes only 30.7% of the published scientific products.

Source: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)

One of the characteristics associated with a quality publication is the number of citations by other authors. Table 9 shows the 10 published papers in the 1989-2011 period with the most citations. As for the number of citations, it generally increases over time, so it is common for articles with more citations to also be older. A recent article with many citations is an indication that the knowledge generated is relevant to the scientific community. The article produced by UAT faculty that has received more citations in the period studied is the article entitled "Kinetic study of the acid hydrolysis of sugar cane bagasse" from the food area by authors Aguilar R, Ramírez JA and Garrote G. Published in 2002 in the Journal of Food Engineering with 92 citations.

Table 9. Publications produced by UAT Faculty between 1989 and 2011 with the most citations.

Publication	Year	Total 2011	Yearly citation average
Aguilar, R, Ramirez, JA, Garrote, G, Vazquez, M. (2002). "Kinetic study of the acid hydrolysis of sugar cane bagasse". <i>Journal of Food Engineering</i> . 55 (4): 309-318.	2002	92	8.36
Swanson, JW, Linskey, AO, Quintero-Salinas, R, Pumariaga, AJ, Holzer, CE. (1992). "A binational school survey of depressive symptoms, drug-use, and suicidal ideation". <i>Journal of the American Academy of Child and Adolescent Psychiatry</i> . 31 (4): 669-678.	1992	86	4.1
Torres, JA, Velazquez, G. (2005). "Commercial opportunities and research challenges in the high pressure processing of foods". <i>Journal of Food Engineering</i> . 67 (1-2): 95-112.	2005	84	10.5
Castillo-Juarez, H, Oltenacu, PA, Blake, RW, Mcculloch, CE, Cienfuegos-Rivas, EG. (2000). "Effect of herd environment on the genetic and phenotypic relationships among milk yield, conception rate, and somatic cell score in Holstein cattle". <i>Journal of Dairy Science</i> . 83(4): 807-814.	2000	52	4
Gamez S; Gonzalez-Cabriales JJ; Ramirez JA; M. (2006). "Study of the hydrolysis of sugar cane bagasse using phosphoric acid". <i>Journal of Food Engineering</i> Volume: 74 (1): 78-88 DOI: 10.1016/j.jfoodeng.2005.02.005	2006	49	7
Rodriguez-Chong A; Ramirez JA; Garrote G; (2004). "Hydrolysis of sugar cane bagasse using nitric acid: a kinetic assessment". <i>Journal of Food Engineering</i> , 61 (2) : 143-152 DOI: 10.1016/S0260-8774(03)00080-3	2004	44	4.89
Ramirez, JA, Rodriguez-Sosa, R, Morales, OG, Vazquez, M. (2000). "Surimi gels from striped mullet (<i>Mugil cephalus</i>) employing microbial transglutaminase". <i>Food Chemistry</i> . 70 (4): 443-449.	2000	38	2.92
Singh, J, Dominguez, M, Jaiswal, R, Adams, GP. (2004). "A simple ultrasound test to predict the superstimulatory response in cattle". <i>Theriogenology</i> . 62 (1-2): 227-243.	2004	38	4.22
Tellez-Luis SJ; Ramirez JA; Vazquez (2002). "Mathematical modelling of hemicellulosic sugar production from sorghum Straw". <i>Journal of Food Engineering</i> . 52 (3): 285-291 Article Number: PII S0260-8774(01)00117-0DOI: 10.1016/S0260-8774(01)00117-0	2002	37	3.36
Dieringer G; Cabrera L; Lara M; (1999). "Beetle pollination and floral thermogenicity in <i>Magnolia tamaulipana</i> (Magnoliaceae)". <i>International Journal of Plant Sciences</i> 160 (1): 64-71 DOI: 10.1086/314099	1999	37	2.64

Fuente: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation)

The second most cited article was published in 1992, it is from the area of Psychology and was entitled "A binational school survey of depressive symptoms, drug-use, and suicidal ideation" by Swanson, Linskey, Quintero-Salinas, Pumariega and Holzer, published in the Journal of the American Academy of Child and Adolescent Psychiatry with 86 citations.

