

CONTEXT: Interviews conducted as part of an investigation into the barriers to, and opportunities for, achieving Circular Synthetics. Research was funded by Business of Fashion, Textiles and Technology Creative Research & Development Partnership (BFTT CRDP—£5.5 million) led by the University of the Arts London, part of the UK Creative Industries Clusters Programme (CICP) funded by the Industrial Strategy Challenge Fund, and delivered by the Arts and Humanities Research Council (AHRC) on behalf of UK Research and Innovation.

Interview ID: BFTT-WP5-200720-20

Interviewee: CEO, non-woven textiles research institute

1: Interviewer

2: Interviewee

1: Perfect. Can you tell me a little bit about the [redacted] and your role within the organization?

2: [redacted] was spun out from the [redacted] in 2005. It literally just turned 15 years old.

1: Wow.

2: It was spun out to focus on industrial research and product development and innovation in nonwovens specifically. We have small scale prototyping equipment for making nonwovens. We're involved in the design and development of nonwovens for many industrial applications. Everything from bulletproof vests to tea bags, from hygiene products to geotextiles. My role within [redacted], I'm now the CEO, looking after all the consultancy business. 90% of our business is consultancy, the other 10% is technology development where we're developing new technology that we're then licensing out to industry.

My background, I'm a textile engineer by training. [redacted]. In between time, I managed to spend 10 years out of the industry and then came back in 2005 to be one of the founder members of [redacted].

1: Perfect. Does [redacted] have any links to [redacted] now or is it mostly separate?

2: Well, it's a separate legal entity. A new, Limited company, but the university is still a shareholder.

1: Okay, so you still have--

2: [redacted]

1: Perfect. Obviously, non-wovens span, as you say, such a lot of different applications, do you focus on any particular area or is it quite open still?

2: It's pretty broad because we're running a consulting business. Different people come in with a different product almost every day. I suppose our business reflects the industry, the nonwoven industry. Where the most research-intensive

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development areas are, medical, hygiene, filtration would be our bread and butter. We get involved in all sorts of areas.

1: Great. Moving on to the next question. We're asking everyone what their experience is of circular synthetics. I guess with regards to [redacted], what I'm asking is, what has your experience been of recycled materials going into nonwovens and then coming out again?

2: I suppose there's two main elements at the moment. There's post-industrial, it's that getting some recycled material either buying recycled material in, and using that in the process itself, or it's taking some of your waste and converting it into a form where you can use it again in the same process. Yes, we've been heavily involved in that area. We've also been involved in some post-consumer recycling as well. Albeit old clothing, apparel, that's then mechanically converted or chemically converted into another feedstock.

We've developed technologies for disassembly as well. Many nonwovens are not used by themselves. Rarely are they just nonwoven products. They're always used in combination with other materials, flat laminates, which tends to make recycling a little bit trickier. We've developed a number of techniques over the years to disassemble products at the end of life so that they can then be separated into different components and recycled.

1: Do those tend to be from one particular industry or another or is it just across the board? I'm just imagining disassembly, maybe automotive or does it tend--?

2: Automotive or packaging. Also, we're involved in some de-labeling corporate clothing to be reused rather than scrapped for security reasons. Yes, it's pretty broad what we're actually involved in.

1: Can you describe that project? The nonwoven part was or was it nothing to do with nonwovens, it was more to do with just--?

2: It's to do with the disassembly [crosstalk].

1: That's interesting.

2: [inaudible 00:13:45] as a yarn-based technology, it was just susceptible to microwaves. We called it [redacted]. It's now being commercialized by a company called [redacted]. [redacted]. Essentially the sewn seam has standard strength of a normal seam, you can wash it as many times as you would do a normal garment. At end of life, you just microwave it quickly and the yarn loses all its strength simply. You can then disassemble the components.

1: That's really interesting.

2: Yes, we designed it to de-label corporate wear. It can also take out zips and buttons to make mechanical recycling a lot easier. Then also reworking any sewn components. We did some work in automotive seating as well.

1: Amazing. Actually, in theory, you could actually take linings out and all sorts with that?

2: Yes. That would be quite an easy approach, yes.

