

# Is the Transition to Bioeconomy a Sustainable Solution in Fast-fashion Industry, Considering the Overconsumption? - Premises for Future Research

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**ABSTRACT** The main objective of the paper is to inquire if bioeconomy is a “saving” sustainable solution to major problems caused by fast-fashion industry - consumption of non-renewable and scarce natural resources, waste generation, pollution - in the actual conditions of overconsumption and consumption intensification due to accelerated increase of global population. A closer look reveals that not only that fast-fashion industry is not bridging the gap to sustainability, but also that its transit to bioeconomy (which is the main alternative proposed by global organisms to increase sustainability) may deepen the global issues wanted to be solved, if the current business models are maintained. Inside evidence that individual overconsumption outpaces the fast-fashion industry’s efforts to create a sustainable bio-economic system, thus is imperative to redesign the business models to use less important natural resources and to reduce the environmental impact, while in parallel discourage the overconsumption. Consequently, fast-fashion business models need to have a sustainable holistic approach and incorporate sustainable measures, which are able to shift the consumer behaviour from overconsumption to sustainable choices, in their marketing objectives, strategies and actions. Based on the findings, premises for future research were proposed.

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Bioeconomy; fast-fashion; sustainable fashion; overconsumption; sustainability.

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## 1. Sustainability – no longer a luxury, but a necessity

With industrialization, humankind has followed an economic trajectory that gradually leads to the depletion of planet’s life support systems. Currently, as a result of the adopted vision, 33% of the land surface and 75% of freshwater resources are allocated to agriculture (UN, 2019a). And natural resources are consumed 1.75 times faster than can be regenerated by the planet (WWF, 2019). This leads to rapid depletion of the existing deposits (BP, 2018). The excessive resources consumption led to increased environmental pollution, with around 300-400 million tons of waste dumped annually in the seas and oceans, and creating about 400 dead marine areas that reach up to 70.000 square km (IPBES, 2019; Sarkar, 2018). At the same time, carbon dioxide emissions rose by 40% and together with other greenhouse gases are inducing climate change through global warming (IPCC, 2018; Harris, Roach and Codur, 2017; Kweku et al., 2018).

But the anthropogenic climate has turned from an environmental problem into an existential threat (World Bank, 2015). It is predicted that anthropogenic climate modification will have as implications: endangering the socio-economic development of last decades (World Bank, 2015), habit destruction and redefining of the world map where humans and other species will live, creating extreme global living conditions that the human species has not experienced before (Frankhauser and Stern, 2016), leading rapidly in the next 100 years (Cahill et al., 2013) to the sixth mass extinction (Barnosky et al., 2011) in which million of species will disappear (IPBES, 2019). In the existing climate change

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scenario, the United Nations' special report "Global warming of 1.5°C" (IPCC, 2018) estimates that there are about 12 years to avoid the disastrous and irreversible level of global warming. As a consequence, in the current conjuncture in which the economic growth that has led to the expansion of the global population, associated with the significant decrease of natural resources and an unprecedented pollution degree of the environment that has generated anthropogenic climate changes with unique magnitude, the sustainable orientation is no longer a tendency or an ethical choice, but it has become a necessity (Ivan et al., 2019) that requires urgent implementation.

Driven by the changing global context, governments, large global organizations and NGO's (eg: UN, EU, World Bank, WHO, UNESCO, Greenpeace, WWF, National Geographic) have made efforts over the past decade to measure and understand the global issues, respectively to identify solutions that allow the reduction of global warming, environmental pollution and the use of non-renewable natural resources in different economic sectors (ec.europa.eu; www.un.org; www.nationalgeographic.org; www.worldbank.org; www.worldwildlife.org; www.greenpeace.org; www.en.unesco.org; www.who.int). The proposed directives mainly focused on the industrial producers in order to determine and assist them to gradually shift towards a more sustainable business model (Greenpeace, 2019a). In contrast, the directives targeted at the population (individual level of sustainability) were scarce, with the main intention to encourage the consumption of several products more environmentally friendly (eg: encouraging the purchase of electric and hybrid cars by offering subsidies and non-taxation – The Guardian, 2019a). Therefore, the directives have not insisted on raising awareness and education towards a sustainable consumption, although such a directive on "sustainable consumption" was included in the 2020 EU agenda "Sustainable consumption and production" (ec.europa.eu).

Throughout this period, the global industrial transition to a sustainable economy has proven to be a slow process, and encouraged by demand, producers continued to produce more, whilst consumers, stimulated by attractive prices, continued to purchase more. Consequently, the results of a transition to a sustainable global economy are delayed (eg: in 2018, the carbon dioxide emissions increased for the seventh consecutive year, whilst those from fossil fuels hit a high record in 2019 – The Guardian, 2019b; The New York Times, 2019b). In order to provide rapid, efficient and long-term effects, the dynamics between the pillars of sustainability – economic, environmental, social (da Costa Maynard et al., 2020) - needs to be supported by sustainability on an individual (personal) level. Therefore, actions for sustainable development must start at a macro-level with the adoption of new sustainable business models (Evans et al., 2017) or a more sustainable activity (White et al., 2019) by all industrial sectors and imply the mobilization of global, local and people actions (www.un.org). However, sustainability must extend to reach the micro-level or the individual efforts, materialised in education and behavioural actions such as consumption (Viswanathan et al., 2014; White et al., 2019). Thus, it can be concluded that in order to obtain efficient solutions to the existing global problems, under the conditions of the time limitation, it is necessary to adopt a more aggressive strategy and to seek sustainability through measures directed at three key actors: industry (producers), governments (decisional factors) and consumers (the population).

