

Entrepreneurial Potential of Brazilian Computing Undergraduates At A Mobile App Development Program

Alexandre Nabil Ghobril, Quézia Dias Januário Neves

Abstract— Digital entrepreneurship has been one of the chief drivers of world economy. In this context, the present research is intended to assess the entrepreneurial profile of students who participate in a program for development of mobile apps at Universidade Presbiteriana Mackenzie in Brazil. For such, this research used the Carland scale to measure the entrepreneurial potential of 32 youth from MackMobile project, also considering their choices in defining the project. The results obtained show that, although participants presented good entrepreneurial aptness in personality traits and innovation dimensions, they need to develop entrepreneurial skills for risk propension and strategic posture to become entrepreneurs. The study indicates opportunities for improvement in programs and projects focused on technical qualification in technology programs, complementing them with methodologies turned to the development of personal entrepreneurial competences.

Index Terms— Digital Markets, Entrepreneurial Potential, Entrepreneurship Education, Student Entrepreneurship.

I. INTRODUCTION

Along the two last decades, many of the best and most important universities worldwide have gone through large transformations. They have incorporated in their mission, in addition to excellence in teaching and research, a commitment with the technological, economic and social development of their surroundings, their region and their country [1].

In this scenario, entrepreneurship, particularly innovative entrepreneurship with high added value, has gained room in the university environment, because it provides opportunity to involve students, professors and the whole academic community in projects with meaning and relevance, connecting research, science and technology to the real world, and transforming knowledge into innovation, products and services to meet the demands of the market and the society in general [2].

In Brazil, this trend was expanded in the last decade, evidenced by the creation of countless entrepreneurship centers, company incubators and accelerators, technological

parks and new startups created by young entrepreneurs from universities [3].

Hence, rather than information and Internet age, we are in the age of connections [4]. The role of the Entrepreneur University is also to select youth with talent, knowledge and entrepreneur spirit and connect them to the ecosystem.

In face of that, the Universidade Presbiteriana Mackenzie offered its students the opportunity to participate in a project, called MackMobile, for creation of apps that promotes qualification in mobile technology and culminates with the development of apps for mobile devices.

The program, developed under a partnership and foment by a large multinational company, has concluded the first class with the development of 24 mobile apps, some of which are in commercial phase, available in virtual stores.

The program development has created, in the University entrepreneur education area managers, the opportunity to expand the project horizons to beyond app development, that is, to the development of businesses and startups by the students.

As a preliminary phase to the effort to support and develop undertakings based on the potential of the apps generated, this research was developed, having as main objective the assessment of the students entrepreneur profile, their knowledge of the business world and their interest in transforming a product created in a startup embryo.

Thus, the research question is expressed as follows: What is the entrepreneurial potential of students that graduated from Mackmobile program?

The specific objectives are: (1) assess MackMobile program youth entrepreneur's potential; (2) address the project types and their market targets; (3) discuss the results in relation to Mackmobile objectives; (4) lights up opportunities to improve MackMobile as a program to develop entrepreneurs.

II. ENTREPRENEUR'S PROCESS AND MOTIVATIONS

Entrepreneurship foundation is the identification and exploration of entrepreneur opportunities, in order to acknowledge the commercial potential that other people are not able to acknowledge. Entrepreneurship leads to recycling of existing products (goods and services) or of the methods to produce them [5].

Moreover, entrepreneurship goes beyond the creation of new businesses. It is the generation of innovation, jobs, income and value to society, promoting economic and social development. It is a fundamental instrument in any society. It must be encouraged because countries and regions with a strong entrepreneur culture expand the opportunities,

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the generation of innovations and economic growth. [6].

A. The entrepreneur process

Several authors have presented models to represent the entrepreneur process dynamics. There is a certain consensus in the academy that entrepreneurship is much more than the entrepreneur himself, his ideas and projects, but a long path that involves stages, learning, influences of external factors, which does not end with the launching of an undertaking, but depends on its sustainability and prosperity.