As previously mentioned, it is important to note that starting in 2001, there was a considerable increase in the number of publications per year, along with scientific quality, which may be exemplified by the increase in the number of citations of scientific papers generated at the UAT. Table 9 shows that among the 10 most cited papers 6 were published since 2002.

Table 10. Main Authors, Academic Bodies they belong to, their SNI levels, and the units where they work.

Production Rank	Name	Number of Publications	Percentage	Academic Body's Development Level	SNI Level	Academic Unit
1	RAMIREZ JA	47	10.02%	Consolidated. Food and Nutrition.	Nivel 2	
2	VAZQUEZ M	47	10.02%		Nivel 2	
3	VELAZQUEZ G	31	6.61%		Nivel 1	MAU Reynosa Aztlán
9	URESTI RM	14	2.99%		Nivel 1	
10	TELLEZ-LUIS SJ	13	2.77%		Nivel 1	
5	PEREZ-CASTANEDA R	22	4.69%	Consolidated. Aquaculture.	Nivel 1	
10	AGUIRRE-GUZMAN G	13	2.77%		Nivel 1	Faculty of Veterinary Sciences
13	SANCHEZ-MARTINEZ JG	11	2.35%		Nivel 2	
4	ALMAZAN C	26	5.54%	Developing. Animal Health.	Nivel 1	
12	MARTINEZ-BURNES J	11	2.35%		Nivel 1	Faculty of Veterinary Sciences
7	MARTINEZ-GONZALEZ JC	14	2.99%	Consolidated. Breeding and Biotechnology and Food Systems	Nivel 1	
11	CIENFUEGOS-RIVAS EG	11	2.35%		Nivel 1	Faculty of Sciences and Engineering
14	GONZALEZ-REYNA A	10	2.13%		Nivel 1	
6	BOCANEGRA-GARCIA V	15	3.20%	Consolidated. Health Sciences.	Nivel 1	MAU Reynosa Aztlán
15	PANDURO MA	10	2.13%	Consolidated Electrical Engineering	Nivel 1	MAU Reynosa Rodhe
8	SALINAS-CHAVIRA J	14	2.99%	Does not belong to any AB	Nivel 1	Faculty of Veterinary Sciences

Sources: Compiled with information obtained from: ISI Web of Knowledge (Copyright © 2011, The Thomson Corporation), CONACYT (2010). List of SNI members for 2011. Retrieved on July 2, 2011. From: <http://www.conacyt.gob.mx/SNI/2011/Paginas/SNI-INGRESO-2011.aspx>. Programa de Mejoramiento al Profesorado <http://www.promep.sep.gob.mx>. Consultado 27 de Junio 2011.

UAM= Unidad Académica Multidisciplinaria

65.88% of publications in high impact international journals were generated by 4 Higher Education Units and by 16 authors mainly associated to 6 Academic Bodies: 5 Consolidated, which include 13 authors, one in the process of being formed by two authors, and one author who does not belong to any AB but is a SNI member (Table 10).

Results clearly indicate that there is a big gap in the ability to generate publishable knowledge in high impact international journals within the UAT. This appears to be the cause of the low levels of recognition scientific production at the UAT receives from CONACYT (SNI and PNPC) as well as from SEP. The latter mainly in the form of the recognition for Academic Body consolidation. As for researchers with a high number of publications (Table 10), who belong to ABs not yet consolidated, it is important to note that a requirement for this recognition is the development of joint research projects which translate into publications in which authorship is shared among the members of the same AB.

Lastly, it is important to note that the authors of this paper do not share the view that to publish is in itself the purpose of research, but a mere indicator of the ability to generate knowledge. A publication in a journal with the greatest impact is generally associated with having generated knowledge of greater importance.