In response to the global environmental challenges, since 2012 the EU strategic vision focused on sustainability development, advancing Europe's transition to business models that incorporate the bioeconomy in all sectors that rely on biological resources, such as the textile and fashion industry (EU, 2018; Bell et al., 2018). In European Union's vision (2018), the bioeconomy implies the use of biomass (from plants, animals, forestry, organic bio-waste, bio-marine, gases and liquids from biomass) as a raw material in production and aims to results as: sustainable use of natural resources by focusing on renewable natural resources, modernization and substitution of non-renewable resources with products created by biotechnologies, a healthy ecosystem where greenhouse gases, plastic debris in water and land degradation are reduced, a circular economy where bio-waste and bio-residuals are reused in production. Currently there are numerous policies, strategies and programs all over the world, designed to increase the adoption and growth of bioeconomy (Hansen, 2016), yet the implementation of the so called sustainable business models in general and for bioeconomy in particular is less researched (Evans et al., 2017). Consequently, there is a gap in understanding how and if these business models can be implemented efficiently with respect of sustainability.

At basics, the purpose of marketing is to stimulate the consumption of goods and services in order to increase the sales and profits of the company (Băbuș et al., 2019). Nonetheless, in the last decades,

the individual consumption has spiralled out of control reaching to excessive consumption or over-consumption, and marketing policies played an important role (Viswanathan et al., 2014). Considering the actual global challenges, scholars in social science fields started to criticize this approach that leads to overconsumption and call for a change in marketing policies (Viswanathan et al., 2014), underlining that the marketing actions need to focus on shifting the consumer decision making towards sustainable choices, considering the “longer-term benefits to other people and the natural world” (White et al., 2019). In other words, a sustainable business model should not stop at production process/level, but has to integrate sustainable marketing policies (product strategies, price strategies, distribution strategies, communication strategies) and objectives (sales, profitability).

In view of the previous statements, the present paper aims at understanding if the transition to business models in bioeconomy is sustainable in case of fast-fashion industry, considering the actual context of over-consumerism and its connection to marketing policies. Can be underlined that fast-fashion industry feels the pressure of integrating sustainability (Dissanayake, 2019).

## 2. Fast-Fashion Industry – a long way to sustainability in the context of overconsumption

One of the main contributors to the aforementioned change in the global context is fashion (clothing, footwear and accessories) and textile industry. The doubling of the world population the past 50 years (UN, 2019a), affordable prices (Bick, Halsey and Ekenga, 2018), frequent sales promotion campaigns (Vuong and Nguyen, 2018), ease of online shopping and the influence of Social Media (Greenpeace, 2017a; House of Commons, 2019), had generated not only a general growth of consumption, but also encouraged the consumerism associated with individual overconsumption, in many sectors including fashion. The consumerism in the fashion sector is fueled by the dominant fast-fashion business model (which led to the phenomenon of the same name), characterized by the production of a larger number of articles in a shorter period of time as a result of “seasons” acceleration up to 52 “micro-seasons” per year (Webster, 2016), constant cost reduction (Ivan et al., 2019; Bick, Halsey and Ekenga, 2018; EPRS, 2019) and short product life cycle (Bhardwaj and Fairhurst, 2010). Therefore, the fast-fashion business model aims at providing a quick response to consumer demand with the use of a fast supply chain (Knošková and Garasová, 2019).

The fast-fashion industry is far from being sustainable, failing to implement changes at a pace that can counterbalance its negative social and environmental impact (Global Fashion Agenda, Boston Consulting Group and Sustainable Apparel Coalition, 2019). Due to consumerism (associated with overconsumption – Dissanayake, 2019; Ütebay et al., 2020; Niinimäki, 2011) and overproduction (Stepien, 2017) specific to fast-fashion phenomenon, the fashion and textile industry leaves a major footprint on the environment (Nagurney and Yu, 2013), becoming one of the largest polluters in the world (Anguelov, 2015; Dissanayake, 2019) and consumer of non-renewable and scarce natural resources (Ellen MacArthur Foundation, 2017). The affirmation is supported by several key aspects:

- The production in the apparel industry has doubled between 2000 - 2014 (Remy et al., 2016). Nowadays, 150 billion clothes are manufactured annually (Farra, 2016) for 7 billion people. As previously stated, most figures are due to fast-fashion business models. An eloquent example is Zara - the flashing brand of Inditex (one of the largest fashion company in the world) – which is able to create 12.000 designs per year, and most apparel items need around six weeks to be transposed from a sketch into a product on the shelf (Fast Company, 2019); this is materialised in an annual high volume of items and estimations show that the majority of 840 million garments produced by Inditex in 2012 were under Zara label (Vox, 2019). Furthermore, the global production in the industry is expected to increase with over 63% by 2030 (House of Commons, 2019).

- Individuals’ wardrobe includes a larger number of apparel items. This is associated with an a high rate of purchase, with Netherlands occupying the first position based on the number of fashion items bought in a year, and followed by United States (Shahbandeh, 2020). For example, on a per-capita level, in the United States the annual average purchase increased by 59.25% since three decades ago, from 40 garments/year in the 1990s to 63.7 garments/year in 2013 (American Apparel & Footwear Association, 2015). Evidence regarding the wardrobe size, shows that in UK, an individual owns in average 152 clothing items, out of which more than half are not being worn on regular basis (Express, 2016). Simultaneously with the increase of purchases, dropped the period of time a customer keeps the clothing items. According to Ellen MacArthur Foundation (2017) the number of

