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Studies and Investigation about the Attitude towards Sustainable Production, Consumption and Waste Generation in Line with Circular Economy in Romania

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Abstract: With a rapidly growing world population and the need to address the issue of consumption of global resource and its associated environmental impacts and other social and economic issues, the demand for a responsible consumption, production and prevention of waste generation become increasingly crucial. With this broad characterization of Sustainable Consumption and Production (SCP), businesses based on circular economy should become the norm. With this goal in mind, an online questionnaire survey was performed on a nationwide scale, to explore consumers' behaviors and attitudes. It was distributed in all four of Romania's macro-regions and reached 642 respondents. The purpose of the study has been to better understand consumers' behavior regarding sustainable consumption and production and examine whether generations play a role in responsible consumer attitudes toward the products. Three generations (X, Y, and Z) have been examined and compared. The results show that what extent those three generation agree with the environment and the benefits of reducing resource consumption, also waste generation, selective collection, recycling and reuse. However, most of them have not adopted and do not intend to adopt consumer patterns based on the circular economy. The findings provide empirical evidence and directions that could help marketers identify their consumer's characteristics and market segments and develop consumer empowerment strategies on the Romanian market.

Keywords: waste generation; circular economy; sustainable production; sustainable consumption; generations (X, Y, and Z); questionnaire

1. Introduction

A growing population can impact the demand and supply of food, fuel, consumer products and services, and other ecosystems, and thereby the marketing industry which is closely associated with the production and consumption of these products and services [1]. Also, the effects of population growth

lead to an increase in waste generation. Global material resource use in 2030 is expected to be twice that of 2010 [1], while the most recent United Nations forecast suggests that the global population is likely to exceed 11 billion by the end of the 21st century [2]. With 7.2 billion people today, the planet is already struggling to meet humanity's demands for land, food and other natural resources, and absorb its waste. In the last four decades, studies dealing with awareness regarding the limits of natural resources pressure business organizations in various sectors to promote innovation in their conceptualization, design, and production methods, until the last stage of product lifecycle [3–5]. The research on perceived value for circular business models and environmentally sustainable consumption and production (SCP) becomes even more relevant when considering that green innovation success depends, among other factors, on fulfilling buyer expectations [6–8]. Circular economy is focused on maximizing what is already in use, at every point of a product's life cycle. It preserves our current way of life by making it technically viable on the long run by producing within a closed system, or loop. To prevent or to decrease waste generation [9], firms and public institutions had to reuse materials through a process of disassembling, recouping and recovering, reinforcing, and, finally, repurposing materials already in use [10,11].

Researchers and modeling experts at the Ellen MacArthur Foundation and the McKinsey Center for Business and Environment estimate that, in a circular economy scenario, consumption of new materials could be reduced [12] by as much as 32% within 15 years, and by more than half, at 53%, by 2050 [13]. Raw materials used in construction, car manufacturing, synthetic fertilizer, pharmaceutical products, and pesticide production, fuels and nonrenewable energy, land use etc. can be replaced with recovered and repurposed materials in cascaded use, in circular businesses [14]. Such innovative technologies will not be sufficient to solve the environmental problems related to the growing product demand [15,16]. To maintain a sustainable environment, a better balance between consumption, waste generation, production and livestock production's impact on the environment will be essential. Also, a change in consumption behavior, business management, and in people education [17–19] will be necessary to reduce manufacturing of products-related GHG emissions [16,20]. This study investigates opportunities and bottlenecks of some alternative and more SCP choices in terms of consumer evaluation with the aim of identifying which types of circular business model are more appropriated for Romanian consumers. To identify their consumer characteristics, an inter-generation segmentation analysis is included. Segmentation research, independent of the method used, is designed to identify groups of elements with common characteristics, e.g., consumers with similar attitudes, motivations, responsible habits or lifestyles. Consumers that are grouped together in a potential target segment are intended to be more alike to each other, and dissimilar to consumers outside the segment [21–24].

Segmentation research allows a better understanding on how to make SCP choices more relevant to different consumers and how to better position sustainable products in a competitive marketing environment. From this angle, distinct consumer profiles can be established, which provide insights on how to target, communicate and convince these distinct groups to make more SCP choices.

Furthermore, the researchers seek to answer the following questions:

- (a) Is there a difference in SCP attitude between the X generation, Millennials (Y) and Post-Millennials (Z)?
- (b) How do consumers' SCP behaviors influence the new circular economy business models?
- (c) What needs to be done to increase green consumption behavior?

Research studies have found that millennials agree with protecting the environment and that there are benefits in reducing resource consumption, selective collection, recycling and reuse. However, most of them have not adopted and do not intend to adopt consumer patterns based on the circular economy and exhibit diverse levels of environmental concern and attitude. In general, millennials showed a more positive attitude or higher environmental concerns compared to other

generations [25,26]. However, whether male and female consumers exhibit different levels of environmental attitude and concern toward SCP remains to be further investigated.

In line with these notions, it is the purpose of this study to provide an understanding of consumers' behavior regarding SCP and generation-based distinctions in attitudes, which can benefit marketers to better understand their consumer characteristics and develop more efficient market communication strategies. The rationale of the relations among the variables are presented in the following sections. The next section provides a discussion and analysis of some of the CE literature including the variety of definitions that exist and identifies some of the limitations of these, frameworks for SCP and generations X, Y and Z analyses. In section three, we work on the research and methods that help us characterize consumer behavior oriented to CE and then we analyzed the questionnaire survey on a national scale. After this, we arrive with the research findings and the conclusion which looks like the most of respondents have not adopted and do not intend to adopt consumer patterns based on the circular economy. Finally, the discussion and final remarks are presented in section six.

2. Background and Analytical Framework

2.1. Frameworks for Sustainable Consumption and Production (SCP)

The formal introduction of the Sustainable Consumption and Production concept occurred during the 1992 World Summit on Sustainable Development, emerging as a response to the sustainability challenges facing communities around the globe. It has been defined by the Norwegian Ministry of Environment, in 1994, as "the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the lifecycle of the service or product so as not to jeopardize the needs of further generations" [27]. Twenty years later, at Rio+20, the United Nations Conference on Sustainable Development reaffirmed the commitment towards SCP via the creation of a 10-year framework of SCP programs.

To achieve sustainable development, efforts should go beyond cleaner production to sustainable consumption [28]. In a narrow sense, sustainable consumption only includes buyer behaviors towards greener products that bring less pollution during production [29]. In a broader sense, it needs a reconsideration to change lifestyles, and changing consumption habits is key for success of sustainable consumption [30]. Generally, sustainable consumption has become increasingly important to prevent non-environmental practices of manufacturers [31]. Thus, sustainable consumption has gained increasing attention all over the world. For SC, in addition to end-users, the producer is also a consumer, e.g., as in the consumption of raw material, consumers of labor and consumers of other producers' products and services [32,33]. Princen [34] has argued that SC in a deep sense addresses: "throughput (the overall flow of material and energy in the human system), growth (increasing economic activity or throughput or both), scale (the relationship of the scope and speed of economic or 'material provisioning' activity to human and ecological capacity), and patterns of resource use (the quantities and qualities of products used, their meanings and their changes per capita over time)".

This view is being reflected in a growing body of research that represents a perspective on the political economy of consumption, e.g., Cohen [35]. The political economy of consumption sees patterns such as intensifying environmental stress, growing economic volatility and widening social inequality as being interlinked that need to be addressed within the same framework.

In existing SCP literature, sustainable consumption and sustainable production are generally treated as two discrete constructs within SCP systems. Sustainable consumption is concerned with "raising awareness and changing consumer behavior, values, and motivations" [36,37]. Sustainable production is mostly concerned with "not only the volume and types of goods and services produced, but the process of making them, the natural resources extracted to make them, and the waste and pollution resulting from the extraction, production, and affiliated process resulting in a particular 'good'" [38]. A rich stream of multidisciplinary research has developed since the SCP concept was

introduced exploring how and why [39] some companies engage in SCP activity as well as measuring the impacts sustainable production processes achieve [40].

As SCP requires consumers and producers to adopt different approaches towards their purchasing and use patterns, it has often been associated with social movements [38]. Yet, SCP has been increasingly associated with improved health and quality of life as well. The Lifestyles of Health and Sustainability (LOHAS) marketplace has emerged as a way to frame and market the direct health and quality of life improvements obtained by consumers embracing sustainable consumption of goods and services.

The political economy perspective makes the green consumerism approach rather shallow, as it mainly addresses (green) technology for more efficient production, green purchasing behavior by end-users of products, and recycling activities at the end of life of products. There are however recent indications that government of especially industrialized countries, in the face of growing resource scarcity, economic-growth stagnation, and pressure from growing social movements [35] might be thinking of this deeper approach. This can be seen in examples such as the European Commission Communication “GDP and beyond: Measuring progress in a changing world”, which outlines an EU roadmap with key actions to improve indicators of progress in ways that meet citizens’ concerns and make the most of new technical and political developments [41]. Consequently, the increased emphasis on efficiency and green consumerism has allowed governments to walk a fine line that pays lip service to SCP while still allowing consumer sovereignty, and tacitly or explicitly encouraging continuous consumption and production. For SCP, the tendency is to understand the drivers of consumption and production and intervening at a preventive level [36].

2.2. The Concept of Circular Economy

This concept originates from the industrial ecology paradigm, building on the notion of loop-closing emphasized in German and Swedish environmental policy, and has been pursued by China’s environmental policy makers as a potential strategy to solve existing environmental problems [42].

