INTERNET LATENT CORPUS JOURNAL
vol. 11 N. 2
(2021) ISSN 1647-7308

https://proa.ua.pt/index.php/ilcj

GREEN RECOVERY: SUSTAINABLE CONSUMPTION BEHAVIOR AND THE CIRCULAR ECONOMY

Andreia de Bem Machado[1], Marc François Richter[2]

Abstract: The world is undergoing many changes, including environmental problems such as a lack of basic sanitation, clean water, pollution, and other issues that have an effect on people's well-being. Sustainable efforts have been made locally to enhance the quality of life of the popultion. As a result, the article aims to highlight green recovery as a means of promoting sustainable consumption for a circular economy. For this purpose, a bibliometric research was conducted as a result of a systematic search in the Scopus database. According to the findings, the study is relevant to the following fields: Environmental Science, Engineering, Chemistry, Chemical Engineering, Energy, Agricultural and Biological Sciences, Business, Management and Accounting, Earth and Planetary Sciences, Economics, Econometrics and Finance, Materials Science, Decision Sciences and Multidisciplinary.

Resumo: O mundo está passando por muitas mudanças, incluindo problemas ambientais como falta de saneamento básico, água potável, poluição e outras questões que afetam o bem-estar das pessoas. Esforços sustentáveis têm sido feitos localmente para melhorar a qualidade de vida da população. Como resultado, o artigo visa destacar a recuperação verde como forma de promover o consumo sustentável para uma economia circular. Para tanto, foi realizada uma pesquisa bibliométrica a partir de uma busca sistemática na base de dados Scopus. De acordo com os resultados, o estudo é relevante para as seguintes áreas: Ciências Ambientais, Engenharia, Química, Engenharia Química, Energia, Ciências Agrárias e Biológicas, Negócios, Gestão e Contabilidade, Ciências da Terra e Planetárias, Economia, Econometria e Finanças, Ciência dos Materiais , Ciências da Decisão e Multidisciplinar.

Keywords: sustainability, circular economy, green recovery, consumer behavior.

Society's current pattern of consumption acts as a manifestation of consumers' values and social position. Quality of life and happiness are increasingly related to material achievements, which leads to a vicious circle: the individual works to consume ever more (Firat et al., 2013).

The consumption of natural resources in the cities of our planet can vary between 60 and 80%. The UN estimates that 66% of the world's population will live in urban centres by 2050 (Harris et al., 2020). As such, several local and global planning initiatives are being designed. These visualize actions to reuse, recover and recycle resources (materials, water, energy, land, and infrastructure) could help address resource scarcity and waste in cities (Williams, 2019).

Since the 19th and 20th centuries, with the beginning of the first industrial revolution, the individual consumes to have a social identity, be part of a group and create bonds (More, 2000). But this consumption pattern is environmentally unsustainable, as the excessive use of natural resources and the large amount of waste generated increasingly contributes to environmental degradation

[1] Professora dos Cursos de Engenharia na Faculdade do Vale do Itajaí Mirim e Pedagogia da Faculdade Municipal da Palhoça - 88130-475, Brusque and Palhoça, Brazil. E-mail: andreiadebem@gmail.com
[2] Professor at the Professional Master Programm in Environment and Sustainability, State University of Rio Grande do Sul, CEP 95400-000, São Francisco de Paula, Rio Grande do Sul, Brazil. E-mail: marc-richter@uergs.edu.br

(Hoekstra and Wiedmann, 2014). People in all countries are realizing, based on the news and the catastrophes that ravage the environment, about environmental problems and impacts, highlighting the greenhouse effect, as well as the pollution of water resources and oceans, and deforestation on a global level, that the form of economic production and consumption, need to change drastically.

Green recovery is one of the actions being discussed all over the planet. This would be a resumption of economic growth through investments in strategic sectors, providing new technologies, innovations in production processes, and more efficient use of public and private resources, lifting people out of poverty and creating jobs (Lahcen et al., 2020).

Circular economy makes part of sustainable development, inspired in particular by notions of economic permaculture, green economy, usage economy or functionality economy, performance economy, and industrial ecology, and which emerges as an alternative to the linear economy. The main point is that the residues/waste from one industry can be used again as recycled raw material by the same or another industry. Also, circular economy intends to develop products with a view to reuse, thus keeping materials in the production cycle (Witjes and Lozano, 2016). Thus, related to the green recovery are the sustainability actions caused, based on the circular economy, listed below:

Reuse/recycling which consists of the stages of dismantling the used product, cleaning its parts, repairing or replacing damaged parts, and testing the quality of the product afterwards;

A process whereby a solid waste substance that would otherwise be unusable is being transformed, including changes in its physical, physicochemical, or biological state, to attribute characteristics to the waste so that it can become a raw material or a product.

