Environmental RFID: measuring the relevance in the fashion industry

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ENVIRONMENTAL RFID:
MEASURING THE RELEVANCE IN THE FASHION INDUSTRY

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Abstract

Fashion industry is globally one of the largest consumers of radio-frequency identification (RFID) tags, which has provided the best practice to manage inventories and respond to local fashion landscapes. As the use of RFID tags has grown, the sustainability thriving fashion industry has turned to "green tags". The purpose of this paper was to evaluate the relevance of environmental RFID tags. The research was conducted in two stages: First, the waste and emission reductions were accounted on a tag level comparing ordinary and green tags. Second, the reductions were extrapolated to the brand-owner level to analyze the impact that the shift to green tags would provide in terms of absolute measures and contribution to sustainability goals. According to the results, the shift to environmental RFID provides a substantial decrease in waste and emissions on a tag level, but limited impact on goals set by brand-owners' sustainability programs. Researchers note that though tags per se represent a small waste stream in the big picture, fashion companies may not have a choice. This paper is one of the first studies on environmental tags.

Keywords: *sustainability, radio-frequency identification, RFID, fashion and apparel, lifecycle assessment*

1 Introduction

During the past decades, RFID has been a growing technology in an industrial digitalization, especially in the areas of supply chain management, manufacturing and asset tracking (see, e.g., the profound literature review by Musa & Dabo, 2016 and Zelbst et al., 2012). Even so, Bose and Yan (2011) argue that there is little discussion in the literature on the environmentally responsible management of RFID. Findings from 13 case studies on the use of RFID in green projects reveal its potential to enhance environmental sustainability, and also to reduce costs and generate revenue by creating new business opportunities (Bose & Yan, 2011). In the study, RFID utilization was defined as "green" if it added economic value to organizations and improved environmentally responsible practices related to information technology.

A recent study of Garcia-Torres et al. (2019) presented a profound literature review of 89 research papers related to traceability and how it can contribute to sustainable supply chain management in the apparel industry. RFID technologies were a topic of several articles reviewed in this study. According to Garcia-Torres et al. (2019), traceability for sustainability can leverage advanced technology (e.g. IoT, RFID, and

blockchain) to achieve sustainability goals in supply chain management, because it facilitates the ability to track and trace as well as manage social and environmental issues.

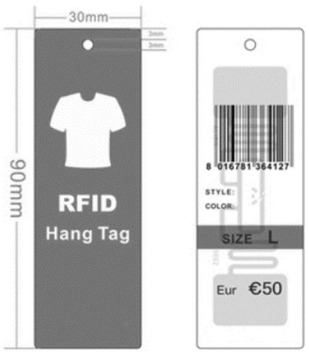

Figure 1: Apparel hangtag with an RFID tag placed inside the board (Seiko RFID 2020)

Another literature review by Denuwara et al. (2019) focused on reporting case studies to highlight the sustainability benefits of RFID technology. Denuwara et al. (2019) concluded that the relationship between RFID technology and the sustainability of the apparel industry is important, due to the increasing use of RFID tags in apparel stores. RFID tags can be used throughout the value chain to provide social and environmental benefits that are greater than the solely economic benefits. Navodya et al. (2019) underlined in their research on sustainable RFID that increasing interest on sustainability consists not only of environmental but also economic and social aspects. Thus, the perspectives of sustainability deal with holistic fairness of fashion industry, where some of the critics are related to child labor, fair distribution of profits, and the short lifecycles of fashion products that increase landfill after brief use of such products by consumers.

In the fashion industry, according to Bertola & Teunissen (2018), tracking technologies such as RFID or advanced product lifecycle management software can potentially link the entire value chain from suppliers to retail channels, and follow products to their end. Many brands, e.g. Max Mara, Fendi, and Michael Kors, are integrating RFID in their products with tracking purposes, mainly to identify fake products, or support interaction with customers in retail shops (Bertola & Teunissen, 2018). According to Kabukcu (2017), RFID in the fashion industry helps to improve inventory management, improve the efficiency of operations, integrate the fashion business model, and increase the responsiveness of the fashion cycle. Kabukcu (2017) also concluded that RFID technology can play an important role in order to propose new solutions for a greener sustainable industrial world. In Florea et al. (2016), the study concluded that item-level tagging can bring benefits to the entire supply chain from manufacturer, the logistics companies, and through to retail. According to Azevedo & Carvalho (2012) the deployment of RFID in the fashion supply chain, despite the potential advantages, must overcome the problems of integration with existing systems. Moreover, the tag cost of RFID systems must be reduced to a more acceptable level, so that item-level tagging can become a reality (Azevedo & Carvalho, 2012). However, the study is 12 years old and, according to market

researchers, fashion today consumes approx. 12 billion units and 60% of the global RFID products (IDTechex 2019). This represents approximately 5–10% of the global fashion manufacturing, which is estimated to produce approx. 100 billion garments in a year (see, for instance, Common Objective 2018).

