

Title: Teaching entrepreneurship in the agricultural
sciences: The case of the Empreenda Agro Sustentável
Program

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Abstract

The objective of this work was to present information on the development of sustainable innovation and entrepreneurship through educational actions by the Empreenda Agro Sustentável University Extension Program. In order to fulfill the proposed goals, workshops roundtables were adopted as a methodology, in order to develop agile management values and techniques and promote entrepreneurship as an agribusiness. The activities were developed in four workshops, which worked with active methodologies, lectures considering the promotion of meaningful and collaborative learning. During the project modules (workshops), participants tested their insights so that additional requests could be made and / or that errors in planning could be found and, debated and mitigated. Through the Empreenda Agro Sustentável program, based on the application of active methodologies, students groups discussed and matured ideas on start-up models, resulting in scalable and negotiable businesses in rural areas. Those teams who were involved in each of the steps (workshops) boosted their entrepreneurial visions through methodologies different of those usually worked in their regular academic curricula of undergraduate courses in agry sciences.

Keywords: Sustainable business, entrepreneurial education, university extension, agribusiness

1. Introduction

The ability to stimulate innovation, especially the disruptive one, associated with entrepreneurship, is fundamental to promote growth and future performance of the agricultural sciences professionals in the new market for services and products (Santos *et al.*, 2015). The act of innovating can be understood as the art of making things happen with creativity and motivation, and it consists in the pleasure of carrying out synergistically any personal or organizational project, a permanent challenge to opportunities and risks, and assuming a proactive behavior in the face of issues that need to be resolved (Melo *et al.*, 2015). This concept brings similarities with the act of entrepreneurship. In this context, the ability to implement innovation is fundamental to the professional's career growth and maintenance

progress, mainly in the agricultural sciences for his new market of services and products (Weisblat & McClellan, 2017).

To be innovative, multiple skills are needed to find alternative solutions to problems and perform ideas that bring improvements (Poon, 2014). When creativity is fostered in the educational environment by the adoption of an entrepreneurial behaviour, the achievement of the student's intellectual autonomy is a consequence (Berg *et al.*, 2020).

To develop creativity in the academic environment, many teaching centers have used active methodologies, which contributes to the knowledge of the contents in activities that the market requires (Poncelet & Hudson, 2015).

In a globalized world where technology is advancing and reaching more and more space, teaching can't be restricted to traditional technical knowledge (Bayhan & Karaca, 2020), and communication should not happen only unilaterally. The student must be the protagonist of learning (Szerwieski *et al.*, 2018). Scientific studies in education focused in the development of entrepreneurship education can provide interesting contributions to highlight new ideas within the agricultural sector.

There are few opportunities for academics to generate sustainable technological innovation, including the practice of the acquired knowledge (Arcila, 2018). In the same way, for an innovative idea to achieve the desired success, it takes much more than technical knowledge.

For a sustainable business to be successful, it takes more than an innovative idea. It must have the tools and trained professionals. Currently, these business categories contribute to the growth of several geographic regions, since they expand not only but also in new locations, besides encouraging employment in their related industries (Alves & da Silva Jr, 2015). Given this scenario, for the learning of professionals to be more effective, several approaches and methodologies arise.

In this context, there must be a greater production of studies and content on entrepreneurship and educational models that best apply in this learning process (Dionello *et al.*, 2020). As a topic of great importance, entrepreneurship education promoted within higher education can be the path to the emergence of sustainable, economically viable and scalable business (Fichter & Tiemann, 2020).

In the educational methodological context, we have active methodologies, which bring the possibility of changing the centrality of the teacher (teaching) to the student (learning) (Pereira, 2019). This methods understand education as a process that is not carried out by someone else, or by the individual, but that happens in the interaction between people through their experience, through words, actions, and reflections. It is believed that entrepreneurial behavior as an inducer of innovation can be stimulated through the use of university extension projects such as the Program Empreenda Agro Sustentável (Martins *et al.*, 2016). The objective of this work was to present information on the development of sustainable innovation and entrepreneurship through educational actions by the Empreenda Agro Sustentável University Extension Program.