Stevenson, Roberts and Grousbeck have proposed one of the first models based on the entrepreneur tasks and on the process of business creation [7]. Later, Mueller e Goic presented a process model structured in four different stages: search, planning, resources organization and execution [8].

More recently, Baron and Shane presented a model consisting of the following phases: idea generation/opportunity recognition; gathering of resources to develop the opportunity; launching of the new undertaking; growth administration and obtention of rewards. In the model, the process is influenced by several factors like government regulations, market conditions, and relationship with partners, clients, investors and entrepreneurs [9].

Figure 1 illustrates the entrepreneur process and its stages: the business idea or concept, the event that triggers the operations, implementations and growth. It is also possible to identify the critical factors that drive the business development in each stage, such as personal, social, organizational and environmental factors.

In a wider analysis, individual variables should be considered, like techniques, motivations, entrepreneurs' characteristics; group level variables like ideas, information from other persons, efficacy in interactions with risk capitalists, clients; social level variables like government policies, economic conditions and technology, because these factors affect all actions and decisions by entrepreneurs in all phases of the entrepreneur process [10].

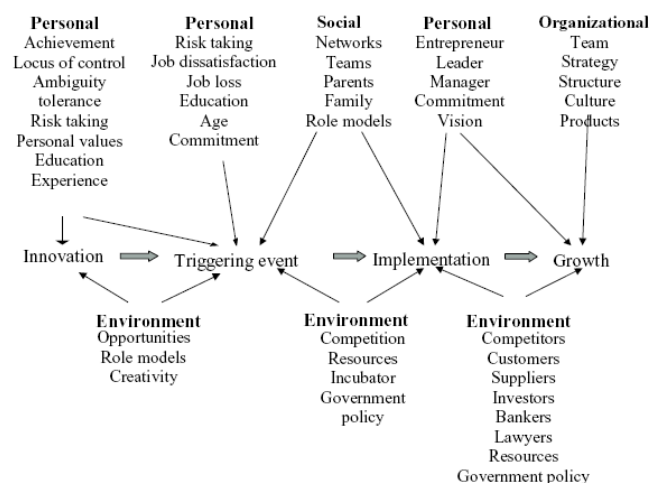


Fig 1: Model of the Entrepreneurial Process [10]

B. Entrepreneurial Motivations

Understanding how a person becomes an entrepreneur is one of the key questions in researches on entrepreneurship.

Several studies have investigated the effects of opportunity and motivation on the propension to undertake [11], [12].

Hui-chen, Kuen-hung e Chen-yi (2014), in a study with 258 persons who participated in a training for entrepreneurs in Taiwan, concluded that motivation, opportunity and skills affect the intention to undertake, balanced by personal attitude, subjective norms and confidence that he can control his destiny [13].

In this context, motivation contemplates proactiveness, availability and wish to search increasingly more information on the object of interest, while opportunity represents entrepreneurs' capacity to identify the opportunity to successfully execute the project. Opportunities can be associated both to changes in the external environment and to individual factors, such as personality, previous knowledge, and capital stock so that the person can identify, assess and dimension the project potential and its associated risks.

III. ENTREPRENEURIAL POTENTIAL

The entrepreneurial potential can be approached from different perspectives. The concepts "entrepreneurial intention", "entrepreneurial potential" and "entrepreneurial orientation" are found in different studies and authors.

The most present construct in the literature is "entrepreneurial orientation". Lumpkin e Dess define entrepreneurial orientation as "processes, practices and activities involving decision making that lead to the ingress in new undertakings and markets". The factors that make up the level of entrepreneurial orientation are: autonomy, competitive aggressiveness, innovation, proactiveness, and risk-taking [14].

Autonomy is an independent action by an individual or group to bring an idea or a vision and pursue it until its execution. That is, the desire and the competence to take advantage of an opportunity and undertake. Proactiveness reflects the initiative in the entrepreneurial process, a prospective view associated to the vision and anticipation of an advantage of the "first-mover". Risk-taking is measured by the disposition to accept high-risk projects and the preference for investing in bolder or more predictable projects to reach the strategic goals.

