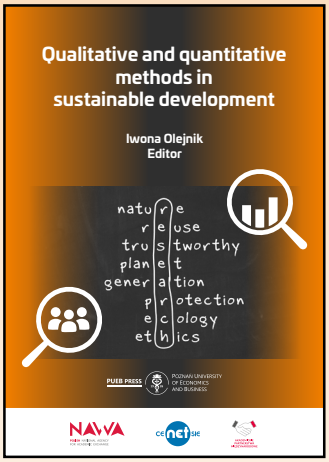


# Qualitative and quantitative methods in sustainable development

**Iwona Olejnik**
**Editor**

NAWA POLISH NATIONAL AGENCY FOR ACADEMIC EXCHANGE

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AKADEMICKIE PARTNERSTWA MIĘDZYNARODOWE

eISBN 978-83-8211-072-2

https://doi.org/10.18559/978-83-8211-072-2

PUEB PRESS

POZNAŃ UNIVERSITY OF ECONOMICS AND BUSINESS

*Qualitative and quantitative methods in sustainable development, pp. 83-116*
*https://doi.org/10.18559/978-83-8211-072-2/03*

3.

# FACTOR ANALYSIS IN SUSTAINABLE DEVELOPMENT RESEARCH

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**Abstract:** Too much data describing a given phenomenon requires synthesizing them. For this purpose, researchers can use various methods of analysis. Factor analysis is one of them.

In this section, first the basic theoretical aspects of factor analysis, as well as the stages of its use are described while presenting the essential minimum necessary to understand the essence of the method.[1] The second part presents an example of the use of this method in research on sustainable consumption. The last part of this chapter presents case study of the use of factor analysis in research on managers' ethics in retail industry.

**Keywords:** factor analysis, sustainable consumption, PRESOR scale.

[1] Readers interested in theoretical details related to this method are referred to the book: Aczel (2009, pp. 768–797).

## 3.1. Theoretical background

In social sciences, many concepts based on data that comprehensively describe a given problem have been created and developed thanks to the use of the factor analysis (FA) method. At the same time, in quantitative research, the number of variables is often so large that it may hinder the interpretation of the results. This especially concerns the situation when attitudes towards a certain phenomenon are studied with the use of many statements that the respondent evaluates according to their own perception. Many of these statements can be closely related to each other, so it may be reasonable to group them together. Factor analysis can be used for this purpose.

Factor analysis is one of multivariate data procedures. Its main purpose is data simplification "by reducing a large set of variables to a smaller set of factors or composite variables by identifying underlying dimensions of the data" (McDaniel & Gates, 2018, p. 454). The resulting unobservable (hidden) variables are called factors (or also constructs, structures and dimensions). They can also be used then in further analyses, e.g., in market segmentation or regression analysis (see case study no. 2 and 3).

In statistical packages, the "factor analysis" procedure, two methods that differ in terms of their assumptions can usually be found. They are factor analysis (FA) and principal-components analysis (PCA). The results obtained with their use are usually remarkably similar (Aczel, 2009).

FA is a relatively simple method used to analyse the structure of the studied phenomenon, i.e., the tested feature obtained, e.g., in quantitative research. It is worth adding that by definition the factor analysis should be conducted on the variables obtained from at least interval scale (this scale is the third level of measurement after the nominal and the ordinal scale). However, this method can also be used in the case of Likert scale popular in social research (preferably a minimum of 5 points). In addition, it needs to be remembered that in the study we should have ten times more observations in comparison with the variables that we want to include in the analysis (i.e., if we analyse 30 statements, the sample on which we conducted the study should not be smaller than 300 respondents) (Costello & Osborne, 2005; Field, 2009).

Thus, in FA it is assumed that each of the correlated variables is affected to a different extent by common factors that explain the observed correlation. Moreover, it is assumed that each of the explicit variables is a linear combination of hidden variables, and a specific factor, separate for each of the variables. The main problem in this method is the selection and determination of directly unobservable factors.

## 3.2. Factor analysis—research steps

The basic stages of factor analysis are presented in Figure 3.1. The first three stages in the application of factor analysis are associated with the process of selecting variables. In databases created on the basis of surveys, lack of data caused by various reasons is often encountered (McDaniel & Gates, 2018, pp. 116–120). Before starting factor analysis, the analyst should therefore examine the available database and prepare one that will be free from data gaps. This is because they could distort the obtained results. There are various ways to replace missing values, e.g.: excluding cases listwise, excluding cases pairwise, and replacing with mean.

The purpose of the second and third steps, i.e., matrix calculation and correlation assessment, is to check whether it makes sense to use factor analysis in the process of data analysis. At least some of the analysed variables should be correlated with each other—if it were not so, each variable would constitute one factor, which of course would undermine the sense of using this method. The assessment of the correlation matrix allows for the removal of variables that are not correlated with others, from further analysis.

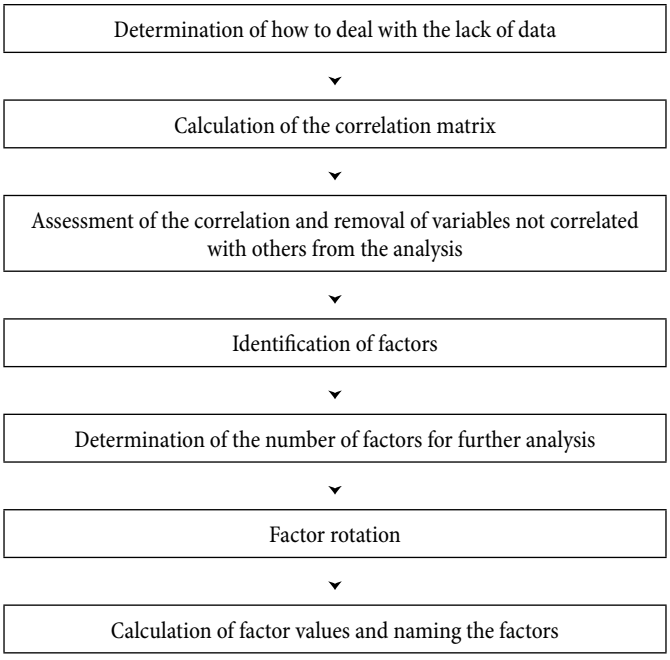


**Figure 3.1. Stages of factor analysis**

Source: Own elaboration.

For reference, Kaiser put the following values on the results:
0.00 to 0.49 unacceptable
0.50 to 0.59 miserable
0.60 to 0.69 mediocre
0.70 to 0.79 middling
0.80 to 0.89 meritorious
0.90 to 1.00 marvellous

Kaiser-Meyer-Olkin test (KMO) enables among others, the selection of variables and the assessment of their usefulness in factor analysis. This test is a measure of how suited our data is for Factor Analysis (*What is the Kaiser-Meyer-Olkin (KMO) Test?* The ideal situation is 0.8 for this test, but lower values are also sometimes accepted.

The second one—Bartlett's test of sphericity, tests the hypothesis that our "correlation matrix is an identity matrix, which would indicate that your variables are unrelated and therefore unsuitable for structure detection. Small values (less than 0.05) of the significance level indicate that a factor analysis may be useful with our data" (*KMO and Bartlett's Test*).

The next important step is to choose a factor extraction method. In this case, the analyst can choose between principal components, maximum likelihood, unweighted squares, generalized least squares, principal axis factoring, alpha factoring, and image factoring. In practice, the first two methods are most often used. It should be added that the "principal components method" is used when we expect that the structure will consist of several unrelated (uncorrelated) factors. It is also applied when we expect the variables to be correlated with each other. On the other hand, the "maximum likelihood" method is used only when we expect that the examined factors will only be correlated with each other. It is not suitable for studying such structures where we do not predict correlation between factors.

In the process of determining the number of factors, various criteria including the Kaiser eigenvalue criterion, the Jolliffe criterion, the Guttman criterion (Jolliffe, 1986), are used.

The next step is the rotation of factors, the aim of which is to obtain such a set that is suitable for their better interpretation in comparison with the primary factors (so that that each variable has a high load in only one factor). In this case, the most frequently used methods include "varimax" rotation, which is used assuming that the dimensions will not be correlated with each other, or "direct oblimin", where it is assumed that the structure will be correlated.

The variance explained analysis enables us to assess whether the separated structure is appropriate. It allows for the determination of differences between the respondents in terms of their attitudes towards the subject of the study, e.g., in terms of sustainable consumer behaviour. All the studied elements (statements)

explain 100% of the information, but obviously in further analyses we want to work on reduced data, and we do not want to consider all dimensions. Therefore, the cumulative percentage of the variance should be analysed. It would be good if this value exceeded 50%.

The interpretation of the obtained results is the final stage of factor analysis. By assessing their factor loadings, it is analysed which of the statements are part of a given dimension. If the load for a given statement (questionnaire item) is the highest, it is assigned to a given dimension. If it is also a part of another dimension, it can be decided that is should be removed or assigned to the dimension in which this load is greater. In the case of negative factor loadings, the meaning of this statement should be analysed inversely.

## 3.3. Sustainable consumption behaviour—an example of application of factor analysis using the IBM SPSS Statistics version 26.0

### 3.3.1. Model assumptions and selection of variables

In order to construct a model of attitudes towards sustainable consumption, the initial step include extracting the elements that build up these attitudes in cognitive, emotional, and behavioural areas. You can try to create these elements yourself, but it is worth using the scales that have already been built and validated.

