Maker Culture: A cost-effective approach

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José César Pontes Moreira[1], Márcia Maria Siqueira Vieira[2] and Josué Gustavo Silva[3]

ABSTRACT

Maker culture has emerged as a social movement that emphasizes the personal production of material goods as opposed to mass industrial production. The aim of this study is to investigate the application of the economic approach in maker culture analysis. Economic analysis can provide a range of insights into the nature of this movement, as well as the implications for society and the economy as a whole. For this, a bibliographic survey was carried out, 30 articles, magazines and books were reached, first; After an analysis of the abstracts and keywords, 20 studies were selected. This is a qualitative-quantitative and exploratory analysis. The study demonstrates that maker culture has a significant impact on the economy, mainly through the creation of new jobs, as well as through the promotion of innovation and technological development. However, the lack of financial investment can be a major obstacle to the expansion of this crop.

Keywords: Maker Culture, Economic Approach, Entrepreneurship, Innovation.

[1] Doctor in Education (UFC), Master in Rural Economics, MBA in Economics, Finance and Market, Specialization in Rural Education, Graduated in Economic Sciences and Pedagogy. Researcher in the following areas: economics, educational technologies, economic development and cooperativism.
E-mail: cesarecon07@hotmailcom
[2] Doctor student in Science and Mathematics (ULBRA-RS). Master in Computing Applied to Educational Informatics (UECE). Specialist in Methodology in the Initial, Final and High School Years (UVA). Graduated in Pedagogy (UECE).
Email: marcia.siqueira@educacao.fortaleza.ce.gov.br
[3] Graduating in Economic Sciences (UFC) and researcher in economic development.
E-mail: silvajosuegustavo@alu.ufc.br

INTRODUCTION

An economic system is defined by the mode of production on which it is based, integrating the productive forces and the social relations of production. The productive forces are the set of techniques, specializations, organizational and administrative knowledge, production spaces, machinery, natural resources, among others. Social relations of production, on the other hand, are a concept that refers to the relationship between the agents that are at the heart of the production process, including those who control the social surplus, that is, the surplus part of material production after deducting production costs (MARX, 1996).

Since the pre-capitalist arrangements, especially with the expansion of long-distance trade and the emergence of the Great European Navigations from the fifteenth to the seventeenth century, the issue of productive surplus has been at the center of the economic system in advent, since trade comes from goods and services produced beyond the consumption needs of a set of people and/or society. However, it is in the consolidation of capitalism, essentially in its industrial phase, in the second half of the eighteenth century, whose division of labor and, consequently, the sustained increase in productivity, raises the production of the social surplus to levels never seen before (FIGUEIREDO, 2019).

In this period, manual production ceased to be the protagonist in the manufacturing process, and the use of machinery massified the availability of goods and services, without, however, establishing measures for the preservation of natural resources essential to the production chains that are disseminated throughout the global market. Thus, from the second half of the eighteenth century to the last decades of the twentieth century, the capitalist system rooted in the productive daily life of the different nations that adopted it was almost entirely conditioned to the principle of economic linearity. That is, the growing extraction of resources from nature, the transformation of these into goods to be traded and, by construction of the system itself, their disposal in the form of waste or tailings (FIGUEIREDO, 2019).

However, this conjuncture took little into account the finite existence of mineral and energy resources, causing social, political and economic issues that even threaten the existence of the linear economic model itself. Such problems, for example, are linked to the depletion of *indispensable commodities* in the production process, to the waste of energy, to the pollution of air, water and soil, and to negative externalities that promote the reduction of well-being and the amplification of inequalities in vulnerable groups (FOUNDATION, 2014).

To clarify, *commodities* are basic products, not industrialized, and their prices are determined by the forces of supply and demand in the international market.

In response to the negative issues and instability caused by the linear economic model of production, new approaches emerge, and the outline of a system whose structuring characteristic is

based on the paradigm of circularity, anchored in principles of economics. In other words, the birth of an economic model based on circular premises, which excels in the reuse of waste and the promotion of sustainable growth, combined with new processes and restorative and regenerative technologies.

This movement in favor of a circular economy, whose debates in these first decades of the twenty-first century have been intensifying at a national and global level, especially with the effects of climate change, has as an ally another practice with common characteristics: the maker culture. Both concepts value creativity, innovation, and collaboration and aim to promote sustainability and reduce inefficient use of resources and pollution (STAHEL, 2019).

The maker movement, in the contemporary and post-war context, specifically, starts from the idea that individuals are capable of creating, altering, and restoring objects, encouraging creative solutions to problems, knowledge sharing, and new approaches to solid waste. In this way, the popularization of maker culture has the potential to revolutionize the way we produce in society. According to Cordova and Vargas:

> The maker movement is based on the philosophy of 'Do it Yourself' (DiY) and 'Do it with Others' (DiwO) and is based on the idea that ordinary people can build, repair, modify and manufacture the most diverse types of objects and projects with their own hands (CORDOVA; VARGAS, 2016, p. 2).

The *maker* movement has deep roots in post-war culture, when the emphasis was on reconstruction and recovery after the ravages of World War II. During this period, there was a push for self-sufficiency, the recycling of materials, and the creation of household objects due to the scarcity of resources (HATCH, 2014).