The Entrepreneurial orientation concept has been used in organizational analysis level, associated to the specific style of an organization director with regard to their strategic direction, be it in the speed and assertiveness of a decision process, or in the implementation of new projects. A company with entrepreneurial orientation is the one where the directors are willing to innovate, to take risks, and to test and introduce new products and services or enter in new markets, continuously seeking new opportunities ahead of the competition. [15].

At the level of individual analysis, one of the most used concepts is Entrepreneurial intention. Entrepreneurial intention indicates a person strong desire to become an entrepreneur. Katz e Gartner defined entrepreneurial intention as the search for information that can be used to help the objective of starting a business [16]. Other authors also sustain the use of models based on the concept of entrepreneurial intention [17], [18].

The Entrepreneurial potential concept involves the desire to undertake along with the perception of its feasibility.

According to the advocates of this concept, entrepreneurial potential is a stronger predictor of an entrepreneurial future than entrepreneurial intention, because it requires that, in addition to the desire, the person presents an observed behavior able to carry out the undertaking [19], [20].

A. Carland Entrepreneurship Index

This model suggests that the entrepreneurial potential is a function of the interaction between the need to undertake, propension to risk and preference for innovation. All these characteristics have strong appeal as classic descriptions of entrepreneurship in several empirical studies.

Carland, Carland e Hoy developed an instrument to measure an individual entrepreneurial potential, measured by CEI – Carland Entrepreneurship Index, which is being improved and applied in other research groups [21]. The instrument measures the personal entrepreneurial orientation and has been largely used in researches on entrepreneurship in several countries and contexts [22], [23].

CEI is a set of 33 pair of statements in a forced choice format, completed by the respondent in self-answer, which measures the individual propension to entrepreneurship in four factors: personality traits, innovation, propension to take risks and strategic posture.

By means of a preference scale, the respondent, while completing the questionnaire, based on his personality and preferences will be framed as more or less entrepreneurial. The scale was not intended to create dichotomic typologies with regard to being an entrepreneur or not, but it is one individual moves on a continuum where all would be entrepreneurs (more or less) according to higher or lower presence of the traits assessed.

IV MACKMOBILE PROJECT

MackMobile is a program developed by the Universidade Presbiteriana Mackenzie in a partnership with a large international software producer, where the students selected through interviews and tests, will be qualified and will develop, in one-year cycle, applications for devices on the producer platform.

The students selected dedicate around 20 hours a week to the project with the support of the partner company infrastructure and methodology and the University professors and deans. The 1st group counted on the participation of 50 students, which resulted in the creation of 24 apps, some of them already homologated by the software manufacturer and are entering now in commercialization phase, being found in virtual stores of apps for smartphones, for sale or download.

V. METHOD

This study is characterized as having a descriptive nature, intended to present and assess, in a more accurate way, the entrepreneurial potential of students who participated in MackMobile project 1st group.

Data were obtained from a questionnaire mailed by email to 50 students who concluded the first class of MackMobile project, to assess their entrepreneurial potential. The sample of respondents was 32 students.

The research instrument out drawn from the adaptation of Carland Entrepreneurial Index (CEI).

CEI was chosen to the present study because it was largely tested and used in several empirical researches in several countries and with different segments of entrepreneurs. It represents, in the opinion of many researchers, a reliable measure of the entrepreneurial potential because it assigns a mark or scoring to the respondent, classifying him as micro-entrepreneur, entrepreneur or macro-entrepreneur.

In CEI model, the micro-entrepreneur considers owning a company as something that may generate income but will seek satisfaction in some activity foreign to his business. The entrepreneur is the one who seeks to establish a relatively safe and profitable business, by innovation, valuing external acknowledgement and admiration. The macro-entrepreneur is characterized by innovation and unceasing search for growth and profit, with his business as the path to his self-realization

However, before the scale application, the researchers were concerned with the instrument validity in its Portuguese version, in terms of clearness and pertinence.

