THE CHALLENGES OF HIGHER EDUCATION IN LATIN AMERICA TOWARDS THE KNOWLEDGE ECONOMY

A. Franco-Crespo¹, V. Ramos¹, F. Herrera¹, H. Chávez²

¹Escuela Politécnica Nacional (ECUADOR)
²Pontificia Universidad Católica del Ecuador / Escuela Politécnica Nacional (ECUADOR)

Abstract

The world economy is increasingly depending on knowledge. This is pushing toward a global shift from the development based on the exploitation of natural resources to one based on science and technology. The future of non-developed and developing countries depends on their capacity to adapt to this transformation. During the last decade, several Latin American countries have made important efforts to increase their science, technology and innovation production capacities. These efforts have resulted in increasing scientific production. However, their capacity to produce local technology and innovation seems still weak. Despite these efforts, their economies continue to rely on the export of primary products of low technological value. Changing this path is the main challenge for the coming years and, given the limited participation of the private sector in R&D activities, universities remain the key actor in any attempt at transformation.

Therefore, the objective of this presentation is to analyze the link between University and society within the Latin American context, aiming to identify bottlenecks and opportunities to promote the transfer of knowledge and technology to public, private and social organizations.

This is a comparative analysis based on secondary sources and statistical data available at the regional level. The main result of this analysis will be a regional typology of the relationship between University and Society that reflects the different strategies used by each country, its limitations, and strengths.

Keywords: University-Society interactions, Latin-America, indicators.

1 INTRODUCTION

Science and technology have become one of the main pillars of modern society’s development. Their importance has increased exponentially through the last centuries and particularly in recent decades. This is the result of the emergence of a new techno-economical paradigm based on the production, circulation and transformation of knowledge [1], [2]. Indeed, global infrastructure such as Internet and mobile communication networks brought new possibilities for production and circulation of knowledge, but also for profit and capital accumulation. Innovative business models have reshaped the global economic scape completely. In just a couple of decades, the so-called GAFA¹ and BATX² have overthrown most of the traditional big companies that led capitalist development for more than a century [3], [4]. Energy, transportation, agriculture, industrial production, culture, no economic sector has escaped to this global reconfiguration [5]. The aim is not anymore to produce more efficiently, but more intelligently. This means to create more profit but also to reduce social and environmental impacts[6].

This transformation has pushed non-developed countries to adapt their local structures to the new global conditions. The need for a shift from the development based on the exploitation of natural resources to one based on science and technology, has become a common place in the official discourses of most of these countries[7], [8]. Hence, during the last decade, several Latin-American countries have made important efforts to increase their science, technology and innovation production capacities [9]. These efforts have resulted in an increasing scientific output, the strengthening of university systems and the improvement of the qualifications of human talent [10], [11].

However, their capacity to produce local technology and innovation seems still weak. Despite these efforts, their economies continue to rely on the export of primary products of low technological value[12], [13]. One of the main bottlenecks of this process is the limited participation of the private sector in R&D activities [14]. This weakness seems to have a double cause. On the one hand, most of the policies implemented in these countries have focused in enhancing Universities capacities. This has strength

¹ For the giants of the Silicon Valley Google, Apple, Facebook and Amazon
² For their peers in China, Baidu, Alibaba, Tencent and Xiaomi
the role of Universities who have become the main locus of scientific and technological production. On the other hand, the lack of vision, qualification and entrepreneurial culture within the private sector has limited has prevented enterprises from investing in R&D activities or innovation. In absence of an innovative private sector, Universities remain the key actor of this process [15].

Under these conditions, any attempt of transformation need to create or strength the linkages between University and Society. This should enable the circulation of resources and capacities concentrated within the Universities and the demands from the public, private and social organizations. How do the Latin-American countries are dealing with this challenge? This is main question our presentation will try to reply.

Based on an exploratory and comparative analysis of secondary sources and statistical data available at the regional level, what follows will try to identify and characterize the different configurations of the relation University-Society within different Latin-American countries. First, we will give a general picture of the state of the Universities in the region. Second, we will present and summarize different attempts to study and measure this relation at national and regional level. Third, we will try to elaborate a regional typology of the relationship between University and Society based on the general picture of Universities presented in the first section and some preliminary data on how countries deal with this relationship. Finally, we will conclude identifying several issues and challenges to be tackled in future research.

2 METHODOLOGY

This is an exploratory and comparative analysis on the relation between University and Society. Our analysis is based mainly on secondary sources and statistical data produced at national and regional level. Given the complexity of the phenomenon, the diversity of approaches and definitions used and the novelty of its study, there is still little consensus on what and how should be studied. Hence, the data available about this relation is still scarce and not always comparable between countries.

