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Executive Summary

The Fashion & Textiles industry is one of the largest employers in Europe, but also one of the largest polluters. While in the beginning of the 20th century clothing was tailored to be used until worn out, the increase of wealth brought with it consumerism. The growth of the fashion sector became dependent on the continuous release of new garments and the disposal of old ones. This model is responsible for the large environmental footprint left by the fashion industry.

However, a collective environmental consciousness is on the rise. There is a clear consumer and manufacturer tendency towards the re-use and recycling of clothing into raw materials. Various initiatives have proven that there are economic and environmental gains to this trend, but have mostly remained limited to individual organisations. The gains to be achieved by the entire chain – from manufacturer to waste managers, distributors and consumers - could be much larger if individual successes would be refined and replicated in a broader European market.

EcoProFabrics is a first step to significantly reduce environmental impact of garment production, by up-scaling the production and exploitation of ‘Infinity’ workwear: The Infinity workwear is an innovative 100% reusable polyester-based collection of garments, which eliminates waste significantly and reduces pollution and the use of natural resources to a minimum. Infinity fabric has been developed by Dutch aWEARness and Becker Tuche GmbH. According to the life cycle analyses, Infinity fabric saves up to 20% CO2 emissions, 50% water usage, reduces waste with 90% compared to cotton garments in the 1st phase of use. By recycling the garments, savings in the 2nd phase of use increase by a further 20%.

With EcoProFabrics, the Infinity collection will be implemented in 6 European pilot actions in the Netherlands, Belgium, Germany, UK, France and the Scandinavian countries, bringing the workwear and its value chain to a full production and distribution scale. The EcoProFabrics project ultimate goal is to close the existing gap in the market in the field of sustainable textiles and their application in workwear by creating a full scale circular economy production model.
Project overview

The EcoProFabrics project has been initiated with the aim to introduce and up-scale into the market the Infinity workwear. Since the design and manufacture of the workwear follows the principles of the Circular Economy, a dedicated closed loop value chain was established covering partners from the manufacture of the fabric, to manufacturing and recycling of garments. During the project duration, the cooperation and work principles of the value chain were tested in practice, success and failure factors have been identified and recorded. In this manner the project has been established to meet the following objectives:

**EcoProFabrics Project Objectives**

- Industrialize the Infinity workwear and up-scale the production process;
- Establish the first worldwide closed loop value chain of sustainable workwear;
- Demonstrate the environmental and economic impacts achieved in a closed value chain compared to the conventional linear supply chains;
- Carry out pilots to support user acceptance, market uptake and establishment of a closed functional value chain;
- Promote market application of the innovative business approach based on shared values and transparency.

**Project Organisation and Partners**

The EcoProFabrics project has been initiated by the founding partner of Dutch aWEARness, Rien Otto, who has been working in the field of sustainable fashion industry for more than two decades. The EcoProFabrics project fits well with the company vision on suitable workwear and development of eco-effective innovations. For the EcoProFabrics project, Dutch aWEARness has been joined by a range of market actors who share the same vision and have a dedicated role in project realization, see Figure 1.

In the EcoProFabrics project, Dutch aWEARness fulfils the role of the chain manager. This means, they ensure that workwear is designed to meet the requirements of the user being “fit for use” and is manufactured taking into consideration the recycling requirements, meaning “fit for purpose”. They control the circular chain by means of the circular track and trace and information system, develop new materials, conduct sales for new customers and arrange the recycling process of the garments. Becker Tuche GmbH is dedicated to fabric weavers for wool, blends and innovative fabrics and plays a crucial role in development of the fabric and its specifications to meet the user demand in performance. Latino Group is a leading manufacturer in Professional Workwear, Military Uniforms and Tactical Equipment, and is responsible for the manufacturing of the workwear. Bukk Fashion Support and Van Schoot Pomp-
centrum are both specialised companies and take care of logistic and personalisation of workwear. EcoChain Technologies application allows value chain partners to calculate the sustainability performance of their process/products on company as well as chain level. Such calculations provide insights in where to invest more effectively, how to reduce the environmental footprint, cut down costs and increase profit in a sustainable way. Royal HaskoningDHV with its heritage of bringing leading expertise and innovation to the market is committed to business integrity and sustainable development. Within the EcoProFabrics project, the company is taking care of the project management and reporting towards the EASME.

Figure 1 - EcoProFabrics project partners
Project Results

The EcoProFabrics project envisions a value chain approach, which means that project results have been achieved in various parts of the chain as visualised in Figure 2 below.

