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RESEARCH ON CIRCULAR ECONOMY IN MEDIUM AND LARGE ORGANIZATIONS IN THE METROPOLITAN REGION OF CAMPINAS

Misael Victor Nicoluci
Administration Course - Unipinhal
Esp. Santo do Pinhal - SP, Brazil
http://lattes.cnpq.br/7725663472467231

Nelson Aparecido Alves
Administration Course at ``Escola de Economia e Negócio da PUC Campinas``
SP, Brazil
http://lattes.cnpq.br/7725663472467231

Rodrigo Hipólito Roza
Administration Course at ``Escola de Economia e Negócio da PUC - Campinas``
SP, Brazil
http://lattes.cnpq.br/4927093770088541

Inês Mascara Mandelli
Administration Course at ``Escola de Economia e Negócio da PUC Campinas``
SP, Brazil
http://lattes.cnpq.br/9891303132251621

Abstract: Sustainable development is a growing concern of our society. In this context, organizations have rethought their business models and the circular economy stands out as an alternative to replace the linear economy. This study aimed to identify the level of awareness and application of the circular economy concept in medium and large organizations in the Metropolitan Region of Campinas. The research was applied as to its nature, qualitative and quantitative from the point of view of approaching the problem and exploratory according to its objectives. It was bibliographical, from the point of view of technical procedures, and also of the survey type, as it resorted to a survey of information with executives for a better understanding of the theme. The results showed that the organizations considered in this study have adjusted their business models, with greater alignment with the precepts of the circular economy, with reverse logistics being a critical point to be better worked on.

Keywords: Circular Economy, Sustainable Development, sustainability.

INTRODUCTION

Environmental issues have become one of the main challenges of modern society due to climate change, waste generation and the lack of sustainable growth, which also compromises social and economic aspects. According to the World Bank (2020), waste generation has grown and in 2020 the world generated about 2.24 billion tons of solid waste. And, often, disposal is inappropriate in places that generate pollution and compromise public health.

Since the Stockholm Conference in 1972, countries have been discussing environmental problems and there is a consensus that society as a whole is responsible for finding viable solutions, regardless of the wealth of each country. In this stakeholder context, for-profit and non-profit organizations play a crucial role in creating a sustainable supply chain.

Mota (2018) states that stakeholders influence corporate behavior, particularly on environmental issues. This way, organizations tend to insert the concept of sustainability in the management of their businesses.

Faced with this reality, the objective of this study is to identify the level of awareness and application of the concept of circular economy in medium and large organizations in the Metropolitan Region of Campinas, together with professionals at the level of coordination and management.

THEORETICAL FOUNDATION

In this section, four macro topics will be addressed: sustainable development, circular economy, life cycle and reverse logistics.

SUSTAINABLE DEVELOPMENT

According to Braga *et al.* (2005), our sustainable development model considers that the three assumptions "inexhaustible supply of energy", "inexhaustible supply of matter" and "infinite capacity of the environment to recycle matter and absorb waste" must be true. According to the authors, it can be said that only the first assumption is inexhaustible, as the Sun will be able to supply our planet for 5 billion years. The other two assumptions are limited.

Kohn (2015) reiterates that sustainability consists of the ability of the ecosystems that make up the environment to carry out, maintain and develop the essential environmental relationships between the basic environmental factors on the planet, which are air, water, soil, flora, fauna and man.

In the last decade, the acronym ESG (*Environmental, Social, Governance*) emerged with the meaning of corporate sustainable development and is a way of measuring the commitment of organizations in this tripod.

The Brazilian Stock Exchange (B3) created the Corporate Sustainability Index (ISE B3) to encourage engagement in these three areas for a better society.

The concept of sustainable development, according to ABNT (2017), is development that meets the environmental, social and economic needs of the present without compromising the ability of future generations to meet their own needs. The same standard defines the environment as the surroundings where an organization operates, including air, water, soil, natural resources, flora, fauna, human beings and their interrelationships.

It is clear, therefore, that there is a concern with natural resources and waste. In this sense, the concept of circular economy comes to replace the traditional linear economy.

CIRCULAR ECONOMY

According to Luiza Santiago from the Ellen MacArthur Foundation cited by Rajabally and Rocha (2021), the linear economy is an economy that extracts resources from nature, transforms and discards them. In the circular economy, value is created and generated from natural resources, while the linear economy extracts value from natural resources. The National Confederation of Industry (CNI, 2019) defines that in the circular economy, energy and material used in activities must be recirculated in order to minimize the generation of waste.

