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D6.2

**FASHION FOR THE PUBLIC SECTOR:
Sustainability study of new handling
system**

By: Karpenja T. and Löfgren C.

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The purpose of the Mistra Future Fashion Program is to deliver knowledge and solutions that the Swedish fashion industry and its stakeholders can use to significantly improve the fashion sector's environmental performance and strengthen its global competitiveness.

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Fashion for the public sector: Sustainability study of new handling system

Overview

Deliverable D6.2

by

Tatjana Karpenja,

Cathrine Löfgren,

INNVENTIA

Previous research in the P6 project (Deliverable D6.1) has shown that public procurement in Europe is becoming more regulated (although on a voluntary basis), whereas environmental requirements are coming higher up on the agenda. The latter is expressed, for example, in terms of introduction of Green Public Procurement (GPP) criteria for Textile in the EU. In Sweden, the Swedish Environmental Management Council (SEMCO) criteria are also available for procurement of:

- Textile and laundry service, and
- Textiles and leather

The research identified that the SEMCOs criteria are frequently exploited by procurers (municipalities and county councils) when purchasing textile and laundry service in the Swedish healthcare sector. The Swedish case study focused on practical overview of current situation with 8 different procurers of hospital clothes and laundry service. Environmental, economic and social dimensions of sustainability of handling of hospital clothes in the existing healthcare system were analyzed.

Current report provides further insight into the public procurement of textile and laundry service. In particular, the report emphasizes on today's knowledge and expectations of different stakeholders *around introduction of new textiles in the health care system*. This is a case study that is on one side represented by Textilia that offers textile and laundry service to companies, on the other side, Stockholm County Council (SLL) that buys such services through public procurement process.

Other parts of the current report contain the latest available information within the Swedish health care system concerning sustainability of introduction of new textiles (e.g. review of LCA studies, examples of best practices).

Table of content

1. Background.....	4
2. Aim and objectives.....	4
2.1. Scope	5
3. Factors that affect value chain actors.....	6
3.1. Textilia	6
3.1.1. R&D at Textilia.....	9
3.2. SLL – Stockholm County Council.....	9
3.3. Producers of new textiles	11
4. Sustainable procurement and research.....	11
4.1. EU and Sweden.....	11
4.2. Research update	12
4.2.1. Disposable vs. reusable hospital clothes.....	13
4.2.2. Sustainability work in project P2	14
4.3. Conclusions	15

1. Background

Previous research in the P6 project (Deliverable D6.1¹) has shown that public procurement in Europe is becoming more regulated, although on a voluntary basis. Environmental requirements are coming higher up on the agenda. From the perspective of introducing new textiles into the Swedish healthcare system as well as sustainability potential of handling of hospital clothing, the following was observed:

- The new textiles shall serve similar functions as their traditional alternatives (e.g. durability) and beyond (e.g. provide comfort)
- Public procurement of eco-labelled articles ordered in larger volumes per each article is desired instead of ordering many different eco-labelled articles in small volumes per each article (for better pricing policy and reduced environmental impact)
- Need for a wider range of ecological textiles and their wider availability on the market

Current report provides further insight into use and handling of hospital clothes (textile and laundry services). In particular, the report emphasizes on today's knowledge and expectations of different stakeholders around introduction of new textiles in the Swedish healthcare system. This is a case study that is on one side represented by Textilia that offers textile and laundry service to companies, on the other side, Stockholm County Council (SLL) that buys such services through public procurement process.

2. Aim and objectives

The aim of the report is to investigate the current status of, and attitudes to, the introduction of new textile qualities in public procurement of hospital clothes.

The following questions were defined to be of interest:

- What is the development of new textile qualities in the healthcare sector so far?
- How are new textile qualities perceived today?
- Which advantages can new textiles offer, what is their future?

The study focuses on the textile and laundry service operations and unfolding its *sustainability potential*.

¹ M. Lindström, T. Karpenja, C. Löfgren, Deliverable D6.1 State of the art and current situation. Sustainability study on clothes and their use and handling in the existing health care system.