The following example uses the scale presented in the article written by Quoquab, Mohammad and Sukari (2019). It contains the statements presented in Table 3.1.

**Table 3.1. Scale to measure sustainable consumption behaviour: example**

| |
|---|
| I always try hard to reduce misuse of goods and services (e.g., I switch off light and fan when I am not in the room) |
| I recycle daily newspaper (e.g., use as pet's litter box) |
| I avoid being extravagant in my purchase |
| I avoid overuse / consumption of goods and services (e.g., take print only when needed) |
| I reuse paper to write on the other side |
| While dining in restaurant, I order food(s) only in the amount that I can eat in order to avoid wasting food |
| I choose to buy product(s) with biodegradable container or packaging |
| I do not like to waste food or beverages |
| I recycle my old stuffs in every possible way (e.g., distribute old clothes among needy people) |
| I reuse shopping bag(s) every time I go shopping |
| I plan carefully before I purchase product or service |
| I do care for the natural environment |
| I use eco-friendly products and services |

| |
|---|
| I purchase and use products which are environmentally friendly |
| I often pay extra money to purchase environmentally friendly product (e.g., organic food) |
| I am concerned about the shortage of the natural resources |
| I prefer to use paper bag since it is biodegradable |
| I love our planet |
| I always remember that my excess consumption can create hindrance for the future generation to meet up their basic needs |
| I care for the need fulfilment of the next generation |
| I often think about future generation's quality of life |
| I try to control my desire of excessive purchase for the sake of future generation |
| I am concerned about the future generation |
| I try to minimize the excess consumption for the sake of preserving environmental resources for the future generation |

Source: (Quoquab et al., 2019).

If we want to apply factor analysis with the use of the SPSS package, the "Dimension reduction" and then "Factor" module (Figure 3.2) is applied.

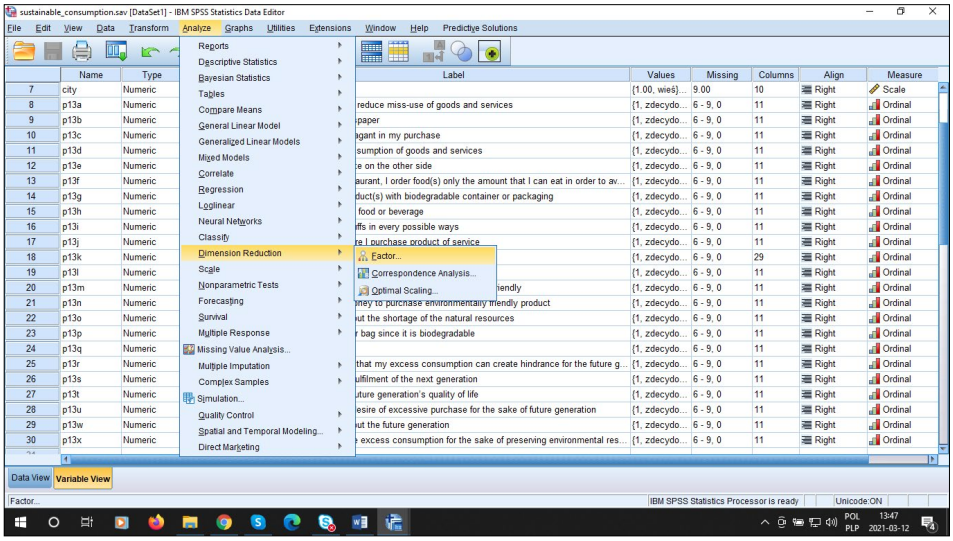


**Figure 3.2. Factor analysis in SPSS program—the first step**

Source: Own elaboration.

All the variables of interest ("Label") are introduced to the analysis, provided that these statements refer to a given phenomenon examining a certain property or feature. Factor analysis will allow for determining whether there are any relationships between these statements, i.e., if a structure can be created within them (Figure 3.3).

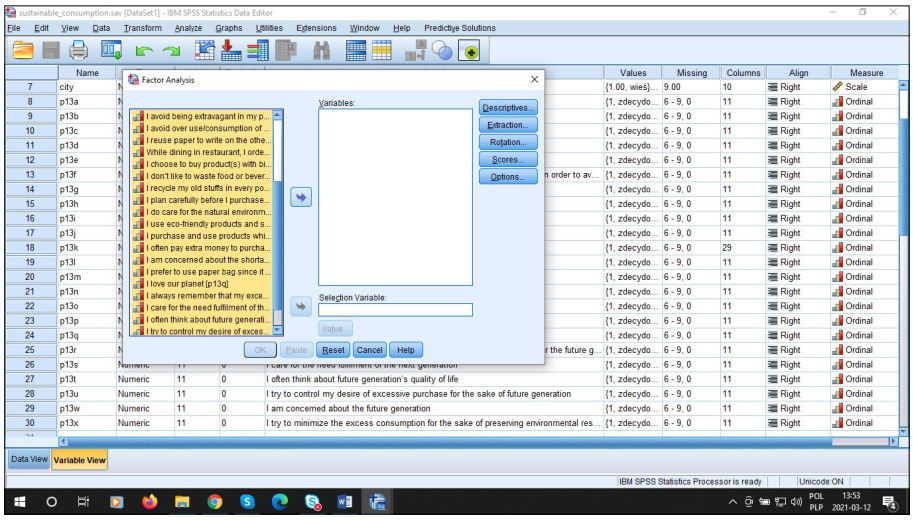

**Figure 3.3. Selection of variables for analysis**

Source: Own elaboration.

Then "KMO and Bartlett's test of sphericity" and "Anti-image" are selected in "descriptives" (Figure 3.4). It should be reminded that the KMO statistics allow for assessing to what extent the data collected in the research can be used for their FA. In general, it would be best if this test were as large as possible. As previously mentioned, the ideal situation for this test is 0.8, but slightly lower values may also be accepted.

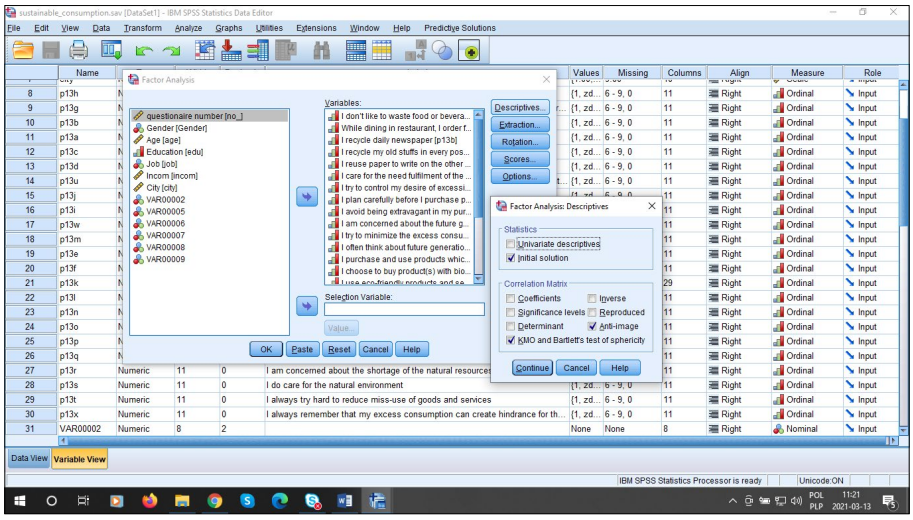

**Figure 3.4. Descriptives**

Source: Own elaboration.

In turn, by selecting "Anti-image" information on the mutual correlation of the output variables will be obtained. "Anti-image matrices" is a huge table with "Anti-image correlation" found in the second half. If any variable found on its diagonal (marked with letters "a") has a value lower than 0.5, then it should be eliminated from further analysis.

Then we move to the next option, i.e., "Extraction" (Figure 3.5). In our example, the "Principal components" method is selected because we are not sure whether the expected structure will consist of correlated or uncorrelated factors. In addition, we also select the "Scree plot" option, which is used to define how many factors should be distinguished. "Based on Eigenvalue" method is another method that will also allow for determining this. By default, the eigenvalue is 1.

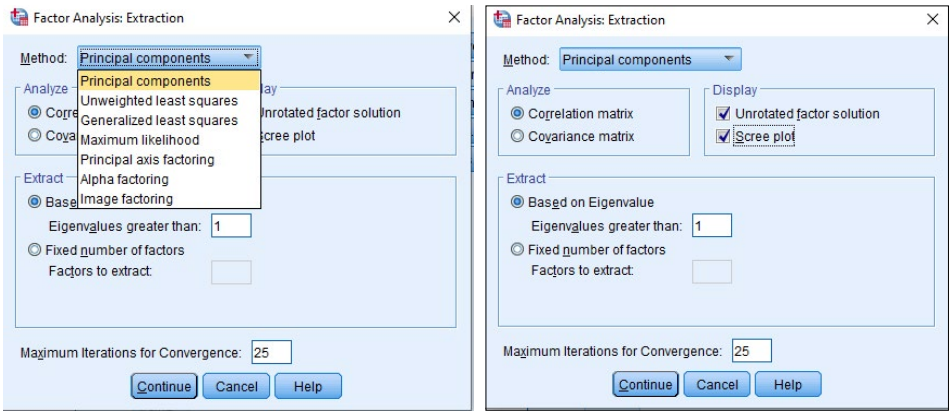


**Figure 3.5. Extraction in FA**

Source: Own elaboration.