People began to realize that they could repair, build, and improve things on their own, often using recycled materials. This post-war period influenced the DIY mentality that is still evident today. Within the contemporary context of the maker movement, Ribeiro (2019) reports that the maker movement, as we know it today, has flourished in recent decades in Brazil.

This is largely due to technological advancement, which has provided more affordable tools such as 3D printers, laser cutters, microcontrollers, and *design software*. That is:

> Many schools have used the idea of maker culture to resignify teaching and improve Education, investing in differentiated learning environments, where students can express their creativity and participate in interdisciplinary experiences and projects [...]. The activities developed through maker projects have a real social impact, as they help students develop creative and effective solutions to real everyday problems. (ROSSI; SAINTS; OLIVEIRA, 2019, p. 1).

These technologies have allowed Brazilian *makers* to go beyond traditional craft skills and expand their reach into electronics, programming, and digital fabrication. Thereby:

> The maker movement is based on the philosophy of 'Do it Yourself' (DiY) and 'Do it with Others' (DiwO) and is based on the idea that ordinary people can build, repair, modify and manufacture the most diverse types of objects and projects with their own hands (CORDOVA; VARGAS, 2016, p. 2).

According to Oliveira, Santos and Souza (2018, p. 25), "in Brazil, knowledge sharing and collaborative culture play an essential role in the *maker movement*". Online platforms, *maker* groups and *makerspaces* have multiplied, allowing Brazilians to share projects, tutorials and ideas, learn from each other and collaborate on joint projects.

According to Carvalho and Bley (2018, p. 26), "makers have in common the use of digital tools to create products and the sharing of information and collaboration in online communities". Therefore, makers, in addition to creating, adapting or transforming a certain artifact, they share their ideas to collaborate with new projects.

The *maker* movement values the idea that anyone, in the Brazilian context, can create, innovate and become an inventor, designer and manufacturer. *Brazilian makers* also stand out for their ability to customize projects according to their needs and preferences, creating unique products adapted to personal taste.

> One of the goals for students with the use of the maker movement at school is to make them more attentive, balanced, positive students, while carrying out collaborative and creative activities helping them to work in spaces where their passions and interests develop (ZYLBERSZTAJN, 2015, p. 9).

Kumar (2006, p. 52) states that "a new information society, despite all its tensions and problems, should be welcomed and celebrated not only as a new mode of production, but as a complete lifestyle".

The transition from a linear model to a production system based on circularity depends, above all, on the social perception that new paradigms are needed for the preservation of the environment and mineral and energy resources. These paradigms are the protagonists of *which maker spaces* play a leading role in promotion, whether in the condition of social projects that they promote in a playful way, or in school disciplines of laboratories that take the form of teaching-learning.

Maker culture has gained increasing popularity as a social movement that values the individual production of goods through the use of technologies that allow the creation of physical objects from scratch. In this sense, maker culture can be seen as a movement that encourages entrepreneurship, technological development, and innovation.

According to Roberto de Souza Pinto, president of the Union of Electrical, Electronic and Similar Appliances Industries of the Electronics Valley (SINDVEL), "the supply of the Electronics Valley is not normalizing and companies are hostage to the import of raw materials, we need to buy

chips, semiconductors and many other items and there is no regular supply" (VALVERDE, 2022, [n.p.]). The industries in the electronics sector suffered during the Covid 19 pandemic:

> A survey carried out last month by Abinee, the association that brings together manufacturers of devices such as cell phones, notebooks, tablets and TVs, shows that 73% of members report difficulties in acquiring components. This explains why 20% of companies are working with lower-than-normal parts inventories. In March, in a brief sign of improvement, the percentage of manufacturers who faced difficulty in purchasing inputs fell to 66% (EXAME, 2021, [n.p.]).

The government needs to design a program for the development of productivity in the productive sector supported by investments in the sector of production goods (machinery, equipment and tools) and inputs, so that the national industry can grow, generate income and give social sustainability to the development program, safeguarding the environmental ecosystem in all its dimensions.

According to studies by the Institute of Studies for Industrial Development (IEDI), presented in a letter published on the electronic portal, in 2019, there are challenges to be overcome:

> Competitiveness problems are of the most varied natures, including systemic cost factors, such as interest rate levels detached from the international reality, scarce sources of long-term financing, complex and onerous tax system, insufficient and deficient infrastructure; and modest productivity gains due to the low investment environment in which the country finds itself. All of this is punctuated by long episodes of exchange rate overappreciation (IEDI, 2019).

In this study, we seek to analyze the contribution of the economic approach to the understanding of the maker culture and movement, highlighting the main economic implications. The economic approach offers a specific analysis framework that allows the understanding of maker culture, as well as its positive and negative effects on the economy and society.

The principles and values that guide the maker culture have a strong relationship with economic principles. The economic approach is based on the idea that the production and distribution of goods and services are fundamental to economic and social well-being. In this sense, maker culture is a practical expression of this approach, as it values individual production and personal skill over mass production, expanding the possibility of new business models.

It values the place. In line with the theory of endogenous development, which argues that the sustainable development of a place or region must be created or generated from the inside out, from the forces of entrepreneurial leaders (*makers*) who excel in the process of generating knowledge and products that revolutionize the culture and the way of producing, leading to economic and social gains for the local and regional community.

