

Engineering Education in Countries of Portuguese Language

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Abstract — *The Portuguese-speaking countries are home to more than 240 million people located across the globe but having cultural similarities and a shared history. The CPLP (Community of Portuguese Language Countries) nations have a combined area of about 10,742,000 square kilometers (4,148,000 sq. mi), which is larger than Canada. The proposal of this paper is to show and discuss with some details how engineering education is developed in countries of Portuguese languages due to the peculiarities in the historic development of the countries.*

Keywords — *Bologna process; policy makers; public school; polytechnic schools; university schools.*

I. INTRODUCTION

The discussions about engineering education in different geographical parts of the world are of great importance. This is a way to promote and increase awareness of contemporary engineering education efforts and, simultaneously, to explore the views of young people, teachers, engineering lecturers and policy makers from other parts of the world. The organization of such panel Engineering Education in Countries of Portuguese Languages is important to bring teachers, researchers and engineering lecturers together to discuss and think over the different ways engineers are formed. It will contribute for the development of innovative engineering curriculum in order to increase the numbers of young people entering engineering courses.

Hereafter we present texts about education in the countries with the objective of briefly informing about how education has developed in countries separated by the sea but sharing common cultural roots, the issues faced by countries and the perspectives for the future.

The real discussions will be developed during the panel session that counts with high level lecturers, very well informed and involved with engineering education in their respective countries. They will bring updated information and

the framework adopted to defeat the present obstacles and demands in order to face the 21st century's educational crisis. A number of questions about the systems of present are expected to be raised, mainly the ones related to the Bologna Process in Europe, as it is reshaping higher education in the member countries. Regarding the Portuguese ex-colonies countries, the education has still without any doubt a lot of Portuguese education style mixed with new world people and natives.

II. PORTUGAL: HISTORY AND NATION

Portugal is one of the oldest nation states in Europe: its foundation in 1139 predates that of its neighbor, Spain, by nearly 350 years. The Romans who arrived in 216 BC called the whole Peninsula Hispania, but the region between the Douro and Tagus rivers was called Lusitania after the Celt Iberian tribe who lived there. When the Roman Empire collapsed in the 5th century, Hispania was overrun first by Germanic tribes, then by Moors from North Africa in 711. Military reconquest by the Christian kingdoms of the north began in earnest in the 11th century and it was during this long process that Portucale, a small country of the kingdom of León and Castille, was declared independent by its first king, Afonso Henriques. It is a sophisticated society present in many parts of the globe, helping to shape the world's civilization. Let us point out some facts brought by Martin Page in his book:

Portuguese Jesuits lived in Japan for generations before our ancestors were aware of the introduction of words in the Japanese language, e.g. "irrigate" which means "thank you." They brought the recipe for tempura. They introduced the technique for manufacturing weapons. The Portuguese also taught the Japanese how to construct buildings to withstand earthquakes and artillery attacks. The pepper plant was brought to India allowing "curry" to be invented.

Portuguese is the third most spoken language in Europe (English, Spanish and Portuguese) even before French and

German. It is the language of cattle ranchers in Northern California and fishing communities along the coast of New England. With over 210 million native speakers, Portuguese is the fifth most spoken language in the world..

III. ANTECEDENTS OF ENGINEERING EDUCATION IN PORTUGAL

Until the nineteen seventies, the following aspects characterized technical teaching in Portugal:

- Exclusive State responsibility, that centralized, funded and defined course programs;
- Weak specialization in technical university courses, with a strong common training component verified in all courses;
- Reduced dimension and concentration of Engineering Schools, which only existed in Lisbon and Porto;
- Dichotomy teaching, based on a hierarchical and exclusive model (since it defined who could be and who could not be an engineer) and by the fact that its output resulted in an inverted labor force pyramid.

New engineering university courses were established in Coimbra, Braga, Aveiro, Lisbon and a few other places from 1972 onwards.

In 1986, a binary separation of the higher educational system was established in Portugal, through the Education's System Basic Law, which integrated higher education engineering institutes into polytechnic teaching in 1988.

In 1988, the Law concerning University Autonomy was also approved. Through this Law, universities were defined as centers for the creation of culture, science and technology transmission and diffusion, which, through their expression of study, teaching and research, enabled them to perform their role in society.

The evaluation of the science and technology system, carried out in 1996 and 1999, confirmed the need to promote connections between research centers, civil society and companies, as well as the need to promote scientific cooperation at the level of national and international mobility [1].

IV. SOME REMARKS ABOUT THE BOLOGNA PROCESS

When analyzing engineering education today in Portugal, (and in Europe) the Bologna process must be mentioned. It is likely to be a unique chance for Europe to modernize its higher education, according to the same principles, with a perspective of reaching a new level of understanding and readability. It has touched off an impressive set of reforms. Nevertheless it must be admitted that the Bologna process may give rise to various criticisms:

- It implicitly links itself to a singular model of higher education (following the same rationale and being directed by the same values);

- It has been designed without considering the reality of the job market (top-down policy);
- It seems to have taken its inspiration from the North American model, which could provide a certain guarantee, but appears indeed to be following a very different path.

For these reasons, which should inform an open and critical debate, the application of the Bologna principle should remain very pragmatic and open to other dimensions, such as:

- The importance of having a limited number of universities in a position to be competitive at the world level;
- The importance of placing some universities, with credible expertise and know-how, in some fields – the so-called technological clusters;
- The importance of keeping a high level of flexibility and response, to launch new types of programs [2].