Given this contextualization, the purpose of this study in this article, is to point out actions on sustainable consumption for circular economy through the green recovery. To this end, the paper is structured into four sections, in addition to this introductory section, with the research procedures being presented presented in the “Methodological Procedures” part (Souza and Machado et al., 2020). In the third section, the bibliometric result is detailed based on scientific publications resulting from this area. The fourth section contains the final considerations, preceded by the references that were used are used throughout the article.

METHODS

To meet the problem of the present research, the study is classified as exploratory-descriptive to describe the theme and increase the researchers' familiarity with the fact, as well as clarify the concepts inherent to the subject under study (Machado et al.; 2021).
The literature search method was a systematic search in an on-line database, with a bibliometric analysis. Bibliometrics is based on mathematical and statistical methods with the intention to map publication patterns from bibliographic records stored in databases (Feather and Sturges, 2003; Santos and Kobaschi, 2009). For the authors, bibliometry allows relevant information such as production by region, temporality of publications, research by area of knowledge, count of literature related to the citation of the study, and impact factor. Mathematical and statistical data contribute to the of a study outcome as well as the reduction of biases, when looking at a certain theme.

For the bibliometric analysis, the study was organized into three distinct stages: planning, collection, and result. These steps are importante to answer the research guiding question: How can sustainable consumption actions lead to the circular economy through green recovery?

Planning began February 2021, when the survey was conducted. Several parameters were established during this process, as a limitation of the search to electronic databases, not contemplating physical catalogs in libraries, given a large number of documents in the Web search bases. In the planning scope, the Scopus database (www.scopus.com) was stipulated as relevant to the research domain due to the relevance of this database in the academic environment and its interdisciplinary character. And it is also one of the largest databases of abstracts and bibliographic references of peer-reviewed scientific literature and its timeliness.

Considering the research problem, the search terms were defined in the planning phase, namely: "sustainable" and "consumption" and "circular" and "economy", and "green" and "recovery." As a main principle for the search, it was decided to use the referred terms in the "title, abstract and keyword" fields, without delimiting temporal, language, or any other restrictions that might limit the results.

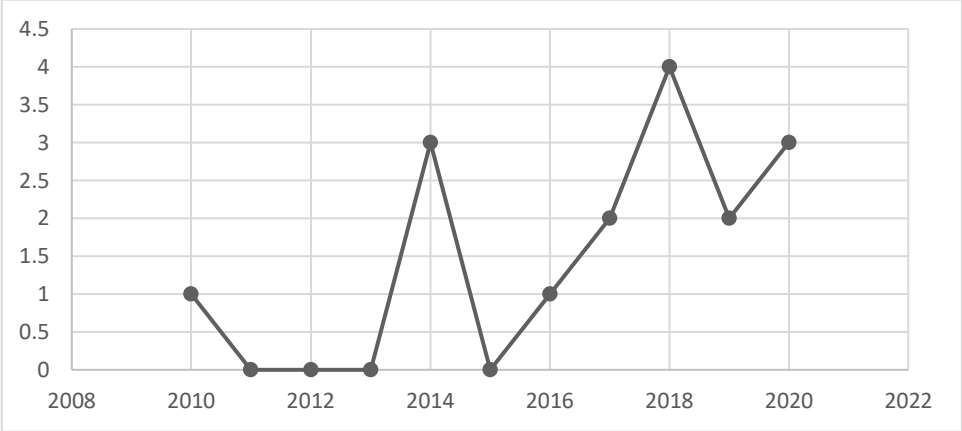
RESULTS AND DISCUSSION

From the research planning, data collection recovered a total of 16 indexed papers, which indicated a record from 2010, the first publication, until 2020.

Results indicated that 16 papers were are written by 38 authors, linked to 45 institutions in 15 different countries, and 172 keywords were are used to identify and index the publications, which were are distributed among 12 areas of knowledge and four types of publication.

In the first moment, the temporal distribution of the papers was analyzed, identifying that the publications were quite shy in the period starting in 2010 with one publication in the area. In 2011, 2012, and 2013, no publications were reported. In 2014, there were three publications in the area. In 2015, there were no publications, while in the year 2016, there was one published paper and in 2017, two scientific publications in peer-review journals. In the year 2018, there were 4 papers published, followed by the year 2019 with 2 publications. In 2020, there was a significant increase with three publications in the area. Graph 1 was prepared for better visualization of these results.