2. Methodology

In order to understand the entrepreneurial students behavior a total population of 1,453 students from the undergraduate courses of Agronomy Engineer, Agricultural Engineer, Animal Science, Forestry Engineer, Veterinary Medicine and Fishery Engineer from the Centro de Ciências Agrárias Aplicadas (CAAA) of the Universidade Federal de Sergipe was considered. The last sample comprised 118 students who regularly were involved in the Empreenda Agro Sustentável Program.

The activities were developed in four workshops, with active methodologies and lectures considering the promotion of meaningful and collaborative learning. During the workshops, the participants tested their insights attending additional requests, providing the errors identification in planning through debates and mitigation.

After all the *Sprints* (workshops activities) were finished, when all modules were covered, a cycle of presentations and development of the abilities went on, showing products through summarized presentations (Pitches).

During the project modules (workshops), participants tested their projects, covering additional requests and/or errors, providing there planning, through the business modeling methods (Lean Canvas and Business Model Canvas), (Flores-Aguilar, 2019; Nidagundi & Novickis, 2017; Osterwalder & Pigneur, 2010).

2.1 Pedagogical Program Planning

The Empreenda Agro Sustentável Program brings the proposal of teaching entrepreneurship in a multidimensional, multidisciplinary and disciplined way. This program used workshops divided into themes that would allow a global understanding of entrepreneurship.

This program combine workshops in a daily format (Figure 1) in order to develop business characteristics and plans with lectures given by highly knowledgeable professionals in their specific areas. With *team-based learning*, the program initially was delimited by the enrollment of participants only in pre-established groups.

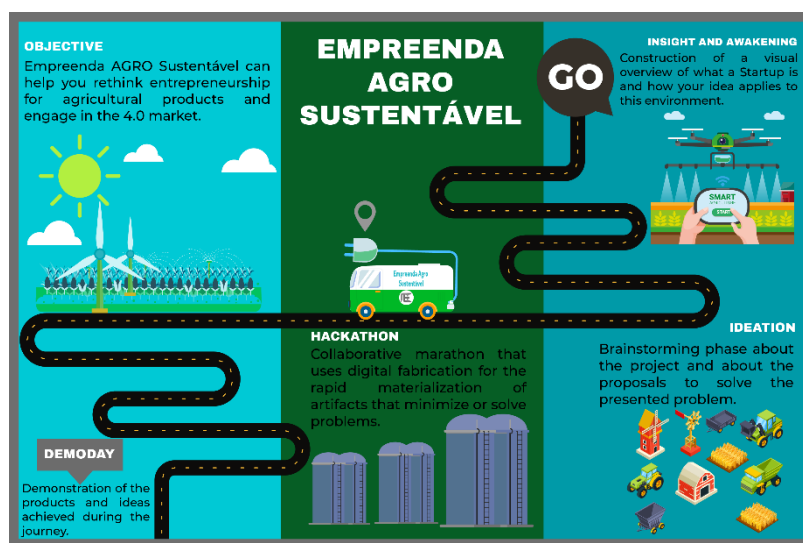


Figure 1. The proposed journey by the Empreenda Agro Sustentável Program

2.2 Mobilization of Teams

Initially, vacancies were opened for students of undergraduate courses registered in the Centro de Ciências Agrárias Aplicadas (CCAA) of the Universidade Federal de Sergipe (UFS), carried out by a team, based in the following criteria:

- They were regularly registered and taking any undergraduate course of UFS, and at least one student registered in the CCAA;
- Show availability of time to take part in all scheduled workshops;
- Willing to deal with teamwork.

The program worked with a number of 118 effective students, the sample number for the research. For the delimitation of the teams, 12 priority productive chains and areas of agrarian development were listed (Table 1).

Table 1. Listed themes Areas suggested to the development of the ideas by registered students in the program.

Listed themes Areas worked in the program	
Sustainable Agriculture	Phytotherapy
Foods	Hygiene/beauty products
Mobile applications	Tourism
Agricultural Automation	Green Livestock
Biotechnology	General technologies
Creative economy	

2.3 Workshops

To better develop the mentoring of the proposed objectives, four events were carried on this research, the "Workshops", that approached themes about entrepreneurship and entrepreneurial behavior.