V. HIGHER EDUCATION IN EAST TIMOR

As a new nation, East Timor is working to develop in several sectors and the education sector has been identified as a top priority by the government of the Democratic Republic of East Timor.

Of the 14 institutes listed, only Universitas Nasional Timor Lorosa'e (UNATIL) is a government university. UNATIL has been receiving 70% of its funding from the government; professors are paid by the government as civil servants. The institution has also received educational infrastructure and other material support to rehabilitate the campus, and for chairs, desks and library facilities from East Timor's government, as well as from other countries including Portugal (Agriculture and Teacher Training), Australia (Economics and Social Sciences), the United States (building reconstruction) and Japan (Technology).

Many private higher education institutions have been opened, in general with the same goals of enabling high school graduates to continue their education and developing East Timor's human resources. The first goal is probably already met. During the UNTAET transitional period, East Timor already had two universities, UNATIL and UNDIL, but they did not have space for all the high school graduates seeking higher education and the students who had their studies interrupted in 1999. UNATIL evolved from Universitas Timor Timur (UNTIM), the public university under the Indonesian occupation. That university was destroyed in 1999 by the Indonesian military and militia violence, and most of the professors, who were Indonesian, left East Timor. Under UNTAET, it was rebuilt and renamed UNATIL, which has become a public university under the now-independent government.

The Higher Institute of Economics and Management (Instituto Superior de Economia e Gestão, ISEG), a private higher education institution focusing on economics, was formed in 1998. Under UNTAET this institute used existing

facilities in Balide, Dili. After independence, ISEG evolved into a full university and became UNDIL [3].

VI. ABOUT EDUCATION IN BRAZIL

Brazil's Higher Education has a history of success that has been facing some problems of both social and financial order. It starts with the creation of Public Universities in the many states of the country, which have worked very well for many years; the Country has achieved and has built a solid reputation even abroad also creating generations of Brazilian scientists and educators. In that aspect, there is still a long road to travel, involving three agents: the State, that has to generate and to apply public politics of science and technology, besides funding them; the University, which responsibility is to form qualified personnel and to create basic science; and the Industry, that should invest in technology creation, besides accomplishing applied research, to incorporate qualified personnel and, therefore, to win competitiveness.

With the creation of Public Universities in many states of the country, which have worked very well for many years, the country has achieved and has built a solid reputation even abroad also creating generations of Brazilian scientists and educators [4]. Despite all problems, professionals and educators of every field of science and technology have been discussing the destiny of education in the country, taking into account the historical moment of the world. Certainly some of these discussions have generated some practical actions at governmental level as a response to the society that considers itself as the most interested party in the issue. In Brazil, the situation is very delicate for engineering and technological fields. Although the proliferation of private universities all over the country expanded the number of 3rd grade students, it does not assure the increase of students in engineering and technology areas.

VII. THE ROLE OF ENGINEERING IN SCIENCE AND TECHNOLOGY IN BRAZIL

Brazil is five hundred years old with a history of races meeting towards the construction of a peoples' identity marked by diversity and cultural richness. Five hundred years which bring the challenge of starting this new millennium building up a new Brazil, a Country where quality of life in daily basis is a concept of its 166.113.000 inhabitants and not only of a minority. Considering the present history of humanity, the importance of engineering and engineers in the development of science and technology is noticeable, they have shaped a new social world order having as a straight consequence the new life style and therefore a new way of thinking.

Recognizing the importance of engineering in the world scenery, Brazil has been working to get the competitiveness of national goods and services by means of incentive to create projects of qualification of professionals through continuing education, for example, and others. Many representative groups, leaderships and agencies have been implementing programs to prepare engineers to increase the efficiency of research system, experimental development, engineering, producing system and market [5].

All these efforts have been having a kind of smooth effect once it is one of the most difficult and also expensive programs of College level, which does not help considerably the inclusion policy. However some Colleges have opted for a softer engineering program offering them in the evening. These programs are lighter and more focused in technical knowledge and less focused in basic sciences. The students in general work all day and choose engineering programs because it is a way to be promoted at work. A third degree diploma opens some doors, it means not only the possibility of earning more money but also of reaching an upper status, socially speaking. It is a fact that, even being a lighter program for the students, it is very hard and in general it takes them more than five years to finish it. The diploma has the same value of a program that prepares engineers of conception. In a certain way, it helps the inclusion policy of education although the number of engineers has been decreasing considerably in the last 10 years [6].

VIII. FINAL REMARKS

It is important to point out the fact that engineering is now of the interest of countries and governments, so engineering education is also of great interest. It is important to know more about the development of policies and actions in different countries, in order to understand the global educational demands. The search for changing to train the professional engineer for the present labor markets as well as the search for the best system in all the countries is clear now.

It is possible to notice that even with the colonization process in Portuguese speaking countries, due to the several other sources of influence because of the immigration waves, the fight for excellence is an ongoing process with peculiar aspects. It is clear that even nowadays, the importance of a language as identity is very high and so is the way it reflects on education.

The knowledge about these countries' engineering education systems will contribute for the reflection about engineering education in a larger spectrum not only centered in west north hemisphere regions of the world. Moreover this overview is a glimpse of education in some corners of the world that can contribute for the global perspective of higher education that is, now more than ever, important for the development of programs such as Engineering Programs.

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