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TECHNOLOGIES TO PROMOTE SUSTAINABLE FASHION TEXTILE IN SUPPORT OF CANADA'S 2030 CLIMATE CHANGE GOALS

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Abstract

With Canada striving to cut its Greenhouse gas emission by 50 percent and bring its waste to zero by 2030 as part of their attempts to meet requirements of the Paris Climate Change Agreement, it is important that Canada addresses all areas of GHG emissions in a strategic manner rather than dealing with the issues on ad hoc basis. Canadian government recently published their GHG emission reduction plan assessing the contribution of each sector towards the annual national greenhouse gas emission in order to assess the gravity of the problem within each sector. The government's lackluster attitude was evident as it failed to recognize the grave dangers of the textile industry in reference to the threats it poses to the environment in general and climate change in particular therefore, not pinpointing it as a separate sector and rather clubbing it under 'waste and others'. These hazards include waste contamination, water wastage, greenhouse gas emissions, river pollution through acidification and addition of microfibers from textile washing etc. This study will particularly focus on two issues. Firstly, the issues of textile waste emanating from excessive production and consumer disposal ending up in landfills, which ultimately disintegrates into GHGs. Secondly, there is a textile washing problem that results in release of millions of microfibers that are the pollutants in the Canadian rivers which not only eat up the oxygen in the rivers but also forms carbon dioxide that affects the ozone layer leading to global warming and climate change. This conceptual paper will review the technologies being used to curb these environmental detriments from the textile industry. Consequently, it will recommend further steps for identified stakeholders to curb the environmental impact emanating from the textile industry. The research will prove beneficial for industry stakeholders including businesses; who can use the consumer insights to build more inclusive business strategies, Government; who can use this to understand the gravity of textile sustainability and incorporate the same in their climate change national plans and Academics; who can use this as a base for further research.

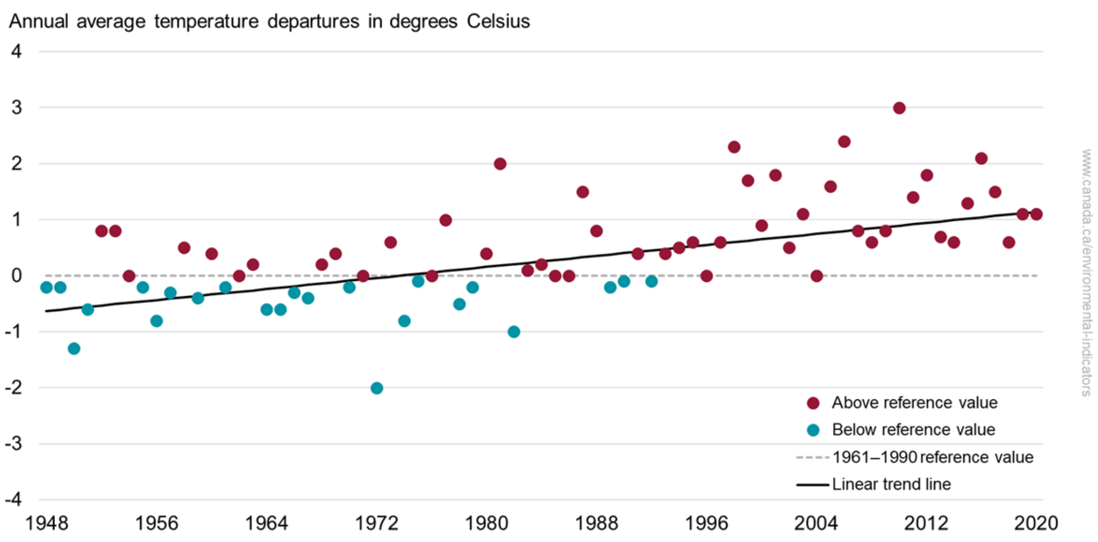
Keywords: *Climate Change, Canada, Technologies, Textile Industry, Environmental Sustainability*

1.0 Introduction

Climate change, also known as global warming, is the increase in the earth temperature (Capstick & Whitmarsh, 2018). This is a phenomena caused by the Greenhouse gases which trap the sunlight, which in normality is supposed to be reflected off the surface of the earth back to the atmosphere (Taylor, 1991). This absorbed solar energy is emitted in different directions (Jogdand, 2020). This is primarily the reason as to why the increase in greenhouse emissions leads to increased temperatures in the earth's surface as well as the lower atmosphere (Lineman, Do, Kim, & Joo, 2015). Many studies have shown that the increase in the earth's temperature has affected and is further predicted to affecting almost all economic sectors hampering the global welfare in terms of its socio-economic impact. This includes labor force productivity (Orlov et al., 2020), fisheries (Gefroy & Wedekind, 2020), Vegetation (Chen et al, 2021), Rice (Liu et al, 2020), Agriculture (Nishimori, 2020) etc.

