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Article

# The Academic Bodies in the system of Polytechnic Universities of the State of Hidalgo and their academic production

# Los Cuerpos Académicos en el sistema de Universidades Politécnicas del Estado de Hidalgo y su producción académica

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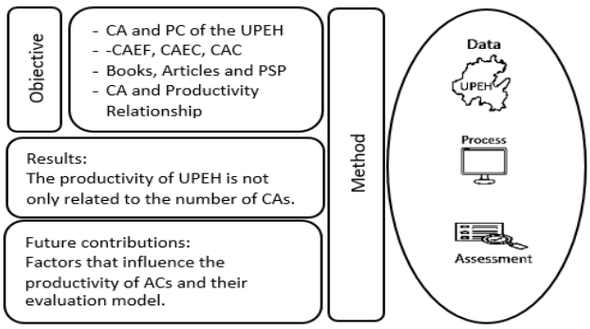
**Abstract**

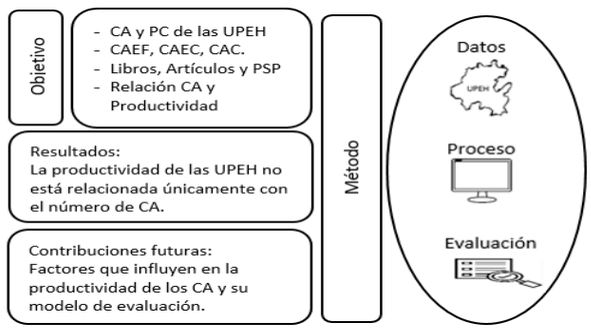
The CAs of the UPs are constituted by PTC around a common object of study, with goals, strategies and academic actions that allow their development and consolidation. Through their LIIADT in their CAs, the PTCs generate and apply new knowledge by providing PCs designated as valid by PRODEP. This work has the purpose of determining the level of productivity of the CAs of the UPEH, according to the number of valid PCs. The results show that the factors that determine the productivity of the ACs of the UPEH are not related only to the number of PCs. It is suggested to reflect on the relevance of the PTC, the integration of their AC, as well as the PC that are generated. As future research, all the factors that influence the productivity of the ACs will be determined to generate a model for evaluating the productivity of the ACs for the UPs.




**Productivity, Academic Bodies, Polytechnic Universities**

**Resumen**

Los CA de las UP se constituyen por PTC en torno a un objeto de estudio común, con metas, estrategias y acciones académicas que permiten su desarrollo y consolidación. A través de sus LIIADT en sus CA, los PTC generan y aplican nuevos conocimientos aportando PC señalados como válidos por el PRODEP. Este trabajo tiene la finalidad de determinar el nivel de productividad de los CA de las UPEH, de acuerdo con el número de PC válidos. Los resultados muestran que los factores que determinan la productividad de los CA de las UPEH no están relacionado únicamente con la cantidad de PC. Se sugiere reflexionar sobre la pertinencia de los PTC, la integración de sus CA, así como de los PC que se generan. Como investigaciones futuras se determinarán todos los factores que influyen en la productividad de los CA para generar un modelo de evaluación de la productividad de los CA para las UP.




**Productividad, Cuerpos Académicos, Universidades Politécnicas**

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## Introduction

The mission of Higher Education Institutions (HEI) is to provide significant knowledge in the formation of human capital, as well as to offer support to the productive sector and society as a whole in order to better face the challenges of globalisation in this 21st century. Thus, in 2001 the Polytechnic Universities (UP) were created as an educational project to offer engineering degrees, bachelor's degrees and postgraduate studies at the speciality level. Their programmes are designed based on the competency-based educational model and are oriented towards applied research and technological development.

The UPs are decentralised bodies of the state governments. This type of institution was incorporated into the higher education system in 2002 with the aim of expanding opportunities for access to public higher education and strengthening the relevance of the educational offer in the regions where they are located (Cruz López, Y. & Cruz López, K., 2008).

On the other hand, the Ministry of Public Education (SEP, 2006) states that academic bodies (CA) are made up of a group of full-time professors (PTC); which are associated by disciplinary areas, by professional profiles that share one or several lines of generation and/or application of knowledge (LGAC), as well as by disciplinary or multidisciplinary topics that are supported by academic objectives and goals.

These PTC are organised to carry out collective research among themselves, form networks with external groups and develop management activities, human resources training, academic tutoring and support for educational programmes, among other functions.