2.3.1 Workshop 1

Seeking a greater engagement of the participants, five strategies/dynamics were applied: Presentation of the ideas initially proposed; Golden Circle; who am I in the Universe?; Discovery of the client and the development of the value proposition (Figure 2).

In this phase, educational dynamics were developed to present the proposed ideas and oral expression, and to develop the value of a new product. In Figure 2 the schedule of the proposed activities is presented.

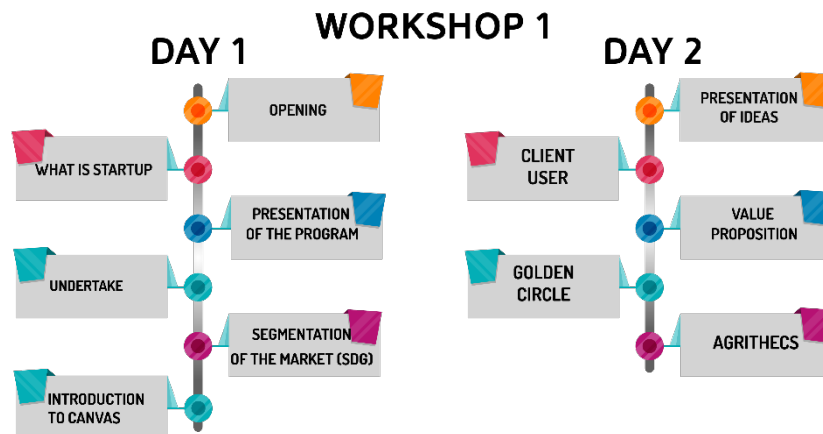


Figure 2. First Workshop of the Empreenda Agro Sustentável Program

2.3.2 Workshop 2

With the macro perspective of the meaning of innovation and business, the second meeting presented the proposal for the discovery of opportunities and the development of insights, working with business hypotheses and innovations mining (Fig. 3). Empathy maps have also been developed to understand customers and users of business ideas.



Figure 3. Second Empreenda Agro Sustentável workshop

After the development of the business persona through the empathy map, from the participant

was expected to reach a holistic view of what he wants to produce as a business. Then they visualized the possibilities and structures of the business, the framework, worked through the *Lean Canvas* proposed by Maurya (2012), based on the development of the Business Model Canvas (BMC) among other materials. He adapted 4 BMC staff, seeking to work on aspects of greater risk to create Startups.

The Lean Canvas was structured by the following fields: Problem, Customer Segments, Unique Value Proposition, Solution, Channels, Sources of Revenue, and, Cost Structure. (Maurya, 2012; Sebrae, 2019). During the workshop, it was recommended to build a board according to Figure 4.

