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## FAST FASHION – SUSTAINABILITY AND CLIMATE CHANGE: A COMPARATIVE STUDY OF PORTUGAL AND CROATIA

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### Abstract

*The fast fashion model is one where the fashion industry produces pieces of clothing in keeping with the latest trends, with low storage and high turnover, making the marketing of the products quick and giving consumers new clothes at affordable prices while increasing the amount of possible produced textile residues from being reused. This article examines the concept of fast fashion and its impact on climate change through an observational analytic comparative study of Portugal and Croatia. Using this type of study, the investigator samples a source population cross-sectionally and then retrospectively assesses the histories of exposures and outcomes of the subjects over a specified time period. The target populations of this study are that of Portugal and Croatia. A questionnaire was conducted, and additional data were collected from the analysis of waste reports and from Eurostat. The results were evaluated using the IBM SPSS Statistics program through descriptive statistics and the Chi-Square independence test. Results show that Portugal has a larger volume of clothing purchases as compared to Croatia, while at the same time Portugal produces more textile waste so the impact on the environment is higher. One of the main reasons associated with the higher production of textile waste is related to the increase of fast fashion. It is therefore important to encourage a circular economy, to stress the importance of stimulating the recycling of textile materials and emphasise the need for increasing the collection of clothing, as well as to invest in recycling technologies. A new model for the textile sector is necessary, one in which clothing, fabrics, and fibres re-enter the economy after use and never end up as waste through the creation of a closed system.*

**Keywords:** *fast fashion, climate change, production, waste*

## 1. INTRODUCTION

Textiles and clothing are a fundamental part of everyday life. It is difficult to imagine a world without textiles. Clothing provides comfort and protection and, for many, it represents an important expression of individuality. The textile industry is also a significant sector in the global economy, providing employment for hundreds of millions of people around the world. Despite these benefits, the way clothing is designed, produced, and worn has certain drawbacks that are becoming all the more apparent (Ellen MacArthur Foundation, 2017).

Today, major international fashion chains offer the latest clothing trends at attractive prices while the manufacturing of such clothing includes many steps and processes that

not only harm the environment, but also the people who make the garments and those who wear them. All steps in the producing of a garment have an impact on the environment, on humans, and on the world economy (ADEME, 2018).

The “fast fashion” model is one of renewal and speed in which the fashion industry constantly produces pieces of clothing, taking into account the latest trends, with low storage and high turnover, making the marketing of the products quick, with consumers always getting the newest clothing at affordable prices (Silva and Oliveira, 2017).

The textile industry works in an almost completely linear manner: large amounts of non-renewable resources are extracted to produce clothing that is often used for a short duration, after which it is mostly sent to landfills or incinerated. The use of this outdated “make-use-discard” model causes devastation to priceless ecosystems and resources as vast amounts of energy, water, and other resources are used to produce clothing (Ellen MacArthur Foundation, 2017).

The use of potentially hazardous substances in textile production has a serious impact on the health of farmers and factory workers, as well as on the environment. Industrial waste and dyes used by the industry often contaminate watercourses. It has been estimated that during washing our clothes release close to half a million tonnes of plastic microfibers into the ocean every year. These fibres are ingested by fish and other marine animals entering the food chain, meaning that we could very well end up eating our own clothes (Teixeira, 2018).

In a circular economy, it is economic activity that builds and rebuilds the overall health of the system to help eliminate waste and pollution, keep products and materials in cycles of use, and regenerate natural systems. Here it is important to recognise that the economy needs to be effectively worked across all scales. This transition does not just mean adjustments designed to reduce the negative impacts of the linear economy, rather it represents a change that creates long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits (Ellen MacArthur Foundation, 2018).

The need for a circular economy is becoming widely acknowledged across Europe and it is being addressed by businesses, society and policymakers, and as a result initiatives are booming (EURATEX, 2017). The implementation of increasingly restrictive environmental legislation and the creation of more competitive markets requires companies to be more productive and environmentally efficient. It is expected that the increase in industrial production will be accompanied by lower consumption and generation of pollutants. In this sense, the textile industry is associated with several activities such as weaving, dyeing, stamping, chemical finishing, among others and intensive consumption of natural resources (water, raw materials, energy, chemicals). Thus in the future environmental impacts should be minimised, environmental aspects must be identified, evaluated and classified (AEP, 2011).

The need to minimise environmental pollution should not only be demanded from fashion companies, but from consumers as well. The impulsive way we buy clothes in large quantities through excessive consumption, without realising the origin of this linear

model, has consequently contributed to a negative environmental impact (Shen, 2014). According to Bento, there are several types of waste, including the textile waste that each human being produces and throws away. Textile waste can be found in the waste we throw away every day, and in this context there are two categories of products which are defined as non-durable goods whose useful life is less than one year, and durable goods whose life extends beyond one year. Thus, by this definition, textile waste is included in the second category because it is a durable waste, although real market dynamics have made it a non-durable product (Bento, 2013).

The equivalent of one garbage truck filled with textiles is landfilled or incinerated every second. At least 108 million tonnes of non-renewable resources are used each year to produce clothing. It is estimated that the textile industry will account for 25% of the global carbon budget by 2050 (thredUP, 2019).

Given the need to understand the reality of these concepts, we proposed the following objectives for this study, namely acknowledgement of the fast fashion concept and its relationship with the circular economy through a comparative study of populations in Portugal and Croatia. We also evaluated the production of textile waste, textile waste management operations, the volume of sales in both countries, and the application of a questionnaire to the source population.