As per Ray et al. (2019), climate change has adversely affected the global food production in terms of crop yields across Europe, South Africa and Australia whereas results in Asia, Southern and Northern America are mixed. Similarly, its diverse implications were assessed in other studies as well which include its impact on the energy optimization on building designs in Australia (Bamdad et al., 2021), decrease in coffee production on plantations in climate affected areas across Americas (Pham et al., 2019), highly climatically stressed natural vegetation in the future with three major ecoregions in California, which are critical to human welfare, being 50 percent affected (Thorne et al., 2017) and extinction of many plants and animals as many would not be able to adapt to the rapidly changing habitat (Brambilla et al., 2018). In addition to these outcomes, the existing literature on climate change shows that it has stressed out the livestock production systems (Rust, 2019) and negatively impacted soil formation, fertility and development (Pareek, 2017). Moreover, it is expected that around 100 million people across the South and East Asian region will be impacted by the water stress caused by climate change (Gao et al., 2018). Similarly, Climate change is causing a multitude of issues in Canada as well as per the recent report on climate change across Canada published by Government of Canada. It shows that temperatures are changing across Canada at double the global rate with Northern Canada being the most affected. Since 1948, there has been an increase of 1.7 °C across Canada to 2.3 °**C** in the northern areas (Bush et al, 2019).

Figure 1: Changes in temperature across Canada between 1948 and 2020



Changes in rainfall and snowfall patterns are predicted in the future leading to increased threat of flooding, droughts and soil moisture deficit. For example, just in the Edward Islands, there has been an increase in temperatures by 1.14 °C in the east and 0.75 °C in the west between 1970-2020, annual precipitation increased by 6 percent on average leading to 20 percent snowfall reduction and an increase in rainfall was ranged 350-470 mm/year from 1991-2020(Abbas, Farooque & Afzaal, 2020). These changes have had a significant negative impact on the water resources and rainfed agriculture, the extent is yet to be investigated in numeric value (Bhatti et al., 2021).

Change in salt levels leading to acidification of Canadian rivers is already seen posing a threat to the marine ecosystems (Zhang, Kwai & Williams, 2020). Amongst other issues in the marine ecosystem, the most prominent ones include changes in organism physiology and population dynamics along with modified communities and ecosystems (Doney, Bush, Colley & Kroeker, 2020). For example, in British Columbia, the supply of Pacific Salmon, Elasmobranchs, invertebrates and rockfishes are most adversely affected due to climate change, which has started to impact the food security and livelihoods of British Columbians (Alvarez, Shumaila, Billon & Cheung, 2019).

Lastly, Climate change is expected to affect Canada's national security due to resource scarcity, natural disasters and climate-induced migration (Brunschot, 2020). Migrations patterns are predicted to maximize due to weather changes therefore, placing more pressure on various provinces of Canada who will experience high demand-supply problem in the coming future (Conger & Fetzek, 2021).Due to these grave implications of global warming, it has become a major cause of global concern, which has further fermented environmental sustainability as a main priority for the world. In a survey conducted by IPSOS (2019), people across 27 countries including U.S., UK, Canada, China, India etc. were asked about the issues that worried them the most and the results showed that global warming, which used to be an issue ranked at 15th out of the total 17 listed issues in the world had jumped to 9th (IPSOS Public Affairs, 2019).