Kirchherr et al. (2017) point out that the circular economy is an economic system that replaces the concept of "*end-of-life*" with reduction, with alternatives for reuse, recycling and recovery of materials in production/distribution and consumption processes. The *Platform for Accelerating the Circular Economy – PACE (2018)* defines that it is an alternative that seeks to redefine the notion of growth, focusing on benefits for society as a whole. It involves decoupling economic activity

from the consumption of finite resources and eliminating waste from the system as a matter of principle. Supported by a transition to renewable energy sources, the circular model builds economic, natural and social capital. "We use more resources than the Earth can sustainably supply – 100 billion tonnes of raw materials annually, of which only 8.6% is recycled back into the economy".

LIFE CYCLE

Braga *et al.* (2005) point out that the product life cycle (any good or service) can be seen by the environmental implications of products and processes, from generation to death. This is known as "cradle to grave". Figure 1 shows the stages of lifecycle analysis.

The authors state that inputs (consumption of water, energy, and various inputs) and outputs (final product, effluents, waste and atmospheric emissions and other environmental impacts) are accounted for each of the stages of the life cycle.

ABNT (2009) defines life cycle as "the consecutive and linked stages of a product system, from the acquisition of raw materials or their generation from natural resources to final disposal".

The life cycle concept can be illustrated in one of the most relevant segments of the circular economy, which is construction. It can be divided into 4 stages, as shown in Figure 2: starting with the project, the manufacturing and construction phase, the operation and maintenance phase and the last stage, the waste disposal phase. These phases are interconnected and interactive. In this last step, there must be a concern to comply with the relevant legislation and with the 3R's technique - reduce, reuse and recycle.
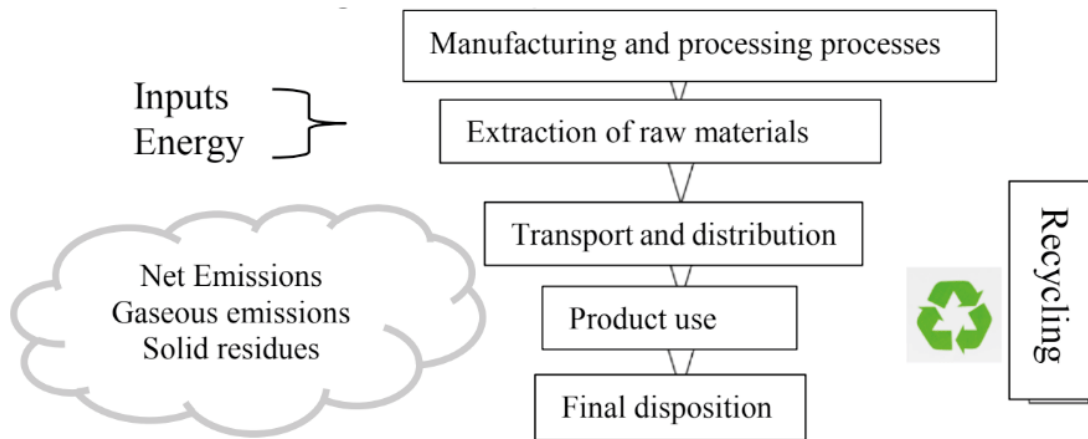
Figure 1-Life cycle sequence
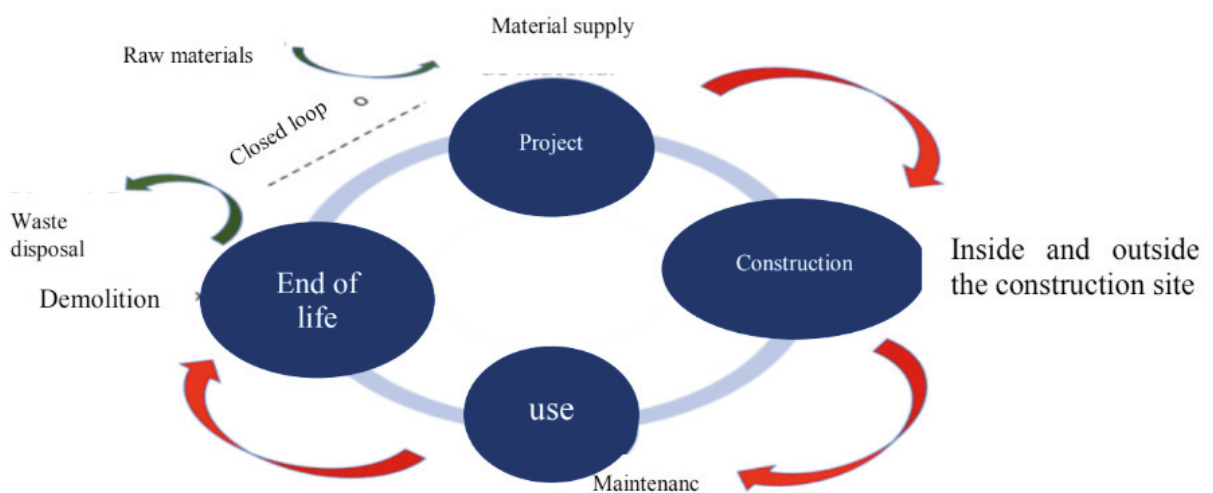
Source: Braga *et al.* (2005)