2.1. Scope

The study reveals sustainability aspects that are essential to consider in public procurement of hospital clothes made of new fabrics.

The findings are clarified in the following chapters in terms of summary and analysis of interviews performed with different actors in the healthcare value chain, literature studies and case study results performed somewhere else.

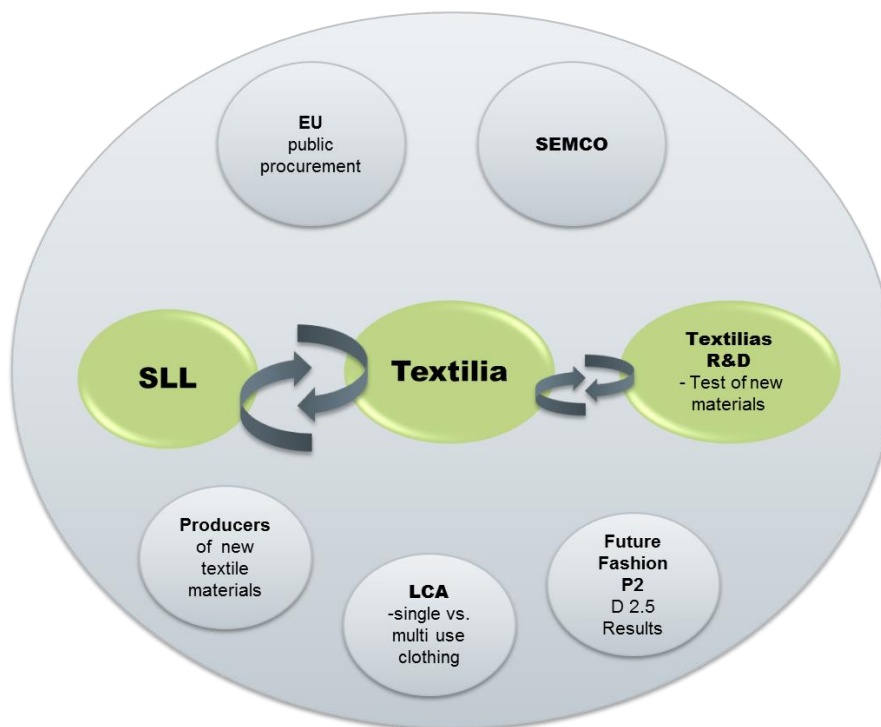


Figure 1 Overview of interacting parties and stakeholders in the current study.

In this study, the two key actors are (see Figure 1):

- Stockholm County Council (SLL)² that buys textile and laundry services through public procurement and
- Textilia³, that offers textile and laundry service

Once new textiles are introduced in public procurement of hospital clothes, the value chain actors will be affected by the EU laws and regulations, environmental requirements set by the Swedish Environmental Management Council (SEMCO) etc. Therefore, it is important to map current challenges and expectation of different value chain actors towards introduction of new textiles, hold a dialogue with all them and communicate the latest research findings.

² SLL, Stockholm läns landsting.

³ Textilia, the Swedish Service Management Company in the textile and laundry service.

3. Factors that affect value chain actors

This chapter describes current situation, challenges and expectations of the value chain actors Textilia (textile and laundry service company), SLL (Stockholm County Council) and, to some extent, Lenzing⁴ (producer of new sustainable textiles).

3.1. Textilia

An interview was performed with the laundry and textile service company Textilia about their laundry process for hospital textiles. The answers are summarized in Table 1 below⁵. This information was collected with aim to deeper understand the requirements that are posed on textiles in the industrial user phase (laundry, including washing and drying processes). It was also important to understand the improvement potential of the process (see also Deliverable D6.1¹ for the initial discussion).



Figure 2 A modern continuous batch washer PowerTrans PLUS⁶.



Figure 3 The compact dryer for a wide range of textiles⁶.



Figure 4 Tunnel finisher⁷.