RFID technologies themselves as well as their manufacturing are also being developed in an eco-friendlier direction. According to Angeles (2013), with increasing concern for environmental sustainability, researchers and practitioners have been exploring the role of RFID in supporting "green supply chains." The study by Angeles (2013) applied the technology organization environment (TOE) framework by Tornatzky and Fleischer, as a useful tool in explaining the RFID system deployments for environmental sustainability. Kanth et al. (2012) introduced the paper-based RFID antennae that yield lower organic emissions to the environment while considerably higher inorganic emissions to the air. Their study results revealed that air is highly affected with toxic emissions in comparison with freshwater, seawater, and industrial soil. In addition, Mukendi et al. (2020), etc., reported recent technology developments by a Finnish–Swedish forestry, pulp, packaging, and renewable materials company, Stora Enso, which offers an environmentally-friendly manufactured "ECO RFID" tag.

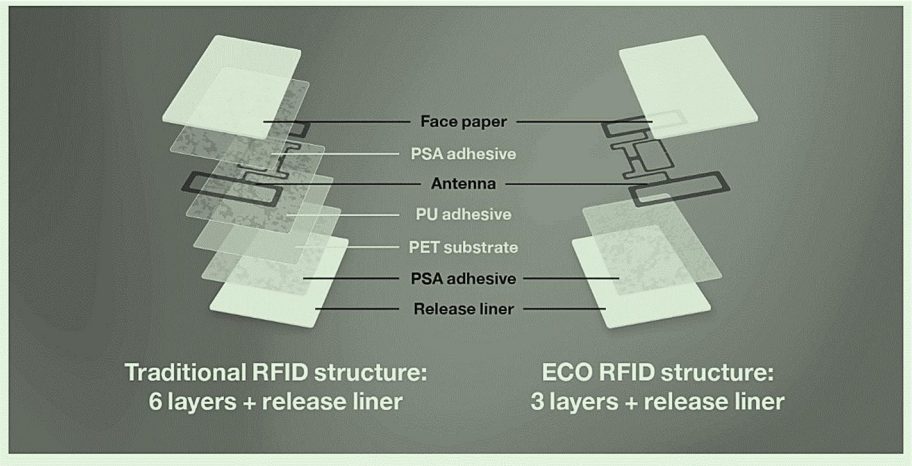

Figure 2: Traditional RFID compared to ECO RFID (Stora Enso 2018)

As the literature review shows, RFID and sustainability are central themes in the global fashion industry. However, until today there has been very little academic research published on sustainability when it comes to RFID tags themselves. This paper addresses that theme by evaluating the relevance of the environmental RFID tag concept for the fashion industry. The sub-questions for the paper are: What is an environmental RFID tag? How do the environmental benefits materialize in green tags? And finally, how relevant is the environmental RFID tag concept for the fashion industry and its brand-owners in understanding the sustainability goals that companies are committed to?

The focus of the paper is on RFID tags, thus the sustainability impact of the Internet of Things framework or advanced data handling is not studied. To keep the research manageable, the focus of the research is limited

to one specific sustainable RFID tag technology picked as an example to be compared against legacy tags. Hence, the research does not examine the various types of environmental tags. Furthermore, the comparison does not take into consideration that the chip used in the tag as the focus of the comparison is purely on the antenna component. Sustainability is generally a wide topic, and in this paper, only the environmental domain is taken into examination; thus, in the terminology, “environmental”, “sustainable” and “ecological” are loosely used as synonyms.

The research utilizes a case study approach in conducting the evaluation; it combines quantitative and qualitative data in analyses. In the secondary research, the authors used common research databases from Google Scholar and university database Primo (see exlibrisgroup.com) for searching topics of sustainability, RFID and fashion throughout the largest scientific publishing houses. As the topic was somewhat new, reputable commercial research institutions were also utilized in the study, such as IDTechEx and McKinsey.