Table 11. Registered Programs at the PNPC, ABs and SNI Members.

Academic Unit	Graduate Programs in	Associated Academic Bodies and their Level of Development	SNI members in the CAB
MUA REYNOSA AZTLÁN	MSc. in Food Technology. Consolidated	Food and Nutrition. Consolidated.	5
	MA in Clinical Analysis. Consolidated.	Health Sciences. Consolidated.	3
MAU REYNOSA RHODE	MA in Electrical Engineering and Electronics. Recent Creation.	Electronic Engineering Consolidated.	4
Faculty of Engineering and Science	MSc. in Agricultural Systems and Environment. Recent Creation.	Dynamics and environmental conservation. Consolidated.	1
		Applied Entomology. Consolidated.	3
		Management, Conservation and Improvement of Plant Genetic Resources. Consolidated.	0
		Breeding and Biotechnology and Food Systems. Consolidated.	1
Faculty of Veterinary Medicine	MSc. in Veterinary and Animal Husbandry. Developing.	Aquaculture. Consolidated.	3
		Animal Health	2
Faculty of Engineering "Arturo Narro Siller"	PhD in Environmental Science. Recent Creation.	Integrated Development of Coastal Areas. Consolidated.	1
		Environment and Sustainable Development. Developing.	
	MA in Industrial Administration. Recent Creation.		0
MAU SCIENCE, EDUCATION AND HUMANITIES		Politics, Administration and Management Education Consolidated.	1
Faculty of Architecture, Design and Planning		Design and green building. Consolidated.	1
MAU REYNOSA AZTLÁN	MA in Criminology and Forensic Science. Developing.	Criminology. In Consolidation	0
Instituto de Ecología Aplicada	MSc. in Ecology and Natural Resource Management. Recent Creation.		1
	PhD in Ecology and Natural Resource Management.		
Facultad de Ingeniería y Ciencias	Major in Telecommunications and Informatics. Recent Creation.	Telematics. Developing.	0
F. Comercio y Administración V.	MA in Business Management. Developing.	Public Administration and Management.	5
	PhD in Management Science. Recent Creation.		
UA de Derecho y C.S "Lic. Fco. Hdz. García"	MA in Communication. Recent Creation.	Strategic Communications. Developing.	1
	MA in Law Recent Creation.		
UAM de Trabajo Social y CDH.	MA in Clinical Psychology and Health. Recent Creation.	Studies in Psychology. Developing.	1

Sources. Compiled with information obtained from: CONACYT PNPC. Existing Programs 2011. Retrieved on September 2, 2011. From: http://www.conacyt.gob.mx/Becas/Calidad/Documents/Listado_PNPC.pdf

PROMEP <http://www.promep.sep.gob.mx>, Retrieved on June 27, 2011. CONACYT (2010). List of SNI members for 2011. Retrieved on July 2, 2011. From: <http://www.conacyt.gob.mx/SNI/2011/Paginas/SNI-INGRESO-2011.aspx>
 PNPC = National Register of Postgraduate Quality Programs
 CONACYT = National Council for Science and Technology
 SNI = National System of Researchers
 MAU = Multidisciplinary Academic Unit
 AU = Academic Unit

Conclusions

UAT scientific production in international indexed journals included in the ISI Web of Knowledge database (Copyright © 2007, The Thomson Corporation), has increased since 2001 to the point of reaching 469 scientific products by 2011. This coincided with an increase in the impact of their publications, as shown by the number of citations they received. However, scientific production has been overall widely dispersed, covering over 58 areas or disciplines of knowledge, and published in 260 journals. This great dispersion seems to be one of the reasons why there are few consolidated academic bodies and a small number of graduate programs included in the PNPC as well as a small group of SNI members at the institution. Scientific production was shown to be strongly related to quality awards granted by CONACYT such as SNI, but it showed little relation to the SEP's PROMEP Profile indicator.

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