Infinity closed loop value chain applied in practice

- Tests have been conducted to develop a range of Infinity fabrics, end user specifications that is suitable for application in workwear, including PPE applications;
- Infinity workwear collection has been developed according to end-user specification resulting in a full workwear collection meeting all requirements;
- A closed loop value chain has been established covering all stages of the product life cycle: from production of the yarns and fabric, manufacture of the garments, recycling of the garments and manufacture of 2nd generation yarns to be used as input for the production of the fabric.
- Dedicated pilots have been conducted to test the Infinity workwear. The primary aim of the pilots was to test the workwear with the users, collect user feedback and respectively adjust the workwear to meet user demands in garments performance. The tests also contributed to testing the cooperation of the partners in the chain. Refer below to a selection of the executed tests.
Pilot: Royal HaskoningDHV Rain Coats

Client: Royal HaskoningDHV
Country: The Netherlands
Type workwear: Rain jackets and trousers
Time frame: November 2015 – June 2016

Supply Chain:
• Shinhan (production of yarns & fabric), Latino Group (Cut, Make, Trim), Dutch aWEARness (chain management), Royal HaskoningDHV (client), Philtex (take back system and recycling), API (production of 2nd generation yarns).

Product description:
• The material is 100% high quality polyester;
• Compliant with EN ISO 20471:2013 and EN 343 (windproof and waterproof, breathable fabric and high visibility).

Test environment:
• 50 employees of Royal HaskoningDHV
• Users were asked for feedback on the comfort and use. Feedback from users was collected few months later and delivered to the product development team.
• Users were offered the possibility to return the rain sets after use for a new set.
Pilot: GEA jacket

Client: GEA
Country: Germany
Type workwear: Safety coats
Time frame: April 2016 - April 2018

Supply Chain:
- Shinhan (production of yarns & fabric), Latino Group (Cut, Make, Trim), Dutch aWEARness (chain management), Royal HaskoningDHV (client), Philtex (take back system and recycling), API (production of 2nd generation yarns).

Product description:
- Color: 278 fluorescent yellow/grey
- 100% waterproof / windproof / breathable / water repellent outer fabric / moisture absorbent coating on the inside / comfortable / Smooth / High tear resistance / Taped seems;
- Outside: Upright collar / hood in collar / Zip under siege with Velcro / 2 pockets / 1 Napoleon pocket / Sleeve narrowing by press studs / Elastic drawstring at hem / Back length 85 cm (L)
- Inside: 1 inside pocket (cotton flame retardant lining)
- Fabric: Infinity with flame retardance PU coating + anti static; ± 250 g / m²
- Size Range: S / XXXL

Certification:
- Protection against heat and flame EN ISO 11612:2008 A1,B1, C1
- Protection in welding and allied processes EN ISO 11611:2007 Class 1 A1
- Limited protection against liquid chemicals EN13034 Type 6 A1:2009
- High visibility EN ISO 20471:2013 minimum class 1
- Protection against thermal hazards of arc IEC 61482-2:2009 class 2
- Electrostatic properties EN 1149-6:2008
- Protection against rain EN 343 + A1:2007 3 -3

Test environment:
- 165 coats for GEA refrigeration

User involvement:
- Interviews with several employees were conducte to discuss required performance & organisation of fitting session.
- The employees are also requested to send their feedback on the use of the coats.
Pilot: Rijkswaterstaat Rain Jacket

Client: Rijkswaterstaat  
Country: The Netherlands  
Type workwear: Fully recyclable rain suits (+ polo shirts, fleece jackets and caps)  
Time frame: May 2015 - September 2016

Supply Chain:
- Rain suits: Lyngsoe (production of rain suits in first cycle) via Intersafe Groeneveld (reseller), Dutch aWEARness (chain management), Rijkswaterstaat (client), Wolkat (take back and recycling), Dolfing (creation of new rain suits)
- The polo shirts, fleece jackets and caps are conventional and are recycled via Philtex (take back and recycling) to non-woven bags. The new clothing (fleece jackets and polo shirts) has been provided by production partner Tricorp, and delivered through Dutch Awearness.

Product description:
- After using the clothing for the stewards for a period of six months, the garments were returned to Dutch aWEARness, to be converted to raw materials and new garments. In 2016, the employees will receive the recycled garments that were previously used by their colleagues. Dutch aWEARness remains the useful owner of the clothing for the period of use. Rijkswaterstaat is obliged to return the garments at the end of its useful life to Dutch aWEARness, as this is associated with reuse of materials. Although the clothes were not worn out, this is a test for Rijkswaterstaat to show that the circular economy concept works.

Test environment:
- 55 stewards of Rijkswaterstaat (they received a package of a rain suit, three polo shirts each, a fleece jacket and a cap twice).