usages decreased by 36% compared to 15 years ago, while Remy et al. (2016) states that the average number of times a clothing item is worn before disposal has halved and is around 7-8. Nonetheless, different patterns can be identified between nations, as a higher disposal rate is specific mostly to developed and emerging countries, in contrast to countries with less purchase power and thus a higher rate of apparel utilisation (Ellen MacArthur Foundation, 2017). Transposed in time, this means that for more than 50% of the fast-fashion items the lifespan is under a year (McKinsey & Company, 2016). Yet, it must be emphasised that the disposal of fashion items after a short period of time is a consequence of overconsumption (behaviour that implies frequent purchase of more apparel than needed and substitution of clothes while they are functional, due to reasons such as social integration, status communication, personal desire to be fashionable, impulsive purchase); but is also a result of poor performance of the low quality garments made with cheap materials and labour (Yoon et al., 2020; Dissanayake, 2019; Niinimäki, 2011; Fletcher, 2012), which additionally reflects in the lack of attachment towards the products (Fletcher, 2012). Concluding, the fast-fashion industry consumes large amounts of non-renewable resources while having an environmental impact, for the purpose of producing goods that are mostly used for a short period of time (Ellen MacArthur Foundation, 2017).

- The industry focuses on overproduction or overstock (Stepien, 2017), which implies that a significant percentage of garments will never be sold (estimated 30% of dead stock by The Australian Circular fashion, 2018, or 25-40% of dead stock by Hausman and Thorbeck, 2010), while a significant amount will be sold with discount in own or third party outlets. At country level, can be mentioned the example of Japan, where the dead stock in 2018 counted 1.5 billion unsold apparel items, out of 2.9 billion items placed in the stores (Nikkei Asia, 2019). At company level, one can see the case of H&M, which in 2018 had a stock of unsold apparel worth 4.3 billion \$; the company also admitted that in the past burned excess clothing (The New York Times, 2018; GritDaily, 2019). The practice of destroying the non-sold stock was applied by other brands such as Walmart, Victoria's Secret, Urban Outfitters, Michael Kors, J.C. Penny, etc. (Vox, 2018), and became common in the luxury sector too (Forbes, 2019). An example in luxury fashion sector is Burberry which destroyed apparel worth 28.6 million £ in 2017 to protect the reputation and brand exclusivity (BBC News, 2018). In a similar manner, in 2016-2017 Richemont destroyed about 437 million £ worth of watches in order to avoid selling them at knockdown prices (The Guardian, 2018). This fast-fashion business model resulting in large amounts of unsold items or sold with discounts affects the profitability of the fashion retailers (Shen and Li, 2015), but the issues extend beyond the company. From the perspective of sustainability, even if the fast-fashion retailers try to dispose the dead stock in a manner that leads to a low impact on the environment (Dazed, 2018), there is still the matter of scarce resources that are consumed during the production process or destroyed throughout disposal, and also the environmental impact of production and distribution (sending products to stores and returning the dead stocks – see Shen and Li, 2015).

- Only 25% of the apparel is recycled, which means that the vast majority of the apparel items will eventually reach to the landfill or are incinerated (Greenpeace, 2017a). Less than 1% of the material used for production is recycled to create other clothes, leading to a waste of materials worth 100 billion \$/year (Ellen MacArthur Foundation, 2017). The recycling process in fast-fashion industry is limited by the very nature of the products, which are manufactured with low quality materials and/or blend fiber materials (Dissanayake, 2019).

- Fast-fashion industry uses non-renewable natural resources (Ellen MacArthur Foundation, 2017) and scarce natural resources. In the apparel manufacturing process prevails the usage of synthetic fibers made from fossil fuels (mainly polyester, acrylic, nylon) and natural fibers such as cellulosic and protein-based with cotton dominating; these are followed at a great distance by wood-based cellulose fibers and other natural fibers, including wool (Ütebay et al., 2020; Koszewska, 2018). Used to manufacture more than 60% of the fashion items, polyester (Rathinamoorthy, 2019) is made mainly from petroleum, a non-renewable natural resource which, according to the most recent estimations, will run out in about 60 years (BP, 2018). Although the natural fibers are renewable, their production depends on non-renewable resources. The entire production process of both synthetic and organic textile fibers, requires large amounts of chemicals and high use of thermal and electric energy mainly produced from non-renewable resources (Ütebay et al., 2020; Choudhury, 2017). The textile industry (includes fast-fashion production) consumes various resources to generate the needed energy,