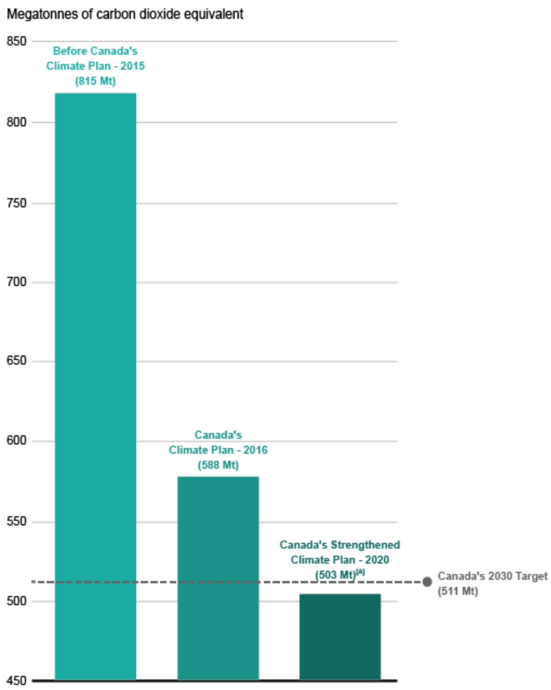
In addition to that, climate change is considered to be the number 1 issue in Canada by the Canadians (Wood, 2019). 7,142 Canadians die from Greenhouse Gas emitting activities annually. A study released by the Canadian Nuclear Association, conducted by Abacus Data in 2020, showed that 91 percent Canadians believed climate change to be a serious issue, 88 percent Canadians were directly impacted by Climate change and although, 89 percent Canadians believed in the importance of meeting the 2030 emission reduction goals but only 17 percent were confident that Canada would actually achieve it (Abacus Data, 2020). Figure 2 appended below shows the economic sector wise greenhouse gas emissions in Canada from 2005 to 2019.

Figure 2: Economic Sector Wise GHG Emissions (Government of Canada, 2020)

Economic sector	2005	2014	2015	2016	2017	2018	2019
National GHG Total	**739**	**723**	**723**	**707**	**716**	**728**	**730**
Oil and Gas	160	190	190	181	183	191	191
Electricity	118	76	79	74	72	62	61
Transport	160	171	172	174	179	184	186
Heavy Industry[a]	87	79	77	76	75	77	77
Buildings	84	85	83	81	86	90	91
Agriculture[b]	72	71	71	72	71	73	73
Waste and Others[c]	57	50	50	50	50	51	51

A collective resolve to deal with climate change was exhibited at a global climate change virtual summit held in 2021 whereby the developed countries including US, UK, China, Russia, Germany, Canada and many others termed Greenhouse gases such as carbon dioxide and methane as the main culprit and stated their policy targets in cutting down on these gases as a way to tackle climate change (Kickmeyer, Daly & Larson, 2021). Amongst others, Canada, ranked 10th on the list of countries of the global greenhouse gases emission emitters (Mohmmed et al., 2019) pledged to cut down its emissions by 40-45 percent by 2030 (Taylor, 2021). Canada first entered the global agreement on climate change at the Paris Climate agreement under the United Nations Framework on Climate Change in 2015 where it pledged to reduce its greenhouse gas emissions by 30 percent below 2005 levels, which was equivalent to 511 Megatonnes (Mt) (Boyd, Turner & Ward, 2015). This is depicted in Figure 3 appended below.

Figure 3: Canada's Projected Emission Reduction Target (2015-2030)



As a measure to bring that resolution into practicality, the Canadian government created their first Pan-Canadian Framework on Clean Growth and Climate Change in 2016 in coordination with all the provinces, territories and the indigenous people, which targeted initiatives encompassing all sectors for carbon reduction (Government of Canada, 2016). Under this agreement, all kinds of GHGs were to be targeted (Pham, 2020). In order to further strengthen their resolve and to support the Pan-Canadian Framework on Clean Growth and Climate Change, Canada released a renewed climate plan termed 'A Healthy Economy and a Healthy Environment' in 2020 (Environment and Climate Change Canada, 2020). Despite the intention, a lot of action needs to be done before the set goals can be realised.

Therefore, in order to meet its objectives, it is imperative that the government initiatives identify all sources of GHG emissions and formulates policies that addresses the problem at all levels on the ground rather than just on the paper and devise a more holistic approach giving importance to all sectors contributing towards the GHG emissions rather than a few hand-picked sectors. This was also pointed out by Gage (2015) in his book, "A Carbon Budget For Canada" which extensively assessed the fallacy in a weak connection between the national goal set by the Federal government and the individual provincial plans to cut GHGs. Gage (2015) further explained that until a uniform plan setting from federal to provincial level is set encompassing goals for each sector, it would become really difficult for the government to reach its desired goals. This is again reiterated by Choquette, Klaudt & Lynes (2021) in their latest research whereby they have emphasized on the incoherence of the national and provincial division of power and governance structure as an impediment to form a truly national climate change action plan and also stressed on the same being the cause of lag in Canada's ability to deliver as per their intentions historically.

