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Study of the entrepreneurial profile of production engineering students from a Federal University in Brazil

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ABSTRACT

With the increasing importance of entrepreneurship for the economic and social development of the country, it is essential that higher education institutions are aware of their role in the training of its students. Therefore, the purpose of this study is to identify the entrepreneur profile of Production Engineering students in a Higher Education Institution located in Southeast region in Brazil, to compare the data with the results provided in the report "Entrepreneurship in Brazilian Universities" developed by Endeavor Brazil and Sebrae, and to contribute to developing strategies to foster entrepreneurship in the institution and in the region where the HEI is located. Therefore, it was performed a case study encompassing 43 students in the eighth semester of the Production Engineering course. The results show that it is necessary to improve the activities related to entrepreneurship, providing theoretical background and practical activities as well to stimulate students' creativity and willingness to become entrepreneurs. The results also show a lack of innovative mindset in the undergraduate students, reinforcing the need of developing initiatives that foster the students to thinking in an innovative way as the development of policies to approach HEIs and the private sector allowing the development of creative solutions better aligned to the market's demands. This study only covered students from the eighth semester of the Production Engineering Course and from one single HEI, so the results cannot be generalized. Future research should use different methods such as survey research to extend the sample beyond the HEI studied, and longitudinal case studies to develop a better understanding of the findings described in this study.

Keywords: *Entrepreneurship; Higher Education Institution; Production Engineering; Innovation.*

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1. INTRODUCTION

The current economic crisis has contributed to increase the number of unemployed in Brazil. According to data from the Brazilian Research Institute (IBGE), in the quarter ended in May 2019, the unemployment rate was 12.3%, representing about 13 million unemployed. This scenario, in line with changes in the global economy and changes associated with the nature of work, where the use of technology replaces many jobs, the development of entrepreneurial skills has become much more necessary. In this context, Coelho *et al.* (2018) argue that the entrepreneurship is increasingly common in Brazil as a career option as a result of socioeconomic difficulties in the country, and limited opportunities of job positions in the private sector.

Entrepreneurship has an important role in economic development since it can contribute to technological innovations, increasing economic efficiency or even creating new jobs (ZHANG *et al*. 2014). Then, many countries have seen entrepreneurship as an effective mean in creating jobs opportunities, increasing productivity and competitiveness; and improving the quality of life and achieving community goals (JENA, 2020). It is recognizes that education and experience may contribute to identify entrepreneurial opportunities. Rideout and Gray (2013) argue that the Global Entrepreneurship Monitor (GEM) cites social and cultural barriers, lack of capital, and lack of education as the three major barriers to entrepreneurship. The authors state yet that, in the U.S., the policymakers focus on education as the first step to increase the levels of entrepreneurship.

According to Lima *et al*. (2015) Higher Education Institutions (HEIs) play a central role in this context since it is no longer enough for these institutions to educate graduates for employment in the public sector or established firms. Fenton and Barry (2014) argue that HEIs can foster entrepreneurship through, for instance: entrepreneurial education (EE), knowledge transfer, academic spin-offs, campus incubators, etc. Increasingly, HEIs have become a place to foster entrepreneurship so that they become active agents contributing to the economic and social development of the region where they operate. As Marques *et al.* (2019) state, the universities are important for technological development because their capability in generating new technology.

Laukkanen (2000) argues that entrepreneurial education is seen as a strategy that can contribute to increase entrepreneurial activity. To Fenton and Barry (2014), and Zhang *et al*. (2014), EE is the most effective means of fostering students' entrepreneurial mindset, and an important antecedent to entrepreneurial intention among the undergraduate students. In addition, Jena (2020) argues that policymakers and educators need a thorough understanding of the aims and objectives of EE to succeed.

Literature has discussed the importance of including new education methodologies in the engineering curriculum aligning them with the technologies, and practical experiences. According to Araújo *et al.* (2020), in doing so, it is possible to attract and retain students, and to develop better professionals for an environment in constant changes. The authors state that the engineering curriculum should focus on innovation through courses related to technological innovation, industrial property, entrepreneurship and project management.

In parallel, Dohse and Walter (2012) argue that several studies have found that external characteristics such as regional context, country institutions, start-up intensity, access to capital has influence on the students' entrepreneurial intention. Their studies show the impact of the regional environment on the regional rates of new firms' formation. Acs and Armington (2004), for instance, have tested the hypothesis that increased entrepreneurial activity in the early stages of the industrial life leads to higher growth rates of regional economies and conclude that higher rates of entrepreneurial activity are strongly related to faster growth of local economies. In addition, Arthmar and Salles (2017) argue that the relationship between entrepreneurship and economic development has been an important subject within the economic science.

