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Association of Consumer Behavior to a Circular Economy: Assessing a Variety of Perceptions and its Correlation in Germany

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Abstract

Complexity in the circular economy concept enforced the integration of disciplines and a holistic approach to engender the implementation. A breakdown to bring a circular economy project to a level of market presumably provides the contribution toward the circular economy prospect. Problem identification is a deficiency in consumer behavior discovery. The objective of the research is to discover the characteristics through demographic analysis as well as to assess the association of attitude and perception toward the circular economy objective. The case is specified in Germany since it introduced effective waste management regarding a cyclical process. The conceptual framework is a model of factors influencing decision-making issued by the European Commission and a model of the Tri-component attitude. The data analysis method is quantitative by adopting a method of Cross tabulation with Chi-Square and Structural Equation Modeling. The findings demonstrated low demand for a circular economy market, price and quality are the highest indicators while buying a product, old adulthood and female respondents tended to put more concern on waste issues, and an increase in willingness to spend more in finance on eco-friendly products positively would rise the intention of engaging in the social and environmental context. This observation is relevant for SDGs objectives.

Keywords: consumer behavior; circular economy; sustainability

1.Introduction

Sustainability was an alternative to address a climate crisis and megatrend issues. Sustainability was considered as a holistic approach, whereby integrated aspects covering, economic, social, and environmental dimensions were met in one framework, established to pursue SDGs toward 2030. It is defined as "Sustainable development meets the needs of the present generation without compromising the ability of future generations to meet their need" (United Nations Academic Impact, n.d.). The assumption of limited needs was in regard to environmental threats and natural resources.

Circular Economy (CE) is still considered a recent idea that has been promoted by European Commission (EC) through «Towards a Circular Economy» in 2014 (Duke et al., 2018). Neligan (2016) generally describes CE as the idea of a transition where the resources are kept for a long-term period wherein this concept features the waste management and minimization of material processing. The linear economy model desperately was supposed to be altered by the CE model (Korhonen, Honkasalo, and Seppälä, 2018, p. 37).

However, the concept of the CE itself required other variables which function as a complement and contributing factor toward an applicable and rational implementation. Kirchherr, Reike, and Hekkert (2017, p. 221) argue, "The main aim of the circular economy is considered to be economic prosperity, followed by environmental quality; its impact on social equity and future generations is barely mentioned. Furthermore, neither business models nor consumers are frequently outlined as enablers of the circular economy". Additionally, Elzinga (2018, pp. 4-5) explicitly emphasizes a gap and a lack of knowledge in terms of circular economy, particularly in the behavioral study. Presumably, a circular economy covers not only waste prevention

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and natural resources efficiency, but also a strategy and model within a business, industries, and markets as they are a part of economic activity.

Consumer attitude, a concept in behavioral economics is perceived as an essential variable to function in a circular economy. The substance of consumer assessment was manifested as EC conducted a behavioral study of consumer engagement in several European countries in 2018. Since the market is derived from the demand, investigating patterns within a consumer perception will demonstrate the knowledge required to fulfill the deficiency and forecast the opportunity of a circular economy project where the benefit returns to a policymaker and business actors (Duke, 2018).

Circular economy within its context and challenge is fully complex, interrelated subjects from waste management, economic model, and energy resources. OECD (Organization of Economic Cooperation and Development) defines the idea of a circular economy in two strands: a flow of material and economic conditions (industrial ecology) (Ekins et al., 2019). By its framework, the raw material is designed to be a product that after its consumption, the waste is recycled and remanufactured to become a new product, the final residual is to be incinerated to produce energy. The model represents how a cyclical process works by two categories: 1) key characteristics (minimized use of natural resources, increased share of renewable energy, reduced emissions, fewer residuals, keeping the value of products); 2) enabling factor (eco-design, repair, refurbishment, and remanufacture, recycling, economic incentives, business models, eco-innovation, governance, and knowledge aspects), see Figure 1 (Reichel, Schoenmakere, and Gillabel, 2016, pp. 9-11).

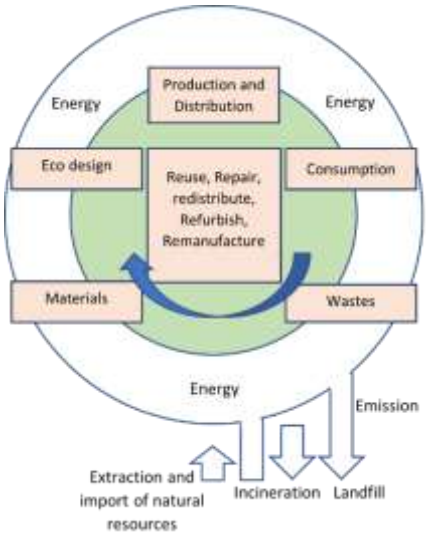

Figure 1. A simplified model of the circular economy for materials and energy

Source: "EEA based on Eurostat, 2015b, 2015c" as cited in "A simplified model of the circular economy for materials and energy" as cited in Reichel, Schoenmakere, and Gillabel, 2016, p. 10 Federal Statistical Office, 2017, as cited in Federal Ministry for The Environment, Nature Conservation, and Nuclear Safety and Consumer Protection, 2018, pp. 7-9).