yet it has a low efficiency in energy use (Choudhury, 2017). For example, China and India, responsible with most of the global of textiles production, are largely using coal-based energy for manufacturing (Niinimäki et al., 2020; Nature climate change, 2018). Instead, for Bangladesh, another large textile producer, the electricity generation relies mainly on natural gas, followed by furnace oil made from petroleum and coal (Hasan et al., 2019). Coal, natural gas and petroleum/oil are fossil fuels, thus non-renewable resource (Rabbani et al., 2017; EESI, s.d.). Fashion industry is also associated to deforestation and soil degradation. Thus, the production of natural textile fibres such as rayon, modal or viscose implies deforestation, with approximately 150 million trees being cut annually for this purpose (<https://canopyplanet.org>). Cotton cultivation covers a large land surface - which is by nature a limited resource - and severely degrades the soil quality (WWF, s.d.; Tobler-Rohr, 2011; Chen and Burns, 2006). If keeping the existing business models, the land used for natural fibres crops is projected to extend by 35% (Global Fashion Agenda and BCG, 2018). The production of animal textile fibres such as wool, mohair, angora, cashmere, camel or alpaca is based on livestock seen as a major stressor on various ecosystems since it needs grazing land and cropland for production of feed-crops (often involving deforestation and soil erosion) and consumes freshwater while polluting water and leading to greenhouse gas emission (FAO, 2006). Among main consequences of deforestation can be mentioned destruction of wildlife habitats and threat to biodiversity, soil erosion and desertification, water-cycle disruption and flooding, loss of carbon storage (FAO, 2018). One can see as an example the consequences of the extension of palm oil and sugarcane plantation (Vijay et al., 2016; Leal et al., 2017). At the same time, the fashion industry is a big consumer of freshwater, totalling 79 trillion litres in 2015 (Niinimäki et al., 2020); although freshwater is renewable, it is a scarce (more than 2 billion people live in regions “experiencing high water stress”, whilst almost double confront with “severe water scarcity during at least one month/year” – United Nations UNWater, s.d.) and increasingly fragile resource and acts as a non-renewable resource if the consumption exceeds its ability of replenishing the supplies (National Geographic, 2019; White, 2013). In the case of organic fibers, the large water usage starts with the irrigation process specific to plant/crop cultivation (Rathinamoorthy, 2019; Rana et al., 2014), comprising around 3% of global irrigation water use (Niinimäki et al., 2020). On the whole, the textile manufacturing process is water intensive, as the ratio of water to textile production is 80-150 liters to one kilogram of fibers (Ütebay et al., 2020) or even more (Suruj-Zaman et al., 2021). For instance, up to 10-20.000 liters of water are required to produce a kilogram of cotton fibers, a shirt or a pair of jeans (WRAP, 2017). Long distance transportation of apparel by container boats and air cargo (The guardian, 2020; Niinimäki et al., 2020; Choudhury, 2017), from the manufacturing plants to stores located all over the world, increases the consumption of non-renewable fuel (Ütebay et al., 2020) made of petroleum and natural gas (Fridell, 2019; Sigh and Sharma, 2015). Furthermore, should be mentioned the packaging, since the tendency in the fast-fashion is to swap plastic shopping bags with paper bags (eg. Inditex, H&M Group – Just in style, 2020); the production of paper bags usually is associated to deforestation.

- Although the apparel items are usually designed in United States or UK (The Guardian, 2020), the manufacturing takes place in lower-cost countries mainly from Asia (Niinimäki and Hassi, 2011), favouring the intensification of the environmental impact due to more permissive regulations regarding pollution and fabric waste caused by inadequate communication of requirements (The Guardian, 2020). As a consequence, around 20% of the global industrial water pollutions comes from the textile treatment and dyeing and bleaching processes with hazardous chemicals (Ellen MacArthur Foundation, 2017), polluting approximately 200 tonnes of fresh water for one tone of material (Nagurney and Yu, 2013) which eventually contaminate the seas and spread around the globe. In many cases, the untreated wastewaters containing even heavy metals with a high degree of toxicity such as lead, mercury, arsenic, cadmium are dumped into rivers and waterways, damaging both the aquatic life and humans’ health (Tchounwou et al., 2012; Kant, 2012). The textile industry in general is a large chemicals’ consumer, using around 8000 synthetic chemicals in different steps of the manufacturing process (Eryuruk, 2012; Kant, 2012), materialised in 43 million tons of chemicals at global level (Ütebay et al., 2020). Even the production of natural textile fibers often requires the use of chemicals as fertilizers, pesticides and insecticides (Rana et al., 2014; Chen and Burns, 2006), which ultimately may contaminate the water and the soil; for example, the production of cotton involves substantial use of fertilizers and pesticides (Suruj-Zaman et al., 2021; Chen and Burns, 2006; WWF, s.d.) and 25% of world’s insecticides (Eryuruk, 2012).

- The total solid waste of fashion manufacturing rises to 92 million tonnes/year (BCG, 2015 cited in EPRS, 2019), obtained by consuming 98 million tonnes/years of non-renewable natural resources (Rathinamoorthy, 2019). Although in the past decade, the fast-fashion industry started to incorporate more “eco-friendly materials” and to move towards a more “ethical production” (Niinimäki and Hassi, 2011), these approaches are not solutions to face the major sustainability problems of increasing usage of non-renewable natural resources or environmental impact, caused by global overconsumption.

- In addition, the most used fiber – polyester - requires up to 200 years to decompose, since it reaches in the environment (Forbes, 2015). By using such synthetic materials, the industry contributes to water pollution with more than half of a million of tonnes/year of plastic microfibers (Rathinamoorthy, 2019). In other words, fast-fashion industry is not only an excessive water user, but also a significant water polluter. At the end of their life cycle, when reaching the landfill, garments continue to pollute the environment. Organic fibers (derived naturally from animals and plants) are biodegradable so they don't contribute to the microplastic pollution; yet, their decompose process in the landfill generates methane - a greenhouse gas with more damaging effects than carbon dioxide (see Ellen MacArthur Foundation, 2017; Planet Aid, 2018). On the other hand, synthetic fibers are mostly non-biodegradable, leading to a high amount of long term plastic waste in landfill which will contribute to microplastic pollution in field and aquatic environments (see Henry et al., 2019; Koszewska, 2018). Beyond the aforementioned problems is the landfill contamination. Since the production of apparel (no matter if made from organic or synthetic fibers) requires multiple chemical usage, when reaching the landfill, will release toxic chemicals contaminating groundwater, soils and even air (Koszewska, 2018; Eryuruk, 2012; Planet Aid, 2018; Ellen MacArthur Foundation, 2017).

- The fashion industry has a substantial carbon footprint, producing in 2018 around 2.1 billion metric tons of greenhouse gas emissions, the equivalent of 4% of global total (McKinsey & Company, 2020). Estimations show an increase with 50% of the fashion industry's greenhouse gas emissions by 2030 if no abatement actions are taken (Worldbank, 2019; McKinsey & Company, 2020). This is a consequence of high energy usage throughout the production process (Niinimäki et al., 2020), various gas emissions during production process (Ütebay et al., 2020; Rana et al., 2014; Ellen MacArthur Foundation, 2017), transportation (BBC News, 2020), retail (BBC News, 2020), unsold stock and waste incineration (Choudhury, 2017). The transportation predominantly done by ship or plane (Choudhury, 2017) releases carbon dioxide into atmosphere; it includes the movement of fibres, materials and products in different manufacturing stages between locations/countries (Niinimäki et al., 2020), shipment of final garments from Asia to stores all over the worlds (Niinimäki and Hassi, 2011), transportation of recycled items and deadstocks. As previously stated, carbon dioxide emissions and other greenhouse gases are associated to climate warming (IPCC, 2018; Harris, Roach and Codur, 2017; Kweku et al., 2018).