In terms of development stages, Brazil has a large geographic heterogeneity, and presents high levels of both intraregional and inter-regional income inequality (TAI; BAGOLIN, 2019). In the same direction Lovell (2000) calls attention to the unequal process of development with geographical and demographic polarization that have distinguish Brazilian society, and the different regions in the country where the Southeast remains the economic and financial center in the country. In this context, Escobar and Gutiérrez (2011) highlight the role of the entrepreneurship in contributing to create social cohesion by empowering people and solving social problems.

In 2016, the Endeavor Brazil in partnership with the Brazilian Micro and Small Enterprises' Support Service (Sebrae) performed the fourth edition of the studied entitled

Entrepreneurship in Brazilian Universities. This study has encompassed data from 70 HEIs, 2230 undergraduate students, and 680 professors covering the five states in Brazil. Taking the students' profile into account, findings show that about one in four students has or wants to have a business; there is a direct relationship between contact with entrepreneurial experiences and the will to undertake. In addition, this same research suggests that, in Brazilian universities, strategies and institutionalization of entrepreneurship programs are lacking and that they only encourage isolated initiatives.

In this context it is important to know the entrepreneurial profile of the undergraduate students from an HEI located in a small city in the Southeast region of Brazil. Therefore, this work aims to identify the entrepreneurial profile of the students focusing on the Production Engineering course, and, then, compare the data with the results provided in the report "Entrepreneurship in Brazilian Universities" developed by Endeavor Brazil and Sebrae in 2016. Thus, it is expected to contribute to the development of fostering and institutionalization strategies of entrepreneurship in the institution, and in the region where the HEI is located.

2. LITERATURE REVIEW

2.1 Entrepreneurship in Brazil

Entrepreneurship is related to the process by which a person identifies, evaluates and explores opportunities to create new goods and services (SHANE; VENKATARAMAN, 2000; FARHANGMEHR *et al.*, 2016). Coelho *et al.* (2018) state that entrepreneurship can be considered as fuel to stimulate the individuals to use their rational and intuitive skills to think in an innovative way. Several studies such as Atienza-Sahuquillo (2017), Farhangmehr *et al.* (2016) and Lima *et al.* (2015) demonstrate the importance that entrepreneurship has acquired in the current context, emphasizing the fact that economic growth and development are related to entrepreneurship, which is a fundamental tool for generating wealth and creating jobs.

Arthmar and Salles (2017) argue that the low requirement of capital, technology, and professional formation make the service sector an option for many Brazilians to have some income. Therefore, each year, thousands of new firms have been created in the country. This type of entrepreneurship where the individuals decided to become an entrepreneur, not as an

option but to survive is named "necessity-motivated entrepreneurship". Accordingly, data from a study performed by Sebrae (2019) encompassing 10339 individual micro entrepreneurs (MEI) show that for 33% of the respondents the "need for a source of income" was the main reason for them in becoming an entrepreneur.

In addition, the report published by GEM in 2019 from Bosma and Kelly (2019) discusses in details the Brazilian scenario. According to the authors: "Brazil has exhibited a distinct political landscape over the past 20 years moving from pegging the value of the real to the U.S. dollar and privatizing public services and state owned companies to an emphasis on combatting income inequalities while also struggling with corruption scandals" (BOSMA; KELLY, 2019, p. 43). The report shows that the Total early-stage Entrepreneurial Activity (TEA) rates has increased in 2009 and 2010, following by a decreasing in 2011 due to changes in the country's leadership. In 2015 the TEA number had an all-time high but motivated mainly by a higher proportion of necessity-motivated entrepreneurship. In addition, the report states that the recession period from 2014 to 2017 where few job opportunities were created or kept has directed to a high proportion of necessity-motivated entrepreneurship.

Bosma and Kelly (2019) concludes that at the same time that Brazil has shown an increase in the levels of entrepreneurial activities, the country also shows low results in terms of growth expectations and innovation, suggesting that entrepreneurs contribute to the economy based on their high collective participation levels, rather than from individual participation level. In addition, the report shows that Brazil presents some barriers to foster entrepreneurship related mainly to low ratings of government support, taxes, and bureaucracy.