1: Oh, nice. Have you done any projects specifically working with post-consumer clothing textiles that might come out of a local authority collection scheme or something like that?

2: Yes, we did quite a lot of work with the [redacted] actually, looking at post-consumer waste, clothing waste, looking at its composition. I know there was a couple of papers published on what the composition of recycled clothing were. Despite there being quite a diverse mixture of fibers, it was surprising how consistent the waste was overall.

1: Oh, that's interesting.

2: Yes. It was literally mainly polyester and cotton in a pretty regular split.

1: I was involved in a Trash-2-Cash project and they took a snapshot. Then that obviously gives you a picture in time, and it was obviously polyester cotton rich. That was interesting to know that it repeats that.

2: What you found is all other synthetics or wool or whatever, they were quite small proportions of the waste stream. They could effectively almost be ignored. A lot of the nonwoven focus is on insulation products, waddings going into mattresses, then there's lots of flame retardant issues. The mattresses need to pass a match test and an FR test. We were working out what FR systems we could develop that would meet a mixed waste. That understanding of what the average blend is like, would mean you put appropriate chemistry on there to make sure it passed the test every time.

1: Yes, that's interesting. When you're looking at those applications, you're able to just take mixed waste and make it smaller, basically. Then you're able to put a mixed fiber nonwoven into it, and you don't need to separate it. That's the benefit, I guess, isn't it?

2: Yes. I think some of the textile recyclers will separate. The cream will go off to the charity shops.

1: Yes, of course.

2: Then they'll have the second level, then a lowest level. That lowest level is the bits that nobody else really wants. That's the bit you can probably derive a bit more value from because it's [crosstalk].

1: I guess even at that point, it's quite polyester rich. What I'm interested in is whether once it's gone into that situation, is there any potential then to recover it, to recover the polyester part in theory later on?

2: Just the polyester part.

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1: Well, no, not necessarily. I'm only saying that because that's what we're focusing on and the potential for polyester actually even when it's gone down to a low level if you like, chemically, you could still get quite a good quality polyester back?

2: Yes, you could chemically recycle it. If there's lots of contamination that could be an issue. In theory, yes you could basically, take it back to it's [unintelligible 00:18:30].

1: If you were, for example, to get a very rich polyester, so, we're working with a sports company and we're focusing a little bit on sportswear, which obviously has quite a lot of 100% polyester with elastane in. What do you think, do you have any ideas, or could you say anything about what the potential for that as a nonwoven product might be if it was quite purely polyester?

2: Well, I think from a chemical recycling perspective, for sure. Usually, the elastane's quite a low percentage, that would probably be quite processable. One of the areas we're looking at, at the moment is mosquito netting. A lot of which is polyester-based. It's a big volume. Some of these companies make up to 12 million nets a month, it's a huge volume but can we get the feedstocks? Where do we get them from? That's what we're looking at at the moment is if we were going to set up a chemical recycling plant, where the mosquito [inaudible 00:19:50] was massive volume application, can we actually get enough waste polyester from the supply chain? At the moment, I'm not sure we could to justify the investment in the chemical plant.

1: You mean that you're looking for recycled polyester to put into the production of mosquito nets?

2: Yes.

1: Okay. That's interesting.

2: It's a fairly practical study at this point just to see if it's economically viable and whether those feedstocks really exist. We're hearing a few things about recycled polyester that it's now costing more than virgin polyester because there's such a demand. Everyone's keen to have a recycled content, that's the only problem. Especially in Europe, there's not a lot of volume going through.

1: No. As far as we can understand as well it's mostly from packaging. The actual textile to textile recycling is not really there.

2: For non-wovens, the plastic bottle route has been established for quite a long time now.

1: It's specifically textiles that you're looking for is it?

2: Yes. Preferably. Yes. We'll look at everything.

1: Are you working with a specific chemical recycler or--?

2: No. It's more for the mosquito netting industry that we're working with just to see what the viability of that--

1: Like a scoping exercise. Okay, interesting. If those garments were going to be mechanically recycled would there be an option there? If they weren't going to go through a chemical route but they have some elastane in.