At the regional level, our analysis uses mainly the discussions, reports and data published by the Ibero-American Observatory of Science, Technology and Society of the Organization of Ibero-American States (OCTS-OEI) [16] and the Ibero-American and Inter-American Network of Science and Technology Indicators (RICYT) [17]. These two institutions have made important efforts to collect, process, harmonize and publish related data for most of the countries in the region. As part of this process, and in coordination with researchers and experts from Argentina, Spain, Brazil, Uruguay and México, they elaborated the Manual of Valencia [18]. This document is the result of several years of work that have led to several agreements among experts about which indicators and how they should measure to evaluate the links between University and Society. Unfortunately, at the time of this research, the first regional survey designed under the guidelines of this manual was still under implementation. Therefore, we couldn’t use its results. Nonetheless, we do use data gathered in previous years as part of the elaboration process of the above-mentioned manual. This data is not always comparable and has several limitations, but it gives us a first insight on how different types of universities manage their relations with Society.

Given the lack of indicators about this relationship at a regional level. The second strategy used to obtain, and access data was to make an exhaustive research on the official documents available at the national level in the institutions in charge of the evaluation or accreditation of Universities. We got access to most of these institutions through the Ibero-American Network for Quality Assurance in Higher Education (RIACES) [19]. However, very few of the consulted reports contain specific data or indicators on the linkages between University and Society. Therefore, we should complement our documentary research with several scientific articles on the subject.

The information obtained from all these sources has been analyzed and summarized in several tables and figures presented in the next section. They will let us identify and suggests key features that can serve to characterize the different models and systems used in each country. This characterization will allow us to identify convergences and divergences among national systems and contrast them with the pathway of development of each country, its potentialities and weakness.
3 RESULTS

3.1 Overview of Higher Education in Latin America

The last OCTS-OEI report on Higher Education published in March 2019 [11], points out several processes and features that characterize the current situation of universities in Latin America. First, it highlights the economic and demographic transformations that have affected the trajectory of the national higher educational systems during the last decade. On the one hand, the commodity boom period started around 2008 let the expansion and improvement of university systems all over the region. However, the economic crisis installed since 2015 brought about budget cuts that slowed down or even stop this process [20]. On the other hand, the demographic transition start to show its long-term effects on the educational systems by slowing down the demand in the “older” countries (Brazil, Chile, Costa Rica or Cuba) or increasing the pressure on the system in the “younger” ones (Ecuador, Bolivia, México or El Salvador)[21].

To a large extent related to the above, a second element that has characterized the evolution of the higher educational systems during this period was the general increase in the number of students enrolled at the university. However, three factors accounts for the differences between countries: the stage of their demographic transition, the rate of the population that has finished secondary school, and the policies and conditions of access to the university [11]. Four cases can be identified: "younger" countries with a high or low enrolment growth and "older" countries with high or low enrolment growth (Fig.1). In addition, it is important to note that most of this growth has benefited private universities (Fig. 2).

This expansion in the enrolment has a direct impact on a third indicator, the higher education coverage rate. As per OCTS-OEI report, countries such as Argentina, Chile or Uruguay have reached the “universalization” rate (more than 50% of the population aged 18-24 years) whereas the rest of the countries are in the “massification” phase (between 15 and 50%). However, the latter can be subdivided into those with a coverage rate above 30% (Ecuador, Colombia or Brazil) and those with a lower rate (Mexico or El Salvador).

A fourth indicator to consider is the number of graduates. This has grown around 50%, passing from 2.5 million in 2010 to 3.7 million in 2016. Most of them, around 84%, finished undergraduate programs, 13% master programs and just 1.3% doctoral programs. 57% were women, and 51% studied in private universities.
As per academic staff, we can suppose that the number of professors and researchers is correlated with the enrolment rate. However, there are some differences between countries that need to be considered. For example, the number of students in Bolivia, Brazil, Cuba, El Salvador and Mexico grew more rapidly than the number of professors. Whereas, Argentina, Chile, Colombia or Ecuador the relation remains more or less the same. The OCTS-OEI report points out that the region has 1.7 million professors, where 45% are women. Among these professors, fewer than 10% has a PhD excepting Brazil, where the ratio is 41.6%.

Finally, we must consider a final feature that will let us classify higher education systems in the region: the financing. Governments remain the main source of money for most of the Universities in the region. However, given the expansion of the private universities there are several countries that need extra financing coming from students and families. For example, Chile and Colombia have increased and privileged private investments, while others like Bolivia, Costa Rica or Peru have increased the funding coming from public funds.