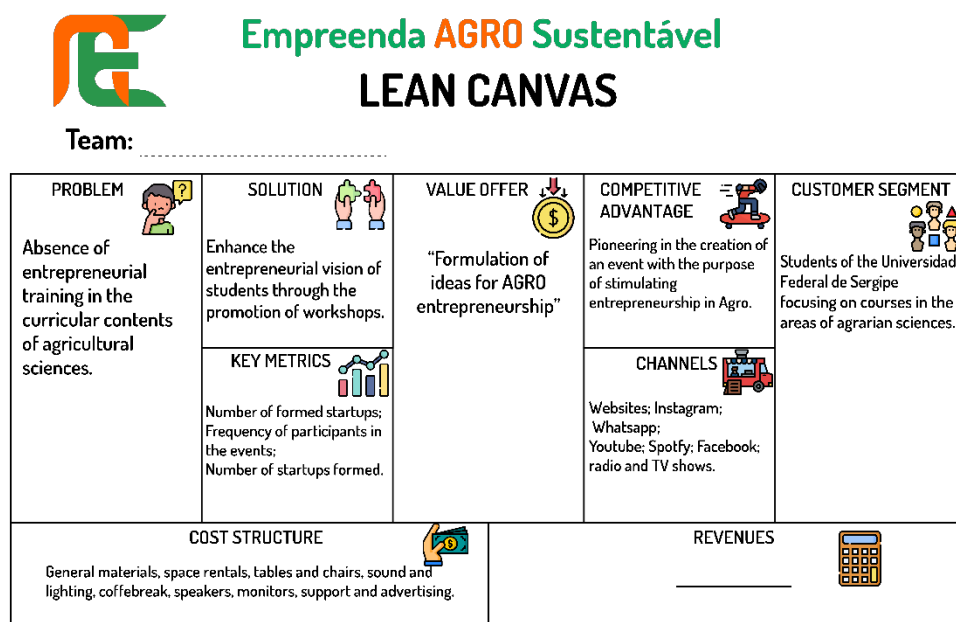


Figure 4. Diagram of the Lean Canvas Model of the Empreenda Agro Sustentável Program

2.3.3 Workshop 3

In this workshop, the Hackathon (Figure 5) was carried out, when the students developed their Minimum Commercially Viable Product (MCVP) according to Aulet, (2019). A Hackathon-style learning workshop brings together people of various abilities to solve one or several proposed problems.

They are usually organized as intense and fast-paced games, where teams generate innovative solutions. In this research, two models were adopted to present the proposals: *Storytelling* and *Storyboard*.

The tool *Storytelling* (TS) is a narrative form that creates a context in which a product or process can be introduced to a developed story. "Story" means history and "telling", to tell (Brites et al., 2018).

The *Storyboard* (BS) is a sequential sketch in an organized way just like a series of comics or

similar to a short film that presents the product or even the narrative context of the TS. The image of a Storyboard conveys a more faithful impression of a real image (Moreira *et al.*, 2018).

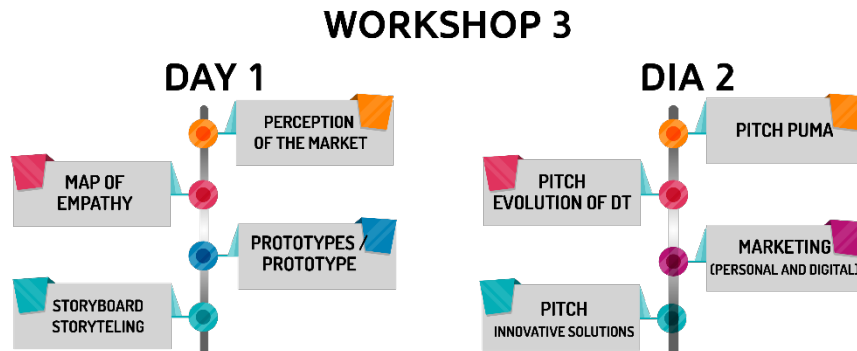


Figure 5. Third Workshop: Hackathon Empreenda Agro Sustentável

2.3.4 Workshop 4 - Demoday

The Demoday or Demonstration Day of the business models of startups was held on November 22, 2019. This was the event in which startups became involved, presented to investors, who are represented by “*venture capitals*”, accelerators or angel investors.

The Workshop was proposed in the format of "Talk Show" with the display of the *pitches* of each business to all audiences present at the event (Figure 6).

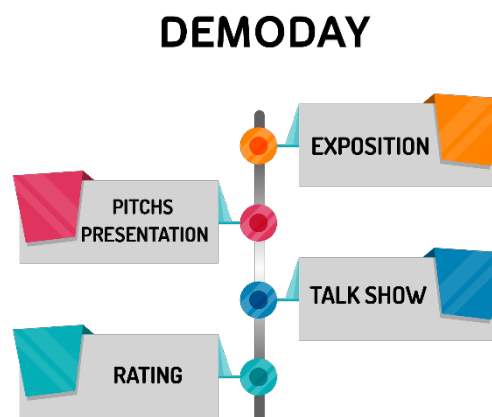


Figure 6. Fourth Workshop: Demoday Empreenda Agro Sustentável

3. Results

3.1 About the teams and participants

The development of this program counted with 26 teams in a total of 118 students from undergraduate courses of the Centro de Ciências Agrárias Aplicadas (CCAA) of the Universidade Federal de Sergipe (UFS), in addition to other courses such as: Visual arts, Administration, Graphic Design, Chemical Engineering, Production Engineering, Marketing and Ecology, enrolled in the 26 teams. After the four events only 15 teams was continuously kept in the program.