The next step is the selection of "Rotation" (Figure 3.6), i.e., checking whether it is there, and if so, arranging (with the use of certain mathematical algorithms) its factor structure. Since we expect the dimensions not to be correlated with each other, we choose "Varimax" (otherwise we would choose "Direct Oblimin").

The last element, "Options" (Figure 3.7), is used to correctly display the factor loadings, i.e., a certain statistic (correlation) between a given structure element (statement) and a given dimension, i.e., a hypothetical structure that can be observed in the data. To obtain some order, the factor loadings must be sorted by size first. Secondly, it is also worth suppressing the so-called small coefficients to separate items that do not form a factor structure. This is because we want to have such a factor structure whose individual elements are closely related to each other. This means that, e.g., if in the research we work on a method that is well located and recognized in theory, like another version of the sustainable behaviour model, then we assume that the "absolute value below" is 0.3 (i.e., the amount of

correlation between the given statement and factor structure); whereas if we test a new tool based on a new theory then we should be more conservative and this value should be 0.4.

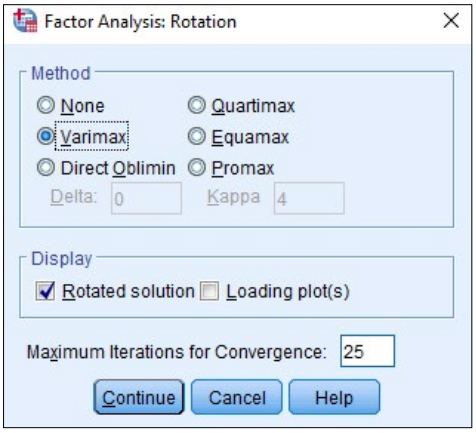


**Figure 3.6. Rotation in FA**

Source: Own elaboration.

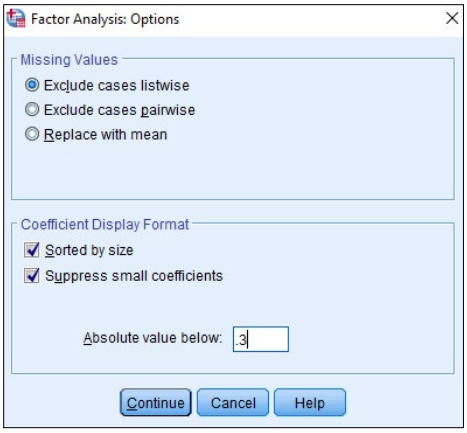


**Figure 3.7. Options in FA**

Source: Own elaboration.

## 3.3.2. Model estimation and analysis

After accepting the above assumptions, the tables presented below are obtained (Tables 3.2–3.5). The first one contains the KMO test statistics, which in our example is 0.866. This is a good result, that indicates a great potential of our data. Therefore, they will probably be a good source for distinguishing the factor structure. The Bartlett's test also shows that factor analysis can be a useful method in our research.

**Table 3.2. Kaiser-Meyer-Olkin and Bartlett's Test**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.866 |
|---|---|---|
| Bartlett's Test of Sphericity | approx. chi-square | 4795.288 |
| | df | 253 |
| | Sig. | 0.000 |

Source: Own elaboration.

The analysis of the "Anti-image correlation" table (the table is too large to be presented here) allowed for including all the statements in further analyses (all correlation coefficients exceeded the value of 0.5).

Table 3.3 presents the resource of common volatility. The "Extraction" column is of primary interest for us. It includes coefficients of correlation between the

result related to a given statement and the factor structure. The values in this column should therefore be as large as possible. "I love our planet" statement has the highest value.

**Table 3.3. Results of extraction**

| Communalities | Initial | Extraction |
|---|---|---|
| I recycle my old stuffs in every possible way | 1.000 | 0.694 |
| I recycle daily newspaper | 1.000 | 0.686 |
| I reuse paper to write on the other side | 1.000 | 0.448 |
| I care for the need fulfilment of the next generation | 1.000 | 0.587 |
| I often think about future generation's quality of life | 1.000 | 0.444 |
| I purchase and use products which are environmentally friendly | 1.000 | 0.457 |
| While dining in restaurant, I order food(s) only in the amount that I can eat in order to avoid wasting food | 1.000 | 0.683 |
| I do not like to waste food or beverage | 1.000 | 0.575 |
| I avoid being extravagant in my purchase | 1.000 | 0.609 |
| I plan carefully before I purchase product or service | 1.000 | 0.667 |
| I choose to buy product(s) with biodegradable container or packaging | 1.000 | 0.582 |
| I use eco-friendly products and services | 1.000 | 0.674 |
| I try to minimize the excess consumption for the sake of preserving environmental resources for the future generation | 1.000 | 0.497 |
| I often pay extra money to purchase environmentally friendly product | 1.000 | 0.594 |
| I avoid overuse / consumption of goods and services | 1.000 | 0.550 |
| I prefer to use paper bag since it is biodegradable | 1.000 | 0.514 |
| I love our planet | 1.000 | 0.724 |
| I am concerned about the shortage of the natural resources | 1.000 | 0.595 |
| I do care for the natural environment | 1.000 | 0.504 |
| I always try hard to reduce miss-use of goods and services | 1.000 | 0.665 |
| I try to control my desire of excessive purchase for the sake of future generation | 1.000 | 0.564 |
| I am concerned about the future generation | 1.000 | 0.319 |
| I always remember that my excess consumption can create hindrance for the future generation to meet up their basic needs | 1.000 | 0.587 |

Source: Own elaboration.

Table 3.4 is the first table directly related to the purpose of factor analysis, i.e., identification of the hidden structure. On the left side of the table there are 23 components, i.e., the number of initial statements considered in this example. Such a situation is not very favourable, because it is difficult to describe the phenomenon using so many dimensions, and therefore we want to reduce this value. So

how many of these factors should there be? This is determined by the eigenvalue criterion (previously, the standard value was 1—see Figure 3.5). In the discussed example, 6 components exceed the eigenvalue of 1.

**Table 3.4. Total variance explained**

| 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 | 5.741 | 24.960 | 24.960 | 5.741 | 24.960 | 24.960 | 2.859 | 12.429 | 12.429 |
| 2 | 2.180 | 9.477 | 34.437 | 2.180 | 9.477 | 34.437 | 2.515 | 10.935 | 23.364 |
| 3 | 1.649 | 7.170 | 41.607 | 1.649 | 7.170 | 41.607 | 2.449 | 10.650 | 34.014 |
| 4 | 1.480 | 6.434 | 48.041 | 1.480 | 6.434 | 48.041 | 1.965 | 8.546 | 42.559 |
| 5 | 1.135 | 4.936 | 52.978 | 1.135 | 4.936 | 52.978 | 1.893 | 8.231 | 50.791 |
| 6 | 1.033 | 4.491 | 57.469 | 1.033 | 4.491 | 57.469 | 1.536 | 6.678 | 57.469 |
| 7 | 0.970 | 4.219 | 61.688 | | | | | | |
| 8 | 0.884 | 3.842 | 65.530 | | | | | | |
| 9 | 0.732 | 3.182 | 68.712 | | | | | | |
| 10 | 0.722 | 3.138 | 71.850 | | | | | | |
| 11 | 0.687 | 2.985 | 74.836 | | | | | | |
| 12 | 0.637 | 2.769 | 77.605 | | | | | | |
| 13 | 0.603 | 2.620 | 80.225 | | | | | | |
| 14 | 0.569 | 2.476 | 82.701 | | | | | | |
| 15 | 0.533 | 2.317 | 85.018 | | | | | | |
| 16 | 0.522 | 2.268 | 87.285 | | | | | | |
| 17 | 0.482 | 2.096 | 89.382 | | | | | | |
| 18 | 0.475 | 2.065 | 91.447 | | | | | | |
| 19 | 0.450 | 1.959 | 93.405 | | | | | | |
| 20 | 0.415 | 1.804 | 95.209 | | | | | | |
| 21 | 0.410 | 1.784 | 96.993 | | | | | | |
| 22 | 0.376 | 1.637 | 98.630 | | | | | | |
| 23 | 0.315 | 1.370 | 100.000 | | | | | | |

Source: Own elaboration.

The scree plot, which is a graphical representation of the data contained in the table above is an alternative to eigenvalue in determining the number of factors. In the discussed example, the scree plot is presented in Figure 3.8. A clear flattening of the line occurs with the 5–6 components, so there should be just 5 or 6 factors. How many of these factors should there finally be? It depends on the

researcher's substantive interpretation and the decision which of these choices will be the better solution. In our example, the adoption of 6-factor model was initially decided, because 6 exceeds the eigenvalue of 1. Moreover, when analysing the cumulative percentage (percentage of the variance explained by individual factors, see Table 3.4), 57.5% of the explained variance we will obtained when distinguishing 6 factors. This means that with the help of 6 separate dimensions, we can explain about 58% of the differences between consumers in terms of their sustainable behaviour (with a 23-element factor structure, we would explain 100% of the information).