This holistic concept is supported by many stakeholders, but is mostly championed by the Ellen MacArthur Foundation, who depicts it as a solution to sustainability and thriving ability for both business and planet.

The concept is usually presented as an alternative to the ‘linear economy’ [43], which according to the Ellen MacArthur Foundation, is synonymous with a ‘take-make-waste’ approach to goods and services production.

Circular Economy is systemic by design of close-looped, restorative, waste-free, based on effectiveness and running on renewable energy [44].

Circular Economy supporters portray it as an exciting and as a whole new way of transforming the economy into a regenerative economic system that will, as a baseline, exist within planetary limits. The concept of a circular business model is becoming prominent in advancing the transition towards a circular economy. The current understanding of concept diverges mostly with regard to production, [45] related resource efficiency strategies such as reducing material leakages, emission reduction and energy recovery [46,47], but also efficient use of products, substituting primary material input by secondary production, extending average lifetime of products through long-life design and measures, such as repair or remanufacturing, and recycling materials [47–49]. The concept of a “Circular Economy” has gained much traction in the global business community in the last 5 years [50].

In order to implement a sustainable procurement process, new sustainable business models that would introduce sustainability into the company’s processes and subsequent value position are required. These require companies to rethink and redesign their business models to better engage with stakeholders, while creating competitive advantages to customers, the company, and society [51,52]. This redesign of business models should transform the relationship between supplier and procurer from a product-focused to a more service-focused one.

A business model is a comprehensive understanding of how a company does business and how value is created [53]. It articulates the logic, data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the company delivering that value. Since a company may have different value propositions, it may have more business models at different organizational levels and, consequently, hierarchical relationships between these business models [54].

The inclusion of sustainability specifications in the procurement process requires a continuous adjustment of the company's internal activities and, therefore, complies with an established vision of corporate sustainability (CS). CS covers the entire life cycle of a product or service, from downstream (i.e., extraction), to upstream (i.e., disposal), and their use. CS has to be addressed holistically, in ways that the stakeholder sustainability specifications are addressed systemically throughout the entire life cycle, now and in the future. The integration of CS into business activities has challenged traditional business models. This has pushed companies to better engage with stakeholders, while creating competitive advantages to customers, the company, and society.

The redesign of business models changes the relationship between the supplier and procurer of goods and moves away from a fully product-focused model to also including service-focused operations. This change results in a shift from selling products to providing service solutions, offering a multi-issue (i.e. economic, environmental, and social) value for the customer needs, including time dimension (i.e. now and in the future). This process also includes other stakeholders involved in the life cycle of the product.

One of the alternatives to become more circular is moving from a product economy to a more product/system combination, where products are recovered. Product-service systems, directed at reducing the total environmental burden of consumption could contribute to the more efficient use of resources. Upon Catherine Weetman, the following principles of the Circular Economy are inspired by nature [55]:

- (a) "Waste = food: in living systems, there is no such thing as 'waste'—one species' waste becomes food for another species. [. . .] We can reduce waste by redesigning products so they can be reused or disassembled at the end of life, keeping the products and their materials at their highest values at all times.
- (b) Build resilience through diversity: this principle uses nature as a model, explaining that living systems are diverse, with many, many different species to support the ecosystem against shocks (e.g. drought, floods). Nature has a wide pool of resources and can share strengths building up the overall, health of the system and creating resilience. Companies, nations and economic systems can use diversity to build resilience and resources.
- (c) Use renewable energy: the circular economy is about many actors working together, creating effective flows of both materials and information, with everything increasingly powered by renewable energy.
- (d) Think in systems: looking at the connections between ideas, people and places to create opportunities for people, planet and profit".

2.3. Generations X, Y and Z

Is it possible that different generations have different consumption habits? Marketers say it is. So, we grouped the results of convenient sampling based on generations: X, Y and Z.

According to Goldman Sachs [56], generation X comprises the persons aged between 37 and 52 in 2017. They prioritize spending on their families (children, housing, etc.) and are faced with higher costs for things like education, healthcare and property, but they are under-indexing on things like autos. According to Aaron Haimovitz, generation X has more spending power than any other generation and their buying behavior will come in line with the following values: they desire to provide for their family, they desire to take care of themselves and they prefer to play it safe [57]. This generation is also seen as resilient and pragmatic which matters not just for consumption, but also for their impact on the world given that X-ers are moving into leadership positions, both within companies and countries [57].

According to Bruce Tulgan, “Generation X started as a term among advertising executives, to serve as a code for those 52 million young Americans they considered difficult to pin down as a target market” [58].

“Since childhood, Xers have been providing themselves to themselves by defining and solving for themselves the problems of everyday life, from making breakfast for themselves when their parents were getting ready for work, to making dinner for themselves when their parents had to work late.”

Misconceptions related to gen X: they are disloyal, they are arrogant, they have short attention spans, Xers are not willing to pay dues and Xers can not stand deferred gratification. The truth is: Xers know that the old fashioned workplace bargain—dues paying and loyalty for security—is obsolete. Also, Xers’ are self-confident, not arrogant. Xers’ natural inclination to multiple focus (homework, remote control, telephone) and selective elimination makes Xers well suited to the multiple technologies of our times. The concept of paying one’s dues depends on a notion of long-term investment. Xers are used to a short-term world in which nothing is certain. Xers have learnt to check carefully feedback from the world around them in order to see what is changing and what is staying the same, what is working and what is not working anymore [58].

Generation Y, or Millennials, come with a different world view, because they grew up in different, changing times, offering them priorities and expectations quite different from the generations before them. The generation comprises of persons born between 1980 and 2000 [59,60].

According to Bruce Tulgan: “The power of diversity has finally kicked over the melting pot. Generation Y is the most diverse generation in history in terms of ethnic heritage, geographical origin, ability/disability, age, language, lifestyle preference, sexual orientation, color, size, and every other way of categorizing people. How do they deal with this? They want to customize everything” [61].

Generation Z, or Post-Millennials, comprises of persons born after 2000 that seem to be more pragmatic and prefer “cool” products over “cool” experiences, as Millennials do, and they want to co-create culture [62].

We expected different ways of thinking among these generations, so we structured our analysis in a way that we could perceive these differences, if any.

3. Materials and methods

3.1. Justification of the Research and Methods

The article deals with two contemporary issues for academic researchers, business practitioners and policy makers. It presents an interesting survey results from Romania focusing on age group differences in attitudes towards different strategies for sustainable production and consumption in line with circular economy, a new must have trend in global business.

For this sociological survey, the instrument used was the questionnaire. Because the authors wanted to capture a larger and varied number of respondents, it was agreed by majority that they would use the online questionnaire as a research method. One of the main reasons for choosing the questionnaire, beyond the lack of a generous budget and limited time, was that it is currently one of the best known ways of obtaining large volumes of data from the Romanian environment for processing and rapid statistical analysis. The questionnaire was composed by the authors based on literature [63].

Therefore, the best environment for administering a questionnaire is the online environment because it is attractive to respondents, ease of answering, but also because it is an ultra-fast and often free method.

3.2. Sample

In the preliminary stage of the study, to test its effectiveness, the questionnaire was pre-tested on 37 respondents between 25th and 30th of March 2016. Respondents were selected non-randomly, based on accessibility. Those participated in the questionnaire’s pre-test phase have not been included in the final sample. As a consequence of the questionnaire’s pre-testing, the authors have amended

the questionnaire, regrouping and reformulating some questions, in order to reduce the size it, as a response to the evaluation of the respondents that regarded questionnaire difficulty and completion time too demanding.

Given the limitations of time and budget, but also due the large geographical area (national level) of the research, the method selected for contacting prospective responded was the transmission of the questionnaire via e-mail. The questionnaire was complemented by explanations regarding the importance of the research. It was also available online between the 11th to the 23rd of April 2016.

The final number of respondents was 642, with 45 incomplete responses. Therefore, the final sample consisted of 597 respondents. The sample covers all four Romanian macro-regions, the demographic structure of the sample being presented extensively in Table 1. In addition, the sample was constituted from respondents from both genders, covering all age categories and all education categories.

The final sample consisted of only the respondents in the X, Y and Z generations. The structure of the final sample is as follows:

- Generation X (between 35 and 44 years), 111 respondents;
- Generation Y (between 25 and 34 years of age), 110 respondents; and
- Generation Z (between 18 and 24 years), 354 respondents.

The detailed categorization of the sample from a socio-demographic perspective and generation sample is listed in Table 1.

Table 1. The socio-demographic composition of the sample.

	N (Number)	%		N (Number)	%
Sex			Age		
Male	358	59.97	18–24 years	347	58.12
Female	239	40.03	25–34 years	106	17.76
Education			35–44 years	69	11.56
Middle School	15	2.51	45–54 years	49	8.21
Professional school	4	0.67	Region		
High School	236	39.53	Macro-region 1 (RO1: NW and Center of Romania)	194	32.50
Post-High School	6	1.01	Macro-region 2 (RO2: NE and SE of Romania)	78	13.03
Faculty/University College	179	29.98	Macro-region 3 (RO3: S of Romania and Bucharest)	178	29.90
Post-University Studies	131	21.94	Macro-region 4(RO4: SW and W of Romania)	121	20.22
Total	597				100

The overall distributions for each generation and each questionnaire item have been determined.