2: You can recycle polyester garments mechanically. Polyester can melt. That can be an issue because it can get quite hot when you're mechanically disassembling those things, various spiky rollers. Typically it can be done. It's all about can you create a product with value at the other end. How much volume is there to how much value can you get out at the other end. That's traditionally been the problem. You tend to have quite low-value waste being turned into a low value good. People are now thinking more that recycling's a better thing, it's more of a premium nowadays. It still has to perform. If it doesn't have the performance it's never going to substitute a virgin material.

1: No. If you're thinking about all your clients and all of the different non-woven applications what is the highest value? I guess it's the highest performance, isn't it?

2: Yes. You can go from aerospace and medical, they've got the highest specifications that we need to meet. Then probably the next step down is automotive. Then you enter automotive and filtration probably, geotextiles, then lower value or lower-- they all have different performative requirements. You either meet them or not.

1: I'm guessing the stuffing companies would probably quite like it to be not all polyester. They probably like a lot of cotton and mix. It would make it more insulating wouldn't it probably?

2: It can do, yes. Just some materials shred up better than others. If it's a knitted fabric, for example, it's easier to mechanically disassemble than if it's a very tightly woven fabric.

1: All right. Okay. Some of the people we've been speaking to seem to suggest like, for example, a fleece, a polar fleece kind of garment is very difficult for mechanical recyclists to-- That's true, is it?

2: It is, yes. It's pretty horrible, yes.

1: Yes.

2: [unintelligible 00:24:10] or somebody who was basically, I can't remember if it was Sainsbury's or B&Q. They were taking the corporate wear and recycling it back into - I think it was probably B&Q - they were recycling it back into an insulation product that then was being sold by B&Q. It was really more of a demonstration project than something that took off regularly I think. It's still pretty nasty stuff to disassemble.

1: Right. Okay. Moving on, I'm just trying to think how to phrase this in the way that's-- so we're looking at what the barriers are basically to a nice textile to textile

circular synthetics system if you like. From your perspective what do you think are the main barriers to achieving that with your non-wovens hat on?

2: Non-woven hat on. The first problem is that probably 45% of all non-woven applications are single-use. It used to be much higher. It's coming down. There's more durable applications at the minute but there's still a huge proportion that are single-use. You think about wet wipes. How many of those are used and disposed of every day? Billions of wet-wipes used every day. That becomes problematic for collection. Normally quite a lot of these are soiled. If they're hygiene products or wet wipes they're contaminated. If it's a medical product it's contaminated. There's not many routes you can do to clean them up. People have tried in the hygiene area but there's other barriers to entry. Even if you end up composting them because they're contaminated in the UK you can't use the compost because they've come from a contaminated human waste source. In other areas of the world, it's fine, it's being done but not in the UK. Not a lot of Europe actually. That's a major limitation.

1: Yes. That is.

2: I see the non-woven as splitting down two sides. There's the single-use products which will probably go down a biodegradability route which makes more sense. Composting. You're not going to collect tea bags and recycle them but can you compost them? Yes, we can probably get there. We're not there yet but the industry's working on it. It's being driven to biodegradability towards home composting. It's a big driver. The durable side is starting to look at circularity. That's clearly the side which makes a lot more sense. More durable products. Bits of automotive components are being recycled now. Bits of mattress components. All these things that have durable applications that last a number of years. There's already supply chains set up. They're starting to work out how can we get it back into another product.

1: Do you think that those mostly, at the moment, they're recycling back into a similar type of product in that they're going back into non-wovens?

2: Yes, I think there's been a focus on upscaling technologies which give you a similar sort of value. The traditional route has been to down cycle. We're now looking at upcycling. I would say it's still in its infancy.

1: Okay. Do you think the extraction of polyester could be in the future part of that?

2: I think it has to be, yes. I think it has to be.

1: Okay. In terms of the cycle in a way, we could be looking at it having it's first high-end sportswear, whatever, then having a couple of little loops which are the non-wovens and the lower grades just to minimize the energy use. Then recovered through chemical.

2: Yes, I think that's the ideal case. If you can make multiple uses of the same product and then chemically recycle it and start again but [unintelligible 00:29:00].

1: Okay. Then technically there aren't really any barriers to that do you think, or is it mostly economic or how do you see that as being the real--?

