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CURRENT ISSUES REGARDING THE RECYCLING OF CONSUMER PRODUCTS AND TRANSPORT PERFORMANCE FROM THE PERSPECTIVE OF THE GREEN CIRCULAR ECONOMY

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Rezumat

Economia circulară și principiile după care aceasta se ghidează au devenit subiectul tot mai multor lucrări științifice, autorii definind această parte verde a consumerismului în multiple și diverse moduri, toate concentrându-se însă pe puterea de decizie a consumatorilor și producătorilor în privința consumului de bunuri şi servicii, respectiv a masurilor practice de maximizare a reciclării și reutilizării deşeurilor rezultate. Această cercetare urmărește evoluția impactului factorului uman asupra mediului înconjurător la nivelul României în intervalul 1948-2024, a Uniunii Europene, Elveției, Norvegiei și Islandei (UEFTA- Liechtenstein) în perioada 2010-2022, respectiv 2004 - 2021. Scopul principal al articolului este de a determina modelele de comportament economic ale principalilor actori de pe piața globală, în privința economiei circulare, cu scopul de a înțelege motivațiile acestora și evident de a recomanda schimbările de mentalitate şi implicit reacţiile, respectiv acţiunile percepute a fi strict necesare pentru o utilizare sustenabilă a materiilor prime şi materialelor utilizate în procesele de producţie. Desigur conceptul de economie circulară este unul de importanţă vitală pentru întreaga societate umană ,mai ales în condiţiile exploziei demografice prognozate în viitorul previzibil. Din multiple motive acest concept este absolut decisiv pentru evitarea colapsului economic,social şi ecologic al întregii planete pe care trăim. Întrebarea fundamentală la care ne dorim să răspundem este „Care sunt principalele comportamente ale consumatorilor și producătorilor în privința economiei circulare?”, pentru a putea determina motivațiile actuale, eventual prognoza viitoare şi recompense care să se dovedească benefice în implementarea principiilor economiei verzi. Studiul are la bază date legate de PIB/capita, rata de reciclare, cantitatea emisă de gaze cu efect de seră și numărul de autovehicule cu propulsie alternativă.

Cuvinte cheie: economie circulară, consumerism, reciclare, reutilizare, comportament de consum

Abstract

The circular economy and the principles by which it is guided, has become the subject of more and more scientific works, the authors defining this green part of consumerism in multiple and diverse ways, but all focusing on the decision-making power of consumers and producers regarding the consumption of goods and services, respectively of the practical measures to maximize the recycling and reuse of the resulting waste. This research follows the evolution of the impact of the human factor on the environment at the level of Romania in the period 1948-2024, of the European Union, Switzerland, Norway and Iceland (UEFTA-Liechtenstein) in the period 2010-2022, respectively 2004 - 2021. The main purpose of the article is to to determine the economic behavior models of the main actors on the global market, regarding the circular economy, with the aim of understanding their motivations and obviously to recommend the changes in mentality and implicitly the reactions, respectively the actions perceived to be strictly necessary for a sustainable use of raw materials and materials used in production processes. Of course, the concept of circular economy is one of vital importance for the entire human society, especially in the conditions of the demographic explosion predicted in the foreseeable future. For multiple reasons, this concept is absolutely decisive for avoiding the economic, social and ecological collapse of the entire planet we live on. The fundamental question we want to answer is "What are the main behaviors of consumers and producers regarding the circular economy?", in order to be able to determine the current motivations, possibly future forecast and rewards that prove beneficial in the implementation of the principles of the green economy. The study is based on data related to GDP/capita, the recycling rate, the amount of greenhouse gases emitted and the number of vehicles with alternative propulsion.

Keywords: circular economy, consumerism, recycling, reuse, consumption behavior

JEL classification: B14, Q53, Q56, D10.

1. INTRODUCTION

Society is faced with a progressive and accelerated decrease in non-renewable resources, as a result it adopts, at least at the declarative level, ethical norms that encourage the circular economy at the expense of the well-known consumerism and the large-scale use of renewable energy resources, especially hydraulic, photovoltaic and wind turbines as a viable alternative to the classic use of fossil fuels as essential generators of greenhouse gases. Both consumers and producers tend to opt for green technologies that provide them, in the first situation, the most appropriate prices in the context of environmental awareness and in the second, the lowest possible costs as a result of reducing the amount of new raw materials needed in the processes of making the products. Although, with

an action plan for the circular economy, part of the EU Industrial Strategy, at the level of the European Union countries the estimated reuse rate of materials was at the level of 2022 of 11.5%, increasing by only 3.3% compared to effective value in 2004 (Eurostat, 2023). Currently, it is worth noting the existence of a multitude of concrete technologies and concepts, which solidly support the basic principles of green consumerism, for example: prioritizing the value and quality of products, maintaining economic growth within the limits of the ecosystem, transforming waste into reusable resources, participation and direct democracy, human creativity and the development, rearrangement and reinterpretation of system components (Nordhaus and Shellenberger, 2007). However, the company chooses to maintain its habits of immediately replacing defective products, discouraged by the product's lifespan, which often ends shortly after the warranty expires. Nordhaus and Shellenberger (2007, p.115) considered that in order to have an impact on the climate change trend, gas emissions had to be reduced by 70% compared to the estimates regarding their evolution since that time. Considering the nearly 54 billion tons of global greenhouse gas emissions in 2022, significant efforts must be made towards the green economy for harmonious and lasting development (Jones et al., 2024, cited in Ritchie , Rosado and Roser, 2020a).