Considering the previous statements, it can be concluded that the fast-fashion industry is far from reaching sustainability, if keeping the same business models or maintaining the slow pace of new business models adoption. The effects of the changes implemented by some important players (eg. Inditex, H&M) seem insignificant at the global level of the industry, which appears to be moving further away from the concept of sustainability. It is becoming clearer that global significant effects in the sustainability direction can be obtained only if the vast majority of fast-fashion players adopt completely sustainable business models, and not only some sustainable actions (eg. such as paper bags for consumers). So, each business needs to be completely and rapidly redesigned to use less non-renewable and scarce resources and to reduce the environmental impact. Yet, considering the resources' scarcity strident issue, the industry may not be able to meet the future needs of customers if their pattern of consumption remains unchanged and based on overconsumption (McKinsey & Company, 2020; Niinimäki et al., 2020). Even the industry' efforts to improve sustainability appear to be outpaced by overconsumption at the individual level and increasing global consumption (Niinimäki et al., 2020, p. 196) as a result of world population growth.

### 3. Assessing possible issues of bioeconomy implementation in fast-fashion industry

For sectors as fashion, European Union encourages the adoption of innovative business models that incorporate bioeconomy as one of the prime means to obtain worldwide sustainability and respond to the environmental challenges (EU, 2018; Bell et al., 2018). Although the global transition of industries to bioeconomy is an ambitious plan, one question rises in case of fast-fashion industry: will this transition be sustainable (imperative condition for success – Bell et al., 2018) and implemented in a timely manner to correct the pressures put by environment, climate change, rapid depletion of natural resources and population growth, while maintaining same consumption patterns? The premises leading to this question results from the following:

- A sustainable bioeconomy involves complex challenges because the implementation requires: modernization, bio-products innovation, bio-technology creation, new business models, skills development and education of all involved parties (UE, 2018; OECD, 2018) and a high level of coordination between policies in various fields at regional, national and even global level (Bell et al., 2018). One can see the case of energy sector, which started the transition to bio-energy two decades ago, thus proving that is a long term process (OECD, 2018). The process is still ongoing, with fossil fuels (coal, oil and natural gas) covering 80% of the global energy consumption in 2017, whilst the renewable energy (with 70% represented by bio-energy) accounted for 17.7% of the total (World Bioenergy Association, 2019). Even in the transport sector, the adoption of biomass-based fuels to replace fossil fuels is a slow process, the first representing 3% of the total fuels used in the sector in 2017 (World Bioenergy Association, 2019). Consequently, throughout the decades-long period required for the transition to bioeconomy in fast-fashion while using the existing business models, the climate change can become critical (UN, 2018), the environment more polluted and the non-renewable natural resources even scarcer, thus endangering planet's ecosystems and future generations' wellbeing (hence not sustainable). As an edifying example, can be reiterated the fact that the deposits of oil/petroleum and natural gases are estimated to run out in several decades (BP, 2018).

- Currently, 29% (weight perspective) of the apparel and textile industry uses natural fibers obtained from biomass such as cotton, linen, flax, cellulose, coir, bamboo, jute, banana, wool, natural leather, natural silk, natural fur and hair, etc. (Ütebay et al., 2020). Many of the aforementioned plant and animal based fibers laid the foundations of the fashion industry (The Harvard Gazette, 2009; Britannica, s.d), thus a transit to bioeconomy involves an incursion to the origins; certainly, the development of novel types of textile fibers (eg. seaweed fibres, milk fibres etc.) and the use of innovative technologies are opening new horizons for the industry (Thangavelu and Subramani, 2016; Eco World, 2020). Yet, some innovative bio-fibers are, at the moment, extremely limited from the quantity point of view and thus very expensive (eg. the price for coat made from lotus fibre costs 5600\$ - Ivan et al., 2009); while for others (eg. algae fibre) the existing technology does not allow diversification, which is essential expectation of apparel consumers. Also, the expansion of plantations for industrial biomass crops required in the transition to bioeconomy, is likely to attract potential conflicts with the agricultural sector, as both will have to provide enough biomass for the global population which is estimated to increase by 35% until 2070 (UN, 2019b). The priority is undoubtedly the provision of food for the population and forecasts show that food production must increase with 50-70% by 2050 (FAO, 2009 cited in OECD, 2018). As already pointed out, extending the production of animal biomass textiles calls for the amplification of livestock activities which also require extended grazing land and cropland for production of feed-crops (FAO, 2006; Chen and Burns, 2006). Furthermore, the expansion of plantations for textile plant fibres might cause over-exploitation of land and erosion, and alongside the alternative wood-based fibres, lead to outcomes such as deforestation, habitat destruction and biodiversity loss, desertification, water-cycle disruption, flooding, loss of carbon storage (FAO, 2018). In other words, the opposite of EU agenda.