## **2. MATERIAL AND METHODOLOGY**

The present research was conducted in 2018/2019 and data collection was performed between January and May 2019. This was presented as a level II observational analytic study. With this type of study, the investigator samples a source population cross-sectionally and then retrospectively assesses the histories of exposures and outcomes of the subjects over a specified time period. The target populations of this study were that of Portugal and Croatia. The total number of participants was 409, with 204 respondents from Portugal and 205 respondents from Croatia.

In the first phase, we collected theoretical data through bibliographic research in order to gather state-of-the-art research. Data collection was carried out by completing a questionnaire, and the questions were based on scientific articles. In addition, data were also collected from Eurostat and from analysing waste reports from Portugal and Croatia, specifically data on the volume of clothing sold, textile waste management operations and textile waste from the countries under review.

The questionnaire included questions that allowed us to obtain socio-biographical data from the subjects. In the first part, we inquired about the knowledge around the theme through questions about fast fashion and circular economy. In the second part, respondents were asked to specify some characteristics of consumer behaviour in general, their fast fashion consumerism habits, frequency of shopping, and what they pay attention to when buying clothes in order to understand their consumption habits and the extent to which they consider the sustainability of their purchases, as well as whether they have sustainable consumption habits or not.

The statistical analysis of the data collected was performed using the IBM SPSS Statistics version 24 software for Windows 7. The use of this software allowed the use of descriptive statistics such as localisation measures and central tendency (mean), dispersion (standard deviation), absolute and relative frequencies. We used the Chi-Square test of independence.

### 3. RESULTS

An analysis of data on textile waste treatment operations and volume of clothing sold in Eurostat was carried out, along with analysing Portuguese municipal waste reports and Croatian textile waste reports.

In this study, the responses to the questionnaire conducted among the two populations were also integrated and consisted of 409 respondents, with 204 Portuguese respondents and 205 Croatian. As regards to gender distribution within the countries, most of the Portuguese and Croatian participants were female, with 174 Portuguese respondents (85.3%) and 114 Croatian (55.6%), whereas the male gender was represented by 30 Portuguese respondents (14.7%) and 91 Croatian (44.4%). The average age of Portuguese respondents was 23.95 years, while the average age of Croatian respondents was 26.11 years, with a total average of 25.03 years. The reason for this age distribution was for probability sampling and willingness to participate in the research.

#### 3.1. Inferential analysis

In both Portugal and Croatia, the growing volume of textile waste has become a pressing concern due to the lack of space for its treatment, as well as viable disposal solutions and associated costs (Costa et al., 2014).

The waste management systems vary from country to country, depending on the structure of the economy, population size, production and consumption patterns, and pre-existing reuse and recycling patterns. On the other hand, the useful life of a product will also influence the urgency of the need to implement a specific waste management system (Bento, 2013).

Table 1. *Total textile waste produced in Portugal in the period 2010 to 2017 (Silva et al., 2013a, 2013b, 2014; Marçal et al, 2015; Marçal and Teixeira, 2016, 2018; Marçal et al., 2017)*

Year	2010	2011	2012	2013	2014	2015	2016	2017
Quantities of TW (%)	3.9	3.6	3.5	5	3.9	3.5	4	4.0
Total quantities of MW (t)	5,183,569	4,888,000	4,525,000	4,363,000	4,474,000	4,523,000	4,640,000	4,745,000
Quantities of TW produced (t)	202,159	175,968	158,375	218,150	174,486	157,853	185,600	190,275

Table 1 shows the percentage values of textile waste (TW) included in municipal waste (MW), as well as the total quantities of MW produced, and the TW quantities produced calculated from this data in mainland Portugal between 2010 and 2017. After analysing the different statistical data and calculations for Portugal, there was a decrease in the production of textile waste from 2010 to 2011, a value also followed by the MW. Table 1 also shows the declining trend of MW in the year 2013, in contrast to the TW which peaked in the quantity produced, and the following year in 2014 the production of TW dropped to values close to the year 2011, while the MW broke the downward trend in production they had had with a steeper rise from 2014 to the last year analysed. In 2015 there was again a decrease in the amount of MW accompanied simultaneously with a decrease in TW, this being the year with the least amount of TW produced, however from this year onward again there was a rise in the values of waste produced. In general, we can conclude that textile waste in municipal waste has had almost the same percentage in total volume during this period but the amount in tonnes is more significant for this research.

Table 2. *Total textile waste produced in Croatia in the period 2010 to 2017 (MZOE, 2019; HAOP, 2017a, 2017b)*

Year	2010	2011	2012	2013	2014	2015	2016	2017
<b>Total TW produced (t)</b>	59,322	59,611	54,903	57,318	57,850	58,627	59,305	59,487

Table 2 refers to the total textile waste (TW) produced in Croatia from 2010 to 2017 as obtained from the Ministry of Environment and Energy of the Republic of Croatia. Textile waste was analysed for the period from 2010 to 2017 and it was observed that the production of TW retained almost constant values throughout the years. Even though it was established that in 2012 there was a decrease in the production of TW, this being the year with the lowest record, and from this again there was a rise in the number of types of waste, there was only a slight decrease in their production in 2015 followed again by an increase in production in the following years. The year 2011 had the highest number of TW produced. In general, we can conclude that textile waste produced has almost the same amount in tonnes and it is significant for this research.