Gürol and Atsan (2006) argues that entrepreneurship has a more critical role for economies of developing countries since it can be recognized as an engine of economic growth, job creation and social issues. For this reason, Mueller and Thomas (2001) highlighted in their studies that in less developed countries, national incentive and education programs aiming to stimulate the entrepreneurial activities have been instituted by national governments. In the same direction, Lima *et al.* (2015) argue that directors of Brazilian universities, based on the assumptions of the changes in the global and national contexts has introduced and expanded entrepreneurship education offering. Besides, as stated by Kuratko (2005) with the expansion of the importance of the entrepreneurship as a potent economic force, the field of entrepreneurship education (EE) has experienced a similar increase.

2.2 Entrepreneurship Education

It is widely acknowledged that Universities are important agents capable of transforming the scientific capital produced by their research in technological innovation. In general, the HEIs have key elements to foster innovation such as trained personnel, specialized laboratories, and partnerships with public and private organizations (MARQUES *et al.* 2019). Alves *et al.* (2019) state that while there is growing interests in stimulating academic entrepreneurship, universities also provide the environment for a student to become entrepreneurs.

Literature has highlighted the importance of entrepreneurship education (EE) in fostering economic and social development through entrepreneur initiatives (e.g. JENA, 2020, FARHANGMEHR *et al.*, 2016, RIDEOUT; GRAY, 2013). In this context, Neck and Greene (2011) state that entrepreneurship and entrepreneurship education is more relevant nowadays than ever before. Indeed, Kuratko (2005) argues that the recent growth and development in the curricula and programs related to entrepreneurship and business creation have been remarkable.

Several authors such as Solesvik *et al.* (2014), Zhang *et al.* (2014), Adekija and Ibrahim (2016) investigate the entrepreneurship intention of undergraduate students and conclude that education is an important driver of the decision to become an entrepreneur. Solesvick *et al.* (2014), for instance, show that students who participated in EE have reported higher intensity of entrepreneurship. According to the authors, EE may contribute to enable students to accumulate assets required to engage in the entrepreneurship process.

Zhang *et al.* (2014) also confirm the results of empirical research that has shown that the presence of education in general and entrepreneurship programs have positive effect on the entrepreneurship intention of the students. In addition, results of the study conducted by Block *et al.* (2013) using data from 27 European countries and the US, have shown that higher the level of education, the greater the likelihood of starting a business. Fragoso *et al.* (2020) state that entrepreneurship training and education in the early stages of students' life may be particularly effective in promoting interest in the topic. Therefore, it is broadly recognized in literature that training and EE could enable students to develop skills and proactive behavior to create and manage new business

In this context, the traditional question "Can entrepreneurship be taught?" is somehow old-fashioned. According to Kuratko (2005), it is clear that entrepreneurship, or certain

aspects of it, can be taught. For him, business educators and professionals have evolved beyond the myth that entrepreneurs are born, not made. Neck and Greene (2011) state that the academic and practical field of entrepreneurship have been at odds about this issue for years, but this situation has contributed to a common understanding that EE is indeed important. Besides, according to Vamvaka *et al.* (2020), the basic assumption of the entrepreneurial intention models that have dominated the entrepreneurship research over the last three decades is that entrepreneurship is a planned, controlled behavior that is intentional rather than instinctive.

Neck and Greene (2011) presents three different approaches used to teach entrepreneurship that they named: "entrepreneur world", "process world", and "cognition world", each one considering different characteristics. Entrepreneur world, for instance, has entrepreneur as level of analysis and focus on the personality traits of individuals. The basic pedagogy is based on business basics, lectures, exams and assessments. In the process world, the focus is the new venture creation so that the level of analysis is the firm. In this world, business cases, business plans, business modeling, are used as primary pedagogy. The cognition world has the entrepreneur and team as level of analyses and focuses on decision-making to engage them in the entrepreneurial activities. The authors state that some educators rely on one approach, while others use two or even the three approaches.

In this same study, Neck and Greene (2011) propose a new approach: the "method world". This approach focus on a portfolio of entrepreneurship practices and techniques considering the three levels of analyses: entrepreneur, firms, and teams in which the pedagogy is based on games, observation, practice, reflection, and design. They argue that the method is teachable, learnable but it is not predictable. Therefore, this approach fits better with our current external environment characterized by increasing levels of uncertainty.