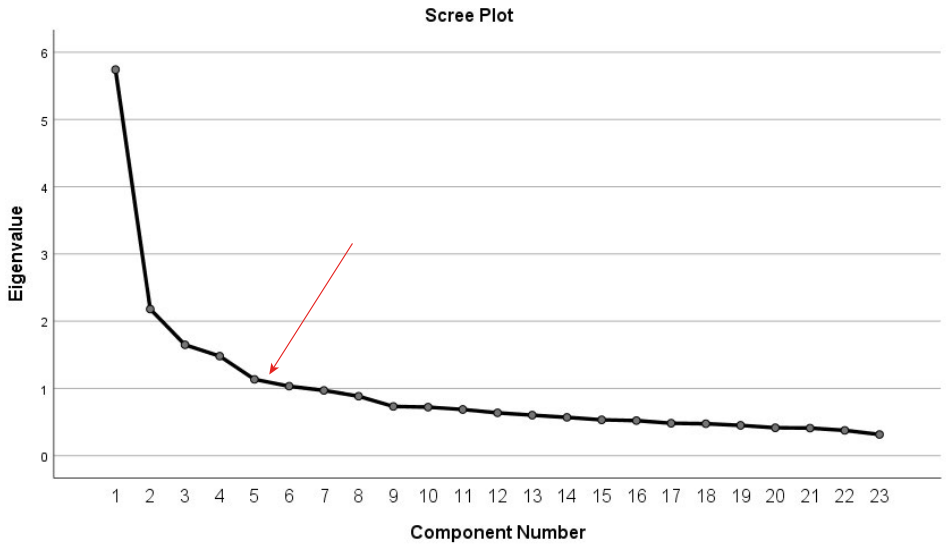


**Figure 3.8. Scree plot**

Source: Own elaboration.

The detailed factor structure is presented in the rotated component matrix (Table 5), containing the factor loadings that make each of the 6 distinguished factors. In some places it is empty, because we previously specified that the program should not show us loads below 0.3 (Figure 3.7).

How to assign a given statement to individual components? For example, it can be seen that there are 6 statements in the first dimension, including 3 which are also elements of other components. If the factor load in a given dimension (for a given questionnaire item) is the highest, then this item is included in that dimension. For example, the statement "I avoid overuse / consumption of goods and services" has the highest factor load in the first dimension (0.599) and will be included in it, but it also belongs to the second dimension (0.376). As previously

mentioned, in this case, the researcher may decide to delete the statements that form more than one factor.

**Table 3.5. Rotated Component Matrix**

| | Component (factor) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| I use eco-friendly products and services | 0.790 | | | | | |
| I often pay extra money to purchase environmentally friendly product | 0.734 | | | | | |
| I choose to buy product(s) with biodegradable container or packaging | 0.663 | | | | | |
| I avoid overuse / consumption of goods and services | 0.599 | 0.376 | | | | |
| I prefer to use paper bag since it is biodegradable | 0.515 | | 0.417 | | | |
| I purchase and use products which are environmentally friendly | 0.400 | | 0.377 | | 0.356 | |
| I always try hard to reduce misuse of goods and services | | 0.803 | | | | |
| I love our planet | | 0.796 | | | | |
| I am concerned about the shortage of the natural resources | | 0.705 | | | | |
| I do care for the natural environment | | 0.632 | | | | |
| I always remember that my excess consumption can create hindrance for the future generation to meet up their basic needs | | | 0.724 | | | |
| I often think about future generation's quality of life | | | 0.621 | | | |
| I care for the need fulfilment of the next generation | | | 0.601 | | | 0.347 |
| I try to minimize the excess consumption for the sake of preserving environmental resources for the future generation | 0.373 | | 0.519 | | | |
| I am concerned about the future generation | | | 0.493 | | | |
| I plan carefully before I purchase product or service | | | | 0.787 | | |
| I try to control my desire of excessive purchase for the sake of future generation | | | | 0.734 | | |
| I avoid being extravagant in my purchase | | | | 0.705 | | |
| I recycle daily newspaper | | | | | 0.802 | |
| I recycle my old stuffs in every possible way | | | | | 0.778 | |
| I reuse paper to write on the other side | | | | | 0.611 | |
| While dining in restaurant, I order food(s) only in the amount that I can eat in order to avoid wasting food | | | | | | 0.803 |
| I do not like to waste food or beverages | | | | | | 0.664 |

Source: Own elaboration.

After analysing the elements that form individual factors, it is worth naming each of these factors in the next stage. For example, the first factor could be called "friendly environment", the third "care for the future generation", and the last "not wasting food".

## 3.4. Testing managers' ethics in retail industry: case study no. 1

Implementation of sustainable business polices and application of corporate social responsibility in various industries relies on the level of business ethics of managers. There are numerous scales in contemporary business literature created for assessing managers' business ethics and their general perceptions towards business ethics. Examples of such scales are PRESOR, EPQ and ATBEQ.

PRESOR scale (abbreviation for: The Perceived Role or Ethics and Social Responsibility) is created to measure how an individual perceives the role of ethics and social responsibility in achieving organizational effectiveness. The scale consists of 13 statements and it was designed by Singhapakdi, Vitell, Rallapalli and Kraft (1996).

EPQ (abbreviation for: The Ethics Position Questionnaire) is an instrument designed by Forsyth (1980) to assess individual differences in relativism and idealism. It consists of 20 items divided into 2 scales: 20 items, two scales: (1) idealism and (2) relativism.

ATBEQ (abbreviation for: The Attitudes towards Business Ethics Questionnaire) was created by Preble and Reichel (1988) to measure attitudes on option selection regarding exact business ethics situations. It comprises 30 statements on business ethics.

The above-mentioned scales are applied over time in various industries in original form or with slight modifications. They are proven by numerous authors as reliable tools in the field of corporate social responsibility and business ethics (see Davis, Andersen, & Curtis, 2001; Promislo, Giacalone, & Welch, 2012; Kurnoga, Knežević, & Šimurina, 2017).

In advance, we will show how factor analysis can be used to analyse data collected by applying PRESOR scale on a sample of managers in retail industry.

In the questionnaire distributed to 1000 managers in retail industry in Croatia, there was a question based on a PRESOR original 13-items scale (Singhapakdi et al., 1996). The question was formulated as a Likert scale evaluation table (see Table 3.6).

**Table 3.6. Survey question in form of the PRESOR scale**

| Statement code | Statement | Indicate level of agreement* | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Q1 | being ethical and socially responsible is the most important thing a firm can do | | | | | |
| Q2 | bending and breaking the rules is acceptable if a firm is making a profit | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q3 | the ethics and social responsibility of a firm is essential to its long-term profitability | | | | | |
| Q4 | overall effectiveness of a business can be determined, to a great extent, by the degree to which it is ethical and socially responsible | | | | | |
| Q5 | to remain competitive in a global environment, business firm will have to disregard ethics and social responsibility | | | | | |
| Q6 | social responsibility and profitability can be compatible | | | | | |
| Q7 | business ethics and social responsibility are critical to the survival of a business enterprise | | | | | |
| Q8 | a firm's first priority should be employee morale | | | | | |
| Q9 | business has a social responsibility beyond making profit | | | | | |
| Q10 | if a survival of a business enterprise is at stake, then you must forget about ethics and social responsibility | | | | | |
| Q11 | efficiency is much more important to a firm than whether or not the firm is seen as ethical or socially responsible | | | | | |
| Q12 | good ethics is often good business | | | | | |
| Q13 | if the stockholders are unhappy, nothing else matters | | | | | |

* Note: 1—fully disagree; 2—disagree; 3—neutral; 4—agree; 5—fully agree.

Source: Own elaboration.

Out of 1000 companies, 220 managers responded to our survey, but there were 215 correctly filled questionnaires. Response rate based on valid questionnaires was 21.5%. For factor analysis some authors suggest that a minimum size should be the number of items in questionnaire times ten (Costello & Osborne, 2005; Field 2009). In case of PRESOR we have 13 items (statements), which means that we should have at least 130 valid responses. In our case 215 > 130, therefore, we can perform factor analysis.

Dataset was entered to SPSS and all steps as explained earlier were performed in order to isolate relevant factors for retail industry managers out of a generally proposed scale. In Table 3.7 data for Kaiser-Meyer-Olkin Measure and Bartlett's Test are shown. In Table 3.8 communalities for all statements are shown. Then variance analysis and rotation matrix are given for two factors (Tables 3.9 and 3.10) and three factors potential solution (Tables 3.11 and 3.12). At the end, there are questions for discussion and analysis.

**Table 3.7. KMO and Bartlett's Test**

| **Kaiser-Meyer-Olkin Measure of Sampling Adequacy** | | 0.926 |
|---|---|---|
| Bartlett's Test of Sphericity | approx. chi-square | 1876.534 |
| | df | 78 |
| | Sig. | 0.000 |

Source: Own elaboration.

**Table 3.8. Communalities**

| | Initial | Extraction |
|---|---|---|
| Q1 | 1.000 | 0.753 |
| Q2 | 1.000 | 0.801 |
| Q3 | 1.000 | 0.695 |
| Q4 | 1.000 | 0.356 |
| Q5 | 1.000 | 0.778 |
| Q6 | 1.000 | 0.322 |
| Q7 | 1.000 | 0.569 |
| Q8 | 1.000 | 0.573 |
| Q9 | 1.000 | 0.773 |
| Q10 | 1.000 | 0.770 |
| Q11 | 1.000 | 0.554 |
| Q12 | 1.000 | 0.766 |
| Q13 | 1.000 | 0.806 |

Source: Own elaboration.

