Entrepreneurship and Engineering

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Abstract – This article aims to demonstrate the importance in adopting an entrepreneurship discipline as obligatory one, in the several degrees of Engineering courses at the Federal Center of Technological Education Celso Suckow of Fonseca –CEFET-RJ. Thinking about the proposal and history of CEFET-RJ, in the education, formation and preparation of professionals into business market and, in consonance with the emergency of entrepreneurship education in the national and international scenery, this work will demonstrate the benefits of such inclusion and will make a brief report about the institution and the actor of entrepreneurship theme - the entrepreneur.

Index Terms – entrepreneurship, enterprising, engineering.

ENTREPRENEURSHIP AND THE ECONOMY

It is discussed a lot, in the specialized literature, about the enterprising agent. As a phenomenon, the entrepreneurship can be seen by several shades: the economical, social and behavior one.

As this work aims to show the importance of a specifically discipline in all degrees of Engineering courses, it will abstain to make large comments concerning the social and behavior aspects.

However, it cannot be adopted the same attitude related to the economical aspect of the phenomenon in study, because it would be neglected a very important engineering area: the creation and expansion of the business market provided by technological development of enterprising initiatives.

Therefore, based on economical point of view, the entrepreneurship has forced a revision from the part of the Classic Theory’s economists (and also the neoclassic one) that treats about the income development and generation, and because of its relevant participation in the unemployment taxes reduction at developed or in development economies.

In 1985 Drucker [1] had already mentioned the entrepreneurship as a primordial factor for the North American economy development. He mentioned a quantitative data of demographic growth and the creation of job places at local business market that; firstly, seemed to be contradictory, because the period analyzed by the author included the years from 1965 at 1985. Such period can be characterized by the “baby boom” phenomena after the Second War and the petroleum crises at 1970’s.

Added to the facts above mentioned, Drucker still enumerates other factors that impacted negatively the numbers of American job places. The largest and more traditional employers of the country – the great corporations of Fortune 500 and the government in their several spheres: federal and state – had reduced the number of recruiting and, more precisely, in the studied period, their real numbers of permanent employed workers had suffered a reduction of approximately, 4 to 6 million work places.

However, and no matter how paradoxical it can be, the North American economy was capable, according to Drucker [1], to increases its total job places from 71 for 106 million (an increment of almost 50%), while its economically active population (above sixteen years) had jumped from 129 to 180 million (about 30% increase). In other words: the local economy was capable to generate more jobs than people's entrance in the job market and also absorb the surplus generated by the “baby boom.”

But if the great employers were reducing its total number of recruiting, the demographic pressure was not causing damages in the job market. And also take into consideration the restrictive scenery for the savings developed due to the petroleum crises at 1970’s, where the new work opportunities were coming from?

It can be said that during the two decades that preceded the years of 1980 there were a kind of decentralization in the jobs generation at North American job market due to businesses growth provided by small and medium companies’ expansion. Drucker [1] informs that in 1985 the magazine The Economist wrote that the United States presented a tax of about 600.000 (six hundred thousand) new businesses being created annually, approximately seven times more than twenty years before.

Last decade, the economist Bruce Kirchhoff [2] also gave the necessary emphasis to the phenomenon of the entrepreneurship according to economic point of view. Compared to the static scenery of the Classic Theory and the neoclassicists' teaching, Kirchhoff tried to demonstrate the theory of “dynamic capitalism” and the entrepreneurship as a propeller spring of jobs creation (endorsing the data above informed by Drucker). For him, the creation, growth, decline and finalization processes of companies is the capitalism essence.

