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INNOVATION TO ACHIEVE THE SUSTAINABLE DEVELOPMENT GOALS (SDG) THROUGH THE USE OF BRAZIL POTENTIALITIES

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INTRODUCTION

The 2030 Agenda for Sustainable Development establishes a roadmap for peace and prosperity for people and the planet today and in the future. The 17 Sustainable Development Goals (SDGs) are at their root, and they constitute an urgent call to action for all nations (developed and developing) to work together in a global partnership (United Nations, 2015).

The contrast between technological progress and developmental sustainability has become a worldwide human–natural–societal dilemma discussed in diplomatic talks, academic research programs, and corporate initiatives (Zhou and Etzkowitz, 2021).

Humanity must come up with creative ideas to critical problems in both innovation and sustainable development (Zhou and Etzkowitz, 2021).

Globalization requires that companies adapt to constant evolution in order to to survive. Companies lead markets through strategic knowledge management (Berbegal-Mirabent *et al.*, 2015).

This study presents the case of a small innovative Brazilian firm that is based on the principles of *Kaizen* (continuous improvement) and sustainable development (Environmental-Social-Economic) to structure its business model, develop new products and processes. It is relevant to highlight that the objective of this study is to present the application of theoretical concepts in business reality.

The firm uses scientific knowledge management to develop new products and processes based on the regional potential to innovate in the market in which it operates, generating a competitive advantage that allows the company to differentiate itself through innovation based on sustainability that contributes to achieving 7 of the 17 SDG – Sustainable Development Goals: SDG 3 – Good health and well-being, SDG 7 – Affordable and clean energy, SDG 8 – Decent work and economic growth, SDG 9 – Industry, innovation, and infrastructure, SDG 10 – Reduce inequalities, SDG 12 – Responsible consumption and production, and SDG 13 – Climate action (United Nations, 2015).

The article is structured as follows: an introduction, the context, a presentation of the problem-situation diagnostic, the proposed intervention with the mechanisms used to solve the problem, the results, and lastly, the technological-social contribution.

INVESTIGATED CONTEXT

The company's founder started its activities in 2013 with an ice cream shop, in which he produced a natural grated coconut to serve as an option for his products.

Within the first year, it was possible to identify the opportunity in the commercialization of natural grated coconut. The firm then started to allocate its resources for the production of this product. As there was no equipment on the market for the processing of natural grated coconut for small companies, the company invested in R&D from the beginning to perform the adaptation and development of the required equipment for this operation to become feasible.

In 2014, he started the activities of a small food industry for the production of just one product, the natural coconut grated. The lack of necessary equipment for small industries prompted the company to invest in Research and Development (R&D) from the start. To reduce

waste, increase productivity, and improve process efficiency. The company has developed new products and new equipment to optimize its operations.

The enterprise has developed and adapted various equipment such as Coconut Sander (200kg), dimensions 1400mm X 1000mm X 1000mm, stainless steel structure: perforated rotating discs, 7hp engine, 1,720 rpm, operating voltage 220/380/440v. Washing System that uses a 1 Tonne Hoist: designed an Automatic Electric Boiler of 25 liters, which reaches a temperature of 140 degrees Celsius, made of stainless steel to withstand the pressure of 3 Bar and the Autoclave for cooking food with 200 liters and temperature up to 120 degrees Celsius with a 3 Bar of pressure.

The company is recognized as innovative by university professors, investors, bank investment analysts, and various business management, architecture and engineering professionals. Arousing the interest of all the actors in which it maintains a relationship. On the other hand, it attributes all its prominence and competitive positioning to its strategic orientation towards Innovation aiming at a Sustainable Development based on the Economic-Environmental-social triad. Therefore, the company applies academic knowledge in its business reality for the sustainable development of the product, generating income and employment from regional potential with the production of food and equipment, utilizing solar technology and automation. The development of the equipment resulted in the creation of a spin-off for its commercialization.

The company's goal is to be the most efficient in the segment, operate with lean production (everything it produces it has been already sold under customer order), and seeks to replicate its business model for coconut processing in other locations in Brazil and around the planet.

The strategy used allows the company to remain highly competitive. In the firm's region, the main economic activity is tourism, and most of its revenue is associated with sales to high-end hotels. In 2020, during the Covid-19 pandemic, the hotels were closed for six months (only 50% of the year), and even so, the firm maintained good results by launching new products, which increased average ticket and customers acquisition. In 2021, the company signed a nationwide supply contract for a large enterprise that will double its revenue only with the minimum monthly sale provided in the contract.