According to Barba-Sánchez and Atienza-Sahuquillo (2017), the rational and the motivational aspects are needed to entrepreneurs. The first encompasses issues related to the environment that create conditions for this; the second, to subjective questions that arise from personal characteristics. In the same direction, Dutta *et al.* (2011) consider entrepreneurship as a result of the interaction between the individual and the opportunities of the external environment. The studies of Jena (2020) show that the support obtained from agents like mentor, government, and financial intuitions could influence the entrepreneurship intention.

In the same line, Vamvaka *et al.* (2020), argue that cognitive and affective antecedents should be addresses and enhanced toward fostering entrepreneurship intention. In this context, EE should, besides of the concern in developing business skills, focus on fostering self-confidence and developing positive emotions toward entrepreneurship. Ndofirepi (2020) defends, for instance, that educators should incorporate and focus on learning content that contributes to students in pursuing meaningful life goals as a way to support the entrepreneurship intentions. In turn, Solesvik *et al.* (2014) praise the role of EE in this context and defend that it can improve human capital skills which in turn can stimulate an entrepreneurship intention to discover new business opportunities regardless of the external environment.

Farhangmehr *et al.* (2016) state that, in order to motivate students to become entrepreneurs, an education policy for entrepreneurship in universities should focus on the development of oriented psychological skills and not just theoretical knowledge. In addition, they argue that universities should focus on hiring and training the entrepreneurship professors capable of conceiving and implementing new technologies; and capable to deal with the inspirational part of the EE (SOUITARIS *et al.*, 2007). Finally, Adekija and Ibrahim (2016) argue that well trained professors and material resources provided by universities to facilitate EE will help the students in the development of required technical and managerial skills that are needed to succeed as an entrepreneur.

2.3 Entrepreneurship Education in Brazil

According to Laurikainen *et al.* (2018), the EE in Brazil is still focusing more on informative learning instead of active learning. For this reason, Araújo *et al.* (2020) argue that new formats for engineering education based on interdisciplinary programs aligned with existing and developing technologies are necessary to attract and train students to be prepared for the current external environment. According to them, it is crucial that the theory introduced in the classroom is connected to the solution of real problems so that the students can deal with practical situations. The authors state that this educational approach has gained more importance after the approval of new National Curricular Guidelines by the Ministry of Education in Brazil in 2019 for engineering courses. These guidelines aim to encourage academic activities such as interdisciplinary projects, teamwork, prototype development, participation in business incubators and other entrepreneurial activities.

However, Schaefer (2018) states that, in Brazil, there is still a focus on the training of undergraduate students to work in the private or public sector. The author argues that the differences between traditional education and entrepreneurial education have generated a need to develop appropriate pedagogical models aligned to the change in the role of the professors, in the role of the student who becomes the protagonist in the learning process, and the adoption of new pedagogical practices with the use of more experiential and dynamic approaches.

In this line, several authors such as Spyrtou *et al.* (2018) and Araújo *et al.* (2020) have also argued that new pedagogical and methodological approaches in HEIs are crucial to foster entrepreneurship. In this context, Garcia *et al.* (2017) state that EE has grown significantly in the last decade, especially in the emerging economies where innovative and entrepreneurial education has become necessary. Severo *et al.* (2019) have studied the relationship between innovation teaching, environment sustainability teaching and entrepreneurship, and their findings show that both, innovation and environment sustainability teaching, are positively related to entrepreneurship according to the perception of 502 students of HEIs in Southern Brazil. The authors conclude that EE is fundamental to develop an entrepreneurial mindset in the undergraduate and postgraduate students.

In parallel, Lima *et al.* (2015) argue that EE in Brazil is growing. However, this is often limited to the development of business plans. In the same line, Flores *et al.* (2008) has analyzed the teaching plans of the entrepreneurship disciplines offered by post-graduate programs in Business Administration in Brazil. According to them, the business plan, innovation, and creating new business opportunities were the most discussed subjects. In addition, an increasing number of Brazilian students have declared that they consider opening their own business so that HEIs can do more to provide quality assistance to foster students' entrepreneurial intent and good career choice (LIMA *et al.* 2015). Therefore, to know the profile of the student who attends entrepreneurship disciplines is important to help the HEIs in developing strategies and to institutionalize entrepreneurial education and, as consequence, to contribute to the economic and social development of the country.

Laurikainen *et al.* (2018) recognize that there are initiatives to support entrepreneurship education in Brazil, many of them supported by Sebrae (such as Entrepreneurship Education Reference Center, National Plan for Entrepreneurial Education). But they argue that the lack of a systematic approach to promote entrepreneurship and

innovation in education, and the lack of strategies from the Ministerial level are barriers in this context.