Table 3. *Textile waste management in Portugal in the period 2010 to 2016 (Eurostat, 2019)*

Portugal				
Textile Waste Management*	Year (t)			
	2010	2012	2014	2016
<b>Recovery Operations (R)</b>	12,439	4,931	7,281	8,287
<b>Elimination Operations (D)</b>	23,218	14,708	13,609	14,618
<b>Incineration Operations (D10)</b>	12	10	1	0
<b>Total Management Operations</b>	35,669	19,649	20,891	22,905

\*(R) = recycling; (D) = landfill; (D10) = incineration

Table 3 refers to the total of textile waste management operations in Portugal for the years 2010 to 2016, presented every two years and adapted from Eurostat. The two-year analysis was carried out for textile waste management operations in Portugal for the years 2010 to 2016, as there were no data for each year, while for Croatia such data were interpreted every year between 2010 and 2017.

In Portugal, regarding the treatment of textile waste during the years under review, it was observed that the amount of waste disposed of, in other words, that was landfilled, is always superior to what was recovered. It was established that 2010 was the year with the highest number of TW managed in all operations levels, which has the highest amount of recycled TW, landfilled and incinerated and compared to 2012, there was a decrease in the amount of waste in all operations, but from this year onward there was a rise in waste recovery operations in 2014 and 2016. Despite this increase, the same did not happen from 2012 to 2014 in the level of waste that was landfilled and incinerated, since the values decreased in 2014, while in contrast, in 2016 there was again a rise in recycling and disposal operations, however, in this year the incineration of TW was null. It should also be noted that over the years incineration operations have decreased, with the tendency to become null.

Table 4. *Management of textile waste in Croatia in the period 2010 to 2017 (MZOE, 2019; HAOP, 2017a, 2017b)*

Croatia								
Textile Waste Management*	Year(t)							
	2010	2011	2012	2013	2014	2015	2016	2017
Recovery Operations (R)	198.5	614.1	932.9	2,036.1	2,796.7	3,176.1	5,436.8	5,515.7
Elimination Operations (D)	1,374.9	1,962.3	1,184.0	732.61	1,054.1	939.6	719.4	750.9
Total Management Operations	1,573.4	2,576.4	2,116.9	2,768.7	3,850.8	4,115.7	6,156.2	6,266.6

\*(R) = recycling; (D) = landfill

Table 4 shows the data on textile waste management operations in Croatia as provided by the Ministry of Environment and Energy of the Republic of Croatia. It was observed that in Croatia, between 2010 and 2012, the number of recycled TW is lower than the landfilled one, but after 2013, recovery interventions became higher than elimination interventions over the years. The year 2010 presented the smallest percentage of recycled waste, whereas 2017 was the year with the highest amount of recycled TW and the lowest amount of landfilled TW. Incineration of TW is not carried out in Croatia.

Table 5. Total volume of clothing sold in Portugal and Croatia in the period 2010 to 2017 (Eurostat, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017)

Total of clothing sold (t)	Year							
	2010	2011	2012	2013	2014	2015	2016	2017
Portugal	521,658	514,146	565,938	568,280	570,176	578,497	624,657	651,199
Croatia	117,318	132,489	142,930	130,196	169,684	177,600	165,213	174,318

Table 5 refers to the volume of clothing sold in Portugal and Croatia from 2010 to 2017 and adapted from Eurostat. In Portugal, there was a decrease in the volume of clothing sold from 2010 to 2011, subsequently followed by a trend of constant ascent from 2011 and the last year under review, 2017, is the year with the highest number of apparel sold.

In Croatia, from 2010 to 2012 there was an increase in the sale of clothing, and this rise was interrupted with the fall of clothing sales in 2013, followed again by a sales volume growth from that year up to 2015, subsequently followed by a decrease in 2016 and a sales increase again in 2017. The year in which the largest number of clothing sold in Croatia was observed in 2015.

In relation to the results obtained in the questionnaire, we tried to evaluate the perception of the participants in relation to fast fashion and the circular economy. When we asked the participants if they knew that the fashion industry is currently the most polluting one on the planet, the response behaviour was very similar in both countries, with most of the answers being “Yes” (62.1%). Regarding whether the respondents were familiar with the concept of fast fashion, for both countries most of the responses were “Yes” (80.2%). Nevertheless, it is possible to establish that this view is more present in the Croatian sample (83.4%, N=171) as compared to the Portuguese sample (77.0%, N=157).

Regarding the different indicators of behaviour in the purchasing of clothing between the two countries, we find that “Price” is more important for the Portuguese respondents when buying (94.6%, N=193) as compared to Croatian respondents (65.9%, N=135). As to “Quality”, both populations responded mostly that they keep this factor in mind (78.0%). Another purchase indicator in which the trend of responses observed was different between the two countries was that of “Necessity”, whereby the Portuguese participants revealed that they pay greater attention to purchasing clothing when they need it (83.3%, N=170) as compared to Croatian participants (31.2%, N=64). As to the factors “Duration”, “Brand”, “Fashion”, “Where it was made”, “Environmentally friendly”, “Made in the country of origin”, both populations responded mostly that they did not take these indicators into consideration when buying clothes. With regard to the indicator “Material from which it is manufactured”, it was observed that respondents in both countries do not pay attention to this (68.0%).