PROBLEM-SITUATION IDENTIFICATION

To comprehend the situation-problem, it is necessary to understand the profile of the company's founder, who had a store for ice cream and açaí sale (very common products in Brazil), in which, upon realizing a market opportunity in the food market of Natural Grated Coconut, became with a plan and change of strategy to start the manufacture of this product.

The company, from the beginning, was already oriented towards taking advantage of business opportunities, characterizing itself as a business based on entrepreneurship designed to opportunity. That is a fundamental strategic aspect of the company, its business model, and its high flexibility and adaptability to new changes.

Borozan and Pfeifer (2014) state that entrepreneurial activity can be related to both business opportunity and a social need to generate income derivative from employment deficiency (for example). Opportunity-motivated entrepreneurship leads to greater

productivity, which is responsible for increasing competitiveness and value creation. There is political interest in their encouragement and growth.

Vivarelli (2013) points out that the sets of business initiatives can be analyzed as a very heterogeneous environment, in which real innovative entrepreneurs are accompanied by passive followers, extremely optimistic people, and even fugitives from unemployment. Davidson and Honig (2003) emphasized the importance of human capital in entrepreneurial activity, stating that the greater quantity and quality of human capital facilitates the perception of opportunities and identification of new profitable activities. After engaging in the entrepreneurial process, these requirements also present a superior ability to exploit identified opportunities successfully.

Motivated by opportunity, the company changed its business from an ice cream store with a quality coconut that was successful among customers to an industry that supplies some of its former suppliers and large stores acquired in the previously operated segment. This point is essential for us to understand the company's profile and its business, how it has been able to adapt, shape, and change itself, allowing the exploration of better opportunities. Without this motivation, it could have remained as an ice cream store forever.

The company's founder, since its inception, sought to deepen and fully understand all coconut processing processes, having visited several industries in the segment. In addition to constantly seeking guidance from SEBRAE – Brazilian Support Service to Micro and Small Companies and FIERN – Federation of Industries of the State of Rio Grande do Norte. The firm's investment in R&D was able to set up an efficient process from the construction to the adaptation of industrial equipments according to its needs, combined with an intelligent layout accordingly to the processes flow.

Coconut grater (200kg), dimensions 1400mm X 1000mm X 1000mm, stainless steel structure, with perforated rotating discs, 7hp engine, 1,720 rpm, operating voltage 220/380/ 440v (Figure 1).

Figure 1: Coconut grater

Source: Company data.

Construction of a washing system with a 25-liter tank for immersing the coconut almond in sodium hypochlorite with a suspension equipment that uses a 1 Tonne Hoist to removes the almond from the chlorinated solution and send into a reservoir with a stainless steel screen coin type and an air blower, both for the removal of excess chlorine (Figure 2).

Figure 2: Washing system

Source: Company data.

The company adapted the sanding machine with gutter inclusion made of 500m PVC collector tube (Figure 3) as well as the extraction equipment (Figure 4).

Figure 3: Sanding machine

Source: Company data.

Figure 3: Extraction equipment

Source: Company data.

The company currently supplies food industries, hotels, and inns (many of them upscale), as well as stores, supermarkets and bakeries.

Upon entering a market dominated by large companies (many of them with extensive manufacturing facilities and more than 500 employees), the small company realized that much of the equipment needed for the efficient processing of its products did not exist in the market, so it started to invest in R&D for the development of the necessary industrial equipment. The company sought ways to differentiate itself in the market, based on knowledge management and technological innovation focused on sustainability.

The main problem identified was that, when analyzing its processes, the company verified that its "production bottleneck" or restriction (the process that limits the production capacity) was the coconut-breaking process. Increasing the coconut temperature facilitates the process of removing the almond. The company then concentrated its efforts to develop a boiler and an autoclave according to its needs (there were no options available on the market).

INTERVENTION AND THE MECHANISMS ADOPTED TO SOLVE THE PROBLEM

In 2020, the company sought external partnerships to form a specialized and technical team consisting of a Production Engineer (Master in Strategy and Doctoral Student in Innovation and Technology Management), Mechanical Engineer, Electrical Engineer, Ph.D. Professor of the Mechanical Engineering course with experience in the development of solar technology equipment, Mechanical Engineer with experience in the development of solar technology equipment, and other Ph.D. Professors in the area of Chemistry and Materials for future projects with the use of by-products from coconut.