Graph 1 - time distribution of the papers

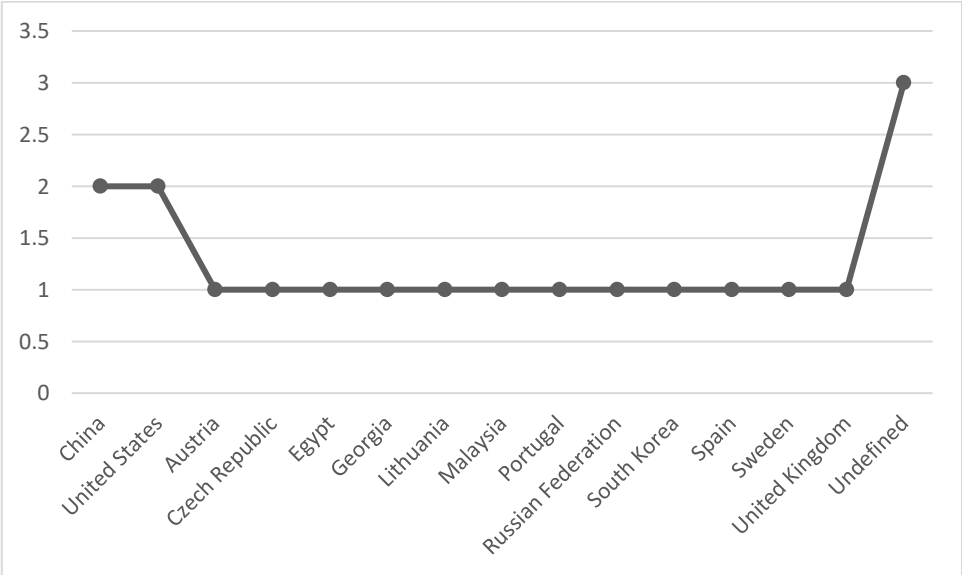


Source: Prepared by the authors (2021)

From the 16 papers obtained in the search, one can observe a varied list of authors, institutions, and countries that stand out in the research regarding the circular economy, green recovery, and sustainable consumption, indicating that the topic of sustainable consumption, circular economy, and green recovery is of general interest.

When analyzing the countries that most publish in scientific peer-reviewed journals in the area, it can be noted that China and the United States stand out with an average of 11% of the total publications, compared to the other countries, with a total of 2 papers each. Graph 2 shows the countries involved:

Graph 2 - distribution of the papers by country



Source: Prepared by the authors (2021)

As can be seen in Graph 2, Brazil is not representative of published scientific articles in this area. How can sustainable consumption actions lead to the circular economy through green recovery?

After reading the title and abstract of all articles, six articles were chosen for full reading, as they were adherent to the research theme, originating for each one the systematic abstract, explained in table 1, below:

TABLE 1 - SYSTEMATIC SUMMARY

YEAR	AUTHOR	TITLE	SUMMARY
2016	MOHAN ET AL.	WASTE BIOREFINERY MODELS TOWARDS SUSTAINABLE CIRCULAR BIOECONOMY: CRITICAL REVIEW AND FUTURE PERSPECTIVES	The article explains that biorefinery will use different technological models of processing that will open paths towards sustainability and also for the development of a bio-based society, providing circular economy.
2016	WITJES E LOZANO	TOWARDS A MORE CIRCULAR ECONOMY: PROPOSING A FRAMEWORK LINKING SUSTAINABLE PUBLIC PROCUREMENT AND SUSTAINABLE BUSINESS MODELS	The article explains the link between procurement and supply practices and proposes a shift from a traditional public procurement process, based on business models of selling products, to a more service-oriented system.
2017	MISHENIN E KOBLIANSKA	PERSPECTIVES AND MECHANISMS OF "CIRCULAR" ECONOMY GLOBAL DEVELOPMENT	The article examines the conceptual, essential and organisational foundations of the circular economy as a tool for 'greening' the economy and achieving sustainable development
2018	KALMYKOVA, SADAGOPAN E ROSADO	CIRCULAR ECONOMY - FROM REVIEW OF THEORIES AND PRACTICES TO DEVELOPMENT OF IMPLEMENTATION TOOLS	The article provides an overview of circular economy literature, theoretical approaches, strategies and implementation cases.
2018	BRADLEY, JAWAHIR, BADURDEEN, E ROUCH	A TOTAL LIFE CYCLE COST MODEL (TLCCM) FOR THE CIRCULAR ECONOMY AND ITS APPLICATION TO POST-RECOVERY RESOURCE ALLOCATION	The article explains a model of solutions that may have sustainability at their core.
2020	ATABAKI, MOHAMMADI E NADERI	NEW ROBUST OPTIMIZATION MODELS FOR CLOSED-LOOP SUPPLY CHAIN OF DURABLE PRODUCTS: TOWARDS A CIRCULAR ECONOMY	The objective of the paper is to move towards the circular economy by redesigning a closed-loop supply chain network for durable products

SUSTAINABLE CONSUMPTION ACTIONS FOR THE CIRCULAR ECONOMY THROUGH GREEN RECOVERY

As changes occur around the world – much of it accelerated by the Coronavirus pandemic – debates about planet preservation, sustainable development, economics, and green recovery are increasingly gaining ground. After all, if there is one word that can define recent times, mainly during coronavirus pandemic, it is "transformation" (Leach et al., 2021). And when we think about this scenario, we would like this transformation to reflect positive changes, for the environment, and companies/industries and society as a whole.