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2: Yes, it's economic and availability. There's not enough infrastructure in place now to support the whole non-wovens industry. Some of these polyester lines are producing 1,000 meters a minute at 6 meters wide. They're producing a lot of fabric in a very short space of time at the minute. There's that barrier to overcome.

1: Yes, just the volume.

2: [inaudible 00:29:40].

1: Okay, great. You've already said this a little bit. I was just wondering. The opportunities are really in this durable section of the non-wovens. Is there anything else you would like to say about what the opportunities are for circular synthetics in the non-wovens?

2: In the non-wovens [inaudible 00:29:59]. I think, to be honest, it goes across the whole industry. At the moment there's probably a barrier that the most commonly used polymer in nonwovens is polypropylene. Polyester is supposed to be high but polypropylene happens to be cheaper. A lot of the machinery is set up to process polypropylene, [unintelligible 00:30:29] generally, not polyester. Certainly from the melt extruding section of the nonwovens industry. There's an opportunity there, but there's an economic barrier to move to polyester in the beginning.

1: Right. That's interesting.

2: If the recycled polyester starts to become more economical than polypropylene, or polypropylene more likely will become more expensive over time, then I can see a move completely, people will move into polyester because it's [crosstalk].

1: What will drive the price of polypropylene up?

2: Lack of oil.

1: Oh right, okay.

2: Probably regulation.

1: There needs to be a policy instrument there, doesn't it, to push it that way.

2: Regulation, consumer awareness that what they're buying is made of a plastic. Sometimes plastics movement is definitely shifting people away from the [inaudible 00:31:31] and the more sustainable fibers. I think costs will be driven probably by oil stopping to be used, or the price of oil, kept as a more of a premium thing.

1: Okay. That leads me on quite nicely. When we've been talking to people we've been asking them this question about COVID and how it's affected the industry, and a lot of people are saying that it's forcing manufacturers to start to think more about their supply chain and try and make it more local. I suppose that recycled polyester is something we've got a lot of locally. Is there anything that you can see in the short-term and the long-term which the COVID pandemic may influence or have an impact on?

2: In terms recycling?

1: Recycling and nonwovens I guess, as well.

2: In general, in nonwovens, [unintelligible 00:32:35] of the industry's seen a massive uplift especially those making PPE. Surgical gowns and facemasks, there's lots of investment going in. New lines, new nonwoven capacity going in to make face masks, not just converting the mask but making the material for the mask as well. That's already happening as capacity is increasing in the UK. There will be an on-cost for that. We estimate some 15 to 20% more for the product. How long the desire will last? I don't know. Once COVID restrictions relaxing will the supply chains go back to the Far East because it's cheaper? Unless there's some sort of ongoing commitment by the UK, certainly by the NHS to support the industry.

1: Those industries that are now making nonwoven PPE in the UK, what were they making before?

2: They were just converting it, mainly. They were converting fabric from China into the masks, into the PPE. Now they're manufacturing the fabric as well, whoever's buying more machines to make the face masks.

1: Sorry, I'm asking you questions you probably don't even know the answer to, but do you think that they're investing that money themselves, or has the government put money into that?

2: It's a mixed bag so some are investing themselves. There's a company called Don & Low who the Scottish Government have given them a £3.5 million grant-- it's a loan, not a grant, loan to buy a new meltblown machine. I think it's £4.5 for a meltblown machine. It's going to be up and running in August.

1: This is really interesting because it's creating capacity around a very specific type of material.

2: Face masks are here to stay and the volumes are going up, they're not going down. There's two issues, there's medical face masks, then there's more the masks for the general public as well. They're trying to supply both markets without stopping the PPE all going to the hospitals.

1: Do you see any evidence or any suggestion that people are now seeing that the collection of that material is important as well or is it just being incinerated because it's so-- the fear over the contamination?

2: It's a contaminated waste. I suspect it's all incinerated as medical waste.

1: At the moment, what material is it? Is it polyester or is it-

2: Polypropylene.

1: -polypropylene? Interesting. Anything else around COVID that--?

2: Wet wipes are also going through the roof as well. Anything to do with infection control. Hygiene, and wet wipes specifically for the hospitals.