By identifying itself with Japanese management models, the company started to implement the principles of *Kaizen* (continuous improvement) and has developed and adapted machinery and equipment to optimize its production processes.

According to Araújo and Rentes (2006), *Kaizen* is the continuous improvement of a complete value stream or an individual process that aims to add more value with less waste.

The company applied the Lean Green concepts, transforming production waste into new product lines, which will be presented later. *Kaizen* is applied simultaneously with the principles of Clean Production because the wasted material that can generate an environmental impact can also be benefited to generate income and employment.

The company focused on Innovation and Sustainability (Environmental-Social-Economic) and formed a qualified technical team for the technological innovation projects development by using principles of Lean Green and Clean Production.

RESULTS

The firm currently sells Coco Ralado Natural and Coconut Snack. It is also running some New Product Development Projects: Coconut Oil, Functional Coconut Flour, and Functional Grated Coconut. Industrial Equipments are also in developement.

The technical team developed a technological innovation project called "Bio Sustainable Automatic Electric Boiler" awarded in the Centelha Innovation Notice of FINEP – Studies and Projects Financier (MCTI –Ministry of Science, Technology and Innovations), SEBRAE – Brazilian Support Service to Micro and Small Companies and CNPQ – Brazilian National Council for Scientific and Technological Development, which resulted in the creation of a new company, a spin-off in the area of Industrial Equipments. The project will result in the registration of a patent at the Brazilian National Institute of Industrial Property (INPI).

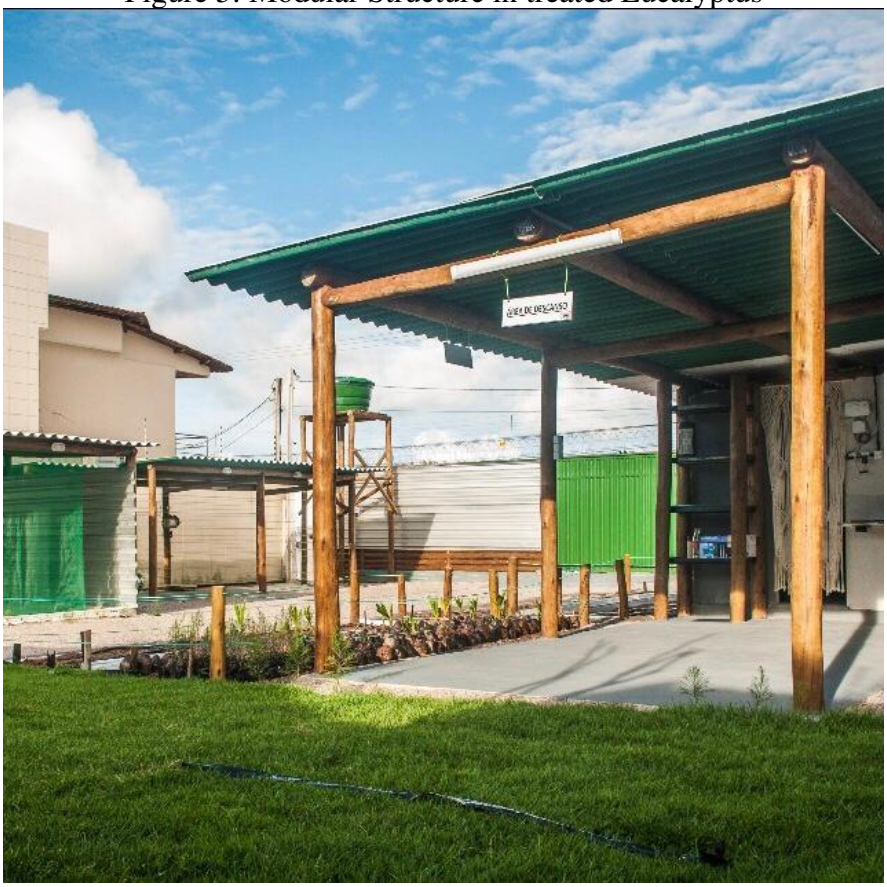
The project entitled "Development of a Sustainable Process for the Production of Functional Coconut Flour, Functional Grated Coconut and Coconut Oil from the Use of Thermal Solar Energy" was awarded 2nd place in the State in the Tecnova Innovation Notice of FINEP and SEBRAE. This project will also result in patents registrations.