This general overview of some of the main indicators on Higher Education shows the heterogeneity of the Latin-American university systems. Based on this information, it seems difficult to establish clear lines that let us establish different models or trends in the way each country manages higher education. Nonetheless, some of these features can help us to make a first grouping exercise. We know for example that younger countries are expanding fast the rate of enrolment, but also that this expansion is leading mainly by private Universities. Whereas, older countries with higher coverage rate seems to have stronger public systems. Hence, we can try a classification with Chile and Brazil as the examples of the private model and Uruguay and Argentina as the models of the public way. Between them we have younger countries tending to the privatisation model (Colombia, Peru, Ecuador) and others closer to the public one (Mexico and Bolivia). As we have stated, this first attempt of classification is not more than an hypothesis to be tested. In the next sections, we will try to establish if there is a link between this classification and the way University interact with Society in those countries.

### 3.2 Measuring University-Society interactions

As we have pointed out, University-Society interactions are one of the main concerns in Latin-American context. During the last decades, Universities have strengthened their scientific and technological capacities but these gains do not seem to be transforming the economic and social conditions in the region. To reshape higher educational systems in order to create and reinforce University-Society interactions and accomplish the so-called “third mission” of University has become therefore a central issue in the public policy agendas of Latin-American countries.

The first step in that direction is to evaluate the state of these interactions and to compare different experiences in the region and abroad. However, this first step is not easy. The diversity of interactions that can occur between these two fields, turn this task a very complex one. In order to deal with this complexity, several researchers and institutions at local and regional level has been working for over a decade trying to define a common framework to measure these interactions. This framework should give account not only of the complexity of these interactions but also of the differences between local context and to guarantee the comparability of the indicators. A first milestone in this process was the publication of the Manual of Valencia in 2017 [18]. This document contains the basic guidelines to
produce comparable indicators at regional level on the way Universities interact with enterprises, government and social organizations in their countries. A first implementation of this Manual started in March 2019. However, at the time of this paper no data was available yet to give some glances about the state of affairs in these interactions in the region. Nonetheless, here we will try to produce a general picture of the phenomenon, based on the documents and data upon which this Manual was built and other studies on the topic produced at national level.

Thus, the first traces of the study of these interactions at regional level should be found in the creation of the RICYT and the “Centro Redes” in Argentina around 1995 one of whose objectives was to measure the social impact of science. Later on, in 2004, Juan Carullo, a member of the same Centro Redes in collaboration with the network VITEC, elaborated a first proposal on how to measure technological linkage for Argentinian Universities [22]. Carullo’s proposal tried to lay the foundations for a battery of indicators based on international standards but applicable to the Latin-American context. He uses some clues from other international experiences and manuals already in use (Frascati [23], Oslo [24], Bogota [25]), but highlights the importance of take into account the access conditions to the sources, the costs, the institutional arrangements and the capacities required in these countries. The proposal contained six types of indicators (extension of the activities, institutional development and regulations, investment and returns, public perception of the activity, satisfaction and relevance, and entrepreneurship). This document served as an input for the periodical discussions organized by the RICYT and lead to the application of a pilot test.

By 2009, the OCTS organized a first workshop for experts in the field of University-Society linkages. As part of this workshop, researchers from the Institute for Knowledge and Innovation Management (INGENIOS), presented a new proposal of indicators [26]. This document established several guidelines for the elaboration of the indicators (to adopt a holistic approach, to keep a balance between measuring activities and their impact, and to avoid using a unique model) and their management (to give universities instruments to develop their own evaluations, to keep flexible information systems and avoid bureaucratic procedures, to minimize the cost of collecting information, and to guarantee the homogeneity of data). It proposes two kinds of indicators: development institutional (policies, staff selection and promotion systems, funding, structures, documentation) and activities (technology commercialization, entrepreneurship, consulting, infrastructure commercialization, research contracts, collaboration with nonacademic entities, staff mobility, internships, workshops and training, curricular alignment, networks, non-academic diffusion). This proposal was discussed, modified and presented in Valencia in 2011 and became the blueprint of the above-mentioned Manual. Since then, this document has been under revision and has incorporated several contributions from researchers and experts from different universities in the region.

In 2016, the OCTS conducted a pilot test of the manual with five universities in Latin-America Quilmes (UNQ) and Litoral (UNL) in Argentina, Autonoma Metropolitana in México (UAM), Campinas (UNICAMP) in Brazil, the La República (IPTP) in Uruguay and one in Spain Jaume I de Castelló (UJI) [27]. The test focused on three dimensions: institutional context, capacities (use and exploitation of knowledge stock and physical infrastructure) and activities (production and development of capacities through education, research and non-academic actions). This test gave several insights on the limitations that the application of these guidelines can find, particularly in accessing certain information at Universities. It warns future applications on the vertical and horizontal biases introduced by the University structures and the particularities of the activities under analysis.

