

The Plant-Based Meat: an analysis from the disruptive innovation theory

MARCELA NAVES COSTA RIBEIRO

FACULDADE DE ECONOMIA, ADMINISTRAÇÃO E CONTABILIDADE DA UNIVERSIDADE DE SÃO PAULO - FEA

PAULO ROBERTO FELDMANN

FACULDADE DE ECONOMIA, ADMINISTRAÇÃO E CONTABILIDADE DA UNIVERSIDADE DE SÃO PAULO - FEA

Agradecimento à órgão de fomento:

Agradecimento ao CNPQ pelo apoio aos pesquisadores envolvidos neste artigo.

THE PLANT-BASED MEAT: AN ANALYSIS FROM THE DISRUPTIVE INNOVATION THEORY

1 INTRODUCTION

This study becomes necessary given the economic importance of the agro-industrial beef system in the economy and the development of a new product that can impact the traditional industry. The meat industry is considered a driving force in the economy of several countries and projections point to a increase in the production volume. On the other hand, research and dietary guidelines shows that meat consumption should decrease in the next few years, due to health or environmental concerns.

Given this scenario, it is possible to observe a trend of market changes, in search of substitute products that do not cause the same negative impact of traditional meat, whether for health or for the environment. Companies from the United States were the first to develop the plant-based meat, a product that has the same taste, appearance and texture of the traditional meat, but are manufactured without ingredients of animal origin, being composed of plants and vegetables, which makes its production not impact the environment negatively and its consumption is not harmful to health.

The plant-based meat is produced and in several countries and sold in supermarkets chains, restaurants and snack bars. A new market has been created by incoming companies that are willing to make an impact on the traditional meat market. The production began around 2011 and some years later began to be distributed and exported to other countries, reaching significant numbers around 2016. In 2019 the product began to be manufactured in Brazil and in may of the same year began to be sold in the supermarkets of the main capitals of the country and in some restaurants. The following research problem thus arises: does plant-based meat have the potential to be a disruptive innovation?

Given the possibility of the impact that the plant-based meat can cause in the current market of meat and, consequently, in the agroindustrial system, it is necessary to analyze in more depth if this product has the characteristics of a disruptive innovation, which means, if it has the potential to interrupt the trajectory of the traditional meat and the companies that produce it, causing a discontinuity of the normal course of a process and a disruption in the market, eliminating companies that were considered dominant (BOWER; CHRISTENSEN, 1995; CHRISTENSEN, 1997). From this information, the main purpose of this article is to verify if the plant-based meat has the characteristics of a disruptive innovation. In addition, this study has as specific objectives analyze the companies that are producing the plant-based meat and to find out if this companies have something in common.

For this analysis it was used an applied, descriptive and exploratory research, through bibliographic research in the academic literature, in national and international journals. It has been found that the plant-based meat has the main characteristics of a disruptive innovation and therefore traditional meat companies must follow the insertion of this product into the market in order to define future strategies so that they do not lose their position in the market.

2 CONCEPTUAL FRAMEWORK

2.1 Agribusiness as a Driving Force of the Economy

IBGE (2017) data position agribusiness as a fundamental force in the brazilian economy. While the industry did not show growth in 2017 and the services sector grew by

only 0.3%, the agricultural sector advanced 13%, which corresponds to about a quarter of the national GDP. Oliveira (2003), states that most Brazilian cities live on rural activities, with growing participation of agribusiness in the country's economy and also in the export agenda.

In Brazil, beef cattle breeding is developed in all states and ecosystems and involves a wide range of production systems, from extensive livestock farming, which occurs in native pastures, with low productivity and using few inputs, to intensive livestock farming high productivity pastures, using pasture supplementation and animal confinement (CEZAR et al., 2005). The production of beef and poultry in the country has significant numbers, according to IBGE (2017). The beef cattle in Brazil in 2017 was 172 million head, producing 30 billion liters of cow's milk and 316 thousand tons of cheese and derivatives. For poultry, the number of heads reached 1.45 billion, including chickens and roosters, and the egg production reached 4.7 billion dozens.

According to MAPA (2017), the total production of beef, pork and chicken in 2016 and 2017 was estimated at 28.5 million tons and the projection for 2026 and 2027 is to produce 34.3 million tons, which would result in a variation of 20.3%. The OECD-FAO (2017), Food and Agriculture Organization of the United Nations, claims that 66 billion animals are slaughtered annually for human consumption. In Brazil, the number of bovine animals slaughtered in 2016 approached 29.7 million heads across the country, according to IBGE (2017).