The movement that proposes to resume post-covid-19 economic activities in a more sustainable way in all areas highlights issues, such as reductions in pollutant gas emissions, decreased deforestation, encouragement of circular economy, conscious use of water, sanitation, and clean and renewable energy (Barbier, 2020). The damage done to the planet is increasing year by year, as the debates in global meetings on climate change heat up. Besides the pandemic caused by COVID-19 also urbanization has increased in the last decades, resulting in a substantial increase in energy and consumption material as well as anthropogenic waste generation (Mohan et al., 2016). Obviously we cannot radicalize and restrict freedoms to restore the planet to the measures currently adopted. Still we urgently need to adopt a new behavior so that sustainable actions can balance out the negative effects. Another positive point of the pandemic and the need for a transformation is that the quarantine period has also made society think more about these issues, as well as the work routine and human relationships (Chen et al., 2020).

Therefore, at this time, when many companies are returning to business, looking for ways to embrace this prevention behavior and encourage a "greener" economy can be more impactful than ever. Among companies that are already moving their business models to fit this new era, those who do not insert a bias of concern for the environment will most probably lose out in the future (Alsayegh et al., 2020; Ding et al., 2020).

Education and awareness guide the population to make more responsible decisions and understand the importance of frequently addressing issues related to environmental impacts. Also, they can encourage changes in attitudes, which are more beneficial to the ecosystem (Gifford and Nilson, 2014). That is why talking about environmental awareness, circular economy, and conscious consumption is so important that we can transform the world into a more sustainable place. A circular economy aims to transform waste into resources and bridge the gap between production and consumption. Unfortunately few has been realized to implement actions (Witjes and Lozano 2016). The authors propose a shift from a traditional public procurement process based on commercial models of selling products to a more service-oriented system based on collaboration between buyers and suppliers. This attitude, throughout the procurement process, can lead to reductions in raw material use and waste generation, while promoting the development of new and more sustainable business models, in line with green recovery and a more circular model. These business strategies should generate increased economic benefits for both parties.

If we stop to analyze, we will see that many of the environmental problems of which we are increasingly aware have spread since the Second World War, based on the way of industrial production and the way people are consuming. As a result, we can deduce that, as a consequence of industrialization, urbanization and human behavior, society has increased a large part of the pollutant emissions that degrade the planet, besides generating waste in exorbitant quantities that are degrading nature because they are dangerous, toxic and often take tens or hundreds of years to be degraded (Sariatli, 2017). It is time to change from a linear economy to a global circular economy, so that waste can be reused and reinserted in the production chain to generate new products, thus preventing further extraction of natural resources, which are increasingly depleting. Linear economics was the basis of industrial production in the 19th and 20th centuries and continues many times. It is a way of living based on the extraction of natural resources at an ever-increasing rate, in which products made from these resources are used until they are discarded as waste without reuse (Smol et al., 2020). In this kind of economy, product value is maximized by the largest amount of natural resource extraction and production of

valuable goods. It is essential to make people and society aware of the circular economy concept and its application as the unique alternative to the linear model, capable of bringing gains to the environment and the entire society (Witjes and Lozano, 2016). A circular economy consists of a continuous development cycle that preserves and improves natural capital, optimizes the production of resources, and minimizes systemic risks by managing finite stocks and renewable flows, offering several mechanisms for creating value dissociated from the consumption of nonrenewable resources. Consumption only occurs based on natural resources. These resources are either regenerated in the biological cycle or recovered and restored in the technical recycling process. Concering the biological cycle, natural life processes restore materials, through human intervention or without it. Regarding the technical process, as long as there is enough energy, human intervention recovers materials and recreates order in a given time (Witjes and Lozano, 2016).

Also the circular economy is based on has three principles: (i) preserving and increasing natural capital, controlling finite stocks and balancing the flow of renewable resources; (ii) optimize the production of resources, circulating products, and materials at the highest level of usefulness at all times, through projects designed with a view to recycling, so that these materials continue to circulate and contribute for the economy; (iii) promoting the efficiency of the system, revealing negative externalities and excluding them from projects, reducing damage to products and services (Witjes and Lozano, 2016). Technological development is aligning in this direction, through work done in industries, but also in research groups and startups, such as new sustainable green technologies focusing on the recovery of polyester and cotton fibers from textile waste, but also from fishing nets, discarded or thrown into seas and oceans (Yousef et al., 2020).

In recent years, environmental health has become important in all parts of the world. To be environmentally aware is to understand that the humans are making part of the environment and to realize that aggressions against nature in fact reflect also in our own life. This ecological awareness should be continuous lifelong learning, emphasizing the complexity of environmental issues and educational approaches accessible to the whole society. Based on this education, the environmental and social awareness of the consumer will be strengthened about the production of goods. Awareness with the environment is also seen as an essential element in response to climate change, involving agendas such as sustainable development, global warming, carbon footprint, renewable energy, and even urban mobility. Therefore, active participation of society and governments, as well an individual and collective responsibility towards the environment, are urgently needed (Sola, 2014; Simsekli, 2015). Mohan et al. (2016) highlight that biorefineries offer a green and sustainable option for a better use of waste in the sense of producing different marketable bioproducts in addition to bioenergy generation, which is not valid for the traditional petrochemical refinery. In this way, residues and waste that would normally be eliminated in a linear economy, are valorized through a number of biotechnological processes favoring circular economy, generating more and more social acceptance nowadays.