User involvement:
- Provision of feedback on the garments.
- Dutch aWEARness provided input for their REBUS project as well through interviews.
- The pilot is published on their intranet to keep employees informed.
Infinity workwear environmental performance

During the EcoProFabrics project the environmental performance of Infinity workwear vs Cotton workwear has been evaluated. The study compared the environmental performance of 10 pairs of trousers, used during a period of two years. For the manufacture of the Infinity fabric 100% virgin polyester has been used. The results of study show that manufacture, use and recycling of Infinity workwear releases 11% less emissions that cause climate change in comparison to Cotton workwear. Further production of Infinity workwear requires 50% less water and the direct impact on humans associated with the workwear is 44% less in comparison to Cotton workwear.

The study used as well the Societal Cost Indicator (SCI) as an endpoint indicator to depict the prevention costs of governments to pollution. The SCI of the Infinity workwear is low, with only 7,36 Euro per set of 10 trousers. For Cotton workwear sets the SCI is 24,95 Euro per set. Infinity has a better performance and SCI than cotton due to less consumption of water for fibre production, land and chemicals that are needed in the production process and use phase in comparison to cotton.

Currently further studies are being conducted to quantify and incorporate into the calculations the environmental savings achieved due to reuse of the workwear for the production of the 2nd generation fabric.

Infinity workwear business performance

In order to be able to record and monitor the performance of the Infinity workwear and work efficiently in a closed loop value chain, a Circular Content Management System (CCMS) has been developed. The CCMS enables Dutch aWEARness and its customers and partners to move from working in a linear supply chain to a closed loop value chain, to transparency and sharing the benefits of a circular economy. The CCMS is an online tool providing integrated track and trace services and other business and environmental related services, see Figure 3. It enables the customer to exactly see what materials have been used in the production process, who has manufactured the garment, and the impact of the garment’s production on the environment. The tool is essential in the circular model to manage the return of the product to become new material in the cycle.

![Figure 3 - EcoProFabrics Track and Trace System](image-url)
The EcoProFabrics Market

Target countries of the EcoProFabrics project are the Netherlands, Germany, Belgium, Scandinavian countries, France and UK. The selection of these target countries is based on the partnership that the project has in these countries with resellers that are active in those specific countries. The market approach is based on connecting production partners to the existing resellers. This approach ensures that the project can make use of existing sale channels, networks, and facilities and therefore avoid a range of marketing relating risks. Cooperation with resellers is mutually beneficial due to resellers’ interest and willingness to innovate and open up new product labels or change existing labels with the production with EcoProFabrics.
The Benefits to the EU

The main benefits towards the EU and other governmental bodies from the EcoProFabrics project can be summarised as follows:

- The project provides a comprehensive overview on working in line with Circular Economy principles. The concept is applied not only in the design and production process but also in the cooperation with partners. This means that partners share the same vision and values and are transparent in their transactions with each other. Performance indicators are being recorded and monitored in the project track and trace system and mutually beneficial improvement actions are being developed and implemented.

- EcoProFabrics project is a working example applied in EU context, especially the legal, economic, environmental and societal context of the European Union countries where the EcoProFabrics pilots are being conducted.

- EcoProFabrics is Europe’s first circular economy initiative for the textiles and garments industry with many lessons learned to be shared with other market actors and governmental bodies. It acts as an innovation platform and an arena for stakeholders that want to think along, learn and share their lessons learned and experiences.

- According the vision of the DG Growth of The European Commission, it is proven in the project “The future of the textile industry in Europe” that the unique ways of working in the project, such as performance based garments, services and closed loop production is securing raw materials for the future for the industry. Using the closed loop repeat orders and the new innovations will give the textile industry a unique selling point and a strong position in competition with countries outside Europe.

- It will secure business and labour for a middle and long term in the European Union member states.

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We translated our lessons learned to a workable transition scheme called “Learning by Doing”. Learning by Doing is a practical and modulated blueprint, that can be used to integrate new production partners in our chain, or set up new circular production chains. In the EcoProFabrics project such approach has been tested and proven by the integration of new production partners for garments and work wear. This has led to the enlargement of our production chain, that made it possible to increase the quantity and quality of garments and to be capable of delivering Tailor made performances. For the garment production we enlarged our production chain with the companies Tricorp and Shinhan. The network of resellers has been increased by the integration of Heigo, Persu at Work, Intersafe Groeneveld and Wiltec. Other producers and resellers are willing to be connected to our production chain.

Our CCMS system (Circular Content Management System) makes it possible to track and trace the materials real time. The system is integrated in our production chain and is made to be used in other production chains also. The system will make it possible to transform linear production chains to circular production chains.

More information about Learning by Doing and CCMS can be found on www.dutch-awareness.com and www.circularchainsystem.com