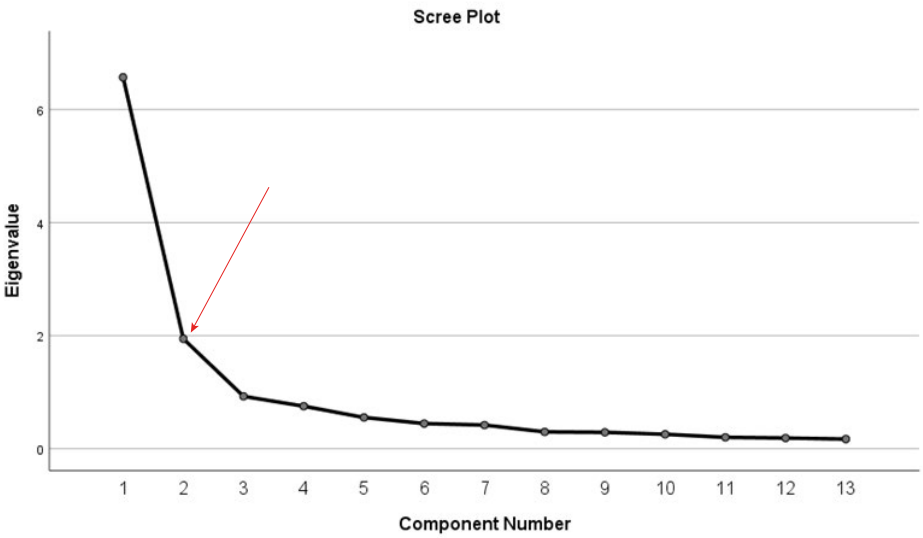


**Figure 3.9. Scree plot—PRESOR scale**

Source: Own elaboration.

**Table 3.9. Total variance explained—solution with two 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 | 6.570 | 50.541 | 50.541 | 6.570 | 50.541 | 50.541 | 6.532 | 50.243 | 50.243 |
| 2 | 1.945 | 14.961 | 65.503 | 1.945 | 14.961 | 65.503 | 1.984 | 15.259 | 65.503 |
| 3 | 0.925 | 7.118 | 72.620 | | | | | | |
| 4 | 0.751 | 5.777 | 78.398 | | | | | | |
| 5 | 0.551 | 4.241 | 82.638 | | | | | | |
| 6 | 0.444 | 3.414 | 86.053 | | | | | | |
| 7 | 0.417 | 3.209 | 89.261 | | | | | | |
| 8 | 0.297 | 2.282 | 91.543 | | | | | | |
| 9 | 0.289 | 2.221 | 93.764 | | | | | | |
| 10 | 0.254 | 1.952 | 95.715 | | | | | | |
| 11 | 0.200 | 1.541 | 97.256 | | | | | | |
| 12 | 0.187 | 1.439 | 98.696 | | | | | | |
| 13 | 0.170 | 1.304 | 100.000 | | | | | | |

Source: Own elaboration.

**Table 3.10. Rotated Component Matrix[a] for two factors solution**

| | Component | |
|---|---|---|
| | 1 | 2 |
| Q13 | 0.898 | |
| Q2 | –0.886 | |
| Q5 | –0.877 | |
| Q10 | –0.876 | |
| Q12 | 0.875 | |
| Q9 | 0.874 | |
| Q1 | 0.863 | |
| Q8 | 0.756 | |
| Q11 | –0.741 | |
| Q3 | | 0.830 |
| Q7 | | 0.746 |
| Q4 | | 0.572 |
| Q6 | | 0.566 |

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization
a. 2 components extracted

Source: Own elaboration.

**Table 3.11. Total variance explained—solution with three 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 | 6.570 | 50.541 | 50.541 | 6.570 | 50.541 | 50.541 | 6.524 | 50.186 | 50.186 |
| 2 | 1.945 | 14.961 | 65.503 | 1.945 | 14.961 | 65.503 | 1.805 | 13.885 | 64.071 |
| 3 | 0.925 | 7.118 | 72.620 | 0.925 | 7.118 | 72.620 | 1.111 | 8.550 | 72.620 |
| 4 | 0.751 | 5.777 | 78.398 | | | | | | |
| 5 | 0.551 | 4.241 | 82.638 | | | | | | |
| 6 | 0.444 | 3.414 | 86.053 | | | | | | |
| 7 | 0.417 | 3.209 | 89.261 | | | | | | |
| 8 | 0.297 | 2.282 | 91.543 | | | | | | |
| 9 | 0.289 | 2.221 | 93.764 | | | | | | |
| 10 | 0.254 | 1.952 | 95.715 | | | | | | |
| 11 | 0.200 | 1.541 | 97.256 | | | | | | |
| 12 | 0.187 | 1.439 | 98.696 | | | | | | |
| 13 | 0.170 | 1.304 | 100.000 | | | | | | |

Source: Own elaboration.

**Table 3.12. Rotated Component Matrix[a] for three factors solution**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Q13 | 0.898 | | |
| Q2 | –0.886 | | |
| Q5 | –0.877 | | |
| Q10 | –0.876 | | |
| Q12 | 0.875 | | |
| Q9 | 0.874 | | |
| Q1 | 0.863 | | |
| Q8 | 0.756 | | |
| Q11 | –0.741 | | |
| Q3 | | 0.830 | |
| Q7 | | 0.746 | |
| Q4 | | 0.572 | 0.460 |
| Q6 | | 0.566 | –0.764 |

Extraction Method: Principal Component Analysis
a. 3 components extracted

Source: Own elaboration.

## 3.5. Local government representatives about retailers—from the CSR perspective: case study no. 2

Retail stores have a significant impact on the lives of consumers—they provide products and services, educate consumers, generally they satisfy a wide range of consumer needs. They also are—citizens of local communities, who pay taxes, invest, participate or organize events, support local communities. It seems reasonable to present how local governments representatives perceive retail chains in the context of CSR and their role as members of local communities. According to corporate social responsibility concept, these entities should take responsibility for the effects of their activities—both positive and negative. However, the question occurs: whether their presence and activities are noticed and appreciated by local governments?

The purpose of the analysis was to establish the factors and their importance for the perception of retailers' social involvement.

A survey was conducted among the representatives of local governments with the use of an internet questionnaire. The choice of the research method was dictated by several reasons. First, the pilot study showed that respondents are reluctant to answer over the phone and ask for a list of questions. The territorial scope of the study eliminated the direct interview method—due to the high costs of reaching interlocutors. The research covered the entire population. As a result, the contact database was used and an electronic invitation to participate in the survey was sent to all local governments. A questionnaire was developed with a link provided in the cover letter. In total, 2,800 invitations to participate in the study were sent by e-mail. 431 questionnaires were collected, which gives a return of 15%. Out of them, 104 respondents did not complete the certificate. The Likert scale was used, where 1: fully disagree; 2: disagree; 3: neutral; 4: agree; 5: fully agree. The research tool was constructed based on the areas of retailers' CSR initiatives indicated in the literature. 18 items included into analysis. You will find more information about the research in Stefańska (2014b).

**Table 3.13. Reliability statistics**

| Cronbach's alpha | Number of items |
|---|---|
| 0.924 | 18 |

Source: Own elaboration.

**Table 3.14. KMO and Bartlett's Test**

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.933 |
| Bartlett's Test of Sphericity | approx. chi-square | 4282.622 |
| | df | 153 |
| | Sig. | 0.000 |

Source: Own elaboration.

**Table 3.15. Communalities**

| | Initial | Extraction |
|---|---|---|
| Retailers act with integrity and in accordance with the principles of fair play | 1.000 | 0.580 |
| Retailers organize charity events for residents in need | 1.000 | 0.606 |
| Retailers sponsor people, organizations and entities by providing financial or material resources | 1.000 | 0.610 |
| Retailers identify problems in the local community and help solve them | 1.000 | 0.740 |
| Retailers educate residents about ecology (e.g., waste sorting) | 1.000 | 0.665 |
| Retailers teach consumers how to eat healthily | 1.000 | 0.683 |
| Retailers use their example to teach what it means to counteract discrimination | 1.000 | 0.704 |
| Retailers find talented people among residents and support their development | 1.000 | 0.704 |
| Retailers organize training for unemployed residents | 1.000 | 0.650 |
| Retailers treat residents as partners | 1.000 | 0.538 |
| Retailers are an important investor for us (they develop the area, build roads, pavements, parking lots, etc.). | 1.000 | 0.635 |
| Retailers are actively involved in environmental protection (e.g., they encourage residents to use eco-bags, set up bins for various types of rubbish, organize tree planting campaigns, etc.) | 1.000 | 0.696 |
| Retailers make a significant contribution to the city's budget | 1.000 | 0.615 |
| Retailers engage residents in joint actions to help those in need (charity campaigns) | 1.000 | 0.682 |
| Retailers organize events, the so-called events integrating residents to achieve goals important for the local community (e.g., competitions, shows) | 1.000 | 0.737 |
| Retailers equip shops with facilities for residents with disabilities to an extent greater than is required by law | 1.000 | 0.562 |
| Retailers operating in our town employ people discriminated against, e.g., because of age, gender, disability | 1.000 | 0.574 |
| Retailers focus solely on selling goods and services | 1.000 | 0.530 |

Source: Own elaboration.