2.0 Literature Review

2.1 Textile Sector and Climate Change in Canada

As per Canada's Greenhouse Gas and Air Pollutants projections 2020, Oil and gas followed by transportation is known to be the major source of GHG emitters in Canada and therefore, grabs much attention from the policy makers but the textile industry, termed as the second largest polluter globally, is completed neglected. This is reflected in Figure 4 below, which depicts Canada government's sector wise targets for cutting their relevant Greenhouse emission by 2030. As per Canada's GHG emission reduction plan, textile is not listed so it is unclear whether it has been overlooked or only seen as part of a sector termed "Waste and others" (Environment and Climate Change Canada, 2020).

Figure 4: Canada's Sector-Wise Emission Reduction Target by 2030

Sources of emission reductions contributing to reaching the 2030 target

Sector	Projected emissions reductions in 2030 (megatonnes of carbon dioxide equivalent)
Buildings	44
Oil and gas	104
Electricity	47
Heavy industry	46
Transportation	12
Waste and others	28
Agriculture	2
Nature-based solutions and agriculture measures	10
Land use, land use change and forestry	17

There are various aspects of the fashion industry, which lead to Greenhouse gas emissions. It is essential that these areas are minutely looked upon and dealt with as they have been and will continue to be detrimental to the Canadian environment and will be important for achievement of Canada's resolution on GHG emissions by 2030 and beyond. To begin with, Textile dumping is an issue world over with almost 92 million global textiles thrown away into the landfills every year (Azminor et al, 2021). In North America, 11 billion kg of textile is dumped every year whereas it is estimated that an average consumer throws away almost 38 Kg of clothing every year (Weber, 2018). 85 percent of the garments thrown away in Canada ends up in the Canadian landfills. The total composition of the 10,000 Canadian landfills includes 85 percent of the wearable textiles and 99 percent of the non-wearable textiles (Gray, 2019). Textiles make up almost 8 percent of total garbage in Canada's landfills (Point, 2019).

Degradation of this landfill waste results in release of toxic and fatal Greenhouse gases. Just on the account of the methane emissions, these landfills generate more than 20 percent of Canada's national methane emissions (Waste Management World, 2021). Methane is considered 80 times more potent compared to carbon dioxide in terms of warming the earth in a 20-year time span thereby, is a significant source of global warming (Borunda, 2019). For every 1 Kg of textile in landfill, 4 Kg of CO_2 is emitted to the atmosphere, which compounds the climate change issue as well. Disposal in these landfills emitted 23 Mt of GHGs in 2019 (Government of Canada, 2021).

Moreover, the global textile manufacturing is estimated to cause almost 20 percent of the global wastewater with production of just one cotton shirt using over 2,700 litres of water (Dhir, 2021). The wasted water during textile production contains dyes, detergents etc. These contain chemical, which have high carbon content. If this water remains untreated then its carbon ends up reacting with oxygen forming carbon dioxide, which is another Greenhouse gas that not only depletes the ozone layer but also results in climatic changes leading to global warming (Lellis, Polonio Pamphile & Pollinio, 2019). Fashion is responsible for 10 percent of the global carbon emissions (Perreault, 2021). Overall in 2019, Canadian landfills and wastewater were responsible for producing over 4 percent (28 Mt) GHGs (Vitello, 2020).

In addition to the wastewater and landfill issue emanating from the textile industry, release of micro plastics from textiles is also a glaring contributor to climate change in Canada. Plastics make up 80 percent of the pollution in Canada's lakes (Government of Canada, 2019). In a study by Plastics Labs, it was revealed that an average household in Canada and US released 533 million microfibers, which are tiny plastics that shed off from polyester, nylon etc. used in textiles, from the laundry into the wastewater treatment system each year (Prairies Climate Center, 2018). Whereas in another study, it was found that more than 87-90 percent of human pollution in Canadian lakes were made up of microfibers (Hoffman & Hittinger, 2017).

A single laundry load of clothing discharges approximately 700,000 micro plastic fibers (Mishra, Rath & Das, 2019). A study by Oceanwise revealed that 878 tonnes of plastic is released through laundry from Canada and U.S. households each year (Vassilenko, 2019). To study the impact of this micro plastic discharged in the sea on the climate change, it is important to understand the phenomena. There is a lot of organic matter on the surface of the seabed that is converted into carbon dioxide. It was found in a recent study that with an increased plastic content in water, the bacteria find a place to prolong its life thereby, consuming more of the oxygen and producing more carbon dioxide (Warren, 2020). This carbon dioxide then causes the climate change, which consequently causes global warming.

