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Life Sciences and Biotechnology: a brief perspective on the role of the University in the formation of entrepreneurs

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***Abstract*— Entrepreneurship in biological sciences and biotechnology areas is a subject of study on the rise in Brazil. However there is a lack of work, studies and reports with different approaches exploring this issue. In case of developing countries it requires continuous assessments that may contribute to train future entrepreneurs and help on accelerating the development of these regions. Thus, in this work we performed a brief analysis on the profile of 24 students of four post-graduate programs in the discipline Scientific Production II: Formation of Entrepreneurs of a Brazilian federal university, evaluating the topic entrepreneurship at graduate and undergraduate levels. Our data infer the need of adjustments in the curricula of Brazilian undergraduate and postgraduate courses of biological, biomedical and healthcare areas to create an environment that encourages entrepreneurial individuals during their professional training at different academic levels to create Biotechnology companies and development on this specific area.**

***Keywords* — Biotechnology, entrepreneurship, biology, entrepreneur, start-ups.**

I. INTRODUCTION

Entrepreneurship can be defined as the pursuit of opportunity without being restricted by limiting resources or risks. It is also described as the process of exploring opportunities in the market and organizing the resources needed to exploit them for long-term gain. It is still considered as the process of planning and organizing opportunities, assuming the risk for a business venture. [1]

Other definitions are similar to those that determine entrepreneurship as the ability to take risk independently to make maximum gains in the market or as creative and innovative skills that adapts to the environment. Finally, entrepreneurship can be regarded as the act of being an entrepreneur who performs innovations, finance and possesses the business acumen in an effort to turn those innovations into economic goods. These actions often result in new businesses or may be part of revitalized organizations in response to an identified opportunity

The most obvious way of measuring entrepreneurship has been based on the creation of new business (the Start-ups). However, in recent years, these definitions already include the social and political forms of entrepreneurial activity. Intrapreneurship is part of this subject as it is when entrepreneurship involves activities within a large organization or company. [2, 3]

According to Paul Reynolds, the participation in new business creation is a common activity among U.S. workers over their careers. [4] This form of entrepreneurship is a major engine of economic growth both in the U.S. and Western Europe, and according to David Audretsch, there are local organizations to support future entrepreneurs, including specialized government agencies, business incubators, science parks and ONGs. [5]

Different authors including Dornelas and Peter Drucker cited by Kurzynski describe entrepreneurs as those who take risks. [6, 7, 8] The behavior of the entrepreneur involves willing to risk his career and financial security on behalf of an idea that can spend a lot of time as well as large amounts of capital on an uncertain venture. In this context, there are risks that are statistically measurable, those difficult to measure statistically and true uncertainty and those that is impossible to estimate or predict statistically.

The entrepreneurship is often associated with true uncertainty, particularly when it comes to bring something really new and not present on the market. However, even if there is a market for selling the idea, there is no guarantee that this will absorb or prefer a new product from an existing category.

The literature describes entrepreneurs as those having

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leadership and other related characteristics (Table 1). They are often contrasted with managers and administrators who are more methodical and less likely to take risks. The entrepreneurs have been able to work in teams with great success.

According to literature, the entrepreneur has a great importance for accelerating economic growth of developed and developing countries. These individuals promote capital formation and create wealth, reducing unemployment and poverty and inherently creating a path to prosperity. Thus the figure of the entrepreneur is an important factor especially in microeconomics but also contributes for the macroeconomics in any country. [9, 10, 11]

Given the potential of entrepreneurship to support economic growth, many governments, for example Brazil, have encouraged a culture of entrepreneurial thinking. This can be done in different ways including by integrating entrepreneurship into education systems, legislating to encourage risk taking and campaigns and programs that align business and universities. [12]

Over the past 15 years, the concept of entrepreneurship is gaining relevance in Brazil. According to Greco and colleagues, helping entrepreneurs stimulates the country growing, generates job opportunities, and higher investment income. Thus, training of entrepreneurs is extremely important for the development of any country, particularly Brazil which is constantly growing. [11, 13]

Table 1. Definition of entrepreneurs by different authors.