Narrowing down to a level of the state, a study case of waste management in Germany presumably is acknowledged as a plausible role model within the cycling process. It included the implementation of the waste hierarchy, synergic regulation as well as policy coherence, and sorting of a waste framework. Statistically, waste generation in Germany decreased from 406.7 million tons in 2000 to 351.2 million tons by 2015 indicated by a

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significant drop in construction and demolition waste. In addition, connecting the link between waste volumes and economic output demonstrated a positive result implied as a climb in GDP from 100 percent in 2000 to 118.3 percent by 2015 and a decrease of net waste volume from 100 percent in 2000 to 86.4 percent in 2015

The unit of analysis is a CE market since European Commission emphasizes the prominence of empowering consumers and public buyers. The substantial observation of the EC, a behavioral study on consumer engagement in a circular economy provided deeply a characteristic and assessment of an experience in practice. The issues though are 1) the intention to engage relatively is high yet the actual engagement is limited; 2) High effort to repair a product, high price, and average quality of a product are identified by a previous study; 3) A need to regulate durability and reparability information within a product (Duke, 2018, p. 183).

A previous study held by EC was to examine the selected products: vacuum cleaners, televisions, dishwashers, smartphones, and clothes. A trend and propensity of society to purchase a new product and a second-hand product were observed by identifying six aspects: brand/model, reparability/durability, repair services, prices, quality, effort/convenience depicted in a model of factors influencing consumer's choice. According to those aspects, the results showed more significant decisions on price, quality, and convenience where the cost was the substantial barrier to engaging in a circular economy (Duke, 2018, p. 178). The main finding demonstrated a willingness to engage in a circular economy model in the upcoming period, yet the actual engagement was still at a low rate. A lack of information regarding durability, reparability, and markets was the main reason why participation in a circular economy model remained at a low rate. Another substantial piece of information thereby showed the consumer's willingness to pay more for better durability and reparability of products (Duke, 2018, pp. 2-4).

Extending a concern of market and research analysis, investigating consumer behavior, in this case, is a strategic tool to derive the precise results. In their relationship, Vahdati, Mousavi, and Tajik implicitly argue that the interrelatedness of consumer perception and attitude leads to shaping behavior, and behavior associating to a market. Furthermore, analysis of behavior becomes the feasible tool to analyze the market whereby interrelated aspects covering attitude, perception, and intention, including background personal aspects are comprehensively assessed. As a result, collective variables such as internal factors, external factors, and consumer attitudes have a role in shaping consumers' purchase intention (Montazeri et al., 2013, as cited in Vahdati, Mousavi, and Tajik, 2015, pp. 835-836).

Similarly, Ajzen and Fishbein explained a relation of the concept of attitude, intention, behavior, and subjective norm to acquire an outcome of behavior influenced by dimension of time, context, target, and action. Narrowing down to a specific model from various models within analysis of behavior, Tri-component model of attitude is substantial to assess the concepts of belief, feeling, and action. The analysis of intention corresponds to the analysis of consumer behavior to provide a pattern and trend toward purchasing products being marketed.

The research will extensively address the characteristic of consumer behavior and its association in Germany since it showed a positive outcome in terms of waste management. The assessment of consumer attitude is to explore the consumer perception identifying its trend and characteristic whereby gender and age are assigned as the parameter. Hypothetically, public opinion will provide a trend and pattern for analysis of CE market as well as its positive association in terms of a circular economy in Germany.

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The interest to analyze consumer attitudes in Germany expectantly will contribute to the development of the circular economy model itself, especially in the Circular Economy market in Germany. In this case, it demonstrated efficiency and policy coherence toward a circular economy from waste management.

The general purpose of the study is to acquire a characteristic and knowledge about consumer perception. It is expected to contribute to SDGs goals 12 (responsible consumption and production) and generally other related SDGs goals. The theory of change is formulated in this research wherein an outcome to contribute to strengthening and evaluating a current circular economy model is expected. The result of this study is essential to academics, industry practitioners, and particularly market analysts. The following objectives specifically are expected: 1) To provide a characteristic of perception within a CE model; 2) To examine the association of consumer behavior to circular economy context.

A study case of Germany would be used as focus research while the study is to discover and evaluate the substance of waste management, consumer attitude, and circular economy as the outcome. The quantitative analysis was accomplished in this paper based on secondary research (desk research). The secondary data was acquired from GESIS (Leibniz-Institut für Sozialwissenschaften) concerning the total 1310 population of residents in Germany by the year 2018. The theoretical framework in this analysis was a model of the market for CE issued by the European Commission complemented by a Tri-component model of attitude wherein the mixed-method approach was a cross-tabulation with Chi-Square and Structural Equation Modeling (SEM). The tool of analysis was R Studio, version: 2022.02.1 Build 461, and IBM SPSS Statistics Subscription, version: 28.0.1.1.1 (15).