2.2 Textile Industry's Environmental Conundrum: Issues and Technological Solutions

This research in particular lays emphasis on two issues which include excessive production and consumption leading to increased waste in the landfills along with wastewater (Niinimaaki et al., 2020) and domestic textile washing leading to microfiber discharge in the sea water causes 35 percent of the microfiber pollution in the atmosphere (Mishra et al., 2020).

Excessive Production and Consumption Turning into Waste

The problem pertaining to waste primarily relates to excessive production and the consumer throwaway culture. The industry stakeholders have placed much stress on both of these issues in the past decades (Shirvanimoghaddam et al., 2020). While the latter has been thoroughly investigated (Whiteley, 1987; Morgan & Birtwistle, 2009; Cooper, 2016; Filho et al., 2019; Riba, Cantero, Canals & Puig, 2020) but the remedies to the former are still much sought after (Muthu & Rathinamoorthy, 2021). Both these issues go hand in hand.

Based on the advent of fast fashion bringing about a revolution in the textile industry, consumers had a much larger variety to choose from at a much lower cost. This fanned the flames of the consumerism culture whereby consumers bought more and after little usage, threw away the garment to buy new ones. This increased the throwaway culture (Wu, 2020). To meet this rising demand, brands resorted to shorter production times and quicker turnaround time from runaway to the outlets (Wiebke, 2020). But since the demand forecasting data were mostly skewed based on assumptions and logic mostly rather than real time data therefore, the brands mostly ended up producing more than the actual demand (Wijetunga, 2020). This excessive production was wasted once the next season approached bringing with it a need for brands to create newer designs to keep up with the market pace and competition. All this has added massively to the solid waste in the landfills that decomposes into Greenhouse gases affecting the environment (Dhir, 2021). According to StatCan, Ontario alone produced more than 10 million tonnes of solid waste in 2018 (Statistics Canada, 2020).

Covid has further exacerbated this consumerism culture due to which the digital transformation of the brands has accelerated. Over the recent years, the Canadian clothing e-commerce has been on a constant increase, which can be seen from apparel ecommerce sales in Canada, which increased from CAD 3.4 Bn in 2018 to CAD 4.25 Bn in 2020 (Galgani & Loiselle, 2020). These online clothing sales are expected to reach CAD 5.14 Bn in 2022 (Sabanoglu, 2020). Also, in terms of percentage, the online clothing sales in Canada increased from 6.8 percent in 2019 to 8.7 percent in 2020 (Sayyida et al., 2021). This increase in ecommerce has increased the importance of the ecommerce supply chain and the consequent sustainability issues in the Canadian fashion ecommerce. This is a relatively alien concept in the Canadian market and the CEO of the Frank and Oak in his recent interview revealed that the Canadian fashion industry is still oblivious to the depths of the ecommerce sustainability even though it has a huge potential to cause an even larger impact on the environment through excessive waste generation than the normal brick and mortar (Stewart, 2019).

To address the waste issue from the consumer throwaway culture in the Canadian fashion industry, there has been lot of research and the Canadian governments as well as other stakeholders have taken many initiatives. Trillium foundation, an agency of the government of Ontario, has funded the Ontario Textile Diversion Collaborative led by Fashion Takes Action since 2016 which aims at accelerating action towards sustainable textile through collaboration, transparency, investment and innovation (Colyn, 2019). Fashion Takes Action has held multiple conferences and events bringing together all the stakeholders to address the issue of circularity in the textile industry. They released Canada’s first feasibility research report on creation of a circular textile industry in 2021. Similarly, the local government in Vancouver struck a partnership with Bank & Vogue, largest retailer of used clothes in North America, to create Return-it depot network across British Columbia to recycle clothes (Lougheed, Metuzals & Hird, 2018). Similarly, brands like North face run a programme called Clothes The Loop initiative that encourages consumer to return used clothes which it sends to an NGO, Soles4souls, which distributed used clothes amongst the needy (Rasmussen, 2020).