Author	Definition	References
David McClelland	Primarily driven by an urgent need for achievement and strong desire to build.	[14]
Collins & Moore	Difficult, driven by pragmatic needs of independence and achievement, rarely willing to submit to authority.	[15]
Bird	Smart, opportunistic, creative and sentimental, prone to ideas, brainstorms, ingenuity and creativity.	[16]
Cooper, Woo & Dunkelberg	Displays extreme optimism in their decision making processes.	[17]
Busenitz & Barney	Prone to overconfidence and generalizations.	[18]
Cole	Four types: the innovator, the inventor of calculations, the promoter too optimistic, and the builder of organizations. No direct relationship to personality, but with the type of opportunity present.	[19]
John Howkins	Ability to prioritize ideas about the data to be nomadic and learn infinitely (creative entrepreneurship).	[20]

The formation of entrepreneurs goes beyond the know-how, adding to the qualifications, knowledge and skills with integration between vocational and basic and applied education. According to Oliveira, the entrepreneur must learn how to learn, knowing how to seek alone the knowledge necessary for the success of your business. [21] According Deffune and Depresbiteres, these individuals must also learn to think, with the ability to solve new problems, adapt to change and overcome conflicts. [22]

Recently, one of the most discussed issues about this subject is related to the ability to generate / create entrepreneurs. Some studies argue that the entrepreneur has natural characteristics, while others infer the possibility of teaching entrepreneurship as an innovative approach.

Based on this context, this article aims to analyze students from four postgraduate courses at a Brazilian federal university about entrepreneurship in the area of life sciences and biotechnology to identify their profile and prior contact with this theme during their academic formation.

II. Methods

The research was conducted during the discipline Scientific Production II: Formation of Entrepreneurs, offered by the Postgraduate Program of Sciences and Biotechnology of Fluminense Federal University. On that purpose, we used a semi-structured questionnaire to the training of undergraduate student as well as their participation in events on entrepreneurship and initiatives involving this context at the University.

In this work, we applied the questionnaire to 24 students of doctoral courses of four different Postgraduate programs including a) the Applied Sciences Health Products, b) General Pathology, c) Veterinary Hygiene and Processing Technology, besides d) Sciences and Biotechnology. These students attended the discipline in 2011 and were invited to participate voluntarily in the study.

After collecting the data, the responses were categorized and evaluated in the proposed content analysis of Bardin. [23] The categories were formed and we identified and categorized the main ideas and concepts. In this work some data will be presented through graphics in simple frequency, according to the proposed Triviños. [24]

III. Results and Discussion

Students Profile

The discipline Scientific Production II: Formation of Entrepreneurs is offered by the Post-Graduate Program of Sciences and Biotechnology of the Federal Fluminense University and is free to all Postgraduate programs from our or other universities. Enrollment is by student's choice with no restriction whatsoever except for Sciences and

Biotechnology program to whom this discipline is mandatory.

The discipline main purpose is to approximate the future doctors to their future labor market, the companies. The discipline approaches important issues like patents, financial funds and support for opening of business, preparing personal and professional resume, business lectures and required profiles currently demanded in the business environment. In this year there were eight students from other graduate programs plus 16 students from the Science and Biotechnology a Post-graduate program.

The analysis of the first part of the questionnaire showed that the students who were interested in the discipline are essentially from medical and biological areas. This is probably because of the Post-graduate program that offers the discipline belongs to the Institute of Biology. Thus, this may have pre-defined the discipline profile for the students, attracting only those from areas directly related to Biology. These individuals were mainly from public universities at the undergraduate level and the average age was 28 years (Table 2).

Table 2. Profile of students of Postgraduate analyzed.