The research question type is inductive and retroductive to develop universal generalization, generating theory from data in the process and relates to the modernism or positive in a school of thought (Blaikie, 2000: 101, cited in Hammett et al., 2014, p. 28). The following research questions consequently are to be addressed: 1) How vary consumer perception for analysis of the CE market in Germany; 2) What is the association between consumer behavior and a circular economy.

To present the analysis and its process, a research paper structure is sequentially divided into specific categories: 1) Introduction; 2) Methodology; 3) Results and findings; 4) Critical assessment and discussion; 5) Conclusion.

2. Methodology

The study is to adopt the model of factors that influence consumer's choice established by the EC. Firstly, an analysis of consumer perception is conducted from a set of variables in regard to market analysis for the circular economy including its characteristics and demand wherein the parameter of this study is gender and age, see Figure 2. Secondly, analysis of attitude is conducted as a complement by modifying a Tri-component model of attitude itself whereby an association to a market for CE is assessed, see Figure 3 for a complement conceptual framework.

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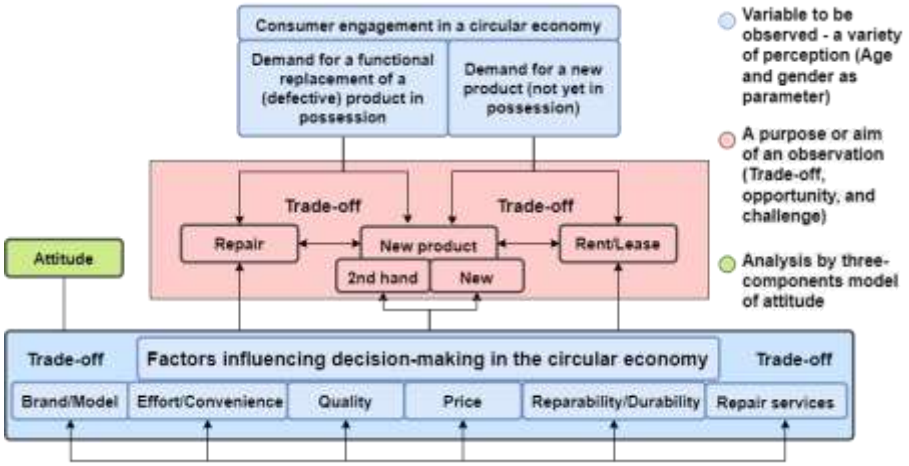

Figure 2. Main conceptual framework of research (Own illustration, based on Duke. et al., 2018, p.178)

Figure 3. Complementary conceptual framework of research (Own illustration, based on Rosenberg & Hovland 1960, Breckler 1984, as cited in Rossmann 2010, pp. 18-19)

To complement, a model of Tri-component attitude substantially provides a framework of how behavior or attitude might be shaped and forecasted from a set of variables. In this case, the information and knowledge regarding attitudes can be possibly identified to complement the previously discussed indicator namely demand for a functional replacement, demand for a new product, and factors influencing decision-making as it is a part of a main model, see Figure 2 (Duke et al., 2018).

In specific, environmental, social, and economic issues are contextualized beside cognitive, affective, and conative aspects and they are categorized as independent variable to represent consumer behavior whereas the intention to engage in CE aspect is categorized as dependent variable to represent the attitude and engagement toward CE. The code is explained later in

Table 1.

Before conducting multivariate analysis, data preprocessing and EDA (Exploratory Data Analytics) is pre-tested in IBM SPSS to explore the dataset. Duplicated data, missing values, and outliers are ignored due to the absence of issues and type of data. Two methods are registered for two different endpoints: 1) Cross tabulation with Chi-Square for analysis significance within different characteristics; 2) Structural Equation Modeling for analysis of association. Type of data is likert-scale, categorical nominal, and dichotomous variable.

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Encoding and scaling, and a reduction of dimension are conducted. Data preprocessing and plot use a package of "likert" (Byer and Speerschneider), "ggplot2", "tidyverse", "dplyr" (Wickham, H et al., 2022), and "fitdistrplus" (Delignette-Muller and Dutang, 2022).

1. Cross tabulation with Chi-Square

For this analysis, data of *Soziodemografische Fragen, Einkauf II* and *Haushaltsgeräte, Haushalt, Abfall, und Ernährung, Haushaltsabfällen* are used due to its relevancy (purchase frequency (non-food), attitude to repair, lease, rent and its argument, a selective product being repaired and purchased, and factors influencing decision-making: price, quality, mode, brand, function, duration, environment friendly, fair production. An assessment of perception of waste issues.