Maker culture is also an important source of innovation, since makers usually use cutting-edge technologies to create new products and services. In addition, the *maker* movement can be seen

as a form of entrepreneurship, as the creation of new products can generate new businesses and jobs. In this sense, maker culture can be seen as an important source of technological and economic development.

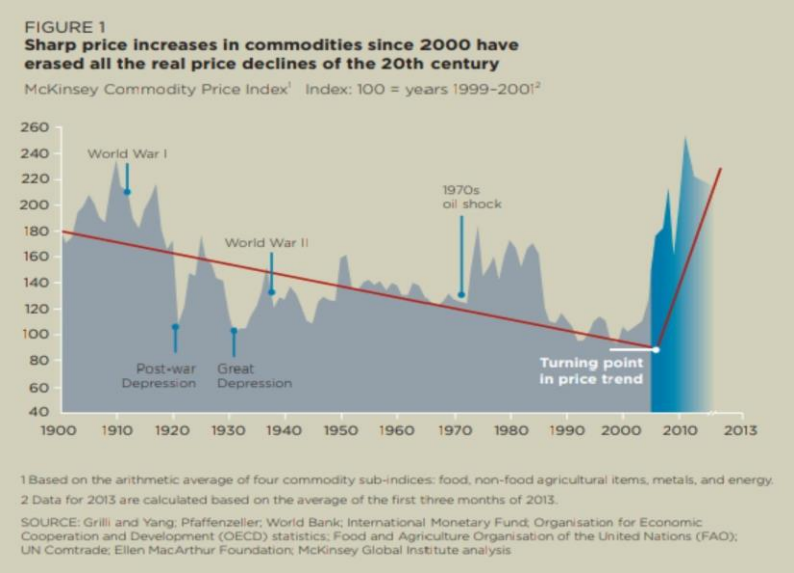
However, the expansion of maker culture can be hampered by an important factor: the lack of financial investment. Many makers do not have enough resources to finance their projects, which can limit their growth potential. Hence the importance of the knowledge of the Theory of Social Capital, which emphasizes the union of agents or people of a given institution or community to achieve objectives that they could not achieve alone (MOREIRA, 2007). The cost-effective approach can help identify the main financial obstacles that *makers* face and suggest alternatives to overcome them.

THE LINEAR ECONOMY, THE CIRCULAR ECONOMY, AND THE CHALLENGES IN THE TRANSITION FROM THE LINEAR MODEL TO THE CIRCULAR MODEL OF PRODUCTION

Since the Industrial Revolution in the eighteenth century, the established economic system has been anchored in the linearity of production, that is, it follows the model of extract-produce-discard. However, the finite condition of mineral and energy resources, indispensable for the success of this process, increases the pressures on global supply chains, creating distortions in *commodity* markets and raising their prices, as can be seen in Figure 1.

In addition, the process of disposing of products causes the accumulation of waste, which ends up resulting in energy inefficiency, since their residual energy is discarded, resulting in losses in the stages of the production life cycles.

Figure 1 - Commodity Price Index between 1900-2013



Fonte: FOUNDATION, 2014, p. 13.

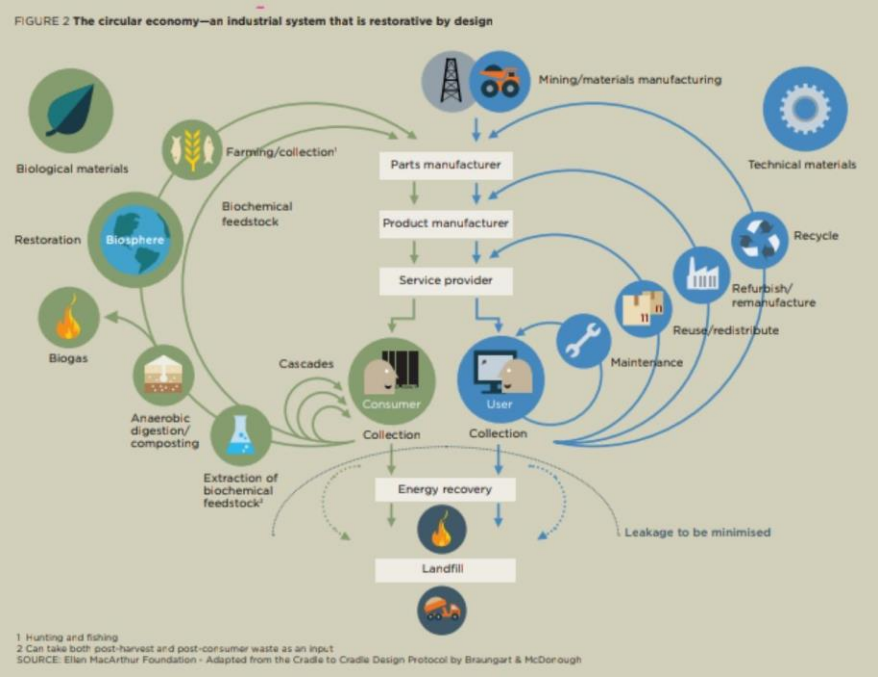
In addition to the issues involving linearity in relation to the non-use of inputs in their fullness, the model requires mass consumption to remain operational, leading to the creation of products with dubious quality to provide the need to change them constantly. In technical terms, this characteristic is called planned obsolescence, that is, the process in which goods are produced with a pre-defined expiration date so that the plaintiffs are always observing the need to exchange them.