Another modern author that it also emphasizes the entrepreneur's importance and the entrepreneurship for the

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economical development was Joseph Schumpeter [3]. In the beginning of last century, he had already detached the fundamental paper that the entrepreneurs carried out in an economy, in contrast with the Classic Theory that praises a certain static and cyclical element to the economical activities, in which all their actors execute certain functions and the market balance should be prevailed. In his opinion, the entrepreneur is the true motor of the economy and the main tool for generation and distribution of wealth through innovations that destroy the market structures, called “destructive creativity.” In other words, it is the entrepreneur's unexpected and innovative action (through new techniques or technologies) that is capable to generate deep changes in the consumers' behaviors, in the forms as the things are done (for new production and administration techniques and adoption of new technologies) and to change the status quo.

The technological aspect of the entrepreneurship and their consequences will be more discussed later in this work.

THE FEDERAL EDUCATION CENTER CELSO SUCKOW DA FONSECA

The Federal Center of Technological Education Celso Suckow of Fonseca – CEFET-RJ is located in the city of Rio de Janeiro and it is a public institution of the Brazilian federal government's teaching, linked to Ministry of Education and endowed with administrative, patrimonial, financial and pedagogic autonomy.

The history of CEFET-RJ and the other Brazilian similar institutions (other Federal Centers of Technological Education) are a reflex of the effort undertaken by Brazil in the search of the industrialization and diversification of its economy during last century.

Its primordial origin remounts to the year of 1909 with the foundation of the Schools of Apprentices and Authors in the Brazilian capitals and had the objective to provide a teaching professional, primary and free.

Along the time, CEFET-RJ changed the name several times and obtained changes in its administrative and pedagogic structure. The current profile was molded in the decade of 1970 and it stays faithful to the initial spirit that gave life to the school.

Being an institution that enjoys so much respect in the academic area, as well as in the business market, CEFET-RJ is constituted of a headquarter (located in the neighborhood of Maracanã, close Rio de Janeiro downtown), two campuses (one of them beside the headquarter) and the other one in another municipal district – Nova Iguaçu – in the periphery of Rio de Janeiro.

CEFET-RJ offers regular courses of medium teaching and the technical professional education of medium level, graduation courses (technology superiors and bachelor), and masters’ degree courses, besides research and extension activities, including masters' degree courses – latu sensu -, and others.

CEFET-RJ worries, as could be seen on its internet domain, with the updating concerning the guidelines of the industrial politics, technological and external trade of Brazil, focusing in: a professional formation that should meet the innovation and technological development; in the industrial modernization which increases the companies production capacity; and in strategic investment at future activities.

In this way, CEFET-RJ became known by the academic area and the business market, as well as by the society in general, as an excellent manpower capacitor and former specialized in supplying the industry business market in several sections such as: metal mechanic, petrol chemical, electric, electronics, telecommunications, computer science and other more that holds the production of goods and services to Brazil.

ENTREPRENEURSHIP IN THE ENGINEERING GRADUATION

In the first two sections of this article, it tried to demonstrate the economical importance of the entrepreneurship phenomenon and to do a brief report of CEFET-RJ profile and history.

In this last part, it intends to approach the need of a specific entrepreneurship discipline adoption, in the engineering courses and compare with other similar experiences in the academic area.

CEFET-RJ offers six specializations in engineering: Production; Electric industrial engineering, Electric (Electronics), Electric (Telecommunications); Mechanics and Automation control. The total number of students are eight hundred.

The curricular grating of these graduations offer, besides the inherent technical disciplines to each specialty, a range of disciplines in other several knowledge areas such as: Organizations psychology, Sociology, Law, Business administration and Economy.

Taking into account the characteristics of graduation courses available at CEFET-RJ, it can be noticed the need of new techniques and technologies development, which should be a constant concern of this institution courses.

And it is exactly in the aspect of new techniques and technologies that the entrepreneurship can be of extreme importance for engineering courses – without detain ourselves to the due concerns that an entrepreneur, being an engineer or not, should have when beginning a new business, such as: planning, leading with uncertainties and opportunities evaluation).

Drucker [1] already said that the systematic innovation is the entrepreneur's tool and the innovation process should be taught and learned in a pedagogic and didactic way.