Table 6. Factors that respondents consider in the act of purchasing clothing

		Origin			p-value
		Portugal	Croatia	Total	
		N (%)	N (%)	N (%)	
Price	No	11 (5.4%)	70 (34.1%)	81 (19.8%)	<0.0001
	Yes	193 (94.6%)	135 (65.9%)	328 (80.2%)	
Quality	No	50 (24.5%)	40 (19.5%)	90 (22.0%)	0.223
	Yes	154 (75.5%)	165 (80.5%)	319 (78.0%)	
Need	No	34 (16.7%)	141 (68.8%)	175 (42.8%)	<0.0001
	Yes	170 (83.3%)	64 (31.2%)	234 (57.2%)	
Duration	No	167 (81.9%)	172 (83.9%)	339 (82.9%)	0.584
	Yes	37 (18.1%)	33 (16.1%)	70 (17.1%)	
Brand	No	161 (78.9%)	146 (71.2%)	307 (75.1%)	0.72
	Yes	43 (21.1%)	59 (28.8%)	102 (24.9%)	
Fashion	No	141 (69.1%)	137 (66.8%)	278 (68.0%)	0.620
	Yes	63 (30.9%)	68 (33.2%)	131 (32.0%)	
Material from which it is manufactured	No	175 (85.8%)	106 (51.7%)	281 (68.7%)	<0.0001
	Yes	29 (14.2%)	99 (48.3%)	128 (31.3%)	
Where it was made	No	198 (97.1%)	193 (94.1%)	391 (95.6%)	0.151
	Yes	6 (2.9%)	12 (5.9%)	18 (4.4%)	
“Friend of the Environment”	No	192 (94.1)	195 (95.1%)	387 (94.6%)	0.653
	Yes	12 (5.9%)	10 (4.9%)	22 (5.4%)	
Made in the country of origin	No	196 (96.1%)	200 (97.6%)	396 (96.8%)	0.393
	Yes	8 (3.9%)	5 (2.4%)	13 (3.2%)	
Total		204	205	409	-



Regarding the behaviour of waiting to purchase clothing during the sale season, it was established that such idealisation when purchasing is more present in the Portuguese population (75.5%, N=154) despite the Croatian population (63.9%, N=131) exhibiting similar behaviour. When comparing the affirmative responses to the idealised expectation when purchasing during the sale season with the fact whether the participants make purchases moderately or not, it was remarkable to note that the Portuguese respondents (87.7%, N=135) make more moderate purchases than Croatian respondents (64.7%, N=66). From this it was then possible to observe that the Croatian population makes more clothing purchases outside the sale season.

Table 7. *Purchase of clothing made from recycled materials or upcycling*

		Origin		Total	p-value
		Portugal	Croatia		
		N (%)	N (%)	N (%)	
Clothing made from recycled materials or materials <i>upcycling</i>	No	24 (11.8%)	59 (28.8%)	83 (20.3%)	<0.0001
	Yes	180 (88.2%)	146 (71.2%)	326 (79.7%)	
Total		204	205	409	

Regarding the trend of purchasing clothes made from recycled materials or upcycling (creative reuse), we found that in both countries the affirmative response was the most frequent (79.7%), however it is still remarkable to note that the Portuguese participants (88.2%, N=180) have this buying trend more present than Croatian participants (71.2%, N=146).

As for acquiring secondhand apparel, we found that most participants in both populations do not tend to buy secondhand clothing (74.6%, N=305).

The frequency of buying new clothes is higher with Croatian respondents (64.9%, N=133) than with Portuguese respondents (57.8%, N=118). There was also the frequency of 24 times a year, two times a month with the Croatian participants (15.1%, N=31) presenting this frequency more compared to the Portuguese (7.4%, N=15). The purchase frequency exceeding 24 times a year was also answered more often by the Croatian respondents (9.3%, N=19) than by the Portuguese (6.9%, N=14).

In addition, it was also established that the frequency of once a year is more present in the Portuguese population (12.3%, N=25) compared to the Croatian population (2.0%, N=4). Some of the participants responded that they did not shop for clothing, and this fact was mostly mentioned by Portuguese participants (4.9%, N=10) as compared to Croatian participants (2.0%, N=4). In Portugal, different purchase frequencies were also observed than those in Croatia, as two times a year (1%, N=2), three times a year (2%, N=3), four times a year (3.4%, N=7), six times a year (1.0%, N=2). In view of the above, it can be established that the Croatian population has a higher purchase

frequency than the Portuguese. It is significant that in both countries when questioned if they buy new clothes every season, most responded with “Yes” (66.5%).

Table 8. *Number of garments that respondents buy per month*

	Origin	N	M	SD	p-value
Items of clothing bought per month	Portugal	204	2.09	1.978	0.139
	Croatia	205	2.40	1.848	0.129

The average number of clothes that participants buy per month is similar in both countries, that being two pieces, with a higher average value in the Croatian population (2.40) compared to the Portuguese (2.09).

Table 9. *Factors that lead participants to prefer fast fashion stores*

		Origin		Total	p-value
		Portugal	Croatia		
		N (%)	N (%)	N (%)	
Brand identity	No	174 (85.3%)	164 (80.0%)	338 (82.6%)	0.158
	Yes	30 (14.7%)	41 (20.0%)	71 (17.4%)	
Price	No	37 (18.1%)	68 (33.2%)	105 (25.7%)	0.001
	Yes	167 (81.9%)	137 (66.8%)	304 (74.3%)	
Fashion	No	132 (64.7%)	144 (70.2%)	276 (67.5%)	0.232
	Yes	72 (35.3%)	61 (29.8%)	133 (32.5%)	
Shop environment	No	194 (95.1%)	202 (98.5%)	396 (96.8%)	0.047
	Yes	10 (4.9%)	3 (1.5%)	13 (3.2%)	
Habit	No	150 (73.5%)	171 (83.4%)	321 (78.5%)	0.015
	Yes	54 (26.5%)	34 (16.6%)	88 (21.5%)	
Total		204	205	409	

We evaluated the frequency of responses of participants who indicated that they did not have a fast fashion preference, which represented 6.11% (N=25) of the total population assessed. Of the 384 participants who presented this preference, we found that in both populations this behaviour is due to the “price” that the clothing of fast fashion stores present, despite this trend of response being more present in the Portuguese population (81.9%, N=167) than in the Croatian population (66.8%, N=137).