The mere notion that products do not have a long shelf life already increases the desire to consume new, more advanced and special. In a culture of: broke, thrown away, buy a new one - without reuse, repair and/or circularity. The origins of planned obsolescence have their roots in the formation of business cartels, such as Phoebus, formed in 1924 in the city of Geneva, to debate the conditions of light bulbs and reduce the useful life from 2,500 to 1,000 hours. Since then, corporations have applied the same logic to encourage the accelerated disposal and consumption of their products (FOUNDATION, 2015).

Regarding externalities, mainly related to the incorrect disposal of chemical inputs used in the production process, which harm the air, soil and the water network of entire regions, they are deeply associated with the linear production model, with serious consequences for the population, increasing the risk of lung diseases, cancers and contamination by neurotoxic agents. Greenhouse gases, for example, are related to climate change and the growth of environmental disasters at various levels. It is pertinent to point out that, according to the concept of scientific racism, the people who are most vulnerable to the negative externalities of production are those who have little income to protect themselves, including living in peripheral spaces and belonging to ethnic groups disadvantaged by the structure present in society (FOUNDATION, 2014).

The circular economy, on the other hand, is an economic concept developed under the aegis of long-term sustainable growth, replacing the problematic linear production model, whose structure has proven to be unsustainable and generates negative externalities that compromise the well-being of society. The circular production process is fundamentally concerned with not only extracting the value of natural capital, but also regenerating it within a cycle, either in the production chain itself or in different industries, as can be seen in Figure 2.

Figure 2 – Industrial cycle expressed in the Circular Economy



Fonte: FOUNDATION, 2013, p. 29.

Thus, the scarcity of natural and energy resources is understood, and that these must be used effectively and efficiently within new business models allied to technologies and restorative processes (GONÇALVES; BARROSO, 2019).

In its structure, the circular economy works with the possibility of *upcycling*, that is, the process of transforming solid waste, useless materials, and discarded objects into goods destined for some new use, whether in a domestic or industrial reproduction process. This technique, however, has particularities that go beyond traditional recycling, as it is not based on the shredding and/or total breakdown of the original material, but rather on maintaining the integrity of the component, resignifying it with occasional updates for new functions (FOUNDATION, 2017).

In organizational terms, the practical transition to a circular economy depends on social and environmental responsibility in the culture of families, companies and, certainly, governments, starting from domestic recycling to the sharing of resources and the implementation of a clean energy matrix that puts renewable options first.

Therefore, the circular model is closely linked to the low-carbon economy that has been advocated by international organizations and entities, such as the United Nations and the European Union. It is worth mentioning that, within its specificities, the assumptions of a commercial society shaped by a circular economy go beyond recycling and reuse and undergo profound changes in the behavior of suppliers and demanders, with a greater focus on the performance of goods and services available in different markets, including a maker culture, of making and creating technological and technical solutions to meet local or/and regional demands. This perspective goes against planned obsolescence.

The challenges surrounding the productive and energy transition to a low-carbon economy are closely connected with the circular economy. However, the magnitude required in this scenario for such profound modifications is unprecedented in history.

> In a world approaching 9 billion people by 2030, including 3 billion new middle-class consumers, the challenge of expanding supply to meet future demand is unprecedented (World Economic Forum, 2014).

A MAKER CULTURE

In the post-World War II period, with the need for labor, scarce resources and the genuine desire for reconstruction, a new concept emerged in the United States of America (USA) and Europe, called "Do It Yourself" (DIY), which culminated in the mainstay of the maker movement. This concept was consistent with the period of uncertainty, due to the destruction caused by the fighting of 1939-1945 and, essentially, the decrease in civilian production in this period.

After 1945, with productive arrangements slowly being reallocated to the production of goods and services and a surplus of military goods, especially in the United States, individuals began to use their creative capacity to build, alter, and restore objects, adding greater value and utility to meet certain needs (PIRES, 2022).

Maker culture has effects on the economy and society. Kumar (2006, p. 50-51) clarifies the following:

> Knowledge not only determines, to an unprecedented degree, technical innovation and economic growth, but is fast becoming the key activity of the economy and the main determinant of occupational change [...] The information society, according to its theorists, generates changes at the most fundamental level of society. A new mode of production begins. It changes the very source of wealth creation and the determining factors of production. Labor and capital, the basic variables of industrial society, are replaced by information and knowledge.

The principles of maker culture, which emphasizes creation and innovation, can be related to the concept of scalability in the economy. Scalability refers to the ability to expand a business model or an idea efficiently and effectively. At school, this scalability contributes to the intellectual development of students. Like so:

> The traditional approach is still quite common in schools in Brazil, so maker activities, based on the constructionist approach, have become a strong trend, and can be seen as a new way of working with technology in school, as it provides practical learning, prioritizing creativity and problem solving. (AZEVEDO, 2019, p. 66).

It can be seen that the maker culture promotes collaboration and knowledge sharing among its members.

According to Anderson (2012), *Makers: The New Industrial Revolution*, this collaboration is essential for the dissemination of innovative ideas and solutions. When knowledge is shared, the barriers to innovation are reduced, which contributes to the scalability of the economy, since ideas can be widely adopted and improved.