With regard to clearness, the question is about the wording of terms, whether the assertions were written so that the concepts to be measured are understandable for the persons involved in the project, and whether they appropriately express what is intended to be measured. As to the pertinence or representativeness, it means to observe whether the items (personality traits, innovation, propension to take risks and strategic posture) really reflect the concepts involved, whether they are relevant and, whether they are appropriate to reach the proposed objectives.

The work presented by Junior e Gimenez, which analyzed the Portuguese instrument validity and reliability to a universe of 495 undergraduate and graduate students, 26 years old in average, concludes, with some exceptions, that CEI Portuguese version has reached good levels of validity and reliability [24].

The authors, however, state that they could not statistically confirm score differences among the respondents who have already started a business and those who haven't. Another issue that deserves consideration in their study is that around 70% of respondents were business administration students who had already had previous contact with entrepreneurial theories and models and who were possibly positively influenced by the entrepreneurial culture and behavior, differently from the universe of computer students who participated in MackMobile.

Likewise, CEI scale presents many assertions that are related to a perspective of a person who is already undertaking, like for example: "I wouldn't have started this business if I wasn't sure that it would be successful"; "I want this business to grow and become powerful"; "People who work for me work hard", which would not be applied to the research universe, that is, youth with just an idea or project with business potential.

In face of that, it was considered prudent to proceed to a verification of the research instrument content validity, applying it in an initial pre-test to 10 students who participate in the University's company pre-incubator, and who provided comments on the clearness and appropriateness of the questions. After the pre-test, the instrument was adjusted, and 12 questions were eliminated, for being considered inappropriate to the respondents' context, and the wordings

of two other questions were adapted, resulting in a questionnaire with 21 questions (Appendix A). However, the original instrument concepts' structure was kept, which contemplates the measurements of personality traits, innovation, propension to take risks and strategic posture.

In addition to CEI questions application with the mentioned adjustments, hereinafter called adjusted CEI, initial questions were introduced to characterize the interviewed, like name, age, email, gender, program, period of the program, family income, job situation, name and market target of the app developed, whether they intend to undertake an entrepreneurial career at some moment of their lives, and, if so, when.

VI. ANALYSIS

A self-answer questionnaire containing 34 questions was used, 12 of them being questions for respondent characterization and about the app they developed, plus 21 questions to assess the entrepreneurial potential.

The 12 initial questions to characterize the students were name, age, email, gender, course, period of the course, family income, first-born son, religion, job situation, name and market target of the app developed, whether they intend to undertake an entrepreneurial career at some moment of their lives, and, if so, when.

The 21 questions for assessment of entrepreneurial potential were divided as follows: 05 questions to measure personality traits, 05 question regarding innovation, 05 questions related to propension to take risks and 06 questions regarding strategic posture. For each assertion the respondent marks a grade from 1 to 10; 1 being never and 10 often. (Annex A)

All 50 participants were contacted and encouraged to answer the questionnaire. After calls and recalls, 32 were answered. The sample indicated the following parameters: 22.2 years as average age; with regard to the current job: 28 % don't work, 12% are self-employed, 22% are trainees and 38% are permanent employees; with regard to family income, 22% stated income up to R\$ 3 thousand/month, 50% between R\$ 3 thousand and R\$ 10 thousand and 28% above R\$ 10 thousand; with regard to schooling or program, almost all are computer science and information systems students, and only two are electric engineering students.

Respondents pointed out 24 projects, indicating its name and target market. To better understand the market segments, we gathered additional information of the real scope of each project with the manager of the program at the University. This allowed us to properly classify the apps in 11 different areas as Education, Entertainment, Sport, Lifestyle, Food, Business, Politics, Business, Health, Social and Tourism. The number of projects is lower than the number of respondents because many projects were taken by teams. Figure 2 shows the number of final projects developed in each area.

