CLOTHING LABELS:
ACCURATE OR NOT?

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INTRODUCTION

With the European Textile Regulation (1007/2011) entering into force in 2011, requirements on labelling and marking of the fibre composition of textile products were harmonized throughout the European Union. The regulation states that labelling or marking of textile products has to be durable, easily legible, visible and accessible and that labels need to be firmly attached. Through this law, it was ensured that consumers are adequately informed on the composition of products at the time of purchase. The regulation also states that products containing two or more components do not need to be labelled if the components are not main linings and where they represent less than 30% of the total weight of the textile product[1].

In 2018, doubts were raised on the accuracy of these composition claims on labels on the Dutch market. With the introduction of the Fibersort, a technology able to categorise textiles based on their composition, deviations between the fibre categorisations given by the Fibersort and the composition claims on labels became apparent to sorters. In November 2018 the Dutch Parliament urged the Government to take action on misleading care labels with the following assumption: "Inaccurate labels on garments' composition impede their potential for recycling"[2].

The Ministry of Infrastructure & Waterways has commissioned Circle Economy to investigate the assumption that labels on garments are inaccurate, to map the consequences of inaccurate composition claims on labels, and to identify the measures required to tackle the challenge of misleading labels. This report summarises the outcomes and conclusions of this research.

ACCURACY OF COMPOSITION CLAIMS ON LABELS

RESEARCH METHODOLOGY

To assess the accuracy of composition claims on clothing labels, a large scale analysis has been carried out to compare these claims with the categorisation of the Fibersort. The Fibersort is an automated sorting technology that uses Near Infra-Red (NIR) to assess the composition of textiles before categorising them into specific fractions. A fraction consists of sorted textiles with a composition between pre-defined fibre thresholds. A more extensive overview of the Fibersort technology, its thresholds and accuracy can be found in the Fibersort Factsheet[3]. Because it uses NIR technology to assess the composition of textiles, the Fibersort only sorts mono-materials: garments comprising a single, homogenous layer of fabric. This study assesses the accuracy of labels on mono-material post-consumer garments, across 8 fractions, by comparing the categorisation of the Fibersort with the composition claim on the label of each individual garment.

The bulk of the sample of this analysis are non-rewearable post-consumer garments. These garments have been discarded by the consumer and have been delivered to a textiles sorter by a collector. The sorter has concluded that these garments have no monetary value on the second hand market, therefore classifying them as 'non-rewearable'. A small percentage of the garments in this sample are unworn, and still have price tags attached.

Throughout their use, especially laundering, garments inherently lose fibres. This is a known occurrence across most textiles, but is especially prevalent in low cost fabrics. The loss of fibres can also have a significant effect on the change of the composition of the fabric, like the ratio between the different fibre types in blends. Assuming 50 washes per item of clothing, the fibre loss can vary between 1-20% for cotton fibres and between 0.5-5% for polyester fibres[4]. This research mainly investigates garments made of low cost fabrics, with a low market value.

Recent studies show consumers dispose of their lowest-priced garments after seven to eight wears[5]. It can therefore be expected these garments have been washed less than 50 times. The fibre loss for the sample of this study is very likely to be lower than the estimates above. However, possible fibre loss must be taken into account when interpreting the results.

10,901 post-consumer garments have been analysed. However, the conclusions regarding the accuracy of labels can only be drawn from the garments with a legible label, this amounts to 7,749 pieces. In addition to this, the total textile composition indicated during the label check must add up to 100% (with a 5% margin) in order for the label to be considered valid. Labels have been found that do not add up to 100%, but errors may have been made when entering the composition. In 295 cases the total composition adds up to a value outside of 100% with a 5% margin, these inputs are not taken into account. The conclusions on the accuracy of clothing labels are based on the 7,454 items of clothing that have a legible and valid label.

Interviews have been conducted with various stakeholders in the textiles supply chain including (global) brands, producers, chemical and mechanical recyclers and label and traceability experts, as well as a desk study of supporting information.

ACCURACY OF LABELS

In this study, a label is considered accurate when its composition claim is within the Fibersort thresholds, with a maximum 5% margin. Figure 1 provides a full overview of the thresholds used per fraction, as well as the interpretation of any deviations found between the Fibersort's categorisation and composition claims on labels.

This research finds that 59% of the analysed labels are accurate. 21% of the labels deviate from the expected composition. For 20% of the garments analysed, the discrepancy between their composition claim and the Fibersort categorisation is even very high.

As illustrated in Figure 2, significant differences have been found in the accuracy of composition claims between pure and blended materials. 77% of the garments with pure composition have an accurate label, whereas only 41% of blends are labelled accurately, that is, both of the fibres in the blend must be correctly labelled for the label to be classified as such. Garments containing a blend of cotton and polyester show the greatest deviations.

FIBERSORT FRACTIONS AND THEIR TRESHOLDS

Expected Composition	Very Low	Low	Correct	High	Very High
Acryclic 100%	<70%	70-89%	>90%	-	-
Cotton 100%	<70%	70-89%	>90%	-	-
Viscose 100%	<60%	60-79%	>80%	-	-
Cotton 50%	<15%	15-34%	35-59%	60-79%	>=80%
Acrylic 50%	<15%	15-34%	35-59%	60-79%	>=80%
Wool 50%	<15%	15-34%	35-59%	60-79%	>=80%
Acrylic 50%	<15%	15-34%	35-59%	60-79%	>=80%
Acrylic 70%	<35%	35-54%	55-74%	75-94%	>=95%
Wool 30%	-	<15%	15-44%	45-94%	>=95%
Cotton 65%	<35%	35-49%	50-74%	75-94%	>=95%
Polyester 35%		<15%	15-44%	45-94%	>=95%
Polyester 65%	<35%	35-49%	50-74%	75-94%	>=95%
Cotton 35%		<15%	15-44%	45-94%	>=95%