The information collected is intended for researchers in the Mistra Future Fashion project P2 (input to Deliverable 2.5), aiming at understanding the industrial laundry process of hospital textiles in more details. These findings also confirmed that parameters important in the laundry process are:

- Water consumption
- Energy consumption (including washing and drying processes)
- Washing detergents consumption
- Washing temperature

These parameters can serve as environmental sustainability indicators when comparing performance of new textiles with the performance of textiles that are currently used. It is worth to notice that

⁴ www.lenzing.com

⁵ Personal communication with Textilia, February 2014.

⁶ www.kannegiesser.de

⁷ www.jensen-group.com

performance of the identified parameters is not only influenced by the properties of textiles but also by types of washing and drying equipment used.

Table 1 Description of the laundry process at Textilia based on the interview.

No.	Question
1	Q: How many times is an average hospital uniform washed before disposal? A: 100 – 150 times. This is possible if it does not have hard stains on it etc.
2	Q: What is the weight of an average washing load? A: 35 or 50 kg or 70 kg. How much can be loaded into a washing machine depends on what type of machine and how voluminous the garments/products are
3	Q: What type of washing machine is used? A: Two different types of washing machines are used, so-called (1) Pipes and (2) Continuous Batch Washers that may contain a number of different chambers (5-18 pcs). The latter combine flexibility, performance and lowest consumption figures. The new PowerTrans PLUS is a workflow deliverer of the overall process in the laundry, see Fel! Hittar inte referenskälla..
4	Q: What washing temperature is used for an average washing load? A: 70 to 75 degrees (alternatively 80 - 85 degrees). The used maximum washing temperature may vary slightly depending on the washing machine used and the decision taken by the facility manager on what maximum temperature to apply at a facility. When the decision is to go up in temperature, it is about to achieve a greater safety margin so that all the laundry has reached a temperature of at least 70 degrees for 10 minutes. Here, there is an opportunity to save energy by improving the process - ensuring that all the laundry reaches up to 70 degrees without the need to go up to a higher temperature for safety.
5	Q: How much electricity is used for washing an average washing load? A: 0,44 kW/kg (compliant with the Nordic Ecolabel requirements) ⁸ .
6	Q: How much water is used for washing an average washing load? A: About 10,08 l/kg, depending on the wash process and what types of goods that is included.
7	Q: What is an average detergent dosage for an average washing load? A: The average detergent dosage for an average washing load is 14,6 gram/kg.
8	Q: What type of detergent is used under normal circumstances? A: The type of laundry detergents and other cleaning agents that are used depends on the type of laundry. Vinegar is e.g. used when there is a need to restore the pH balance and Biosoft is a fabric softener. Some examples of detergents and cleaning agents that are being used by Textilia: BiSoft, Vinegar, Sonril, Aqua Blocks, Sanoxy, Lunosept, Mineral Blue, Christal, Spirit.
9	Q: How many uniforms are in an average drying load? A: 35 kg post 110 pieces 50 kg post 160 pieces 70 kg post 230 pieces