The rest of the paper is organized as follows: Chapter 2 introduces the research method and the two-fold approach adopted. Chapter 3 talks about RFID as an inspection unit, including sections that discuss the waste and emissions of traditional RFID tags and an introduction of ECO RFID as an example of an environmental tag product. Chapter 4 summarizes the results both from the tag and end-user perspectives. In the last chapter, the paper discusses the conclusions and future studies.

2 Methods

The research was conducted as a case study on the ECO RFID tag technology, which was picked as an example of an environmental RFID tag for comparisons. The purpose was to explore what specifically makes a green tag environmental, as well as how relevant the environmental benefit of an RFID tag was for the fashion brand-owners. According to Voss et al. (2002), the case study approach allows questions of why, what, and how by focusing on one concrete area of investigation. As stated, the research was meant to be an exploration that provides details of environmental RFID topic and enables further studies in the area.

The research method adopted a two-steps approach in conducting the evaluation: ECO RFID was first inspected at a tag level using lifecycle assessment (LCA) to identify the technical improvements that the tag provides in terms of reduced amount of emissions and waste. After accounting for the single unit reductions, the results were secondly analyzed within the context of fashion industry and brand-owner to further analyze the relevance of the environmental tag in the market.

LCA is a concept that simulates production from cradle to crave in order to analyze the inputs, processes, and output of a manufactured unit, accounting for raw material and energy use, emissions and waste; along with end-products with their side streams. However, the way that the LCA concept is applied varies from

one context to another, and academia thus notes that even the simplified LCA methods cannot provide a ‘one size fits all’ approach (Hur et al., 2005). In this paper, the LCA results reflected the manufacturing and post-usage phases, which mostly set traditional and environmental tags apart from each other.

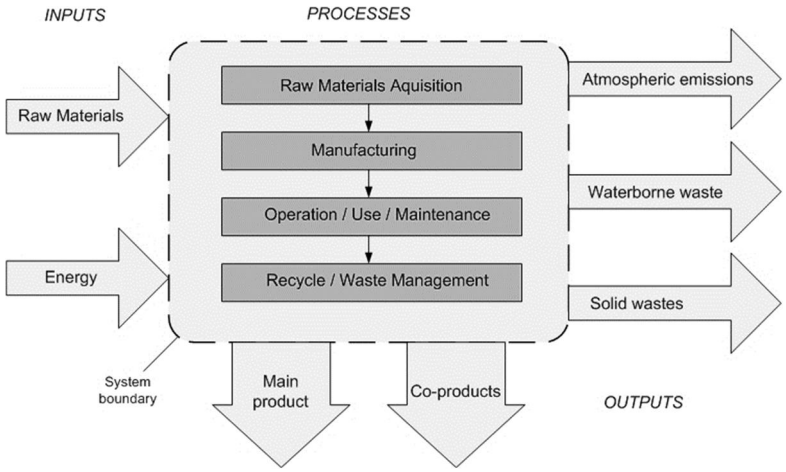

Figure 3: Main stages and typical inflows/outflows considered in lifecycle assessment (PennState 2020)

3 RFID Tag level inspection

As RFID technology has developed and gained increased adoption, the focus has turned into the environmental impact of the RFID tag itself. Key questions in this area concern, e.g., what the effect on the environment of these tags is once the underlying item is eradicated, what the recyclability of these tags is, and how these tags are able to support the concept of the circular economy. There is also increased vigilance and regulatory norms especially in Europe, like REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) and WEEE (Waste of Electrical and Electronic Equipment), which enforce buyers of RFID tags to be more aware of what goes into the tag and its impact on the environment.

3.1 Waste and emissions

While a single RFID tag has a very small chemical and physical footprint to make a sizable impact on the environment, the waste accumulates when environmental impact is accounted from billions of tags. According to IDTechEx (2019), 18 billion RFID tags shipped globally in 2019 with growth projections to 55 billion tags by 2029. Figures 2–3 present the situation in Europe related to the number of RFID tags used in addition to the CO2 emission impact (Rand Europe 2020).