Figure 2 - Construction lifecycle x circular economics and supply chain

Source: Based on Spisakova *et al.* (2022)

REVERSE LOGISTIC

The first publications on reverse logistics were made by the *Council of Supply Chain Management Professionals* (CSCMP) in the United States in the early 90s, therefore 30 years ago. According to the CSCMP (2022), reverse logistics is a specialized segment focused on the movement and management of products and resources after the sale and after delivery to the customer. Includes product returns for repair and/or credit.

Leite (2017) states that reverse logistics is the area of business logistics that plans, implements and controls the flow and corresponding logistical information, from the return of after-sales and post-consumer goods to the business cycle or production cycle, through reverse distribution channels, adding economic, ecological, legal, corporate image value, among others.

According to Izidoro (2015), reverse logistics is based on the reverse flow of traditional logistics, which aims to deliver the product or service to the customer. It is responsible for returning after-sales and post-consumer products and sending them to different destinations. These products can be remanufactured, recycled or reused. Another possibility is sending to landfills or incineration (as in the case of medical waste). The National Solid Waste Policy (PNRS) - Law Number 12,305/2010 already defines the reverse logistics system for manufacturers, importers, distributors and traders of pesticides, their packaging and waste; Batteries; tires; lubricating oils, their waste and packaging; fluorescent lamps, sodium and mercury vapor and mixed light; and electronic products and their components.

METHODOLOGY

CHARACTERIZATION OF RESEARCH

According to Silva and Menezes (2000), this scientific research from the point of view of its nature is applied, as it intends to generate knowledge about how the *stakeholders* of medium and large organizations in the MRC are behaving when the subject addressed is Circular Economy.

As for the point of view of how to approach the problem, it is a quantitative research, since the data collected on the responses of the organizations can be quantified and analyzed statistically. (FONSECA, 2002). In addition to being a qualitative research, which according to Ganga (2012), aims to obtain information on how medium and large organizations have been dealing with the circular economy based on the vision of their stakeholders.

From the point of view of its objectives (Gil, 2017) it is an exploratory research, with the objective of providing greater knowledge on the subject Circular Economy in medium and large organizations in the Metropolitan Region of Campinas - RMC. In addition to carrying out a bibliographical survey on relevant topics. And interviews with executives who work with this subject in their organizations.

This scientific research is the result of an investigation with a group of executives trained to answer questions on the subject, as it is the reality they experience in the organization. From the point of view of technical procedures (GIL, 2017) it is a bibliographical research, as a survey of theoretical references was carried out mainly on Sustainable Development, Circular Economy and its Life Cycle, as well as Reverse Logistics, because of the relevance of knowing the which has already been studied and published in journal articles, books (FONSECA, 2002) and

technical standards. Additionally, it is a *survey* research, as information was raised with a group of executives from medium and large organizations about how the organization deals with the subject internally (SANTOS, 1999).

These executives who participated in the research represent an intentional non-probabilistic sample, representatives of the target population (FONSECA, 2002). In the research carried out, the respondents and not even the organizations were identified, as secrecy is important in *survey* research (SILVEIRA; CÓRDOVA, 2009).