In the same direction, Lima et al. (2015) argue that some Brazilian institutions offer entrepreneurship centers business incubators, business plan competitions; and practical and academic events that stimulate entrepreneurship. In their study, they state that the students show higher entrepreneurship intention and demand for EE at universities, compared with the international studies. In this context, the authors claim for the importance of increasing and diversifying entrepreneurship education beyond the business plan. Finally, they conclude that despite of the Brazil has evolved in the field of EE in the last couple of years, the country faces some challenges that have to be overcome to improve EE in Brazil like to increase the contact of the students and the entrepreneurs and their reality; more practical approaches; and to train professors and other agents in EE.

3. METHODOLOGICAL PROCEDURES

A case study was performed to achieve the proposed purpose; it is a method to understand a past or current phenomenon depicted from multiple sources that can include primary and secondary data from direct observation, interviews, archives, etc. Meredith (1998) state that case study uses both quantitative and qualitative methodologies. According to Leonard-Barton (1990, p. 263), the method is suited for exploratory and hypothesis generation rather than hypothesis-testing. As stated by Yin (1989), its main purpose may be to describe a situation.

Data was collected using a questionnaire applied for all the Production Engineering undergraduate students enrolled in the discipline of Entrepreneurship in 2017 and 2018. This discipline is offered once a year for undergraduate students in the eighth semester of Production Engineering course. The instrument to collect data was developed based on the report “Entrepreneurship at the Brazilian Universities” provided by Endeavor Brazil in partnership with Sebrae in 2016.

The questionnaire had included 5 multiple-choice questions related to the respondents’ willingness for the entrepreneurship; their main motivation in the work, the product or service offered in case of them to become an entrepreneur, for instance (available in Appendix). The questionnaire was applied at the beginning of the school semester, and data

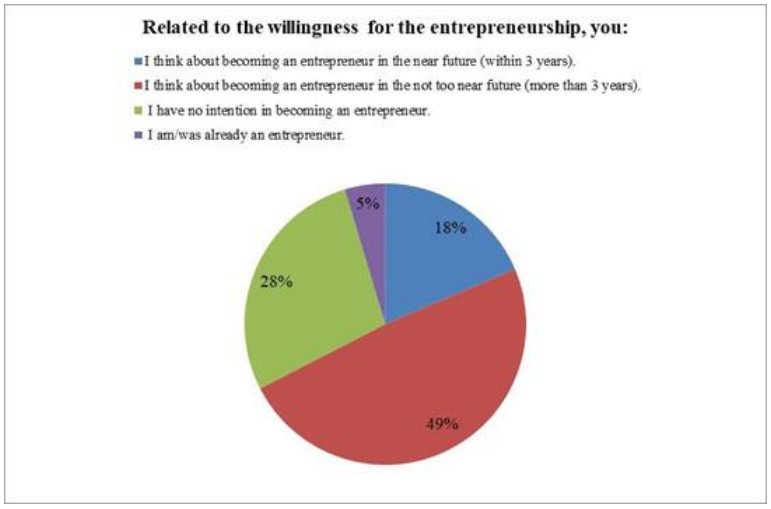
were obtained from 43 undergraduate students (24 students in 2017, and 19 students in 2018). Results were presented in graphs performed in MS Excel v. 2010.

4. RESULTS AND DISCUSSION

In the HEI studied, the discipline of Entrepreneurship is mandatory for students in the 8th semester of the Production Engineering course. Figure 1 shows that the majority of these students are potential entrepreneurs (67%). However, 49% of these students that consider becoming an entrepreneur think in doing that in a period of more than three years. When these data are compared to the study conducted by Endeavor Brazil and Sebrae in 2016, it is clear that the number of students with an entrepreneurial profile is much higher in the HEI studied than in the 2016 survey, where 20.7% said they were potential entrepreneurs. These results may be due to two reasons 1) the course of entrepreneurship itself may have contributed to the students' interest in the subject and 2) the current economic situation in the country with a high number of unemployed people and uncertainty about their placement in the market after completing the graduation course. When the percentage of students who have already developed or develop any entrepreneur activity is analyzed, the results are nearly equal: 5% of the students in the HEI, and 5.7% in the Endeavor survey. Even though the majority of students in the HEI analyzed have the perception they have an entrepreneurial profile (72%), a still considerable number of students have the perception that they do not have the entrepreneur profile, representing 28%.