1: Any negative impacts on anything that you've noticed?

2: Only the environment, I think. I think the main negative impacts are that people can't, they've been stopping manufacturing so manufacturers have [inaudible 00:36:14] especially with assembly grants. The nonwoven production might only have five people operating a massive production line. You can do it socially distanced, but if you're assembling and putting materials together then that tends to be much more labor-intensive and I think those are the companies that are the most affected by COVID. Purely from a social distancing perspective.

1: Okay, perfect. Thank you for that. I'm going to just post this into the-- We may repeat ourselves a little bit on this I think because you already spoke a little bit about the garments but let's just see if there's anything different comes out. In the chat, I've just posted a link.

2: Repeating myself is what I do best.

1: No, it's good. It reinforces the point but it's nice to get a few things mapped out. Then when we come to put all this together we should hopefully have some quite interesting maps. Do you see the slides?

2: It's just coming up now, it's loading. Working towards it. Okay, yes.

1: Got it? Cool. The company that our case study for this is a teamwear manufacturer. The reason why I was interested in what you were saying about the de-labeling is because they do a lot of school uniform type sportswear. They work a lot with private schools, also big athletic organizations. Their produce has identities on it that mean that it can't be resold basically. That was quite interesting what you said about that. Basically what I'd like us to talk about now is how these specific garments which is a pair of running leggings, which is 100% polyester with elastane, and a fleece with a zip and logos. What their lifecycle does look like now from the point of view of nonwovens. I know they're not nonwovens but if we think about their lifecycle, so if you just talk and then I'll type.

2: From the point of view of nonwovens what happens to that garment at end of life is that what we're talking about?

1: Yes, exactly.

2: Not a lot I would imagine, from a perspective. They're two quite difficult materials to recycle mechanically. I've seen the running leggings have quite a high elastane content, which also could potentially produce issues with contamination. From our perspective, convert that into the nonwoven, only really a chemical recycling process would be applicable.

1: Okay. What did you say about the fleece? The fleece is, maybe it's just difficult to process.

2: I'd say difficult to mechanically disassemble. If you can construct the fleece differently then maybe it could be mechanically disassembled much more easily.

1: Explain to me what you mean by that?

2: Well, it's quite tightly knitted at the moment. You've got fibers running-- it's like a sliver knit almost to make a fleece. You've got these additional fibers, which create a fleecy texture and they're coming out of the surface of the fabric, because of the tightness of it, it tends to be quite difficult to deconstruct it, to get a mechanical point into there. We spoke a little bit about melting and the temperature raised because it's difficult when-

1: Oh, I see yes.

2: -the materials are tightly put together. Could you design the fleece to be disassembled in that process, but still have the properties that are required during its lifetime?

1: Do you know anyone who's looking into that ?

2: No, I just thought of it off the top of my head, but they're probably not conscious that it's a major problem.

1: Well, everyone has brought this up and it wasn't actually the reason I put that in. I put it in because I thought that it would provoke some comment around the microfiber pollution issue, but actually what came out was that it's really difficult to mechanically recycle. I'd be interested to know is it worth saving these? From a consumer perspective, someone said, this is such a valuable material from a user perspective. The microfiber pollution issue and the fact that you can do literally nothing with it at the end of life, it feels like a difficult garment.

2: It is. That's its current state. It doesn't mean it has to be that forever.

1: No.

2: It's how the fleece has been designed. It was designed with only its first use in mind.

1: If it was made a looser knit, then potentially that could make it perhaps worse for fibrillation could it or--?

2: What, for fiber loss?

1: Yes.

2: Well, it depends how you design the product. You could fix the fibers in, in a different manner.

1: Sounds like you want to take this on .

2: Sounds like an interesting project.

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1: Well, one of the things that we'll probably pull out of this is that there have been some quite interesting little nuggets that we've talked about as we've been going along. We'll probably just highlight some of these potential possible opportunities as well, which is great. Anything else? Maybe I'll just put on there because we mentioned it before, "Currently can't--" Well, should I say currently can't de-label them or maybe I should put, "Emerging technologies for de-labeling."

2: Yes.