Prior to the analysis, the equation is set as $f_i(j)$ where i = category for gender or age separately and (j) = the frequency for each variable, $\in \{0, 1310\}$. Gender is set into f_{male} = male participant and f_{female} = female participant. Age <35 is converted into f_{YA} = young adulthood, age 36 – 55 is converted into f_{MA} = middle age, age >56 is converted into f_{OA} = old adulthood. The classification of age is based on an approximation of age range in general to differ across generation as the difference of young and old generation might produce the important knowledge. Gender proportion indicates $f_{male}(j)$ = 664 (50.69%), $f_{female}(j)$ = 646 (49.31%), N = 1310 whereas age proportion indicates $f_{YA}(j)$ = 484 (36.95%), $f_{MA}(j)$ = 575 (43.89%), $f_{OA}(j)$ = 251 (19.16%), N = 1310.

The analysis is conducted by a package of "tableone" in R. The function of "CreateTableOne" is executed to acquire the output followed by the argumentation of the Chi-Square test for "testApprox", Fisher test for "testExact", One-way test for a normal test and Kruskal test for a non-normal test (Yoshida and Bohn, 2015). As the parameter is gender and age, both variables become "strata". All variables are set into categorical nominal data types: perception to repair, rent, purchase 2nd product, the product being purchased and repaired, factors influencing decision-making, attitude to purchase, and perception to waste issue.

The first assumption of hypothetical test in the Chi-Square test:

- H_0: $f_{male} = f_{female}$
- H_1: $f_{male} \neq f_{female}$

The second assumption of hypothetical test in the Chi-Square test:

- H_0: $f_{YA} = f_{MA} = f_{OA}$
- H_1: f_{YA}, f_{MA}, f_{OA} are not equal

To interpret, if $p < 0.05$ = reject H_0 hypothesis or it is statistically different and has no relationship (independent), if $p > 0.05$ = do not reject H_0 hypothesis or it is not statistically different and has relationship (dependent). α = 0.05 or 95% confidence level.

2. Structural Equation Modeling

For this analysis, data of *Fragen zur Sozialen Milieus* is identified due to its relevance for acquiring the variable of perception and intention to engage in a circular economy model where it covers the general aspect of

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the economy, social, and environment (Rückert-John, 2020). In this case, the Tri-component model of attitude is the assumption to justify the core concept of attitude for the CE market,

Before creating a model, a selection of eight variables (exogenous) is based on the consideration of the sustainability aspect. As the circular economy is one of the sustainability models, the construction of measurement is based on economic, social, and environmental aspects, This assumption is in accordance with the contribution to investigating the opportunity and challenge within the CE market as well as to justify which factor is the most associated by testing the correlation coefficient in between.

Table 1. Construct measurement for Tri-Component Model of Attitude

Construct	Questionnaire	Variable	Code
Cognitive/ belief	I trust in the forces of the free market. The market will ensure that what needs to change (economic issue)	Free market	S3_4
	We need more economic growth in the future, even if it burdens the environment (economic and environmental issue)	Economic growth	S3_15
Affective/ emotion	There is little chance for us to make it these days (social issue)	Opportunity	S3_7
	I have the impression that I have to try harder and harder not to slip socially (social issue)	Social context	S3_17
	I am very interested in what is new in the cultural scenes (social issue)	Culture	S3_6
Conative/ Behavior	It is important to me to contribute new ideas and to be able to give impulses (social issue)	Contribution	S3_1
	I am willing to spend more for environmentally friendly products (environment and economic issue)	Eco-friendly product	S3_3
Attitude/ intention	It is often the case that I am very involved in social or ecological issues (social and environmental issue)	Strong engagement	S3_14

Own illustration, based on Rückert-John, 2020

Validity and reliability are tested before analyzing the data (Krieg, 2014, p. 22). Reliability is checked by Cronbach's alpha to overview the internal consistency. The purpose of Cronbach's alpha is to check the reliability of the grouped data (Statistics How To, n.d.). By its process, after setting ordered data, a scale into 5 = absolutely agree, 4 = somewhat agree, 3 = somewhat disagree, 2 = absolutely agree, 1 = NA, a package of "umx" in R is installed whereby a function of "reliability" is run after converting the data frame into a data matrix (Bates, et al. n.d.). On the other hand, validity is measured by exploratory factor analysis, conducted in IBM SPSS. The analysis is set as follows: the extraction method = PCA (principal component analysis); rotation method = "varimax", and sampling adequacy = KMO (Kaiser-Meyer-Olkin) (Geert, n.d.).

Structural Equation Modeling is run by R. A package of "lavaan". A function of "sem" is used to fit after constructing the model (Rosseel et al., 2022) whereas a plot is drawn from a package of "lavaanPlot" (Lishinski, 2021) and "semPlot" (Epskamp, 2022). The additional argument is set by converting the data into "as.numeric" prior to fitting the model. Afterwards, the construction is a structural model and measurement model by setting the equation through the argument as follows: S_CG =~ S3_4 + S3_15, S_CN =~ S3_1 + S3_3, S_AF =~ S3_17 + S3_7 + S3_6, and S3_14 =~ S_CG + S_CN + S_AF for direct and indirect effect, (Bollen, and Noble, 2011, p. 15639).