OECD-FAO (2017), says that production will show strong growth in the coming years and is likely to continue its rapid growth over the next decade. In 2026 a 13% increase in world meat production is expected, compared to 2016, which represents an increase of almost 20% over the previous decade.

In spite of projections for future market growth, OECD-FAO (2017) states that in 2016 world meat production grew by only 1%, specifically in the Americas and Europe, offset by a drop in production in China and Australia. This was the second smallest increase in the last decade, with the decrease occurring mainly in pork production, while beef and chicken meat expanded. World meat trade, on the other hand, showed a 5% increase, returning to trend levels that had declined in 2015.

For Oiagen et al. (2013), agro-industrial production chains are being influenced by new market needs and trends, creating new challenges and opportunities for the sector. The main challenge for rural producers and agricultural industries has now been to increase productivity and supply of agricultural products, while avoiding degradation and ensuring the maintenance of production resources, according to Figueira, Zambalde e Sugano (2011). Thus, advances are required in the meat production system in Brazil in several aspects, but mainly in access to technological innovations, in the management of technologies and in the relationship between the agents of the production chain.

Another current challenge relates to environmental issues since, according to Massruhá and Leite (2016), agriculture is the economic activity most affected by climatic conditions. The water crisis, climate change and global pressure to provide clean energy in a sustainable way and ensure food security are matters that are on the agenda. As the volume of production and export of beef is high, the impact on the environment also has significant numbers, as presented in the next topic.

2.1.1 The Impact on the Environment and Human Health

Food has a major impact on the environment as the production activities of some foods release greenhouse gases and other substances such as ammonia and pesticides. Animal husbandry is one of these activities, accounting for 14.5% of total greenhouse gas emissions, surpassing the entire transportation sector. The activity also uses a large amount of essential

raw materials such as water, nitrogen and phosphate, placing agriculture as responsible for 92% of the water consumption on the planet, where animal products are most responsible for the high index. Livestock is responsible for 80% of the world's agricultural land use. In Brazil, 45% of the land is for pasture, 29% refers to forests and forests, 18% to crops and the other 8% are used for other activities (HOEKSTRA; MEKONNEN, 2012; VAN DOOREN; BRINK, 2017; MILMAN; LEAVENWORTH, 2016; IBGE, 2017).

Besides that, several studies point to the harm that the meat can cause to health, such as heart disease, diabetes, some cancers and overall mortality. The same studies point out how a plant-based diet can bring benefits in the prevention of these diseases (CHAINANI-WU et al., 2011; SALAS-SALVADÓ et al., 2011; LANOU; SVENSON, 2010; ORLICH et al., 2013).

Recommendations from scientific and regulatory bodies in several countries have led to a considerable increase in interest in plant-based diets. In 2009, Switzerland was the first country to recommend that its residents observe environmental issues when making food choices. The US Department of Agriculture, in its report on dietary guidelines for the years 2015 to 2020, says it is advisable to make a change in food consumption by adopting a diet with an emphasis on vegetables. In 2016, the Dutch government recommended that no more than two servings of meat per week should be eaten, equivalent to 500 grams. In the same year, the UK government released dietary guidelines recommending that animal protein be replaced with plant proteins. The Chinese government aims to reduce the consumption of meat of its population by up to 50% by 2030, with the aim of reducing the emission of carbon dioxide in one billion tons (GEILING, 2016; USDA, 2015; MILLMAN; LEAVENWORTH, 2016).

According to Hughes et al. (2014), the number of American vegetarians, those who not consume meat, poultry, fish and seafood, grew from 2.3% in 2006 to 3% in 2009, reaching 5% in 2011. Despite of small, one notices a support and percentage increase. The OECD-FAO (2017) states that global meat consumption tends to stagnate by 2026, influenced by consumer preferences and attitudes. As for meat eaters, there is a trend towards the choice of freely bred meat and antibiotic-free meats, but it is not yet clear what extent consumers are willing to pay extra for it.

FAO (2010) states that the world's population has grown rapidly and by 2050 the demand for food will increase by about 60%. For Tilman and Clark (2014), if meat consumption trends continue as they are today, by 2050 there will be an estimated increase of up to 80% in greenhouse gas emissions from food production and global deforestation, and an increase in illness and a decrease in life expectancy. Broad adoption of diets with fewer meats, fats, oils and sugars could reduce greenhouse gas emissions from the agro-industrial system, reduce deforestation and species extinctions, and prevent chronic diseases related to diet. The implementation of new food solutions is a global challenge and a relevant opportunity for the environmental and public health cause.

Krelling (2019) states that the consumption of red meat per capita in Brazil is about twenty-six kilos per year. The country has a demand for alternative proteins to meat, which is not currently being served, even with the high productivity of national agricultural systems.