3.3. Items Development and Samples

All the items in the questionnaire were developed based on the literature review. We then interviewed scholars in the field as well as ten consumers with different characteristics in terms of gender, ages, education, and family income. This focus group reviewed our questionnaire for clarity and importance of the items. Based on their comments, we did minor modification, mainly on wording, to avoid confusion. The method of research used was the survey, based on an online questionnaire with 16 items. Detailed information about the study's hypothesis and the questionnaire design can be found at <https://sites.google.com/site/economicirculara/> but also in the paper "How Supportive Are Romanian Consumers of the Circular Economy Concept: A Survey" [64], where the coarse results of the research were presented.

The collected data were analysed with the IBM SPSS software. For analysis, the Kruskal-Wallis H test (KWt) was used. It is considered to be a non-parametric alternative to the One-Way ANOVA. The post-hoc test that SPSS uses after a KWt is the Dunn-Bonferroni test that is based on collaborative economy applications [4]. When performing the KW test, the following assumptions were made:

1. The dependent variable is on an ordinal scale. All analyzed items were either measured on a 5-point Likert scale (Complete agreement to Complete Disagreement for questions 11 and 12) or a 6-point scale (Always to Never for question 8);
2. The independent variable consists of two or more categorical independent groups. The independent variable is the generation in which the respondent belongs. The independent variables are the socio-demographic variables, as age: there are three independent generations groups considered: X, Y and Z;
3. The observations are independent of each other. Each respondent is a different individual and there is no dependency among groups.

There was no assumption of homogeneity of variance as this is not a requirement for doing the KWt [65–67]. From these, the authors considered important to underline the following:

- Scores as “important” and “very important” for the items showing concern for the environment, as the variables: Q1, Q2, Q3, Q4.1, Q4.2, Q5, Q6.1, Q6.2, Q6.3, Q6.4, Q7, Q9.1, Q9.2, Q10.1 and Q10.2). The items are presented in Table 2.

Table 2. Items reflecting the concern for the environment.

Item No.	Item
Q1	Concern for the environment
Q2	Agreement with selective waste collection in the view of recycling
Q3	Agreement with selective waste collection in order to avoid depletion of natural resources
Q4.1	Agreement with a “zero waste—all resources reused” type of economy
Q4.2	Agreement with a “zero waste—all resources reused” type of economy
Q5	Agreement with selective collection of waste in all households
Q6.1	Agreement with the increase of the efficiency of resources use, through resource savings
Q6.2	Agreement with increase of resources’ use efficiency through recycling
Q6.3	Agreement with increase of resources’ use efficiency through substitution
Q6.4	Agreement with increase of resources’ use efficiency through reduction of used resources
Q7	Agreement that energetic valorization of waste brings economic savings
Q9.1	Agreement with macroeconomic beneficial effects of the CE business models based on reuse
Q9.2	Agreement with macroeconomic beneficial effects of the CE business models based on recycling
Q10.1	Agreement with environment beneficial effects of the CE business models based on reuse
Q10.2	Agreement with environment beneficial effects of the CE business models based on recycling

- Scores as “frequently”, “very frequently” and “always” for the items showing the ecologic activities that they realized so far (Q8.1, Q8.2, Q8.3, Q8.4, Q8.5, Q8.6, Q8.7 and Q8.8) are presented in Table 3.

Table 3. Item reflecting the ecologic activities.

Item No.	Item
Q8.1	I go to work with a public transport vehicle
Q8.2	I go to work by bicycle
Q8.3	I go to work sharing a personal car with some friends
Q8.4	I collect separately the waste of papers
Q8.5	I collect separately the waste of plastics
Q8.6	I collect separately used oils
Q8.7	I bring used batteries to collection centers
Q8.8	I bring light bulbs to collection centers

- Scores for “Important” and “very important” to Q11 Preference of renting over buying, in the future, to contribute to the reduction of negative events on the planet, respectively reduce of resources used and Q12 Agreement with advantages of renting over buying, in order to reduce resource use are presented in Table 4.

Table 4. Items reflecting the sharing behavior.

Item No.	Name of the Variable	Item
Q11.1	Preference for renting over buying, in the future, in order to contribute to the reduction of negative events on the planet, respectively reduce of resources used	Apartment or other type of accommodation
Q11.2		Car
Q11.3		Electrocasnic equipment
Q11.4		IT equipment (PC, laptop, etc.)
Q11.5		Mobile phone equipment
Q11.6		Hobby related products (bicycle, sky, etc.)
Q11.7		Clothes
Q12.1	Agreement with advantages of renting over buying, in order to reduce resources' use	The product's service falls in the company's yard
Q12.2		The risk of not liking the product is lower
Q12.3		It is financially more advantageous
Q12.4		The ridding of the product, at the cycle's end, is in the attribution of the company
Q12.5		From the environment point of view

Final shares have been calculated as division of the data mentioned above to the total volume of each sample.

4. Research Findings

The percentage of respondents considering the attitude towards the environment as “important” and “very important” in the total sample have been calculated.

We can observe that although all three generations have a major favorable attitude towards the business and consumption models that have a lower impact on the environment, the most concerned are, in ascending order, the X-ers, the millennials and the Z generation presented in Figure 1.

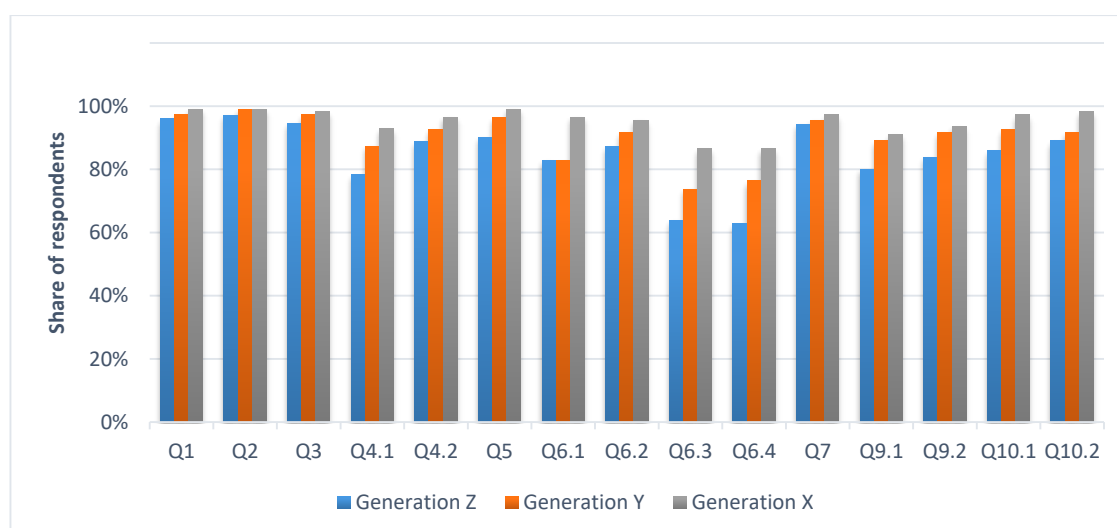


Figure 1. Attitude towards the consumption activities and of the ecologic production, in each generation.

Though the concern for the environment is important to all the three generations, the ecologically concerned behaviour adopted so far are relatively infrequent as can be seen in Table 5.

Table 5. Ecological activities achieved so far.

	Q8.1	Q8.2	Q8.3	Q8.4	Q8.5	Q8.6	Q8.7	Q8.8
Gen Z	59%	9%	29%	33%	33%	21%	17%	14%
Gen Y	46%	6%	26%	55%	55%	27%	45%	28%
Gen X	28%	8%	32%	75%	71%	47%	59%	34%

The most frequent behaviors, in all three generations, are: separately collection of paper and of plastic waste and separately collection of used batteries. Also, generation X is the generation most engaged in ecologic type of consumption, followed by generation Y and generation Z.

The big picture on the ecological patterns of consumption shows that the X-ers are most responsible in comparison with generation Y. Generation Z is the least involved in such activities.

Seventy five percent of X generation respondents reported behaviours of selective collection of paper waste, 71% separately collect plastic waste, 59% bring used batteries to special collection centers, 34% take used light bulbs at a special recycling centers and 32% share the car with other colleagues when going to work.

Generation Y is behind generation X with regard to ecologic activities, but we expect a more pronounced ecologic behavior once they become older. This trend is not in accordance with the behavior of Ys in the West, where Ys are more expected to establish the trend and adopt ecological behaviours.

The people in Z generation score the most at commuting to school or work with public transport, but this behavior is most probably due to the lack of financial resources required for buying a personal car, rather than an ecological reason.

Moreover, we cannot foresee changes in ecological attitudes in the near future, as can be seen in Table 6, where the preference of renting over buying a series of goods is presented. For comparison, the millennials in the US “would rather buy a car and lease a house. Seventy-one percent of millennials would rather buy than rent a car, whereas 59% would rather rent a house than buy one. More than 61% of them admit that they can't afford a house” [68].

Table 6. Preference of renting over buying, in the future, to contribute to the reduction of negative events on the planet, respectively reduce of resources used.

	Q11.1	Q11.2	Q11.3	Q11.4	Q11.5	Q11.6	Q11.7
Gen Z	24%	5%	14%	16%	16%	51%	14%
Gen Y	25%	1%	19%	20%	18%	47%	18%
Gen X	16%	1%	17%	28%	29%	59%	10%

Unfortunately, it seems that these business models based on the circular economy [69–71] will have to educate customers from the current Y and Z generations in the future.