Undergraduation	Students (n)	Age (year)	University	Sex
Biology	8	22-52	Public and Private	3 (F), 5 (M)
Veterinary	6	25-41	Public	3 (F), 3 (M)
Nutrition	3	28-53	Public	3 (F)
Biomedicine	3	24-28	Public	1(F), 2(M)
Pharmacy	2	28-31	Private	1(F), 1(M)
Physical Education	1	51	Public	1(F)
Chemistry	1	30	Public	1(F)

STUDENTS AND BUSINESS COMPANIES

Most students responded negatively (n = 19) when asked about previous relationship with any business company. Only five of them responded affirmatively with only two reporting prior employment (Table 3).

This result is consistent with the profile observed more frequently in Brazilian biology students as they often continue their academic education, pursuing Masters and PhD without a prior experience that enables them directly to the business environment. This lack of expertise / experience has led researchers to often ignore the demands of the business sector, whether public or private, including their timing work. This contributes to the research distancing, whether basic or applied, to those who could benefit from it and companies that could generate/sell an applicable product to society.

Table 3. Students previous contact with business companies.

Undergraduation	Students (n)	Contact with business companies (Y-Yes, N-No)	Contact
Biology	8	1(Y), 7(N)	Former employer
Veterinary	6	1(Y), 5(N)	Friendship with the owner
Nutrition	3	1(Y), 2(N)	Former trainee
Biomedicine	3	1(Y), 2(N)	Former employer
Pharmacy	2	2(N)	-
Physical Education	1	1(Y)	Friendship with the owner
Chemistry	1	1(N)	-

ENTREPRENEURSHIP AND UNDERGRADUATE STUDENTS

Only three of the 24 students participating in the survey (12.5%) reported having contact with the entrepreneurship theme during college when asked about the presence of this subject during undergraduate period (Figure 1). Regardless of whether or not there has been any discipline who somehow approached this question during the graduation of these students, we can infer that this contact was not enough to keep this issue in a relevant context in the memory of those individuals.

The lack of this subject in these students training emphasizes the importance of reviewing this context within the curriculum of undergraduate courses of the Brazilian universities. The knowledge about entrepreneurship may help on overcoming venture obstacles and not considering them insurmountable barriers or leading bankruptcy in the first 2-5 years of the business project due to personal ignorance.

A similar survey conducted with students of Informatics, Management and Engineering from Federal University of Rio Grande do Sul in Brazil showed that all respondents at the end of their undergraduate training had links with companies. However, most did not attend lectures on entrepreneurship or even attended seminars on this topic (55.6%). [25] These data are in agreement to those observed in this work with graduate students in the biomedical area (Figure 1).

All 24 students say they have had some contact with the subject entrepreneurship during his postgraduate course (Figure 1). However, among the 24, six individuals stated that this was a compulsory subject whereas the others reported as non-formal contacts (folder and e-mail). This non-formality in obtaining information about entrepreneurship can generate misconceptions on the subject, again complicating the issue about teaching an entrepreneurial profile that should be facilitated during this

academic audience.

According to Oliveira, students of undergraduate courses with a more entrepreneurial profile (Administration, IT and Engineering) also obtain information about entrepreneurship in an informal way (55.5%). [25] Again, it becomes evident the need of information offered in a more formal manner and that can contribute in the context of an entrepreneurial identity for these students.