**Table 3.16. Total variance explained**

| 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 | 9.015 | 50.085 | 50.085 | 9.015 | 50.085 | 50.085 | 4.331 | 24.064 | 24.064 |
| 2 | 1.276 | 7.091 | 57.177 | 1.276 | 7.091 | 57.177 | 4.060 | 22.557 | 46.620 |
| 3 | 1.220 | 6.776 | 63.953 | 1.220 | 6.776 | 63.953 | 3.120 | 17.333 | 63.953 |
| 4 | 0.915 | 5.083 | 69.036 | | | | | | |

| 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 % |
| 5 | 0.761 | 4.228 | 73.264 | | | | | | |
| 6 | 0.623 | 3.460 | 76.725 | | | | | | |
| 7 | 0.558 | 3.100 | 79.825 | | | | | | |
| 8 | 0.524 | 2.910 | 82.735 | | | | | | |
| 9 | 0.510 | 2.836 | 85.571 | | | | | | |
| 10 | 0.482 | 2.676 | 88.247 | | | | | | |
| 11 | 0.366 | 2.031 | 90.278 | | | | | | |
| 12 | 0.338 | 1.880 | 92.158 | | | | | | |
| 13 | 0.317 | 1.758 | 93.917 | | | | | | |
| 14 | 0.248 | 1.380 | 95.297 | | | | | | |
| 15 | 0.243 | 1.347 | 96.645 | | | | | | |
| 16 | 0.217 | 1.208 | 97.852 | | | | | | |
| 17 | 0.210 | 1.165 | 99.017 | | | | | | |
| 18 | 0.177 | .983 | 100.000 | | | | | | |

Source: Own elaboration.

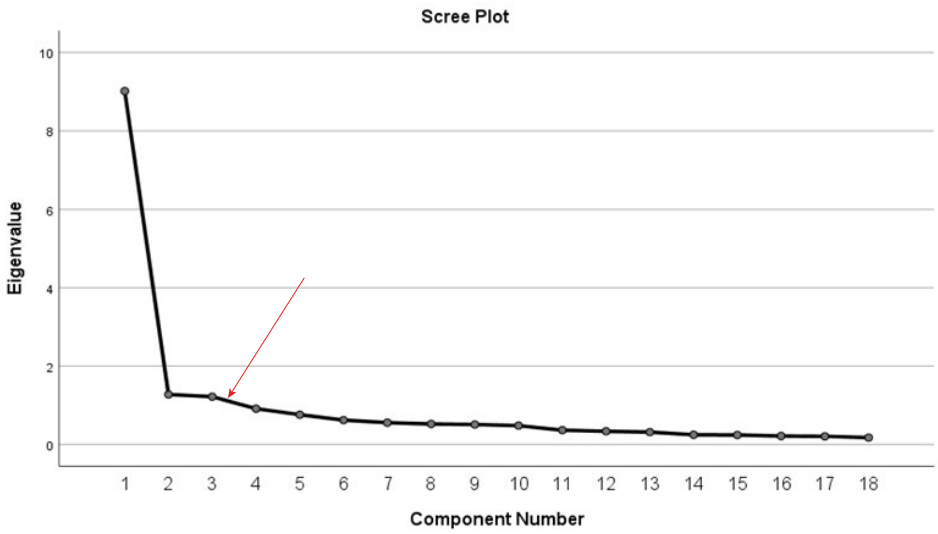


**Figure 3.10. Scree plot**

Source: Own elaboration.

**Table 3.17. Rotated Component Matrix[a]**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Retailers identify problems in the local community and help solve them | 0.765 | | |
| Retailers sponsor people, organizations and entities by providing financial or material resources | 0.735 | | |
| Retailers act with integrity and in accordance with the principles of fair play | 0.734 | | |
| Retailers organize charity events for residents in need | 0.643 | | |
| Retailers treat residents as partners | 0.609 | | |
| Retailers use their example to teach what it means to counteract discrimination | 0.589 | | 0.545 |
| Retailers educate residents about ecology (e.g., waste sorting) | 0.568 | | 0.538 |
| Retailers teach consumers how to eat healthily | 0.551 | | 0.562 |
| Retailers are an important investor for us (they develop the area, build roads, pavements, parking lots, etc.) | | 0.737 | |
| Retailers make a significant contribution to the city's budget | | 0.734 | |
| Retailers are actively involved in environmental protection (e.g., they encourage residents to use eco-bags, set up bins for various types of rubbish, organize tree planting campaigns, etc.) | | 0.715 | |
| Retailers organize events, the so-called events integrating residents to achieve goals important for the local community (e.g., competitions, shows) | | 0.683 | |
| Retailers equip shops with facilities for residents with disabilities to an extent greater than is required by law | | 0.638 | |
| Retailers engage residents in joint actions to help those in need (charity campaigns) | | 0.636 | |
| Retailers operating in our town employ people discriminated against, e.g., because of age, gender, disability | | 0.605 | |
| Retailers organize training for unemployed residents | | | 0.673 |
| Retailers focus solely on selling goods and services | | | –0.713 |
| Retailers find talented people among residents and support their development | 0.508 | | 0.601 |

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 6 iterations

Source: Own elaboration.

The extracted factors were used in *k*-means cluster analysis to identify segments of local governments—according to their opinion about retailer operating in their region. Two segments were identified.

**Table 3.18. Final cluster centres**

| | Cluster | |
|---|---|---|
| | 1 | 2 |
| Component 1 | 0.74097 | –0.52443 |
| Component 2 | –0.44762 | 0.31681 |
| Component 3 | –0.24051 | 0.17022 |

Source: Own elaboration.

**Table 3.19. Number of cases in each cluster**

| | | |
|---|---|---|
| Cluster | 1 | 155.000 |
| | 2 | 219.000 |
| Valid | | 374.000 |
| Missing | | 57.000 |

Source: Own elaboration.

## 3.6. Testing attitude of Socially Responsible Employee: case study no. 3

The aim of the research was to identify the attitude of employees toward environment—both in place of living and in working place, and then to identify whether that fact influences the services at work. The research was conducted among store employees. The survey was quantitative and limited only to the workers directly involved in customer service. The selection of the sample was purposive. The respondents for the survey were selected among shop-assistants from shops selling FMCG, clothes and cosmetics. 272 people participated in the survey in a selected group of Polish cities. The analytical tool for the quantitative survey was based on the author's own detailed collective interviews with employees of shops. Likert scale was applied (from 1 to 5, where 1—means strongly disagree and 5—strongly agree). You will find more results from the research in Stefańska (2014a) and Stefańska (2018).

**Table 3.20. Scale to measure attitude of employees toward environment: example**

| No | Items |
|---|---|
| a12_1 | I take part in charity events organized outside my job |
| a12_2 | I try to segregate rubbish at home (plastic, waste paper, glass, etc.) |
| a12_3 | I try to save water and electricity at home |
| a12_4 | I buy organic products to satisfy my own or my family's needs |
| a12_5 | I help others for myself, not to please my employer |
| a12_6 | I do not hesitate to submit suggestions for improving work so that customers are more satisfied |
| a12_7 | I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money, etc.) |
| a12_8 | I participate in CSR activities more out of fear of getting a job than out of my own free will |
| a12_9 | I make other employees aware if they do something to the disadvantage of clients |
| a12_10 | I would be more involved in helping those in need if it mattered to my boss |
| a12_11 | I admonish someone who forgot to turn off the light or turn off the tap in the store |
| a12_12 | In the case of a product that is put away anywhere, I take it to the right place by the customer |

Source: Own elaboration.

## Results of research

**Table 3.21. Reliability statistics**

| Cronbach's alpha | *N* of items |
|---|---|
| 0.797 | 12 |

Source: Own elaboration.

**Table 3.22. KMO and Bartlett's Test**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.776 |
|---|---|---|
| Bartlett's Test of Sphericity | approx. chi-square | 845.886 |
| | df | 66 |
| | Sig. | 0.000 |

Source: Own elaboration.

**Table 3.23. Communalities**

| | Initial | Extraction |
|---|---|---|
| I take part in charity events organized outside of my job | 1.000 | 0.360 |
| I try to segregate rubbish at home (plastic, waste paper, glass, etc.) | 1.000 | 0.704 |
| I try to save water and electricity at home | 1.000 | 0.708 |
| I buy organic products to satisfy my own or my family's needs | 1.000 | 0.541 |
| I help others for myself, not to please my employer | 1.000 | 0.474 |
| I do not hesitate to submit suggestions for improving work so that customers are more satisfied | 1.000 | 0.513 |
| I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money) | 1.000 | 0.600 |
| I participate in CSR activities more out of fear of getting a job than out of my own free will | 1.000 | 0.655 |
| I make other employees aware if they do something to the disadvantage of clients | 1.000 | 0.609 |
| I would be more involved in helping those in need if it mattered to my boss | 1.000 | 0.536 |
| I admonish someone who forgot to turn off the light or turn off the tap in the store | 1.000 | 0.634 |
| In the case of a product that is put away anywhere, I take it to the right place by the customer | 1.000 | 0.468 |

Source: Own elaboration.