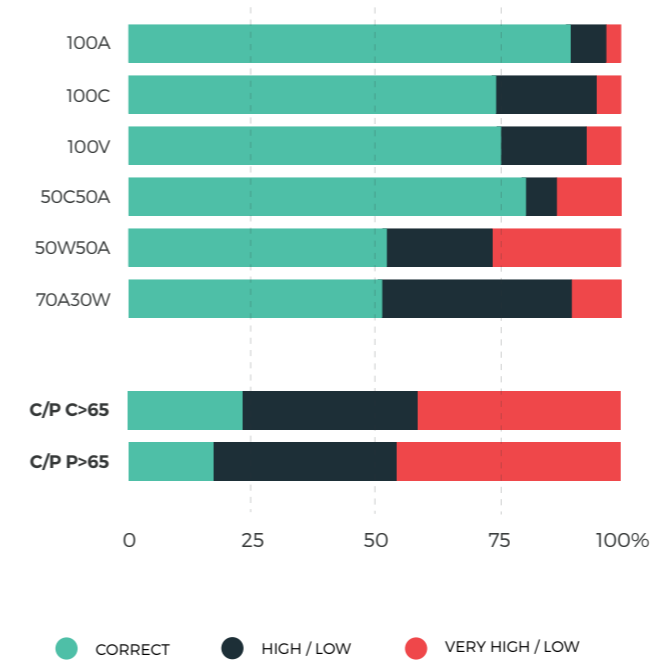*Figure 1*

LABEL ACCURACY PER FRACTION

Figure 2

The outcomes of this study reinforce the findings of an earlier, internal inquiry conducted by the Ministry. This internal inquiry, also conducted using the Fibersort, had a sample size of 489 post-consumer garments and found that 54% of labels were within a 5% margin of the Fibersort classification, 26% were within a 40% margin and 20% deviated more than 40%. The internal inquiry also assessed the accuracy of composition claims on new material samples and pre-consumer garments and showed that 79% of the material samples and 75% of the garments had accurate labels. Considering the small amount of items analysed (39 material samples and 20 pre-consumer garments), these results suggest label inaccuracy also occurs in new products however, a more extensive research with pre-consumer products is required to obtain reliable representative data.

As outlined previously, the accuracy of claims differ considerably between fractions. This research includes a vast sample of cotton polyester blends, 35% of all garments analysed consists of a cotton polyester blend. The previous internal inquiry included a wider array of fractions, while cotton polyester blends were a smaller part (9%) of the sample. Furthermore the internal inquiry assessed the deviation between Fibersort analysis and the composition claim on the label per individual garment, while this research only considers the deviation between the Fibersort thresholds per fraction and the individual labels. This could indicate that deviations identified in this research might be larger if the analysis had taken place per individual garment rather than per fraction.

The outcomes of this study are also validated by an earlier assessment by the Netherlands Food and Product Safety Authority (NVWA) on the labelling of fabric sold on markets and in fabric shops and that is intended to be used for domestic garment production[6]. NVWA's assessment concluded that for 13 out of the 56 samples (23%) analysed the composition was strongly different from the composition claims on their labels. The fibres claimed were either not present, or present in very high/low concentrations compared to the composition claims on the labels. This is in line with this research, which finds that 20% of the garments analysed have a very strong deviation between the Fibersort categorisation and composition claims on their labels.

POTENTIAL CAUSES FOR INACCURATE LABELS ENTERING THE MARKET

European Member States, responsible for the implementation of the European Textile Regulation in their own territories, have assigned authorities that are accredited to verify the accuracy of composition claims on labels. However, the brands and retailers that have contributed to this research do not experience any auditing from such authorities on composition claims for garments entering the Dutch market. The aforementioned publication by the responsible authority, the NVWA, on the accuracy of composition claims is the only report on this subject, dates back to 2003 and is only assessing rolls of fabric intended for home use, while numerous reports have been published in the past years on the use of chemicals in garments.

The accuracy of composition claims on garment labels is not a high priority topic on the agendas of the authorities responsible for the compliance of national and international laws and regulations of products offered on the Dutch market. The Netherlands Food and Consumer Product Safety Authority (NVWA), focuses its activities on product groups and companies that could create considerable health and safety risks, should laws and regulations not be adequately implemented. Seeing as the purpose of labelling the composition of the garment is primarily to protect consumer interests, ensuring the accuracy of these label claims is not something the NVWA deems to be a high priority. Another authority which may have a vested interest in assuring the accuracy of clothing labels is Customs. As Customs only consider risk profiles put forward by the NVWA, imported textiles are not intercepted to verify their compliance of the European Textile Legislation. However, Customs does intercept imported goods in relation to import charges, which could differ considerably amongst materials

(for instance, the difference in charges applied to cotton vs. wool could be up to 10%). If there are indications that composition claims are inaccurate so as to minimise charges that apply, customs might intercept imported goods. Such a check would then only compare customs declaration forms with composition claims on garment labels and does not include an assessment of the accuracy of claims on the labels themselves.

POTENTIAL CAUSES FOR INACCURATE LABELS IN THE SUPPLY CHAIN

Brands and retailers have numerous measures in place to ensure composition claims on labels reflect the actual composition of their products, as required by the European Textile Regulation. These measures range from long lasting supplier relationships, to extensive testing on fabric and/or product-level. There is no harmonised testing procedure nor are brands required to test whether the actual composition matches the label claims.

Through interviews with different players across the supply chain, it has become clear that larger brands often have more capacity to implement checks for label accuracy, with some large brands having their own label compliance department and/or on-site auditors in the production countries. Smaller brands often rely on the information provided by the supplier and do not perform their own composition tests.