The Programme for the Professional Development of Teachers (PRODEP) states that the CAs in the UPs are groups of PTCs that share one or several Innovative Lines of Applied Research and Technological Development (LIIADT), which are mainly oriented towards the assimilation, transfer and improvement of existing technologies, and a set of academic objectives and goals. These ACs work on research projects that meet the specific needs of the productive sector and participate in advisory and consultancy programmes for this sector (Diario Oficial de la Federación, 2023).

According to the above, the UPs' ACs are constituted to contribute to solving problems and satisfying the needs of the productive sector through their LIIADTs, assimilating, transmitting and improving existing technologies (PROMEP, 2024).

Cáceres-Mesa et al., (2023), state that the Programme for the Professional Development of Teachers (PRODEP) classifies the CAs in a scaled manner into: Cuerpos Académicos en Formación (CAEF), Cuerpos Académicos en Consolidación (CAEC) and Cuerpos Académicos Consolidados (CAC). This organisation is based on the academic capacity of its members.

To be promoted in these three levels of CA, HEIs need to maintain the number of professionally trained PTCs, preferably with the highest academic degree, with recognition of the National System of Researchers (SNI) and Desirable Profile, the diversity and quality of their individual and collective scientific production, their participation in teaching and training of human resources, the development of research projects, as well as in collaborative work with academic peers from other HEIs in thematic networks of research and management. In particular, scientific production (SP) is one of the most important indicators for the evaluation of academic staff, academic staff and HEIs.

Candia Luján et al., (2023) point out that CP refers to the number of academic publications that show the results of research in different areas of knowledge. From this point of view, academic production is established as a level of competitiveness; which becomes an evaluation variable that is measured by the level of dissemination of the valid products generated; such as books published in recognised publishers, articles published in refereed or indexed journals, papers, awards, patents or copyrights (Rodríguez-Maya, et al., 2018).

Additionally, for the UPs, projects with the productive sector (PSP), applied basic research reports, didactic-pedagogical innovation, intervention, curricular development, innovation with social commitment and well-founded digital resources are considered as part of CP, or academic production (Diario Oficial de la Federación, 2023).

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To stimulate CP in Mexico, the government implemented different support programmes for CTPs and ACs. The SNI was created in 1984; in order to become a member and receive financial support, researchers must show evidence of scientific publications in journals indexed in high-impact databases (CONACyT, 2024).

In 1996, the Teacher Improvement Programme (PROMEP, 2024) was created under the National Development Plan 1995-2000, which was derived in response to the recommendations of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in order to improve the professionalisation of teaching staff in Mexico. Subsequently, in 2013, PROMEP became PRODEP. It is worth mentioning that both federal programmes were characterised by issuing calls for proposals to financially support the performance of teaching and research staff, as well as HEIs, through the training and evaluation of the CAs.

In this way, the UPs join the federal programmes to obtain economic benefits and contribute to their mission through the professionalisation of their PTCs, as well as the formation of CAEFs, CAECs and CACs.

In Mexico there are 64 UPs; particularly in the state of Hidalgo there are 6 that form the system of Polytechnic Universities of the State of Hidalgo (UPEH). In this system, CA have been integrated, according to the guidelines of the PROMEP-PRODEP programmes.

A timeline shows the UPs located in the state of Hidalgo, starting from the year of their foundation: Polytechnic University of Tulancingo (UPT) 2002; Polytechnic University of Pachuca (UPP) 2003, Polytechnic University of Francisco I. Madero (UPFIM) 2005; Universidad Politécnica Metropolitana de Hidalgo (UPMH) 2008; Universidad Politécnica de Huejutla (UPH) 2012 and Universidad Politécnica de la Energía (UPE) 2014 (PRODEP, 2024).

However, Negrete Urbano, et al., (2021) state that the UP agenda began to change significantly during the beginning of the new century.

Initially, the agenda showed an insistence on decentralisation, attention to social demand and planning; however, over a period of two decades, it shifted to issues such as accreditation, as well as evaluation to obtain extraordinary resources for quality.

As can be seen, for more than twenty years, CP has not been one of the priority issues on the agendas of the UPs.

Similarly, Velázquez and Ramírez (2023) argue that scientific research in the UPs has lagged behind. In particular, these authors point out that there has been a slow but steady growth; in other words, research work has not ceased, although it is still not enough.

The above shows that there is a gap to be covered by the ACs that make up the UP group in order to generate knowledge and strengthen the productive sector through the application of science, which, today, is the time to create links, not only in the university-business relationship, but also to collaborate to solve the areas of opportunity presented by the productive sector in each region, and thus fulfil the raison d'être for which these institutions were created.

