REPORT

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REPORT – FINAL

Professional laundry service or On Premise Laundry (OPL) and home washing

- What is more sustainable?

REPORT

This report was developed by ÅF Infrastructure AB on behalf of:

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Fédération Belge de l'Entretien du Textile (FBT) BE

Groupement des Entreprises Industrielles de Services Textiles (GEIST) FR

Textile Services Association (TSA) UK

Verband Textilpflege Schweiz (VTS) CH

Wirtschaftsverband Textil Service e.V. (WIRTEX) DE

ETSA- European Textile Service Association

Deutscher Textilreinigungs Verband e.V. DE

TRSA USA

Sveriges Tvätteriförbund (ST) SE

REPORT

Summary

- The European professional textile service industry has a strong focus on reducing the environmental impacts from the industry, with average use of water, electricity, chemicals and fuel constantly decreasing.
- Extending the lifetime of textiles is crucial for the environmental performance of textile service. The technical knowhow, selective substitution/repairing of smaller damages and use of professional machine parks and high quality chemicals used in professional textile service companies can increase the lifetime of textiles, thereby decreasing environmental impacts.
- The rental business model commonly used in professional textile service will also stimulate use of high quality textiles, while lower quality textiles might be a more attractive solution in case of OPL, in order to minimize initial investment costs.
- Previous LCAs have demonstrated 20-30% savings of CO_2-emissions from professional textile service compared to home washing. Optimization of the washing process was identified as one of the main reasons to these results.
- These savings can motivate transport distances of textiles distances more than 800 km long.
- The textile service industry is an important creator of jobs with limited needs of language skills amongst workers. The industry has an important role in integration of people newly arrived to Europe. Many companies are already involved in programs providing internships and employments and there is a strong will from the industry to develop this even further, through close collaboration with local and national governments.
- In OPL, textile service is not the core activity of the company. Thereby, tasks that could have been done by persons with developing language skills are done by persons that could focus on other activities where their skills are needed. Thus, using staff trained for other core activities to handle textile service in OPLs or using home washing is a lost chance for integration.
- According to academic studies, professional textile service commonly result in lower costs per kg of textile and year when compared to OPL, as investments in machinery and costs for administration (including routines and fees needed to fulfill with safety and environmental legislation) are divided between a higher number of customers in professional laundries.
- Professional textile service relies on a business model built on sharing, in line with the concept of sustainable resource use and circular economy. Through sharing of investment, professional textile service can invest in more efficient technology.
- Externalizing textile service to experienced professionals, presenting high levels of know-how and with an inherent incentive to constantly improving quality and reducing environmental impacts, gives clients more time to focus on their core activities.

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1 Background

The textile services industry is an important contributor to the European economy, with an annual turnover of around €11 billion in 2012 (ETSA, 2017). Throughout the EU, the industry is employing around 135 000 individuals (ETSA, 2017). However, today both On Premise Laundry (OPL) and home washing exists in both the public and the private sector e.g. hospitality, industry and service areas. According to Deloitte (2014) the market for rental textile service could more than double if more companies, municipalities and institutions chose professional textile service rather than OPL or home washing for employers workwear and other textiles. The choice between these alternatives must of course take several aspects into consideration, such as quality, overall costs, effect on working environment, social impacts and environmental impacts.

The aim of the present report is to investigate the sustainability performance of professional textile service industry, in comparison to OPL and home washing of primarily workwear and other textiles used in a professional context, including environmental, social and economic aspects, as well as overall quality of textile services.

2 Method

The report is based on collection and analysis of relevant statistics and official data describing the textile service industry. The report also contains an extensive review and analysis of previous studies, investigating different aspects of sustainability within the textile service industry and scientifically based comparisons between professional and non-professional alternatives. The study is limited to the European market, with a special focus on Germany, Belgium, Switzerland, Sweden and Denmark.

The selection of aspects investigated here is based on the three pillars of sustainability, including environmental, social and economic aspects. The aim of the present report is not to investigate the performance of individual companies, but rather the professional textile service industry as a whole, within the framework of the three pillars of sustainability.

Below, each one of these areas is broken down to concrete topics, such as job creation, energy use etc. and the performance within the industry in relation to these topics is presented and analyzed.