In this research, the cotton polyester blends show the biggest deviation between the Fibersort categorisation and the composition claims on labels. In our conversations with suppliers and brands, several potential causes for these deviations are identified:

Image 1: Content label reads 100% Diverse Recycled Fibres

Image 2. Lost in translation: The content claim differs per language, where for US the label reads 85% Acryclic 15% Mohair but for the GB it reads 75% Acrylic 25% Mohair

Unintentional inaccuracy due to complex textiles supply chain

The textiles supply chain is long and complex. Information on composition is transferred from yarn maker, to fabric weaver, to garment manufacturer, to brand directly or indirectly, through middlemen. The lack of supply chain transparency has been identified as a key challenge to address environmental and social challenges in numerous publications and was recently named the second most important topic on the agenda of the Chief Purchasing Officers of the world's largest brands[7].

For the 65% cotton 35% polyester fraction analysed in this study, unintentional inaccuracy is probable for 29% of the garments. In these cases, labels state a lower cotton content (15% of the sample) and/or a higher polyester content (14% of the sample) than the garment's actual composition. Considering the market values of these materials (cotton is more expensive than polyester), intentional inaccuracy is not probable in these cases. Additionally, a deviation of up to 20% of the cotton content could also be as a result of fibre loss occurring during the use of a garment, as described previously.

During this analysis, a number of garments found in the 70% Acrylic 30% Wool fraction were made up of recycled materials, see Image 1. Their label clearly states 100% diverse recycled fabrics, but this does not give any indication as to the origin or makeup of any of the fibres included in this blend. In the quest for accelerating the circular economy, in which high value recycling plays a role, it is important to consider how to communicate recycled fibres to the consumer. The Dutch Norm Commission (NEN) is currently working on standardising a definition for circular textiles. The current European Textile Regulation should anticipate this new material development, and consider how best to include this in the labelling requirements.
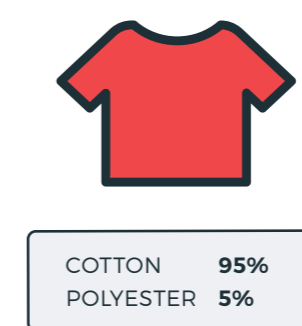
Intentional inaccuracy maximising a product's value

Financial incentives can exist to maximise composition claims on specific materials, mainly in relation to natural fibres like wool and cotton. The outcomes show that in the case of the cotton polyester blends, 31% of the garments categorised by the Fibersort to contain 65% cotton and 35% polyester, have a label claiming content of 95% cotton or above. Such large deviations between declared and actual cotton content cannot only be the result of fibre loss. These outcomes suggest that intentional exaggeration of cotton content is indeed plausible.

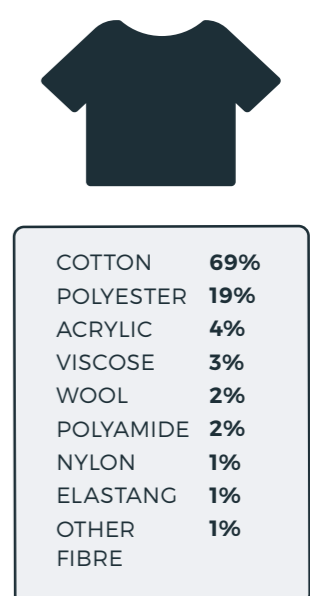**WHEN ANALYSING COTTON RICH COTTON-POLYESTER BLENDS (C/P C>65) WE SEE THE FOLLOWING;**

1 in 3 shirts has an average label of 9 different fibres

COTTON	65%
POLYESTER	35%
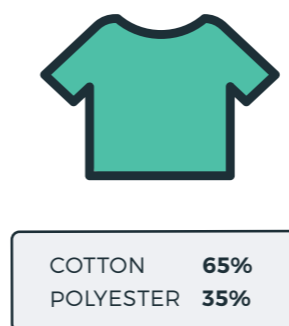
1 in 3 shirts correctly indicates 65% Cotton 35% Polyester

COTTON	95%
POLYESTER	5%

1 in 3 shirts incorrectly exaggerates the cotton content as being very high

COTTON	69%
POLYESTER	19%
ACRYLIC	4%
VISCOSE	3%
WOOL	2%
POLYAMIDE	2%
NYLON	1%
ELASTANG	1%
OTHER FIBRE	1%

As all garments analysed for this research are post-consumer garments, outcomes mostly reflect situations from the past. The inaccurate claim of high cotton content that this analysis finds could, for instance, reflect the peak in Cotton prices in 2011[8]. Deviations between composition claims and actual compositions of garments currently in store might therefore be smaller than the outcomes that this study implies, due to the fluctuating cost of cotton. However, the system that allowed garments with inaccurate labels to enter the Dutch market has remained unchanged. The sample analysed did contain a large amount of new garments, some even with price tags still attached. The age of the garments is not part of the scope of this study, but some extreme estimates suggest that consumers discard some of their lowest-priced garments after just seven or eight wears and that more than half of fast fashion produced is disposed of in under a year[9]. Consumers wear their clothes 36% less than they did 15 years ago[10]. Therefore while part of the sample analysed could reflect situations from the past, the research outcomes certainly show there is a reason for concern on the accuracy of composition claims for newer garments as well.

CONSEQUENCES OF INACCURATE LABELS

Although the European Textile Regulation serves to properly inform consumers about the composition of products at the time of purchase, the results of this study show that consumers are likely to be misled in 41% of the cases, especially when purchasing garments that consist of multiple fibre types.

In an American consumer survey, 63% of consumers cited fibre composition as an important factor in the choice of purchasing a garment[11]. Contrary to regulation on product safety and the use of chemicals in textiles, an inaccurate label does in most cases not have an impact on product safety. However, there are consumers who have specific requirements for the composition of textiles they purchase, for instance due to allergies, religious or personal convictions. With

specific materials such as wool, consumers with an allergy could experience physical discomfort if labels do not adequately indicate the wool content of the products they purchase.