The company built a Sustainable Mobile Factory made with treated Eucalyptus. The firm seeks to sell the mobile factory (Figure 4, Figure 5, and Figure 6). It created a functional prototype that is in the process of implementing a repeatable, scalable, sustainability-based industrial business model. In which coconut producers will be able to purchase the manufacturing plant with all the equipment to add value and stop transporting the fresh coconut with the price of R$0.60 per unit (which may have even lower values and is highly affected by seasonality) to produce and transport products with a market value of up to R$30.00/kg.

Figure 4: Sustainable mobile factory

Source: Company data.

Figure 5: Modular Structure in treated Eucalyptus



Source: Company data.

Figure 6: Modular structure in treated Eucalyptus, boiler and water tank

Source: Company data.

All of the water used in coconut manufacturing is returned to vegetable seedlings with the application of Clean Production and Lean Green. As the company works in the development of the equipment with solar technology, it also carries a constant analytical reflection of its processes seeking the best way to perform each activity, in line with its vision of being the most efficient company in the segment.

The firm is developing new food products and new industrial equipment with solar technology. Despite being inserted in a competitive market, the company itself maintains a good position through knowledge management and sustainability-oriented innovation to generate competitive advantages.

Adopting the outlined strategy places the company in a "comfortable" market position, as evidenced by the fact that even in the middle of the Covid-19 pandemic, the company remains profitable. During this period its main customers: high-end hotels, were closed for 6 months in 2020 and the company was still able to obtain similar revenues to the previous year due to the launch of new products trials. The Coconut Snack (Figure 7), and the Coconut Substrate for plants (Figure 8). With the launch of new products in the food area, revenue in 2023 is estimated to be 300% higher than in 2020.

Figure 7: Coconut snack

Source: Company data.

Coconut Snack (Figure 7) is the product involved in a sales contract for a large company. The minimum purchase that was established in this contract will already increase the company's revenue by 100%. If the product is well accepted, and the buyer decides to increase the minimum quantity, the invoicing can be increased even more instantly (high purchase volumes). The company is also developing other products that will be extremely representative in the increase of future sales: Traditional Coconut Oil and two other innovative products: Functional Grated Coconut and Functional Coconut Flour.

Figure 8: Coconut substrates

Source: Company data.

In the market validation test of coconut substrates for plants, more than 6,000 units of products were sold to more than 20 customers. The company is currently adapting the specific standards to obtain a license for the production of this category of products. Negotiations are in progress with major clients in the northeast of Brazil and São Paulo. Additionally, it was verified that the product can be used to fill upholstery of benches and sofas, even being used in the automotive industry, it also has applications in the civil construction area in addition to all possible applications for a natural fiber with the benefit of sustainability and reduction of the environmental impact.

There are several scientific describing the benefits of applying coconut fibers to concrete reinforcement. The concrete with coconut fibers, when compared to the conventional one, sustained the tension even after rupture, thus being able to be beneficial in terms of safety,

preventing the material from breaking abruptly. In addition, there is also the benefit in the environmental issue (Lemos and Frendenberg, 2019). The coconut fiber, when manufactured and formed in sheets, becomes an excellent option in terms of thermal and acoustic insulation, having a wide area of application. Large-scale production reduces the cost of the composite considerably, with the potential to stand out in the market due to its low cost and high quality (Moretto *et al.*, 2020).

The strategy used allows the company to have a portfolio of projects, in which the cost of executing each project, development time, and the financial benefits from each initiative are analyzed. Currently, the company is testing a boiler with solar energy, internet of things (IoT), and machine learning technologies to increase its production capacity. It is also developing a solar oven for the manufacture of coconut snacks (Figure 7) and another solar oven for the production of coconut charcoal, which already has several interested potential customers.

Each product segment can generate new business and penetration into new markets, considerably increasing the revenue generated and profitability, if we consider that many of the products such as Coconut Charcoal, Coconut Powder, and Coconut Fiber originate from old waste from the production process.

When transforming a material that was previously treated as waste (with additional disposal costs and also often being incorrectly disposed of, thus generating an environmental impact) into a product with added value, there is an even greater financial gain, in addition to the social and environmental benefits.