3 Environmental sustainability

The engagement in reducing negative environmental impacts from the textile service industry is very strong in Europe. Key environmental data on the use of Water, Electricity, Chemicals and Oil (WECO) per kg textile is commonly measured and presented yearly by companies in the industry. National averages are commonly presented by national business organizations, who are also monitoring and analyzing the developments in these key figures over time.

In many cases, authorization processes for membership in national business organizations for textile service companies credit low WECO-values. One example of this

is the authorization process of BVT (the Danish organization for professional textile service companies), giving higher points to companies with lower use of water, electricity, fuel and chemicals (BVT, 2017). The mandatory reporting of these data result in higher consciousness amongst all member-companies and creates clear incentives for improvements.

3.1 Energy use

According to ETSA, industrial laundries reduced their gas and oil consumption by more than 16% over the period 2007-2015. Over the same period of time, 24% less electricity was used to provide the same services within the industry. The figures are based on a survey amongst 96 workwear plants and 63 flat linen plants. According to the same survey, in 2015, the average electricity use per kg workwear and mats was 0.21 kWh and 0.19 per kg flat linen. In the same year, the average amount of fuel used per kg workwear and mats was 1.20 kWh and 1.33 per kg flat linen (ETSA, 2016).

The best practice levels, showing the performance of the best 20% laundries, were in 2011 determined to 0.20 and 0.15 kWh electricity/kg for workwear and flat linen respectively. The best practice fuel use was determined to 0.98 and 1.19 kWh/kg respectively for workwear and flat linen the same year (ETSA, 2011). In addition, more resource efficient equipment is often used for washing flat linen, for example the so-called tunnel washers or continuous batch washers (CBWs) mentioned below.

The Danish research institute Teknologisk Institut performs independent investigations of the energy use within the Danish textile service industry annually. Data from 2016 shows that the electricity use varies between 0.08 and 0.7 kWh/kg textiles, with an average of 0.22 kWh/kg. The same survey shows that the fuel use per kg textiles varies between 0.1 and 1.7 kWh, with an average of 0.95 kWh (Teknologisk Institut, 2017).

In Germany, the average electricity consumption is 0.22 kWh/kg textiles. The average amount of fuel used per kg of textile is 1.59 kWh. Gas is becoming more and more common as fuel, currently representing more than 80% of total fuel use (Wirtex, 2017).

3.2 Water use

According to ETSA, industrial laundries reduced their water consumption by 24% over the period 2001-2011 (ETSA, 2014). The figures are based on a survey amongst 96 workwear plants and 63 flat linen plants. In 2015, the average water use per kg workwear and mats was 11.2 l/kg and 8.2 l/kg of flat linen (ETSA, 2016).

The Danish research institute Teknologisk Institut performs independent investigations of the water use within the Danish textile service industry annually. Data from 2016 shows that the water use varies between 2 and 20 l/kg textiles, with an average of 10 l/kg (Teknologisk Institut, 2017). The average water consumption in the German textile service industry is 11 l/kg (Wirtex, 2017). However, many German companies have a much lower use, between 6 and 10 l/kg (DTV, 2017).

Berendsen is the largest textile service companies in Europe, operating in 16 European countries. The company has a strong focus on environmental optimization of the textile service process. The achievements in 2016 included, amongst others;
- Investment in high pressure presses that remove the water from the linen more efficiently requiring reduced energy for drying, as well as in more efficient batch tumble dryers in the UK.
- Renewal of ventilation systems, reducing electricity consumption by approximately 20% in Bolsward, Netherlands.
- Retrofitting of an older plant for textile service in l Dietzenbach, Germany, resulting in reduced water and energy consumption by approximately 40%.

3.3 Use of chemicals

According to ETSA, in 2011, the average use of chemicals per kg workwear was 37 g/kg and 17.9 g/kg of flat linen. The figures are based on a survey amongst 96 workwear plants and 63 flat linen plants (ETSA, 2014). The survey demonstrates that the consumption of chemicals to launder flat linen is significantly lower than the consumption for processing workwear, as a result of higher soiling levels in the case of workwear. In professional textile service, knowhow, experience and daily fine-tuning of the equipment used provides high potentials for processes which are optimized for the needs of the specific client. In a recent survey performed in the Netherlands, where six OPLs were investigated form different aspects, it was seen that use of softened water was applied very limitedly in the visited locations. Softened water simplifies stain removal, lessens wear of the textile and is better for the machinery, which makes it an important precondition for good washing processes (CINET, 2016). In home-washing, use of softened water is of course even less heard of. Studies have also indicated generally low knowledge about correct dosage of chemicals in home washing. In a survey amongst 1000 swedes, more than half (54%) of the respondents do not follow the instructions for dosage of washing powder. In the age-group 23-35 years, more than 70% find correct dosing of washing powder difficult (Whirlpool, 2012). Thus, results from the studies cited above indicate a higher risk for sub-optimization of chemicals in OPLs and home washing.