While they are legally obliged to adequately inform consumers on the composition of the products they put on the market, brands and retailers have not (yet) faced any (public) legal repercussions for inaccurate labels. In the case that a brand discovers a label as being inaccurate, the entire shipment whether in store or still underway, will have to be recalled to be 'relabelled'. This often happens by stickering the incorrect content claim with the correct claim on top. This procedure is necessary due to the strict requirements of the Regulation stating that the labels must be accurate at the time of purchase. The extent to which these stickers are still attached and legible after long term use is unclear, it seems quite probable these stickers will no longer be attached to the label at time of reuse, therefore misleading the second, third or fourth consumer.

The main concern raised in the Dutch Parliament in relation to inaccurate composition claims on labels was the obstruction they cause for recycling of post-consumer textiles. This statement has been verified with established as well as upcoming recyclers for textiles. Most recyclers indicate that they do not rely on the composition claims on labels to determine the composition of their recycling feedstock. Using post-consumer textiles as their feedstock, labels are not always present nor legible once they reach the recycler. Sorting by way of manually checking the labels would also increase the processing costs significantly. Recyclers that do label checks experience deviations between the actual composition of these garments and the composition claims on their labels. Many therefore, when in doubt on the accuracy of labels, perform additional tests, like light and/or burning tests to determine the presence of polyester in their feedstock.

Recyclers do however experience a barrier to the potential recycling of post-consumer textiles caused by labels. This barrier does not relate to the accuracy of the composition claims, but rather to the presence of the label itself. A more extensive description of the challenge of 'label pollution', its consequences and potential measures is described in Chapter 3.

It should also be noted that because this research analyses mono-materials only and given the 'leniency' of the European Textile Regulation, in that it only requires components to be labelled if they are main linings or represent more than 30% of the total weight of the textile product, that the inaccuracies of label claims are a more widespread issue, and could possibly affect a greater percentage of more complex clothing and textile products, that are not represented in this analysis.

RECOMMENDATIONS TO INCREASE THE ACCURACY OF LABELS

The outcomes of this research indicate that doubts regarding the accuracy of composition claims on labels are justified, especially for products containing more than one fibre type. The Dutch government has a range of instruments to increase the accuracy of composition claims on clothing labels.

Strengthening existing measures: Focus on Enforcement

The government could take a structural approach in enforcing the European Textile Regulation. This could be done in collaboration with the NVWA to establish a risk profile for the purpose of intensifying checks in stores and/or at the border. This would require freeing up capacity at the NVWA and Customs for the purpose of carrying out checks.

Checks at the border:
According to UN Comtrade[12], The Netherlands currently imports 7,800 tonnes of garments per year including; accessories, babies clothing and knitted or crocheted items. Imported garments would need to be checked at their point of entry. This could be achieved by housing the Fibersort (or similar) technology at key points of entry. This would require the technology to be accredited as a valid means of controlling the textile composition. The Fibersort technology, as well as comparable alternatives, has limitations in that scanning only mono-materials would disqualify any multi-layered items from being checked for label accuracy which entails a considerable limitation of the scope of these checks. Sufficient human resources should be made available to handle the manual process of unpacking and repacking the controlled garments and checking of labels, and if needed impose any sanctions.

The impending Dutch national EPR scheme might mean that this regulatory checking measure would need to be enforced anyway as higher fees would be applied to garments with a higher environmental footprint and/or a lower potential for reuse and recycling.

Checks on shop floor:
Specific fibre compositions could be targeted based on their potential risk profile ie. blends and/or wool as a first step. A global retailer indicated that random shop floor sample tests were carried out in Poland and Italy and mainly tested the wool fibre claims. These individual checks can be costly, and the speed at which some shop floors have a complete stock turnover (some every 2 weeks) could warrant the test results futile.

Both of these checks would require establishing sanctions for non-compliance of regulations regarding label accuracy. As other European Member States might have implemented checks on composition claims, a wider benchmark of best practices from abroad should be carried out to inform measures that will strengthen the enforcement of the European Textile Regulation in the Netherlands.

System Innovation: Transparency in the Supply Chain

There are alternative ways of safeguarding information throughout the supply chain, mainly through either innovative traceability tools or collaborating with the sector to improve procedures.

Innovative traceability tools:
Traceability tools might represent a possible turning point to trace the origin and characteristics of a product, hence increasing the transparency within global supply chains. It could allow information to be passed among various supply chain actors hence increasing the reliability of composition claims. Besides, traceability tools could allow for supply chain partners to identify hotspots where inaccurate claims occur most.

The industry could focus on the development and application of tracking systems, such as DNA, RFID and QR codes. The government could encourage the development of these systems through financially supporting such innovations. However, these innovations should not become a new obstacle for the recycling of textiles, as described in detail in the following chapter on label pollution.

Collaborating with the sector
It is integral to increase awareness along the supply chain of the various issues, possible causes and risks associated with the inaccuracy of label claims. Small to medium brands specifically need support in understanding the risks involved in relying fully on one's suppliers without conducting third party tests on the clothing composition. Smaller brands also have the least capacity, and resources to implement and check all of their incoming items.

While some larger producers already have an extensive quality control system in place, and the composition of their products are tested at several stages in their supply chains, deviations between the label and a garment's actual composition do occur. There are no uniform guidelines for producers to apply. This research shows that there is reason to expect clothing producers to review the effectiveness of their own methods of labeling products.