The assumption of hypothetical test in SEM analysis following the model of Tri-component of attitude (the attitude (S3_14) is constructed from affective (S_AF), cognitive (S_CG), and conative (S_CN):

- H_1: There is a positive association between cognitive and attitude
- H_2: There is a positive association between conative and attitude
- H_3: There is a positive association between affective and attitude

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To interpret, if $p < 0.05$ = reject H_0 hypothesis or it is statistically significant, if $p > 0.05$ = do not reject H_0 hypothesis or it is not statistically significant. α = 0.05 or 95% confidence level. Positive regression coefficient indicates positive association whereas negative regression coefficient indicates negative association.

3. Results and findings

Overall, demographic data demonstrates a balanced proportion in gender as male respondents accounted for 50,69% whereas female respondents is 49,31%. On the other hand, the age range is 8 – 65. Non-parametric test, nevertheless, is presumed (Krieg, 2014).

Generally, the descriptive statistics demonstrate that among the selected products such as cloth, furniture, small- and big electronic equipment, buying 2nd product and repairing of those products are little undertaken since the highest percentage is 3,4% for all categories (relative frequencies). Yet the reasons vary depending on the categories. The other indicator of evaluation such as buying behavior, use of smartphones, and cloth seems to highlight the positive signal to the CE market where the efficiency is justified (Rückert-John, 2020).

Overall results in terms of perception to waste highlight the significance of awareness and put concern for waste issues within each case. Corporate responsibility and policy instruments interestingly are the highest percentage within the most supported item determined by “absolutely agree”, 59% and 50% respectively. On the other hand, the intensity to purchase and own a new product remarkably is high in correspondence with a price (72,4%) as the most considered item, in this context, a cloth as the selection of product (Rückert-John, 2020).

On the other hand, the data for issues within social milieus shows that intention or perception to contribute and innovate (contribution), readiness to spend more on the eco-friendly product (eco-friendly product), a feeling of difficulty for not slipping down in a social context (social context), and interest in a new culture scene (culture) lie in the highest percentage for category of “somewhat agree”, 54.0%, 43.9%, 36.6%, and 35.2% respectively. On the other hand, a need to bolster economic growth by ignoring the environment (economic growth), intention to engagement in social and environmental issue (strong engagement), a belief in a free market, and a feeling of little opportunity to bring about something (opportunity) seem to highlight the selection of “somewhat disagree”, 41.5%, 39.7%, 38.3%, and 37.6% respectively (Rückert-John, 2020). Environmental issues are well concerned.

1. Characteristics of consumer perception

A proportion between gender demonstrates a significance, so the age by a classification. f_OA presents a balance proportion between f_male and f_female (ratio of 128:123) while f_YA and f_MA present a different proportion, the higher f_male proportion for f_YA (ratio of 309:175) and higher f_female proportion for f_MA (ratio of 343:232) (Rückert-John, 2020). Nevertheless, a balanced proportion is granted.

To analyze and examine the market for CE, the analysis is divided into factors influencing decision-making and attitude of buying, purchase of 2nd product, repair of product, and renting of product. A conceptual framework is used to seek expectancy, opportunity, and challenge based on age and gender. Additional

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knowledge regarding perception to waste issues by no means is ignored due to the assessment of contribution and support. The focus areas are the most categories within the variables, the differences between the variable and its significant levels (Duke et al., 2018).

To sum up, based on a total population of 1310 observation in Germany, demand for 2nd product, repair of product, and renting of product presumably still considered low. The argument is supported by the evidence of average frequency for investigating reparability information, a preference to own tools, instead of renting, and a price comparison as the most important consideration in decision-making. However, the efficiency and interest to purchase recycling materials might be used as a note to discuss and open the opportunity further, including an evaluation of the most considered aspect such as price.

Apart from that, the opportunity and challenge might be varied across the categories in terms of what type of products and services mostly selected by the respondents and who are they since the parameter is the level of gender and age. From this result, the characteristics are justified case by case, yet there is little specific trend or deviation for describing the general overview since the proportion slightly differ.

Table 2 provides the outlook of what is the most selected category by the respondents, at the same time what type of gender and age the most respondents choose based on a statistical significance of 5%.

