



# Disposal behaviour of Czech consumers towards textile products

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## ABSTRACT

A proper attitude towards clothing close to the end of its life cycle and optimal post-consumer textile disposal behaviour have a potential to cause less environmental damage in both global and local perspectives. Only limited data on consumer behaviour toward textile products, textile waste and its passage to municipal waste streams are available in the Czech Republic. This paper reports on a survey conducted among 1046 respondents, attempting to identify differences in consumer behaviour towards textile products using advanced statistical methods.

The results suggest that gender, age, education, income, and number of household members are statistically significant demographic characteristics for textile waste separation, while the number of children is not significant.

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## 1. Introduction

Production of textile goods has a long-term rising tendency worldwide. The global clothing and textile products market size was valued at USD 925.3 billion in 2018 (GVR, 2019) and represented about six percent of world exports of manufactured goods in 2017 (WTO, 2018).

The same situation is in apparel and fibre production (FAO and ICAC, 2013). Both cotton fibres and polyester fibres represent over fifty percent of textile fibre production worldwide, which is associated with severe environmental risky stages (Altun, 2012). Many processes of textile finishing, such as colouring of apparels or other final fitting of textile, also create environmental problems (Gonzales et al., 1988; Alper et al., 2008; Zaharia and Suteu, 2012).

A proper attitude towards textile has the potential to reduce production of clothing and textile products with its negative environmental impacts. Sorting, consequent re-using and recycling together with textile material utilization and energy recovery also save primary natural resources. The modes of disposal behaviour of consumers are a key factor for influencing the environmental impacts.

The main aim of the presented study was to learn if and how different demographic characteristics of the Czech population are statistically relevant to post-consumer textile disposal behaviour.

The area of consumer behaviour toward textile waste, particularly its environmental aspects, has not been subject of research

attention yet. Only few studies worldwide are oriented to the post-consumer textile waste (Daneshvary et al., 1998; Domina and Koch, 1999; Tojo et al., 2012; Morgan and Birtwistle, 2009; Bianchi and Birtwistle, 2012; Maldini 2019). A vast majority of studies in the Czech Republic focuses on the amount of municipal solid waste in general or to separation of solid waste. These studies are mostly related to topics such as cost effectiveness and production of waste on the level of municipalities (Šauer et al., 2008; Balner, 2011; Slavik and Pavel, 2013; Benešová et al., 2016; Rybova et al., 2018).

This study intends to contribute in order to investigate post-consumer textile waste behaviour on a representative sample of inhabitants of the Czech Republic using advanced statistical methods.

## 2. Used textiles disposal and the role of consumers

The increasing amount of textile at the global market, which is usually represented by lower-quality and cheap fashion pieces, is linked with changes in consumer behaviour. Although consumers spend less of their income on clothing, they shop more often and buy more fashion pieces than any time before (Nordås, 2004). These changes in textile products consumption and consumer behaviour toward clothing are referred to as fast fashion (Ghemawat and Nueno, 2003; Clark, 2008). Further, many fashion retailers encourage consumers to go shopping more often through impulse purchasing strategies when they offer new collections every few weeks (McAfee et al., 2004).

Such purchase behaviour and consumption of textile goods are closely linked to a transformation in disposal behaviour (Bruce and

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Daly, 2006; Tojo et al., 2012; Maldini, 2019). A faster passage of post-consumer textile to waste streams occurs due to the enormous amount of textile products launched on the market, their lower quality and shorter lifespan of fast fashion pieces. Increasing amount of textile waste as well as an estimated continuous growth of municipal solid waste in general has been expected worldwide (Hoorweg and Bhada-Tata, 2012).

Post-consumer textile waste is defined as a textile product, which the owner no longer wants and decides to dispose of it (Domina and Koch, 1999; Hawley, 2006). Re-using of worn clothing, such as giving to family or friends and donating to charities, are most frequently used ways to prevent textile from becoming household waste (Morgan and Birtwistle, 2009). A part of this waste ends up in the municipal solid waste streams and mainly landfilled without any possibility of effective utilization.

On average, municipal solid waste is composed around four to five percent by weight of textile. Available data is from Kaikoura landfill in New Zealand, where landfilled waste composed four percent of textile in the period from 2007 to 2008 (MENZ, 2009). Similar data was collected in England, where textile waste represented four to five percent by weight of municipal solid waste in 2002 and 2003 (Woolridge et al., 2006). In the Czech Republic, it is on average 5.5 percent in the period from 2005 to 2009 (Balner, 2011). According to an earlier research, less than 4 percent of textile in municipal solid waste streams in the Western Europe occurred (Reidy, 1992).