This research shows that there is reason for brands and producers to reasses the effectiveness of their own practices. The extent of the problem of the inaccuracy of labels often goes unnoticed in the industry. The government can play a crucial role in raising awareness and driving the sharing of best practices that ensure the accuracy of labels such as quality procedures, purchasing practices and sustained supplier relationships within the textiles sector. This benchmarking could take shape through existing partnerships, such as the national Sustainable Clothing and Textile Covenant and/or branch organisations, as well as on an international level through platforms like the Sustainable Apparel Coalition.

3

LABEL POLLUTION AS A BARRIER TO RECYCLING

RESEARCH METHODOLOGY

As described in the previous chapter, some recyclers involved in this research indicated that labels are a barrier for textile-to-textile recycling not due to inaccurate composition claims but rather as a pollutant of their feedstock. In the event that the composition of a label is not compatible with the composition of the main fabric, labels would need to be removed to ensure recyclers use a homogeneous feedstock.

Checking the compatibility of labels is included in the scope of this analysis. For all 10,901 garments analysed, the presence of the label was tracked. In the case that a label was attached to the garment, an assessment was made on whether or not the material the label was made of was compatible with the composition of the full garment. The presence of hardware and other contaminants (like embroidery, lurex thread) was also indicated for each of the garments. In doing so, an overview was created on the presence of labels, their compatibility with the composition of the whole garment and whether or not the label was the only contaminant creating a barrier for recycling.

LABEL POLLUTION

Of the garments analysed in this research, 24% do not have a label (anymore). 17% have a compatible label while 55% of the garments analysed in this research have a non-compatible (polyester) label, as illustrated in Figure 3.

In 33% of the garments analysed, the presence of a non-compatible label was the only contaminant limiting their potential to be recycled. This mainly occurred in the pure fractions as 67% of these items consist of only one fibre type and can therefore already be recycled through existing mechanical recycling technologies. Mechanical technologies are most affected by the presence of non-compatible labels since chemical technologies either recycle feedstocks containing polyester or can handle a certain level of feedstock contamination, which often becomes a waste bi-product of their process.

Labels are often cut out, leaving a small piece of label that contaminates an otherwise homogeneous feedstock for recycling. Cut out labels were not taken into account in this research as garments with a cut out label were categorised as 'no label' together with the garments without any trace of a label. Therefore, the issue of label pollution is even larger than indicated in this research.

TYPE LABEL

- Label as the only contaminant — 33%
- no label — 24%
- more contaminants than only the label — 22%
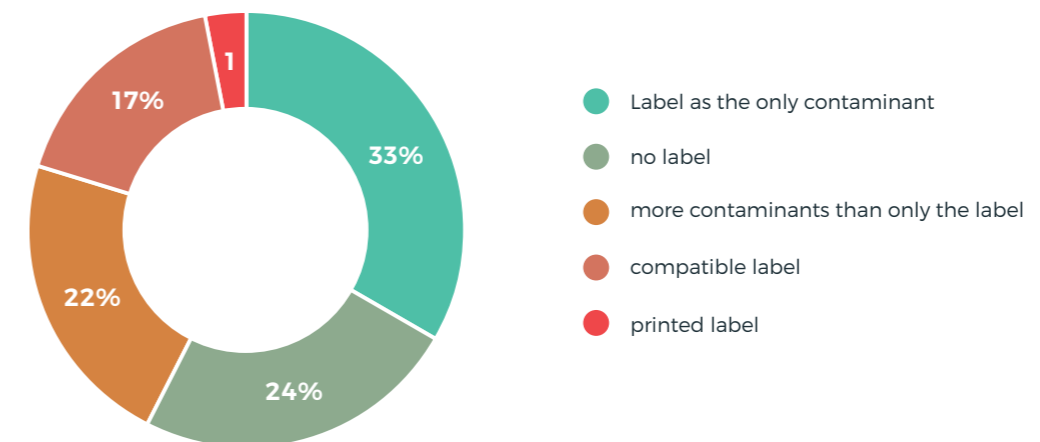- compatible label — 17%
- printed label — 1

Figure 3

POTENTIAL CAUSES OF LABEL POLLUTION

In order to comply with the European Textile Regulation in a cost-effective way, labels with sometimes as many as 9 pages are attached to products. Brands large enough to have their own label compliance team, amalgamate all country specific legislations of the markets they sell in, and use the strictest regulation of each to create their own internal labelling regulation which they then apply to all of their products. These are often made of polyester due to the low price and robustness of the raw material. Alternative labels such as compatible or printed labels are used, however not on a large scale. These labels or prints usually perform less well on the technical durability requirements for clothing labels set by the European Textile Regulation.

Many consumers cut the labels out of their clothing shortly after purchase, due to aesthetic reasons or because of their wearing comfort. Many producers encourage consumers to remove labels after purchase with a scissors symbol. 24% of the sample in this study no longer had a full length label, and yet the left over portion of label still amounts to label pollution.

Removing clothing labels in the end-of-use supply chain is labour intensive and therefore expensive. The presence of incompatible labels is a frequently mentioned barrier to the processing of post-consumer textiles, in particular to mechanical recycling. Many chemical recycling technologies can deal with limited contamination of their material feedstocks by, for example, labels, but this is at the expense of the efficiency of the process. These technologies are however still being developed.

CONSEQUENCES OF LABEL POLLUTION

Before clothing can be recycled, and after it has been sorted, it needs to be prepared for shredding. This involves removing any contaminants such as hardware (buttons, zippers etc), or clothing labels. Labels are often polyester and often white, if the colour and/or material from which its made are not compliant with the main fabric, they must be removed. The removal of the labels is only done manually which creates a significant (financial) barrier for textile-to-textile recycling at scale. Even labels that have been cut out by consumers themselves (as prompted by the scissors icon on the label) still cause contamination for the recyclers, see Image 3.