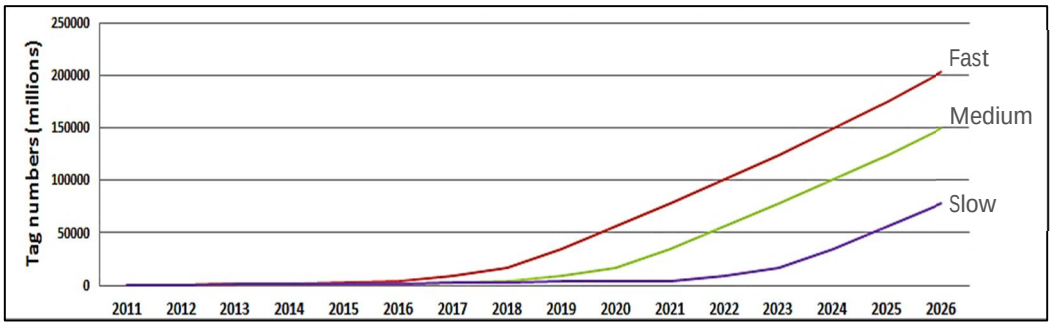

Figure 4: Estimated relevant passive tag numbers for Europe/technological development scenarios (Rand Europe 2020)

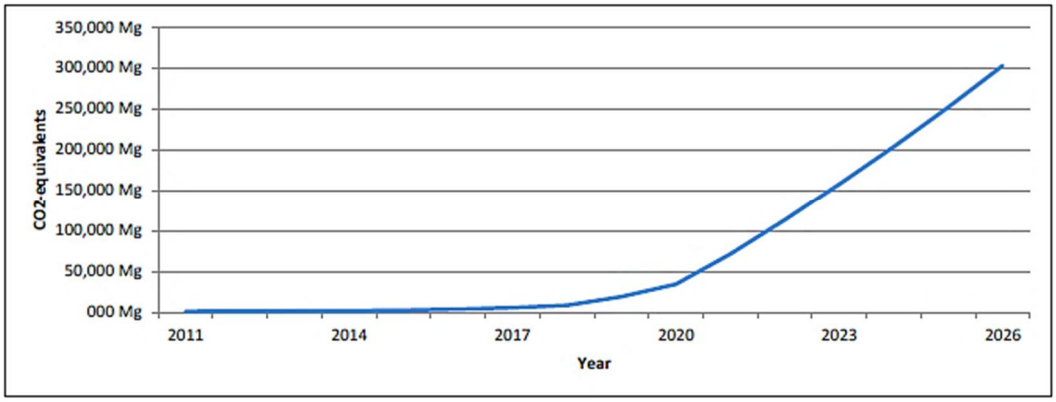

Figure 5: Estimate CO2 emission in Europe from the medium scenario of RFID tag volume growth (Rand Europe 2020)

The environmental impact of a traditional RFID tag appears in three areas: (1) Carbon footprint – the ecological impact of producing RFID tags, including components that go into an RFID tag.
(2) Chemical effluent impact – the amount of chemical effluents and use of water in the manufacturing process that can be measured in terms of eutrophication and acidification impact related to nitrogen oxides, sulfur dioxide, and COD water emissions in the manufacturing process. (3) Plastic waste – the amount of plastic material being created as part of the finished RFID tag product that influences recyclability of tags itself and eventually goes to landfill.

The chemical used during the production process has been one area that new sustainable RFID technologies have addressed with alternative production methods. The solution has included using laser-cutting and additive printing methods. Both processes use paper as a base material instead of polyester plastic that has been the traditional substrate used in RFID tags. In traditional tag processing, the heat-stabilized polyester film and aluminum foil are first laminated. Excess aluminum is removed with a wet etching process using chemicals and water and causing waste. Additional face paper has then been used to convert the inlay to a tag, together with release paper and label adhesive.

The RAND report estimates the carbon dioxide footprint of the traditional RFID structure across three size footprints (small 894 mm^2, medium 2219 mm^2, and large 4171 mm^2). The unit of analysis focuses on the raw-material consumption, where the highest refers to large according to previous sizes.