Derived from the above, this work aims to determine the level of productivity generated in books, articles and projects with the productive sector (PSP) by the ACs that are in formation, in consolidation and consolidated by UPEH system. Based on the results obtained, this analysis will allow reflection to generate new work strategies in the UPEHs, their ACs and the form of organisation of the PTCs.

In this work it is proposed that the greater the number of CAEF, CAEC and CAC in the UPEH, the greater the PC in books, articles and PSP will be.

In order to determine the productivity of the CAs of the UPEHs, an investigation was carried out in relation to the number of academic bodies (CAEF, CAEC and CAC) that exist in each of the institutions in question.

It is worth mentioning that the information was obtained from the website accessible to all UPs, through the Ministry of Public Education of Hidalgo (SEPH), particularly in the educational offer for higher education (SEPH, 2024). The results are presented in Table 1.

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**Box 1**

**Table 1**

CA in the UPEH.

| UPEH | CAEF | CAEC | CAC | Total |
|---|---|---|---|---|
| UPT | 5 | 3 | 1 | 9 |
| UPP | 13 | 6 | 1 | 20 |
| UPFIM | 5 | 2 | 0 | 7 |
| UPMH | 7 | 2 | 0 | 9 |
| UPH | 1 | 0 | 0 | 1 |
| UPE | 0 | 0 | 0 | 0 |
| Total | 31 | 13 | 2 | 46 |

*Source. SEP – Hidalgo, 2024. https://sep.hidalgo.gob.mx/ofertaeducativaES/.*

Likewise, PC in relation to books, articles and PSP was obtained from the website of each UPEH, through the SEPH, particularly in the educational offer for higher education (SEPH, 2024). The results are presented in Table 2.

**Box 2**

**Table 2**

PC in the UPEH.

| UPEH | Scientific production | | | Total |
|---|---|---|---|---|
| | Articles | Books | PSP | |
| UPT | 56 | 8 | 13 | 77 |
| UPP | 7 | 0 | 0 | 7 |
| UPFIM | 24 | 16 | 11 | 51 |
| UPMH | 34 | 0 | 9 | 43 |
| UPH | 0 | 0 | 0 | 0 |
| UPE | 8 | 0 | 0 | 8 |
| Total | 129 | 24 | 33 | 186 |

*Source. SEP – Hidalgo, 2024. https://sep.hidalgo.gob.mx/ofertaeducativaES/.*

The data analysis was carried out using descriptive statistics. Table 3 shows the relative frequency of the CA (CAEF, CAEC and CAC) in each UPEH, according to the data presented in Table 1. Where for each of the UPEHs the following is calculated:

$$fr = \frac{CA\ number}{total\ number\ of\ CA} * 100 \quad (1)$$

**Box 3**

**Table 3**

Relative frequency of CAs in UPEHs

| UPEH | CAEF | CAEC | CAC | Total |
|---|---|---|---|---|
| UPT | 16% | 23% | 50% | 20% |
| UPP | 42% | 46% | 50% | 43% |
| UPFIM | 16% | 15% | 0% | 15% |
| UPMH | 23% | 15% | 0% | 20% |
| UPH | 3% | 0% | 0% | 2% |
| UPE | 0% | 0% | 0% | 0% |

*Source. Own elaboration*

Similarly, Table 4 shows the relative frequency of CPs (Articles, books and PSPs) in each UPEH, according to the data presented in Table 2. Where for each of the UPEH the following is calculated:

$$fr = \frac{PC\ number}{total\ number\ of\ PCs} * 100 \quad (2)$$

**Box 4**

**Table 4**

Relative frequency of CPs in the UPEHs

| UPEH | Scientific production | | | Total |
|---|---|---|---|---|
| | Articles | Books | PSP | |
| UPT | 43% | 33% | 39% | 41% |
| UPP | 5% | 0% | 0% | 4% |
| UPFIM | 19% | 67% | 33% | 27% |
| UPMH | 26% | 0% | 27% | 23% |
| UPH | 0% | 0% | 0% | 0% |
| UPE | 6% | 0% | 0% | 4% |

*Source. Own elaboration*

On the other hand, the arithmetic mean, a simple measure of central tendency, was applied to determine the average CA and PC in the UPEH system, where it is calculated:

$$\bar{X} = \frac{X_1+X_2+\cdots+X_n}{n} = \frac{\sum_{i=1}^{n} X_i}{n} \quad (3)$$

The information was calculated from the data presented in Tables 1 and 2. The results are presented in Tables 5 and 6.