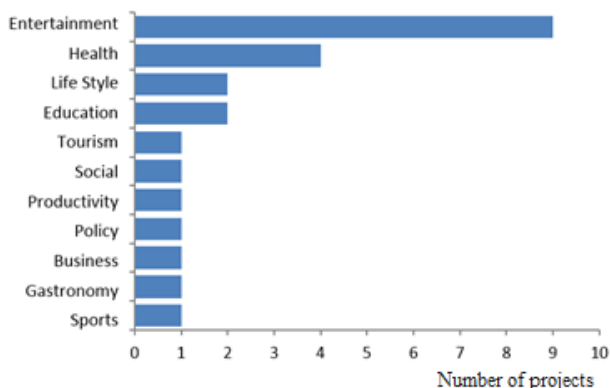


Fig 2 - Market segments of mobile apps

Results sign the prevalence of entertainment projects, mainly games, followed by health, life style and educational applications. Project descriptions and target markets show their preferences for creating or proposing solutions related to themes that are relevant to their day-to-day experience. Other point that deserves attention is that most of the projects, although based on an innovative idea, does not necessarily fill a real market demand. From the 24 projects presented, only 3 seemed to attend a clear external market demand, as the one attaching the needs of a car racer to improve his data performance analysis, other delivered to fill a doctor's need for diabetics patients and glicor control and the third developed to solve a problem of professional musicians to the right tune of their instruments.

When analyzing the entrepreneurial potential of the students, the research compared the average scores obtained by each of the respondents, calculated in a scale from 10 to 50 in each dimension of entrepreneurial potential in CEI scale. As can be seen in Figure 3, the entrepreneurial characteristics most present in respondents were personality traits and innovation, being less prepared to take risks and with still more difficulties with regard to strategic posture

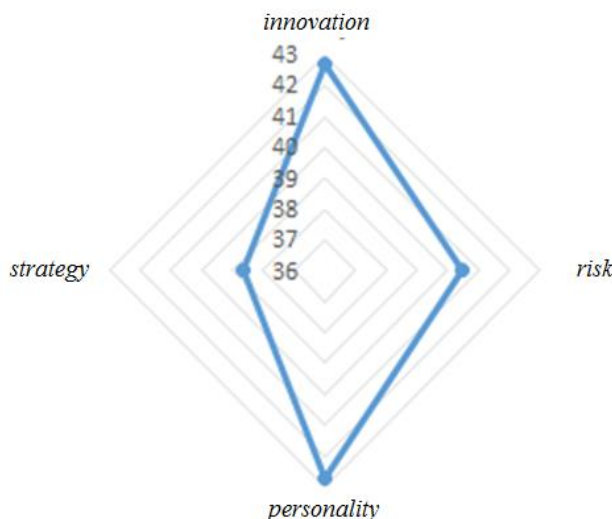


Fig 3 - Average scoring in each CEI scale dimension maximum=50 scores

These results are consistent with other researches on propension to undertake entrepreneurial competences among university youth, showing that dimensions like strategic posture and risk taking deserve the attention of educators in planning their project and related activities.

VII. FINAL CONSIDERATIONS

Forming professionals with entrepreneurial skills has been a guideline in many top universities worldwide. In view of that, entrepreneurial education has been increasingly discussed and expanded, either as a form of developing in students their non technical personal skills and their soft skills, as required for the work market, or to create a generation of persons prepared to start and manage their own innovative businesses with higher success potential.

This vision guided Mackenzie Presbyterian University staff to hold the MackMobile program, turned chiefly to computer sciences students and culminating with the development of apps to mobile devices, with the following objective: develop technical and entrepreneurial skills on the students and leverage business startups that could be supported by the University business incubator.

Nevertheless, after the conclusion of the first group of MackMobile, it could be noted that most of the apps didn't become viable commercial products nor even generated student interest to develop startups. After a debate among managers of MackMobile program and the staff of the Center of Entrepreneurship, there was a common understanding that the program should be improved in some aspects, considering also the entrepreneurial potential of the students and the mechanisms to help them to build better value propositions in accordance with market demands. This was the main motivation for the development of this research.