A parallel regarding the circular economy - obviously only in a certain segment - can be made between communist and capitalist countries. The style of governance is a strong determining factor in shaping the consumption behavior of the population. A measure found in both societies is the SGR (guarantee-return system) as it is called in the capitalist one and involves paying an additional fee for each returnable packaging, which can be recovered by recycling at special centers, where the value of the guarantee is received in cash, in the form of a voucher or by bank transfer. However, consumers face many obstacles such as the short program of access to devices, the refusal of packaging, their non-recognition, long queues, the discordance of use between Romania and other countries of the European Union (lack of technological cohesion), the filling of internal storage spaces but also lack of education regarding the behavior of consumers who feel social shame and associate this measure with a trend of "poverty".

According to the paradox of Keynes (1936, cited in Collins, 2017) the more we consume the better we live. However, the principle elaborated more than 80 years ago could not foresee a development on the scale of today. With the exponential technological progress and the asymptotic acceleration of production, the negative effects did not hesitate to appear. In fact, the negative effects tend to become truly devastating effects from year to year, with almost apocalyptic future

forecasts. More than ever we need to maximize our utility in a sustainable and equitable way for generations to come

In this article we aim to study the behaviors of consumers and producers, state interventions, all this from the perspective of the circular economy, determining the motivations of the former, the practices and strategies of the latter.

Next, we address the literature review, detail the methodology used, and share our results, discussion, and conclusions.

2. LITERATURE REVIEW

Ever since Boulding (1966, cited in Hart, 2019, p.1) humanity has been considering the concept of "circular economy". Thus, the Earth compared to a "spaceship" has finite resources that require cooperation, equity and ultimately care for the "own nest". According to the principle of utilitarianism, utility should be maximized, economically speaking, consumption. However, considering the ideas of Rawls (1971, cited in Hart, 2019, p.2) human behavior should move towards equality of opportunity from one generation to another. The circular economy broadly defines the improvement of the use of resources, the minimization of their extraction, the maximum reduction of waste and the prevention of its occurrence. On a moral level, this requires better conduct by redefining social, economic and environmental values. The paradox of our days reveals a progressive diminution of resources and an upward and accelerated evolution of waste (Velenturf and Purnell, 2017, p.1438). It is not the concept or the theoretical framework that imposes obstacles to implementation, but the application methods themselves.

Worth mentioning is the IPAT formula (Ehrlich and Holdren, 1971; Ehrlich and Holdren, 1972; Commoner, 1972; Commoner et al., 1971, cited in Velenturf and Purnell, 2017, p.1440) which links and measures the impact of economic development with the consequences on the environment. (,,IPAT: environmental impact (I) = population (P) x affluence (A) x technologies (T)”), where (A) stands for the average consumption of each person in the population.

The circular economy is based on several fundamental principles and characteristics: first, the power of the inner circle provides for the repair and maintenance of a product until the end-use stage, followed by the reuse and remanufacturing of components, the second, the power of extending the life cycle aims,, saving' material, energy and labor to create a new product or component. The third principle, called cascade use, is based on the use of "second-hand" in a first stage, after which the retransformation until the completion of a complete cycle, when the material returns to the biosphere. Lastly, the power of

uncontaminated raw materials lies in the quality of the product, an aspect that allows the longevity of its use (Ellen Macarthur Foundation, 2015, p.8).

Iordachi, Popa and Popa (2022, p.9) mention the principle of the "3Rs": "reduction - reuse - recycling" representative of the communist period, later developed by adding other criteria necessary for the adoption of the circular economy, namely the reduction to 0 of waste , thus reaching the "9Rs": "refuse, rethink, reduce, reuse, repair, renovate, remanufacture, rethink the purpose, recycle, recover", improperly said because we have 10 elements in mind.
Williams (2016, pp.46-47) defines a lot of criteria that are the basis of recycling and reuse: political will, education, consumer behavior change programs but also regulations to encourage the development of a sustainable circular economy globally. The author raises the issue of the proliferation of high-tech equipment, which with decreasing prices can lead to significant amounts of waste. Repair and reuse could prevent this, but recycling tends to capture the trend. The mobile phone industry is an example of anti-environmental practices, offering subscriptions of shorter and shorter durations in order to motivate consumers to purchase a new good at the end of the period with an insignificant discount, in return for the returned "old" product . The ultimate argument of the companies lies in the demands of the consumers, eager for innovation. The problem actually lies in the attitude of customers, who casually accept the "lifetime" considered normal, thus encouraging consumerism (Wieser, 2016, pp.156-159).

The European Union is also promoting a series of pro-circular economy measures by which it wants to replace the "manufacture, use and dispose" principle with recycling and reuse (Völker, Kovacic and Strand, 2020, p.103¬). The authors define these objectives of the European Union towards the green transition as imaginative resources, also mentioning the achievable and less achievable directions of the Green Deal: “circularity as a characteristic of biophysical flows, as a distinct market model that focuses on renting and sharing instead of ownership, as a guide to industrial production focused on the quality (in the sense of longevity) of products, and as a bureaucratic procurement policy." (Jasanoff and Kim, 2009, 2015, cited in Völker, Kovacic and Strand, 2020, pp.115-116).