DATA COLLECTION AND ANALYSIS TECHNIQUES

To collect the data, a data collection instrument called a questionnaire was used, with a previously established script, with ten multiple-choice questions, that is, closed questions with 4 to 5 possible answers. The instrument was answered in *Google Forms* by the thirteen informants, who have coordination, management or higher positions and who work in organizations with the subjects addressed. The researchers sent the questionnaire link to the organizations by email or WhatsApp, explaining the objective of the work, requesting participation and informing about the secrecy of the names of informants and organizations. The answers were performed without the presence of the researchers.

For the tabulation and analysis of the collected data, through the previously mentioned instruments, statistical methods were used, including the reports provided by the *Google Forms*.

RESULTS

Next, the results obtained with the research carried out will be presented. For each of the questions, a graph and analysis of the results obtained will be shown.

CONCERN OF ORGANIZATIONS IN USING AND ACQUIRING RESOURCES FROM RENEWABLE SOURCES

Graph 1 shows that the vast majority of respondents (84.6%) believe that organizations must be concerned with acquiring raw materials from renewable sources of animal, vegetable, fabric, metal, wood, paper and cardboard origin, among others. Even when selecting suppliers, the sustainable origin of the materials must also be considered. Additionally, organizations must use some source of renewable energy, solar or wind, and also start investing in a fleet of electric vehicles. For 84.6% of the managers, these investments are viable. Only 15.4% of stakeholders believe they are indifferent or disagree with these investments by organizations. Meets PACE (2018), described in section 2.2.

REVERSE LOGISTICS IN ORGANIZATIONS

Graph 2 reveals that almost half of the surveyed organizations (46.2%) practice reverse logistics for products manufactured by the organization and the Engineering and Research and Development area considers sustainable components for the development of new products and services. It can be seen that there are still many organizations (53.9%) that do not consider the responsibility of having to deal with the waste of products placed by them on the market (15.45% rarely + 38.5% occasionally). This is worrying and reveals that the National Solid Waste Policy (PNRS) needs to be expanded and enforced.
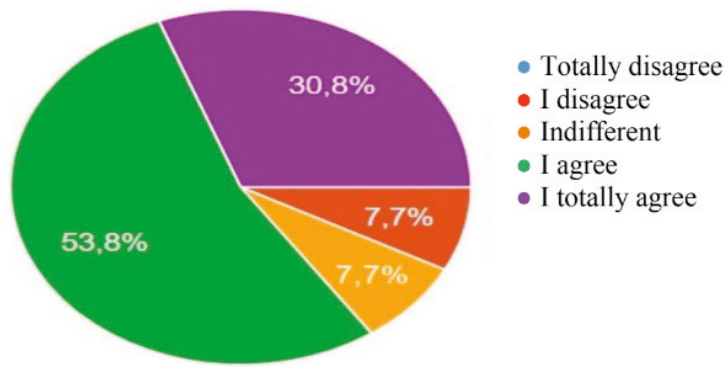
Graphic 1: Concern about renewable resources

Source: Elaborated by the authors (2022)
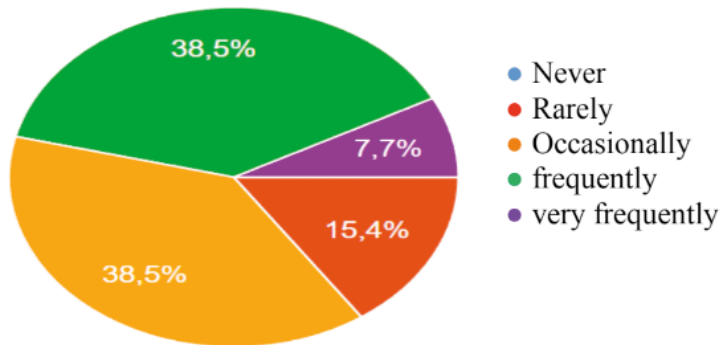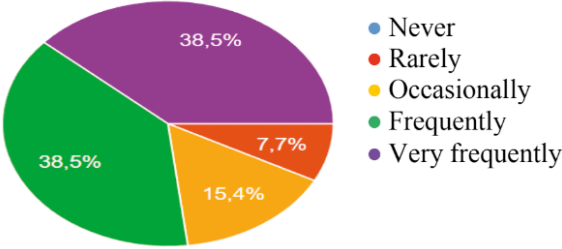

Graph 2: Reverse logistic

Source: Elaborated by the authors (2022)