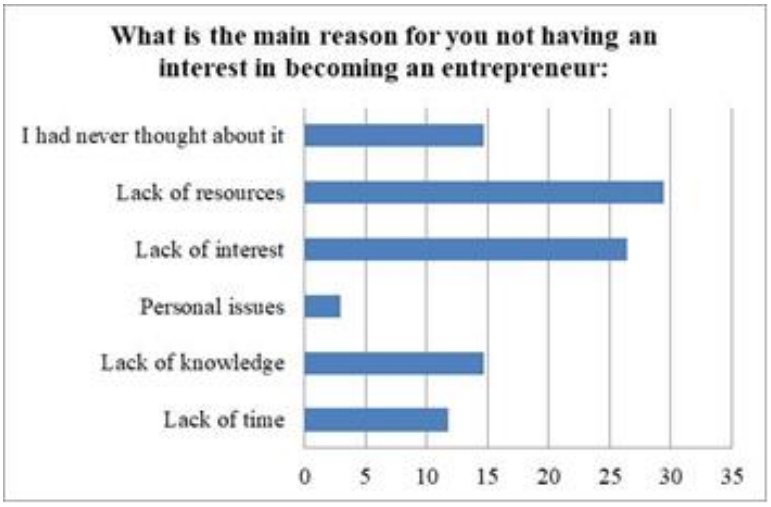
Among students who say they are “non-entrepreneurs” (28%), they were asked to point out the reasons that contributed to the lack of interest in entrepreneurship. Figure 2 presents these results in percentage, it is important to highlight that this question allowed multiple responses from the respondents.

Figure 1 – Willingness for the entrepreneurship



Source: Authors (2020).

Figure 2 – Main reasons for not have an interest in becoming an entrepreneur



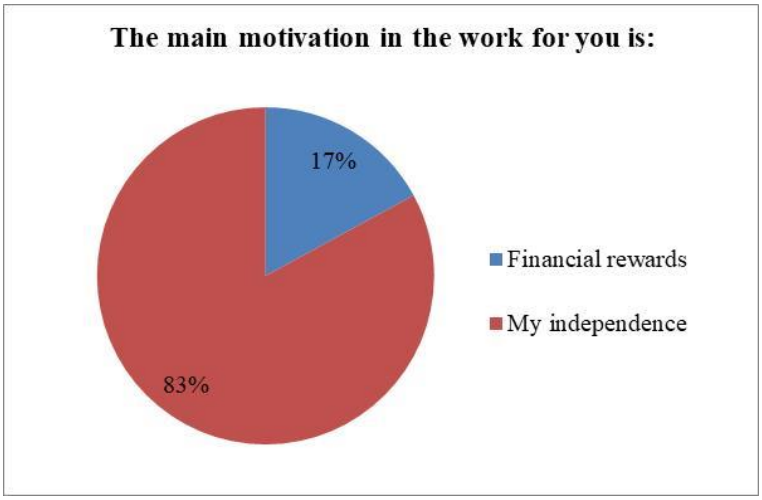
Source: Authors (2020).

The results show that undergraduate students consider the lack of resources the greatest barrier to become an entrepreneur. In addition, the most frequent responses are related to lack of interest and knowledge in the subject. One possible explanation may be related to the fact that the questionnaire was applied at the beginning of the school semester, thus, many of these students may not have had the appropriate with subjects related to entrepreneurship. Therefore, HEIs have a crucial role in this context in the sense of developing initiatives to foster the entrepreneurial culture, to develop professors and also to provide support to encourage the creation of new businesses, for example, investing in

business incubators, pre-acceleration programs, mentoring, and multidisciplinary lectures. Findings from Endeavor Brazil and Sebrae (2016) also show that lack of resources and lack of interest are highly cited by the respondents (34.5%), in addition 29.9% of the respondents said that they have never think about becoming an entrepreneur. These results support our findings that it is fundamental to provide the students with knowledge in this area to foster entrepreneurial initiatives.

Regarding the main motivation in the work, 83% of the respondents answered that what they expect is their independence, to the detriment of financial rewards. This result can be seen in Figure 3. A possible explanation is that this generation (the average age of students in the eighth semester of Production Engineering course is 22 years old) seek for autonomy at work, and prefer not to not to be subject to the rules and procedures that they consider to be present in private companies. This result go against the findings from the research performed by Endeavor Brazil and Sebrae (2016) that pointed out that regardless the entrepreneurial profile, most of the students (about 58%) have the financial rewards as the main motivation in the work.