Most companies express interest in the circular economy, which could reduce their costs, input of natural resources, waste and amplify the message of sustainability of economic development and greening. The stereotype of "selfish entities" oriented towards profit maximization in the context of the lack of government support no longer makes sense. In fact, the authors claim that the principles of this transition are not in agreement with the objectives of the regional development policy, to improve the economic, social and territorial cohesion of

the European Union, with companies facing barriers in addressing the measures necessary to reduce consumerism and adopt the circular economy (Velenturf et al., 2019, pp.1-13).

According to Ratner et al. (2021, p.25) involvement in the educational process brings benefits in the direction of the circular economy, it develops positive behaviors regarding saving, recycling and reuse, and investments in this branch translate into pro-ecological measures. However, the average behavior (PEB) knows a major obstacle, the lack of information about the real consequences of the atrocious extension of consumerism, on the environment.

3. RESEARCH METHODOLOGY

The main purpose of this research is to study the patterns of economic behavior at the level of consumers and suppliers, under the auspices of the environmental awareness trend and the measures implemented at the global and local level. Considering the current deplorable situation of the environment, the paradox of the increase in the amount of waste simultaneously with the reduction of the use of non-renewable/alternative resources, the inappropriate behaviors of consumers and production companies at the level of Romania, respectively the EU, the research questions of the article are:

1. What are the main behaviors of consumers and producers regarding the circular economy?

2. How do these behaviors impact green consumerism?

3. What needs to be changed about them to ensure sustainable future development?

The circular economy or green consumerism requires an analysis at the neuroeconomic level to develop and outline new models of consumption and sales behaviors in a society theoretically focused on sustainability, recycling and reuse.

Ecological footprint and biocapacity (both measured in global hectares) are issues that interest us collectively, being aware of the efforts needed to reduce the former and maintain the latter. In order to understand how the Romanian people perceive the concept of circular economy and what are the behavior patterns, respectively the motivations of consumers at the level of the country in the following respects: use of the guarantee-return system (SGR), recycling and reuse, we created a questionnaire of 25 questions. The research was carried out online, between June 18 and June 30, 2024, on the Google Forms platform, and the technique used was that of the "snowball", which, although, from a statistical point of view, does not result in a representative sample, it offers qualitative information about the studied group. As scaling methods we used simple scales:

the semantic differential and the Likert scale, but also comparative scales: the Fishbein Rosenberg model. The information was taken from both male and female persons, aged at least 18 years, and for the complexity of the research, people from two different environments were surveyed: rural and urban. A total of 150 respondents answered the questionnaire, of which 94% claimed to have recycled at least once in their life.

Also to see if the level of economic development of the country influences the recycling rate and if vehicles with alternative propulsion (Hybrid Electric Vehicle, Plug-In Hybrid Electric Vehicle, Battery Electric Vehicle) have an impact on the amount of greenhouse gases emitted (measured in million metric tons of CO_2e equivalent), we first collected data on GDP per capita (based on 2011 international dollar purchasing power parity) (WITS, 2024) and recycling rate (Eurostat, 2024a) for the year 2004, respectively 2021, at the level of the EU states, Switzerland, Norway and Iceland.

In the second case, we focused on a period of 13 years (2010-2022) and on data at the level of EU countries related to the number of vehicles with alternative propulsion (European Environment Agency, 2023) and the amount of gases emitted with greenhouse effect (Eurostat, 2024b). To correlate the data and determine the type and intensity of the link between the numerical variables, we used the non-parametric method of calculating the Spearman rank correlation coefficient, the data not being normally distributed. A first deepening of the theme is carried out through the Romanian case study, which focuses on the evolution of the positive or negative influencing factors of the circular economy from the beginning of 1948 until now, comparing the role of the current state with that of the communist period in ensuring compliance with measures leading to sustainability. We also collected data on the average total CO2 emissions of a car with an internal combustion engine (European Environment Agency, 2024) as well as the equivalent for an electric car, at the level of the European Union for the year 2021, with the aim of calculating the percentage of their reduction following the replacement of classic vehicles with electric ones depending on the energy generation methods specific to each country studied.

4. DATA, RESULTS AND DISCUSSION

The circular economy with all its principles is not a new topic. For this reason, we will carry out a comparative analysis at the level of Romania between the measures from the communist period (1948-1989) regarding recycling and reuse and the capitalist one, mainly the years 2023-2024, representative of the introduction of the guarantee-return system (SGR), as state involvement. The

current system (SGR) involves the recovery of the suspended guarantee when purchasing drinks with glass, plastic or metal packaging on which the relevant logo is inscribed, in the form of cash, voucher or bank transfer. At the level of Romania in 2024, according to ReturoRo (2024, cited in Codruț, 2024) in the first 6 months after the launch of the system, approximately 85% of the amount of packaging was collected from consumers, which recycled in this way determines a quality of secondary raw material superior to any another way of recovery, also ensuring the application of the bottle-to-bottle principle successfully. A similar concept practiced during the communist period provided for the withholding of a tax at the time of purchase of any good that had glass packaging if you did not have another to exchange. At the time of returning the packaging, the counter value was returned to you. We have in mind an obvious principle of circularity in both cases, reuse. Compared to today, the containers did not require a transformation, in other words, there was no significant energy consumption in order to be reused. It is true that the materials used to produce glass require larger quantities and the CO2 emissions are stronger than those for plastic, but the life span is also longer and the environmental impact in case of non-recycling is lower. A disadvantage of the communist system is represented by the non-observance of hygiene conditions, not knowing where or for what purpose the containers were used before. Apparently, regardless of political doctrine, people are more willing to recycle if the benefits are obvious and tangible, and the return-guarantee system found in both cases represents a good practice, encouraging long-term sustainability.