In other words, some half of the millennials do not try to adopt an experiential type of consumption behavior, staying to the traditional ways of behavior. The new business models based on the circular economy will have to invest in educating the market through awareness and education campaigns.

The Millennials are aware of the advantages of the experiential types of consumption behavior, as can be seen in Table 7.

Table 7. Agreement with advantages of renting over buying, in order to reduce resources' use.

	Q12.1	Q12.2	Q12.3	Q12.4	Q12.5	Avg.
Gen Z	55%	69%	53%	66%	71%	63%
Gen Y	65%	66%	45%	63%	66%	61%
Gen X	81%	76%	65%	79%	79%	76%

X-ers rate the advantage of buying over renting as being either important or very important on average 76% of the time, while Generations Y and Z respondents rate it only 61% and 63%, respectively. To see if there are significant differences between groups, we used the Kruskal–Wallis H test, which is an omnibus test, followed by a post-hoc test.

A Kruskal Wallis test was conducted to evaluate differences among the three generations (X, Y, Z) on median change in eco-friendly activities undergone in the past by respondents (N = 559). Of the eight types of activities presented in the questionnaire, six were found to be significantly different (Table 8). A follow-up test was conducted to evaluate pairwise differences among the three generations.

Table 8. Hypothesis Test Summary for Question 8.

Item No.	Test Statistic	Sig.	Decision
8.1	H = 34.596	0.000	Reject the null hypothesis.
8.2	H = 1.973	0.373	Retain the null hypothesis.
8.3	H = 4.437	0.109	Retain the null hypothesis.
8.4	H = 67.015	0.000	Reject the null hypothesis.
8.5	H = 48.556	0.000	Reject the null hypothesis.
8.6	H = 21.967	0.000	Reject the null hypothesis.
8.7	H = 77.754	0.000	Reject the null hypothesis.
8.8	H = 39.011	0.000	Reject the null hypothesis.

Regarding the use of public transportation for commuting to and from work, the results indicated a significant difference between generations X–Y ($p = 0.02$), X–Z ($p < .001$) and Y–Z ($p = 0.45$). Significantly more people from the Z generation use public transportation compared with Y and X generation and significantly more people from the Y generation use public transportation compared with X generation.

Regarding the selective collection of paper waste from Q8.4, the results indicated a significant difference between generations Y and X ($p = 0.022$), Z and X ($p < 0.001$) and Z and Y ($p < 0.001$). Significantly more people from Generation X collect paper waste as compared with each of the other two categories and significantly fewer people from Generation Z collect paper waste selectively.

Related to Q8.5, the selective collection of plastic waste, the results indicated a significant difference between generations Y–X ($p = 0.040$), Z–X ($p < 0.001$) and Z–Y ($p = 0.001$). Significantly more people from the X generation collect plastic waste as compared with each of the other two categories and significantly less people from the Z generation collect plastic waste selectively.

In the case of selective collection of used oil from Q8.6, the results indicated a significant difference between generations Y–X ($p = 0.014$), Z–X ($p < 0.001$). Significantly, more people from the X generation collect used oil as compared with the other two categories. There is no significant difference between the Z and Y generations.

The results regarding the selective collection of used batteries (Q8.7) indicated, a significant difference between generations Y–X ($p = 0.044$), Z–X ($p < 0.001$) and Z–Y ($p < 0.001$). Significantly more people from the X generation collect used batteries as compared with each of the other two categories and significantly less people from the Z generation collect used batteries selectively.

At the Q8.8 regarding the selective collection of used light bulbs, the results indicated a significant difference between generations Z–X ($p < 0.001$) and Z–Y ($p < 0.001$). Significantly, less people from the Z generation collect used light bulbs as compared with the other two categories. There is no significant difference between the X and Y generations as can be seen in the Figure 2. We go further to evaluate

differences among the three generations (X, Y, Z) of the seven types of resources presented in the questionnaire, two were found to be significantly different, as presented in Table 9.

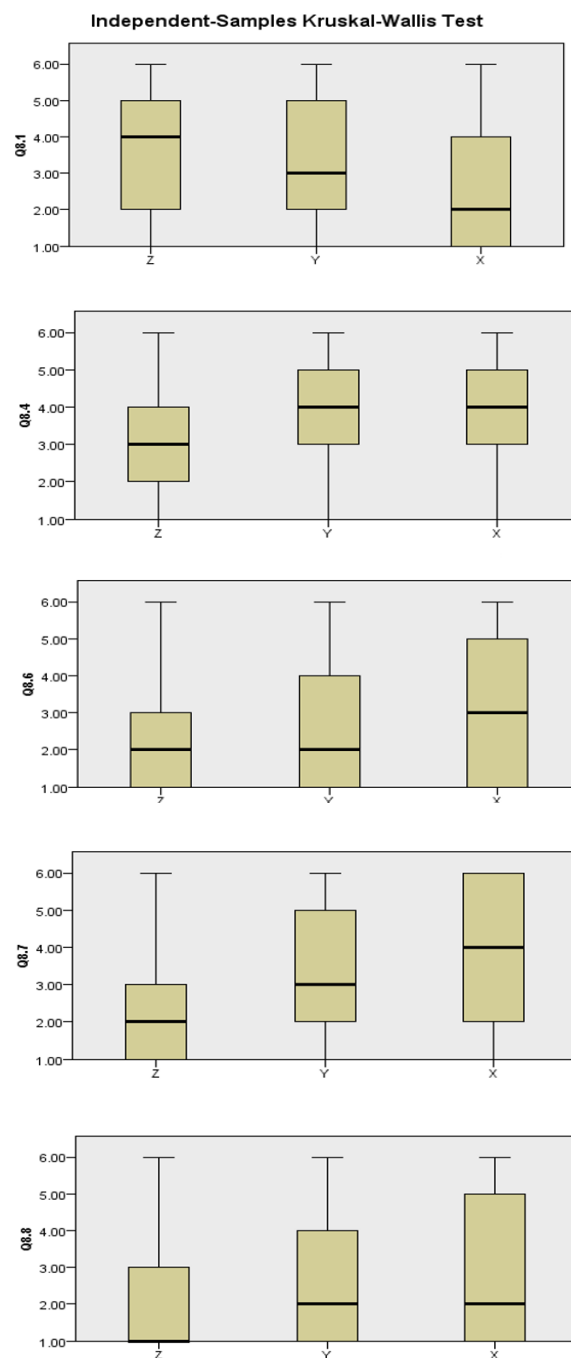
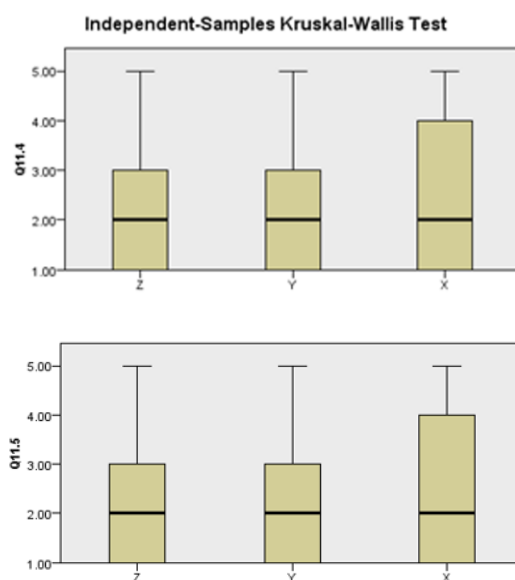


Figure 2. Sample structure of the three generations for the cases where the null hypothesis was rejected regarding ecological patterns of consumption adopted.

Table 9. Hypothesis Test Summary for Question 11.

Item No.	Test Statistic	Sig.	Decision
11.1	H = 4.568	0.102	Retain the null hypothesis.
11.2	H = 4.880	0.087	Retain the null hypothesis.
11.3	H = 0.543	0.762	Retain the null hypothesis.
11.4	H = 7.683	0.021	Reject the null hypothesis.
11.5	H = 9.206	0.010	Reject the null hypothesis.
11.6	H = 4.036	0.133	Retain the null hypothesis.
11.7	H = 2.450	0.294	Retain the null hypothesis.

Consumers attitude regarding the preference for renting instead of buying IT equipment (Q11.4), showed a significant difference between generations Z-X ($p = 0.017$). Significantly, less people from the Z generation are willing to rent IT equipment as compared with people form the X generation. There is no significant difference between the X-Y and Y-Z generations as can be seen in the Figure 3.

**Figure 3.** Preference of renting above buying.

A significant difference was observed between generations Z-X ($p = 0.008$) regarding the preference for renting instead of buying mobile phones (Q11.5). Significantly, less people from the Z generation are willing to rent mobile phones as compared with people form the X generation. There is no significant difference between the X-Y and Y-Z generations.

Related to Q12 we observe that of the five items presented in the questionnaire, two were found to be significantly different (Table 10).

Table 10. Hypothesis Test Summary for Question 12.

Item No.	Test statistic	Sig.	Decision
12.1	H = 19.652	0.000	Reject the null hypothesis.
12.2	H = 2.599	0.273	Retain the null hypothesis.
12.3	H = 5.798	0.055	Retain the null hypothesis.
12.4	H = 15.310	0.000	Reject the null hypothesis.
12.5	H = 5.387	0.068	Retain the null hypothesis.