The other preference indicators presented were most of the responses considered not relevant to the preference of fast fashion choice. However, the preference of stores by the “Brand identity” parameter was mostly mentioned by Croatian respondents (20.0%, N=41) as compared to Portuguese respondents (14.1%, N=30). The preference parameter “Fashion” was mentioned mostly by the Portuguese respondents (35.3%, N=72) than by the Croatian respondents (29.8%, N=61). Portuguese participants (26.5%, N=54) also mentioned that this influence on purchase is due more to “Habit” as compared to Croatian participants (16.6%, N=34), while the responses to the “Store environment” factor were similarly responded more often by the Portuguese population (4.9%, N=10) than by the Croatian population (1.5%, N=3).

Table 10. Stores with the highest frequency of purchase

			Origin		Total	p-value
			Portugal	Croatia		
			N (%)	N (%)	N (%)	
Brands	ZARA	INDITEX	92 (56.1%)	87 (69.6%)	179 (61.9%)	0.588
	Bershka		51 (31.1%)	51 (40.8%)	102 (35.3%)	0.977
	Stradivarius		54 (32.9%)	35 (28.0%)	89 (30.8%)	0.021
	Pull and Bear		43 (26.2%)	35 (28.0%)	78 (27.0%)	0.303
	H&M		22 (13.4%)	70 (56.0%)	92 (31.8%)	<0.0001
Total			164	125	289	

Of the 50 stores that participants considered to be where they bought clothes most often, the five most mentioned and existing in both countries were selected, of which four (ZARA, Bershka, Stradivarius and Pull and Bear) belong to the Inditex group, with the remaining one being H&M. The most preferred store in both countries was ZARA (61.9%, N=179), but this choice is most noted by the Croatian population (69.6%, N=87) than by the Portuguese population (56.1%, N=92). Bershka had the same number of preferences in both countries (35.3%, N=102), while Stradivarius and Pull and

Bear represented a higher frequency response of clothing purchases by the Portuguese respondents than by Croatian respondents. The H&M brand showed the most frequency of purchase in Croatia (56.0%, N=70) compared to Portugal (13.4%, N=22).

#### 4. DISCUSSION

In view of the results obtained, it is possible to establish that Portugal has a higher number of textile waste produced as compared to Croatia, and this may be related to many factors. One of these relates to the fact that in Portugal there is still no specific legislation for this waste stream, thus, in this context, textile waste should be considered as emerging residual waste and a feasibility study of the execution of a specific flow should be elaborated and also the larger population should be taken into consideration. This way the mandatory introduction of the selective collection of textiles in Portugal from 2025 comes to establish new challenges at different levels, from how it can reduce its production, under which conditions it is to process its collection, what solutions exist for the treatment of this type of waste and which are the most appropriate (Marçal and Teixeira, 2018).

In Croatia, there has been an improvement in terms of textile waste management operations from 2013, in which recovery operations later that year became superior to those of elimination. In this way, it becomes important to mention Croatia only becoming a member of the European Union (EU) in 2013 and being in transition as an EU member in the field of waste management. These values can be justified due to changes that have occurred, whereas from 2013 there has been a significant improvement in textile waste management towards a circular economy (Dinkelberg, 2018).

Portugal has a higher total number of management operations in comparison to Croatia, the value of textile waste deposited in landfill remains above the value that has been recycled over the years, and in addition, Portugal performs incineration of textile waste, an operation that is not carried out in Croatia. Despite the controversy surrounding incineration, according to a study conducted by Xará, this waste treatment process plays an important role in the management of all types of waste in Portugal. The existing units have an intensive use and the possibility of installing new units is recognised and will certainly contribute to the country being self-sufficient in waste management and for improving energy performance (Xará, 2009). However, from an ecological point of view, incineration should not be considered as a treatment strategy given the direct (air pollution) and indirect (contamination of soils and aquifers) impacts that this practice may have (Bento, 2013).

Based on the data obtained in Table 5, it appears that Portugal produces more textile waste. One of the main reasons associated with the production of textile waste is related to the increase of fast fashion, as large fashion chains have changed the way people buy. In this way, clothes became a disposable good, because fashion is constantly changing and the quality of the clothes worn has decreased substantially (Bernardino, 2019). The fact that the Portuguese are buying clothes more often and in greater quantities may

be at the root of the problem, because this results in clothing that is put “out of use” or considered “old” being thrown away and there are no well-defined structures for the recycling of such waste in Portugal (Culto, 2019). In addition, the Portuguese textile industry is considered one of the oldest industries, and currently remains as one of the most important national business sectors (DGAE, 2018). In this way, the strong production of clothing in the country can contribute simultaneously to the high production of textile waste. About five million tonnes of textile waste are eliminated annually by EU countries, together with a fraction of urban waste (Šemanjski, 2019). Estimates suggest that 95% of the clothes eliminated in conjunction with the urban waste could be used again, reused, recycled or modified and transformed to a better product (upcycling) (Lu and Hamouda, 2014). Instead, the vast majority of clothing is thrown out with the municipal waste and ends up in landfills or is incinerated. Not only is this a massive waste of all the resources used to manufacture these items, but it creates even more pollution through emissions of hazardous chemicals and greenhouse gases due to incineration or deposits in landfills (Cobbing and Vicaire, 2016). Within the textile industry, only 13% of the total material input is recycled by some means after clothing wear. Most of this recycling consists of raw materials being used in other industries and in lesser applications be it as insulation material, cleaning cloths, and mattress stuffing. These are all currently difficult to recapture and most likely constitute a final use (Ellen MacArthur Foundation, 2017).