2.2 Disruptive Innovation and Market Impact

Pereira et al. (2015), argue that the constant changes in the market mean that organizations have to continually follow new innovation alternatives in products, services and processes. Chesbrough (2007) argues that the product, technology and market life cycle is getting shorter, reducing the profitability of technologies and innovations generated in organizations. This unstable and dynamic scenario creates opportunities and challenges for

companies, arising from emerging technologies, according to Sainio (2004). For Hamel (2000), companies that achieve success in this context are those that can change the expectations of consumers through imagination and increasingly complex innovations, creating new forms of relationship, new distribution channels and new skills.

From the 1990s, Bower and Christensen (1995) and Christensen (1997) began to spread a new concept of innovation, called disruptive technology. The authors argue that the interruption of an established performance trajectory of a product or a company, and the discontinuity of the normal course of a process, generates a disruption in the market, eliminating companies that were considered dominant. For Lui, Ngai and Lo (2016), disruptive technology modifies competition parameters and enables the construction of new categories of services, products and processes. Cândido (2011), points out that these technologies break barriers and present new solutions, more efficient than existing ones.

Christensen and Raynor (2003), evolving in the studies related to the subject, replaced the term disruptive technologies by disruptive innovations, based on the concept that the cause of the disruption in the market is not the technology itself, but the way in which it is implemented and the way this technology is exploited by organizations. For Cândido (2011), the change in nomenclature allowed a greater comprehension of the application of the theory, including the innovation in the services and business models. From 2009 and 2010 there was a significant evolution of studies on the subject, being possible to perceive the increase of the use of the concept in the scientific environment, mainly in the United States, United Kingdom, India and Germany.

According to Bower and Christensen (1995), competitive companies are always ahead of their competitors in the development and commercialization of new products, and because they are so focused on meeting the current needs of their customers, they do not give due attention to new technologies that seem to be geared to other markets, small and emerging. Usually, these technological changes are not radically new or difficult, but they present a package of attributes of performance different from the one that the traditional client values historically. It happens that this package evolves very quickly, making the new technology to be valued in the market. Marôcco et al. (2014) point out that competitive organizations are those that are open to these technological changes and discontinuities and use their knowledge to identify and implement new ideas.

Pereira et al. (2015), emphasize that, in addition to the innovation process for products and services, it is necessary for companies to focus on innovation in the business model. A new market brings with it new needs and requirements, making it necessary for organizations to seek new management structures in order to achieve leadership in this market. For Sainio (2004), recognizing in advance the opportunities and threats arising from disruptive innovation enables companies to act quickly on the restructuring and adaptation of the current business model, which will allow the proper exploitation of the potential of new products, services and processes.

The concept of disruptive innovation is broad and applies to different areas of knowledge, and can be applied in organizations of different segments. Recent studies by Christensen, Grossman and Hwang (2009) and Christensen, Horn and Johnson (2010) deal with disruptive innovation in health and education respectively. Another contemporary study by Cupani and Watson (2018) lists a hundred disruptive innovations emerging from various segments, such as autonomous vehicles, wireless energy transfer, concentrated solar power, and a significant amount of disruptive innovations in agribusiness, demonstrating the high feasibility of implementing innovations in this sector.

Faced with the need to reduce the environmental impacts generated by meat production and in order to meet new consumer trends related to health concern, food organizations have invested in the research and development of a new product considered by

Cupani and Watson (2018) as a disruptive innovation, the cultivated meat. This subject will be discussed in depth in the topic below.

2.2.1 Disruptive Innovation in the Agroindustrial System of Meat: the plant-based meat

The trends in the agricultural sector show that there are demands for innovations in all stages of the production chain, whether due to the need to increase productivity, to environmental issues or to the new demands of the consumer market, constituting a highly monitored and automated "innovative farm". Several disruptive innovations have been employed in agribusiness and will directly impact the routine of the population and the economy (MASSRUHÁ; LEITE, 2016). Cupani and Watson (2018) cite some of these innovations, namely: vertical agriculture, precision farming, micro-scale environmental energy collection and plant-based meat, the focus of this article's analysis.

Strom (2016) cites three studies conducted by research companies in the United States related to the consumption of animal protein substitutes. One, led by the NPD Group and Midan Marketing in 2015, in the United States, showed that 70% of meat consumers use a substitute for animal protein at least once a week and 22% said they are using those substitutes more often than last year. An industrial analysis carried out by the company Mintel points to the growth in the sale of alternative products to meat by 3.7% between 2012 and 2014. Another research by Markets & Markets states that by 2022 the consumption of animal protein substitutes will reach 5.9 billion dollars, growing 6.6% per year, starting in 2016.