Business proposals focused on their largest number of applications: mobile App 27.1%, followed by businesses for sustainable agriculture 19.5% was presented (Figure 7). Currently, many paid and free agricultural mobile applications have been developed for rural areas, covering several areas inside and outside the rural property, helping the agricultural development for both large and small properties (Silva, 2017).

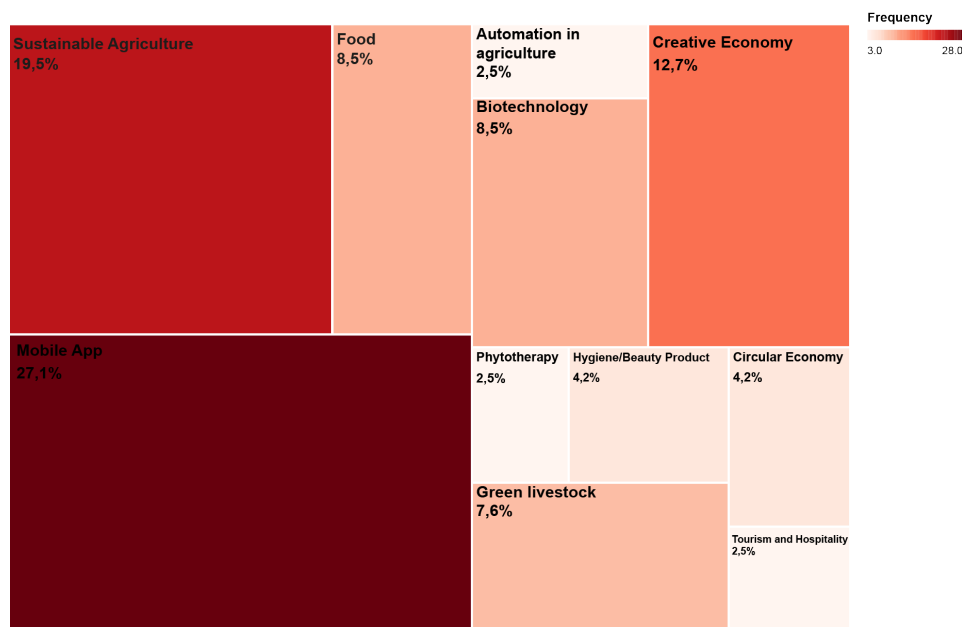


Figure 7. Potential and business proposals areas of the teams

The under graduate course with the higher participation was Agronomy Engineer, representing 47.32% of this total, while Animal Science, Agricultural Engineer, Forest Engineer, and Fisheries and Aquaculture Engineering took part in percentage terms, respectively, with 19.64%, 11.61%, 6.25% and 4.46% of the total enrolled students.

The number of participants decreased during the workshops until 15 teams composed of 3 to 5 students who reached and transformed ideas into business models, in a training process through active methodologies. Evasion of academic projects can be explained by the lack of a culture that promotes educational models within the university that stimulate the practices in projects that show students how to leverage their professional life projects. Also, contribute to students' evasion and lack of interest, the lack of perspective on life change and distance from the entrepreneurial culture.

The program highlighted the need for proposals in order to explore this segment within the

university since entrepreneurship is still little encouraged in the academic environment. Unfortunately this is not very common, especially within the agricultural sciences, what could contribute to training of capable professionals in entrepreneurship, bringing characteristics and knowledge that will help them in the job market.

To mitigate these increasingly complex problems in agricultural production, advances in intelligent agriculture, decision-making methods based on information techniques, precision agriculture, and new embedded technologies, offer important tools to face these challenges, while maintaining agricultural sustainability. Agricultural practices not only focus on enriching agricultural productivity but also help to reduce harmful environmental impacts related to sustainability (Adnan *et al.*, 2018; Ye *et al.*, 2020).