1: I think that our case study would be really interested to hear about that technology. The next slide is the same thing again, but then this time what could it look like in the future? What should it look like for these garments? We could even just start by saying the fleece is designed differently.

2: Yes. Yes, that's--

1: From the sort of as well for the onwards technology, from the non-wovens point of view?

2: What the [unintelligible 00:44:04] should look like?

1: Well, both of them. What could the non-woven potential be for these?

2: The fibers are a reasonable grade. The polymer itself, it's really about getting into a ball which a nonwoven process for use. Either that is back into polymer chip that you can create back into an extruder. Or it's designing a garment whereby, when you mechanically recycle it, it doesn't lose all its fiber length. That's the real issue. There's nothing wrong with the fiber once you've mechanically recycled it. It's just the fact that it's so short, you can't really do anything with it.

1: A mechanical recycling process which doesn't shorten the--?

2: It takes [unintelligible 00:44:55] longer [unintelligible 00:44:56] because that can then be fed into all the products, into other processes.

1: In a sense, do you mean unraveling it?

2: Yes. Why not? If you unraveled it and then chopped up the fiber, you'd have much more fiber length than you do by mechanically separating it with a pin.

1: It's so interesting. I think that would be amazing. Disassemble.

2: The biggest barrier is still the value of whatever you've made at the end of it. I don't see buying higher value applications from these sorts of waste material.

1: Then do you mean then, with the longer fiber length, would that be for a non-woven application?

2: Yes.

1: Okay. Higher value, non-woven applications, durable - going to put that there just so I remember. Do we need to get rid of the elastane or can that still be part of this picture?

2: Yes, potentially it could be used. There's no reason why elastane would be bad in a product. Really, could we envisage products which take advantage of that elastane content and have some elastic recovery?

1: Brilliant. This is great. Elastane, though, it's quite integral to the-- I'm sorry, I don't know much about the structure of these fibers, but you couldn't separate the elastane out during that process of disassembly, could you? or could you?

2: It will depend on how they'd made the yarns. If they're spun yarns, then no, because you're basically mixing the fibers together and then twisting them to make spun yarn. If they're just yarns laid in next to the polyester yarns, then maybe you could, but would there be enough of a market for that? It's quite a small proportion it seems, it'd be better to use it if you could.

1: Actually, one of the things that someone else said was that elastane actually has really poor durability. By the point at which the leggings come to the end of their life, they're quite often the waistband has gone and some of the elasticity has gone. Even in the service industry, they don't use elastane anymore. I think this was in Sweden someone said this. They were using the EME because the elastane just doesn't last long enough.

2: Yes. Over time it does degrade and it loses its elasticity. That may be a good or a bad thing. Designing a product that you don't want the elasticity, it then becomes less of an issue.

1: Brilliant. Anything else to add here?

2: Yes. There are certain applications which won't except fiber that they don't where it's been. There's a barrier to entry there because of [inaudible 00:48:34].

1: What applications are those that would except recycled material?

2: It can be anything, even wipes. You'd think wipes, they'd shove anything in there, but they don't .

1: I suppose it's anything which comes into contact with people in a very intimate way?

2: Absolutely, yes.

1: We didn't talk about traceability. Have you been looking at all at any technologies or ways of making fibers or textiles traceable through, or materials traceable, through non-wovens?

2: No, we haven't. It's not a big issue at the moment, but we envisage it could be in the future. At the moment, there's just a blanket ban for certain applications. At the

same time, these cotton pads you wipe makeup off your face with, they use 100% recycled post-industrial recycled cotton.

1: Oh, really. That's interesting.

2: Nobody really knows it. It's not advertised. They use the waste from the spinning, cotton spinning process.

1: They won't take post-industrial polyester waste or polypropylene waste?

2: No.

1: That's interesting, isn't it? I wonder why that is. Because if it's post-industrial then it's the same, isn't it?

2: Pretty much, yes.

1: Has anything caught your eye in terms of what's going on in the traceability because there are a few things - technologies - which are trying to make fibers traceable through the garment life cycle.

2: There's nothing coming into nonwovens at the moment, I would say. That's anyone's working on specifically. It will be in the systems there that they are talking about. It'll be in the fiber itself. If you could track a fiber that would be the best. I don't think the technology's there yet.