In accordance with the circular economy strategy, which is currently one of the key strategies of the European Union, used clothing should be handled through a defined waste hierarchy in different ways and via proper waste management as secondary raw materials. These materials are fed back into the economy (EC, 2019). According to the waste hierarchy, which was set by the European Commission as a basic concept of waste management principles, other steps, such as preparing for re-use, recycling, other recovery e.g. energy recovery and waste disposal, represent proper handling of waste itself (EC, 2008). The waste management hierarchy is applied in Waste legislation and policy of the EU Member States as a priority order and the Czech Republic applied it via Waste Management Plan of the Czech Republic for the period 2015–2024 in November 2014 (GOV, 2014). Following this legislation, the paper works with handling options of post-consumer textile in household adapted according to waste hierarchy principles. The level of the prevention of the textile waste is well represented with the slow fashion attitude (Clark, 2008). The level of re-use is represented by donating textile or using worn out textile as humanitarian aid. Other environmentally friendly options of utilization of textile waste are ranked as follows: production of new products (recycling) and material and energy recovery (waste replaces other materials or particular function of raw materials in the plant or in the wider economy (Eurostat, 2014). Landfilling of the textile waste is the most improper way of textile waste handling.

Regarding the hierarchy, consumer behaviour plays an essential role in the process of determining where post-consumer textile and textile waste terminate.

### 3. Methodology of the survey

In order to learn about the disposal behaviour of Czech consumers towards the textile products and waste, a statistical survey was conducted.

The survey structure was inspired by a literature review (particularly by the studies by Daneshvary et al., 1998; Domina and Koch, 1999; Tojo et al., 2012; Morgan and Birtwistle, 2009; Bianchi and Birtwistle, 2012). In comparison with the above-mentioned stud-

ies, our survey was dealing with a much larger sample of respondents. The survey was also methodologically influenced by a similar survey performed in the Czech Republic by Šauer et al. (2008). However, no Czech study has investigated the textile issues as its sole topic. Previous studies dealt rather with all components of the household waste. The draft of the questionnaire was discussed with both governmental and NGO experts on the field. Proper understanding of questions and the ability of respondents to answer all the questions (particularly using different types of questions and scales) was pilot tested in a group of 15 respondents.

Primary data was collected in March 2016 using quota sampling as a widespread method in field research, which is a non-probability sampling technique wherein the assembled sample has the same proportions of individuals as the entire population with respect to specific characteristics (Explorable, 2009). Survey participants over 15 years of age living in the whole Czech Republic were selected. The survey was carried out in the form of moderated interviews using *Computer Assisted Personal Interview* (CAPI) by a professional pool research company (ppm factum research, Ltd.). According to several analyses, this approach ensured a higher response rate than mail surveys (Groves, 2009). In total, 1046 questionnaires were obtained, processed and analysed using IBM SPSS statistics software.

The questionnaire included two main groups of questions. The first group was related to consumer shopping, disposal behaviour, consumer attitude towards textile, consumer awareness of the environment, level of information about textile waste sorting separation, re-using and recycling, level of confidence towards selected institutions and public authorities, and willingness to change habits. It also included more specific questions such as the distance of textile waste collection points, the size of the storage space in the apartment or presence of solid fuel boiler in the household.

In the second part of the questionnaire, supporting information for further statistical analysis was collected: demographic information of respondents, such as age, status, gender, education, income, number of children, number of family members, type of housing, average apartment area and electoral preferences, was collected.

The information about consumer disposal behaviour of textile waste represents the most important output of the survey for this study. Primarily, eight options of handling unusable and/or worn out textile in households were defined: throwing away to the bin, burning in the solid fuel boiler in the household, giving to family or friends, selling as second-hand goods, taking directly to the waste collection yard, tossing into the textile container, donating directly to the charity organization, carrying away and storing in the weekend house.

Further, the eight options listed above were subsequently divided to two different groups according to the environmental impact of unusable or worn out textile from households handling. Positive or negative impact was based on the referred waste management hierarchy principles (EC, 2008). Positive impact options include: (i) tossing into the textile container, (ii) giving to family or friends, (iii) selling as second-hand goods, (iv) donating directly to the charity organization and (v) taking directly to the waste collection yard. Negative impact options include: (vi) throwing away to the bin and (vii) burning in the solid fuel boiler in the household.