Regarding the advantage of service being a responsibility of the company (Q12.1), a significant difference was found between generations Z-X ($p < 0.001$). Significantly, less people from the Z

generation see it as an advantage as compared with people from the X generation. There is no significant difference between the X-Y and Y-Z generations.

With regard of the advantage of the company being responsible of the product after its end of life, a significant difference was found between generations Y-X ($p = 0.003$) and Z-X ($p = 0.001$) it was observed after that Q12.4 was analyzed. Significantly less people from the Z and Y generations see it as an advantage as compared with people from the X generation. In Figure 4 it is presented a comparison between question Q12.1 and Q12.4.

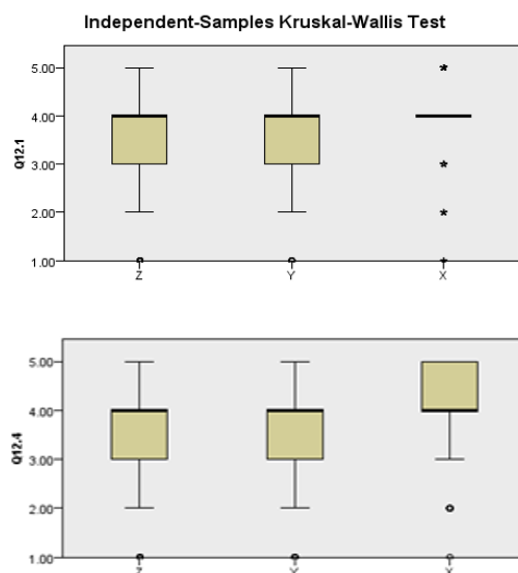


Figure 4. Agreement with advantages of renting instead of buying.

We can say that Generation Y agrees with the concern towards the environment and with the advantages of the reduction of consumption of resources, of selective collection of waste, of recycling and reuse of goods. However, most of them did not adopt and they do not try to adopt consumption patterns based on circular economy. In other words, circular businesses will have to educate their markets to change their consumption patterns.

The fact that X-ers do not regularly use bus to go to work can be explained by the fact that they have higher income and can afford to use their private car. A chi-squared test (Table 11) reveals that people in the X generation have a significantly higher income than expected, in the over 2500 lei category.

Table 11. Chi-Square Tests, Analysis of Income category by generation.

	Value	df	Asymp. Sig. (2-Sided)
Pearson Chi-Square	336.550 ^a	6	0.000
Likelihood Ratio	401.524	6	0.000
Linear-by-Linear Association	298.400	1	0.000
N of Valid Cases	549		

Note: "a" 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.91.

A Principal Component Analysis was run with a Varimax rotation on all the items. The determinant for the correlation matrix was positive ($t = 2.607 \times 10^{-9}$), the KMO value was quite high 0.738 and Bartlett's Test of Sphericity was significant ($\chi(595) = 2302.644$) indicating that the sample is adequate for factor analysis.

The communalities were all over the threshold of 0.4, the minimum being 0.540. A nine-component solution emerged explaining 67.268% (Appendix A). The rotated component matrix (Appendix B)

contained both factors with less than 3 items and cross-loadings. The items in question were excluded in an iterative process until a satisfactory solution was obtained.

The final correlation matrix still had a positive determinant and with a higher value ($t = 3.113 \times 10^{-6}$), KMO value remained unchanged and Bartlett's Test of Sphericity was still significant ($\chi(276) = 1523.707$). The communalities were all above 0.4 (minimum 0.460).

The six resulting components explained a total of 66.317% of variance (Appendix C). The resulting rotated component matrix is presented in Appendix D. The resulting factors are:

- Factor 1 - The preference for renting things (Q11.1, 11.2, 11.3, 11.4, 11.5, 11.7)
- Factor 2 - Selective collection of waste (Q8.5, 8.7, 8.8, 8.4, 8.6)
- Factor 3 - Advantages of renting things (Q12.3, 12.3, 12.4, 12.5)
- Factor 4 - Attitude towards recycling (Q9.2, 10.2, 4.2)
- Factor 5 - Efficiency of resource utilization (Q6.1, 6.3, 6.4)
- Factor 6 - Attitude towards selective recycling (Q3, 5, 7)

After performing a reliability test, the Cronbach Alpha values in Table 12 were obtained for:

Table 12. The Cronbach Alpha values.

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 5	Factor 6
0.879	0.854	0.833	0.820	0.784	0.784	0.671

Except for the last factor, the other sub-scales showed very good reliability, meaning that they are appropriate for measuring the construct that they are part of.

For each of the factors the factor scores were computed by using the regression method.

The regression scores were used for performing an analysis of variance (ANOVA). The only statistically significant group mean differences that emerged were for factor 2 and factor 6, which are presented in Table 13.

Table 13. Multiple Comparisons.

Tukey HSD							
Dependent Variable	(I) Generation	(J) Generation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
REGR factor score 1	Z	Y	0.37582016	0.28869418	0.397	−0.3090169	1.0606572
		X	−0.10459045	0.29827522	0.935	−0.8121556	0.6029746
	Y	Z	−0.37582016	0.28869418	0.397	−1.0606572	0.3090169
		X	−0.48041061	0.38966896	0.436	−1.4047789	0.4439577
	X	Z	0.10459045	0.29827522	0.935	−0.6029746	0.8121556
		Y	0.48041061	0.38966896	0.436	−0.4439577	1.4047789
REGR factor score 2	Z	Y	−0.18382441	0.26894151	0.774	−0.8218044	0.4541556
		X	−0.77175135*	0.27786700	0.017	−1.4309043	−0.1125984
	Y	Z	0.18382441	0.26894151	0.774	−0.4541556	0.8218044
		X	−0.58792694	0.36300752	0.241	−1.4490493	0.2731954
	X	Z	0.77175135 *	0.27786700	0.017	0.1125984	1.4309043
		Y	0.58792694	0.36300752	0.241	−0.2731954	1.4490493
REGR factor score 3	Z	Y	0.58819174	0.27465435	0.086	−0.0633402	1.2397237
		X	0.22386989	0.28376944	0.711	−0.4492848	0.8970245
	Y	Z	−0.58819174	0.27465435	0.086	−1.2397237	0.0633402
		X	−0.36432185	0.37071850	0.589	−1.2437361	0.5150924
	X	Z	−0.22386989	0.28376944	0.711	−0.8970245	0.4492848
		Y	0.36432185	0.37071850	0.589	−0.5150924	1.2437361

Table 13. Cont.

Tukey HSD							
REGR factor score 4	Z	Y	−0.38196220	0.28273440	0.370	−1.0526615	0.2887371
		X	−0.50554393	0.29211764	0.198	−1.1985021	0.1874142
	Y	Z	0.38196220	0.28273440	0.370	−0.2887371	1.0526615
		X	−0.12358172	0.38162466	0.944	−1.0288674	0.7817040
	X	Z	0.50554393	0.29211764	0.198	−0.1874142	1.1985021
		Y	0.12358172	0.38162466	0.944	−0.7817040	1.0288674
REGR factor score 5	Z	Y	−0.04674463	0.28629596	0.985	−0.7258927	0.6324034
		X	−0.26980126	0.29579740	0.634	−0.9714885	0.4318860
	Y	Z	0.04674463	0.28629596	0.985	−0.6324034	0.7258927
		X	−0.22305663	0.38643192	0.833	−1.1397461	0.6936328
	X	Z	0.26980126	0.29579740	0.634	−0.4318860	0.9714885
		Y	0.22305663	0.38643192	0.833	−0.6936328	1.1397461
REGR factor score 6	Z	Y	−0.30319261	0.28050109	0.528	−0.9685941	0.3622089
		X	−0.83820486*	0.28981022	0.012	−1.5256894	−0.1507203
	Y	Z	0.30319261	0.28050109	0.528	−0.3622089	0.9685941
		X	−0.53501226	0.37861022	0.337	−1.4331471	0.3631226
	X	Z	0.83820486 *	0.28981022	0.012	0.1507203	1.5256894
		Y	0.53501226	0.37861022	0.337	−0.3631226	1.4331471

* The mean difference is significant at the 0.05 level.

They are also more prone to live in urban areas as opposed to rural settings. The people in this category are significantly more involved in selective collection of different types of waste (paper, plastic, used oil, batteries and light bulbs). They are also significantly more willing to share their IT and mobile equipment. They see it as an advantage that companies take care of servicing and disposing of their products once they have reached their end of life.

People from the Z generation regularly use buses, mostly because of financial reasons. Significantly more people from the Z generation earn less than 1000 lei per month. They don't engage in selective collection behaviors and are less willing to share their IT or mobile devices.

5. Conclusions

There are, without doubt, many factors influencing the SCP. The described circular business models provide huge opportunities for companies, customers and the environment. These benefits alone, however, will not translate into widespread acceptance of the idea of circular economy business models [72–75].

From the results of the survey regarding the attitude towards the environment and the adoption of new behavior models and responsible consumption among consumers in Romania, it has been possible to determine the level at which the consumers' concerns lean toward the effects of the traditional production and consumption of goods in the environment. At the same time, the research has sought to highlight eco-friendly behavior that consumers have, including conservation behavior in daily life. Moreover, the study investigates the attitudes of consumers toward the desirability of business models based on CE [75,76].

Consumer behavior will play an important, if not the most important, role in the shift towards a circular economy by SCP.