The global economy has made investments in environmental education and climate awareness programs, to stimulate the use of renewable energies, but the results are not yet satisfactory enough as required. Companies are increasingly focussed on their socio-environmental responsibility, thus trying to do their part for a more sustainable world, in addition to being more attractive to consumers who are increasingly aware of the sustainability issue. Caring for the environment, being socially responsible, and adopting better governance practices are factors that help companies' balance sheets (Barman, 2018). In other words, businesses that commit to best management practices, including the adoption of environmental and social best practices,

end up having more sustainable operations in several aspects, including economic and risk management – and, as a consequence, generate better results over time (Koller et al., 2019). These environmental, social, and governance (ESG) practices generate several positive impacts, such as greater profitability and even an improvement in their market value over time. The adoption of the circular economy by companies aims to "design out" waste. Green take-back, seen as the basis of the circular economy, increasingly decreases waste of residues, generating less waste - as goods are designed and optimized for disassembly and multiple reusability cycle (Tunn et al., 2019). These strict component and product cycles define the circular economy and differentiate it from disposal and even recycling, where large amounts of energy and embodied labor are lost. Secondly, circularity introduces a clear distiction between consumable and durable components of a product. In short, in the circular economy, people are not “consumers” but “users.” The “buy and consume” logic of the linear model in the circular economy is replaced by “sharing” or “renting” goods. The crucial point is that there is a return of products back to the productive system (reuse or re-utilization of goods and waste). In this sense, awakening everyone's responsibility in the face of the scarcity or end of the planet's resources is essential (Seroka-Stolka and Ociepa-Kubicka, 2019).

The current state of circular economy implementation in different companies is discussed by Kalmykova et al. (2018), assessing both theoretical approaches, such as articles reporting case studies of circular economy implementation, as well as implementation strategies. The authors inform that while parts of the value chain, such as consumption/use and recovery/recycling, are indeed prominent, other items, such as manufacturing and distribution, are rarely discussed. On the other hand, the author’s highlight that the implementation levels of the strategies used to implement the circular economy indicate that many market-ready solutions already exist.

Bradley et al. (2018), meanwhile, are proposing a "Total Life Cycle Cost" model in favor of the implementation of the circular economy and its application to post-recovery resource allocation in order to challenge the current status quo of costly green decisions. The basis of this model should also require a general process innovation in favour of the implementation of the circular economy to achieve a positive net cost-benefit of the total life cycle of products, remembering that more and more consumers are demanding changes in this sense.

Finally, Atabaki et al. (2020) are indicating the use of multi-objective closed-loop supply chain models for durable products, considering energy, emissions, and recovery facilities towards a circular economy. These are different models developed to deal with different types of uncertainties, revealing the superiority of circularity compared to the traditional linear economy. These models include the development of new materials for substitution of non-recyclable materials, the design of devices for disassembly, manufacturing processes in order to be able for the use of recycled materials, fabrication efficiency, technology interventions to enable recovery of residues, new methods to collect and separate these residues (O’Connor et al., 2016).

According to Antonio Guterres, the UN Secretary-General, the emergence of Covid-19 showed the vulnerability of the still current development model: "the choices we will make in the coming months for the recovery of the world economy will be decisive to understand if we will commit the mistakes of the past again or if we will think about a new development model, more sustainable, fair, resilient and lasting" (UN, 2020). A close look at the coronavirus crisis will promote a green pick-up to support an economic recovery that creates new jobs and combats climate change, thus investing in a better future for the new generations (UNCC, 2019).

Through a focus on renewable energy, the world must pursue energy efficiency, decarbonization, and the electrification of new sectors. There should be an urgent focus on the circular economy and a just energy transition to ensure sustainable development that leaves no one behind and addresses the needs of communities that still rely on fossil fuels and are at risk of energy poverty (Olabi, 2019). Mohan et al. (2016), meanwhile, speaks of a circular economy and that in this

sense, the production of bioenergy and biomaterials are increasingly significant, thus decreasing the carbon footprint of countries.

It is vital to raise awareness about how individuals consume in order to promote conscious consumerism. This idea grows as more people realize the impact of every good produced, starting with the exploitation of natural resources necessary to produce a good until the end of its product life and its disposal. Todo esse processo tem efeitos sobre o meio ambiente que são positivos para o meio ambiente. With the aid of basic attitudes, we can transform the current scenario, reducing the generation of waste, pollution, deforestation, and thus decelerating harmful effects on the environment. As a result, the concept of a circular economy is focused not only on resource use but to a greater extent on resource formation, resource creation, thus laying the methodological basis for resource management, consistent with the goals and tasks of "green economy" and sustainable development (Mishenin and Koblianska, 2017). The concept of circular economy focuses not only on resource use but also on resource formation, resource creation, thus establishing the innovative methodological basis for resource management in line with the goals of a green economy, and sustainable development.