The company's participation in the food market grows and consolidates. At the same time, the company sees the possibility of a highly accelerated growth of other businesses in which it participates, which were only possible through investment in R&D and Innovation, team-building with highly skilled technique where each one assumes the role inherent to their specialization.

The team is an extremely important part of any business model, as the correct and effective allocation of each person for each activity is essential for optimizing the time spent on each activity, quality results and reducing the need for rework.

All businesses in which the company operates based on the pillars of Economic-Environmental-Social Sustainability may present exponential growth in the upcoming years, the firm is prepared to take advantage of all the possible opportunities to increase income through the reuse of materials and replication of the business model developed.

TECHNO-SOCIAL CONTRIBUTION

The contribution of the study is to present an alternative to the traditional industrial model with the use of innovation to achieve various Sustainable Development Goals (SDGs). All stakeholders are very satisfied with the results of the partnership projects.

The company's business model was built on the three pillars of Sustainable Economic-Environmental-Social Development. In this way, the company generates income from the use of Clean Energy and Coconut by-products (old waste) transformed into new sources of income.

Collaborations for innovation focused on sustainability enable the development of new products, contemplating social and environmental aspects with concepts of collaborative economy, income distribution, solidarity economy and circular economy. Serving as an example for other similar initiatives to be adopted in other places.

SDG 3 - Good health and well-being

The company manufactures healthy foods, recommended by several nutritionists to integrate a balanced diet, being even recommended for athletes. The company encourages a healthy lifestyle and sells natural products, free of preservatives, which is one of the commercial differentials of food products. There is also an internal work with its production collaborators so that a participative management is carried out in the path of a continuous process improvement. There is a constant concern to check if the production collaborators are satisfied with the working conditions and if they have any suggestions for improvement.

The sustainable mobile factory in Eucalyptus structure is quite cozy, many visitors say it looks like a hotel or a restaurant, it is not a traditional factory environment with many walls, a lot of concrete and with a "closed box" appearance. The environment has natural ventilation and green area. Additionally, during production the collaborators put the songs they like to play, which makes the environment lighter and the work seems to become less tiring and stressful.

SDG 7 - Affordable and clean energy

The company has developed a solar boiler that uses clean energy for production in the food industry. Currently, Most industrial boilers available on the market use the burning of fossil fuels like natural gas or biomass such as coal, firewood, and sugarcane residuals.

One of the largest emitting sources of atmospheric pollutants, mainly carbon monoxide, are industrial operations that use combustion in their processes (Zhong *et al*., 2017). Thus producing greenhouse gases and contributing to the increase in global warming.

Arbex et al. (2004) state that biomass combustion is the largest source of production of toxic gases, particulate matter, and greenhouse gases on the planet, it influences atmospheric chemistry and physics, produces species that completely change the pH of rainwater, and impact the thermal balance of the atmosphere by interfering with the amount of solar radiation reflected into the area. Studies show that the exposure of living beings to many elements can produce, in the short and long term, harmful effects on health. Health effects from long-term exposure to smoke from biomass burning have been associated with acute respiratory infections in children, chronic obstructive pulmonary disease, pneumoconiosis, cataracts and blindness, pulmonary tuberculosis and adverse effects on pregnancy.

SDG 8 - Decent work and economic growth

Employees have an active voice within the initiative and all solutions are designed to improve their work activities. The sustainable boiler was developed to automate the coconut breaking process that was previously manually. Thus, the company is interested in constantly improving work activities by improving the automation of repetitive processes that enable employees to spend their time in other activities.

The initiative results in a positive economic impact with the development of products from the reuse of old industrial waste and with the development of industrial equipment that uses clean (solar) energy, creating new jobs and income in the place where it operates. Additionally, it has a positive impact on the purchase of products from local and national suppliers, indirectly moving other markets.

The sale of the complete Sustainable Mobile Factory will result in a high socio-economic impact. Coconut producers will be able to add value to their final product, not selling Coconut in nature - R$0.60/unit (which may have even lower values and with a price highly affected by seasonality) to sell products with a market value of up to R$30.00/kg, generating income, employment and development for the regions in which they are installed.

SDG 9 - Industry, innovation, and infrastructure

This study describes an industry that has innovation, sustainability and knowledge management as the heart of its competitive strategy that enabled the development of innovations in food, industrial equipment and civil construction areas.