A specific category is represented by the option (viii) carrying away and storing in the weekend house (see Table 1). In fact, it is not waste yet, but it is not clear when it appears in the waste streams. However, the use of this option was necessary to avoid missing answers. In the survey, only 9 respondents chose this option exclusively; 21 others did not choose any of the options.

For all these categories, questions on a frequency with a six point ordinal scale (from “several times a month” to “once every few years”, and “never”) were applied. Thus, it was possible to

**Table 1**  
Handling of textile waste evaluated from environmental perspective.

Textile waste handling options	Evaluation of the options from an environmental perspective
Throwing away to the bin	Negative
Burning in the solid fuel boiler in the household	Negative
Tossing into the textile container	Positive
Giving to family or friends	Positive
Selling as second-hand goods	Positive
Donating directly to the charity organization	Positive
Taking directly to the waste collection yard	Positive
Carrying away and storing in the weekend house	–

identify respondents who sort waste – answers “never” in both categories (i) and (ii) – and who do not – answers “never” in all the categories (iii) – (vii); see [Table 2](#).

As expected, the group “sometimes separation, sometimes disposal” is clearly quite large (587). Therefore, we examined in detail the responded frequencies of the different ways, in which textiles are disposed of, to identify households that *tend* to separate waste (199) or *tend* to dispose waste (194), and households which cannot be distinguished on the basis of data (194; see [Table 2](#)).

The data matrix contains, almost exclusively, categorical variables. The contingency tables are the basis for the analysis of such variables. Relationships – associations – between pairs of such variables can be verified by chi-square test based on the data in the sample. The condition of proper use of this test is following: the frequencies of the majority (over 80%) of the table cells are large enough, at least 5 ([Agresti, 2002](#)). This requirement is not met in our data, although the sample size is large (sparse contingency tables). Implementation of the exact test would be computationally challenging, so we applied Monte Carlo method to estimate the significance of the test ([Mehta and Patel, 2011](#)).

As suggested by [Agresti \(2002\)](#), a cell-by-cell comparison of observed and estimated expected frequencies helps to show the nature of the dependence. A standardized Pearson residual is asymptotically standard normal, so when it exceeds 2 in absolute value, its value indicates a lack of fit in the cell (at the usual significance level of 0.05); in [Tables 3–6](#), such residuals are bold. The multidimensional relationships are presented in the [Table 7](#).

To verify possible multidimensional relationships, a log-linear model was used. Different model variants were tested (at the significance level 0.05) to find the most parsimonious model that best accounts for the variance in the observed frequencies. Parameters of the resulting model then describe only the dependencies that were evaluated as significant based on the performed tests ([Agresti, 2002](#)).

**Table 2**  
Handling options of textile waste in the survey sample.

Option	Frequency	Percent	Valid percent
Separation	279	26.7	27.5
Disposal	150	14.3	14.8
Propensity to separation	199	19.1	19.5
Both separation and disposal	194	18.5	19.1
Propensity to disposal	194	18.5	19.1
<i>Sometimes separation, sometimes disposal</i> (Subtotal of the 3 lines above)	587	56.1	57.7
Only storage	9	0.9	–
Missing response	21	2.0	–
Total	1046	100	100

## 4. Results of the data analysis

The main aim of the study was to identify distinct disposal behaviour in relation to textile products of the Czech consumers with different demographic characteristics. Results for gender, age, education, income and number of children are presented in this chapter.

### 4.1. Gender

The chi-square test showed gender dependence, i.e. the difference between male and female behaviour in handling worn textiles (test statistic  $\chi^2 = 56.1$ ;  $df = 4$ ;  $p$ -value = 0.000). [Table 3](#) includes adjusted residual; based on these it can be stated that there are significantly more men in the response “disposal” and significantly more women with “the propensity to separate”, than we would expect in the case of independence (significant residual in tables are bold). Other differences are not significant.

### 4.2. Age

The chi-square test showed the dependence of disposal behaviour on the age – see [Table 4](#) ( $\chi^2 = 22.8$ ;  $df = 12$ ;  $p$ -value = 0.029). Significantly more people in the oldest age group (60+) do not separate textile waste, significantly fewer are in the group “propensity disposal” (so their answers are quite unambiguous). This group of consumers tends to treat textiles in ways which extend the life cycle of these products or enable other utilization rather than disposable waste without any possibility of use – see [Table 5](#) (significant test,  $\chi^2 = 18.2$ ;  $df = 9$ ;  $p$ -value = 0.033).