Based on these trends, some companies have started the production of plant-based meat, including Beyond Meat, founded in 2009 in California, USA; Impossible Foods, founded in 2011 also in California; and Fazenda Futuro, founded in 2017 in Rio de Janeiro, Brazil. As it is a new product on the market, it is possible to find it with several names besides plant-based meat, such as: cultivated meat, cultured meat, herbal meat, vegetable meat, synthetic meat, feak meat.

According to Barbosa (2017), the product is a laboratory-created food, based on analyzes by scientists who isolated the animal flesh molecules to understand its composition, identified similar molecules in plants and then used the same meat architecture to unify them. The Good Food Institute, GFI (2019), says that the plant-based meat have the same flavor, texture and appearance of the traditional meat. It is in this respect that it differs from soybeans meat and *in vitro* meat.

According to UFRGS (2018), soybean meat, or textured soy protein - TSP, is obtained industrially from soybean, water, oil and dietary fiber and is considered as an extender thereof not as a substitute product as its texture, taste and appearance differ from those of traditional meat. *In vitro* meat is produced from animal stem cells, according to Stephens (2010), and also does not have the same texture, taste and appearance of traditional meat. In addition, *in vitro* meat faces consumer resistance due to the way it is produced and because of the higher production costs compared with the traditional meat, which ends up rendering its production unviable on a large scale.

GFI (2019) argues that plant-based meat is a revolutionary solution to the problems associated with the impacts of beef production on the environment, as it dramatically reduces the need for areas for grazing, water use and emission of greenhouse gases, and does not present health hazards. According to Beyond Meat (2019), a study by the University of Michigan compared the environmental impact generated by the production of a conventional beef burger and a plant-based meat burger, and concluded that the plant-based meat burger uses only 1% of the water needed for a traditional beef burger, emits only 10% of the amount of greenhouse gases and uses only 54% of energy.

According to Strom (2016), the CEO of Tyson Foods, one of the largest food companies in the world, said that the future of food can be meatless and in 25 years, about 20% of beef production will be from plant-based meat.

Two major players dominate the international plant-based meat market: Beyond Meat and Impossible Foods, both located in the state of California, United States. In Brazil, Fazenda Futuro, which started its activities in 2019, has dominated the market. According to Terazono and Bradshaw (2019), the aim of these companies is to attract beyond non-meat vegetarians and vegans who do not consume any animal products. The focus is on consumers who consume meat, but want to decrease their intake for health and environmental issues, or for looking for more tasty options.

The company Impossible Foods, received about 250 million dollars from investors like Bill Gates and Google. The goal of the company is to completely replace the animals with a technology of food production, until 2035 (IMPOSSIBLE FOODS, 2019). The Beyond Meat company became public in May 2019 and raised \$ 241 million, with appreciation of 163%. Their expectation is to exceed the revenue of \$ 210 million by the end of 2019 (ALLEN, 2019). At the opening of the sales of Fazenda Futuro, were sold 400 hamburgers, against the estimated 150 for the day. After that, two million units were sold through July 2019 (GFI, 2019).

As for the ingredients, there is some variation between the three companies, but the main ingredients are the same. The product produced by Beyond Meat (2019) consists of water, pea protein isolate, canola oil, coconut oil, rice protein, mung bean protein, natural flavors, methylcellulose, potato starch, sunflower oil, salt, potassium chloride, apple extract, vinegar, lemon juice concentrate, color blend, sunflower lecithin, pomegranate fruit powder, lycopene, vitamins and minerals. The Impossible Foods (2019) burger are made of water, soy protein, coconut oil, sunflower oil, potato protein, methylcellulose, yeast extract, cultured dextrose, food starch modified, soy leghemoglobin, salt, vitamins and minerals. The Fazenda Futuro recipe, according GFI (2019), is made from water, soy protein, pea protein, bean flour, vegetable fat, onion, seasoning meat flavor, salt, sugar and beetroot powder.

Vieira and Sugano (2017) state that one of the determinants of consumer behavior in the face of new technologies is the ease of access to the product, as well as compatibility with their values, lifestyle and consumer needs. Regarding the ease of access, Beyond Meat (2019) and Fazenda Futuro (GFI, 2019), sell their products in the department of fresh meat, along with meat of animal origin, in order that the consumer does not need to go to other sectors of the market looking for the product. Impossible Foods (2019) has chosen to distribute its hamburgers through partners such as fast food chains and restaurants.

3 METHODOLOGY

As to its nature, the study is classified as applied research, whose results can be applied in solutions of real problems, being directed to commercial objectives and to the development of new products oriented to the needs of the market (APPOLINÁRIO, 2009).