The ability to create prototypes quickly is one of the pillars of maker culture. According to Gershenfeld (2005), in "FAB: The Coming Revolution on Your Desktop", rapid prototyping allows ideas to be tested and refined in an agile way. This is critical for scalability, as it allows innovations to be perfected before they are implemented on a large scale.

> Analyzing the new possibilities of using the maker culture, it could be seen that when we started the procedure of detachment from the traditional teaching model and started to produce knowledge through the use of the maker culture. (AZEVEDO 2019, p. 67).

The maker culture values the customization of products and solutions. The ability to adapt products to individual needs is essential for scalability in the economy, since solutions can be targeted at different market segments. This democratization of technology contributes to scalability, since more people can participate in creation and innovation.

While the concept of "Do It Yourself" was not entirely new or inherent in these historical conditions, it is true that throughout human development, creativity has always played an essential role in invention and craftsmanship. However, it is at this moment that the objective of reducing individuality, reusing materials and establishing new paradigms in the dissemination of knowledge in a community format advances and finds new possibilities.

However, in the post-war decades of the 50s and 60s, although they are seen as the fertilization phase of what would become the maker culture and education present in the daily life of the twenty-first century, it is essential to realize that the feverish dissemination of this movement occurred with the production of the first personal computers in the 70s and 80s.

The maker movement, whose name derives from the English verb *to make* , is the massification of "Do It Yourself", imbued with a systematic practice of construction, modification and restoration of objects, often creating new concepts, through spaces where collectivity and the sharing of information and tools are indispensable, in a practice in which individualism loses space for the improvement of production to be maximized. In addition, the "being *maker*" carries in its philosophy the protagonism in the mode of creation, from the formulation of the concept to the application of the "Hands On", a change of scheme that goes on a collision course with the massive production process present in industries, of which the subject is only a component in the gigantic machinery of production, without mastering all the knowledge of the process.

Thus, immersed in the notion of collectivity, Maker Spaces or FabLabs emerge, places prepared for "hands-on" practices, with equipment and tools that seek to help in the creative process

and, necessarily, in the application of this creativity in resignifications that will solve real problems. Such spaces are generative sources of teaching and learning, including people of various ages and different knowledge, but who, following common desires and niches, are able to work in cooperation and establish a true *maker culture.*

Likewise, schools are key players in the dissemination and impacts that the *maker* movement is capable of conceiving. Since in its most elucidative characteristics is the use of modern technological resources. These resources are increasingly common in the reality of children, adolescents and young people, due to the almost universalization of such electronic technologies and the internet in the daily lives of families, making them grow in a true digital nativity.

Traditional teaching, therefore, begins to present incompatibility with the reality in which it is established, requiring new approaches that place students at the center of their own learning. Maker education, in this sense, sows vast opportunities for experimentation, discoveries, mistakes and the achievement of innovative solutions in the classroom, integrating *maker* activities with the syllabus.

Currently, a huge number of supporters are joining the *maker* culture and placing the movement as one of the most prominent innovation hubs of the 21st century, especially with the organization of mechanisms for the dissemination of works and perspectives on the area. The creation of Make Magazine, by Dale Dougherty, in 2005, with an emphasis on step-by-step projects, symbolized the imminence of an increasingly professional and systematized maker movement, whose members are collaborating to form a worldwide network of connections in maker fairs, adding to the movement traces of entrepreneurship and new personalized business niches, replacing mass products and, therefore, standardized (STURMER; MAURICIO, 2021).

Furthermore, the academic interest in relation to the "Do It Yourself" lifestyle has gained momentum with the panorama of *maker education*, with pedagogues, andragogues and other professionals interested in the teaching area willing to carry out more research *in loco*, to understand the consequences of this active methodology. In political and governmental terms, the maker movement appears as an ally in the fight against climate change, encouraged, in particular, in the European Union and in NGOs around the world. In the United States, for example, former President Barack Obama established the National Day of Making National Maker Day, celebrated every June 17 (PAULA; MARTINS; OLIVEIRA, 2021).

The consolidation of *maker* thinking and its satellite communities, such as FabLabs and makerspaces, can contribute significantly to promoting habits and conditions that align with the circular production system. This, in turn, holds positions complementary to the *maker culture*. Therefore, it is up to political and economic agents to perceive such synergies and establish the necessary incentives for the "symbiosis" of both movements (SILVA; SOUZA; TEIXEIRA, 2019).

Although the *maker* movement and the circular economy have distinct conceptual frameworks, as well as particular histories and ultimate purposes, the characteristics that govern both are glimpsed from the panorama of sustainability, collaboration, and the development of new processes and technologies to streamline the way in which waste apparently useless for its original uses is reintroduced into society. In addition, both approaches applied together are able to accelerate the entrepreneurship process, with business projects being born based on the technique of upcycling and reuse of discarded materials, generating products with a longer useful life.

Thus, it is inferred that the circular economy has a growing role in the world in terms of changes in production and consumption habits and behaviors, taking the lead in the ability to shape the thinking of communities and populations willing to see in the economic process more than the harmful linearity. In other words, for companies, especially manufacturing industries, to transition from an economy based exclusively on harmful extractivism, it is essential that the mentality of society as a whole evolves towards the paradigm of circularity. Whether in schools or in social projects, the *maker movement* carries with it this willingness to be inductive in the process.