1: No. I'm just going to put fiber tracking just because-- This is the future so who knows. Everything's on the table. Anything else you want to add or shall we move on?

2: No, nothing more.

1: Okay. The third slide is just like a really rough roadmap if you like. It's not even a roadmap, but it's like starting here, the next 5 to 10 years, what needs to happen, do you think?

2: Looks like a fiber to me.

1: It is, a crimped fiber.

2: In terms of the roadmap where we need to get to. The nonwovens, there's probably-- I think chemical recycling is-- infrastructure, and volume, and cost.

1: Infrastructure, volume, and cost. Volume and cost, you're talking about feedstock, are you?

2: Yes. Collection comes into that, doesn't it? Having the ability to chemically recycle [unintelligible 00:52:11]. Collecting it cost-effectively. Wherever you get humans involved it tends to be quite expensive. Any kind of sorting, collecting from the right sources, and getting them to a chemical recycler makes it inherently expensive at the moment.

1: Potentially the collection is a bit different for-- Collection of post-consumer is one thing which we've been looking at quite a lot in the other interviews, but also with nonwovens is potentially the collection after the nonwoven use phase. I guess it would all have to be organized business to business?

2: Very much so.

1: In some way.

2: There are usually opportunities to sell your waste to somebody. A company I used to work for, they had the edge trims. They made the nonwoven and they'd trim the edges off, they're making it into reels or into a roll good of a certain size and then they'd sell the edge trim. It went into numerous applications. One of it went into dog bedding, so somebody would take it and chop it up and create dog bedding out of it. Another person would make capillary matting for horticulture. There are already structures in place to sell your waste or sell it into-- Somebody will come and collect it.

1: Okay. When you say structures in place is there anything specific that you can think of which enables that to happen?

2: No. It's just purely on a commercial basis, so if they can make use of it then they do.

1: Okay. Anything else? We talked a bit about policy instruments. Does that need to be on this map?

2: I think so, yes. Absolutely.

1: We're talking about garments. There's the EPR, the extended producer responsibility. I don't know if that would go as far as what's happening in other industries for example that you're working with, in nonwoven. Is there anything else on the horizon which you can see as being--?

2: The big one it's the single-use plastics [unintelligible 00:54:51], the nonwovens [unintelligible 00:54:52] it's hidden in wipes and hygiene first.

1: That's going to drive the biodegradability do you think?

2: Yes, of course. Automatically, most wipes have been a mixture of polyester and viscose. They're going to be switching to [unintelligible 00:55:19] based wipes.

1: Okay. For the durables it's mostly going to come through the particular industries that they're in, isn't it? So automotive have quite strong regulations already, don't they, around recycling?

2: It's the end of life vehicle directive, yes.

1: Because I'm thinking of this in a particular way I'm thinking about garments through to another application, through to recovery again, back to garments. What

I'm thinking is quite interesting how these different policies may interact, or how they'll work together.

2: One of the issues with the end of life vehicle directive is that it's based on weight. I think they need to recover 99% of the weight, and there's only 43 kilos of textiles, maybe there's a bit more, but there's not a huge amount compared to the weight of the car.

1: This is always a problem with plastics. It comes up again and again. I've been working with plastics for quite a long time but we were looking at packaging 10 years ago and it wasn't quite there yet with the recycling. It was always because of the volume. It didn't work with the cost.

2: At the moment the textiles in the car are the poor man's bit of the recycling trend.

1: That's interesting. We could almost do with the yardage or fiber count for recycling targets.

2: This is happening, the single-use plastics directive's impacting nonwovens. What we see is there will be other policy instruments going through for the durable accumulations as well.

1: Okay, What are those? Do you know what they are yet or they--?

2: No. There's nothing posed at the moment. The European Green Deal, isn't there?

1: Yes, okay.

2: How it's going to impact durables yet we don't know.

1: Okay, brilliant. Anything else that you think needs to happen to make this?

2: There's going to be bioplastics coming in.

1: Yes. How do you see that affecting durable? Is there potentially a problem with the contamination of bioplastics into durable streams or is it not a problem?