As for the objectives, it is a descriptive and exploratory research. According to Gil (2010), descriptive research has as main objective to describe the characteristics of a certain population, phenomenon or the establishment of relationship between variables. It is also characterized as an exploratory research, since it aims to develop, clarify and modify ideas and concepts from the formulation of precise problems or searchable hypotheses. Through a bibliographical and documentary survey the exploratory research provides an approximate overview of a given fact.

Regarding the way of approaching the problem, the qualitative methodologies meet the needs of the study and will allow a deeper understanding of the phenomenon to be

studied. Considering the general and specific objectives of this study, the tool used to collect data was the bibliographic research in the academic literature, in national and international journals.

4 RESULTS AND DISCUSSION

To achieve the goal of verify if the plant-based meat has the characteristics of a disruptive innovation, was used the main definitions of baseline authors regarding disruptive innovation, as Bower e Christensen (1995), Christensen (1997), Christensen e Raynor (2003), Christensen, Grossman e Hwang (2009) e Christensen, Horn e Johnson (2010), as presented in the table 1.

Table 1 – Disruptive Innovation X plant-based Meat

Disruptive Innovation	Plant-Based Meat
Life expectancy of competitive advantage diminishes to the degree that technology and tastes change.	Number of americans who do not ingest meat grew 5 percent in 2011 and 2016; Substitutes will grow by 6.6% a year; Global meat consumption will stagnate by 2026.
New technologies that offer lesser perceived benefits at a much lower cost, could replace the existing ones.	Cost is not lower yeat, but is very similar to some types of products.
Smaller company with fewer resources.	Beyond Meat x Tyson Foods; Fazenda Futuro x JBS.
Incumbent focus on improving their products for their most profitable customers. They exceed the needs of some segments and ignore the needs of others.	Several types of meat burgers but only the soy hamburger as an alternative.
New entrants target those overlooked segments gaining a foothold by delivering more-suitable functionality.	Impossible foods: received \$250 million from investors like Bill Gates and Google, to invest in surveys.
New entrants move upmarket delivering the performance that incumbents' mainstream customers require, while preserving the advantages that drove their early success.	Beyond Meat: serves 11 thousand restaurants. Impossible foods: produces 6,000 tons of synthetic hamburger per year.
Disruption has occurred when mainstream customers start adopting the entrants offering in high volumes.	Not yeat, but Beyond Meat expectation is to exceed revenue of \$210 million by the end of 2019.

Source: The authors, 2020.

It was possible to verify that plant-based meat has the main characteristics of a disruptive innovation. But some aspects are not yet a disruptive innovation, mainly: the meat is not yet priced lower than the traditional beef burger, but as companies began to have a higher production volume, this may occur; traditional meat customers have not yet adopted meat as the main product compared to traditional meat.

Despite these differences, the main characteristics of the plant-based meat are related to a disruptive innovation, such as: increasing number of meat substitutes; it is being produced by smaller companies with fewer resources; new entrants target those overlooked segments gaining a foothold by delivering more-suitable functionality.

To meet the specific objectives to analyze the companies that are producing the plant-based meat and to find out if this companies have something in common, a comparison between the companies are made, with the available information, as shown in the table 2.

Table 2 – Comparison between the companies

	Beyond Meat	Impossible Foods	Fazenda Futuro
Foundation	2009	2011	2017
Location	California, EUA	California, EUA	Rio de Janeiro, Brazil
Achievements	May 2019: became public and raised \$241 million, with appreciation of 163%.	Received \$250 million from investors like Bill Gates and Google.	At the opening of the sales were sold 400 hamburgers, against the estimated 150 for the day; 2 million units sold through July 2019.
Company's goal	Expectation to exceed revenue of \$210 million by the end of 2019.	To completely replace the animals with a food production technology, by the year 2035.	Achieve beyond the vegetarian market. Have the meat refrigerators as main competitors.
Productive capacity	Serves 11 thousand restaurants.	At its maximum capacity, the factory produces 6,000 tons of synthetic hamburger per year.	Is capable of producing 150 tons of hamburgers.
Product price on the market	US\$17	US\$14	US\$ 8 (R\$ 29)
Principal ingredients	Water, pea protein, canola oil, coconut oil, rice protein, mung bean protein, natural flavors, methylcellulose, potato starch, sunflower oil, salt, potassium chloride, apple extract, vinegar, lemon juice concentrate, color blend, sunflower lecithin, pomegranate fruit powder, lycopene, vitamins and minerals.	Water, soy protein, coconut oil, sunflower oil, potato protein, methylcellulose, yeast extract, cultured dextrose, food starch modified, soy leghemoglobin, salt, vitamins and minerals.	Water, soy protein, pea protein, bean flour, vegetable fat, onion, seasoning meat flavor, salt, sugar and beetroot powder.