Graph 6: Scarcity of resources X Macroeconomic Solution

Source: Prepared by the authors (2022)

## PRACTICE OF THE 3R'S TECHNIQUE (REDUCE, REUSE AND RECYCLE) FOR ENVIRONMENTAL MANAGEMENT

Graph 3: Practice of the 3R's
Source: Elaborated by the authors (2022)

The vast majority of respondents (77%), according to Graph 3, use the practice of the 3R's technique (Reduce, Reuse and Recycle), thus investing in internal environmental management, separate recyclable waste and also have the certification in the environmental area. Barreiro-Gen and Lozano (2020) identified that organizations listed on the Global Reporting Initiative (GRI) need to improve their 4R's strategy to contribute more to the Circular Economy and *link* theory with their practices.
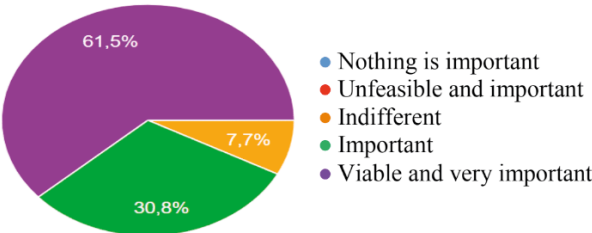
CIRCULAR ECONOMY VS LINEAR ECONOMY
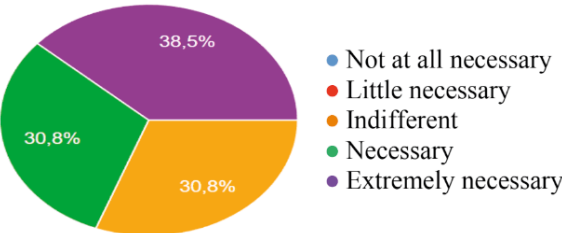
Graph 4: Circular Economy and Linear Economy
Source: Prepared by the authors (2022)

69.3% of the respondents, based on Graph 4, stated that there is a great contrast between the circular economy, which is a production/consumption model that involves the reduction, reuse, recovery and recycling of materials and energy, minimizing the extraction of resources, maximizing reuse, increased efficiency and new business development. The circular economy contrasts with the current production process, which has the practice of extract-produce-discard what we call linear economy. Still 30.8% believe it is indifferent to use the circular economy, instead of using the linear one. This result differs from the CNI survey (2019), in which only 30% of participating companies responded that they had already heard about the circular economy before the survey, while 70% were introduced to the topic for the first time. One consideration is that most of the CNI sample was small businesses.

RELEVANCE OF THE CIRCULAR ECONOMY FOR THE ENVIRONMENT

Graph 5 Relevance of Circular Economy for the environment
Source: Prepared by the authors (2022)

Graph 5 shows that the vast majority claim that the circular economy is viable and very important, as it is a relevant economic model for the preservation of the environment. In this economy model, it is possible to use to the maximum and even later to reuse all the elements that participate in the production chain. But, on the other hand, still 7.7% of stakeholders believe that this economic model is indifferent.

SCARCITY OF RESOURCES X MACROECONOMIC SOLUTION

Graph 6 shows that most respondents understand that it is possible to act with social responsibility, followed by reducing the extraction of raw materials, the use of the 3R's and rethinking the current economic model. In other words, they are the precepts of sustainable development addressed in section 2.1 of this study.

CONCEPT OF CIRCULAR ECONOMY AS A POLICY GOAL

The concept of circular economy emerged in a discussion thinking about the idea of a political goal, in a context of scarcity and rising prices of resources and climate change, as an alternative and necessary way to increase the efficiency of the use of materials, energy and consequently sustainability. Stakeholders (69.2%) pointed out that the scarcity of physical resources is the main argument for implementing the circular economy. However, 30.8% understand that there are difficulties in adopting this new sustainability model as it is long-term in terms of reducing environmental degradation and adding value.

## POSSIBLE TRANSITION FROM THE CURRENT LINEAR ECONOMY TO THE CIRCULAR ECONOMY

To drive the transition from the current linear economy to a circular economy, economic, financial and market factors are very important, since technical solutions already exist, but their application in practice is limited due to lack of resources and acceptance of the Marketplace. Around 40% of the executives pointed out the need to rearrange the institutional system, following the principles of the circular economy, including the allocation of investments and lines of credit.