Garments that are made up of more than one layer would technically require each layer to be separated from the other into the individual components, however this presents a labour intensive process, and would require further fibre content validation for each component to assure a homogenous feedstock. The process of removing hardware and other potential fibre contaminants for garments made up of more than 1 fabric, currently only happens with garments where the content is fairly well known, such as jeans which are highly likely to have a high cotton content. Some contaminants, such as sequins, metallic thread and elastane are financially not viable to separate from the main fabric, presence of these contaminants are problematic even for chemical recyclers.

In order to aid recycling, high quality input is necessary. The presence of any type of contaminant hinders not only the business case for recycling, but the efficacy of the recycling process too. Non-rewearable garments for which recycling is not feasible from either a technical and/or financial point of view can only be converted into a lower value product (such as mattress filling, insulation materials) or incinerated.

Image 3: The effect of a white polyester label in an otherwise black 50%Wool 50% Acrylic batch of recycled material

ALTERNATIVES FOR THE CURRENT LABEL

Regulations require a physical label to be securely attached to products that are sold on the European market. The label needs to be durable and remain legible after numerous washes. The aim of the label is to inform the consumer of the origin, composition and care instructions for the product. However, does the need to inform the consumer outweigh the potential for the product to cycle back into the value chain at its end of use? As traction increases to design textiles fit for reuse and recyclability, alternative information carriers could be considered to fulfil the current role of labels.

Several initiatives are assessing potential alternatives to the traditional sewn in, polyester label. Some producers have started using compatible labels on their products, for instance more and more cotton labels can now be found on cotton products. In the event these compatible labels are able to meet the same technical requirements as the traditional labels, the challenge of label pollution could be solved. However, there are product groups where a compatible label might be more difficult to develop, for instance for wool and acrylic products. Next to labels made from compatible materials, printed labels are starting to be used throughout the industry. However, this solution will not address the full challenge either as some product groups, like denim, are more suited to printed labels as opposed to woolen sweaters. Another limitation with printed labels is their lack of durability, and the large amount of information that needs to be included on the product. Relevant other methods of conveying this information include:

- DNA tracking, with the aim to safeguard the integrity of fibre, is used primarily in the cotton supply chain, but may be used with other natural fibres such as wool and silk as well. This new form of verification has yet to be scaled, but yields promising results as the technology does not rely on any hardware or different physical material to be attached to the clothing in order to identify it, see for example Fibertrace or Integritex

- RFID tags as they are currently used in the textiles industry are primarily there for item tracking, and logistics management. The technology relies on radio frequency and comes in the form of a thin aluminium antenna with a silicone cell which needs to be affixed to either a clothing label or hangtag. However, some issues do present themselves- some RFID tags taken from post-consumer clothing which have been tested internally at a third party tester, showed no longer to be useful after they had been washed an unspecified amount of times. The metal composition of the RFID tag, as attached to a label, does not help or accelerate any current recycling efforts either. The future is likely to hold an interesting opportunity for RFID tags, in that bulk scanning of multiple garments is possible without needing a direct line of sight to the tag. This would greatly aid the sorting of textiles into homogenous streams of secondary resources, although automated sorting technologies like the Fibersort allow for this same functionality without the need of adding a physical tracker to textiles.

Interestingly though, there is a disconnect between how the industry might use RFID tags- largely for logistics and inventory tracking and how the consumer might want to use RFID tags in the future- to verify and authenticate product specifications.

- The radio frequency the RFID tag uses in the logistics sector is not integrated into consumer smartphones. Similarly the codes that consumer smartphones are able to read are not ones suitable to use for inventory or tracking purposes.

- It has been suggested by some brands and retailers that QR codes might present a very useful solution, especially when looking at the need to amend an incorrect label. The downside to QR codes is however, that they rely on a static web link, which, due to a number of reasons, may change over the course of time resulting in lost information. Consumers would need to store the information of the garment in a virtual wardrobe, so as to access it at all times and this information would need to be transferred again to subsequent users of the garment.

Many technologies mentioned above, though interesting for supply chain transparency, are still susceptible to human error. At the point of information entering the system, whether housed on RFID, QR or DNA tracking, human hands need to input the baseline information. As with the label accuracy findings, the intentionality behind falsifying information is something that could still occur.