While there have been ongoing efforts to manage the landfill wastes, the companies have always found it hard to deal with the inaccuracies in demand forecasting and wastage through the marketing material. In the last few years, with technologies like Artificial Intelligence and Augmented Reality gathering prominence, which has been especially fast tracked due to the pandemic, a solution is round the corner (Silvestri, 2020). Artificial Intelligence is the ability of a robot to do tasks using a computer that are normally undertaken by humans. It has wide application and can be used in any field to collect intelligence enhancing consumer experiences, forecasting, inventory management etc. Artificial intelligence is being termed as the guiding force for the retail industry as it can provide close to real time data leading to much accurate consumer demand forecasting and the consequent inventory management which will, in turn, be immensely useful from minimizing waste from excessive production (Laaziz, 2020). Artificial Intelligence allows fashion retailers and manufacturers to navigate real time data, collect authentic business intelligence and accordingly, make informed decisions saving time, cost, creating efficient processes to produce according to the actual demand (Silva, Hassani & Madsen, 2020). This helps cut on the extra produce, which adds to the waste landing in the landfills (Adams et al., 2020).

Artificial Intelligence is classified in five categories including machine learning, decision support system, expert system, optimization and image recognition and vision. Each can be used to increase efficiency and sustainability in the fashion supply chain (Candeloro, 2020). Canadian Government is already spending a lot on Artificial Intelligence and is one of the recognized global leaders in the field but to reemphasize their interest in Artificial Intelligence, the government has proposed to spend US 444 million over the next 10 years in the current budget (Government of Canada, 2021). Since textile is not recognized as a separate sector and is only categorized under waste and others in terms of GHG emission therefore, it still has not seen much emphasis from the government.

In addition to that, Augmented Reality is another technology that is foreseen to impact fashion marketing and consumer experience in a big way (Chylinski et al., 2020). Augmented Reality is an interactive experience that helps to recreate the real time world environments in a computerized version optimizing the consumer experience through replication of the sensory stimuli including visual, audio etc (Mcmillan, Flood & Glaeser, 2017). Many fashion brands have already started to use augmented reality to allow consumer to try on their preferred brand designs online in virtual fitting rooms. It has been noted that a big brand like Modcloth recently reported a reduction in the return of the online bought clothing of almost 26 percent, almost all of which would normally end up in the landfill waste (Boardman, Henninger & Zhu, 2019).

Discharge of Microfibers (Microplastics) from Washing

This is certainly a problem that warrants more in-depth research and many more initiatives by the Canadian government and industry stakeholders. First ever Canadian Arctic wide study of anthropogenic particles including microfibers and microplastics in marine sediments from 14 sites was conducted by Adams et al. (2021) and it was found that almost 70 percent of the microplastics/microfibers contained in the sediments were of human origin (Adams et al., 2021). Moreover, in another research on the characterization of microplastics in the surface waters of Northern Saskatchewan river located in Alberta, Canada, it was noted that majority of the microplastics were from human origin predominantly consisting of dyed cotton and polyester which are normally excreted from textiles (Bujaczek et al., 2021). It is evident that microplastics released from textiles are a major source of contamination of the Canadians rivers, which consequently adds massively to the GHG emissions. This analysis is yet again fermented by another recent study which concluded that over 50 percent of the microfibers in the waste water eventually entering the rivers come from the textile laundry process (Tian et al., 2021).

In order to curb this issue, it has been seen that industry stakeholders have long sought to find technologies to either capture microplastics from the textile during its washing in the washing machine or that could be installed in the residential water systems which could filter the microplastics or microfibers from the wastewater excreted after the wash. For these purposes, various technologies have been tested thus far (Mishra, Singh, Rath & Das, 2021). GoJelly is one such technology backed by the European Union that has been tested for this purpose (Rothe, 2020). It is developing a filter made of jellyfish mucus, which allows for the capture of micropalstics from the water treatment plants before it is release to the environment (Emadodin, Reinsch, Ockens & Taube, 2020). Previously used technologies including membrane biological reactor, rapid sand filter, dissolved air floatation etch do not remove fiber whereas jelly fish mucus filter seems to be cost effective, less expensive in terms of infrastructure required including energy and operations, makes use of an otherwise nuisance jelly fish but is found to be efficient against removal of microfibers. The technology is still being tested under the EU Horizon project (Dierking, 2018). The filtration of microfibers from the water ways is relatively less examined but in order to find a technologically sound and cost term sustainable solution, the government of Canada needs to focus on funding initiatives and support programmes for enablers and companies who are working in the field (Freeman et al., 2020).