Upon the previous documents and the insights of the pilot test, the definitive version of the manual was launched in 2017 and its first application at regional scale started in 2019. This final version keeps the three-dimensional structure of its predecessors (institutional context, capacities and activities) and highlights the challenges of developing and manage comparable indicators at international level without losing the Latin-American specificities. Table 1 contains the definitive list of indicators contained in this manual. Finally, this document develop a methodological proposal on how to collect the information required to measure these indicators at three levels (rectorates, academic unities and academic groups) and echoes the recommendations of the pilot test warning practitioners on how to access and guarantee the quality of information and avoid vertical and horizontal segmentation.

As we have pointed out, the first application of these guidelines is still under implementation and therefore no data was available at the moment of this research. However, based on the result of the pilot test, some data available on the RICYT and some documents produced at national level we will try to present a general picture of the University-Society interactions in the region.
3.3 Toward a typology of University-Society interactions in Latin America

Given the scarcity of comparable data on this particular subject, we will limit our analysis to three sources: general indicators on science and technology of the RICYT, the results of the pilot test of the Manual of Valencia applied in 2016 and some documents we have found at the national agencies or institutions in charge of the evaluation or accreditation of Universities.

From the first source, we know that R&D expenditures financed by Universities increased by about 85% between 2010 and 2016. However, this expenditure represents only 4% of the total R&D expenditure in the region. 53% was financed by governments and 39% by enterprises. On the other hand, the Universities were the main user of these funds (39%) [11]. Fig. 5 and 6 show the sources and users of R&D funding at national level. These indicators can be used as proxies of the institutional indicators about financial resources, dimension and orientation of the R&D.

A second indicator on the dimension and orientation of the R&D and the capacities available at Universities is the number of researchers and its distribution by sectors of activity. From the same sources, we know that there are around 384,227 researchers in Latin-America and that this number increased about 32% between 2010 and 2016. Fig. 7 show the distribution of these researchers by sector and country.

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<th>Dimension</th>
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<td>Capacities</td>
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<td>Non-academic dissemination</td>
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<td>Participation in networks</td>
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Figure 5. R&D Expenditure by source
Figure 6. R&D expenditure by execution sector
Figure 7. Distribution of researchers by sector
The results of the second source of information are closer to the guidelines of the Manual but limited to 6 universities. These universities are middle-sized (10,000 to 50,000 students). The older ones (UNL, UNICAMP and UAM) are bigger and the academic offer is more diversified while the younger ones are smaller (UNQ y UJI) and their academic offer is limited. These universities count between 1,000 and 3,000 professors. All of them are researchers in the UNICAM, UAM and IPTP but only 50% in UNQ, UNL and UJI. The institutionalization of the University-Society interactions seems to be a recent phenomenon. A common pattern suggests that most of them started by individual initiatives of some academic staff that derived in institutional forms due to the complexity of the activities. In the older universities, this process started to happen around the 80. The younger ones did it at the beginning of the 2000. A second feature of this process is that most of them started at the faculty, Department or Institute level and then they were taken in charge by specific departments of the general administration of the universities. A third institutional feature is that all of them have included some sort of University-Society interaction in the norms and plans of their institutions. However, the value of these activities is underrated in the selection and evaluation process of the academic staff.

Another dimension measured by this pilot test was the allocation of the financial resources by activity. Three universities (UAM, UJI and UNQ) privileged the R&D expenditure, while the others (UNICAM, IPTP and UNL) diversified its expenditures in different types of interactions with society: technological transfers, diffusion and extension. This division is visible also in the relation between the R&D expenditure and the income coming from contracts with non-academic actors. UNICAM, IPTP and UNL receive more income from these activities that the expenditures they do on R&D.

This pilot test also focused on the contracts for scientific and technological services. In this case, UNICAMP, UJI and UNL got much more contracts than the UNQ; IPTP and UAM. Most of these contracts aim to provide technical assistance and consulting services (UNQ) and analysis and test (UJI, IPTP and UAM). We also found R&D services (IPTP, UNICAMP and UAM) and training services (UNICAMP, UJI, IPTP and UAM). This data shows two different strategies among the studied universities, those who privilege and specific activity (UNQ, UJI) and those who are more diversified (UNICAM, IPTP and UAM).