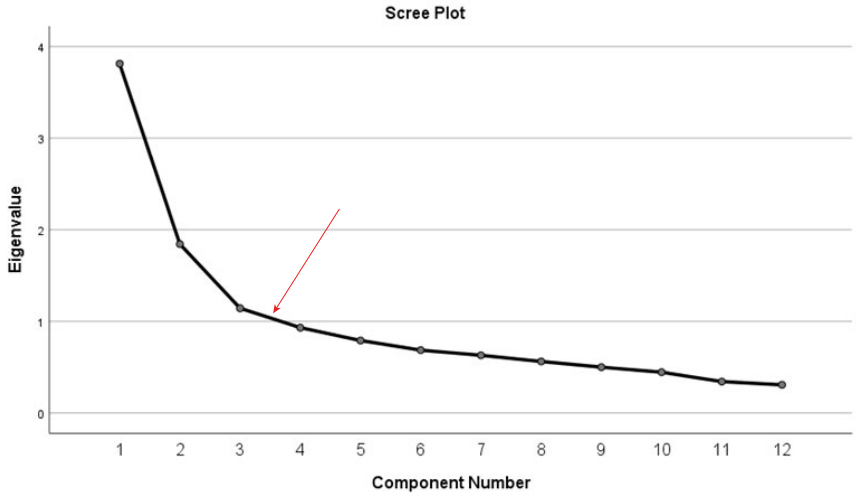


**Figure 3.11. Scree plot**

Source: Own elaboration.

**Table 3.24. Total variance explained**

| 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 | 3.813 | 31.774 | 31.774 | 3.813 | 31.774 | 31.774 | 2.363 | 19.690 | 19.690 |
| 2 | 1.844 | 15.367 | 47.141 | 1.844 | 15.367 | 47.141 | 2.357 | 19.641 | 39.331 |
| 3 | 1.144 | 9.531 | 56.672 | 1.144 | 9.531 | 56.672 | 2.081 | 17.342 | 56.672 |
| 4 | 0.932 | 7.763 | 64.436 | | | | | | |
| 5 | 0.792 | 6.596 | 71.032 | | | | | | |
| 6 | 0.686 | 5.718 | 76.750 | | | | | | |
| 7 | 0.630 | 5.249 | 82.000 | | | | | | |
| 8 | 0.563 | 4.689 | 86.689 | | | | | | |
| 9 | 0.500 | 4.170 | 90.859 | | | | | | |
| 10 | 0.446 | 3.715 | 94.574 | | | | | | |
| 11 | 0.343 | 2.859 | 97.434 | | | | | | |
| 12 | 0.308 | 2.566 | 100.000 | | | | | | |

Source: Own elaboration.

**Table 3.25. Rotated Component Matrix[a]**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| I take part in charity events organized outside my job | | | |
| I try to segregate rubbish at home (plastic, waste paper, glass, etc.) | | 0.832 | |
| I try to save water and electricity at home | | 0.833 | |
| I buy organic products to satisfy my own or my family's needs | | 0.617 | |
| I help others for myself, not to please my employer | | 0.540 | |
| I do not hesitate to submit suggestions for improving work so that customers are more satisfied | 0.693 | | |
| I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money) | | | 0.645 |
| I participate in CSR activities more out of fear of getting a job than out of my own free will | | | 0.802 |
| I make other employees aware if they do something to the disadvantage of clients | 0.714 | | |
| I would be more involved in helping those in need if it mattered to my boss | | | 0.728 |
| I admonish someone who forgot to turn off the light or turn off the tap in the store | 0.752 | | |
| In the case of a product that is put away anywhere, I take it to the right place by the customer | 0.592 | | |

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 5 iterations

Source: Own elaboration.

After analysis of table 3.25 the decision was made to remove item a12_1., because the value of the loading was below 0.5 (*I take part in charity events organized outside my job*). New updated analysis was conducted.

**Table 3.26. Reliability statistics**

| Cronbach's alpha | Number of items |
|---|---|
| 0.782 | 11 |

Source: Own elaboration.

**Table 3.27. KMO and Bartlett's Test**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.761 |
|---|---|---|
| Bartlett's Test of Sphericity | approx. chi-square | 775.310 |
| | df | 55 |
| | Sig. | 0.000 |

Source: Own elaboration.

**Table 3.28. Communalities**

| | Initial | Extraction |
|---|---|---|
| I try to segregate rubbish at home (plastic, waste paper, glass, etc.) | 1.000 | 0.720 |
| I try to save water and electricity at home | 1.000 | 0.727 |
| I buy organic products to satisfy my own or my family's needs | 1.000 | 0.586 |
| I help others for myself, not to please my employer | 1.000 | 0.469 |
| I do not hesitate to submit suggestions for improving work so that customers are more satisfied | 1.000 | 0.529 |
| I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money) | 1.000 | 0.594 |
| I participate in CSR activities more out of fear of getting a job than out of my own free will | 1.000 | 0.674 |
| I make other employees aware if they do something to the disadvantage of clients | 1.000 | 0.611 |
| I would be more involved in helping those in need if it mattered to my boss | 1.000 | 0.552 |
| I admonish someone who forgot to turn off the light or turn off the tap in the store | 1.000 | 0.625 |
| In the case of a product that is put away anywhere, I take it to the right place by the customer | 1.000 | 0.449 |

Source: Own elaboration.

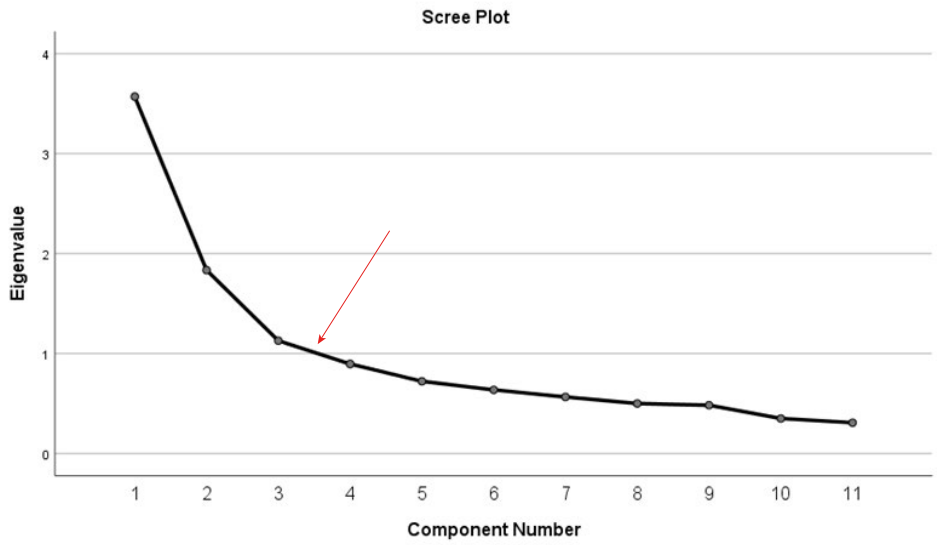


**Figure 3.12. Scree plot**

Source: Own elaboration.

**Table 3.29. Rotated Component Matrix[a]**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| I try to segregate rubbish at home (plastic, waste paper, glass, etc.) | | 0.840 | |
| I try to save water and electricity at home | | 0.842 | |
| I buy organic products to satisfy my own or my family's needs | | 0.639 | |
| I help others for myself, not to please my employer | | | |
| I do not hesitate to submit suggestions for improving work so that customers are more satisfied | 0.714 | | |
| I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money) | | | 0.626 |
| I participate in CSR activities more out of fear of getting a job than out of my own free will | | | 0.816 |
| I make other employees aware if they do something to the disadvantage of clients | 0.711 | | |
| I would be more involved in helping those in need if it mattered to my boss | | | 0.737 |
| I admonish someone who forgot to turn off the light or turn off the tap in the store | 0.748 | | |
| In the case of a product that is put away anywhere, I take it to the right place by the customer | 0.576 | | |

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 5 iterations

Source: Own elaboration.

Again, one of the items loading was below 0.5, so the researcher decided to remove item a12_5. (*I help others for myself, not to please my employer*).

**Table 3.30. Reliability statistics**

| Cronbach's alpha | Number of items |
|---|---|
| 0.767 | 10 |

Source: Own elaboration.

**Table 3.31. KMO and Bartlett's Test**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.738 |
|---|---|---|
| Bartlett's Test of Sphericity | approx. chi-square | 684.353 |
| | df | 45 |
| | Sig. | 0.000 |

Source: Own elaboration.

**Table 3.32. Communalities**

| | Initial | Extraction |
|---|---|---|
| I try to segregate rubbish at home (plastic, waste paper, glass, etc.) | 1.000 | 0.753 |
| I try to save water and electricity at home | 1.000 | 0.736 |
| I buy organic products to satisfy my own or my family's needs | 1.000 | 0.588 |
| I do not hesitate to submit suggestions for improving work so that customers are more satisfied | 1.000 | 0.492 |
| I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money) | 1.000 | 0.596 |
| I participate in CSR activities more out of fear of getting a job than out of my own free will | 1.000 | 0.685 |
| I make other employees aware if they do something to the disadvantage of clients | 1.000 | 0.621 |
| I would be more involved in helping those in need if it mattered to my boss | 1.000 | 0.543 |
| I admonish someone who forgot to turn off the light or turn off the tap in the store | 1.000 | 0.667 |
| In the case of a product that is put away anywhere, I take it to the right place by the customer | 1.000 | 0.494 |

Source: Own elaboration.