The second aspect exclusively describes the consumer behavior induced by the regulations imposed by the authorities through which citizens collected paper, cardboard, construction and clothing waste to be recycled and transformed into new products, requiring less or even zero input of resources. At the same time, the students at the end of each school year were obliged to bring their books and notebooks, so that the former would be used by future generations and the latter would be recycled. We are thus talking about the principle of equity between generations and about preserving biocapacity as much as possible.

And nowadays this habit is taking over as many consumers as possible, who are "forced" by local regulations to collect waste separately, so that it can be recycled and reused, a situation that leads to mass education.

Analyzing the amount of CO2 emissions (Ritchie, Roser and Rosado, 2020b) from the communist era to the present (1948-2022), using the average rate of dynamics, resulted in an average annual increase per capita of 1 %, i.e. 0.03 tons of CO2 per capita. In other words, although at country level the amount of

emissions has decreased considering the negative evolution of the population, individually we pollute more from one year to the next.

Examining the correlation between the degree of economic development and the recycling rate of the countries of the European Union, Switzerland, Norway and Iceland (UEFTA-Liechtenstein) at the level of 2004 (see fig. 1), the coefficient is 0.66, and for 2021 (see fig. .2) is equal to 0.37. The results indicate in both cases a positive direct link, of moderate intensity. Considering the evolution of the average recycling rate (from 23.9% in 2004 to 40.8% in 2021) we can claim that the upward trend of GDP per capita directly influences the increase in the recycling rate, and the states still in emerging stages of development occupy the lowest places of the ranking in this regard.

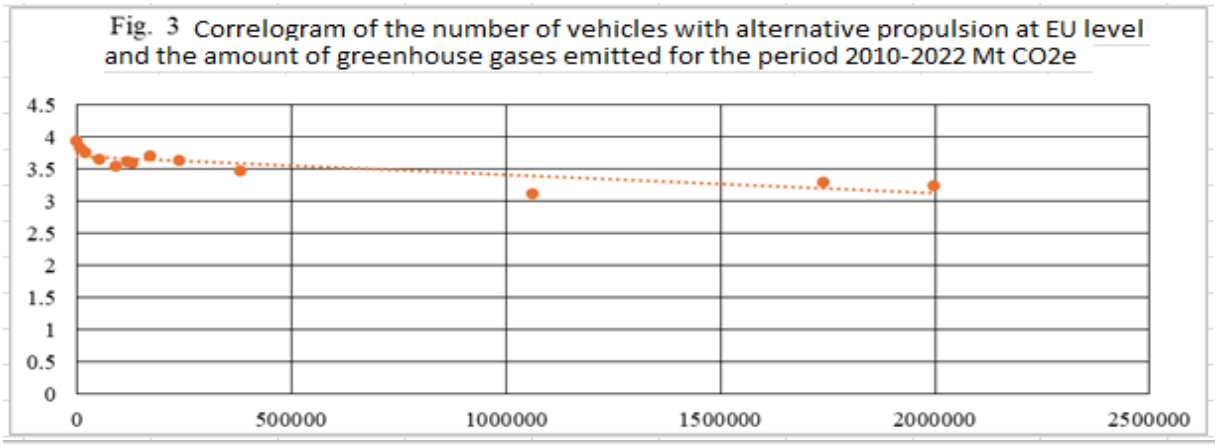


Fig. 3 Correlogram of the number of vehicles with alternative propulsion at EU level and the amount of greenhouse gases emitted for the period 2010-2022 Mt CO2e

Fig. 3 Corelogramă număr autovehicule cu propulsie alternativă la nivelul UE și cantitatea de gaze cu efect de seră emise pentru 2010-2022 ($MtCO_2e$)

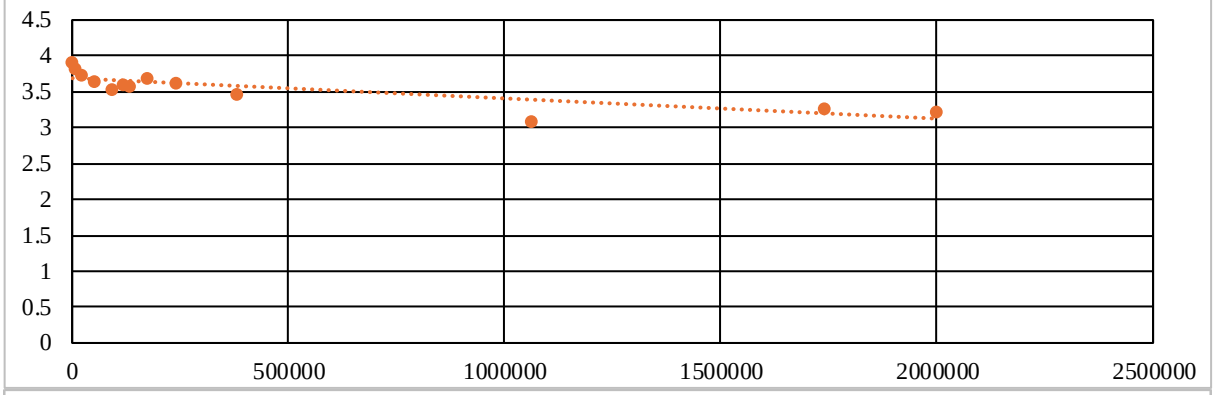


Fig. 1 Corelogramă PIB/cap locuitor (dolar internațional 2011) 2004 și rata de reciclare (%) 2004 pentru țările UEFTA (*excepție Liechtenstein)