⁸ The Nordic Ecolabel (in Swedish: Svanen), www.svanen.se

No.	Question
10	<p>Q: What type of drying machine is used by Textilia?</p> <p>A: When the laundry is to be dried, a tumble dryer or a so-called finish tunnel on steam usually is being used, see Figure 3 and Figure 4. Everything that can be hanged on a hanger will be dried in a finish tunnel (pants, shirts, etc.). Small things will be dried in the tumble dryer (stockings, etc). Some products are first dried for a while in a tumble dryer and then mangled it in mangle (sheets, towels).</p>
11	<p>Q: How much electricity is used for drying an average drying load?</p> <p>A: The average is 2.5 kWh/kg of steam energy throughout the production process.</p>
12	<p>Q: Where do the water effluents go?</p> <p>A: It is transported to municipality's wastewater treatment plants.</p>
13	<p>Q: Under normal circumstances, is rinse, softener or any such products used during washing or drying? If so, what types of products is used and what is an average dosage for such products for an average washing or drying load?</p> <p>A: Different types of products are used. For example Sanoxo, Lunosept, Mineral Blue, Christal, Spirit. The average usage is 20.44 gram/kg (this includes detergent and fabric softener, of which the detergent share is 14.6 gram/kg). Swerea can be contacted for further reference⁹.</p>
14	<p>Q: Under normal circumstances, are the hospital uniforms ironed? If so, what is the average electricity used for ironing one uniform?</p> <p>A: Under normal circumstances the hospital uniforms are not ironed. Only special items are ironed and in such cases a press machine is being used (only for garments in 100% cotton). The most common way is to use a finish tunnel.</p>
15	<p>Q: Is there any transportation between the hospital and the washing facility? If so, what is the means of transportation, what is the average distance, and what is the weight of an average load per transport (including return transport)?</p> <p>A: The average distance between the hospital and the washing facility can vary depending on which washing facility you study, as well as the load per transport. For one of the washing facilities the average distance is 50 km between the hospital and the washing facility. Another facility may have an average distance of 150 km. For a facility with short distances the average cargo quantity can be a bit low, averages load 4-5 tons with a small truck. The maximum weight of a load that a truck can take is 17 tons.</p>
16	<p>Q: Any other washing process-oriented parameter(s) that is important when switching from one material to another?</p> <p>A: No dry cleaning is being used, only water washing process.</p>

It is important to have an understanding of current situation with use and handling of hospital clothes. It will then be possible to compare and analyze the benefits and challenges of switching to new textiles.

There is a potential to reduce the environmental impact in the washing and drying process when

⁹ Referred to Anne-Charlotte Hanning, SWEREA, www.swerea.se

introducing new textiles, for example by reducing the drying time in the process which will in turn result in reduced energy consumption.

3.1.1. R&D at Textilia

Textilia is driven and proactive in the development of requirements for textiles through its participation in e.g. standardization of textiles within the SIS¹⁰, including both conventional healthcare textiles for bed, hygiene, staff and patient but also for surgical fabrics for more specific demands³.

The company performs tests on new materials. One example of Textilia's proactive work towards introduction of new textiles is a new material that consists of modal fibers, polyester and cotton.

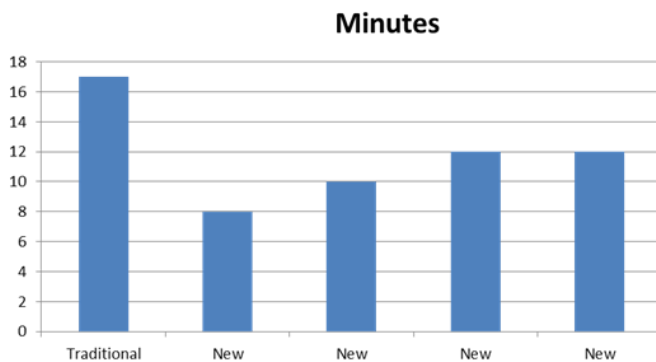


Figure 5 Drying time⁵.

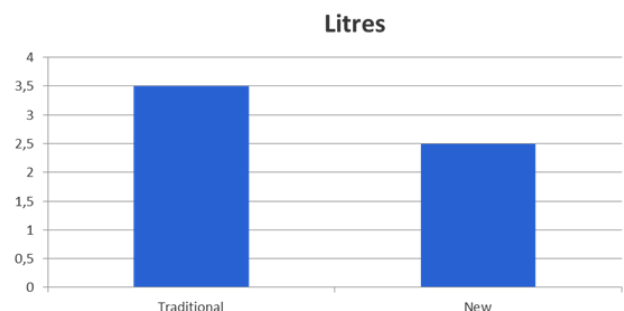


Figure 6 Use of water⁵.

In the pilot study, washing and drying of towels made of this new material resulted in less water and energy consumed. In particular, drying time was shortened from 17 minutes (100% cotton) to 12 minutes (the new material), see Figure 5. In particular, the drying time of the new material was 8 minutes after the first wash and stabilized itself at 12 minutes after a number of washes.