Sustainable consumption is a concept that describes the set of actions, principles, and reflections that culminate in a conscious way of acquiring, using, and disposing of products that have no further use (Gillani and Kutaula, 2018). The referred actions are possible by understanding how our attitudes impact the environment, being capable of destroying it and compromising the life on planet Earth. Therefore, it is up to each person to make the choices that have positive effects or at least reduce the impacts on nature. By definition, sustainable consumption encompasses conscious consumption practices, green consumption also called responsible consumption, and applies to the entire production chain (Sachdeva et al., 2015).

Sustainable consumption implies choosing products that: 1) used fewer natural resources in their production; 2) guarantee decent employment for those who produced them; 3) are easily reused or recycled, and 4) are needed by the consumer (Young et al., 2010). This idea became popular, especially after the debates at Rio 92 - the United Nations Conference on Environment and Development. "The main causes of the continuing deterioration of the world environment are unsustainable patterns of consumption and production, especially in industrialized countries. A serious source of concern, such consumption trends of consumption and production cause the exacerbation of poverty and imbalances" (UN, 1992). Thus the need to reconcile the social, environmental, and economic areas to promote sustainable and continuous development became evident. In other words, although consumption is one of the main drivers for the economy of nations, it is vital to take into account its impacts on nature, adapting it to prevent the deterioration of the planet (Young et al., 2010).

Sustainable consumption is crucial because it serves as an awareness-raising tool for everyone to do their bit for environmental preservation. Based on the premise that every action counts and that, little by little, it is possible to turn the game around, allowing thus, each time, more sustainable development. But for this to happen, everyone must participate instead of leaving the fight against irresponsible consumerism solely in the hands of governments and other authorities. Without a joint effort of all, the levels of environmental degradation will continue to grow, worsening an alarming scenario (Machado and Richter, 2020).

According to data compiled in a United Nations report, the Earth lost, between 1970 and 2014, approximately 60% of vertebrate animal species. Tollefson (2019) reported that around one million species face extinction nowadays due to human activities that threaten ecosystems. Invertebrates today, 42% of terrestrial species, 34% of aquatic species and 25% of marine species are threatened with extinction. Another threat to life in the oceans is anthropogenic pollution. Every year, 8 million tonnes of plastic are dumped into the lakes, rivers, and oceans.

Global warming, the result of the increase in the greenhouse effect due to the emission of polluting gases, is yet another factor that harms life on the planet. Since the end of the 19th century, the average temperature has risen between 0.8 ºC and 1.2 ºC, affecting survival and quality of life in various regions of the planet. If degradation continues at this pace, researchers estimate 4.5 million to 7 million premature deaths by 2050 (UNEP, 2019). Hence the need to raise public consciousness on the importance of sustainability (Machado and Richter, 2020), and actions, both individual, and collective, to reverse the situation, focusing increasingly on sustainable consumption, and circular economy.

The change to a more conscious consumption adds a series of advantages for nature, organizations, and society as a whole, which are listed below:

- Food, drinks, and cosmetics with few or no substances harmful to health, such as pesticides or agrochemicals;
- Increased supply of natural resources due to reduced pollution of soil, groundwater, rivers, and oceans;
- Favors the exchange of fossil fuels (coal, oil, and derivatives) for clean energy sources, with savings for the consumer in the medium and long term;
- More pressure on companies to include concern for the environment and social questions as a priority in their production, and disposal processes;
- Reduction in the amount of waste disposed of in nature;
- Reduction in the emission of pollutants and GHGs (greenhouse gases), which cause global warming;
- Encouraging the circular economy, with an emphasis on the reuse, maintenance, and recycling of inputs;
- Longer product life cycle, reducing the need to replace them and spending on new items;
- Preservation of flora and fauna species by discouraging burning and destruction of their natural habitat.

CONCLUSIONS

Green Recovery is one of the cases of environmental awareness in evidence. The global movement represents a more sustainable and inclusive economy that invests in strategic sectors and uses resources consciously, resulting in more jobs and economic and environmental improvements, such as by reducing greenhouse gases. The idea gained repercussion with the coronavirus pandemic because resuming economic activities, still based on a linear economy logic, based on natural resources may generate more problems than solutions in the future. In addition, thinking about a "greener economy" encourages the circular economy and the emergence of more sustainable cities, with better life quality. The actions of sustainable consumption for the circular economy through green recovery take advantage of technological advances, which will open ways for sustainability and the development of a bio-based society by enabling the circular economy.

Another action is directed at the conscious consumption movements that have been increasing worldwide. Persons who apply the term to their routine tend to practice not only acts that result in immediate benefits, such as not wasting water and recycling waste but also acts that result in long-term social, environmental, and economic benefits. Some examples are more active behavior for the common good, such as voting for policies that defend environmental issues.