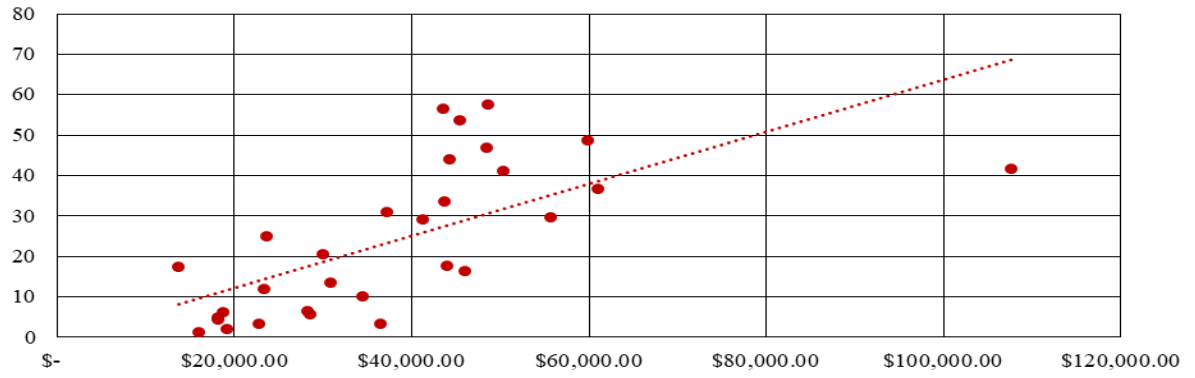
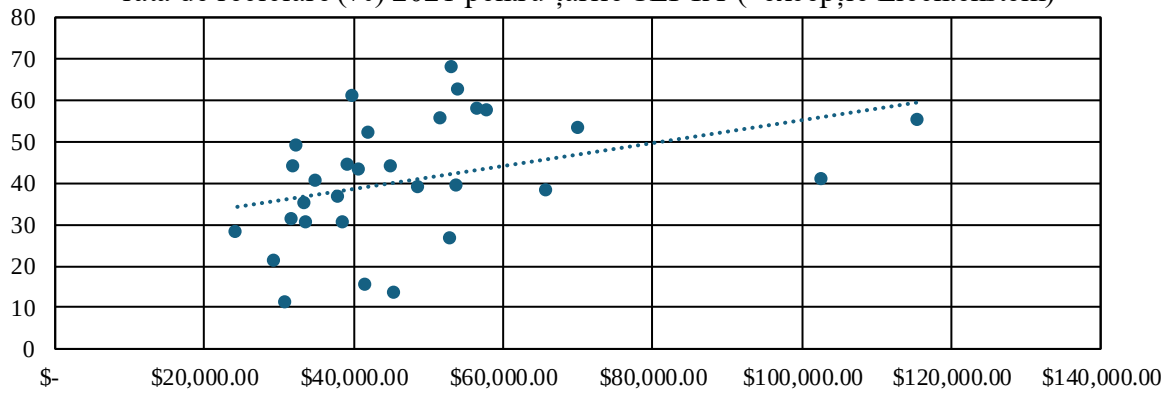


Fig. 2 Corelogramă PIB/cap locuitor 2021 (dolar internațional 2011) și rata de reciclare (%) 2021 pentru țările UEFTA (*excepție Liechtenstein)



Source: Authors' adaptation based on data from: (WITS, 2024; Eurostat, 2024a
Source: authors' adaptation based on data from: (European Environment Agency, 2023; Eurostat, 2024)

As for the relationship between the number of vehicles with alternative propulsion and the amount of greenhouse gases emitted, in the period 2010-2022, it is observed that it is negative and strong inverse, with a coefficient of -0.82 result (see fig. 3), which can be interpreted as follows: the upward trend of vehicles of this type causes an evolution in the opposite direction of the polluting gases emitted.

Another perspective worth mentioning is that of electric cars, which promise a long lifespan, reduction of toxic emissions, maintenance and operating expenses. However, in a study carried out by Toyota, called the "1:6:90 Rule", the company reveals that for the same amount of raw materials needed to manufacture an electric vehicle (One Battery only EV), it can produce six plug-in hybrids -in or 90 hybrid vehicles and that the combined lifetime carbon reduction achieved by 90 hybrids exceeds 37 times that of a single electric vehicle, without leading the discussion to the future lack of electricity needed for battery supply (Automology, 2024). Considering this information, we made a comparison between the countries of the European Union, analyzing both the degree of pollution of internal combustion cars and electric ones (taking into account CO2 emissions for: electricity production, electric car manufacturing and electric battery recycling) determining depending on the methods of obtaining energy sources which of the two represents a better alternative depending on the country. To obtain these data, we took into account European statistics for the year 2021, related to the degree of pollution (Campbell, 2022; European Environment Agency, 2024), average annual mileage (ACEA, 2024, p.4) and lifetime (Held et al., 2021, p.1; E-on, 2024) at the level of the two types of cars (see table 1).