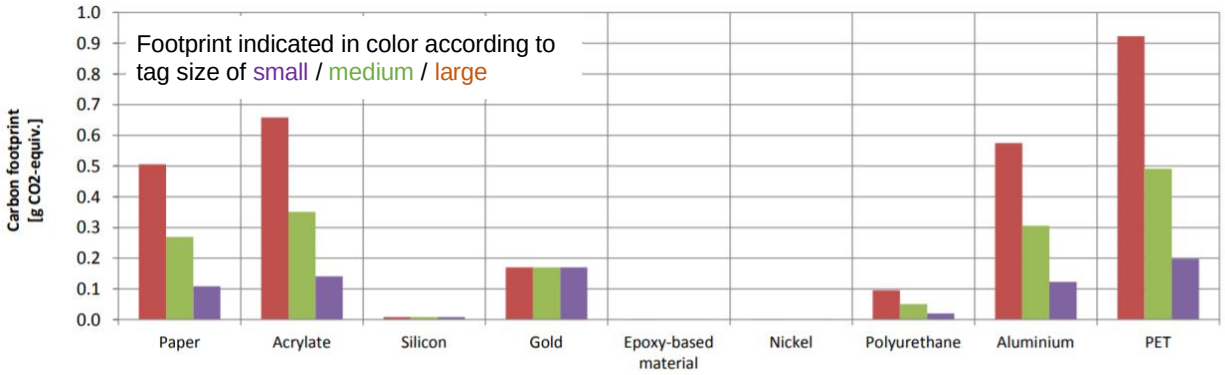

Figure 6: Raw-material use in traditional aluminum based RFID tags (RAND Europe, 2012)

The polyester substrate and the acrylate layers used as adhesives account for the highest CO2 footprint. The sustainable technology option, which eliminates the use of these chemicals, has a direct impact on the carbon footprint.

Similarly to the recyclability perspective, flame retardants or pigments used in plastic parts in traditionally manufactured RFID tags – such as potassium or bromine – may also be carried into the recycling or disposal processes, and are seen as environmentally critical in polymer recycling, so the recyclability of tags with polyester substrates is much more difficult. The RAND report estimates a large size tag (4171 mm^2 area) to have around 290.7 mg/tag of polyester plastic.

3.2 ECO RFID as an example of the environmental RFID tag

ECO RFID technology produces RFID using an additive approach to print the antenna directly on paper. The key benefits of ECO RFID are the lack of plastic layers in an RFID tag, avoiding the use of chemicals common in the traditional etching process, and significantly lower carbon footprint achieved by a less-energy intensive manufacturing process. ECO RFID is reported to provide similar performance, reliability, and comparable cost structure as the traditional RFID tags. Thus, it is expected to provide similar financial and operational benefits as traditional tags. As the so-called carbon tolls discussed in politics have not yet been decided, environmental tags also do not have influence on regulatory costs as of yet.

Figure 6 illustrates the comparison of various manufacturing technologies commonly desired by retail brand-owners counting as the highest RFID use segment globally. The dimensions used in the graph illustrate the requirements set by practitioners on RFID tags. First, the technology must be *performant*, which allows solid reading results in a variety of settings. Second, the technology must be *reliable;* as the tags that become defected will result in lost items in a system ran on RFID. Third, the *price* for the future must allow high

volume use of RFID. Fourth, the comparison takes into account a *price roadmap*, which varies significantly between old and new technologies, and is typically central in renewable innovations facing markets today. While old technologies are at their peak with efficiency, the innovations are still at the early phase of scaling, and are yet to achieve efficiency through market adoption and incremental technology development. Lastly, the product must be *sustainable* in order to support the brand-owner to meet his sustainability targets at every frontier.