- The fast-fashion industry is already a big consumer of freshwater (Niinimäki et al., 2020) and a future transition to bioeconomy doesn't seem to solve the problem. Both cultivation and processing of natural fibres from plants (especially cotton), as well as animal breeding and processing of animal fibres, will require the use of large amounts of clean water (OECD, 2018). Thus, other conflict scenarios can emerge. Along land, the production of biomass for textile fibres will compete with food

production (agriculture and livestock) for clean water. This in the conditions in which, half of world's population already lives in areas with stressed water condition, encountering difficulties in ensuring the daily needs of freshwater and/or to practice subsistence agriculture (United Nations UNWater, s.d.). The numbers are projected to increase in the following decade, and due to drought and desertification intensification, the water deficit is estimated to cause the relocation of 24-700 million people (United Nations, 2009). In addition, the misuse of this resource necessary for life, through overconsumption, can have disastrous ecological consequences – one can see the severe impact of cotton irrigation on major ecosystems such as the Areal Sea, Indus Delta or Murray Darling River (White, 2013; WWF, s.d). A more recent solution emerged to the problem of freshwater scarcity, namely the desalinisation of saline water (which is an abundant resource); yet, currently the technology is expensive and energy-intensive (AzCentral, 2019; The New York Times, 2019a) and is able to solve the issue only in the water-stressed areas with access to saline water. The production of biomass feedstock supply and the existing technologies have already raised criticism in the bio-energy sector, although it has two decades of experience in bioeconomy implementation; various scholars underline that the large scale production of biomass can intensify issues associated to land use, competition with food production and threat to biodiversity (Bauer et al., 2020). This supports the concern that, while maintaining excessive consumption, bioeconomy may not be the wonder-solution for fashion industry and other industries, as it reduces the pressure on some non-renewable resources (such as those based on fossil fuel) during the production stages, but it increases the pressure on other natural scarce resources vital to human and nature survival (freshwater, land, impact on biodiversity). Even in the optimist scenario that is based on apparel consumption reduction, the current business models relying on bioeconomy (technologies and processes, textiles and materials, resources depletion) may not be able to answer to the environmental challenges.

- Fast-fashion industry is already a major environmental polluter, with impact on water, soil and air. The transition to bioeconomy can reduce the usage of non-biodegradable synthetic fibers (mainly polyester) and thus less plastic will be released in the environment when products reach the end of life. However, it is expected a high usage of chemicals (eg. fertilizers, insecticide and pesticide for crop production, chemicals needed to process the natural fibres - Rana et al., 2014; Suruj-Zaman et al., 2021; Chowdhury et al., 2015) expected to lead to chemical contamination by waste discharging in rivers' affluents and landfill (Koszewska, 2018; Eryuruk, 2012; Ellen MacArthur Foundation, 2017; Chowdhury et al., 2015). Energy consumption (mainly from fossil fuel - Niinimäki et al., 2020; Hasan et al., 2019) is expected to be lower for natural fibers processing than in case of synthetic fibers (eg. cotton needs 40% less energy than polyester production – see Rana et al, 2014); yet, the overall energy use of the industry will maintain a high level as the apparel worldwide consumption is projected to grow (House of Commons, 2019). Even with the transit to bioeconomy, the emissions of greenhouse gas will continue to be a significant issue for fast-fashion industry, because: a) some natural fibres (eg. cotton) can lead to higher emissions of CO<sub>2</sub> and SO<sub>2</sub> than polyester (see Rana et al., 2014), b) livestock raised for animal fibre production emit greenhouse gases such as methane and nitrous oxide which have a higher effect on global warming than carbon dioxide (Grossi et al., 2018), c) transportation in the fast-fashion industry is responsible for a high amount of greenhouse gas emissions (BBC News, 2020) and is expected to intensify even with the progress to bioeconomy; this is on one hand as a direct consequence of growth in clothing-production demand while maintaining the present consumption patterns (House of Commons, 2019), and on the other hand because many current business models based on bioeconomy focus on the nature of fibres for production and don't reconsider changing the overproduction and deadstock management, or the logistics that involve vertical disintegration, remote production and division of manufacturing process between locations/countries (Milewski and Milewska, 2018; Niinimäki et al., 2020).

- There are no universally accepted instruments and indicators to measure biomass sustainability (OECD, 2018). Although the European Union (European Commission, 2020b) reiterated the decision to implement the bioeconomy in Europe, it also emphasized that it can cause agricultural damage and intensive deforestation and thus monitoring systems are imperative in the respective areas.

Synthesizing, the transition to bioeconomy within the current fashion business models is a slow process and can intensify some critical issues that humanity is already facing or are projected to occur in the next decades. Moreover, all existing alternative fashion business models for sustainability are



likely to be overshadowed by the consumerism associated with individual overconsumption, so the industry needs to redefine and develop new business models (Niinimäki et al., 2020; Gazzola et al., 2020). More and more scholars and global organisms begin to underline that a simple transition to business models that integrate sustainable elements in the production stages (eg. type of materials used, processes, energy source), is not enough to respond to the global environmental issues and solve the dependence on non-renewable and scarce natural resources (Michell and Henry, 2019; Niinimäki et al., 2020; Gazzola et al., 2020; McKinsey & Company, 2020; ec.europa.eu; House of Commons, 2019). Consequently, to achieve sustainability, the fast-fashion industry needs to consider at least:

- to use mixt fashion business models that apply various methods, not only bioeconomy and thus to reduce the pressure put on some natural resources. Possible alternatives that already exist in incipient stages, but that need a redesign to be more sustainable, efficient and suitable to expand on a larger scale: recycling both natural and synthetic materials and fibres (M-Grain GmHb, 2020; Niinimäki et al., 2020), upcycle apparel made from pre-consumed or post-consumed textile waste (Paras and Curteza, 2018), redesigning apparel deadstock and reselling (EuroNews, 2020), reselling in outlets or under different brand name (one can see the case of Japanese Rename brand – Nikkei Asia, 2019), custom clothing production and personalization (Fletcher, 2012), second hand clothing selling (Herjanto et al., 2016), clothing rental, sharing or swapping systems (Niinimäki et al., 2020; McKinsey & Company, 2020; Fletcher, 2012), etc. Also, the ideas of circular economy and circular bioeconomy start to get attention (European Commission, 2020a; Niinimäki et al., 2020).