Table 1. Internal combustion engine and electric motor vehicle statistics at EU level, 2021

Item	Value
Average annual mileage of a motor vehicle (EU)	12500 km
Average lifetime of a motor vehicle equipped with an internal combustion engine	28,4 ani
Average lifespan of a battery electric vehicle	10 ani
Equivalent emissions for the production of a vehicle with a thermal engine	5600000 g CO_2
Equivalent emissions for the production of a battery-powered electric car	8800000 g CO_2
Average CO2 emissions of a passenger car with an internal combustion engine NEDC 2021	107,5 g CO_2/km
Total CO2 emissions of an internal combustion engine car over its lifetime	43,7625 t CO_2
Lifetime in km of a car equipped with an internal combustion engine	355000 km
The average consumption of an electric car	17 kw/100 km
Lifetime in km of an electric car	125000 km
The ratio between the lifetime of a car equipped with an internal combustion engine and an electric car	2,84
Equivalent emissions for recycling a lithium battery used for electric cars	204400 g CO_2

Source: author adaptation and calculations based on data from: (Campbell, 2022; European Environment Agency, 2024; ACEA, 2024, p.4; Held et al., 2021, p.1; E-on, 2024; Gopal, 2023; Electric Vehicle Council, 2024)

Referring to these we calculated the average total CO2 emissions of a car with an internal combustion engine throughout its life as well as the equivalent for an electric car. We concluded that at a lifetime of 355000 km (multiplying the average annual mileage by the lifetime in years) of an internal combustion car, approximately 3 electric cars are needed (2.84). To determine how much CO2 emissions are reduced due to electric vehicles compared to classic ones we subtracted from a percentage of 100% the ratio of the total emissions of an electric car to an average lifetime equal to a car equipped with a combustion engine internal CO2 emissions in tonnes and the total CO2 emissions of a passenger car with a combustion engine (internal combustion) throughout its lifetime. At the level of the European Union, the average quantity of emissions is reduced by 28%, the states that have electricity production mainly focused on renewable sources reach percentages of 39%-40% (Iceland, Sweden and France), and those that are concentrated on fossil fuels do not exceed 17% (Poland, Malta and Cyprus).

Table 2. Total pollution reduction percentage of an electric car compared to a car equipped with an internal combustion engine at EU level, year 2021

Country	Emissions for the generation of electricity - grams CO_2/kWh	Total emissions of an electric car with an average lifetime equal to a car equipped with an internal combustion engine tonnes CO_2	Percentage reduction of total pollution of an electric car compared to a car equipped with an internal combustion engine
Austria	136,0228	28,4629805	35%
Belgium	131,90462	28,37546918	35%
Bulgaria	415,29013	34,39741126	21%
Croatia	210,45667	30,04470024	31%
Cyprus	564,4531	37,56712438	14%
Czech Republic	471,7906	35,59804625	19%
Denmark	222,96477	30,31049736	31%
Estonia	450,62585	35,14829531	20%
Finland	135,48746	28,45160453	35%
France	59,76878	26,84258258	39%
Germany	394,53833	33,95643551	22%
Greece	383,11206	33,71362728	23%
Hungary	238,50417	30,64070961	30%
Ireland	353,81693	33,09110576	24%
Italy	339,27637	32,78211886	25%
Latvia	176,06837	29,31394886	33%
Lithuania	220,9302	30,26726275	31%
Luxembourg	162,60162	29,02778043	34%
Malta	504,50452	36,29321705	17%
Lower Countries	352,35175	33,05997069	24%
Poland	756,86566	41,65589128	5%

Portugal	210,48354	30,04527123	31%
Romania	289,959	31,73412475	27%
Spain	193,53647	29,68514599	32%
Sweden	41,79765	26,46069606	40%
Slovakia	167,34006	29,12847228	33%
Slovenia	269,40344	31,2973191	28%
UE (27)	272,628	31,365841	28%

Thus, regarding manufacturers, we demonstrated at the European Union level that the current market trend focused on sustainability in the automotive industry, which promotes the electric or alternative propulsion vehicle as a better substitute for the classic one, is not based on a consistent practical basis with the theoretical one. We have thus shown that these vehicles can be really useful only in countries that produce 100% renewable or mostly renewable energy within the national energy mix, otherwise the degree of pollution does not know a significant reduction. Practically, at this moment the unique and huge advantage of these vehicles is actually the reduction of pollution in large metropolises - pollution moving outside the metropolitan area, where classic power plants are installed, usually using fossil fuels. Obviously, the share of electricity produced from non-polluting or low-polluting sources - hydro; photovoltaic. wind or even nuclear - it is higher, the more the reduction percentage of the total pollution of an electric car, compared to a car equipped with an internal combustion engine, becomes higher. All the more so in the case of fully electric cars or with alternative propulsion, the equivalent emissions for the recycling of lithium batteries used for electric traction also appear. Summarizing the above, it follows that global/planetary pollution will remain at least at the same value if we continue to produce electricity with classic sources polluting and non-renewable. In fact, even if we reach the perfect technology of direct motor traction with green hydrogen or, deliberately exaggerating, with nuclear fusion, the essential remains with which primary energy source will we produce that ideal "green" fuel or that nuclear energy of fusion. And especially at what cost and with what energy yield will we produce them. It should be mentioned that a notable exception to this rule is Norway - not included in the EU, where practically the entire electricity requirement is produced in hydroelectric power plants or parks onshore or offshore wind turbines - although it possesses extremely large reserves of fossil fuels, especially natural gas, but also oil.