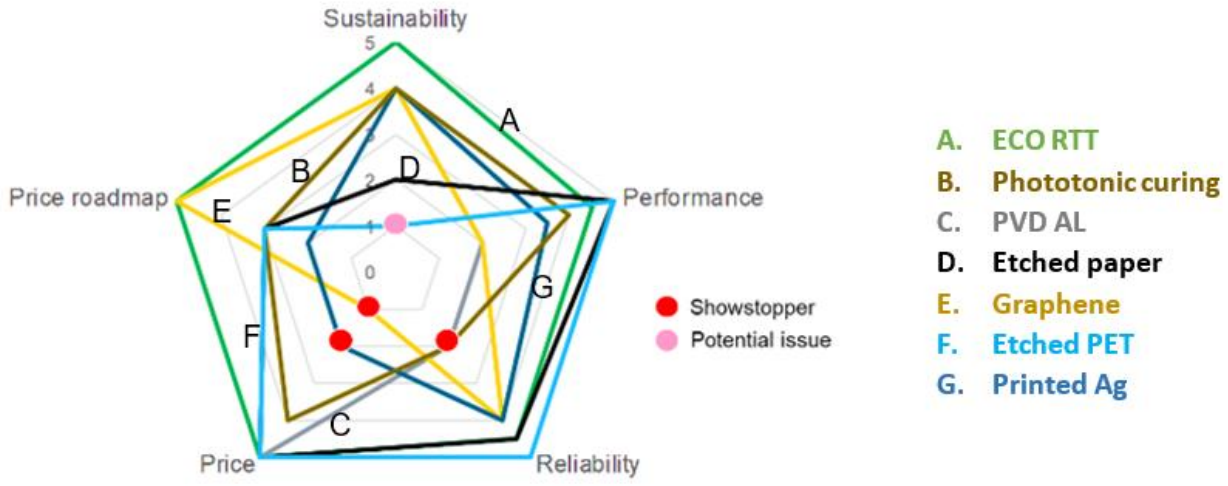

Figure 5: Comparison of alternative RFID technologies (Stora Enso 2018)

4 Results

This chapter reviews the results at tag level, and reflects the accounted improvements in the fashion industry and brand-owner perspectives to evaluate the relevance.

4.1 Tag-level environmental benefits

Alternative comparison made between the printed environmental RFID tag and traditional polyester tag highlights the impact of substrate during production and post-use, and energy consumption at the production machinery level. Table 1 summarizes the results found in an LCA (lifecycle assessment), a study focusing on three sustainability emissions between an environmental and traditional polyester tag (Stora Enso, 2020).

Table 1: Comparison between sustainable and legacy tag in three areas (Stora Enso 2020)

Impact vs tag technology	Greenhouse gas g CO2-eq/tag	Eutrophication 10^{-3}g PO4-eq/tag	Acidification 10^{-3}g SO2-eq/tag
Polyester tag	3.5	0.0036	0.019
Environmental ECO tag	1.4	0.0021	0.012
Difference (measure)	2.1	0.0015	0.007
Decrease (%)	60 %	41.67 %	36.84 %

The use of paper substrate in an environmental RFID tag process and lower energy consumption in manufacturing exerts a significant CO2 emission impact compared to the traditional polyester substrate. Elimination of water usage and effluent treatment in the antenna manufacturing process has a significant eutrophication and acidification impact.

4.2 Fashion industry context

While the global RFID market was, in 2019, 18 billion tags in total, the fashion and apparel industry applied 12 billion units in garments to track the inventories. According to one taxonomy, a large company consumes over 800 million RFID tags, a mid-sized company uses 350-800 million tags, and small companies are below 350 million tags. The boutique fashion companies typically vary from larger production of some millions of garments to very small tailor shops with some hundreds of clothing items a year. The use of this taxonomy allows the evaluation of the impact of environmental RFID on a corporate level. In following Table 2, the sustainability impact is looking at an average company, where the volume of tagged items is 350 million units.

Table 2: Impact on an average company with a tag volume of 350M units

Environmental Impact Indicator	Environmental RFID Technology (Mgr.)	Legacy RFID Technology (Mgr.)	Difference per tag	Annual Impact when 350M pieces tagged
GHG (CO2 g/tag)	3.5	1.4	2.1 (61%)	735,000 kg of CO2 reduced
EP (10^{-3}g PO4/tag) + AP (10^{-3}g SO2/tag)	13.8	22.7	8.9 (39%)	3,115 kg of PO^4 and SO^2 reduced
Plastic (mg/tag)	0	290.7	290.7 (100%)	1,017,450 kg of plastic reduced
Total	1,755 tons of reduced impact			

It is estimated that 12 billion pieces of fashion apparel items were tagged in 2019. If the above environmental impact analysis is extrapolated to worldwide volumes in the fashion industry, green tags could have reduced 50k tons of total waste reductions in RFID tags alone. By 2029, the number of apparel

estimated to be tagged with RFID should grow to 55–60 billion units per year. Total waste reduction with environmental RFID tags will then be 275k tons in the fashion industry alone.

4.3 Brand-owner perspective

With increased consumer activism and awareness of sustainability impact of the way companies operate, there is a growing demand for companies to respond to these concerns (see, for instance, McKinsey 2020). The three selected case companies from the fashion and apparel industry have set ambitious sustainability goals and have become high volume RFID users during the past few years. With each of them, the number of RFID tagged items is expected to be one billion items, which is representative of their true volumes. The following examination outlines the sustainability goals each company has set in identifying areas that connect with environmental RFID, and therefore has validity as a source for improved sustainability performance.