Table 2. Summary of variety of perception in analysis of market (characteristics based on what to whom)

Attribute	Middle age	Old adulthood	Young adulthood	Male	Female
Decision-making for buying clothes	Quality	Function, Fair production	Mode, Brand	Brand, Duration	Price, Mode
Consumer buying behavior	Often purchase of refilled package, sometimes Investigating information of reparability service	Sometimes online shopping	Often purchase from recycling materials	sometimes Investigating information of reparability service	Often purchase of refilled package, sometimes online shopping
Frequency of replacing smartphone and cloth	Purchase of a top (cloth) several times a year	Replacing smartphone less often than 4 years			Replacing smartphone less often than 4 years
Efficiency for smartphone and cloth		Not replacing smartphone until broken, not receiving new smartphone regularly through a contract		Not keeping unused cloth, Purchase a new cloth while the old one broken	
Selected items of 2nd product		Never buy clothes, never buy multimedia devices, never buy toy, never buy furniture, never buy work tool, never buy small electrical equipment, never buy big electrical equipment		Never buy clothes, never buy toy, never buy furniture, never buy work tool	never buy multimedia devices, never buy small electrical equipment, never buy big electrical equipment
Reason to buy 2nd product			2nd product is more favorable, efficiency in management		
Selected items of repair of product	Never go repairing cloth, never go repairing small electrical equipment	Sometimes go repairing multimedia devices, sometimes go repairing big electronic equipment, never go repairing shoes	Never go repairing furniture	Never go repairing shoes	Sometimes go repairing Big electronic equipment
Reason not to repair product		New product is more favorable, little ability to repair	Cost of time, preference to having updated product	Preference to having updated product	
Self-repair of cloth and service		Self-repair of cloth for little broken things			Self-repair of cloth for little broken things, self-repair service for day-to-day tools
Attitude to handling (renting) tools		Not collating the tool which seldom used, selling or donating			Lending the tool which seldom used, selling or donating

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Attribute	Middle age	Old adulthood	Young adulthood	Male	Female
		unused tools			unused tools
Reason not to renting		Preference to own tools		Expensive, cost effort, preference to own tools	

Own illustration, based on Rückert-John, 2020. The characteristic is based on the highest percentage within the most category per issue, a level of statistical significance = 5%

On the other hand, analysis of perception provides substantial interest to policy instruments and corporate responsibility as mitigation of increased waste issues. A little support for local repair services and the intention to self-repair things support the assumption of low demand for the repair of the product. Consequently, even though the low demand for the CE market is considerably identified, the interest to contribute to waste issues and the environment is remarkably high as illustrated by the high percentage of waste concern, awareness of disposal, and support of the cost of plastics.

Overall results demonstrate that old adulthood puts more concern on efficiency, has high interest to waste issues, and tends to have a self-repair and owning things. On the other hand, young adulthood presumably seems to position in realistic attitude, and little spend the effort to discuss about waste issues. This evidence prevails to differentiate between male and female respondents that female participant puts more interest to waste issues, rather than male respondents.

2.Association between consumer behavior and circular economy

Analysis of reliability firstly demonstrates a good score. Alpha reliability = 0.7049, Standardized alpha = 0.7059. The result is considered acceptable resulting in a closely related set of items as a group (Statistics How To, n.d.). Analysis of correlation among groups shows a positive correlation. The highlighted area significantly indicates a correlation coefficient (r) of >.40. The most correlated item is between economic growth (S3_15) and free market (S3_4), r = 0.447. The other correlation coefficient of 0.4 are between social context (S3_17) and opportunity (S3_7), r = 0.440, between strong engagement (S3_14) and culture (S3_6), r = 0.426, between strong engagement (S3_14) and eco-friendly product (S3_3), between culture (S3_6) and contribution (S3_1). It seems that one item might correlate to two or more items leading to multicollinearity. Yet, since the overall determinant is 0.247, it might be presumed acceptable. In this case, 0.2-0.3 might be considered weak whereas 0.4 might be considered moderate (Schober, Boer, and Schwarte, 2018). Also, the preponderance of the P-value nearly is 0.000.

The validity test shows a set of component groups where it nearly fits the constructed model of the Tri-Component attitude. The score >.6 indicates a high relationship between the value within a single factor group (factor loading). Free market (S3_15) and economic growth (S3_4) seem perfectly paired for the cognitive aspect. Contribution (S3_1), eco-friendly product (S3_3), and strong engagement (S3_14) determine a perfect group as well. Opportunity (S3_7) and social context (S3_17) fits as well, yet without a culture (S3_6) since it is included in another factor group (factor loading), on the left side (Geert, n.d.). Apart from that, as the KMO score is 0.745, it is considered moderate (middling) (Statistics How To, n.d.).

On the other hand, the scree plot, presents the eigenvalues of >1 (y-axis) corresponding to a sharp drop of the line for a factor or component of either 2 or 4 (y-axis). Eigenvalues indicate the common variance within the

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variables. The higher the eigenvalues, the stronger the factor. As a result, one might presume that three factors are acceptable as the eigenvalue is about 1.3 (Geert, n.d.).