Customers that embrace the classical economic theory, purely motivated by rational monetary considerations, would be easy to convince to buy a more expensive but more durable product if this would reduce their overall lifetime costs. At the same time, such customers would be willingly sending back articles after use if this would be rewarded with a small monetary incentive. It has become well known, however, that consumers are not always rational, objective and utility maximizing. Instead, they tend to base their decisions on other, more subjective beliefs about the product or service in question. Different areas of technological and service advancements have shown that reasonable innovations take longer than expected to reach widespread acceptance, despite their proven usefulness. Consumer resistance to change learned purchasing behavior generally explains this paradox. Members

of Generation Y tend to agree with the concern for environment and with the advantages the reduction of the resources' consumption, of selective collection of waste, of recycling and reuse of goods bring. Most respondents in this generation have not adopted or attempted to adopt consumption patterns based on the circular economy although they are the ones who support the costs of risk and waste. Among the steps that should be taken, we can recommend a good education of these consumers on circular economy spirit and to increase the responsibility of the Industrial Economy because most of them are delegating the responsibility for utilization to the buyer-owner-user of their products, and for the end-of-life to the state or third parties. It also implies that there are supplementary breaks to the financial sustainability of these business models [77]. The X-ers are well educated in recycling behaviors and are more open to circular economy. The Z generation is the least engaged in selective collection and must be educated in this sense.

According to the analysis of the questionnaire, the following conclusions have been reached:

- (1) The results of principal component analysis are six factors as we presented in the above and in the case of selective collection of waste (Factor 2), the X generation has a statistically significant higher ($p = 0.017$) score than the Z generation, meaning that they are more open to it. The same is true in the case of the attitude towards selective recycling (Factor 6). The X generation is statistically significant ($p = 0.012$) more open to recycling than the Z generation.
- (2) Though all three generations have a generally favorable attitude towards the business and consumption models which have a lower impact on the environment, the most concerned, are the X-ers, followed by the millennials and lastly, the Z generation.
- (3) Though the concern for the environment is important to all the three generations, the ecologically-concerned behaviors adopted so far are relatively infrequent. The most frequent behaviors are: separately collection of paper and plastic waste and of used batteries. Also, generation X is the most engaged in ecologic type of consumption.
- (4) Regarding the ecological patterns of consumption, results show that the X-ers are most responsible in comparison with generation Y and that generation Z is the least involved in such activities. Respondents from the X generation presented behaviors of selective collection of the paper waste (75%), plastic waste (71%), used batteries (59%), used light bulbs (34%) and 32% of them share their car with other colleagues when going to work.
- (5) Generation Y is behind generation X in ecological activities, but we expect a more pronounced ecological behavior once they become older, as they have learned from their parents. This trend does not correspond to the behavior of members of generation Y in the West, where Ys are more expected to establish the trend and of adopting ecological behaviors.
- (6) Generation Z scores best at going to school or work by public transport, but this behavior results most probably from lack of financial resources rather than from ecological mindset.
- (7) Moreover, we cannot foresee changes in ecological attitudes for the near future, as can be observed related to the preference of renting over buying for a series of goods. For comparison, the millennials in the US "would rather buy a car and lease a house. Seventy-one percent of millennials would rather buy than rent a car, where as 59% would rather rent a house than buy one. More than 61% admit that they can't afford a house" [74].
- (8) Unfortunately, it seems that these business models based on circular economy will face difficulties in targeting generations Y and Z in the future. In other words, some half of the millennials are trying to adopt an experiential type of consumption behavior, sticking to the traditional ways of behavior. The new business models, based on circular economy, will have to invest in educating the market through awareness and education campaigns. More than half of the millennials agree on the advantages of the experiential types of consumption behavior.
- (9) X-ers rate the advantage of buying over renting as being either important or very important on average 76% of the time, while Y and Z generation respondents rate it only 61% and 63% respectively.

- (10) Generation Y agrees with the concern towards the environment and with the advantages offered by the reduction of consumption of resources, of selective collection of waste, of recycling and of reuse of goods.

6. Discussions and Limitations of the Study

The success of certain business models based on new ways of SCP, give a glimpse at the opportunities for new business models in different industries [78].

This might only be the starting point for changing the entire economy. More research in the realm of circular economy will contribute to the meeting of the expectations described earlier. In particular, practical research focusing on consumers' behavior on SCP in the acceptance process will be highly beneficial for those designing new circular economy business models. A profound knowledge of the latent motives and norms underlying consumer reasoning is a prerequisite for developing a convincing value. The study's limits come from the study's sample, given the method of research.

The sample is large enough to say the results of the study are convincing but the representativeness is at the level of the investigated sample. This study can be used to understand what would motivate consumers to make the transition to a circular economy, being an important aspect for state and companies to know how to react. The directions for studying consumer behavior can be a point of view related to resource utilization issues, and concrete provisions should be formulated to regulate the behavior of peoples in the utilization of material resources.

Also, Y generations is more open in reducing resource consumption, recycling and reuse, meaning that generations X and Z should be studied in the idea of encouraging them in their approach to a circular economy. In this way the results obtained may be working hypotheses for larger sample surveys from several countries to see if consumers' behavior on sustainable production and consumption it is similar to that in Romania.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Total Variance Explained by the Initial Factors									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.882	19.664	19.664	6.882	19.664	19.664	4.105	11.729	11.729
2	4.371	12.487	32.151	4.371	12.487	32.151	3.680	10.515	22.244
3	3.502	10.007	42.158	3.502	10.007	42.158	3.037	8.677	30.921
4	1.834	5.240	47.398	1.834	5.240	47.398	2.687	7.676	38.597
5	1.743	4.979	52.377	1.743	4.979	52.377	2.626	7.503	46.100
6	1.584	4.525	56.903	1.584	4.525	56.903	2.299	6.569	52.670
7	1.368	3.909	60.811	1.368	3.909	60.811	2.237	6.390	59.060
8	1.256	3.589	64.400	1.256	3.589	64.400	1.522	4.349	63.409
9	1.004	2.868	67.268	1.004	2.868	67.268	1.351	3.859	67.268
10	0.958	2.736	70.004						

Total Variance Explained by the Initial Factors									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
11	0.950	2.715	72.718						
12	0.831	2.375	75.093						
13	0.802	2.291	77.384						
14	0.708	2.023	79.407						
15	0.667	1.907	81.314						
16	0.603	1.723	83.037						
17	0.569	1.626	84.663						
18	0.544	1.553	86.216						
19	0.522	1.491	87.707						
20	0.501	1.433	89.140						
21	0.455	1.301	90.441						
22	0.420	1.199	91.640						
23	0.395	1.128	92.768						
24	0.378	1.080	93.848						
25	0.301	0.859	94.707						
26	0.291	0.830	95.537						
27	0.265	0.757	96.294						
28	0.241	0.688	96.983						
29	0.220	0.628	97.611						
30	0.202	0.578	98.189						
31	0.170	0.485	98.674						
32	0.146	0.418	99.092						
33	0.125	0.357	99.449						
34	0.105	0.301	99.749						
35	0.088	0.251	100.000						

Extraction Method: Principal Component Analysis.

Appendix B

Rotated Component Matrix ^a of the Initial Factors									
	Component								
	1	2	3	4	5	6	7	8	9
Q11.3	0.852								
Q11.5	0.843								
Q11.4	0.786								
Q11.2	0.785								
Q11.7	0.780								
Q11.1	0.574					−0.475			
Q8.7		0.786							
Q8.8		0.786							
Q8.5		0.782							
Q8.4		0.736					0.314		
Q8.6		0.715							
Q8.2		0.557							
Q12.5			0.801						
Q12.4			0.799						
Q12.3			0.668						

Rotated Component Matrix ^a of the Initial Factors									
	Component								
	1	2	3	4	5	6	7	8	9
Q12.2			0.662						
Q12.1			0.635						
Q4.2				0.752					
Q9.2				0.739					
Q10.2				0.623		0.403			
Q6.2				0.562	0.534				
Q11.6	0.442		0.357	0.464					
Q6.3					0.791				
Q6.4					0.778				
Q6.1					0.657				
Q9.1						0.759			
Q10.1				0.362		0.674			
Q4.1						0.521			0.326
Q7							0.720		
Q3		0.304					0.630		
Q2							0.627		
Q5		0.314					0.523		
Q8.1								0.797	
Q8.3					0.316			−0.675	
Q1									0.805

Extraction Method: “a” Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. ^a Rotation converged in seven iterations.

Appendix C

Total Variance Explained by the Final Factors After Problematics Factors was Removed									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.325	22.186	22.186	5.325	22.186	22.186	3.855	16.062	16.062
2	3.758	15.658	37.844	3.758	15.658	37.844	3.322	13.841	29.902
3	2.630	10.957	48.801	2.630	10.957	48.801	2.521	10.506	40.408
4	1.641	6.839	55.640	1.641	6.839	55.640	2.243	9.344	49.752
5	1.434	5.975	61.615	1.434	5.975	61.615	2.134	8.891	58.643
6	1.128	4.702	66.317	1.128	4.702	66.317	1.842	7.674	66.317
7	0.935	3.895	70.212						
8	0.807	3.362	73.574						
9	0.743	3.094	76.668						
10	0.715	2.980	79.648						
11	0.696	2.898	82.547						
12	0.561	2.339	84.885						
13	0.523	2.180	87.065						
14	0.488	2.034	89.099						
15	0.439	1.830	90.929						
16	0.403	1.680	92.608						
17	0.351	1.463	94.071						
18	0.305	1.271	95.342						
19	0.267	1.112	96.454						

Total Variance Explained by the Final Factors After Problematics Factors was Removed									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
20	0.257	1.069	97.523						
21	0.214	0.892	98.415						
22	0.145	0.602	99.017						
23	0.123	0.512	99.529						
24	0.113	0.471	100.000						

Extraction Method: Principal Component Analysis.