Neves and Marques (2022) highlighted that

people with a high level of education are more inclined to buy recycled products, as well as to separate their leftovers for recycling. There is also some resistance by older people to adopt new practices that benefit the Circular Economy, practicing the traditional linear economy.

It is clear that *stakeholders* expect incentives to implement the circular economy.

PILLARS AND CHARACTERISTICS OF THE CIRCULAR ECONOMY MODEL CONSIDERED BY STAKEHOLDERS
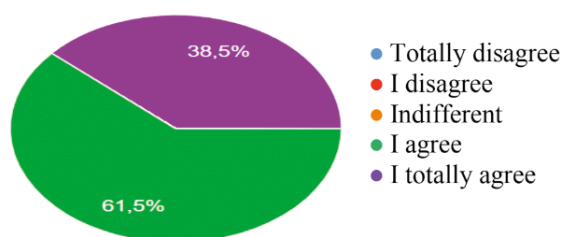
Graph 9: Pillars and Characteristics of the Circular Economy Model
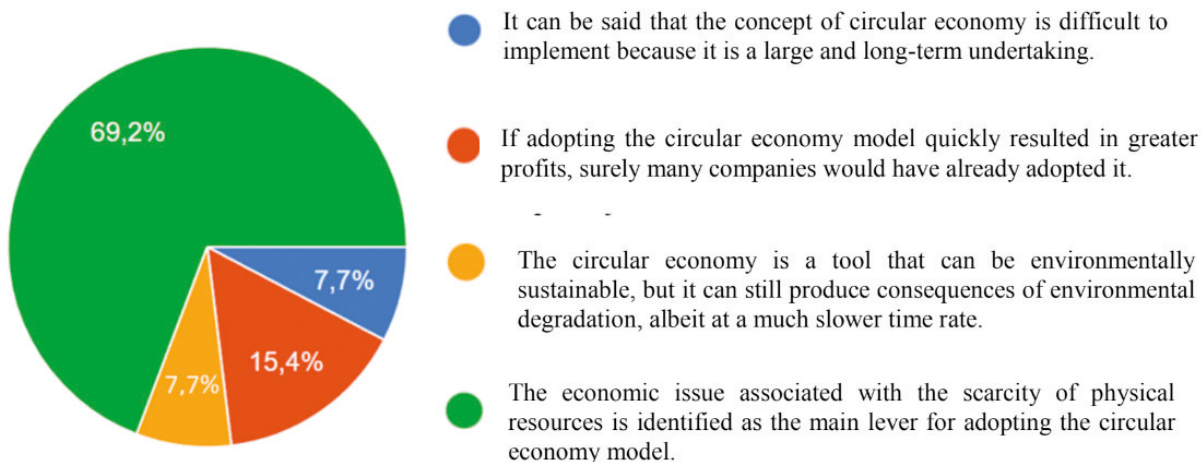
Source: Elaborated by the authors (2022)

According to graph 9, all respondents who participated in the survey agree that they stand out as Pillars and characteristics of the Circular Economy Model:

No Waste Products; resilience and diversity; shift to renewable energy sources; think of the system as a whole; increase and preserve natural capital.
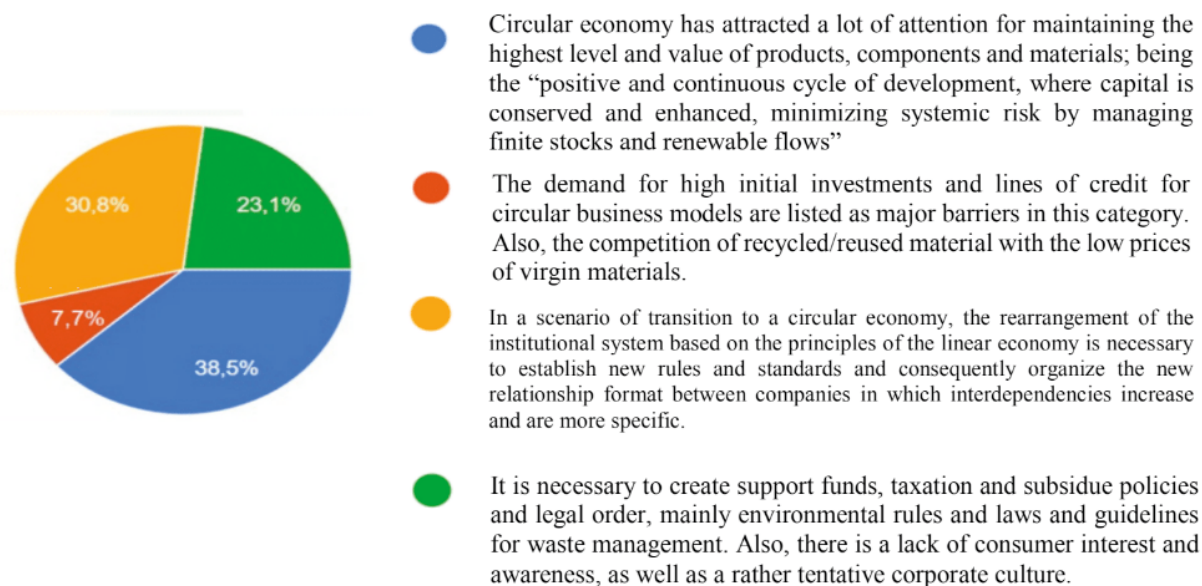
FEASIBILITY OF IMPLEMENTING A SUSTAINABILITY MODEL