### 4.3. Education

Significantly more people with university education separate textile waste. On the contrary, there are significantly fewer such people with basic education separate textile waste. The disposal behaviour of consumers towards textile products depends significantly on education; see [Table 6](#) ( $\chi^2 = 16.7$ ;  $df = 8$ ;  $p$ -value = 0.034).

### 4.4. Income

There were 314 missing responses in the question on income. Due to this rate of missing responses, generalization is not possible.

Income is usually correlated with education. It was therefore necessary to examine the relationship of three variables: (i) handling of textile waste (HANDLING), (ii) education (EDU) and (iii) income (INCOME). There were four categories defined for monthly household income, from lowest to highest.

Based on the log-linear model used, the relation in the previous paragraph is mediated by income. Disposal behaviour of textile products is influenced by income, income is influenced by education. More educated people, i.e. people with usually higher incomes, tend to separate (see [Table 6](#)).

### 4.5. Number of household members

When examining how the handling of textile waste depends on the number of household members, the chi-square test is significant; see [Table 8](#). ( $\chi^2 = 27.6$ ;  $df = 16$ ;  $p$ -value = 0.035). Small households (1–2 members) do not separate textile waste significantly more. This can be explained by the age of the household members and by a higher share of small households among pensioners.

The number of children under 18 years of age living in the household was also investigated. The number of children under

**Table 3**  
Handling options of textile waste by gender.

Option		Gender		Total
		Woman	Man	
Separation	Count	154	125	279
	Adjusted residual	1.7	−1.7	
Propensity to separation	Count	134	65	199
	Adjusted residual	<b>5.2</b>	<b>−5.2</b>	
Both separation and disposal	Count	98	96	194
	Adjusted residual	−0.1	0.1	
Propensity to disposal	Count	87	107	194
	Adjusted residual	−1.8	1.8	
Disposal	Count	43	107	150
	Adjusted residual	<b>−5.9</b>	<b>5.9</b>	
Total	Count	516	500	1016

**Table 4**  
Handling options of textile waste by age.

Option		Age (years)				Total
		15–29	30–44	45–59	60 or more	
Separation	Count	69	71	67	72	279
	Adjusted residual	1.2	−1.3	0.1	0.1	
Propensity to separation	Count	34	70	50	45	199
	Adjusted residual	<b>−2.0</b>	<b>2.4</b>	0.5	−1.1	
Both separation and disposal	Count	44	49	44	57	194
	Adjusted residual	0.2	−1.1	−0.4	1.3	
Propensity to disposal	Count	47	63	49	35	194
	Adjusted residual	0.7	1.4	0.6	<b>−2.7</b>	
Disposal	Count	32	35	31	52	150
	Adjusted residual	−0.3	−1.5	−1.0	<b>2.7</b>	
Total	Count	226	288	241	261	1016

**Table 5**  
Recognizing post-consumer textile as secondary raw material or as disposable waste by age.

Option		Age (years)				Total
		15–29	30–44	45–59	60 or more	
Waste	Count	51	61	36	51	199
	Adjusted residual	1.4	1.0	<b>−2.1</b>	−0.3	
Rather waste	Count	82	83	82	78	325
	Adjusted residual	1.7	−1.1	0.7	−1.2	
Rather raw material	Count	66	104	83	84	337
	Adjusted residual	−1.3	1.5	0.4	−0.7	
Raw material	Count	31	43	48	63	185
	Adjusted residual	−1.9	−1.5	0.8	<b>2.6</b>	
Total	Count	230	291	249	276	1046

**Table 6**  
Handling of textile waste by education.

Option		Education level			Total
		Basic	High school	University	
Separation	Count	127	101	47	275
	Adjusted residual	<b>−2.6</b>	1.0	<b>2.4</b>	
Propensity to separation	Count	101	77	21	199
	Adjusted residual	−0.6	1.4	−1.1	
Both separation and Disposal	Count	101	70	23	194
	Adjusted residual	−0.2	0.6	−0.5	
Propensity to disposal	Count	110	60	24	194
	Adjusted residual	1.2	−1.1	−0.2	
Disposal	Count	97	41	16	154
	Adjusted residual	<b>2.8</b>	<b>−2.2</b>	−1.0	
Total	Count	536	349	131	1016

18 in the household was reported by all respondents. The dependence of the options of handling on the number of children was not proven (sparse table; exact test; test statistic 17.8; df = 16; p-value = 0.336).