Transport is considered a major factor in greenhouse gas emissions, and these are closely related to the attitude of economic agencies vis-à-vis the implementation of the circular economy. Romania, although it experienced an increase in the car fleet (resulted by multiplying the number of cars per 1000 inhabitants by the number of inhabitants) from 1989 to 2021 (Macrotrends, 2024;

Autolatest, 2023) by more than 500%, the amount of CO2 emitted decreased with 63%. (Ritchie, Roser and Rosado, 2020b) In other words, it is not transport that contributes significantly to the increase in the degree of pollution, but the actual production process of components, respectively finished products, an aspect also demonstrated by the negative and strong inverse relationship resulting from correlating the number of motor vehicles with alternative propulsion with the amount of greenhouse gases emitted at EU level.

Analyzing the questionnaire related to consumer perception of the measures used to develop the circular economy, of the 141 respondents who passed the filter questions, 25.5% recycle once a week, followed by equal percentages (19.9%) who usually do it once or two or three times a month. 97.2% of them claim that plastic bottles and containers are among the favorites when they choose to recycle. Referring to the questions for which we used the Likert scale as an interpretation method ("What do you think about the recycling systems implemented in Romania?"; "What do you think about the recycling systems at the level of the European Union countries?" and , "What do you think about the implementation of generally valid vouchers?") the highest score was given for the "generally valid voucher" attribute of 4.40, the average score of the questions being 3.98. Thus, 63.1% have a very favorable opinion referring to it. Regarding the recycling systems at the level of Romania and the European Union, 38.3% have a neither favorable nor unfavorable opinion for the first case, and for the second 53.9% see the situation in a favorable light. Therefore, there is room for improvement at the level of Romania.

To the questions for which we used the semantic differential, 86 out of 141 respondents expressed their total agreement with the statement "Re-education of consumption behavior is necessary for both consumers and companies", obtaining a score of 1.418, a sign that they are aware of gaps in resource management education. More than 80% agreed or strongly agreed about the significant contribution in increasing the recycling rate that the SGR brings. As for the Fishbein-Rosenberg model, it was used to obtain the importance of each criterion considered in the questions, and their importance being normalized show that the recycling activity is seen as essential by the respondents, followed by the reuse of the component parts of the products at the expense of new purchases, the way of collecting the value of the guarantee and the effective way of functioning of the guarantee-return system (SGR).

119 respondents claim that they constantly recycle to contribute to the development of a green economy, and 112 are also interested in recovering the value of the warranty stopped at the time of purchase. The reasons in favor of constant recycling that also obtained many positive responses are the reduction of

the carbon footprint (109), providing an example and equal opportunities for future generations (113, 107), aspects that determine an awareness of the principles of the circular economy by respondents. Considering also the counterargument to constant recycling, 61.7% claim that they do not have the necessary time. Over 50% experienced problems using Return Warranty Machines (RVMs), mostly non-acceptance of compliant products, long queues, multiple input to acceptance and unavailable storage space, issues that call for program rethinking and better management of recycling centers. To the question "Have you been put in a situation where a good under warranty breaks down shortly after its expiration?" only 12.8% were not put in such a situation, a matter that involves a future analysis on the conditions of production of the goods and the establishment of warranty terms that will result in the cause and hidden reasons of the accuracy of the resistance of the products.

5. THE ROLE OF CONSUMER PSYCHOLOGY IN DRIVING SUSTAINABLE RECYCLING AND TRANSPORT PERFORMANCE WITHIN THE GREEN CIRCULAR ECONOMY

Motivation is the majo driver in consumer behavior towards recycling. Intrinsic motivations, such as environmental concern and personal satisfaction, play a crucial role in encouraging individuals to engage in recycling activities.
Social norms aso heavily influence consumer recycling behavior no matter the age or social background. In addition to that, convenience is a critical factor affecting consumer recycling behavior. The ease with which consumers can access recycling facilities or services directly influences their participation rates.

To promote and adopt green circular economy principles, policymakers need to consider the psychological drivers of consumer behavior. Introducing incentives, such as tax breaks or rewards for recycling, can enhance motivation. Additionally, implementing stringent regulations and providing adequate infrastructure can ensure convenience and compliance. Public awareness campaigns that highlight the social and environmental benefits of recycling can also shift social norms towards more sustainable behaviors.

The role of consumer psychology in driving sustainable recycling and transport performance is paramount within the green circular economy. By understanding and addressing the psychological factors that influence consumer behavior—motivation, social norms, and convenience—policymakers, businesses, and consumers can collectively promote and adopt sustainable practices. Through targeted incentives, infrastructure improvements, and public

engagement, the green circular economy can thrive, ensuring a sustainable future for all.