Table 3. Summary statistics of SEM

	Latent variables	Estimate	Std. Err	Z-value	(P>|z|)	Std. Lv	Std. all (ß)	Variance estimate	R^2 estimate
Latent	S_CG=~							0.534	
	S3_4	1.000				0.731	0.680	0.621	0.463
	S3_15	0.928	0.086	10.816	0.000	0.678	0.658	0.604	0.432
	S_CN=~							0.326	
	S3_1	1.000				0.571	0.572	0.671	0.327
	S3_3	0.979	0.68	14.426	0.000	0.559	0.542	0.751	0.294
	S_AF=~							0.102	
	S3_17	1.000				0.319	0.298	1.045	0.089
	S3_7	0.837	0.136	6.148	0.000	0.267	0.260	0.982	0.068
	S3_6	2.312	0.276	8.391	0.000	0.738	0.711	0.533	0.506
	S3_14							0.451	0.566
Regression	S3_14~								
	S_CG	-0.053	0.100	-0.530	0.596	-0.039	-0.038		
	S_CN	1.991	0.939	2.120	0.034	1.137	1.116		
	S_AF	-1.273	1.618	-0.787	0.431	-0.406	-0.399		
Covariance	S_CG~								
	S_CN	0.223	0.025	8.851	0.000	0.535	0.535		
	S_AF	0.131	0.019	6.801	0.000	0.559	0.559		
	S_CN~								
	S_AF	0.166	0.022	7.654	0.000	0.912	0.912		

Own illustration, based on Rückert-John, 2020. Std. Err *Standard error*, Std. Lv *Standard level*, Std. all *Standard all*, S_CG *Cognitive*, S_CN *Conative*, S_AF *Affective*, S3_1 *Contribution*, S3_3 *Eco-friendly product*, S3_4 *Free market*, S3_6 *Culture*, S3_7 *Opportunity*, S3_14 *Strong engagement*, S3_15 *Economic growth*, S3_17 *Social context*

The general overview of Table 3 presents the summary statistics of SEM (Structural Equation Modeling) where unstandardized and standardized coefficients are highlighted. Firstly, in latent variables, all variables have a statistical significance, p 0.000.

The overall regression coefficient indicates a positive correlation with less standard error score. In regression output, determining a variable of strong engagement (S3_14) as the dependent variable, only a variable of conative associates positively whereas cognitive and affective shows a negative regression coefficient with higher standard error. Though, a statistical significance only is detected for the conative aspect, p 0.034. In this context, various assumptions might occur including multicollinearity. Apart from that, analysis of covariance among latent variables randomly demonstrates a relationship where it has a high score, conative and affective might predict cognitive whereas affective might predict conative, p 0.000.

The evaluation of SEM (Structural Equation Modeling) seems acceptable. R square for each variable 0.06 - 0.56 (weak), see Table 3. Estimator = Maximum Likelihood, Model Test User (Test statistic = 307.601, Df = 15, P-value (Chi-square) = 0.000), Model Test Baseline Model: Test statistic = 1831.979, Df =28, P 0.000. Comparative Fit Index (CFI) = 0.838, Tucker-Lewis Index (TLI) = 0.697, RMSEA (Root Mean Square of Approximation) = 0.122 (P 0.05), SRMR (Standardized Root Mean Square Residual) = 0.072. In this case, for example, RMSEA score and R square are poor or weak, yet CFI and SRMR are considered adequate (Interpret of indices of CFA / SEM goodness of fit, n.d.). The conative aspect is positively associated with a strong engagement. The path analysis in illustrates the relationship assessment for each variable where the score is

derived from regression coefficient, covariance, and variance. Firstly, the variable of opportunity (S3_7) and social context (S3_17) have a higher variance of>9. All observed variables apparently have a variance of about 0.6. From unstandardized regression output, see Table 3, we reject the null hypothesis indicating the positive association between the variable of strong engagement (S3_14) and variable of conative (S_CN) by 95% confidence level, P <0.05. The conative estimate in the regression equation is 1.99 indicating the mean increase of strong engagement (S3_14) for every additional one unit in the conative aspect (S_CN).However, the cognitive and affective slopes are negative, -0.05 and -1.27 respectively indicating the mean decrease of strong engagement (S3_14) for every additional one unit in a cognitive and affective aspect. Therefore, with 95% confidence level, we do not reject the null hypothesis since there is no statistical significance, p 0.596 and p 0.431 respectively (Krieg, 2014, pp.309-334)