Water consumption during washing process was also reduced, see Figure 6. In this experiment, 200 towels were used by both guests and staff at a hotel and feedback was received after 14 days of usage of the towels.

3.2. SLL – Stockholm County Council

The facts from SLL, purchaser of textile and laundry service, related to current situation and the interest towards new textiles in public procurement are summarized below¹¹.

Current situation

The materials used in hospital clothes today are cotton, polyester and organic cotton. The textiles can be a mixture of the different materials e.g. 50% cotton and 50% polyester or it can be 100% cotton. For some product categories, such as surgical clothes there are specific requirements for the fabric to be used (e.g. the fabric should not dust off).

¹⁰ Swedish Standards Institute (SIS), www.sis.se

¹¹ Personal communication with SLL, February 2014.

SLL's approach to hospital clothes has changed in recent years, indicating that development is now guided towards:

- Using fewer colored textiles, whereas now there are only two colors of hospital clothes are currently in use, blue and white.
- In terms of design, good functionality of a gown and not too many pockets are desired.

SLL obtains information about new and more sustainable textiles that may be of interest to use in the healthcare system from the following sources:

- Textilia
- Textile suppliers
- By own information search

The requirements in public procurement of textiles of today focus on the user phase. In the future, SLL believes that more aspects will be included, in particular requirements throughout the entire life cycle (e.g. including waste phase).

Procurement process and criteria from sustainability point of view

The important criteria in the procurement process of today are:

- Hygiene
- Function. Hospital clothes must meet certain requirements, performing well and safely during use, including quality aspects.
- Environmental impact. Requirements on transportation (fuel), chemical content in detergents, the type of fibers used in clothing (recycled fibers, virgin etc.).

The latest version of procurement agreement containing the list of requirements was introduced in 2010 and entered into force in 2013. Next procurement agreement will not enter into force earlier than 2020. If the new procurement document was created today, the requirements would have been different, e.g. more demand for recycled fiber and renewable fibers.

Today the procurement process works well with regard to the environmental and social requirements. All county councils in Sweden set the same requirements on social aspects of sustainability, which is coordinated nationally.

There are requirements in the public procurement process that are of interest but these are not relevant to set at present time. Probably in few years' time when development has progressed further and the requirements will be realistic to fulfill (e.g. requirement for recycled and/or renewable fiber content).

As a whole, the procurement agreement is the result of a regular strategic and sustainability work. A separate environmental strategy is considered as not relevant due to the fast changing textile development, making it difficult to follow a certain strategy over a longer period of time.

Testing new textiles and hospital clothes

As was mentioned above, a number of criteria related to hygiene, function and environmental impact must be met by a new material in order to become suitable for hospital clothes, as their traditional alternatives.

New products are tested in real time environment. Usually, a department is selected to test new products, followed by evaluation procedure. For instance, a test of towels made of a new material can be performed at a selected hospital department. Once the towels are approved, these will be used on a larger scale.

3.3. Producers of new textiles

Lenzing¹² is a producer of new textile fibers, which supplies the global textile and nonwovens industry with cellulose fibers. The company is a supplier to many business-to-business markets.

Lenzing's portfolio ranges from dissolving pulp, standard and specialty cellulose fibers to engineering services. The fibers are made of cellulose; the natural raw material is wood which contains about 40% cellulose. The fibers have good properties such as absorbency and moisture management. Lenzing's industrial production process provides purity and clearly defined, uniform quality.

One of their products is Tencel, a nonwoven cellulosic fiber. Tencel is manufactured using an eco-friendly process with minimal environmental impact. The production process is based on a solvent spinning process. Some of Tencel's physical properties are high strength, low linting, excellent purity, high absorbency and it is smooth. Tencel fibers can be produced at different lengths depending on the application and product requirements.

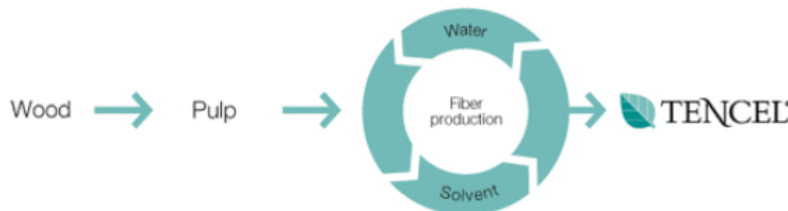


Figure 7 The Tencel production process¹².