Appendix D

Rotated Component Matrix ^a by the Final Factors After Problematics Factors was Removed						
	Component					
	1	2	3	4	5	6
Q11.3	0.863					
Q11.5	0.846					
Q11.4	0.780					
Q11.2	0.773					
Q11.7	0.772					
Q11.1	0.619					
Q8.5		0.814				
Q8.7		0.807				
Q8.8		0.786				
Q8.4		0.771				
Q8.6		0.700				
Q12.5			0.812			
Q12.4			0.796			
Q12.3			0.725			
Q12.2			0.637			
Q9.2				0.825		
Q10.2				0.743		
Q4.2				0.743		
Q6.4					0.834	
Q6.3					0.812	
Q6.1					0.672	
Q7						0.704
Q3						0.694
Q5						0.653

Extraction Method: "a" Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. ^a Rotation converged in six iterations.

References

1. Euromonitor International. Available online: <http://blog.euromonitor.com/2016/12/what-drives-demand-natural-resources.html> (accessed on 3 April 2017).
2. United Nations. Available online: <https://www.un.org/development/desa/en/key-issues/population.html> (accessed on 5 April 2017).
3. Organisation for Economic Co-Operation and Development. Available online: <https://www.oecd.org/innovation/inno/2105727.pdf> (accessed on 8 April 2017).

4. Gallarza, M.; Gil, I.; Calderon, H. Destination image: Towards a conceptual framework. *Ann. Tour. Res.* **2002**, *29*, 56–78. [CrossRef]
5. Bungau, S.; Bungau, C.; Tit, D.M. Studies about last stage of product lifecycle management for a pharmaceutical product. *J. Environ. Prot. Ecol.* **2015**, *16*, 56–62.
6. Sezen, A.; Cankaya, Y.S. Effects of Green Manufacturing and Eco-innovation on Sustainability Performance. *Procedia Soc. Behav. Sci.* **2013**, *99*, 154–163. [CrossRef]
7. Porter, M.E.; Van der Linde, C. Green and Competitive—Ending the Stalemate. *Harv. Bus. Rev.* **1995**, *5*, 120–134.
8. Yang, C.J.; Chen, J.L. Accelerating preliminary eco-innovation design for products that integrates case-based reasoning and TRIZ method. *J. Clean. Prod.* **2011**, *19*, 998–1006. [CrossRef]
9. Tit, D.M.; Bungau, S.; Nistor Cseppento, C.; Copolovici, D.M.; Buhas, C. Disposal of Unused Medicines Resulting from Home Treatment in Romania. *J. Environ. Prot. Ecol.* **2016**, *17*, 1425–1433.
10. Popescu, D.E.; Bungau, C.; Prada, M.; Domuta, C.; Bungau, S.; Tit, D.M. Waste Management Strategy at a Public University in Smart City Context. *J. Environ. Prot. Ecol.* **2016**, *17*, 1011–1020.
11. Bungau, S.; Suci, R.; Bumbu, A.; Cioca, G.; Tit, D.M. Study on hospital waste management in medical rehabilitation clinical hospital, Baile Felix. *J. Environ. Prot. Ecol.* **2016**, *16*, 980–987.
12. Ellen MacArthur Foundation. Available online: <https://www.ellenmacarthurfoundation.org/case-studies/pre-consumer-waste-a-gbp-1-9-billion-opportunity-awaits> (accessed on 15 June 2017).
13. The McKinsey Center for Business and Environment. Available online: <https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/how-we-help-clients/mckinsey-center-for-business-and-environment> (accessed on 17 June 2017).
14. International Organization for Standardization. Available online: <https://www.iso.org/standard/23149.html> (accessed on 20 June 2017).
15. Garnett, S.T.; Franklin, D.C.; Ehmke, G.; Van Der Wal, J.J.; Hodgson, L.; Pavey, C.; Reside, A.E.; Welbergen, J.A.; Butchart, S.H.M.; Perkins, G.C.; et al. *Climate Change Adaptation Strategies for Australian Birds*, National Climate Change Adaptation Research Facility; The National Climate Change Adaptation Research Facility: Gold Coast, Australia, 2013; pp. 1–940, ISBN 978-1-925039-14-6.
16. Butchart, S.H.; McCarthy, D.P.; Balmford, A.; Bennun, L.A.; Buchanan, G.M.; Burgess, N.D.; Donald, P.F.; Fishpool, L.D.; Garnett, S.T.; Leonard, D.L.; et al. Sharing Future Conservation Costs—Response. *J. Sci.* **2013**, *339*, 271–272. [CrossRef] [PubMed]
17. Badulescu, D.; Bungau, C.; Badulescu, A. Sustainable development through sustainable businesses. An empirical research among master students. *J. Environ. Prot. Ecol.* **2015**, *16*, 1101–1108.
18. Bungau, C.; Badulescu, A.; Badulescu, D. Assessing the Effectiveness of Mobility and Study Abroad Stages During Doctoral Programmes: A Case Study. In *ECRM2014-Proceedings of the 13th European Conference on Research Methodology for Business and Management Studies: ECRM 2014*; Academic Conferences Limited: London, UK, 2014; p. 473.
19. Prada, M.F.; Popescu, D.E.; Bungau, C. Building Education, Source of Energy Saving in Romania. In *Proceedings of the 15th National Technical-Scientific Conference on Modern Technologies for the 3rd Millennium*, Oradea, Romania, 23–24 March 2015.
20. Nistor, S.; Popoviciu, G.A. (Eds.) *Climate*; World Wildlife; MEDIMOND SRL: Bologna, Italy, 2016; pp. 157–162. Available online: <https://www.worldwildlife.org/initiatives/climate> (accessed on 3 July 2017).
21. Pieniak, Z.; Verbeke, W.; Olsen, S.O.; Hansen, K.B.; Brunso, K. Health-Related Attitudes as a Basis for Segmenting European Fish Consumers. *Food Policy* **2010**, *35*, 448–455. [CrossRef]
22. Business Forecasting. Available online: <http://businessforecastblog.com/some-observations-on-cluster-analysis-data-segmentation/> (accessed on 5 July 2017).
23. Beane, T.P.; Ennis, D.M. Market Segmentation: A Review. *Eur. J. Mark.* **1987**, *21*, 20–42. [CrossRef]
24. Motoiu, E.; Pavel, O.A.; Lakatos, E.S. A brief quantitative analysis of clusters from the creative industry in Romania. *Rev. Appl. Soc.-Econ. Res.* **2016**, *11*, 57–66.
25. Lewandowski, M. Designing the Business Models for Circular Economy—Towards the Conceptual Framework. *J. Sustain.* **2016**, *43*. [CrossRef]
26. Eurostat Press Office. Available online: <http://ec.europa.eu/eurostat/documents/2995521/6839731/1-21052015-AP-EN.pdf/c3f5f43b-397c-40fd-a0a4-7e68e3bea8cd> (accessed on 12 July 2017).
27. UN Environment. Available online: <http://web.unep.org/10yfp/about/what-scp> (accessed on 15 July 2017).