2: I think the biggest problem is they're not very biodegradable. Assumption that they're biodegradable, and most of them are industrially compostable. They're not compostable from a home combusting sense. They're also not that compatible with processing at the moment. They're expensive, they're difficult to process. It's in its infancy. Polyester was discovered in the early 1930s. It's had nearly a century of development on it to get it where it is today. Certainly, it wasn't until the 1980s that it became quite processable and widespread. The bioplastics have got to go through the same cycle.

1: It seems like a good fix. Also, I can see that it's the knowledge about them like how you communicate what that stream is and how you deal with it in different forms could be quite challenging.

2: It is. People don't understand what they're working with at the moment, they're just going because the consumer will think it's better if it's made from a plant.

1: Sorry to go back to what I said before but would it potentially be a contaminant for more durable plastics?

2: Yes, it could do. Especially for the mechanical recyclers [inaudible 00:59:54] way you can separate those materials out.

1: Do you know of anyone who has tried to? How would you identify the difference between the two of them? I'm presuming like an infrared or any kind of automatic sorting thing wouldn't work.

2: It'd be quite difficult because a lot of them you may derive them from different sources but they still become a polyester. How do you derive one polyester from another? Quite tricky.

1: Don't know, I'm not a chemist. I don't know what the difference is-- It's your kind of feeling that actually the durable-- the polyesters, the durable applications. Are you feeling in favor of polyester as opposed to some of these biodegradable ones or--?

2: I think yes if you can set up the recyclability chain and make it truly circular, then there's nothing wrong with polyester, you can still make it. You can make it from a renewable source.

1: Just to move on to the last slide, and then that's the end of the interview. I sent you through these definitions. Really, we've just set these up quite quickly, just to get to as a provocation to get people to talk through something around what a definition for these circular synthetics could be. I was just wondering if you've got any feedback, anything that you think's missing or shouldn't be in there or--?

2: I'm just reading them now. [pause 01:01:43] Are you thinking-- To take the example of the plastic bottle that's then recycled into a textile. That would count as a circular synthetic fiber. Really you'd prefer a circular synthetic textile to become a circular synthetic fiber again.

1: Yes, yes. That's what we-- That would ideally. Obviously the bottle to fiber thing has happened, it's not sustainable really. It's like moving on to the next stage and we wouldn't really consider the bottle to fiber to be part of this vision if you like.

2: Yes. I think, just thinking about it from a nonwoven perspective, I think that's fine.

1: This doesn't-- we wrote this before we had these interviews where people where started to say, "Is there like an interim step, mechanical step?" It doesn't include that actually, as a potential--

2: Nonwoven is not necessarily a textile either to be a circular synthetic textile or not one of them.

1: It's not in there yet, but it could be, we could add it.

2: Yes.

1: I guess the vision is that even if it was to have a temporary, not temporary, but like a short phase in a lower, say lower grade, but lower value application that it would always have the ability to then go back into a kind of a higher value polyester again.

2: Yes.

1: Recoverable.

2: That makes sense. [pause 01:03:59] Yes. I don't think I've got anything else to add.

1: Thank you very much for spending this time with me then. It's been incredibly useful and you've highlighted some things that no one else has. Thank you for that. Is there anything else you want-- just generally, any comments?

2: No, I don't think so. Just, thanks. Thanks for inviting me. I can hear your perspective as well and understand a little bit about what other people might be saying. You're going to publish the findings and circulate them, are you?

1: Yes, yes. First of all, we're going to invite everyone we've interviewed to review what we come up with as a synthesis, like an interim phase, to get some additional feedback. Then we will publish a public report, which will be aimed at the industry. It will have all of our findings and observations. That will be available.

2: What's the timeframe for that? When are you going to--?

1: I'm about to send out an email to our interviewees, actually, because I think our aim is to have an online kind of review session for our findings, initially in September. We're going to ask people just to put a bit of time aside for that if they can. At the moment, we're waiting to hear if we've got an extension because of COVID. We should have finished at the end of September, but then the report I don't think now will be available. We'll have a three-month extension on September, basically, we hope, so it'll be before the end of the year.

2: Okay, great.

[End of audio]

[01:06:45] [END OF AUDIO]