- to significantly invest in research in bioeconomy field (the next revolution in production – OECD, 2018) and recycled fibres field, as at the moment they are the most promising alternatives to be implemented on a global scale: innovating new fibres and technologies that consume low amounts of chemicals, water, land surface, energy and have a reduced carbon footprint.

- promoting fashion business models that adopt sustainability at all levels, hence with a holistic approach: eg. to significantly improve sustainability for transportation, is necessary to incorporate transportation methods based on sustainable fuels, but also to reconsider the logistics management in order to diminish the fuel consumption and limit the transport adopting actions such as reducing the vertical disintegration, shortening the distance between manufacturing plants and final customers, minimizing the movement of overstocks and waste, etc.

- to support the strengthening of legislation, transparency and control throughout the entire supply chain, in order to reduce industrial pollution. Due to vertical disintegration, many companies have difficulties in tracing where their products are cut and sewn, making difficult to estimate their real negative impact on the environment (House of Commons, 2019).

- educating and reshaping consumer behaviour towards a sustainable consumption (White et al., 2019; McKinsey & Company, 2020), although this implies a degrowth of the global fashion industry (Niinimäki et al., 2020; Greenpeace, 2017b). Since visible sustainable results can be obtained only with a collective participation (Bamberg et al., 2015), a radical change in consumers' mindset towards the adoption of individual sustainability can be rather possible if major organisms (governments, large global organizations and NGO's) get involved and promote educational programs. Nonetheless, through marketing decisions, fast-fashion companies can reshape consumers' behaviour to reduce overconsumption and encourage sustainable choices. In addition, "marketing and sustainability are inextricably intertwined" (White et al., 2019; Viswanathan et al., 2014), thus the fast-fashion business models aiming to promote sustainability need to incorporate sustainable measures in their marketing objectives, strategies and actions.

#### **4. Reshaping fast-fashion business models to diminish overconsumption and encourage sustainable choices – premises for future marketing research**

As a response to the actual global challenges and the deficient transit to sustainability, criticism over overconsumption has emerged, calling for a shift in companies' overall marketing strategy, from focusing on increasing sales and profits to providing longer-term benefits to society (White et al., 2019; Viswanathan et al., 2014; Thorisdottir and Johannsdottir, 2019). As discussed, this seems to be a mandatory requirement to increase the probability for a successful implementation of sustainable measures such as the transit to bioeconomy.

Therefore, in order to assist the sustainability deployment on an individual (personal) level and reshape the overconsumption behaviour and encourage sustainable choices, fast-fashion business models must change and integrate sustainable marketing strategies that cover the entire marketing mix (product, price, place, promotion). This involves redesigning the fast-fashion industry, taking actions and decisions that are quite the opposite of those currently implemented, such as:

- limiting the consumption and reducing overconsumption by: changing the marketing objectives from centring on increasing sales and profits, reducing the frequency of purchase (eg. practicing higher prices, fewer discounts and less often, a reduced number of collections in a year), limiting the impulse purchase by controlling its drivers, smaller-size stocks which can induce in consumer's mind the idea of product scarcity but also diminish the dead stock size, etc.
- increasing products' lifespan and modifying the disposal rate, by borrowing good practice from fashion luxury industry, such as: delivering higher-quality and more durable even collectible products, designing products with styles that match previous collections, designing collections with products predominantly following a more classical approach and a small percentage based on volatile trends, etc.
- communication actions that focus on promoting the idea of value and sustainability and on increasing customer's attachment towards products
- reducing the over packaging and using recycled material for packaging at all levels
- limiting the number of physical stores and moving to online, in order to reduce the environmental pressure from retail, etc.

Critics may say that customers can be reluctant to such radical change. Nonetheless, the current Covid-19 pandemic provides an actual and recent context in which people worldwide chose to significantly reduce the purchase of apparel. As a consequence, the forecasts for the fashion industry indicate a sales dropping by 30% in 2020 (BCG, 2020), corresponding to a substantial change in consumption behaviour.

Nonetheless, since the issues regarding the sustainability in fast-fashion industry, the implications of fast-fashion's transit to bioeconomy, and the role of overconsumption in the implementation of sustainability in fast-fashion are scarcely approached in the literature, several premises for future research can emerge.

First of all, although the fast-fashion industry is well researched, there is a limited number of studies aiming to understand consumer's perspective on consumption, sustainability and industry's impact, the overconsumption and its mechanism (eg: Alimen, 2014; Sari and Hanifah, 2018; Vuong and Nguyen, 2018; Greenpeace, 2017a). Also, some reports and articles discuss only in a superficial way the role of apparel manufacturers in stimulating overconsumption (Ivan et al., 2019; Bick, Halsey and Ekenga, 2018; EPRS, 2019). Thus, future studies can focus on:

- Defining overconsumption in fast-fashion, measuring the level of overconsumption, establishing patterns of overconsumption (based on segments of customers, products categories, etc), proposing measurement tools and identifying the drivers behind overconsumption and possible inhibitors (from apparel company, customer and society perspectives), level of awareness, identification of triggers that can decrease overconsumption
- Measuring the real impact of overconsumption in fast-fashion industry on sustainability and environmental issues. The present paper just brought in attention some issues, yet in-depth analysis is necessary.
- Identification of means to provide value in fast-fashion industry, and means to increase customer attachment to garment.
- Consumer's attitude towards apparel disposal, drivers for apparel disposal, identification of disposal methods and behaviour, identification of ways to reduce the disposal and increase the life span of clothing.
- Identification of exact marketing strategies that can be applied in fast-fashion business models to limit the consumption and reduce overconsumption. The previous mentioned actions can be considered as a starting point for study.
- Identification of marketing communication themes and influencers (in the sense of message transmitters) to which consumers may be sensitive, in order to reduce overconsumption and purchase products with a higher value. To educate the consumer, the right messages should be used in the

marketing communication actions. Even when people are not open to change their purchase behaviour due to the awareness of sustainability's importance, other triggers can be used in communication. For example, Dilip Kapur mentions that, his customers choose to purchase the Hidesign bags because they are healthier (through the production process), and not because they are durable, resistant, natural and sustainable (Ivan et al., 2009). Another example can be the association made, by some customers, between "greener" products and status gain (Griskevicius et al., 2010 cited in Ivan et al., 2009).