**Box 5**

**Table 5**

Arithmetic mean of CA in the UPEH System

| UPEH | CAEF | CAEC | CAC |
|---|---|---|---|
| Total | 31 | 13 | 2 |
| $\bar{X}$ | 5 | 2 | 0 |

*Source. Own elaboration*

**Box 6**

**Table 6**

Arithmetic mean of PCs in the UPEH system

| UPEH | Scientific production | | |
|---|---|---|---|
| | Articles | Books | PSP |
| Total | 129 | 24 | 33 |
| $\bar{X}$ | 22 | 4 | 6 |

*Source. Own elaboration*

Finally, to determine the productivity of the PHEUs, it is calculated by considering the production obtained among the total factors employed; and it is represented by the following equation:

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$$PG = \frac{production\ obtained}{total\ factors\ employed} \quad (4)$$

Although there are several factors that concur to obtain scientific products, in the particular case of this study, only the factor of academic bodies in each UP is considered, where:

$$P = \frac{scientific\ production\ (PC)}{academic\ bodies\ (CA)} \quad (5)$$

The results are shown in Table 7.

**Box 7**

**Table 7**

Productivity of the UPEH

| UPEH | PC | CA | Productivity |
|---|---|---|---|
| UPT | 77 | 9 | 8.56 |
| UPP | 7 | 20 | 0.35 |
| UPFIM | 51 | 7 | 7.29 |
| UPMH | 43 | 9 | 4.78 |
| UPH | 0 | 1 | 0.00 |
| UPE | 8 | 0 | N/A |

*Source. Own elaboration*

## Results

According to the results obtained, it can be seen that, of the total number of CA of the UPEH, the highest frequency (43%) was obtained by the UPP. Of the total number of CAs, the UPP has 50%, 46% are CAECs and 42% are CAEFs. However, of the total number of CPs of the UPEH, the UPP has a frequency of 4%, which only corresponds to 7 articles.

On the other hand, the UPT and the UPMH presented a frequency of 20% each, in relation to the total number of CA of the UPEH. However, the frequency distribution for the UPT is 16% CAEF, 23% CAEC and 50% CAC; in contrast to the UPMH, which has 23% CAEF and 15% CAEC. In relation to the total CP of the UPEH, the UPT has 41%, where 43% are articles, 33% books and 39% PSP.

In a different way, the UPMH has 23% of the total CP of the UPEHs as a whole, where 26% are articles and 27% are PSP. This shows that the productivity of the UPT is 18% higher than that of the UPMH. This difference may be based on the frequency of CAC (50%) and CAEC (23%) that the UPT has, compared to the UPMH, which has no CAC and only 15% of CAEC.

In relation to the total number of CA of the UPEH, UPFIM obtained a frequency of 15%; representing 16% of CAEF and 15% of CAEC. In relation to the total PC of the UPEH, UPFIM has a production of 27%, representing 19% in articles, 67% in books and 33% in PSP. This is interpreted as good productivity. It is observed that, with a lower number of CA, its PC is in articles, books and PSP; despite the fact that there is no CAC. Finally, UPH has only one CAEF, which represents 3% of the total CA of UPEH and 0% of PC. On the other hand, UPE has 0% in CA and 6 articles representing 8% in PC.

In sum, it can be observed that, of the total number of UPEH (6), there are 46 CA; which present a relative frequency of 67% of CAEF, 28% of CAEC and 4% of CAC. In the same sense, the arithmetic mean is 5 CAEF, 2 CAEC and 0 CAC.

With regard to the CP of the UPEHs, out of a total of 186 products, the relative frequency in articles is 69%, in books 13% and in PSP 18%. The arithmetic mean is 22 articles, 4 books and 6 PSPs.

According to the above data (Table 7), it can be seen that the productivity of the UPEH is not only related to the number of CA.

Particularly in the UPT, with the same number of AC (9) as the UPMH, its productivity is almost twice as high as in the UPMH (8.56 and 4.78, respectively).

On the UPP side, productivity is .35; that is, with 20 CA they only have 7 PC. Conversely, UPFIM's productivity is 7.29, which means that with only 7 CA they have managed to develop 51 PCs.

Finally, UPH has zero productivity due to the fact that with one CA there are still no CPs. On the other hand, the UPE has 8 PCs without a single CA.

## Conclusions

PRODEP, through the curriculum capture module, offers a means to quantitatively and qualitatively determine the academic productivity of research professors (Rodríguez-Maya, et al., 2018).