Source: The authors, 2020.

Regarding the year of foundation, the company Beyond Meat shows itself as the most mature in the market, with 10 years of experience, while Fazenda Futuro is still in its initial phase. Maturity can be one of the ones responsible for the superior performance of other companies.

The foreign companies are located in the state of California, in the Silicon Valley, the most famous innovation centre, that became the world scientific and technical Center, where a lot of profits companies was born. The characteristics of this innovation cluster may have had positive influences on this companies, as a stimulus to R&D, partnerships with universities, influence and government support and venture investments (KONSTANTINOV; SAKULYEVA; MAKEEVA, 2019).

The goals of the three companies are bold and demonstrate that they aim to attack the traditional meat market, creating a disruption in it. According to Bower and Christensen (1995), companies are often so focused on meeting the current needs of their customers that they do not pay due attention to new technologies that seem to be geared towards other small and emerging markets. This can happen to companies in the traditional meat market if they treat the meat as a product for the vegetarian market and not for traditional meat customers.

Plant-based meat, as a disruptive innovation, initially presents a package of performance attributes different from the one the traditional client historically values, according to Bower and Christensen (1995). It happens that this package is evolving very quickly, making the new technology to be valued in the market.

As for the ingredients used by the companies, it is noticed that the difference between them is small. Therefore, it can be concluded that the determinants for the success of the companies will be related to factors other than flavor, but rather easy access to the product (VIEIRA; SUGANO, 2017) and innovation in the business model (PEREIRA et al., 2015).

5 FINAL CONSIDERATIONS

When compared to the disruptive theory from Christensen (1997), it is clear that the plant-based meat has many characteristics of a disruptive innovation, therefore it can be considered a disruptive innovation. It is a new product and many consumers have not had access to it yet. But it is not yet possible to assess whether it will replace traditional meat consumption or whether it will be used as a food supplement.

A new market brings with it new needs and requirements, making it necessary for organizations to seek new management structures in order to achieve leadership in this market. Since new products considered as disruptive innovation have the capacity to interrupt trajectories of established products and companies, causing a discontinuity of the normal course of a process and a disruption in the market, eliminating companies that were considered dominant (BOWER; CHRISTENSEN, 1995; CHRISTENSEN, 1997), it is necessary that the companies that operate in the agroindustrial system follow closely the development of the plant-based meat and invest in R&D in order that they can prepare themselves and define future strategies to face this innovation.

For future studies, it is suggested to analyze the acceptance of meat on the market and to identify the impact on producers and distributors of traditional meat, given the importance of this market to the economy of the countries in question.

REFERENCES

- ALLEN, M. A Beyond Meat se torna pública e arrecada US \$241 milhões. The Good Food Institute, 2019. Available in: <<https://gfi.org.br/2019/05/04/a-beyond-meat-se-torna-publica-e-arrecada-us-241-milhoes/>>. Access: 27 jun. 2020.
- APPOLINÁRIO, F. Metodologia da ciência: filosofia e prática da pesquisa. São Paulo: Cengage Learning, 2009.
- BARBOSA, V. A carne do futuro poderá ser 100% carne e 0% animal: servido? Revista Exame, 2017. Available in: < <https://exame.abril.com.br/ciencia/futuro-podera-ser-livre-de-carne-como-a-conhecemos-servido/> >. Access: 20 jun. 2020.
- BEYOND MEAT. Available in: <<https://beyondmeat.com/>>. Access: 27 apr. 2020.
- BOWER, J. L.; CHRISTENSEN, C. M. Disruptive Technologies: catching the wave. Harvard Business Review, p.43-53, jan./feb. 1995.