The company is recognized as innovative by university professors, investors, bank investment analysts, and various business management professionals, architecture, and engineering. The company is also recognized as innovative by FINEP (MCTI), SEBRAE, CNPQ, owners, and managers of large food industries, university professors, investors, bank investment analysts, and various business management professionals, architecture, and engineering. It has recently received a visit from the Public Agency Secretariat of Economic Development of Rio Grande do Norte state, which believes that this type of initiative is very relevant for the state and seeks to encourage companies that choose to follow sustainable development.

SDG 10 - Reduce inequalities

The initiative contributes to the reduction of inequalities as it generates jobs and income in Rio Grande do Norte, which is a state located in the Northeast region of Brazil. According to PNUD (2016) this is the region of the country with the lowest HDI (0.663). The HDI of the State of Rio Grande do Norte is 0.684, still much lower than the Federal District (0.824), São Paulo (0.783), and Santa Catarina (0.774).

The acquisition of the Sustainable Mobile Factory by coconut producers located in disadvantaged regions and often dependent on large industries and large companies will be able to be more independente, generate income and jobs with the implementation of an innovative business model capable of generating high-profit margins as well as transform the local economy.

SDG 12 - Responsible consumption and production

This study presents how innovation can be used to transform industrial production considering available natural resources and local potential to develop sustainable technologies and products capable of reducing environmental impact, stimulating production and conscious consumption that values companies and businesses that conserve natural resources and do not pollute the environment.

SDG 13 - Climate action

The goal is to take urgent action to combat climate change and its impacts (United Nations, 2015). Zhong *et al.* (2017) claim that industries are one of the largest emitting sources of air pollutants, especially carbon monoxide.

Most industrial boilers available on the market use the burning of fossil fuels or biomass. As already presented in the description of the contribution to achieving SDG 7 - Affordable and clean energy, the developed technology has a direct impact on reducing the emission of polluting gases that contribute to global warming. Technology is a solution-focused on the industrial sector, pointed out as one of the main responsible for global warming.

REFERENCES

Araujo, C. A. C., & Rentes, A. F. (2006). A metodologia kaizen na condução de processos de mudança em sistemas de produção enxuta. Revista Gestão Industrial, 2(2).

Arbex, M. A., Cançado, J. E. D., Pereira, L. A. A., Braga, A. L. F., & Saldiva, P. H. D. N. (2004). Queima de biomassa e efeitos sobre a saúde. *Jornal Brasileiro de Pneumologia*, *30*, 158-175.

Berbegal-Mirabent, J., García, J. L. S., & Ribeiro-Soriano, D. E. (2015). University–industry partnerships for the provision of R&D services. *Journal of Business Research*, *68*(7), 1407-1413.

Borozan, D., & Pfeifer, S. (2014). Exploring entrepreneurs' motivation: Comparison of Croatia, European post-socialist and developed countries. *The Journal of Entrepreneurship*, 23(2), 263-287.

Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of business venturing*, *18*(3), 301-331.

Lemos, A. M., & Frendenberg, F. C. (2019). Estudo da utilização de fibra de coco em vigas de concreto. *Engineering Sciences*, 7(2), 1-8.

Moretto, B. F., Misturini, G., da Silva, S. A., & de Souza, J. (2020). Estudo do uso da fibra do coco como isolante termo-acústico. *INOVAE-Journal of Engineering, Architecture and Technology Innovation* (ISSN 2357-7797), 8(1), 95-116.

Pnud. (2016). Desenvolvimento humano nas macrorregiões brasileiras**.** Pnud Brasil, Retrieved July 2, 2021, from https://www.undp.org/content/dam/brazil/docs/IDH/undp-br-macrorregioesbrasileiras-2016.pdf

United Nations. (2015). THE 17 GOALS. Department of Economic and Social Affairs Sustainable Development. United Nations. Retrieved July 5, 2021, from https://sdgs.un.org/goals

Vivarelli, M. (2013). Is entrepreneurship necessarily good? Microeconomic evidence from developed and developing countries. *Industrial and corporate change*, *22*(6), 1453-1495.

Zhong, Q., Huang, Y., Shen, H., Chen, Y., Chen, H., Huang, T., ... & Tao, S. (2017). Global estimates of carbon monoxide emissions from 1960 to 2013. *Environmental Science and Pollution Research*, *24*(1), 864-873.

Zhou, C., & Etzkowitz, H. (2021). Triple Helix Twins: A Framework for Achieving Innovation and UN Sustainable Development Goals. *Sustainability*, *13*(12), 6535.