REFERÊNCIAS

Alsayegh, M.F., Abdul Rahman, R., Homayoun, S., 2020. Corporate Economic, Environmental, and Social Sustainability Performance Transformation through ESG Disclosure. *Sustainability 12,* 3910. https://doi.org/10.3390/su12093910.

Atabaki, M.S., Mohammadi, M., Naderi, B., 2020. New robust optimization models for closed-loop supply chain of durable products: towards a circular economy. **Comput. Ind. Eng.** 146, 106520–106530. https://doi.org/10.1016/j.cie.2020.106520.

Barbier, E.B., 2020. Greening the Post-pandemic Recovery in the G20. Environ. Resour. Econ. 76, 685–703. https://doi.org/10.1007/s10640-020-00437-w.

Barman, E., 2018. "Doing Well by Doing Good: A Comparative Analysis of ESG Standards for Responsible Investment", in Barman, E. (Ed.), Sustainability, Stakeholder Governance, and Corporate Social Responsibility (Advances in Strategic Management, Vol. 38), Emerald Publishing Limited, Bingley, UK, pp. 289–311. https://doi.org/10.1108/S0742-332220180000038016.

Bradley, R., Jawahir, I.S., Badurdeen, F., Rouch, K., 2018. A total life cycle cost model (TLCCM) for the circular economy and its application to post-recovery resource allocation. **Resour. Conserv. Recy.** 135, 141–149. Elsevier BV. https://doi.org/10.1016/j.resconrec.2018.01.017.

Chen, Z., Marin, G., Popp, D., Vona, F. (2020). Green Stimulus in a Post-pandemic Recovery: the Role of Skills for a Resilient Recovery. Environ. Resour. Econ. 76, 901–911. https://doi.org/10.1007/s10640-020-00464-7.

Ding, W., Levine, R., Lin, C., Xie, W., 2020. Corporate immunity to the COVID-19 pandemic. NBER Working Paper nº 27055. NBER Working Paper Series. http://www.nber.org/papers/w27055 (accessed 3 May 2021).

Feather, J., Sturges, R.P., 2003. International encyclopaedia of information and library science, Routledge, London.

Firat, A., Kutucuoglu, K., Rikan Saltik, I., Tunçel, O., 2013. Consumption, consumer culture and consumer society. J. Commun. Posit. Pract. 13, 182–203. https://www.researchgate.net/publication/320929948_Consumption_consumer_culture_and_consumer_society (accessed 22 May 2021).

Gifford, R., Nilsson, A., 2014. Personal and social factors that influence pro-environmental concern and behaviour: A review. Int. J. Psychol. 49, 141–157. doi: https://doi.org/10.1002/ijop.12034.

Gillani, A., Kutaula, S., 2018. An introduction to special issue: sustainability and ethical consumerismo. Manage. Decis, 56, 511–514. http://doi.org/10.1108/MD-03-2018-949.

Harris, S., Weinzettel, J., Bigano, A., Källmén, A., 2020. Low carbon cities in 2050? GHG emissions of European cities using production-based and consumption-based emission accounting method. J. Clean. Prod. 248, 119206. https://doi.org/10.1016/j.jclepro.2019.119206.

Hoekstra, A.Y., Wiedmann, T.O., 2014. Humanity's unsustainable environmental footprint. Science, 344, 1114–1117. https://doi.org/10.1126/science.1248365.

Kalmykova, Y., Sadagopan, M., Rosado, L., 2018. Circular economy – from review of theories and practices to development of implementation tools. **Resour. Conserv. Recy.** 135, 190–201. https://doi.org..1016/j.resconrec.2017.10.034

Lahcen, B., Brusselaers, J., Vrancken, K., Dams, Y., Da Silva Paes, C., Eyckmans, J., Rousseau, S., 2020. Green Recovery Policies for the COVID-19 Crisis: Modelling the Impact on the Economy and Greenhouse Gas Emissions. Environ. Resour. Econ. 76, 731–750. https://doi.org/10.1007/s10640-020-00454-9.

Leach, M., MacGregor, H., Scoones, I., Wilkinson, A., 2021. Post-pandemic transformations: How and why COVID-19 requires us to rethink development. World Dev. 138, 105233. https://doi.org/10.1016/j.worlddev.2020.105233.

Machado, A.B., Richter, M.F., 2020. Sustainability in times of pandemic – COVID-19. Recima 21, 1, 264–279. https://doi.org/10.47820/recima21.v1i2.25.

Machado, A.B., 2021. "Integrative Review: Relationship between Big Data and educational content repository", in: Souza, M.J. and Au-Youg Oliveira, M. (Eds.), Top 10 Challenges of Big Data Analytics, Nova Science publishers, Nova York, NY, pp. 63–86.

Mishenin, Y.V., Koblianska, I.I., 2017. Perspectives and mechanisms of "circular" economy global development. **Market. Manag. Innov.** 2, 329–343. https://doi.org/10.21272/mmi.2017.2-31.