Figure 3 – Main motivation in the work

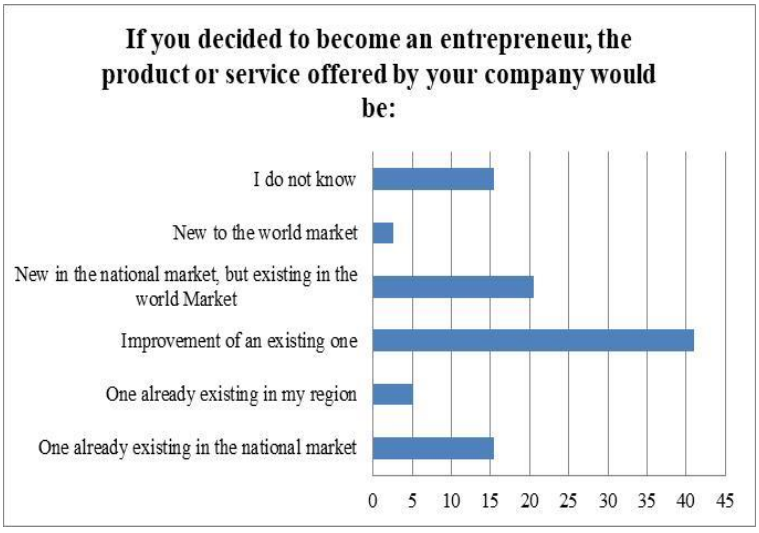


Source: Authors (2020).

Figure 4 describes in percentage the type of product that students who think being a potential entrepreneur would offer in the market. By analyzing the data it is possible to conclude that the respondents do not see themselves offering something innovative, limiting to offer an improvement of existing products, only 2.6% say that they would produce something completely new to the market. These results are somehow aligned to the findings

from the Endeavor Brazil and Sebrae (2016) research which show that most of the respondents think they would produce something already existing in the national market (75%), and only 1.4% something completely new. Analyzing these results, the Endeavor Brazil and Sebrae, (2016, p.5) concludes that to innovate is not in the mind of the most students in the HEIs, and they argue that these results should be different especially because of the respondents are immersed in the research and educational centers. The GEM's (2019) report also supports these findings since it shows that Brazil has low results in terms of growth expectations and innovation. These results show that it is necessary to stimulate a changing in the students' mindset through the application of tools to foster creativity, such as brainstorming, canvas, design thinking so that they can identify opportunities to produce something that is innovative, and the HEIs have a fundamental role in this task.

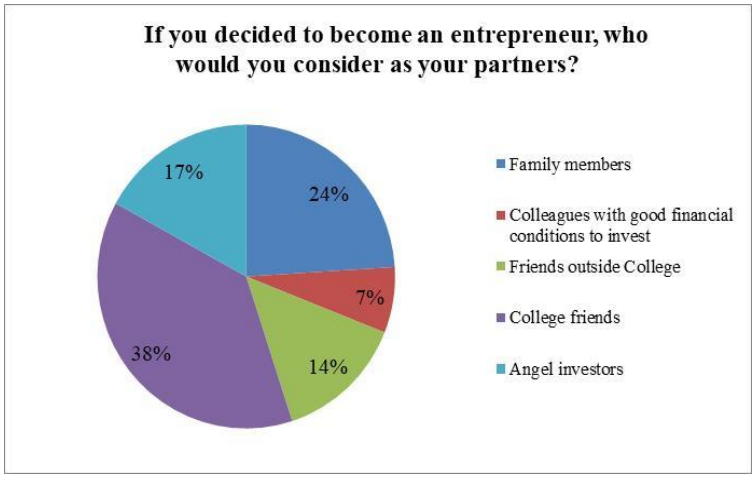
Figure 4 – Type of product that potential entrepreneurs would offer in the market



Source: Authors (2020).

Finally, it was asked to the undergraduate students which persons they would see as partners, in case of them to decide to invest in their own business. The results are described in Figure 5.

Figure 5 – Potential partners of entrepreneurs



Source: Authors (2020).