3.2 Workshop 1 development

The activities were held in the 9th and 10th of August 2019, an opportunity to present the Workshops program, called “The Journey”. This Workshop was focused on the development of lectures that addressed topics related to entrepreneurship, such as startups, entrepreneurial behavior, and entrepreneurial culture, problems (market segmentation) according to the SDGs (Sustainable Development Goals) and Agritechs in the lecture “Digital technologies and opportunities for Agribusiness”. Based on the active methodologies as a pedagogical basis, the Lean Canvas workshop was held with a focus on the value proposition (Figure 8).



Figure 8. Workshop 1: (a) Lecture on market segmentation and (b) Lean Canvas discussion

3.3 Workshop 2 development

The second workshop took place on August 30 and 31, 2019, when topics such as the search for opportunities as a fundamental characteristic of an entrepreneur, collaborative economy “Coworking”, and the benefits of shared space were addressed. These were cross-cutting themes that contributed to the theoretical teams support (Figure 9a). Proactively deepened the knowledge about each Lean Canvas block (solution, channels, key metrics, competitive advantage, revenues, costs, and closing the value proposal) (Figure 9b).

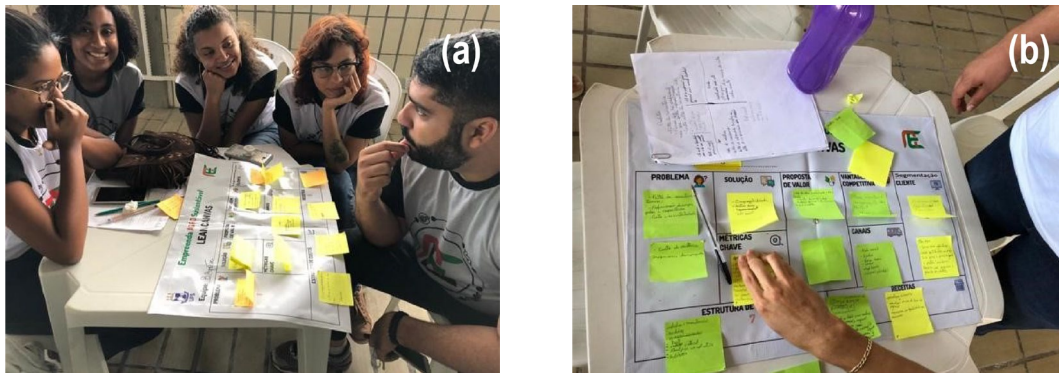


Figure 9. Workshop 2: (a) Team Discussion and (b) Building Lean Canvas

3.4 Workshop 3 development – The Hackathon

The third workshop was held on 18 and 19 October 2019. This workshop was conducted as a Hackathon when the perception of the market was worked out, and the construction of prototypes such as “Storyboard” and “Storytelling” (Figures 10a-b). Meetings like Hackathon comprise programming marathons, when the teams worked on their ideas and build a Minimum Viable Product through prototyping.



Figure 10. Workshop 3: (a) Deepening the discussion and (b) Prototype workshop

3. Workshop 4 development – The Demoday

The Demoday or Demonstration Day (Figure 11) of the startups' business models was held on November 22, 2019. That was the event in which startups (groups of students) presented their products to investors, represented by *venture capitals*, accelerators or angel investors. On that occasion, young entrepreneurs presented their projects searching for investments.