Table 3: Environmental RFID contribution to the company specific goals (Companies' sustainability reports)

Company and goal	Validity	Theme	Proof-points
Decathlon (Environmental RFID contribution rate 3/5) Decathlon is the largest global sporting goods retailer, headquartered in France and present in 52 countries worldwide. The purpose of Decathlon is "to sustainably make the pleasure and benefits or sport accessible to the many". The key sustainability focus areas for Decathlon include:			
Eco-design (making sure that the production of goods meets the needs of users while creating the lowest possible impact on the environment and society)	Yes	General benefits	5014 tons of reduced impact
CO2 emission reduction (they have committed to a 75% reduction in CO2 emissions by 2026)	Yes	CO2	Reduction of CO2: 1B tags x 2.1gr/tag = 2.1M kg
Supplier compliance around working conditions and water, soil, air pollution impact	No	Company-specific	
Sustainable packaging strategy (100% of packaging to come from sustainable sources)	Yes	Recyclability	Reduction of plastic waste at landfill: 1B tags x 290.7 = 2,907,000 kg
Incorporating circular economy in the value-chain including promotion of repair/re-sale/re-use	No	Links to all RFID	
H&M (Environmental RFID contribution rate 4/6) Hennes & Mauritz AB is a Swedish multinational fast-fashion clothing retail company. It operates in 62 countries and is the second-largest clothing retailer after Inditex. H&M's sustainability vision is: "with the help of technology and innovation, lead the change towards circular and renewable fashion while being a fair and equal company".			
Reduce waste by aligning supply to demand and use of efficient distribution operations	No	Links to all RFID	
Improved transparency about sourcing through improved visibility on Tier-1 / Tier-2 suppliers they source from, as well as	No	Links to all RFID	

sharing product sustainability information online for consumers			
Circular product design and sale including dedicated store formats to sell unused overstock as well as ability to recycle unsold stock for new products	Yes	Recyclability	Reduction of plastic waste at landfill: 1B tags x 290.7 = 2,907,000 kg of
Sustainable packaging strategy focus including eliminating unnecessary plastic packaging and moving from single-use model to reusing models by 2025	Yes	Plastic	
The aggressive target of being a climate positive value chain by 2040, including focus on leadership in energy efficiency	Yes	CO2, Energy efficiency	Reduction of CO2: 1B tags x 2.1gr/tag = 2.1M kg
Chemical management through the use of safe and toxic-free products in their supply chain through establishing a hazard-based scoring system for substances being used in their supply chain	Yes	Green production, chemical etching	41.67% lower eutrophication and 36.84% acidification
Inditex (Environmental RFID contribution rate 3/5) Inditex is globally one of the biggest fashion groups headquartered in Spain. It operates in 93 markets worldwide with various brands: Zara, Pull&Bear, Massimo Dutti, Uterque, Bershka, Oysho, Stradivarius and Zara Home. In 2002, Inditex launched a Strategic Environmental Plan, and currently the company is running Sustainability Plans that are integrated into all product life cycle stages and supply chain stages.			
Design and sustainable raw materials	Yes	Plastics	Reduction of plastic waste at landfill: 1B tags x 290.7 = 2,907,000 kg of
Environment, health & safety issues in manufacturing	Yes	Green production, chemical etching	41.67% lower eutrophication and 36.84% acidification
Green to pack & warehouse management	No		
Eco-efficient stores and sustainable packaging	Yes	CO2	Reduction of CO2: 1B tags x 2.1gr/tag = 2.1M kg
Human rights in the supply chain	No	Company-specific	

The previous companies, in similar manner to the leading global fashion and apparel brands in general, are translating sustainability into four pillars, which are focusing on greenhouse gas emissions, sustainable packaging related to sustainable raw-material use, human rights, and the circular economy. Sustainable tag technology responds to three areas out of four, and hence has a significance on a tag level to sustainability goals. In this paper, we understand that sustainable packaging entity refers to green manufacturing methods in order to avoid double accounting of plastic, which is part of the circular economy objective. Green manufacturing in sustainable tags means avoiding water consumption, pollution, and production waste.