28. Narayanaswamy, V.; Stone, L. From cleaner production to sustainable production and consumption in Australia and New Zealand: Achievements, challenges, and opportunities. *J. Clean. Prod.* **2007**, *15*, 711–715. [CrossRef]
29. Organisation for Economic Co-operation and Development (OECD). Available online: <https://www.oecd.org/edu/school/programme-for-international-student-assessment-pisa/33690904.pdf> (accessed on 22 July 2017).
30. Marchand, M.; Walker, S.; Cooper, T. Beyond Abundance: Self-Interest Motives for Sustainable Consumption in Relation to Product Perception and Preferences. *J. Sustain. Consum.* **2010**, *2*, 1431–1447. [CrossRef]
31. Mont, O.; Plepys, A. Sustainable consumption progress: Should we be proud or alarmed? *J. Clean. Prod.* **2008**, *16*, 531–537. [CrossRef]
32. Geels, F.; McMeekin, A.; Mylan, J.; Southerton, D. A critical appraisal of Sustainable Consumption and Production research: The reformist, revolutionary and reconfiguration positions. *J. Glob. Environ. Chang.* **2015**, *34*, 1–12. [CrossRef]
33. Schumacher, E.F. *Small Is Beautiful: A Study of Economics as If People Mattered*, 1st ed.; Blond and Briggs: London, UK, 1973; pp. 1–319, ISBN 0-06-091630-3.
34. Princen, T.; Maniates, M.; Conca, K. *Confronting Consumption*, 2002 ed.; MIT Press: London, UK, 2002; pp. 1–392, ISBN 9780262661287.
35. Cohen, A. A consumers' republic: The politics of mass consumption in postwar America. *J. Consum. Res.* **2004**, *31*, 236–239. [CrossRef]
36. Lorek, S.; Fuchs, D. Strong sustainable consumption governance—Precondition for a degrowth path? *J. Clean. Prod.* **2013**, *38*, 36–43. [CrossRef]
37. Prinet, E. Sustainable Consumption and Production. In Proceedings of the North American Workshop on Sustainable Consumption and Production and Green Building, Ottawa, ON, Canada, 31 January–1 February 2011; One Earth Initiative Society: Vancouver, BC, Canada, 2011. Available online: https://scpgreenbuild.files.wordpress.com/2011/01/background_paper_1_sust_cons_prod.pdf (accessed on 2 September 2017).
38. Barber, J. Mapping the movement towards sustainable production and consumption in North America. *J. Clean. Prod.* **2007**, *15*, 499–512. [CrossRef]
39. Dyllick, T.; Hockerts, K. Beyond the business case for corporate sustainability. *J. Bus. Strateg. Environ.* **2002**, *11*, 130–141. [CrossRef]
40. Veleva, V.; Ellenbecker, M. Indicators of sustainable production: Framework and methodology. *J. Clean. Prod.* **2001**, *9*, 519–549. [CrossRef]
41. European Commission. Available online: http://ec.europa.eu/environment/beyondgdp/index_en.html (accessed on 2 September 2017).
42. China Dialogue. Available online: <https://www.chinadialogue.net/article/show/single/en/10298-Opinion-China-will-be-key-to-creating-a-global-circular-economy> (accessed on 3 September 2017).
43. Lakatos, E.S.; Rusu, T.; Crisan, O.A. An effective alternative to linear economy: Circular economy. *AGIR Bull.* **2017**, *31*, 21–31.
44. Lakatos, E.S.; Crisan, O.A.; Lakatos, D.; Bejan, M. Circular economy paradigm. A challenge for the intelligent city. *AGIR Bull.* **2017**, *1*, 191–201.
45. Ortan, C.; Ciomos, A.O.; Pavel, O.A.; Lakatos, E.S. Circular economy and the field of electronic and electrical components. *AGIR Bull.* **2016**, *29*, 175–182.
46. Prada, M.; Popescu, D.E.; Bungau, C.; Pancu, R.; Bungau, C. Parametric Studies on European 20-20-20 Energy Policy Targets in University Environment. *J. Environ. Prot. Ecol.* **2017**, *18*, 1146–1157.
47. Vesselenyi, T.; Bungau, C.; Husi, G. Research Equipment and Computation Techniques for Intelligent Building Applications. In Proceedings of the 2014 IEEE/SICE International Symposium on System Integration, Tokyo, Japan, 13–15 December 2014; pp. 228–233.
48. Rada, E.C.; Cioca, L.I.; Ionescu, G. Energy recovery from Municipal Solid Waste in EU: Proposals to assess the management performance under a circular economy perspective. In Proceedings of the MATEC Web of Conferences, Sibiu, Romania, 7–9 June 2017; EDP Sciences: London, UK, 2017; Volume 121, p. 05006.
49. Rada, E.C.; Cioca, L.I. Optimizing the Methodology of Characterization of Municipal Solid Waste in EU under a Circular Economy Perspective. *Energy Procedia* **2017**, *119*, 72–85. [CrossRef]
50. Ionescu, G.; Rada, E.C.; Cioca, L.I. Municipal solid waste sorting and treatment schemes for the maximization of material and energy recovery in a latest EU member. *Environ. Eng. Manag. J.* **2015**, *14*, 2537–2544.

51. Ragazzi, M.; Fedrizzi, S.; Rada, E.C.; Ionescu, G.; Ciudin, R.; Cioca, L.I. Experiencing Urban Mining in an Italian Municipality towards a Circular Economy vision. *Energy Procedia* **2017**, *119*, 192–200. [CrossRef]
52. Bungau, C.; Blaga, F.; Gherghea, C. Kaizen Implementation for Cost Reduction in Manufacturing Process Product “Driver Control Board”. In Proceedings of the International Conference on Production Research—Regional Conference Africa, Europe and the Middle East (ICPR-AEM)/3rd International Conference on Quality and Innovation in Engineering and Management (QIEM), Cluj Napoca, Romania, 1–5 July 2014; pp. 55–58.
53. Orban, M.; Cristorean, C.; Crisan, O.A.; Lakatos, E.S. Eco-innovative methods and technologies for reducing and recycling of persistent organic pollutants from environment-an overview. “SCIENCE AND ENGINEERING” Magazine. *AGIR Bull.* **2017**, *32*, 651–660.
54. Chiaroni, D.; Urbinati, A. Circular Economy Business Models: Towards a new taxonomy of the degree of circularity. In Proceedings of the XXVII Edition of the Annual Scientific Meeting, Bergamo, Italy, 13–14 October 2016; Italian Association of Management Engineering (AiIG): Bergamo, Italy, 2016; pp. 1–27.
55. Weetman, C. *A Circular Economy Handbook for Business and Supply Chains: Repair, Remake, Redesign, Rethink*; Kogan Page Publishers: London, UK, 2016; p. 18.
56. Goldman Sachs Research Newsletter. Available online: <http://www.goldmansachs.com/our-thinking/pages/macroeconomic-insights-folder/gen-x/report.pdf> (accessed on 25 October 2017).
57. Goldman Sachs. Available online: <http://www.goldmansachs.com/our-thinking/pages/millennials/> (accessed on 5 November 2017).
58. Tulgan Tulgan, B. *The Manager’s Pocket Guide to Generation X*; Human Resource Development: Minneapolis, SUA, 1997; p. 4.
59. Hofmann, E.; Hartl, B.; Elfriede, P. Power versus trust—What matters more in collaborative consumption? *J. Serv. Mark.* **2017**, *31*, 589–603. [CrossRef]
60. eMarketer. Available online: <https://www.emarketer.com/Article/No-One-More-Sharing-Economy-than-Millennials/1015886> (accessed on 10 November 2017).
61. Tulgan, B. *Not Everyone Gets a Trophy: How to Manage Generation Y*; Wiley & Sons: Hoboken, NJ, USA, 2009; pp. 8–9.
62. Visioncritical. Available online: <https://www.visioncritical.com/generation-z-infographics/> (accessed on 11 November 2017).
63. Massey, J.T.; O’Connor, D.; Krotki, K. Response rates in random digit dialing (RDD) telephone surveys. In Proceedings of the American Statistical Association, Section on Survey Research Methods, Washington, DC, USA, 6–10 August 1997; pp. 707–712.
64. Lakatos, E.S.; Dan, V.; Cioca, L.I.; Bacali, L.; Ciobanu, A.M. How Supportive are Romanian Consumers of the Circular Economy Concept: A Survey. *J. Sustain.* **2016**, *8*, 789. [CrossRef]
65. Vargha, A.; Delaney, H.D. The Kruskal-Wallis Test and Stochastic Homogeneity. *J. Educ. Behav. Stat.* **1998**, *23*, 170–192. [CrossRef]
66. Pagano, R.R. *Understanding Statistics in the Behavioral Sciences*, 4th ed.; West Publishing Company: St. Paul, MN, USA, 1994; pp. 1–640, ISBN 978-1111837266.
67. Laerd Statistics. Available online: <https://statistics.laerd.com/spss-tutorials/kruskal-wallis-h-test-using-spss-statistics.php> (accessed on 16 November 2017).
68. Forbes. Available online: <https://www.forbes.com/sites/danschawbel/2015/01/20/10-new-findings-about-the-millennial-consumer/#160609ed6c8f> (accessed on 16 November 2017).
69. IMSA. Available online: https://groenomstilling.erhvervsstyrelsen.dk/sites/default/files/media/imsacircular_business_models_-_april_2015_-_part_1.pdf (accessed on 17 November 2017).
70. Schulte, U.G. New business models for a radical change in resource efficiency. *J. Environ. Innov. Soc. Transit.* **2013**, *9*, 43–47. [CrossRef]
71. CEPS. Available online: <https://www.ceps.eu/publications/understanding-circular-economy-europe-resource-efficiency-sharing-platforms-ceps> (accessed on 17 November 2017).
72. Harvard Business Review. Available online: <https://hbr.org/2015/01/what-is-a-business-model> (accessed on 17 November 2017).
73. Moldovan, A.; Lakatos, E.S. Studies to Evaluate Consumer Attitudes toward the Environment and Adopting New Business Models Oriented towards a Circular Economy. Master’s Thesis, Technical University of Cluj-Napoca, Cluj-Napoca, Romania, 2016.

74. Boulding, K.E. *The Image: Knowledge in Life and Society*; University of Michigan Press: Ann Arbor, MI, USA, 1961; pp. 1–184, ISBN 978-0472060474.
75. Babut, G.B.; Moraru, R.I.; Cioca, L.I. Kinney-Type Methods: Useful or Harmful Tools in the risk assessment and management process. In Proceedings of the International Conference on Manufacturing Science and Education-SIBIU-Romania, Sibiu, Romania, 2–5 June 2011.
76. Mentink, B. Circular Business Model Innovation: A Process Framework and a Tool for Business Model Innovation in a Circular Economy. Master's Thesis, Delft University of Technology & Leiden University, Leiden, The Netherlands, 2014.
77. ING. Available online: https://www.ing.nl/media/ING_EZB_Financing-the-Circular-Economy_tcm162-84762.pdf (accessed on 18 November 2017).
78. Frankenberger, K.; Weiblen, T.; Csik, M.; Gassmann, O. The 4I-framework of business model innovation: A structured view on process phases and challenges. *Int. J. Prod. Dev.* **2013**, *18*, 249–273. [[CrossRef](#)]



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