Analysing the results obtained by the questionnaire was interesting in order to ascertain the possible association between the country of origin of the respondents, the level of knowledge, attitudes, and behaviours towards fast fashion and the circular economy.

An average citizen buys 60% more clothes and keeps them for about half the time as compared to 15 years ago (Cobbing and Vicaire, 2016). Currently, this is used as a means of “tempting exclusivity” where some brands do not produce large quantities of the same clothing, but “small batches of new products”. The restriction of only a few pieces available in stores creates a sense of urgency. Should a customer decide to wait some time to think about the purchase, all pieces may have disappeared when they return. This pressure increases the need and frequency of purchase, creating the term “Blink-and-You-Miss-it-Fashion”. Fashion brands have this attitude because their intention is to create the desire to buy, to make an artificial need that manipulates the consumer to go more often to their stores. This is the essence of shopping today and our disposable society. In addition, low prices have also made it possible to increase the number of clothes purchased and the speed of consumption behaviour (Fuchs, 2016). The euphoria around sales and consequently lower prices often causes people to shop for clothes without thinking, which results in excessive and uncontrollable consumption (Pereira, 2019). As observed in the results of the questionnaire according to our research, the Portuguese respondents who make purchases during the sale season try to buy clothes in a moderate way, only buying those clothes they really need, while the Croatian respondents are the ones who tend to lose more control at this time.

Although the results of the questionnaire reveal that in both countries the practice of

buying secondhand clothing is still rare, according to thredUP, secondhand clothing is expected to make up to 1/3 of clothes closets by 2033. If everyone bought used clothing instead of new per year, we could save 2.5855 billion kg of CO<sub>2</sub> emissions, the equivalent of half a million cars taken off the road for a year; 11 billion kWh of energy, the equivalent used to illuminate the Eiffel Tower for 141 years; 94.6352 billion litres of water, the equivalent to filling 1,140 Bellagio Fountains; and 203.66 million kg of waste, the equivalent to the weight of 1 million polar bears (thredUP, 2019).

Nevertheless, according to the questionnaire applied, we found that in both countries the most observed frequency of clothing purchase is 12 times a year (61.4%, N=251), or once a month, and the average number of clothing items purchased are two pieces of clothing per purchase, which creates a considerable impact on the environment. Knowing that it takes 2,720 litres of water to produce one t-shirt, and 200 litres of water to produce a pair of denim jeans respectively, this would be the equivalent to the amount one person drinks over a period of three years and taking 285 showers (Fashion Revolution, 2017). Now imagine that these 251 respondents buy a pair of trousers and a t-shirt per month, this would mean the equivalent of a total of 1,460,820 litres of water that would be wasted.

According to a study carried out by Khan and Malik, the first step in the global textile supply chain is textile production, the process by which natural and synthetic fibres are made. Most of the clothes we buy are made from cotton or polyester, and both are associated with significant impacts on health through its production process and fabric. When the fabrics are dyed, additional wastes are produced, since untreated wastewater from dyes is often released in local water systems, together with heavy metals and other toxic substances that may adversely affect the health of animals and nearby habitats (Khan and Malik, 2014). The sustainability of the fibres that constitute our clothing refers to the practices and policies that reduce environmental pollution and minimise the exploitation of people or natural resources to meet the lifestyle needs. Natural cellulosic and protein fibres are believed to be better for the environment and for human health and, in some cases, manufactured fibres are thought to be more sustainable. Fabrics such as Lyocell, made of bamboo cellulose, are manufactured in a closed production cycle, in which 99% of the chemicals used to develop fabric fibres are recycled (Bick et al., 2018). The use of sustainable fibres will be essential to minimise the environmental impact of textile production. In both populations, clothing material is not considered at the time of its purchase, and these studies prove that more attention should be paid to this factor so that more sustainable purchases are made. When confronted about the stores where the respondents buy their clothing most often, the responses were mostly “fast fashion”, although some brands are already more concerned with environmental sustainability. Inditex, a conglomerate of Spanish textile companies, which includes ZARA, Bershka, Stradivarius and Pull and Bear, has already tried to present solutions to the problem created by its fast fashion through the creation of its Join Life Program. This program claims that all products under this label are made with more sustainable raw materials, such as organic cotton, from genetically modified seeds and cultivated

with natural fertilisers, or from Tencel, a fibre produced in a closed circuit that reuses 100% of the water and proceeds from forest timber managed in a controlled manner, guaranteeing their reforestation. Furthermore, a social and environmental commitment is presented that enables the delivery of clothes used in collection containers located in some stores of the group. All clothes that are donated, as well as remnants of fabrics from the production of the collections, are delivered to community organisations, where they can be separated and classified to have the most suitable destination, whether for social projects or for transforming into new fibres (Inditex, 2018). H&M has also introduced an initiative for the collection of textiles towards a sustainable future very similar to that of the Inditex group, where the collection of textiles is made through containers in stores. The objective of the initiative is to enable the processing of the donated textiles into other products (which can be transformed into textile fibres or used in the manufacture of insulating or cushioning materials for the automotive industry, for example), such as new collections or cleaning cloths while clothing delivered in good condition can be sold as secondhand items. The only difference between these programs is that for each bag of textiles that is donated at an H&M location, a voucher is offered which can be used for a future purchase (H&M, 2019).