Also, Cora Ball or Fiber Free, laundry balls, are also used to capture synthetic fibers from the washing machine. Lastly, Lint LUV-R and Showerloop have also been tried as washing machine filtration filters to filer microplastics. A study for their effectivity on a fleece blanket showed that Cora Ball reduced the number of discharged microplastics by 26 percent whereas Link LUV-R was found to be more effective with a decrease of almost 87 percent (Schmalts et al., 2020).

In a recent study by Napper, Barret and Thompson (2020), six available devices were tested. In-drum devices used inside the washing machine included Guppy friend washing bag, Cora Ball and Fourth element washing bag whereas the other three were External filters including XFiltra, Lint LUV-R and Planet Care. Their efficiency in reducing the fibers was examined and the respective results were Guppyfriend washing bag (54%), Cora Ball (31%), Fourth Element Washing Bag (21%), XFiltra (78%), Lint LUV-R (29%) and Planet Care (25%). This means that there is a great potential reduction in the release of microfibers that eventually end up in the marine life eventually entering our food chains or entering the soil in the crops affecting the produce. Furthermore, as already mentioned, since this chemical agents carry high carbon content and react with oxygen to produce more Carbon dioxide , therefore, their reduction is results in minimized GHG emissions. Despite that, implications of their effective use need to be further investigated to define the extent of their benefit but whatever the case may be, it is highly important that these options are thoroughly investigated to propose a solution to this menace.

Canadian government had recently tabled a bill under its 2030 climate initiative to list all products containing plastics to be termed as toxic materials and also tax materials, which include plastics. This will also impact the textile industry. Furthermore, as a part of Canada's zero waste policy by 2030, Canadian government has granted four innovative companies a grant of CA $ 150,000 each. Two of these are focusing mainly on the textile plastic waste (Remington, 2021). These include Cacith Inc and Met-Tech Inc, which are focusing on textile waste from polyester and nylon-based clothing (Environment and Climate Change Canada, 2021). Cacith Inc is creating a network of recyclers to quantify textile waste and find market for these otherwise wasted products (Vitello, 2021) whereas Met-Tech Inc. is working on developing a low cost process to recycle waste clothing which aims at new technology to eliminate bottlenecks minimizing recycling of wasted textiles and also to commercialise the use of cellulose and starch-based polymer materials (Atkins, 2021). The primary focus of these technologies has been on the recycling aspect of the textile industry which is expected to reduce the disposal of textiles in the landfills just like benefits of other recycle programmes. Despite that, no new technological innovation or idea has been brought to the forefront with regards to the issue of excessive production or textile laundry. Therefore, these are areas which are yet to be investigated.

3.0 Conclusion

Despite these positive steps and movement in the right direction, the government needs to do a lot more in regards to the textile industry. The real data pertaining to the textile waste needs to be obtained with all areas of waste excretion identified then only a concerted effort can be made to forge a plan to control waste from textile effectively. Canadian government needs to give more importance to fashion sector as the apparel retail contributed over USD 27.5 bn in revenue in 2020 (Shahbandeh, 2021). Moreover, the environmental impact of the textile industry is diverse ranging from release of GHGs to impacting the marine life as well the human life and adding to the greatest threat of all, climate change; which will eventually effect not only all economic sectors but also the Canadian way of living. Therefore, the Canadian government needs to focus on targeted initiatives to educate its citizens on fashion sustainability, formulate support and funding programmes for companies and concerned stakeholders who want to carry out thorough research on the technologies empirically testing their viability, usage, nation-wide adoption by the concerned and how it can be of benefit for their own well-being in the long run. This will be highly useful in achieving their goal of cutting down GHG emission by 50 percent till 2030 and curbing climate change.

4.0 Future Research

There is a lot of room for further research on this topic as textile is a big industry and the waste problem lies at various points in its ecommerce as well as brick and mortar supply chain that adversely affects the environment adding to the Greenhouse gases causing climate change. The researchers need to focus on empirically testing the technologies that can help curb the plastic pollution from textile laundry. In addition to that, since artificial intelligence and augmented reality are developing fields so the researchers could also focus on their applicability in terms of textile's ecommerce sustainability and how it can be useful to minimize the environmental impact. With Climate change becoming a bigger threat to the global security especially in countries like Canada, it is high time that all the stakeholders including the researchers utilize their efforts and energies in developing effective solutions to the environmental problems in the textile industry that are major cause of Greenhouse emissions which consequently lead to global warming and climate change.

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