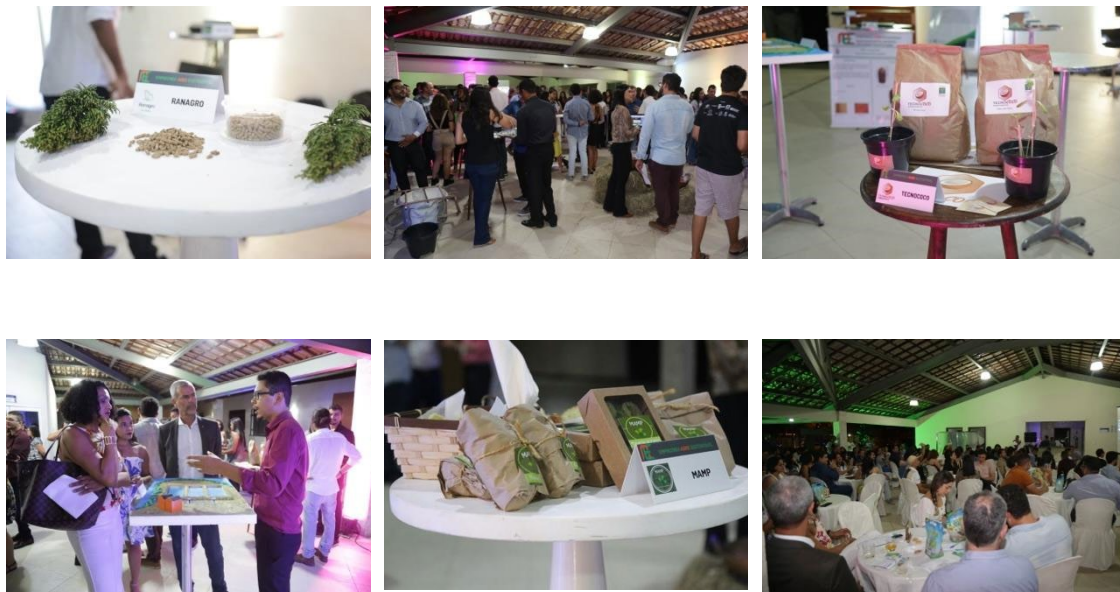


Figure 11. Workshop 4 – Demo Day show

3.6 Developed Products and Brands

The teams' work resulted in 16 brands (Figure12), developed throughout 5 (five) months hard work of 15 groups based in lectures, discussion's groups and mentoring, as follow.



Figure 12. Portfolio of the developed brands.

3.6.1 Aqua Plant

Startup, which seeks to eliminate the uncertainties that afflict the farmer regarding his production, based in a closed aquaponics system, with water recirculation. At the end of the process, the producer will guarantee protein and vegetables quality. The product is integrated in technical help packages, both directly to the producer and also in contracts with municipalities

3.6.2 Agrion

Application developed by digital systems, in order to directly connect producers to markets retailers about buying and selling agricultural products where profitability is predicted by charging tax on the total amount of sales differentiating wholesale and retail sales values and percentage of income by product.

3.6.3 BAgroTec

This App connects the producer to the professional who works with agriculture production, solving problems in the field, and at the same time generating a job market for professionals. Besides the App, the BAgroTec website help in the producers registration in the mobile platform.

3.6.4 Agropec

The business model is based on the production of lamb meat with zootechnical efficiency and financial management. The bonus of the results, purchase and sale of agricultural products with predicted profitability occurs through the collection of taxation over the total amount of sales, differentiating wholesale and retail sales values, and percentage by product.

3.6.5 Agro View

Developed product to monitors production in the field. To be more assertive in identifying and deciding to apply the products at the right time, customers have to sign a monthly contract, that provide planning related to pests control and other related activities in order to avoid unnecessary costs.

3.6.6 Be Soluções

To reduce water waste, this system has been proposed. Unlike the current systems that have a high cost and do not have as many resources in a unified way, as a single equipment, a product was developed to provide a high precision using a system of data collection in real time, in the specific place of the culture.

3.6.7 Grão Nordeste

Knowing the reality of the small and medium farmers about the lack of a storage unit, losing part of their harvest forcing them to sell at the lowest price, a Northeastern startup present a low cost and sustainable silo, avoiding unnecessary expenses and waste of in the stored production.

3.6.8 Horta House

This product solves the problem related inadequate consultancy for urban gardens, that does not meet this growing demand. Then trying to solve this problem, many people end up taking instructions from people who rarely have an adequate qualification and technical recommendations, which sometimes end up causing the cultivated plants not to respond as desired. Here is the solution, Horta House.