## 5. CONCLUSION

At this moment, we can state with all certainty that our society can be defined as a fast and disposable one. In order to try to counter this tendency, we must move towards a slow movement, one that advocates living at an appropriate pace and being present in the current fashion as an alternative to mass production. In practical terms, this would mean defending a circular economy, the development of versatile parts, produced with quality materials and timeless design, which can be used for many years without falling out of fashion. Slow fashion is ready to impose itself, to advocate for long-lasting clothing, recycling, reuse of materials, upcycling, secondhand shopping, and a do-it-yourself (DIY) mindset. This means a new, more ethical and responsible consumption model where priority is given to transparency and quality of work and the final product, consideration to the durability, originality, and finish of the products, as well as to the working conditions of those who work in the creative process. In essence, it is about making the process of designing products more humane, respecting the workers, the communities, the consumers and the planet (Âncora Verde, 2018).

During and after the life cycle of textile products, it is necessary to evaluate the priorities necessary for taking measures to prevent the generation of waste. It is essential to urge for the repair and reuse of textiles and to proceed to recycle and other types of recovery. Landfills and incineration should not be considered as options for final treatment. Different humanitarian or social organisations may be important in the process of collecting used clothing and the main actors for their reuse. The quantities of clothing involved in this process may be significant, however, data on the quantities collected are not subject to the obligation to declare data on the basis of waste management

regulations, as this collected clothing is part of the process until it is classified as waste (Šemanjski, 2019).

At the same time, efforts must be made to raise awareness among consumers on the need to treat this type of waste differently, to not mix it with other municipal waste so that it can be recovered and recycled. Consumer awareness plays an important role for more sustainable consumption, for clothing to be worn longer, as well as for its potential reuse and appropriate disposal at the end of life. Therefore projects that educate consumers and encourage sustainable behaviour should be supported (APA and Gabinete do Secretário de Estado do Ambiente, 2018).

Despite progress made in the transition to a circular economy, waste management continues to be a major challenge. According to the European Commission, Portugal is one of the countries at risk of missing the EU target of recycling 50% of municipal waste by 2020. Based on 2017 data, the overall recycling rate is 28%, so there is still a lot of progress to be made towards this goal (European Commission, 2019). One of the measures can be the creation of the efficient textile waste management.

Croatia is only now at the beginning of its transition to a circular economy. As a result of suboptimal planning of waste management, insufficient incentives for waste management according to the waste hierarchy, inadequate (door-to-door) separate collection of waste, a lack of a clear allocation of tasks, insufficient coordination between the different administrative levels, and poor application of enforcement capacity, Croatia is lagging behind in achieving the targets set for EU's waste management. Croatia was late in adopting the national waste management plan and the waste prevention program, which are necessary for reflecting the existing policies and developing a strategy to achieve EU waste management. These key implementation documents are also relevant to securing key funds within the EU policy framework (Dinkelberg, 2018).

Even though Croatia is still in transition as a member of the EU and in adopting a strategy for waste management at the EU level, it does have better management of textile waste and consequent lower waste production of this type of waste compared to Portugal. These results may be justified by the fact that in Croatia there is already a well-defined flow and management of textile waste, and it should be noted that it does not incinerate this waste, which should be taken as an example by Portugal. As regards to Portugal, it was observed that there has been a greater trend in textile waste production over the years, which may be related to a failure in management, its strong textile industry and a large amount of clothing purchased by the Portuguese population associated with the issue of fast fashion.

In conclusion, it is important to encourage a circular economy as a new future for fashion, to stress the importance of stimulating the recycling of textile materials, to emphasise the need to increase clothing collection and to invest in recycling technologies. Consequently, the creation of a new model for the textile sector is necessary, one that is based on the principles of the circular economy, in which clothes, fabrics, and fibres re-enter the economy after their use and do not end up as waste through the creation of a closed system where there is no waste. Additionally, much of the updated and com-



prehensive data on the volumes of clothes eliminated and used globally have not been compiled. This lack of information shows a limited interest by politicians and a lack of transparency in the fashion industry on their use of resources and wasted amounts.

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## APPENDIX – QUESTIONNAIRE

### Fast Fashion and Circular Economy

The following questionnaire is intended to collect data for an investigation being done by the University of Applied Sciences of Velika Gorica and by Coimbra Health School under the theme “Fast Fashion in a Circular Economy”. The main objective is to determine the state of information of the population about fast fashion and circular economy. It is important that you answer all the questions seriously and honestly so that conclusive results can be obtained. Your responses to this questionnaire are anonymous and confidential, with the sole purpose here being academic and no economic or financial interests.