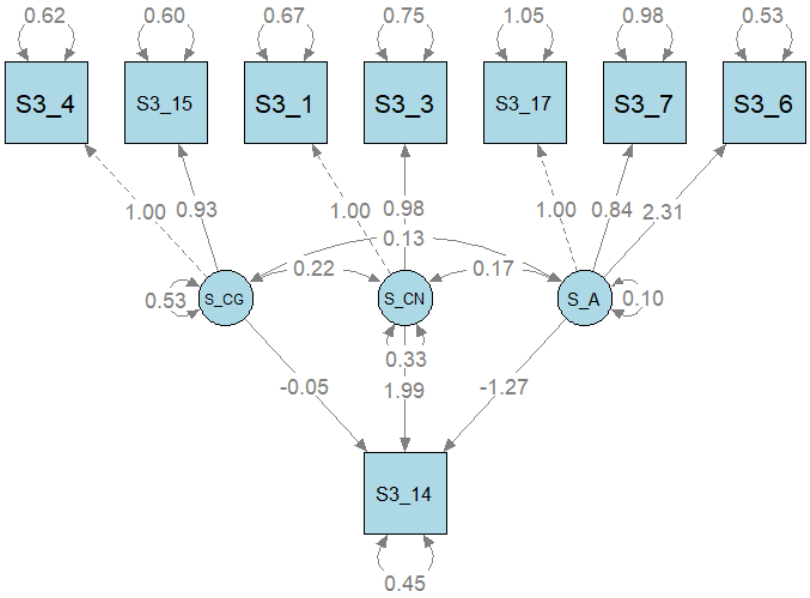

Figure 4. Path analysis of SEM

Own illustration, based on Rückert-John, 2020. S_CG Cognitive, S_CN Conative, S_AF Affective, S3_1 Contribution, S3_3 Eco-friendly product, S3_4 Free market, S3_6 Culture, S3_7 Opportunity, S3_14 Strong engagement, S3_15 Economic growth, S3_17 Social context

To conclude,

- H1: There is a significant positive association between the conative aspect and strong engagement shown by p < 0.05 to support the evidence of a positive regression coefficient
- H2: There is no significant association between the cognitive aspect and strong engagement shown by p > 0.05 to support the evidence of a negative regression coefficient
- H3: There is no significant association between the affective aspect and strong engagement shown by p > 0.05 to support the evidence of a negative regression coefficient

Generally, a variable of conative aspect highly correlates to a variable of strong engagement where the conative aspect is derived from a variable of contribution and eco-friendly product. In this case, a positive engagement in social and the environment contextualized for a circular economy concept might be perceived

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from the willingness to spend more within the financial aspect for buying the eco-friendly product as well as the intention to contribute from ideas and influence.

On the other hand, regardless of statistical evidence, the cognitive aspect, a belief that is obtained from a variable of the free market and economic growth, presumably has the negative aspect to increase the strong engagement in social and the economy. Similarly, it prevails for the affective aspect, the emotion which is derived from a variable of culture, opportunity, and social context. For details of a construct measurement, see Table 1. Simultaneously, assessing the attitude itself might highlight the environmental aspect as the higher contributor to the strong engagement in social and the environment.

4. Critical assessment and discussion

The selection of demographic analysis through gender and age as a parameter was proposed as the factors uncovering preferences, perception, attitude, and decision-making process where the characteristics might be patterned. A construction by modeling the Tri-component of attitude complements the attribute where the attitude revealed the intention so that the policy instrument and business model might reassess and reevaluate. Similarly, by data analysis method, Cross tabulation with Chi-Square and SEM were a plausible method to acquire the intended output of characteristics and attitude or perception assessment. In this paper, SEM is used to construct the variable of attitude where it produced a new empirical variable and assessed the measurement error.

Also, a statistical inference for a model of attitude is proven only in one variable so the other variables might need more assessment. Consequently, additional evaluation presumably is needed such as changing the fit model, method analysis, or checking for the assumption of multicollinearity.

In this work, the researcher discussed only the characteristics of the CE market for a specific case. Indeed, the effectiveness of waste management requires sophisticated technology and policy coherence, yet it leads to strategic industry. The analysis of the market was the implementation of perception assessment which corresponded to evaluating an overview of the current circumstance toward the opportunity and challenge of CE. Yet, as the low demand for the CE market is considered, strategic mitigation and plausible policy instruments are demanded.

In this case, one might concern with standardizing price, quality, and function as the motive and interest in accordance with the willingness to contribute an eco-friendly product supported by an evaluation of policy instruments and corporate responsibility. This work generally did not focus on a specific product or consumer attitude toward a certain case. Rather, a general overview where a selection was based on a daily-life product being used by the households where the implication and expectation are to provide characteristics within the perception as well as associate the importance of consumer behavior to the objective of CE. However, assessing a variety of public opinion generally relies on subjectivity and consumer behavior contributes only to market analysis, even a change of behavior and a bias in setting variables might possibly occur

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5. Conclusion

CE is required to replace the linear economy and to address such environmental concerns. The importance of a bottom-up context and characteristic should not be left behind. Consumer behavior helps to strengthen and pursue the CE goal, particularly in terms of market research. This study discovered that older adults and female respondents are the groups with the greatest interest in environmental and waste issues.
The main substances are quite valuable in determining which way the market is moving. There is a significant amount of support for a willingness to contribute ideas as well as environmentally friendly products. However, with the evidence of limited demand for renting, repair, and 2nd products, mitigation and reevaluation might be suggested. Also, policy tools and companies might be considered for reflection and evaluation. Price, quality, and function are the most important factors to consider while buying a product in this scenario. To sum up, a variety of homework to do is still await. A further study extension related to assessment of companies, business model, and policy instruments might add the values and knowledge for CE objective.

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7. Confidentiality Clause

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