3.6.9 ItecAgro

This Platform offers a direct interaction with a multidisciplinary team focused on agro, which uses digital systems to boost its business in an innovative, entrepreneurial and sustainable way; propose access to an easy channel through digital systems in order to develop solutions through quality technical help, generating value to the producer and promoting socio-environmental responsibility, working with excellence.

3.6.10 Impacto Pescados

Startup specialized in the creation of type shrimp (*Litopenaeus vannamei*) using a diesel-powered pump for suction of sea water, making water exchanges more frequent, making the culture time shorter, launching a quality product on the market with a shorter growing period.

3.6.11 La Flora Pet

Observing the growth of the PET market in recent years and the persistent pains suffered by the owners of these animals, mostly related to high cost and accessibility to efficient treatments, La Flora Pet develops natural and artisanal products based on extracts or essential oils. After registering personal data of the client and user, personalization comprises choosing the extract or essential oil according to the desired therapeutic purpose, and also the format, color and size of the product delivered in the customer's address.

3.6.12 MAMP

Palm (*Opuntia cochenillifera*) is not a conventional food in Brazil, however, in Mexico and other countries with Mexican influence, there are already over 200 recipes using this species. The Fitness market has a great demand for healthy food, so we brought Palm as an alternative to supply this lack of the market, currently supplied with high-cost products, different from our low cost and high products.

3.6.13 Ranagro

With the market becoming increasingly competitive, it is necessary to innovate in order to achieve a satisfactory and economically viable result for the producer and consumer, besides bringing innovative technologies to the ranch sector, specially in the frog market. The ration offered on the market is the same used to raise fish, which causes less use of the meat and increases the cost for fattening.

3.6.14 Tecno Coco

The idea is to generate a cyclical production chain where the the coconut is produced commercialized to the retailers, discharged elsewhere and then processed by our Startup, returning to the field as an agricultural input, helping in productivity.

3.6.15 Une Agro

UneAgro has developed an application where the producer can advertise his products in a practical and quick way, without leaving home, where he will find a wide range of interested customers. The application is developed for both farmer and distributor.

4. Discussion

The objectives proposed by the Empreenda Agro Sustentável Program were accomplished once several undergraduate students from agrarian sciences and other areas of knowledge at UFS were mobilized and challenged to create startups proposals using active methodologies in a pre-acceleration phase.

Despite the growing interest in innovation research in the academic environment, the development of new products from the teaching units, very few studies currently explore how the academic environment interferes in the development of new products aimed at the rural environment sustainably. This study shows that the university with the university extension program can also be a pre-acceleration center for new businesses and enterprises.

The 15 teams presented their Business Models with great consistency, attracting the attention of investors, or putting themselves up for discussion with accelerators, who will search for investors. In this way, universities and colleges can promote quality knowledge, fostering students' self-efficacy and entrepreneurial intent.

The improvement of Entrepreneurial Education in higher education, especially in agricultural science courses, with an emphasis on practice and contact with new businesses, can directly contribute to the formation of professionals capable to generate new scalable businesses, based in the purpose of the development of the entrepreneurial spirit promoted by the program, together with self-efficacy, can be positively influence educational programs, as presented in the results.

The Empreenda Agro Sustentável Program was a pioneer in conducting actions with this formation of contents for the university education of agrarian sciences in the state of Sergipe, with a strong contribution on the increase of the entrepreneurial behavior, even in situations where the entrepreneurial intention face the lack of interest of entrepreneurial behavior by the student's family.

This project shows that participants in university extension projects positively develop their entrepreneurial ambitions and the development of new businesses planned in the pre-acceleration stage, and find greater security for the next step, which is the acceleration of their business plans.

For the next works, it is recommended that the dimension of entrepreneurial motivation must

be studied, which actions leading students to seek extension courses and programs that deal with this theme, to understand what have to be done to this individual develop a new business, until it becomes the object of your personal fulfillment.

And finally, it is recommended to develop an action research, which allows evaluating the students taking part in the acceleration phase of their ideas developed during the pre-accelerator program, making it possible to assess the program's levels of influence after the phase proposed in this study.

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