1. What is your gender?
  - a) Female
  - b) Male
2. Age?
  - a) \_\_\_\_\_
3. How often do you usually buy new clothes?
  - a) Once per week
  - b) Two times per week
  - c) More than two times per week
  - d) Once per month
  - e) Two times per month
  - f) More than two times per month
  - g) Once per year
  - h) I don't buy
4. How many clothing pieces do you buy per month?
  - a) \_\_\_\_\_
5. Do you buy new clothes every season?
  - a) Yes
  - b) No
6. What do you consider when buying clothes? (you can choose multiple answers)
  - a) Price
  - b) Quality
  - c) Necessity
  - d) Duration
  - e) Brand
  - f) Fashion
  - g) Material of which it is made
  - h) Where it was made

- i) Environmentally friendly
  - j) Made in the country of origin
7. In which stores do you buy mostly?
- a) \_\_\_\_\_
8. Do you usually wait to buy clothing during sales?
- a) Yes
  - b) No
- 8.1. If yes, do you usually make those purchases in a moderate way, buying only the clothes you really need?
- a) Yes
  - b) No, I get carried away, and I end up buying what I do not need
9. Are you familiar with the concept of fast fashion - brands ZARA, H&M, Pepco...?
- a) Yes
  - b) No
10. Comparing various clothing stores, what makes you choose fast fashion stores?
- a) Brand identity
  - b) Price
  - c) Fashion
  - d) Store environment
  - e) Habit
  - f) Other
11. Are you aware that the fashion industry is one of the worst polluters on the planet?
- a) Yes
  - b) No
12. Give us your opinion on how fast fashion is connected with the circular economy?
- a) \_\_\_\_\_
13. Would you buy clothing made from recycled materials or upcycling materials?
- a) Yes
  - b) No
- 13.1. Please explain your answer.
- a) \_\_\_\_\_
14. Do you buy secondhand clothes?
- a) Yes
  - b) No
- 14.1. Please explain your answer.
- a) \_\_\_\_\_

## „BRZA MODA” – ODRŽIVOST I KLIMATSKE PROMJENE. KOMPARATIVNO ISTRAŽIVANJE HRVATSKE I PORTUGALA

Sanja Kalambura, Sílvia Pedro i Susana Paixão

### Sažetak

*Model „brze mode“ u modnoj industriji podrazumijeva proizvodnju trendovskih odjevnih predmeta koji imaju kratko vrijeme skladištenja i oglašavanja te su dostupni kupcima po povoljnim cijenama. Međutim, takav način proizvodnje potencijalno povećava količinu tekstilnog otpada. U ovom radu istražujemo koncept „brze mode“ i njen utjecaj na klimatske promjene usporedbom između Portugala i Hrvatske. Istraživanje je istodobno opisno i analitičko. Primjeri dolaze iz presjeka populacija ovih dviju zemalja, nakon čega se retrospektivno analizira povijest predmeta istraživanja kroz izloženost ovom fenomenu i posljedice te izloženosti tijekom određenog vremenskog razdoblja. Podatke smo prikupili pomoću upitnika te analizom izvještaja o otpadu i podataka iz EuroStata. Rezultate smo analizirali pomoću programa IBM SPSS koristeći deskriptivnu statistiku i hi-kvadrat test. Rezultati su pokazali da se u Portugalu kupuju veće količine odjevnih predmeta u odnosu na Hrvatsku te da Portugal proizvodi više tekstilnog otpada pa je time veći i njegov učinak na okoliš. „Brza moda“ je jedan od glavnih razloga za povećanje količine tekstilnog otpada. Upozoravamo na važnost poticanja kružne ekonomije, stimuliranja reciklaže tekstilnih materijala, povećanjem sakupljanja tekstila i ulaganja u reciklažne tehnologije. Ključno je stvaranje novog modela zatvorenog ekonomskog sustava za tekstilni sektor u kojem bi se odjeća i materijali ponovno koristili te ne bi završavali kao otpad.*

**Ključne riječi:** brza moda, klimatske promjene, proizvodnja, otpad

## „SCHNELLE MODE” – NACHHALTIGKEIT UND KLIMAWANDEL. VERGLEICHENDE FORSCHUNG IN KROATIEN UND PORTUGAL

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### Zusammenfassung

*Unter dem Modell „der schnellen Mode“ versteht man in der Modeindustrie die Herstellung von Trendkleidung, die eine kurze Lager- und Werbezeit hat und für Kunden zu günstigen Preisen erhältlich ist. Diese Produktionsweise verursacht jedoch möglicherweise eine große Menge des Textilabfalls. In dieser Arbeit erforschen wir das Konzept „der schnellen Mode“ und seinen Einfluß auf den Klimawandel auf Grund eines Vergleichs zwischen Portugal und Kroatien. Die Forschung ist zur gleichen Zeit deskriptiv und analytisch. Die Beispiele stammen aus dem Schnitt der Bevölkerung dieser zwei Länder, danach analysieren wir rückblickend die Geschichte des Forschungsgegenstands durch die Ausgesetzttheit diesem Phänomen, sowie die Folgen dieser Ausgesetzttheit im Laufe einer bestimmten Zeit. Die Angaben haben wir mit Hilfe von Fragebogen und durch die Analyse der Berichte über Abfälle und Angaben von EuroStat gesammelt. Die Resultate haben wir mit Hilfe des IBM SPSS-Programms unter Anwendung der deskriptiven Statistik und des Chi-Quadrat-Tests analysiert. Die Resultate haben gezeigt, dass man in Portugal mehr Kleidungsstücke als in Kroatien kauft, und dass Portugal mehr Textilabfall produziert, somit ist seine Auswirkung auf die Umwelt größer. „Schnelle Mode“ ist einer der Hauptgründe für die Erhöhung der Menge des Textilabfalls. Wir weisen auf die Wichtigkeit der Unterstützung der Kreiswirtschaft hin, auf Förderung der Wiederverwertung von Textilstoffen, indem Textilien gesammelt werden und man in Wiederverwertungstechnologie investiert. Am wichtigsten ist die Schaffung eines neuen Modells des geschlossenen Wirtschaftssystems für die Textilbranche, in dem man Kleidung und Materialien wieder verwenden würde und sie nicht auf dem Abfall landeten.*

**Schlüsselwörter:** schnelle Mode, Klimawandel, Produktion, Abfall