Graph 10 highlights that 92.3% of the *stakeholders* who participated in the survey believe that it is feasible to implement a production/consumption model in organizations that involves the reduction, reuse, recovery and recycling of materials and energy, minimizing the extraction of resources and maximizing reuse, with the aim
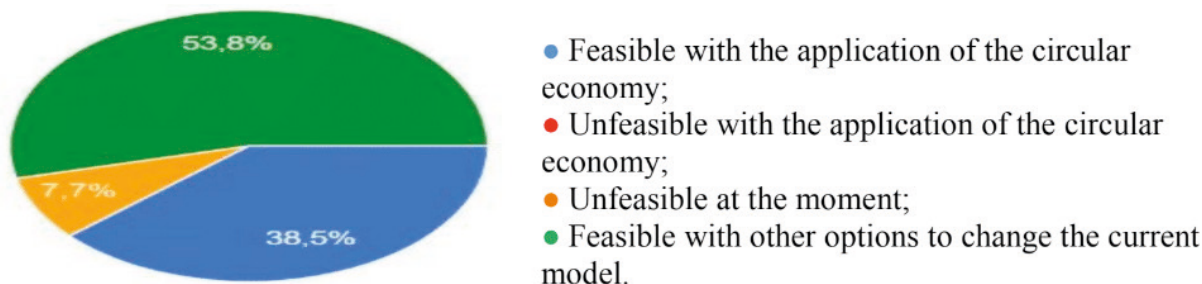
Graph 7: Concept of Circular Economy as a policy goal

Source: Prepared by the authors (2022)

Graph 8: Possible transition from the current Linear Economy to the Circular Economy

Source: Elaborated by the authors (2022)

Graph 10: Feasibility of implementing a Sustainability Model

Source: Elaborated by the authors (2022)

of reducing the extraction of raw materials from the environment as much as possible and maintaining sustainability. Of these, approximately 50% of respondents believe that it is necessary to implement, but suggest that there must be changes in the current model.

CONCLUSIONS

This study sought to identify the level of awareness and application of the circular economy concept in medium and large organizations in the Metropolitan Region of Campinas. The objective of the research was achieved, showing that there is awareness among executives regarding the circular economy, since practices for using the pillars and characteristics of the circular economy model were identified. On the other hand, it brought to light that reverse logistics, which consists of giving an adequate destination to post-consumption/waste, is still a challenge and needs to be expanded in this transition from linear to circular economy.

Seeking alignment with the precepts of the circular economy, this study is in line with the CNI survey (2019), as it shows that organizations have adjusted their business models. The main ones are: resource recovery, product as a service, sharing, circular inputs, product life extension and virtualization. It is therefore necessary to change the *mindset* from the linear economy to the circular economy in the approach to business, from profit to innovation and creation of new values, as well as from an ethical point of view, emphasizing that, instead of thinking only about competition, it is necessary to reflect on collaboration.

As a suggestion for the continuity of this study, the authors suggest the application of the data collection instrument of this research in other organizations, in order to increase the sample. In addition, they propose a survey on compliance with the National Solid Waste Policy - Law 12.305/2010, as this research identified that it is a critical aspect in the circular economy.

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