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However, the SEP, through the Under-Secretariat of Higher Education (SES) and the General Directorate of University and Intercultural Higher Education (DGESUI, 2024) carries out actions to promote the integration of PTCs in CA. To this end, it issues a call for Public Higher Education Institutions (IPES) attached to PRODEP, so that they can register new CA proposals; or, through the evaluation of existing CAs, they can achieve a higher degree of consolidation. In this sense, to determine the degree of consolidation of an academic body, its members must provide documentary evidence of the collegiate work carried out, show common goals to generate knowledge and carry out applied research, as well as show solidity and maturity in the LIIADT. For all levels of CA consolidation, the academic products that will be considered valid to provide evidence of collegiate work are: books, book chapters, refereed articles, indexed articles, intellectual property, patents, prototypes and technical reports. Likewise, according to the level of the AC, the PTC must have a Doctorate or Master's degree and have the Desirable Profile Recognition.

As can be seen, there are several factors to consider when evaluating the productivity of the ACs. Nevertheless, and in a first approach to the topic of productivity of the ACs of the UPEH, in this work the PC was proposed as the only factor of analysis for the productivity of the ACs. It was argued that the greater the number of CAEFs, CAECs and CACs in the UPEHs, the greater the CP in books, articles and PSP. However, the results obtained showed that the productivity of the UPEHs is not only related to the number of CA.

addition to what the DGESUI points out in order to evaluate the CAs, it is observed that it will be necessary to study other factors such as: 1) time (referred to as the seniority of the UP, as well as of the CAs since their formation and during their escalation), 2) CV of the PTCs (observing age, experience, professional training relevant to the educational programme and with postgraduate studies, recognitions and distinctions, occupation and distribution of time in the performance of their functions, among others) and 3) economic resources obtained by any federal, state or HEI programme for the PTCs and/or CAs.

Therefore, as future research, it is established to study and determine the factors that influence the productivity of CAEF, CAEC and CAC. In this way, it will be possible to build a model that provides an instrument and its methodology to evaluate the productivity of the CAs.

On the other hand, it could be seen at the time of data collection that the information on the websites of each institution is not homologous. In some cases, the professional profile of the PTCs is shown, their academic degree, the line of research in which they work, whether they belong to the SIN or have a desirable profile. However, in other cases there is little or no information regarding the PTCs, their PC and the CAs.

In this sense, it is suggested to standardise the structure and content of the UPEH web pages. But even more important is to invite HEIs to reflect on the relevance of their full-time teaching staff, the integration of their ACs, as well as the PCs generated.

This will allow them to find opportunities for improvement so that they have greater possibilities to carry out collaborative, equitable and quality work; which will contribute to the training of students capable of facing current challenges, favouring the productive sector to solve its areas of opportunity and; particularly for the UPEHs, to show themselves as institutions that contribute wealth to society as a whole.

## Declarations

### Conflict of interest

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that might have appeared to influence the article reported in this paper.

### Availability of data and materials

The availability of the data obtained in this research was through the SEPH website, particularly in the educational offer for higher education (SEPH, 2024).

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However, in each of the UPEH web pages the information is not complete or homologous, particularly in the UPP it is not possible to consult the PCs, in the same way it happened in the UPH. Contact was sought via email and telephone but no response was received.

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There is no funding of any kind. It is carried out with its own income, which limits the collection of data in situ.

**Abbreviations**

| | |
|---|---|
| CA | Academic Bodies |
| CAC | Consolidated Academic Bodies |
| CAEC | Academic Bodies in Consolidation |
| CAEF | Academic Bodies in Formation |
| DGESUI | General Directorate of University and Intercultural Higher Education |
| IES | Higher Education Institutions |
| IPES | Public Higher Education Institutions |
| LGAC | Lines of Generation and/or Application of Knowledge |
| LIIADT | Innovative Lines of Applied Research and Technological Development |
| PC | Scientific Production |
| PSP | Projects with the Productive Sector |
| PTC | Full-Time Lecturers |
| PRODEP | Programme for the Professional Development of Teaching Staff |
| PROMEP | Programme for the Improvement of Teaching Staff |
| SES | Under-Secretariat for Higher Education |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |
| UP | Polytechnic Universities |
| UPE | Polytechnic University of Energy |
| UPFIM | Polytechnic University of Francisco I. Madero |
| UPH | Polytechnic University of Huejutla |
| UPMH | Metropolitan Polytechnic University of Hidalgo |
| UPP | Polytechnic University of Pachuca |
| UPT | Polytechnic University of Tulancingo |
| UPEH | Polytechnic Universities of the State of Hidalgo |
| SEP | Ministry of Public Education |
| SEPH | Secretariat of Public Education of Hidalgo |
| SNI | National System of Researchers |

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