Kumar (2006, p. 56) considers that the "information society will be revolutionary". It can be said, currently, that the *maker* movement will be a revolutionary culture, a lifestyle, which will help humanity to deal with the imbalances in the social and productive areas, if the institutional agents collaborate for the communication and financing of the *maker* movement. It is not a fad, but a necessity, which can be clearly seen in economic models, government programs and studies on the use, reuse, exploitation and scarcity of natural resources.

Today, as in the industrial and post-industrial period, there are contradictions, at the same time that there is standardization in the way of consuming and being, there is also a movement towards being, creating individually or with few employees, producing flexibly and personifying consumer demand. Kumar (2006, p. 89) presents that "the revival of artisanal skills, a class of service not necessarily linked to capitalism and willing to contest it on certain points, but these, is the most notable aspect of which is the domination exercised by transnational corporations, of unprecedented wealth and power".

In the economy, the global market is global companies, with powerful leaders, who make money flow from market to market, according to the expected returns. There is also a flexibilization of production, dispersion and decentralization, replacement of marketing and mass production; there is a movement of more leveled hierarchies and emphasis on communication, an increase in outsourcing, franchising and marketing between companies, an increase in flexible time workers, and now, after the Covid 19 pandemic, in an increase in companies and workers who adopt remote work (*home-office*), extinction of functions in public and private companies, increase in people who seek

entrepreneurship as a strategy for insertion in the market and self-employed people who work from home.

Thus, the *maker* movement is a space to create and co-create, in an *interpreneutral* movement of entrepreneurship, emerging *startups* and promises of wealth, with the implementation of solutions and products and processes that respond to market opportunities and families.

According to Kumar (2006, p. 61) there are changes, such as the "development of individualistic ways of thinking and behavior; the culture of free enterprise, the end of universalism and the standardization of education... fragmentation and pluralism in values and lifestyles". If, on the one hand, man stepped on the moon, on the other hand, man was unable to live together and establish a peaceful, just and environmentally sustainable society, and to develop spiritually, developing virtues and practical principles of cooperation, collaboration and sustainability. The maker culture has this spirit of doing and being a sustainable, supportive, cooperative, collaborative movement and at the same time it values initiative and personal creation.

ECONOMIC THEORIES RELATED TO *MAKER PRODUCTION*

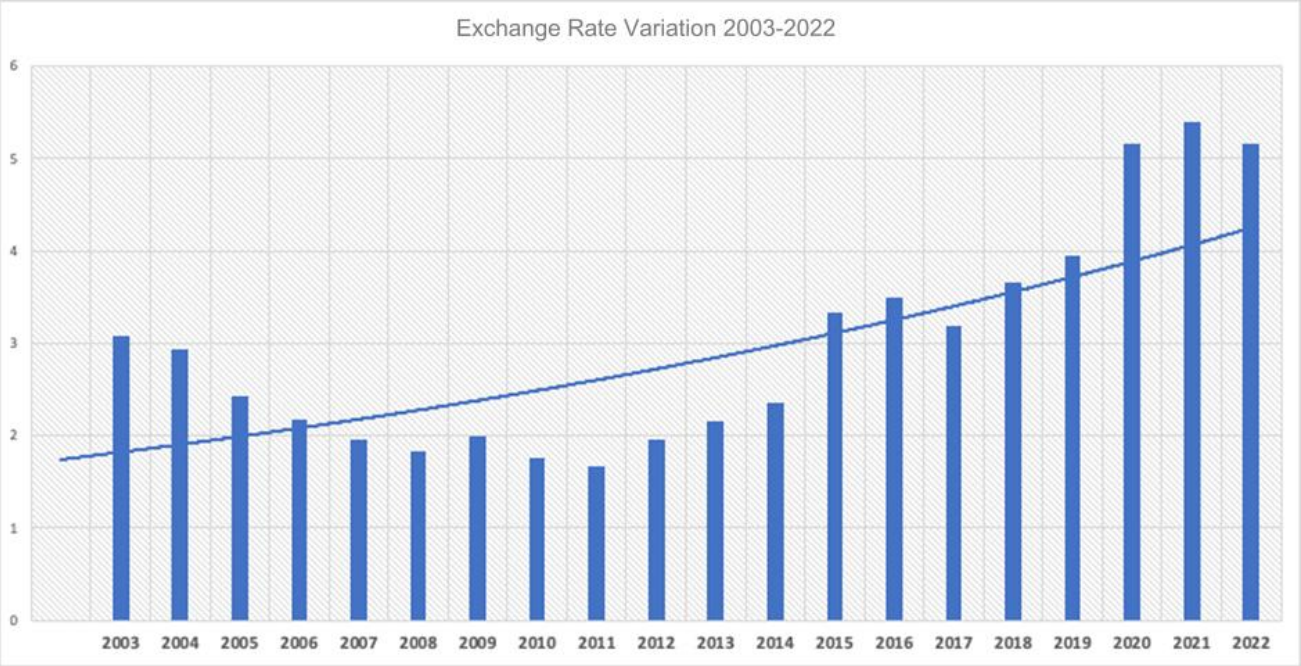
There are some economic theories that can be related to *maker production*. Among them, the most directly related ones will be displayed in the next subsections.