**Table 3.33. Total variance explained**

| 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 | 3.309 | 33.090 | 33.090 | 3.309 | 33.090 | 33.090 | 2.265 | 22.651 | 22.651 |
| 2 | 1.743 | 17.428 | 50.518 | 1.743 | 17.428 | 50.518 | 2.015 | 20.148 | 42.799 |
| 3 | 1.125 | 11.248 | 61.766 | 1.125 | 11.248 | 61.766 | 1.897 | 18.967 | 61.766 |
| 4 | 0.861 | 8.610 | 70.376 | | | | | | |
| 5 | 0.672 | 6.718 | 77.095 | | | | | | |
| 6 | 0.570 | 5.705 | 82.799 | | | | | | |
| 7 | 0.566 | 5.658 | 88.457 | | | | | | |
| 8 | 0.489 | 4.889 | 93.346 | | | | | | |
| 9 | 0.352 | 3.515 | 96.861 | | | | | | |
| 10 | 0.314 | 3.139 | 100.000 | | | | | | |

Source: Own elaboration.

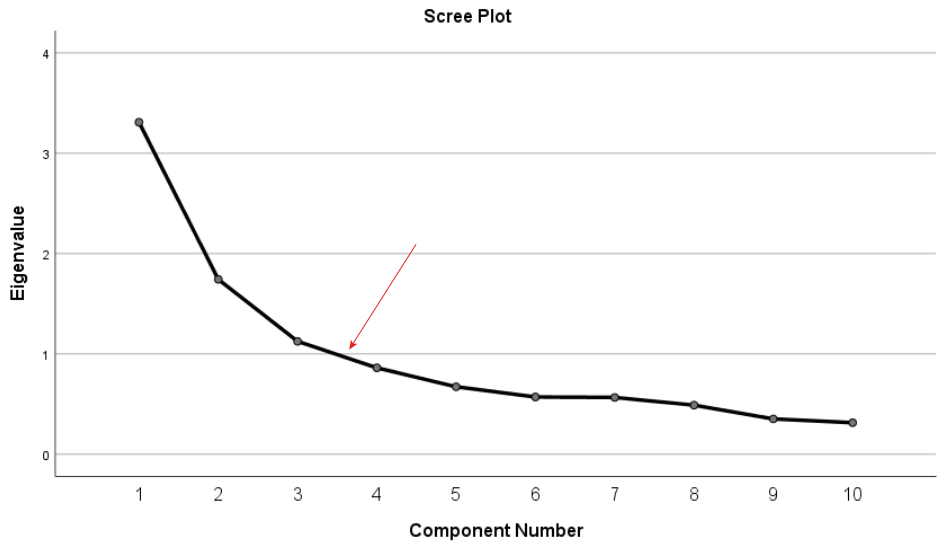


**Figure 3.13. Scree plot**

Source: Own elaboration.

**Table 3.34. Rotated Component Matrix[a]**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| I try to segregate rubbish at home (plastic, waste paper, glass, etc.) | | 0.855 | |
| I try to save water and electricity at home | | 0.845 | |
| I buy organic products to satisfy my own or my family's needs | | 0.644 | |
| I do not hesitate to submit suggestions for improving work so that customers are more satisfied | 0.689 | | |
| I try to initiate social, charity or ecological activities in the store for a specific person or family (e.g., collection of clothes, food, caps, money) | | | 0.620 |
| I participate in CSR activities more out of fear of getting a job than out of my own free will | | | 0.824 |
| I make other employees aware if they do something to the disadvantage of clients | 0.729 | | |
| I would be more involved in helping those in need if it mattered to my boss | | | 0.728 |
| I admonish someone who forgot to turn off the light or turn off the tap in the store | 0.783 | | |
| In the case of a product that is put away anywhere, I take it to the right place by the customer | 0.599 | | |

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 4 iterations

Source: Own elaboration.

The extracted factors were used in regression linear model to identify the influence of those factors on services provided by employees working directly with customers (in accordance with diffusion model). The following results were obtained (Tables 3.35–3.38).

Dependable variable Y consists of 3 items transformed into index: *I advise clients on choosing the right products for them, even if it is not the most profitable for the store (chain of stores); I encourage my customers to buy ecological or fair-trade products, although they are sometimes more expensive; I recommend the goods to customers as if I were buying for myself.*

Independent variables are factors extracted in previous analysis: pro-ecological attitude (1), work engagement (2), extrinsic motivation (3).

**Table 3.35. Model summary**

| Model | *R* | *R* square | Adjusted *R* square | Standard error of the estimate |
|---|---|---|---|---|
| 1 | 0.583[a] | 0.340 | 0.332 | 0.64010 |
| 2 | 0.583[b] | 0.340 | 0.334 | 0.63883 |

a. Predictors: (Constant), REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1
b. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1

Source: Own elaboration.

**Table 3.36. ANOVA[a]**

| Model | | Sum of squares | df | Mean square | *F* | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 52.891 | 3 | 17.630 | 43.030 | 0.000[b] |
| | Residual | 102.841 | 251 | 0.410 | | |
| | Total | 155.732 | 254 | | | |
| 2 | Regression | 52.890 | 2 | 26.445 | 64.801 | 0.000[c] |
| | Residual | 102.841 | 252 | 0.408 | | |
| | Total | 155.732 | 254 | | | |

a. Dependent Variable: Y
b. Predictors: (Constant), REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1
c. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1

Source: Own elaboration.

**Table 3.37. Coefficients[a]**

| Model | | Unstandardized coefficients | | Standardized coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. error | Beta | | |
| 1 | (Constant) | 3.823 | 0.040 | | 95.369 | 0.000 |
| | pro-ecological attitude | 0.312 | 0.040 | 0.396 | 7.722 | 0.000 |
| | work engagement | 0.333 | 0.040 | 0.426 | 8.302 | 0.000 |
| | extrinsic motivation | –0.001 | 0.040 | –0.002 | –0.033 | 0.974 |
| 2 | (Constant) | 3.823 | 0.040 | | 95.558 | 0.000 |
| | pro-ecological attitude | 0.312 | 0.040 | 0.396 | 7.737 | 0.000 |
| | work engagement | 0.333 | 0.040 | 0.426 | 8.318 | 0.000 |

a. Dependent Variable: Y

Source: Own elaboration.

**Table 3.38. Excluded variables[a]**

| Model | | Beta in | *t* | Sig. | Partial correlation | Collinearity statistics |
|---|---|---|---|---|---|---|
| | | | | | | tolerance |
| 2 | extrinsic motivation | –0.002[b] | –0.033 | 0.974 | –0.002 | 1.000 |

a. Dependent Variable: Y
b. Predictors in the Model: (Constant), work engagement, pro-ecological attitude

Source: Own elaboration.

## Questions / tasks

1. What is the main purpose of factor analysis?
2. What are the differences between factor analysis and principal-components analysis? Find in literature.
3. Based on Kaiser-Meyer-Olkin test (KMO), is our data suited for Factor analysis? Explain your answer.
4. What number sig. 0,000 in Bartlet's test tells us? Can we proceed with factor analysis?
5. Look at the table 3.8 where communalities are given. Interpret the table.
6. Examine shown tables regarding two and three factor possible solution. Which solution is more acceptable and why?
7. Once you have decided which solution is more acceptable, analyse which statements form which factor. Name factors based on components included.
8. Research a literature how to improve factor analysis by cutting off (or eliminating) questions with a problematic data in commonality table. Suggest which question(s) to eliminate in this example to get more robust and reliable results!

9. Given example was based on PRESOR scale. Investigate which statements are consisted in EPQ and ATBEQ methodology. Discuss how would you organize data collection to enable factor analysis according to those two scales. Can you anticipate what statements could form factors according those two scales?
10. Interpret Cronbach's alpha value, KMO and sphericity Bartlett test parameters.
11. Interpret scree plot.
12. What are your recommendations for items with loadings above 0.5 and doubled in two factors?
13. How would you name those factors to reflect their core meaning? Interpret them.
14. Research a literature how to improve factor analysis by cutting off (or eliminating) questions with a problematic data in commonality table. Suggest which question(s) to eliminate in this example to get more robust and reliable results!
15. Extracted components were applied in *k*-means cluster analysis. As a result, two clusters were identified. What can we tell about them?
16. How would you improve the analysis?
17. Interpret Cronbach's alpha value, KMO and sphericity Bartlett test parameters.
18. Interpret scree plot.
19. What are your recommendations for items with loadings above 0.5 and doubled in two factors?
20. How would you name those factors to reflect their core meaning? Interpret them.
21. What is your opinion about the decision to remove items—first 12_1 and then 12_5. Were they correct?
22. Extracted components were applied in regression linear model to identify whether they influence the quality of provided services by employees. As a result, two clusters were identified. What we can say about them? Analyse results step by step from table 3-35–3.38.
23. How would you improve the analysis?

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