Lenzing has a scientific development of the full range of pulp technology, covers also the complete process chain from wood to fibers, (including the chemistry of wood ingredients). Innovative workwear can be made of Tencel blended with cotton. This new textile has properties such as the optimum moisture absorption, reduced bacterial growth and is smooth to wear. The textile has high fiber strength, is robust and therefore makes it suitable for use in industrial laundry. It can manage a numerous of laundry cycles, the Tencel fabrics dry up to 25% faster compared to standard fabrics (saves energy, costs and time) and the wearing comfort (moisture absorption) can be doubled compared to standard fabrics¹².

To summarize, Tencel is profiled as an environmentally sound fiber. It is made of renewable raw material (wood), produced in a sustainable manner (with relatively low energy and water consumption needed) and offers other actors in the textile value chain (textile manufacturers and users) possibility to use and handle the textile products in more responsible and sustainable way. With these properties, the Tencel products can be seen as one alternative fiber to use, e.g. for future hospital clothes.

4. Sustainable procurement and research

This chapter summarizes changes in public procurement of textile and laundry service on the EU level and Sweden, as an update on the Deliverable D6.1¹. An overview of the latest research findings on sustainability aspects in public procurement is also provided alongside.

4.1. EU and Sweden

Public authorities spend around 18% of GDP on procuring works, goods and services, making procurement a powerful level for achieving specific societal goals¹³.

¹² <http://www.lenzing.com/en>

New rules on public procurement and concession contracts were approved by the EU Parliament in January 2014, which means in practice that these will overhaul the current EU public procurement rules and for the first time sets common EU standards on concession contracts to boost air competition and ensure best value for money by introducing new award criteria that place more emphasis on environmental considerations, social aspects and innovation. The new rules will be published in March 2014 in the Official Journal of the European Union and a two-year implementation period will take place in the Member States.

Thanks to the new criterion of the 'most economically advantageous tender' (MEAT) in the award procedure, public authorities will be able to put more emphasis in quality, environmental considerations, social aspects or innovation while still taking into account the price and life-cycle-costs of what is procured. The new criterion is stated to 'put an end to the dictatorship of the lowest price and once again make quality the central issue'¹³.

More information was requested from the EU by the authors of this report in February 2014. Of particular interest was the question on how the new EU public Procurement rules will impact the Green Public Procurement (GPP) recommendations for Textiles (see Deliverable D6.1¹), which is a voluntary instrument in the EU. The requested answers are not yet available from the EU.

In Sweden, currently available environmental criteria for textile and laundry service were introduced by SEMCO in January 2011. Since then technical and law updates were performed, while no new environmental criteria added or removed¹⁴.

Many activities are ongoing in the R&D of new fabrics nowadays. Therefore SEMCO has initiated a process of updating the available environmental criteria. The first step is to hold an expert meeting and discuss the status of the procurement criteria.

SEMCO receives information about R&D of new fabrics by:

- Monitoring the area
- Following the development of various eco-labels
- Information from the Swedish Chemicals Agency and
- By coordinating the national Substitution Group, which is a cooperation group for the county councils in Sweden.

Another interesting initiative on sustainable public procurement takes place in the Nordic countries. The cooperation concentrates around Life Cycle Costs (LCC) and common criteria. Of today, a pre-study has been performed investigating the potential cooperation around socially and environmentally sustainable cooperation in public procurement¹⁵. In Sweden, The Swedish Agency for Public Management (Statskontoret) is the cooperation actor.

4.2. Research update

The latest research update includes an overview of an LCA study performed by the Örebro County Council (ÖLL) and general update on continuation of work in project P2.