THEORY OF ECONOMICS OF PRODUCTION COSTS

Proposed by Ronald Coase, this theory suggests that the existence of transaction costs can lead to the creation of organizations that produce in-house, rather than buying products on the market. In *the maker* culture, transaction costs are reduced, since it is possible to produce items autonomously, without depending on third parties (NELSEN, 2016).

The chart below shows the exchange rate variation of the real (R$), in relation to the dollar (U$$) sale. When the exchange rate is valued, it means that external prices have decreased, because fewer dollars will be needed to acquire a certain commodity. The trend line shows a favorable scenario for imports, including inputs for industry and electrical and electronic products. See the following graphic:

Chart 1 – Exchange rate change 2003-2022



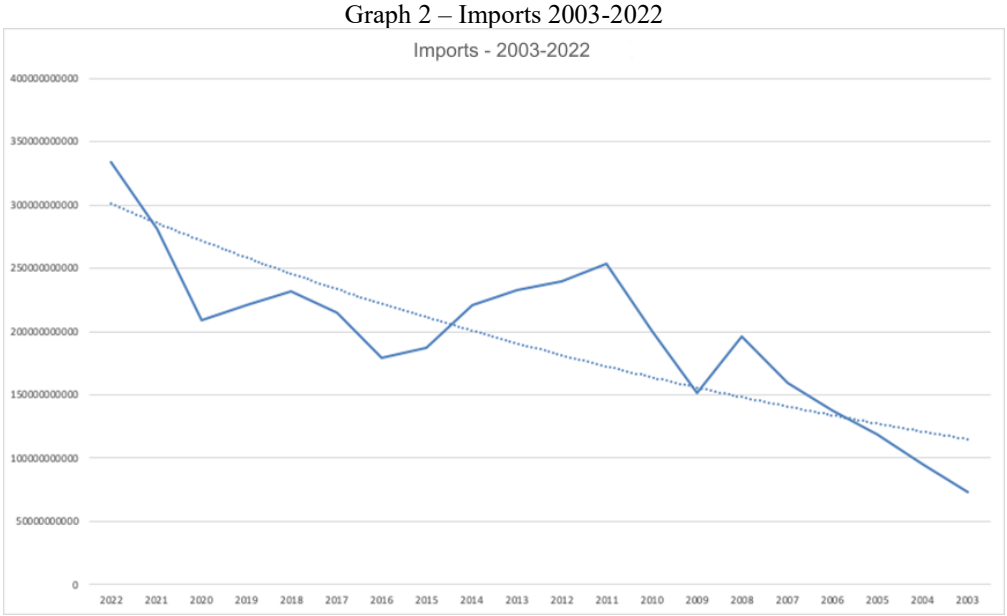
Source: Adapted from IPEADATA, 2023.

It is worth remembering that:

> 'Exchange rate is the price of a foreign currency measured in units or fractions (cents) of the national currency. In this case, the foreign currency is the dollar. The average rates are calculated for buying and selling and use the daily quotations of the reference period to perform the calculation, in this case, the year. The daily rate used for such calculation is called PTAX. In this case, it is the sales fee' (IPEADATA, 2023).

See also the next graph:

Graph 2 – Imports 2003-2022



Source: COMEXSTAT/MDIC, 2023.

According to Peremuter (2019, p. 278):

> With the drop in the prices of both printers and the inputs that are used to produce the objects, the scenario in which the user will be able to design, customize, choose the materials, size and colors of their next shoe (or bag, or shirt, or coat) seems to be close.

The top 10 products imported by Brazil in 2021 are shown in the table below:

Table 01 – Products imported by Brazil in 2021

	Product	**Good phob us$**
First	Fertilizers or fertilizers	13.4 billion
2nd	Fuel oils from petroleum or bituminous minerals	12.1 billion
Third	*Other Products - Manufacturing Industry*	8.9 billion
4th	Medicines and pharmaceutical products, other than veterinary	7.3 billion
5th	Thermionic valves and tubes	7.1 billion
6th	*Telecommunication Equipment*	7.0 billion
7th	Parts and accessories of motor vehicles	6.7 billion
8th	Organ-inorganic compounds	5.9 billion
9th	Natural gas, liquefied	3.9 billion
10th	*Non-electric motors and machines*	3.8 billion

Source: FAZCOMEX, 2023.

Now, the analysis of another economic theory follows.

OPEN INNOVATION THEORY

Developed by Henry Chesbrough, this theory suggests that in the age of knowledge, companies need to open up to external collaboration in order to accelerate innovation. In *maker* culture, techniques and tools are often shared openly, which allows for the creation of new products and solutions more quickly. Kumar (2006, p. 53) states that "networks restructure the power and the flow of communication within the company, from vertical to horizontal [...]. The computer will destroy the pyramid."

According to Anderson (2012), maker culture promotes creation, innovation and problem solving through manufacturing and creative thinking. This author emphasizes how this culture encourages entrepreneurship, as it empowers individuals to turn their ideas into reality and create innovative products or solutions.

Authors such as Osterwalder and Pigneur (2010) highlight the importance of creating business models that are scalable, but also adaptable to customer needs. This approach aligns with valuing personalization in maker culture, which can be incorporated into startup business models.