Finally, we will complete this general picture with some insights coming from an exhaustive research on the online documents available at the national institutions in charge of the evaluation or accreditation of Universities. Six over twenty-one national institutions whose website is linked to RIACES, have at least one document related to the University-Society interactions. However, most of these documents have little, if any, empirical information about the subject. They are either general theoretical elaboration on the matter or normative documents conceived to guide the evaluation of Universities. Nonetheless, these guidelines can give us some clues on how each country conceives these links and the consequences these policies can have in the behavior of the institutions and the actors of the system.

For example, the Ecuadorian normative establishes that higher education is a public good and therefore Universities are considered non-for-profit organizations [28]. In that sense, they must be accountable for the public resources they receive and they have to orient their actions to the general benefit. Hence, this conception emphasizes the social role of the University and demands a periodical evaluation of their impact on society. In consequence, the evaluation model designed to monitor Ecuadorian universities had a specific section to measure University-Society interactions. However, compared with the guidelines of the above-mentioned manual, the indicators used for this model seems very limited: links to collectivities, follow-up of graduates, number of programs related with society and the budget of these programs [29]. A revised version of this model, launched in 2015 suggest a more comprehensive evaluation with two main dimensions: institutionalization (planning, and resource management) and results (projects and programs)[30].

We got similar documents for the Colombia, Panama and Paraguay. In the first and second cases, their evaluation focus on university extension and they take into account: strategic guidelines, organization, formulation and evaluation of proposals, follow up of activities and financing [31], [32]. From a different perspective, the Paraguayan model establishes two policies: professional training and inter-institutional linkage. For the first one, they evaluate: relevance, efficiency and impact on the productive sector and follow up policies, communication and support to graduates. In the second case, they evaluate relevance, opportunity and efficiency of the links with other academic and non-academic institutions[33].

Finally, got a comparative analysis on the evaluation process of postgraduate programs in Brazil, México, Chile and Colombia. This document gives us also some clues on the dimensions and indicators considered for this kind of exercise. Five dimensions are considered: relevance, coverage and evolution
of the program, linkage with society, enhancement of productive organizations, innovations, financing [34].

The scarcity of empirical data and the heterogeneity of the above-presented data and documents prevent us from giving any conclusive scheme. However, based on the general overview of Higher Education in the first section we can try to outline some general ideas that can help to develop future analysis. We have proposed a general classification of the Latin-American universities in four groups: Chile and Brazil as the examples of the private model; Uruguay and Argentina as the models of the traditional public way; Colombia, Peru, Ecuador as the younger countries tending to the privatization model and Mexico and Bolivia as the younger countries tending to the public one. These classifications find some echoes in the data on University-Society interactions. For example, while Chile and Brazil register a more important participation of the private sector in R&D, Uruguay and Argentina expenditure is mainly financed by the government and the universities themselves. However, the second group present a division regarding this variable. While Ecuadorian R&D expenditure is mainly financed by the government, the Colombian one is private. But in both cases the execution of those projects is just partially managed by universities. Mexico follows the same trend as the Ecuadorian case. Regarding the distribution of researchers some contradictory trends can be identified. While in Colombia and Bolivia most of the researchers are in the University, in Argentina and Chile they are more diversified. Regarding the results of the pilot test, we can see that the Brazilian University (UNICAMP) is the one diversified interactions with society while the Argentinian (UNQ) follow a more classical strategy of specialization focused on technological transfers. The other universities are more difficult to classify. Finally, regarding the information gathered from the evaluation institutions of other countries we can see that the evaluation of the University-Society interactions starts to be institutionalized but in different ways. Countries like Ecuador has started to focus in certain aspects suggested by the Manual of Valencia, like the institutionalization of the management of these activities, while others keep using models of evaluations limited to a narrow perspective of the university extension projects. Nonetheless, these documents show that discussion on this subject start to reach policy makers.

4 CONCLUSIONS

This paper aimed to analyze the University-Society interactions within the Latin-American context. We have highlighted the importance of this interaction in the dawn of a new techno-economic paradigm based on the production, circulation and transformation of knowledge. We have also shown the progress made by several countries in the region in strengthening their technological and scientific capacities during the last decade, but also we have identified some bottlenecks that prevent the capacities accumulated within the Universities to reach public, private and social organizations and trigger a more intelligent development path. In order to address these issues, the analysis of the University-Society interaction is essential. However, the evaluations and data on the subject are still scarce. We have tried to take a first step in that direction by systematizing some available information and trying to give some clues to analyse the trends and models followed by different countries in the region. The lack of empirical and comparable data prevents us from doing a valid classification of these trends and models, but we have proposed some hypothesis that consider different features of the higher educational systems in the region determined by economical, demographic and political factors. We will test this hypothesis when the data of the first application of the Manual of Valencia is available for public research.

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