Table 4: Sustainability pillars among fashion retailers

Sustainability Focus Area	**Global sustainability initiatives**	**Impact of using Environmental RFID tags vs legacy RFID tags**
Greenhouse gas emission reduction (CO2)	CDP / UNFCCC	High
Sustainable packaging and reduction of single use plastics and waste	FSC / PEFC	High
Human rights and supply chain transparency	UNGP	Low (Not much difference between environmental and legacy RFID tags)
Circular economy	EM Initiative	High (due to higher biomass of environmental RFID tags, 80% can be recycled)

5 Conclusions and discussion

This research paper addressed the environmental contribution of so-called green tags, which the literature review revealed to be an under-covered topic in academia, despite the increasing interest among fashion business practitioners. As the fashion industry was seen to move on to sustainable practices, it was seen as important to evaluate whether the environmental tag would be relevant for the companies and brand-owners in understanding the goals they have set.

Although this paper used only one specific environmental RFID tag technology to evaluate the sustainability performance against legacy tags, it provides reference to the impact that green tags are in general able to provide. The key contributions of sustainable tags are related to avoiding single-use plastics (100%), significantly reducing greenhouse gas emissions (up to 61%), and a manufacturing method that especially minimizes chemical waste (up to 39% in this paper).

At the large corporate level, where volumes are one billion tags a year, the environmental RFID brings concrete reduction of an environmental load derived from RFID tags, which in everyday language is the equivalent of 300 football fields of plastic and over 500 households' annual emission of greenhouse gases. Furthermore, as the technology evaluated is based on the printed electronics concept, it is likely to further increase the environmental impact by decreased logistics if the printing is located near the place where source tagging is made. Global supply chains typically contain greenhouse gas emissions that are rooted in the shipping of production supplies such as RFID tags. Traditional RFID tags are manufactured in large entities that do not allow flexible placement of production, in similar manner to new-generation sustainable tag manufacturing.

The underlying research question of the relevance of the environmental tag concept is not univocal. The research reveals that the RFID specific contribution in a fashion company level is limited, and hence does not significantly solve the sustainability challenge of a brand. However, two points suggest that the concept

continues to have relevance despite this: first, turning the fashion business to an environmentally friendly direction may require consistent decisions favoring green alternatives in all areas if companies aim to shift manufacturing and operations to be sustainable: there is unlikely to be one silver bullet that changes everything. Second, for consumers, small signs (such as plastic straws in the fast food business as a benchmark), are typically meaningful indications of the company's values and attitude that communicate taking sustainability seriously. For these reasons, fashion companies are likely unable to compromise in labelling, which is often used to indicate size and price but also to talk about the product and brand consumers are considering to buy. By this token, the researchers come to the conclusion that the environmental tag contributes significantly in tag-level waste and emissions, and pose relevance to fashion brand-owners.

As RFID is used to create a digital representation of an item for supply chain analytics and make rationalizations throughout the chain, it already provides opportunities for sustainable improvement as a concept. One of the future questions are if the same can be done without adding an RFID tag. Today, the alternatives have been based on optical recognition, which so far has not been a viable route on most occasions due to several reasons, e.g., their inability to read without a reference point.

The research paper was meant to open discussion of the environmental RFID tags, and as such it was exploratory by nature. The case study setting allowed describing the key structures of what enforces environmental goals on a tag level and to consider what kind of results it might lead to in a wider context. However, the approach taken leaves much room for further discussion, research and validation.

Future studies are recommended in the LCA approach, which is a topic that needs wider debate on the right measuring model. Standardized measuring model would provide a commonly accepted criterion for green tags and would foster the use of it. The validation of impact will be carried out through another research approach which does not look at one product technology alone but broadly at environmental tags and reports using a quantified method as to how the green tags perform in practice; and if there are practical new observations of deviations compared to traditional tags made on plastic and not on paper. Since this study looked only at the environmental perspective, it would be interesting to see research that aims to resolve sustainability topics more widely via RFID. From the consumer perspective, it would also be important to create and test concepts that would simplify the communication of the "sustainability grade" of a fashion product at the time of purchase. It is currently difficult to understand, as a consumer, if a product is sustainably produced. From the market dynamics standpoint, any data or research that is able to report how the landscape changes in the RFID market by developing new end-use categories (such as the food sector) and new technologies (such as environmental tags) is valuable. At the moment all this is left to private institutions, which does not provide the neutral and open discussion forum that academia does.

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