The Danish research institute Teknologisk Institut performs independent investigations of the water use within the Danish textile service industry annually. Data from 2016 shows that the water use varies between 1 and 39 g/kg textiles, with an average of 17 g/kg (Teknologisk Institut, 2017).

Investment in research and collaboration with the biotech-industry has resulted in vast advances in the use of enzymes in the textile service industry. By using enzymes in their wash processes Berendsen, the largest laundry company in Europe, has been able to lower the washing temperature, do fewer rewashes and use fewer chemicals. Enzymes are used mainly in workwear laundries, but also introduced in several hospitality laundries. In 2016, the process had been introduced in 31 laundries within the company. The process replaces partially undesirable chemicals with less harmful biodegradable chemicals and at the same time, improves whiteness and quality (Berendsen, 2017).

3.4 Optimization

The amount of resources used per quantity of textiles washed is strongly related to optimization of the washing process. One of the most important aspects here is the filling grade. Many professional textile service premises have machines with different capacities in order to optimize the equipment used to each specific client and batch. This is more difficult in home and OPL washing. In fact, in a survey amongst 1000 swedes, more than half (52%) admits to commonly wash single items or half-full machines. Lack of professional knowledge of the washing process can thereby lead to sub-optimization of resource use (Whirlpool, 2012). In the case of OPLs, recent studies in the Netherlands have showed that industrial washing- and drying processes are significantly more energy efficient (CINET, 2016). According to this study, the energy consumption in OPLs is on average of 1.7 times as high as the average from industrial laundries, with tops of 2.2 times. On top of that, the water consumption is roughly twice as high. One of the reasons behind OPL being less optimized is the fact that these commonly are located in buildings that restrict the types of energy and machinery used, in combination with workers with low know-how and experience of textile service.

3.5 Transports

In order to guarantee payback on investments in modern washing technology, it is often necessary to concentrate different flows of textiles to production sites, which is related to a certain amount of transports. This also increases the possibility to create jobs in areas where there is a lack of working places. The Swedish textile service industry offers several examples of how textile industry service has been concentrated to areas with high unemployment rates, playing an important role in the local business (see Social sustainability below).

According to previous LCAs of industrial washing, emissions from transports of textiles (including up-stream fuel production emissions as well as production and maintenance of transport vehicles) corresponds to less than 5% of overall greenhouse gas emissions from the industrial washing of work-wear (2.0 LCA Consultants, 2007). The same LCA also stated that the energy use in industrial textile service is about 30% lower than in home washing, when transports not are considered (2.0 LCA Consultants, 2007). Using data from producers of light trucks (vans) commonly used in distribution of textiles (Mercedes Benz, 2017), shows that textiles can be transported over 800 km, while maintaining the higher energy efficiency in professional textile service (for details, see appendix).

Greenhouse gas emissions from transports are in general decreasing due to a constant increase of bio-based fuel in diesel, as a result of EU-directives. Also national/regional transport legislation is affecting overall environmental impacts from transports. As an example, in Belgium (Flanders, Wallonia and Brussels) a kilometer tax was applied to heavy-goods vehicles over 3.5 tons in 2016, having the effect of further optimizing logistics within the textile service industry (LCNI, 2016). These general trends will reduce

CO_2-emissions also from transports performed within the textile service industry. However, many companies are acting proactively to further reduce their transport-related emissions.

CWS-boco in the Netherlands has developed its own type of vehicle – the Smart Box. This light-weight vehicle is optimized for textile collection and delivery through removal of all superfluous ballast. This has increased the loading capacity by almost 80% - at the same time as the physical effort for staff loading and unloading the vehicle is reduced. This saves almost 200 liter of diesel per vehicle and year (CWS-boco, 2015).

Hr Björkman is one of Swedens largest textile service industries for carpets. All transports within the company are performed with biogas vehicles, using biogas from waste materials (Hr Björkmans, 2017).

KåPi tvätt in Sweden only uses renewable fuels in their transport vehicles (KåPi tvätt, 2017).