¹³ <http://www.msr.se/sv/Hem/Aktuellt/Nyhetsarkiv/Nya-EU-direktiv-om-offentlig-upphandling--ett-steg-narmare-en-hallbar-upphandling/> and <http://www.europarl.europa.eu/news/en/news-room/content/20140110IPR32386/html/New-EU-procurement-rules-to-ensure-better-quality-and-value-for-money>

¹⁴ Personal communication with SEMCO, March 2014.

¹⁵ <http://www.statskontoret.se/nyhetsarkiv/nordiskt-samarbete-for-hallbar-offentlig-upphandling/>

4.2.1. Disposable vs. reusable hospital clothes

The consumption of materials is extensive within the county councils in Sweden. For the Örebro County Council (ÖLL), the total climate impact is caused by energy and media demands (41%), materials consumption (25%), transportation including hospital and business trips (16%), food (10%) and medical gases (6%)¹⁶.

The aim of the study was to reduce the environmental impact from the material consumption at ÖLL. It was identified that the product groups with high carbon footprint were, for example, garbage bags, gloves, aprons, surgical drapes and *disposable clothing*. Therefore, reduced consumption of selected disposable products was targeted and, for some of the disposable products, the County Council has shifted from non-renewable to renewable raw materials.

ÖLL's strategy to reduce its total climate impact was to:

- Reduce material consumption by changing working routines
- Reduce material consumption by shifting to reusable clothing, instead of using disposable clothing
- Increase the use of more 'environmentally friendly' materials
- Improve logistics

ÖLL's approach was also to identify the environmental requirements that should be set already in the procurement process. Development of environmental requirements for the procurement process resulted in the following priority list:

- Resource-efficient products
- Products made of renewable materials
- Products made of recycled materials
- LCA/EPD¹⁷ as part of tender
- If possible, use products made of monomaterial
- Innovation procurement
- Extended market analysis

The project also included an LCA study where disposable vs. reusable surgical gowns were compared, see Figure 8.



Figure 8. LCA study of surgical gowns, reusable vs. disposable¹⁶.

¹⁶ Örebro Läns Landsting, Minskad miljöpåverkan från förbrukningsmaterial. Presentation av arbetet inom Örebro Läns Landsting, Sara Richert, miljöcontroller.

¹⁷ Environmental Product Declaration (EPD).

The LCA study results in Figure 9 show that the environmental impact from the disposable surgical gown is significantly higher compared to its reusable alternative. This is valid for all environmental impact categories analysed. For instance, the impact category '*Climate change*' that accounts environmental impact in terms of greenhouse gases (GHG) indicated that the impact from the reusable gown is only ca 18% of the disposable gown impact.

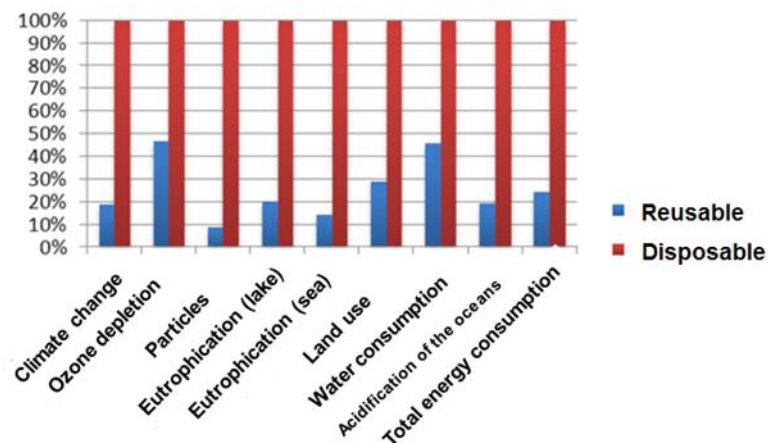


Figure 9 Results - disposable and reusable products' environmental impact¹⁶.

As a result, ÖLL considers to include essential environmental requirements into in the procurement process in order to ensure reduced environmental impact from own activities. LCA was used for informed decision-making and the products compared showed that the reusable surgical gown was to prefer over the disposable alternative.