Therefore, the research could access two different dimensions: the students' aptitude and potential to become entrepreneurs and their capacity to find out a relevant problem and a market niche, which is also another important issue to make the idea turn into a successful business.

Assessing the level of entrepreneurship and the entrepreneurial potential of the students brings two advantages: first because, while identifying those skills not developed by them indicates opportunities for the project qualification and improvement; second because it helps identify persons interested and with potential to develop their own businesses and supports them in this path.

In order to proceed to the assessment of MackMobile youth entrepreneurial potential, we assigned a score to compare them at four dimensions: personality traits, innovation, propension to take risks and strategic posture.

Results have shown that certain students have perceptible differences compared to the others in terms of aptness to undertake entrepreneurial projects and identify market opportunities. External factors that may influence this difference were not analyzed in this work, though there are several studies indication the variables that can explain them, like family influence, life experience and even beliefs or religion.

The students see themselves, in average, as having personality traits comparable to those that characterize the entrepreneur, particularly proactiveness and self-confidence. They also see themselves as innovative, creative, though

some of them confound having many ideas – sometimes disconnected from the market needs – with innovation.

The chief difficulties, in average, as indicated by the scoring of entrepreneurial potential, are associated to risk-taking, management and strategic vision skills. This signs an opportunity to improve the program, not only in the selection phase, looking for candidates with an open-ended entrepreneurial mindset, but also during the program, proposing activities, lectures and mentoring that leverage their soft skills and typical entrepreneurial competences.

The other important constraint showed by this research is the difficulty that most of them present to address a relevant project with real market demand.

One limitation worth mentioning is that part of the analysis is focused on the student's answers and personal perception on their behavior, which not always corresponds to reality. It means that an additional care must be taken in the reading of the results.

Two important contributions of the present work are outstanding: from the point of view of knowledge to the academic environment, the research advances for describing personal skills and career aspirations, innovation, vision of opportunities, strategy and management skills of young students of technology-based higher education, an area that counts on few works published. At the management side, the project also helps identify and provide a better understanding of how much this kind of program can help technology students to become entrepreneurs and the challenges associated with it. The reflections and insights are useful not only for Mackenzie University staff but, in a wider perspective, for managers of similar programs running in other universities that also focus in technology and entrepreneurship education.

Finally, the works starts from a belief that entrepreneurial skills can be acquired and developed and the university can and should encourage it with the entrepreneurial education.

We suggest the replication of this research in other similar contexts to confirm and expand the analysis herein presented.

APPENDIX A

Research Instrument (CEI adapted questions)

1. I search for information on my projects in different sources (I search similar projects)
2. I implement new ideas in projects I'm working (I can't help making changes in projects already started)
3. I often assess new opportunities for projects
4. I always think of new ideas to solve persons or companies problems
5. My projects are innovative (I try to create new solutions through my projects)
6. I calculate risks before a new step (I rationally assess new projects' advantages and disadvantages)
7. I take risks to reach my professional goals (I would forego my current job or get a loan to start a new important project)
8. I keep my objectives even in face of outcomes that are not initially satisfactory
9. I trust in my capacity to overcome challenges

10. I consider myself as the chief responsible for my projects performance and conclusion
11. I act before being pushed by circumstances
12. I join the collaborators in tasks to meet deadlines
13. I take the responsibility for the conclusion of works on time
14. I sacrifice my personal life to conclude tasks
15. I assume responsibility for solving problems that may hinder the development of my projects
16. I make clear projections of the future of my projects
17. I define clear and specific short, middle and long-term goals.
18. I continuously review short-term goals (I write them down)
19. I adopt procedures to ensure that the work will meet quality standards.
20. I use personal contacts to reach my goals
21. I encourage the participation and team spirit of collaborators/team in the search for a solution to a problem.

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