Textilia Tvätt & Textilservice in Sweden has reduced their use of diesel vastly by introducing a liquid fuel based on a mixture of biogas and natural gas in their distribution vehicles (Textilia, 2017).

CWS-boco in Germany has invested in electric vehicles for collection and delivery of textiles (CWS-boco, 2015).

Transport of workwear should also be seen from a hygiene perspective. Although it might seem environmentally efficient for workers to change at home and wear their workwear while traveling to and from work, this can create risks for contamination of co-travelers, as well as contamination of workwear (and thus clients in contact with workers during the day) through contact with other travelers. In a survey performed amongst 1 600 European households in 2012, as many as 50% of respondents who are washing their workwear at home, reported to also wear work clothes to and from the workplace (GfK, 2012)[1].

It is important to remember that in some cases, professional textile services are compared to off-property laundry in public regime for institutions in a specific municipality. In these cases, transports for collection and delivery of textiles from generators within the municipality will be the same in both alternatives. The distance to the service plant can however be longer when choosing professional textile service, as textiles from several different municipalities will be managed in the same plant. The fuel use is however commonly lower per km in transports between densely populated areas, when compared to the fuel use in city-driving. Professional textile service companies with in-house distribution service commonly have vast know-how and experience in

[1] GfK survey on "consumer behavior in the private cleaning of work clothes" conducted by the European Textile Services Association (ETSA), was conducted between July and November 2012 in Belgium, Germany, Poland And the United Kingdom. In each country about 400 participants were interviewed by means of an online questionnaire and in personal interviews. The survey participants work in the following sectors and sectors: construction industry, public service, health sector and medicine, mechanical engineering, food industry, retail / food market, agriculture / horticulture, chemical / petrochemical industry, road construction and fishing. The detailed study results are available on the ETSA website www.textile-services.eu.

planning of logistics, in order to optimize transports within the company. As an example, CWS-boco has developed an in-house rout planning application “Opimize my day”. This is used for all their transport services in order to optimize driving routs and fuel use (CWS-boco, 2015).

Finally, the development of more powerful batteries, fast charging equipment and reduced investment costs is rapidly making the use of electric vehicles more relevant also for the textile service industry. The use of renewable energy in electric vehicles will further decrease both local and global environmental impacts from the textile service.

3.6 Water treatment

A survey amongst 96 workwear plants and 63 flat linen plants in Europe shows that approximately 40% of the workwear laundries have installations for pH neutralization, and around 50% have some form of extended wastewater treatment. For the flat linen laundries around 25% have pH neutralization and around 20% have some kind of extended wastewater treatment (ETSA, 2014). Typically, the installation of an extended wastewater treatment plant includes some recycling of the treated water. Hence these installations reduce the consumption of fresh water but increase the consumption of electricity. It should however be remembered that the on-site water treatment performed by the industry reduces the electricity consumption in municipal wastewater treatment plants.

Victor Vask is a family owned textile service company at Bornholm (Denmark). The company used around 15 m^3 of water each day when they in 2015 decided to invest in in-house water treatment. Today, all water is treated in-house until possible to reuse. To compensate for water evaporated in the process rainwater is collected and treated before being used as input to the processes in the laundry (Viktor Vask, 2017).

3.7 Renewable energy production

The Swedish professional textile service industry has increased the use of renewable energy vastly in later years. Previously, energy used in the laundry process was typically generated from combustion of oil or fossil gas. Today, many companies have converted their oil or gas combustion facilities in order to use pine oil, rape methyl ester (RME) or pellets.

Bröderna Fraimans Tvätteri in Sweden converted from oil to RME, resulting in a CO_2-reduction by 75%.

KåPiTvätt converted from natural gas to pellets, resulting in a reduction by 990 tons of CO_2 per year.

Tvätteriet i Alingsås in Sweden has converted the previously gas-fired heater to pellets and reduced their CO_2-emissions by 1500 ton per year.

3.8 Control by authorities

Throughout Europe, professional textile service industry plants are closely monitored by authorities. In countries like Sweden, companies are commonly required to report yearly consumption of chemicals, water and energy per ton of textile, and authorities perform plant visits as often as every second year (Tvätteriförbundet, 2014). Similar controls are made by German authorities (Schumacher, 2017).