## 5. Discussion and conclusions

The survey presented in this paper shows that demographic characteristics of gender, age, education, income, and number of

**Table 7**  
Log-linear model selection.

Step	Effects	Chi-Square	Df	Sig.	
0	Generating Class	EDU*INCOME*HANDLING	0.000	0	–
1	Deleted Effect	EDU*INCOME*HANDLING	31.470	24	0.141
	Generating Class	EDU*INCOME, EDU*HANDLING, INCOME*HANDLING	31.470	24	0.141
	Deleted Effect	EDU*INCOME	41.659	6	0.000
2	Generating Class	EDU*HANDLING	6.051	8	0.642
		INCOME*HANDLING	24.689	12	0.016
		EDU*INCOME, INCOME*HANDLING	37.521	32	0.231
3	Deleted Effect	EDU*INCOME	44.752	6	0.000
		INCOME*HANDLING	27.781	12	0.006
3	Generating Class	<b>EDU*INCOME, INCOME*HANDLING</b>	37.521	32	0.231

**Table 8**  
Handling options of textile waste by number of household members.

Option		Number of household members					Total
		1	2	3	4	5 or more	
Separation	Count	39	92	72	60	16	279
	Adjusted residual	0.0	–1.4	1.1	0.4	0.4	
Propensity to separation	Count	26	71	46	44	12	199
	Adjusted residual	–0.4	–0.2	–0.2	0.5	0.5	
Both separation and disposal	Count	23	75	41	44	11	194
	Adjusted residual	–0.9	0.7	–0.9	0.7	0.2	
Propensity to disposal	Count	21	64	53	46	10	194
	Adjusted residual	–1.4	–1.1	1.4	1.1	–0.1	
Disposal	Count	33	68	27	17	5	150
	Adjusted residual	<b>3.1</b>	<b>2.5</b>	–1.7	– <b>3.1</b>	–1.2	
Total	Count	142	370	239	211	54	1016

household members are statistically significant for understanding the different attitudes towards the textile waste separation. The variable of number of children in the household is not significant. Although similar conducted studies used a different methodology of surveys (mail surveys with no quota sampling), demographic variables as income (Daneshvary et al., 1998; Domina and Koch, 1999), age (Daneshvary et al., 1998; Domina and Koch, 1999; Bianchi and Birtwistle, 2012) and number of household members (Daneshvary et al., 1998; Domina and Koch, 1999) were also significant in post-consumer behaviour towards textiles in other countries worldwide. Future research should address in more detail behaviour in families with children - the role of “inheriting” the clothing from child to child, because worn textile is usually stored and it is hard to predict when it ends in municipal waste streams. Considering the fact that other studies operates with gender unequal number of respondents (Daneshvary et al., 1998; Bianchi and Birtwistle, 2012; Maldini 2019), the role of gender in post-consumer behaviour towards textile products should be also investigated in more detail. In addition, the analysed data showed that more people in the 60+ population do not separate textiles. This phenomenon is presumably related to the shifted role of clothing across generations, as other studies demonstrated (Maldini, 2019).

According to the results of the study, better addressed information campaigns should be realized to support proper handling options with post-consumer textile, ideally in collaboration with policy-makers in both national and municipal level. The focus should be on consumers who don't separate or have lower propensity to separate unusable or worn textiles – men in general, less educated consumers and those with lower income.

The consumer behaviour toward textile has also an ethical dimension. The textile materials and clothing production are located mainly in developing countries and are produced under low investments and operation costs (Nordás, 2004; Clark, 2008). Moreover, exploitation of employees, including sexual exploitation of women, bad and dangerous working conditions, corruption and absence of respect for human rights in general are present in many

of these countries. The extension of textile products life cycle has a potential to mitigate negative environmental and social impacts not only in developing countries (TI, 2013; IGLHR, 2013; IGLHR, 2016; HRW, 2015).

For better understanding of the environmental and ethical impacts of the whole textile and fashion industry and for the formulation of general policy recommendations, focused international research projects would be advisable. Such projects should establish a common research tool which ensures a better cross-country comparison of the results, especially when the implementation of circular economy principles is taken account in European and many other countries.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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