6. CONCLUSIONS

By evaluating the results of our study, we detected the simultaneous evolution of the influencing factors on the circular economy, which have as their starting point the consumer motivated by: immediate and tangible benefits, by the intervention of the status and by the marketing strategies of the companies. Our research analyzed at the level of Romania, as a case study, the motivations, perceptions and behavioral models of consumers mainly regarding the guarantee-return system, as an initiative successfully implemented according to the requirements of the European Union.

Our questionnaire, although unrepresentative, presents the opinions of respondents who are aware of the need for recycling and reuse activities for the environment, understanding the principles of the circular economy and participating in their implementation, but pushed by the state and the financial sanctions imposed by it, the opportunity cost of recycling at the expense of others activities decreasing with the emergence of ways to recover the mandatory tax stopped at the time of purchase. The comparison between the two relatively recent periods, characterized by governments with different political leanings, suggests the obvious involvement and its importance in educating consumption behaviors. As Hart (2019, p.3) argued, a role as a planner and allocator of resources as a possible solution to waste to make economic processes more efficient seems to be the impetus that society needs. The circular economy or green consumerism is difficult for individual consumers to adopt, as it is impossible for them to estimate the effects of their own actions on the present and future environment. For this reason the author believes that their role is to choose a government that encourages such movements. (Hart, 2019, p.119)

Currently, a much better education can be done through apparent rewards, for example the sum of 50 money, which in other European Union countries is translated into 50 forints or 50 cents, threshold psychological for which the individual is willing to recycle, even if the value differs from country to country and depends on the degree of economic development. SGR-type measures make an important contribution to the recovery, recycling and reduction of aluminum, glass and plastic packaging, known for their longevity and impact regardless of its intensity on the environment.

According to our study, the lack of economic cohesion between UEFTA member states (except Liechtenstein) leads to different recycling rates, with

strong states at the top of the ranking, with up to 60% of waste recycled. The increase in GDP per capita has a positive influence in this trend, marking a simultaneous evolution of the economic, social and educational level, if we refer to the measures on environmental protection. We conclude some positive aspects that urge both consumers and producers to collaborate in society's mission to protect increasingly scarce resources for future generations: the state, which through the implementation of SGR and legislative regulations manages to motivate them consumers to recycle, educating them indirectly by consolidating a position of power through the companies responsible for the marketing of finished products and by forcing producers to use recycled materials in their manufacturing processes, thus reducing the necessary input of new resources.

Regarding measures with a negative impact, they translate into a vicious circle between consumers and producers, which guided by the appetite for innovation, new and fashion in the first case and the desire to maximize profit in the second lead to the accelerated development of consumerism. The warranty periods are getting shorter, subscriptions for significantly shorter periods than in the past that have as their end point the purchase of a new product, marketing strategies that are increasingly innovative and captivating for the consumer, the trend focused on organic products at exorbitant prices, the launch frequent new products that do not show significant improvements beyond design, reduced quality and reliability, policies to minimize production costs, visible short-term advantages and hidden negative long-term implications are just some of the aspects that on the surface promise an evolution of society, not taking into account the impact on the present and future environment.

As a result of our research, we have identified an acute need to inform and educate consumers about the real impact that waste and pollutant emissions have on the environment, beyond assumptions rooted in local culture, considered to be true. This aspect correlated with a continuous improvement of the infrastructure and the recycling process of different materials could lead to promising results in terms of waste reduction and resource conservation. The main disadvantage of the RVM infrastructure, identified by the questionnaire respondents, is the impossibility of recycling caused by the unavailability of machines, a discouraging aspect for initiatives of this kind. At the same time, in order to facilitate recycling, it is recommended that economic agents accept any kind of bottles or boxes, not only those marked with the SGR logo, and even if in the short term the companies, respectively the state, would come out financially in the red depending on the way of subsidizing the with this measure, the recycling rate would increase and the amount of waste and new resources needed in production would be minimized. Additionally, the use of generally valid vouchers after

recycling could significantly contribute to increasing its rate, an attribute highly appreciated by the respondents.

Another recommendation for businesses is to expand recycling systems for complex devices such as electronics and household appliances without driving consumerism, but still providing immediate and certainly more consistent benefits than in the case of blankets. We are talking about a program similar to SGR that does not require direct contact with company personnel, a theme that can represent future research on the factors that make consumers more open to recycling when human interaction is absent.

We have also identified a tendency of businesses to use the concept of circular economy and the effect on the environment as marketing messages, strategies that are positively reflected in their profit, an aspect that gives way to a future comparison between the profit of companies before and after the use of these practices.

Our recommendations come as ideas resulting from the analysis of the specialized literature and the interpretation of the studied phenomena, so they are limited by them. The research can be continued by estimating the macroeconomic effects in a hypothetical case that envisages the implementation of the circular economy beyond the recommendation stage, and countermeasures are sanctioned at a tougher level than the current one.

At the end of this presentation, it must be clearly stated that recycling as a component action of the circular economy has an infinitely larger series of fields targeting recoverable materials - in relation to those presented in the present article, where we summarized a well-known and relevant example, namely that of collecting and recycling/reusing glass, plastic or aluminum packaging - and not all of them. The example treated and analyzed still has an immense ecological value at the planetary level, considering the huge terrestrial, aquatic and even oceanic deposits of toxic elements hardly degradable, especially consisting of plastic mass waste of various shapes, sizes and origins, with devastating effects on an immeasurable natural wealth, namely marine/ocean fauna.

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