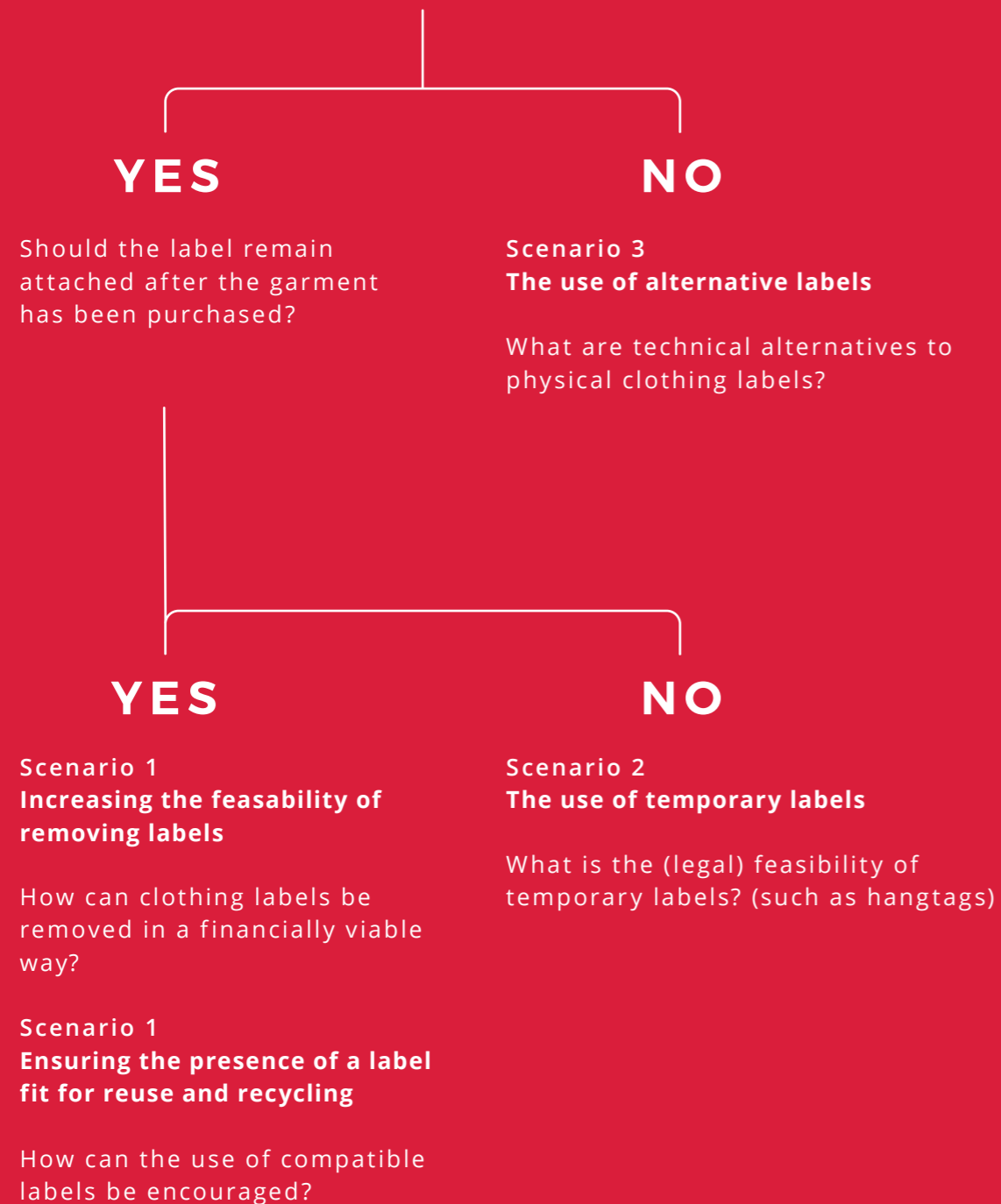## RECOMMENDATIONS FOR COMBATING LABEL POLLUTION

While circularity has become an increasingly important topic on the Dutch (political) agenda, the conversion of old textiles into new textiles is hampered by European requirements for product labelling. The European Textile Regulation requires sustainable, legible, visible and accessible labeling or marking of a product in order to inform consumers of their composition when purchasing. Marking by way of a printed label is often not possible, so in most cases a physical label is chosen, which must be firmly attached to the product. This label is then an important physical and financial barrier for the return of the raw materials, inherent to the product, to the value chain. Governments are faced with an important dilemma: does the importance of informing the consumer by firmly attaching a label take precedence, or does the subsequent circular potential of a garment hold more weight?

The below decision tree is a guide to the considerations that governments can make between the need to inform the consumer and the potential for the reuse of raw materials. Each of the choices will lead to further measures that can be taken to combat the problems surrounding label contamination.

LABEL POLLUTION: STRATEGIC DILEMMAS

IS A PHYSICAL, SECURELY ATTACHED LABEL NECESSARY FOR EACH GARMENT? (AS PER THE EUROPEAN TEXTILES REGULATION)

YES

Should the label remain attached after the garment has been purchased?

YES

Scenario 1
Increasing the feasability of removing labels

How can clothing labels be removed in a financially viable way?

Scenario 1
Ensuring the presence of a label fit for reuse and recycling

How can the use of compatible labels be encouraged?

NO

Scenario 2
The use of temporary labels

What is the (legal) feasibility of temporary labels? (such as hangtags)

NO

Scenario 3
The use of alternative labels

What are technical alternatives to physical clothing labels?

SCENARIO 1: INCREASING THE FEASIBILITY OF REMOVING LABELS

Several recyclers indicated that the presence of incompatible labels is a major obstacle to the recycling of textiles. If labels are retained in their current form, extra measures will need to be taken to realise the Dutch ambition toward circular textiles. In order to aid this, (more) effort can be made to develop technologies that allow a limited degree of contamination, in the form of incompatible labels, in their raw materials. As previously mentioned, this is already the case for chemical recycling technologies that are currently under development. Existing mechanical technologies however, have the need for a homogenous raw material without label contamination. The technical and financial feasibility of label removal must be further explored by the industry, and could be supported financially through innovation grants. Where possible (fiscal) measures can be considered by the Dutch government to make the manual removal of labels financially feasible.

SCENARIO 1: ENSURING THE PRESENCE OF A LABEL FIT FOR REUSE AND RECYCLING

The European Regulation requires that a label is firmly attached to the product when purchased by the consumer. What happens after the purchase has not been recorded or governed by the Regulation. Many labels have scissors with a dotted line at their base, with which consumers seem to be encouraged to remove the label after purchase. If in a circular textile industry the label also serves to inform both future owners of the garment and a recycler about the composition, such a suggestive instruction on labels should not occur. To this end, the industry should stop placing the scissors symbol on labels, and the European Textile Regulation should lay down restrictions to encourage this.

SCENARIO 2: THE USE OF TEMPORARY LABELS

Clothing labels must be firmly attached to the product and remain legible for an extended period of time. If the composition claims are indeed only important at the time of purchasing the garment, the use of temporary labels could be applied. For example, several retailers are exploring the use of QR codes on hangtags, that can easily be removed immediately after purchase, as is the case with price tags. Information about the item of clothing would then be stored in a digital wardrobe. In order to make such alternatives possible, the requirements for the firm attachment of labels should no longer be part of the European Textile Regulation. The European Commission could, on the basis of research into the feasibility and side effects of temporary labels, ensure the European Textile Regulation allows for their use.