Mohan, S.V., Nikhil, G.N., Chiranjeevi, P., Reddy, C.N., Rohit, M.V., Kumar, A. N., Sarkar, O., 2016. Waste biorefinery models towards sustainable circular bioeconomy: critical review and future perspectives. **Bioresour. Technol.** 215, 2–12. https://doi.org/10.1016/j.biortech.2016.03.130.

More, C., 2000. Understanding the Industrial Revolution. Routledge, New York, NY.

O'Connor, M.P., Zimmermann, J.B., Anastas, P.T., Plata, D.L., 2016. A Strategy for Material Supply Chain Sustainability: enabling a circular economy in the electronics industry through green engineering. **Acs Sustain. Chem. Eng.** 4, 5879–5888. https://doi.org./10.1021/acssuschemeng.6b01954.

Olabi, A.G., 2019. Circular economy and renewable energy. Energy, 181, 450–454. https://doi.org/10.1016/j.energy.2019.05.196.

Sachdeva, S., Jordan, J., Mazar, N., 2015. Green consumerism: moral motivations to a sustainable future. Curr. Opin. Psychol. 6, 60–65. https://doi.org/10.1016/j.copsyc.2015.03.029.

Sariatli, F., 2017. Linear Economy Versus Circular Economy: A Comparative and Analyzer Study for Optimization of Economy for Sustainability. Visegrad J. Bioecon. Sustain. Dev. 6, 31–34. https://doi.org/10.1515/vjbsd-2017-0005.

Seroka-Stolka, O., Ociepa-Kubicka, A., 2019. Green logistics and circular economy. Transp. Res. Proc. 39, 471–479. https://doi.org/10.1016/j.trpro.2019.06.049.

Simsekli, Y., 2015. An Implementation To Raise Environmental Awareness of Elementary Education Students. Procedia – Soc. Behav. Sci. 191, 222–226. https://doi.org/10.1016/j.sbspro.2015.04.449.

Smol, M., Marcinek, P., Duda, J., Szoldroeska, D., 2020. Importance of Sustainable Mineral Resource Management in Implementing the Circular Economy (CE) Model and the European Green Deal Strategy. *Resources* 9, 55. https://doi.org/10.3390/resources9050055.

Sola, A.O., 2014. Environmental Education and Public Awareness. **J. Educ. Soc. Res.,** 4, 333–337. https:/doi.org/10.5901/jesr.2014.v4n3p333

Sousa, M.J., Machado, A.D., 2020. "Blockchain Technology Reshaping Education: Contributions for Policy", in: Sharma, R.C., Yildirim, H., Kurubacak, G. (Eds.), Blockchain Technology Applications in Education, IGI Global, Pensylvania, pp. 113–125. https://doi.org/10.4018/978-1-5225-9478-9.ch006

Tollefson, J., 2019. Humans are driving one million species to extinctio. Nature **569**. https://doi.org/.1038/d41586-019-01448-4.

Tunn, V.S.C., Bocken, N.M.P., Van den Hende, E.A., Schoortmans, J.P.L., 2019. Business models for sustainable consumption in the circular economy: An expert study. J. Clean. Prod. 212, 324–333. https://doi.org/10.1016/j.jclepro.2018.11.290.

UN – United Nations, 1992. “Sustainable Development: Agenda 21”. https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf (accessed 22 May 2021).

UN – United Nations, 2020. "The recovery from the COVID-19 crisis must lead to a different economy". https://www.un.org/en/un-coronavirus-communications-team/launch-report-socio-economic-impacts-covid-19 (accessed 29 May 2021).

UNCC – United Nation Climate Change, 2019. UN Chiefc on September Climate Summit: “Beautiful Speeches Are Not Enough”. https://unfccc.int/news/un-chief-on-september-climate-summit-beautiful-speeches-are-not-enough (accessed 28 May 2021).

UNEP – United Nations Environmental Programme, 2019. “Sixth Global Environment Outlook: summary for policymakers”. https://papersmart.unon.org/resolution/uploads/k1900199_-_unep-ea-4-18_-_advance.pdf (accessed 28 May 2021).

Williams, J., 2019. Circular cities. Urb. Stud. 56, 2746–2762. https://doi.org/10.1177/0042098018806133.

Witjes, S., Lozano, R., 2016. Towards a more Circular Economy: proposing a framework linking sustainable public procurement and sustainable business models. Resour. Conserv. Recycl. 112, 37–44. https://doi.org/10.1016/j.resconrec.2016.04.015.

Young, W., Hwang, K., MacDonald, S., Oates, C.J., 2010. Sustainable consumption: green consumer behaviour when purchasing products. Sustain. Dev. 18, 20–31. https://doi.org/10.1002/sd.394.

Yousef, S., Tatariants, M., Tichonovas, M., Kliucininkas, L., Lukolinte, S.I., Yan, L., 2020. Sustainable green technology for recovery of cotton fibers and polyester from textile waste. J. Clean. Prod. 254, 120078–120090. https://doi.org/10.1016/j.jclepro.2020.120078.