According to Christensen (2011), the empowerment of the individual plays a fundamental role in innovation. Maker culture and entrepreneurship empower individuals to innovate and create solutions to problems, often starting on a small scale, similar to the concept of "disruptive

innovation." According to Blank and Dorf (2012), building an entrepreneurial ecosystem that supports the growth of startups is crucial. This ecosystem often includes makerspaces and maker communities, where collaboration, knowledge sharing, and innovation take place at scale.

According to Ries (2011), startups are companies that often arise from innovative ideas and have the agility to grow quickly. This author highlights the importance of continuous innovation and agile learning for the success of a startup. This aligns with the experimental and iterative approach of *maker culture*.

According to the list of the fourth edition of *rankingporvir.org*, a project of the Inspirare Institute, which had the participation of 1,591 companies, the ten *startups* that stood out the most in the area of education in 2019 were the following:

Table 2 – Inspirare Project Ranking

EDTECH (*Startups* in the area of education)	**Activity**	**Origin**
1. **Dschool**	Online innovation school that helps large companies in the era of digital transformation with training for new skills.	São Paulo
2. **Happmobi**	We develop solutions for distance education with data mapping to identify technical gaps.	São Paulo
3. **Startup Mundi**	Gaming experience to accelerate open innovation and entrepreneurial education.	São Paulo
4. **Blox**	Curriculum management educational system designed for high school institutions, higher education institutions and corporate universities.	São Paulo
5. **Mastertech**	Training in large-scale digital skills: programming, digital business, digital marketing, data science and UX design.	São Paulo
6. **Keeps Active Learn**	Artificial intelligence-guided learning platform, which enhances the user experience with a high level of sharing, personalization, and engagement.	Santa Catarina
7. **Escribo Innovation for Learning**	Escribo equips teachers so that their students can achieve learning standards and become proficient in digital literacy skills.	Pernambuco
8. **Engage**	Gamified learning platform that increases employee participation in training by 4x.	São Paulo
9. **Kriativar**	It promotes changes in education and business processes through technologies such as artificial intelligence, augmented reality, and virtual reality.	Minas Gerais
10. **Oops Education**	Cell phone application for school attendance control.	Rio de Janeiro

Source: PORVIR, 2023.

It is noticed that there is a concentration of startups in the State of São Paulo, 60% of startups. The Northeast has only one startup, which demonstrates that investments and entrepreneurial ecosystem are more favorable in the Southeast and South regions of Brazil.

SHARING ECONOMY THEORY

This theory proposes a paradigm shift in which users become the producers of goods and services, rather than passive consumers. In maker culture, this idea is put into practice, since people can create products with their own hands and share them with the community.

The sharing of information has effects on several markets, as Kumar (2006, p. 47) says: "the exchange of information around the world between scholars and specialists is also rapidly becoming a reality". The catalogs of large libraries and archives can be consulted from a number of different locations with the aid of a computer terminal. Much of the material stored in these libraries can also be read on site in the form of microfilms or microfiche.

The world's major electronically linked stock markets make instant adjustments to stock prices in response to information transmitted by computer screens. The purchase and sale of shares during the 24 hours of the day becomes, for the first time, a possibility and, increasingly, the practice".

THEORY OF SOCIAL CAPITAL

Having Pierre Bourdieu and James S. Coleman as precursors, it deals with the value that social relations have in the creation of economic value. According to this theory, networks of relationships and social norms are fundamental for the creation of trust, reciprocity, and cooperation, which are essential for the functioning of an economy. Social capital can be seen as a collective asset that is built and maintained through participation in organizations and social interaction. Social capital can be harnessed to generate economic benefits, such as access to resources, information, and business opportunities. Maker production can be seen as a form of social capital construction, since collaboration between members of the *maker community* is an essential aspect of this movement (MOREIRA, 2007).

These theories demonstrate that *maker culture* has profound implications for the economy and the way companies and individuals produce and consume goods and services. In part, the maker movement is well articulated and intertwined with the principles of cooperative economy.

Cooperative economics is a form of economic organization in which groups of individuals voluntarily come together to create a democratic enterprise, where decisions are made equally among its members and financial results are divided fairly among the participants, according to their

production and participation in society. In *maker* culture, this approach can be seen as a form of collaboration and teamwork, with individuals sharing knowledge and skills to build joint projects.

The *maker movement* values the autonomous production of objects and the exchange of knowledge in communities of practice, which is why we work a lot in networks and in cooperative and collaborative movements. This approach can be compatible with the cooperative economy, since it allows the creation of groups of people who share resources, knowledge, and the production of goods in a collaborative and egalitarian perspective.

Thus, the cooperative economy can be an interesting way to apply the *maker culture* in the economy, favoring the sharing of knowledge and resources, in addition to stimulating the formation of communities focused on innovative and participatory projects.

CONCLUSION

We conclude that the economic approach is a valuable tool for analyzing maker culture. Through it, we can understand the main characteristics of this movement and the implications for the economy and society as a whole. The *maker* culture can be seen as an important stimulus for entrepreneurship and innovation, in addition to representing a significant potential generator of jobs and income.

The *maker* culture tends to consolidate, since companies are in a more flexible production process. The use, reuse and rational use of natural resources requires new production processes, based on new technologies and the creativity of the makers or makeans.

However, the lack of financial investment can be a significant obstacle to the growth of *maker culture*, which underscores the need for public policies that encourage the expansion of this movement.

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