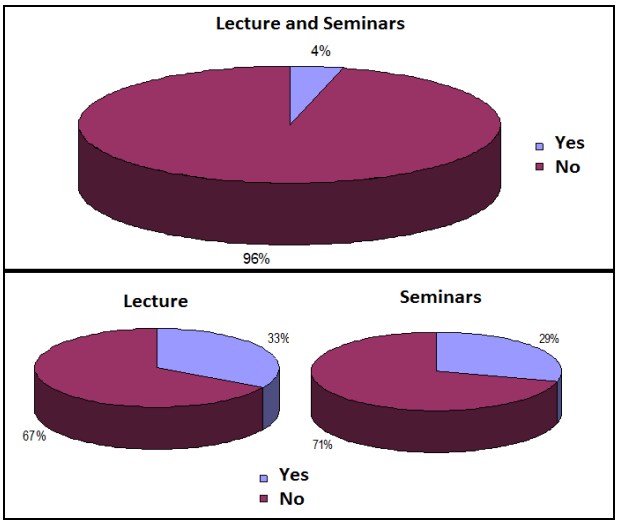

Fig. 2. Participation in events (lectures and seminars) about entrepreneurship during undergraduate (up) or graduate (below) period.

This is corroborated by the study "Overview of Biotechnology in the World and in Brazil", conducted by the Brazilian Agency for Industrial Development - ABDI and the Center for Management and Strategic Studies - CGEE, involving government, academia and industry participants, which pointed out several difficulties and bottlenecks on the current Brazilian scenario in relation to human resources, classified into two major groups: (i) training and (ii) fixing and talent attraction. [10] Difficulties related to training included poor interdisciplinary and multidisciplinary formation and incipient innovation (management, entrepreneurship, designs, patents, etc.) of the undergraduates, graduate students and the actual trainers. Regarding to the maintenance and attraction of new talents, we highlight the low salaries and little fiscal and tax incentives to support companies on setting and attracting talent.

Due to identification of this lack of entrepreneurship information at undergarduation level that the discipline Scientific Production II: Formation of Entrepreneurs was originally created and offered by the Post- Graduate Program of Sciences and Biotechnology in a compulsory way seeking help to change this national scene.

Students and the participation in events on entrepreneurship

The evaluation of the participation of these students in lectures and seminars about entrepreneurship during their undergraduate period revealed only 1 student with this experience (Figure 2). This infers that the biological, biomedical and healthcare areas in the university have not targeted this type of approach for presenting this subject, usually common to technological areas such as engineering. These data are strengthened by the work described by Oliveira in undergraduate courses in technology that showed 40% of students had participated in entrepreneurial seminars, lectures and workshops. [25]

This lack of focus onto professionals from biological, biomedical and healthcare areas meets the current Brazilian deficit on biotech companies, who rely on these professionals choice of willing to risk opening a new company and their commitment to that situation that involves an inherent financial risk.

We found that 6-7 post-graduate students frequented lectures and seminars, which is a low rate (27-33%). About 70% not even heard a lecture on the subject, which could be enlightening for some of them as stimulate the entrepreneurship behavior on others (Figure 2). This result becomes even more frightening considering the studies from Biominas Foundation and supplemented by information from an article published in the journal Nature Biotechnology on the development of biotechnology in Brazil and applications in the area of human health. [11, 26] They showed that the biotechnology in Brazil in the recent years has succeeded with considerable progress and innovative solutions but still need great minds to improve it. The absence of a stimulating environment on the Brazilian universities compromises the country's ability to found and encourage these great minds to help on the Brazilian development on this specific area.

IV. Conclusion

The challenge to improve productivity and competitiveness of enterprises is still present in the current scenario of rapid change and global economy. Thus, it is not enough to create a company, but also make it sustainable. This is still a major challenge, requiring much more than technical and infrastructure, but ways of thinking and acting committed to innovation.

The role of the entrepreneurs in the development of a country is undeniable. They are essential for all business organizations, as they bring new perspectives, identifying opportunities and assists in innovation. This case study pointed to the lack of information and disclosure on this topic in the academic areas of the biological, biomedical and health services, especially at the undergraduate level.

Therefore this work infers the necessity of focusing on this issue still at the undergraduate period of biological, biomedical and healthcare professionals formation, so they can contribute entrepreneurially in creation and management of new businesses in the medical and biotechnology development, significantly contributing to the countries growth, specially Brazil.

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