Figure 5 show that the majority of respondents see as possible partners, colleagues from the University itself (38%), or family members (24%). These results are supported by the findings from Endeavor Brazil and Sebrae (2016) that has found that among the potential entrepreneurs, 43.6% expect to start a business with friends from the University, and 39.3% with members of their families. Findings show that it is important for students to increase their network of contacts with people outside the University so that, in this way, they have contact with individuals from different backgrounds and life experiences, contributing to exchange experiences and complement technical training in the development of new business. In addition, only a minority appointed angel investors (17%) as potential partners. When we analyze the small percentage of respondents who viewed angel investors as potential partners in conjunction with the data presented in Figure 2 where many students answered that the main reason for not undertaking was the lack of resources, it is possible to conclude that it is necessary to improve knowledge students about the possibilities of obtaining resources from different sources.

5. CONCLUSIONS

The present work aimed to identify the entrepreneurial profile of Production Engineering students from an HEI located in a small city in the southeastern Brazil. Among the sample analyzed, the results show that most of the students have an entrepreneurship

intention in the long run, and the main motivation for that is to reach their independence at work. But, the lack of resources to invest, lack of interest, and knowledge in the subject were considered important barriers for the students in becoming an entrepreneur. In addition, the respondents do not see themselves offering something innovative, limiting to think an improvement of existing products. This result implies a lack of ambition in producing, or wondering something disruptive. Finally, the students see their colleagues and members of their family as potential partners in case of becoming an entrepreneur.

All those findings show that it is necessary to improve the offer of activities related to entrepreneurship in the HEIs that have a central role in stimulating creativity and the student's willingness to become an entrepreneur. In this context the HEIs should invest in practices aiming to develop technical and interpersonal characteristics of the undergraduate students. Besides, it is important that HEIs invest in training for professors, not only those directly related to the entrepreneurship classes, but for everyone inside the university that could be an agent of entrepreneurship and, therefore, may better support students in the entrepreneurship journey.

In addition, the application of tools such as brainstorming, canvas, design thinking can contribute to stimulate not only the creativity of students in the development of innovative solutions, but also interest in the topic. Besides, as defended for several authors, the pedagogical methods should be designed in such a way that they heighten students' awareness of the rewards of pursuing the entrepreneurship as a career.

Summarizing, to offer a wide range of courses and activities by the HEI studied, in addition to the entrepreneurship discipline itself, can contribute in a way that it can institutionalize entrepreneurial education. Besides, it is also important to think in developing policies to bring the private sector closer to the university to foster students to think in solutions better aligned to the market's demands, and in a more innovative way and, then, contribute to the economic and social development of the country. From a practical perspective, the empirical results of this study can be interesting for policymakers, since they can help to design new policy measures to promote an entrepreneurial culture, as well as developing new and existing entrepreneurial ecosystems. This study may also contribute to the HEIs to improve their policies and contents of entrepreneurship programs and initiatives, and to recognize the importance of investing in the development of the entrepreneurship professors.

Further research is needed to develop insights into, among others, the influence of the external environment in the willingness of the students to the entrepreneurship; the effects of personal characteristics of the students in their entrepreneurial intention; to investigate the initiatives related to the entrepreneurship developed by the HEIs, and the influence of these initiatives on the creation of new business. In addition, it is important to extend the study beyond the Production Engineering course in the same HEI, and to different HEIs as well. This study has some limitations mainly regarding the research method applied: first, the case was focused on the Production Engineering undergraduate students enrolled in the course of Entrepreneurship, limited only to one HEI, therefore the results cannot be generalized. Future research should use different methodologies, including longitudinal case studies, different methods to collect data such as in-deep interviews, and survey research to develop a better understanding of the mechanisms behind the results reported in this study.

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APPENDIX – Research Instrument (Source: adapted from ENDEAVOR, Entrepreneurship in Brazilian Universities, 4ª ed. 2016)

1) Related to the willingness for the entrepreneurship, you:

a) I think about becoming an entrepreneur in the near future (within 3 years).
b) I think about becoming an entrepreneur in the not too near future (more than 3 years).
c) I have no intention in becoming an entrepreneur.
d) I am/was already an entrepreneur.

2) The main motivation of the work for you is:

a) Financial rewards
b) My independence

3) What is the main reason for you not having an interest in becoming an entrepreneur:

a) Lack of time
b) Lack of knowledge
c) Personal issues
d) Lack of interest
e) Lack of resources
f) I had never thought about it

4) If you decided to become an entrepreneur, the product or service offered by your company would be:

a) One already existing in the national market
b) One already existing in my region
c) Improvement of an existing one
d) New to the world market
e) I do not know

5) *If you decided to become an entrepreneur, who would you consider as your partners?*

a) Family members
b) Colleagues with good financial conditions to invest
c) Friends outside College
d) College friends
e) Angel investors