- BRASIL. Ministério da Agricultura, Pecuária e Abastecimento - MAPA. Projeções do agronegócio: Brasil 2016/17 a 2016/27. Brasília, 2017. Available in: < <http://www.agricultura.gov.br> >. Access: 16 jul. 2020.
- CÂNDIDO, A. C. Inovação disruptiva: reflexões sobre as suas características e implicações no mercado. IET Working Paper Series. 2011.
- CEZAR, I. M.; QUEIROZ, H. P.; THIAGO, L. R. L.; CASSALES, F. L. G.; COSTA, F. P. Sistemas de produção de gado de corte no Brasil: uma descrição com ênfase no regime alimentar e no abate. Campo Grande: Embrapa Gado de Corte, 2005.
- CHAINANI-WU, N.; WEIDNER, G.; PURNELL, D. M.; FRENDA, S.; MERRITT-WORDEN, T.; PISCHKE, C.; CAMPO, R.; KEMP, C.; KERSH, E. S.; ORNISH, D. Changes in emerging cardiac biomarkers after an intensive lifestyle intervention. *The American Journal of Cardiology*, v.108, n.4, p.498-507, aug. 2011.
- CHESBROUGH, H. Business model in innovation: it's not just about technology anymore. *Strategy & Leadership*, v.35, n.6, p.12-17. 2007.
- CHRISTENSEN, C. M. *The innovator's dilemma: when new technologies cause great firms to fail*. Cambridge: Harvard Business School Press, 1997.
- CHRISTENSEN, C. M.; GROSSMAN, J. H.; HWANG, J. *The innovator's prescription: a disruptive solution for health care*. United States: The McGraw Graw-Hill Companies, 2009.
- CHRISTENSEN, C. M.; HORN, M. B.; JOHNSON, C. W. *Disrupting class: how disruptive innovation will change the way the world learns*. United States: The McGraw Graw-Hill Companies, 2010.
- CHRISTENSEN, C. M.; RAYNOR, M. *The innovator's solution: creating and sustaining successful growth*. Boston: Harvard Business School Press, 2003.
- CUPANI, A.; WATSON, R. Table of disruptive technologies. *Tech Foresight*, 2018. Available in: < <https://www.imperial.ac.uk/business-school/events/exed-resources/disruptive-technologies-navigating-new-opportunities-and-risks/> >. Access: 24 jun. 2020.
- FAZENDA FUTURO. Available in: <<https://impossiblefoods.com/>>. Access: 27 apr. 2020.
- FIGUEIRA, M.; ZAMBALDE, A. L.; SUGANO, J. Y. Inovação de modelo de negócio em uma empresa de biotecnologia agrícola. *Revista de Administração e Inovação*, São Paulo, v.8, n.2, p.106-131, abr./jun. 2011.
- Food and Agriculture Organization – FAO. *How to feed the world in 2050*. Roma: 2010. Available in: < http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf >. Access: 15 jun. 2020.

- GEILING, N. The Netherlands' new dietary guidelines take meat off the menu. Think Progress, 2016. Disponível em: < <https://thinkprogress.org/the-netherlands-new-dietary-guidelines-take-meat-off-the-menu-a97c40f05d84/#.kmgk2tfc5> >. Access: 15 ago. 2019.
- GFI - GOOD FOOD INSTITUTE. Available in: < <http://gfi.org.br/> >. Access: 23 jun. 2020.
- GIL, A. C. Métodos e técnicas de pesquisa social. São Paulo: Atlas, 2010.
- HAMEL, G. Leading the revolution. Boston: Harvard Business School, 2000.
- HOEKSTRA, A. Y.; MEKONNEN, M. M. The water footprint of humanity. PNAS, v.109, n.9, p.3232-3237, feb. 2012.
- HUGHES, G. J.; KRESS, K. S.; ARMBRECHT, E. S.; MUKHERJEA, R.; MATTFELDT-BEMAN, M. Initial investigation of dietitian perception of plant-based protein quality. Food Science & Nutrition, v.2, n.4, p.371-379, 2014.
- IMPOSSIBLE FOODS. Available in: <<https://impossiblefoods.com/>>. Access: 27 apr. 2020.
- Instituto brasileiro de economia e estatística – Censo Agropecuário, 2017; IBGE, 2017. Available in: < <https://censos.ibge.gov.br/agro/2017/resultados-censo-agro-2017.html> >. Access: 03 jul. 2020.
- KONSTANTINOV, V.; SAKULYEVA, T.; MAKEEVA, V. Development of economic tools for managing regional innovation clusters. Journal of Entrepreneurship Education, v.22, special issue, jan./abr. 2019.
- KRELLING, F. Market Report Brazil. The Good Food Institute, 2019.
- LANOU, A. J.; SVENSON, B. Reduced cancer risk in vegetarians: an analysis of recent reports. Cancer Management and Research, v.3, n.4, p.1-8, dec. 2010.
- LUI, A. K. H.; NGAI, E. W. T.; LO, C. K. Y. Disruptive information technology innovation and the cost of equity capital: the moderating effect of CEO incentives and institutional pressures. Information e Management, v.53, n.3, p.345-354, 2016.
- MARÔCCO, A. P.; PORTO, C. B.; OLIVEIRA, J. G. W.; ZANETTI, M. C. V. A tecnologia disruptiva presente em aplicativos móveis para chamadas e serviços de táxi. Revista Cereus, Gurupi, v.6, n.1, p.125-142, jan./abr. 2014.
- MASSRUHÁ, S. M. F. S.; LEITE, M. A. A. Agricultura digital. RECoDAF – Revista Eletrônica Competências Digitais para Agricultura Familiar, Tupã, v.2, n.1, p.72-88, jan./jun. 2016.
- MILMAN, O.; LEAVENWORTH, S. China's plan to cut meat consumption by 50% cheered by climate campaigners. The Guardian Journal, jun. 2016. Available in: < <https://www.theguardian.com/world/2016/jun/20/chinas-meat-consumption-climate-change> >. Access: 15 jun. 2020.