Secondly, the concept of sustainability in fast-fashion industry is less approached, some studies being related to supply chain (Shen, 2014; Popescu, 2016), integration in business models (Thorisdottir and Johannsdottir, 2019) or brief insides in the theme (Arrigo, 2015). Future research should focus on identifying and analyzing possible sustainable business models and their actual level of sustainability, starting with bioeconomy, but extending to custom clothing production, second hand clothing selling, apparel sharing, rental or swapping. For example, reusing material waste from other fashion companies as a new business model, can't be an alternative production solution on long run; given that fashion industry uses robots to cut materials in order to optimize their production process, the material waste from the cutting process is decreasing. Also, the use of recycled materials (eg. plastic for Nike shoes) contributes only temporary to solving the plastic pollution problem, since after the usage the plastic goes back on the landfill. Yet, an in-depth look at fashion luxury industry which made more steps towards the adoption of sustainability (Arrigo, 2015; Campos Franco et al., 2019), may provide solutions that can be adapted for fast-fashion industry. Luxury fashion promotes high-quality, durability and timelessness, therefore is able to offer high value and create product and brand attachment, satisfying a large variety of needs ranging from functional to psychological (Ciornea et al., 2011a; Ciornea et al., 2011b; Ciornea, 2013).

Thirdly, research among consumers of bio-products is limited. Most studies focus on bio-energy (eg. Radics et al., 2016; Garcia-Maroto et al., 2015; Sopha and Klockner, 2017; Sopha et al., 2011) and bio-fuel (eg. Radics et al., 2016; Van de Velde et al., 2011; Savvanidou et al., 2010); here can be included also the study of Sijtsema et al. (2016) on perceptions towards products based on bio-mass in general. In addition, Gam (2011) underlined the importance of conducting more studies in order to understand the reason behind purchase of environmentally friendly products in fashion domain. Therefore, future studies could explore the aspects related to actual and potential consumer behaviour towards bioeconomy implementation in fast-fashion (eg. attitudes towards bio-mass existing and innovative materials; attitudes and importance of fewer chemicals use in the production process of fibres and materials; etc.).

Nonetheless, the preceding premises should be seen as the beginning in research in this domain.

## 5. Conclusions

The present study aimed at identifying if the transition of fast-fashion industry to business models that focus on bioeconomy is sustainable in the actual context of overconsumption, and to establish premises for future research for marketers.

Analysis shows that fast-fashion industry is far from reaching sustainability, and the transit to bioeconomy, considering the current business models, not only does not lead to sustainability but seems to deepen the actual problems regarding non-renewable and scarce natural resource depletion and pollution. Since the industry's effort to improve sustainability appears to be outpaced by overconsumption at the individual level, in order to create a sustainable bioeconomic system in fast-fashion industry, it is essential to discourage overconsumption and reorient the consumers towards value. In order to make customers switch from overconsumption to individual sustainability, major organisms (governments, large global organizations and NGO's) need to implement educational programs, whilst fast-fashion companies need to incorporate sustainable measures in their marketing objectives, strategies and actions. Therefore, the fast-fashion industry needs to redefine and develop new business models to use less important natural resources and to reduce the environmental impact, while reducing overconsumption.

Based on the outcomes, several premises for future research were proposed, in the direction of: a) measuring overconsumption's dimension in fast-fashion industry, its impact on sustainability implementation and environment, b) assessing sustainability in fast-fashion and bioeconomy models as sustainable solutions, c) understanding the consumer behaviour towards bio-products in fast-

fashion industry. Although the premises were developed from a marketing perspective, in order to find complete answers to this complex problem, interdisciplinary and transdisciplinary research is needed too. The analysis of bioeconomy's sustainability in fast-fashion industry in the actual context of overconsumption is an interdisciplinary topic, which involves data collection from various fields such as: economy (analysis of business strategies and consumer behaviour which are marketing prerogatives), environment-ecology (analysis of the effects on the environment, pollution level, consumption of non-renewable and scarce natural resources, global warming), sociology and psychology (importance of clothing use – conspicuous behaviour, social affiliation and social position display in various cultures, the phenomenon of “shopping addiction”, etc.), biology and biochemistry (sustainability evaluation for alternative bio-products and biotechnologies discovered, sustainability of agricultural expansion and animal husbandry), demography (analysis of the effects of global population growth) and even political (evaluation of strategies with purpose of solving environmental challenges, advanced by governments and world organizations, at regional, national and international level).

The main contribution of the paper is in the academic field, because it reveals a big gap in the research of issues related to the sustainability of bioeconomy in fast-fashion and the sustainability of fast-fashion in general. Yet, the findings should be a wake-up call for global organisms (governments, large global organizations) that push bioeconomy as a “saving” solution for solving the major issues related to global environment and see it as the next revolution in production (OECD, 2018). The topic is not only current, but the answer to the question addressed may have implications on how economic strategies should be approached in order to provide viable solutions to the existing global problems.

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