The literature concerning the entrepreneurship discusses the conceptual width of the term. Because, in strict sense, it is not all new business that can be considered as enterprising. The aspect which characterizes a task work as entrepreneur is the identification of an opportunity didn’t explored previously, a new market niche and the development of a new product or production technique.
So, the technology becomes a crucial and differential aspect for the success of a new business and, as already mentioned above, the engineering, being an exact science, necessarily needs to work with the technological aspect of its activity.

By one side it has a technical formation in engineering and it needs a technological teaching; by the other side an area as the entrepreneurship which emphasizes innovation needs as elementary needs to be taught.

Empiric and conclusively, it can be verified a necessary causal connection and inter-communication between the engineering and entrepreneurship.

However, some aspects should be taken into account so that the proposal object of this work can be indeed understood. The market profile needs to be taken into account.

An important analysis tool for the market profile, as well as the entrepreneur's profile is Global Entrepreneurship Monitor (GEM); it should be taken into consideration that GEM works with a wider concept of the entrepreneurship, that is, the opening of small businesses or the autonomy-job is considered an enterprising initiative. GEM is a research concerning the entrepreneurship in the world and accomplished at thirty four countries of all the continents, being coordinated internationally by London Business School, of England, and for Babson College of the United States.

Trying to define criteria for an objective evaluation of the entrepreneurship in the researched countries, the study elaborated an indicator that measures the level of enterprising activity in these countries, called Tax of Enterprising Activity (TAE). The select data are in percentage terms and inform how many people from nation workforce is dedicated to an enterprising activity (as owner or manager of a new activity) less than 42 months, including people in the age group of the 18 to the 65 years.

For this indicator, Brazil occupies the sixth world place in terms of enterprising activities. In other words, the Brazilian can be considered, in a general way, an enterprising agent by nature, be for subject of psychological profile or “from necessity”. This discussion won't be considered in this work. Another important information collected by GEM in 2004 (the results of the research of 2005 still were not published) it is the technological aspect of the entrepreneurship, which was already mentioned previously. For the researched data and the statistical cuts used by the methodology of used research, Brazil is in a group of countries eminently enterprising and that, however, makes use of obsolete technology and with little innovation.

Through the select information from GEM, it is clearly the importance that the engineering courses – as offered by CEFET-RJ – have for the expansion of the entrepreneurship. If it is take into account the importance of the phenomenon, added to the structural lacks of the Brazilian entrepreneurship, it can be verified how this technical area of the human knowledge can increase the economical development of a country as Brazil.

But, indeed, which can the benefit that the institution of a discipline focused to the theme can bring, in practical terms, for the enterprising engineer?

For answering this question, this study is based in the doctorate theory presented by the teacher and doctor Liliane Oliveira Guimarães [4] from Getúlio Vargas Foundation in São Paulo (institution well considered in Brazil) and who investigates the results coming with the adoption of entrepreneurship disciplines in the graduation courses and Master Business Administration (MBAs) in the North American universities And, for free analogy, it can be extended to the courses of Engineering.

In the conclusion of her work, where she could live the academic experience in Saint Louis and Indiana universities, and also at Babson College (academic reference in the teaching of the entrepreneurship), Guimarães [4] affirms that the teaching of the entrepreneurship exercises the capacity of new businesses identification; stimulates the creativity and the innovation; and, the most important, the implementation of enterprising disciplines in the curricular grating stimulating the creation of Entrepreneurship Centers, which, for her time, contributes to a narrowing of relationship of the institutions with the community.

**CONCLUSION**

Analyzing the characteristics of CEFET-RJ, since the constituent elements of its foundation, till the concern in maintaining updated and tuned with the Brazilian needs, it can be concluded that the adoption of entrepreneurship’s disciplines in the courses of Engineering is a possibility for the phenomenon consolidation, technological reinforcement and networking expansion of the teaching institution with the environment which is inserted.

**REFERENCES**