- OIAGEN, R. P.; BARCELLOS, J. O. J.; CANOZZI, M. E. A.; SOARES, J. C.R.; CANELLAS, L. C.; ALVES, C. O.; TAVARES, H. R.; COSTA, F. M. *Ciência Rural*, Santa Maria, v.43, n.8, p.1489-1495, ago. 2013.
- OLIVEIRA, A. U. Barbárie e modernidade: as transformações no campo e o agronegócio no Brasil. *Revista Terra Livre*, São Paulo, v.2, n.21, p.113-156, jul./dez. 2003.
- Organization for Economic Co-operation and Development – Food and Agriculture Organization of the United Nations - OECD-FAO. *Agricultural outlook 2017-2026*. Paris: OECD Publishing, 2017. Available in: < <http://www.fao.org/3/a-i7465e.pdf>>. Access: 16 jul. 2020.
- ORLICH, M. J.; SINGH, P. N.; SABATÉ, J.; JACELDO-SIEGL, K.; FAN, J.; KNUTSEN, S.; BEESON, W. L.; FRASER, G. E. Vegetarian dietary patterns and mortality in adventist health study. *JAMA Internal Medicine*, v.173, n.13, p.1230-1238, jul. 2013.
- PEREIRA, S. A.; IMBRIZI, F. G.; FREITAS, A. D. G.; ALVARENGA, M. A. Business model as na inducer of disruptive innovations: the case of Gol Airlines. *International Journal of Innovation*, v.3, n.2, p.28-42, 2015.
- SAINIO, L. M. A framework for analysing the effects of new, potentially disruptive technology on a business model case: bluetooth. *International Journal Electronic Business*, v.2, n.3, p.255-273, 2004.
- SALAS-SALVADÓ, J.; MARTINEZ-GONZÁLEZ, M. A.; BULLÓ, M.; ROS, E. The role of diet in the prevention of type 2 diabetes. *Nutrition, Metabolism & Cardiovascular Diseases*, v.21, n.2, p.32-48, 2011.
- STEPHENS, N. In vitro meat: Zombies in the menu? *Scripted*, v.7, n.2, p.498-507, aug. 2010.
- STROM, S. Tyson Foods, a meat leader, invests in protein alternatives. *The New York Times*, New York, 2016. Available in: < https://www.nytimes.com/2016/10/11/business/tyson-foods-a-meat-leader-invests-in-protein-alternatives.html?_r=0 >. Access: 23 jun. 2020.
- TERAZONO, E.; BRADSHAW, T. Empresário quer salvar o mundo com hambúrguer vegano que sangra. *Folha de São Paulo*, 2019. Disponível em: <<https://www1.folha.uol.com.br/ambiente/2019/05/empresario-quer-salvar-o-mundo-com-hamburguer-vegano-que-sangra.shtml>>. Access: 14 mai. 2020.
- TILMAN, D.; CLARK, M. Global diets link environmental sustainability and human health. *Nature International Journal of Science*, v.515, p.518-522, 2014.
- UFRGS – Universidade Federal do Rio Grande do Sul. Available in: <<http://www.ufrgs.br/alimentus/objetos-de-aprendizagem/soja/proteina-vegetal-texturizada>>. Access: 25 jun. 2020.
- UNITED STATES OF AMERICA. United States Department of Agriculture – USDA. 2015-2010 dietary guidelines for americans. Washington, 2015. Disponível em: < <http://health.gov/dietaryguidelines/2015/guidelines/> >. Access: 15 ago. 2019.

VAN DOOREN, C.; BRINK, L. Eating more sustainably. Netherlands Nutrition Centre, Holanda, mai. 2017. Available in: <
https://www.voedingscentrum.nl/Assets/Uploads/voedingscentrum/Documents/Professionals/Pers/Factsheets/English/Fact%20sheet_Eating%20more%20sustainably_2017.pdf
>. Access: 15 jun. 2020.

VIEIRA, K. C.; SUGANO, J. Y. Pesquisas sobre comportamento do consumidor de inovações tecnológicas: uma revisão sistemática (1997 – 2017). XLI Encontro da ANPAD - EnANPAD 2017, São Paulo, 2017.