4.2.2. Sustainability work in project P2

Development of a life cycle methodology for sustainable textile value chain is ongoing by partners in the Future Fashion program. In particular, the project P2 'Clarifying sustainable fashion' works on the deliverable D.2.5 - Development methodology regarding LCA including chemical risk assessment.

A base scenario is developed in the study and Life Cycle Inventory (LCI) data is being collected for different garments such as T-shirt, jeans, dress, jacket and shift (hospital gown), see Table 2. When the base scenario is fully designed and tested (in May 2014), various new fabrics will be compared with the traditional alternatives listed in the Table 2 are analyzed.



Table 2 The Garments included in the study¹⁸.

Garment	Material	Gender	Size	Colour	Construction
T-Shirt	Cotton	Unisex	Medium	White	Knitted
Jeans	Cotton including elastin	Female	Medium (30/32)	Dark blue	Woven
Dress	100% polyester	Female	Medium		Knitted
Jacket (shell jacket)	Shell: polyamide Liner: polyester	Female	Medium	Black	Non-woven, removable liner
Shift (hospital gown)	50% cotton / 50% polyester	Unisex		White	Woven

At the time of writing the current report, the environmental assessment was still developed. The readers are recommended to consult D2.5 upon completion for further knowledge and conclusion on the project's environmental research. Thus, current report serves as input to further sustainability work in the Mistra Future Fashion Program.

4.3. Conclusions

- **What is the new textiles development in the healthcare sector so far?**

The new textiles development within the healthcare sector is ongoing actively. Textile fiber producers, textile producers, and textile and laundry service companies perform R&D on new textiles. The trend is towards more sustainable products, from environmental, economic and social perspectives. This is valid for the whole value chain, from raw material production, use phase, to waste handling.

In the healthcare sector, it is common to run pilot tests with new textile products prior introducing these on a larger scale. The important requirements to fulfill are:

- Hygiene
- Function
- Environmental impact

Alongside with development of new textiles, public procurement is also on the way to renew itself. New rules on public procurement and concession contracts were approved by EU in January 2014. These will overhaul the current public procurement rules and put more emphasis on environmental considerations, social aspects and innovation. How these will affect the Green Public Procurement of Textile is still to be analysed.

In Sweden, currently available environmental criteria for textile and laundry service are going to be updated during 2014.

- **What are the opinions on new textiles today?**

¹⁸ Personal communication with Gregory Peters, Associate Professor, Chemical and Biological Engineering, Chalmers University of Technology (project P2).

Current study that analyzed public procurement process of textiles and laundry service between procurer Stockholm County Council (SLL) and service provider Textilia has resulted in several further insights:

- The share of recycled fibers and renewable fibers will increase in textiles
- The share of blended textiles will increase (e.g. 100% cotton as a monomaterial will to some extent will be substituted by new materials made of blend material, e.g. cotton/modal/tencel).
- The requirements in the public procurement process of textile and laundry service will be updated and preferably include e.g. requirements for recycle and/or renewable fiber content.

- **What advantages offer new textiles and their believed future?**

It is important to analyze advantages of new textiles throughout the whole value chain.

From the textile producer point of view, sustainable raw materials are in focus (e.g. energy and water efficient consumption). Sustainable textile production in combination with engineered textile properties opens new possibilities for their customers in the value chain.

From the textile and laundry service company point of view, smart and innovative textiles behave more sustainably in the washing and drying processes, e.g. shorter drying time and reduced energy consumption, and manage many laundry cycles.

In the use phase hygiene, function and environmental impact criteria are the most important and must be fulfilled by textiles used in hospital clothes regardless the textile type. The new textile could offer properties such as comfort (e.g. smooth to wear), moisture absorption, reduced bacterial growth etc.

To conclude, unfolding sustainability potential of new textiles in the use phase and laundry service phase is a dynamic task that involves different value chain actors such as authorities, producers, converters, users, recyclers etc. Case study-approach is an efficient way to analyze challenges, possibilities and pave the way forward for new and sustainable textiles.