SCENARIO 3: THE USE OF ALTERNATIVE LABELS

Potential alternatives to physical clothing labels are currently being explored within the industry. If the presence of a physical label, with an eye on the recyclability of the garment, is no longer a requirement, technologies such as DNA tracking could replace physical labels. Such initiatives could enable consumers to view the product information in store or online and store it in a digital wardrobe when purchased. To make alternative labels a reality, the requirements of the European Textile Regulation will also have to be adjusted. The European Commission could select the most suitable alternatives based on assessment of the feasibility and side effects of all alternatives being developed, and ensure the European Textile Regulation allows for their uptake.

4

CONCLUSIONS AND RECOM- MENDATIONS

ACCURACY OF COMPOSITION CLAIMS ON LABELS

The accuracy of composition claims on clothing labels is not always credible. Only 59% of garments in this research had an accurate label, but there is some nuance to the problem when delving deeper into the fibre types. Pure fibres have a label accuracy rate of 77%, whereas the labels on blended compositions are only accurate in 41% of the cases. The highest discrepancy is seen between the cotton polyester blends, showing an accuracy rate of only 23%.

Both the Dutch government and clothing producers have at their disposal instruments to increase the accuracy of clothing labels. The government can focus on strengthening the enforcement of the European Textile Regulation through structural checks on the accuracy of clothing labels at the border and in stores, while acknowledging that this will never cover the entirety of textiles coming in to the Netherlands. Increasing transparency throughout the value chain is an important theme in the clothing industry, and several initiatives are working on the development of traceability systems. The development of these systems can be accelerated by the government through its innovation funds. This research shows that there is a need for producers to assess and improve the effectiveness of their procurement practices and procedures for labelling. The government can contribute to this by incentivising the exchange of best practices among producers.

LABEL POLLUTION AS AN OBSTACLE FOR RECYCLING

Aside from the inaccuracy of labels, their very presence on clothing is a major obstacle for recyclers. Labels compromise the purity of recycling feedstock from both a fibre and colour standpoint. The purpose of labels is to inform consumers when purchasing the product, but this requirement could be offset by the negative effect of the label on the recyclability of the product. The current importance of circularity on the (political)

agenda means that Dutch policymakers must consider the downstream effects of existing European regulations. Based on a trade-off between the importance of product information and recyclability, the Dutch government could advocate for more stringent or flexible labelling requirements from the European Textile Regulation.

RECOMMENDATIONS FOR FOLLOW-UP

This research used the Fibersort technology to sort fractions of post-consumer garments, the output of these verified fractions were then individually checked against the composition claim on their labels. The accuracy of the Fibersort was determined using third party lab testing, the results of which can be found online. The fractions where the Fibersort has the most accurate results is where this research found the biggest deviations between label claims and Fibersorted fraction. The lab testing was done on different garments to the ones that were manually sorted for the purpose of this research. A combined research where lab tests complement the label checks of Fibersorted garments could further add to the robustness of the conclusions on labels accuracy.

The Fibersort technology has been used to categorise mono-material post-consumer garments, this means that only the simplest, and most preferred input for recycling was analysed in this research. As the analysis only considered post consumer textiles, the research outcomes could partly reflect situations from the past. Furthermore, the actual composition of the textiles analysed could have changed during their use by consumers, in the form of fibre loss. Therefore the outcomes of this research should be validated using a similar analysis with pre-consumer textiles.

The aim of this study was to verify the assumption that clothing labels are inaccurate, to explain the consequences of inaccurate labels, and to propose measures to address this problem. Although several possible causes have been set out for deviations between the actual composition and labels, no clear conclusions can be drawn on the basis of this investigation regarding the extent to which inaccurate labels are a conscious or unconscious act. The results of this investigation certainly give rise for a supplementary investigation in which the origin of and possible motivation for inaccurate labels can be conclusively investigated.

Alternatives to labels are being developed. The effectiveness, feasibility and (side) effects of these alternatives have not yet been clearly identified. If alternative and/ or temporary labels are considered, further research should be conducted to consider the potential and impediments of such alternatives in the decision to switch to another form of labeling.

	Potential measures from the industry:	Potential measures from the Dutch government:	Potential measures from the European government:
Increasing the accuracy of labels by:			
Increasing enforcement through structural checks		Explore the feasibility and impact of enforcement based on an international benchmark	
Increasing supply chain transparency through traceability systems	Develop and implement traceability systems throughout supply chains	Support the development of traceability systems through innovation grants	Support the development of traceability systems through innovation grants
Improving effectivity of procedures throughout supply chains	Develop or improve own procedures for labelling	Raise awareness within the industry on the challenges relating to inaccurate composition claims Accelerate the exchange of best practices to assure the accuracy of labels within the industry	
Reducing label pollution by:			
Increasing the feasibility of label removal	Explore the technical and financial feasibility of label removal	Support the development of methods for label removal through innovation grants Explore potential (fiscal) measures to ensure the financial viability of manual label removal	
Ensuring labels are fit for reuse and recycling	Remove the scissors symbol from labels to avoid encouraging consumers to remove the label		Incorporate restrictions in the European Textile Regulation on the use of a scissors symbol on labels
Using temporary labels	Explore the potential use, feasbility and (counter) effects of temporary labels		Explore the (legal) feasibility of temporary labels; if appropriate allow for their use through the European Textile Regulation
Using alternative labels	Explore the potential use, feasbility and (counter) effects of alternative labels		Explore the (legal) feasibility of alternative labels; if appropriate allow for their use through the European Textile Regulation

Regulatory and legislative instruments

Economic instruments

Soft Instruments

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