According to the Swedish environmental legislation, professional textile service companies are required to continuously investigate the possibilities of changing from more to less environmentally damaging chemicals, handle waste with strict care and chose best available technology, amongst others (Miljöbalken, 1998). The same content can partly be found also in other EU-countries, meaning that textile service industries all over Europe constantly is working to make sure they are constantly improving their selection of chemicals in their processes.

The knowhow and time it takes to undertake all considerations needed in order to fulfill the demands from authorities should not be under-estimated. If regulations are violated, there are not only risks of damaging the environment, but also of potential fines.

3.9 Certificates

Use of certified quality, environmental and energy management systems is a well-recognized manner for systematic identification of improvement potentials and implement measures to reach these potentials. Use of different management systems becomes more and more common amongst professional textile service companies, while studies have shown that this is very uncommon amongst OPLs (CINET, 2016). An increasing number of professional textile service companies have implemented the ISO 9001 quality management as well as the ISO 14001 environmental management system. Both 9001 and 14001 standards require authorized third party review. This ensures systematic monitoring of key indicators related to quality and environmental performance, and continuous developments and improvements. Both standards (9001 and 14001) were recently updated, now containing even stronger demands related to lifecycle thinking, as some of the organization's significant environmental impacts can occur during the transport, delivery, use, end-of-life treatment or final disposal of its product or service. By providing information, an organization can potentially prevent or mitigate adverse environmental impacts during these life cycle stages. The organization considers the extent of control or influence that it can exert over activities, products and services considering a life cycle perspective (ISO, 2015).

3.10 Carbon footprint

An assessment of the overall carbon footprint (i.e. emissions of greenhouse gases) from professional washing and drying of workwear compared to washing and drying at home has demonstrated almost 30% savings from professional textile service (2.0 LCA Consultants, 2007). In an earlier study (Hansen and Holst, 2001), the professional textile

service industry was proven a 20% lower carbon footprint, compared to home washing of workwear. Optimization of the washing process was identified as one of the main reasons to these results. These LCAs do not take into consideration that both home washing machines and industrial machines have become more energy and water efficient over the last decade. This, as well as the increased use of renewable energy within the professional textile service industry (including transports) over the last decade would be of relevance to consider in an updated LCA. As an example, CWS-boco, one of the largest textile service companies in Europe, has since several years back purchased 100% renewable energy for all their production sites in Germany and the Netherlands (CWS-boco, 2015).

It is important to stress the many difficulties included in the development of this type of comparative LCAs. As an example, around 50% of European workwear laundries have some form of extended wastewater treatment, meaning an increased use of electricity for wastewater treatment on-site, but a reduced electricity consumption in municipal wastewater treatment plants. Home washing of workwear will however increase the load on the municipal system, although this commonly not is acknowledged in an LCA.

3.11 Circular economy

Production of textiles is rather resource demanding. Thus, careful handling of textiles to guarantee that these can be used for long periods of time is of key importance for sustainable textile service. After a long life, textile waste will have to be taken care of. This has previously commonly meant combustion. However, technologies for material reuse and recycling is growing and there are several examples of how the professional textile service industry has contributed to innovations in the spirit of circular economy.

The Danish company DFD is collaborating with the textile designer Kaus Samsøe. In his new collection LEFTOVER for the brand Samsøe, discarded T-shirts from DFD are redesigned and used as material in new designer clothing (DFD, 2017).

The German textile produced Lauffenmüle produces workwear for health and care workers based on bio-degradable fibres which can be composted after the life-cycle. The workwear collections Infinito and Reworx are both based on a cradle-to-cradle principle (C2C product innovation institute, 2017).

In Sweden, textiles made from organic cotton were asked for in a public procurement for hospital textiles. However, Textilia (one of the larger textile service companies in Sweden) had the idea of proposing textiles made from recycled PET-bottles, recycled cotton and wooden fibers. Although the public agency initially was sceptic, Textilia managed to convince them to change the wording in the procurement call, enabling use of these new materials, developed specifically to be washed industrially. Compared to the use of organic cotton, the 227 000 products (towels, sheets and baby-blankets) currently used in the hospitals, result in yearly savings of 275 million liters of water (used in cotton production). In addition, the energy needed for drying is reduced by

23%. This demonstrates that the experience and know-how from professional actors in the industry makes companies willing to advance even faster and deeper in a direction of environmental sustainability than demanded and asked for by public agencies (Textilia, 2016).

Also in Sweden, Berendsen is involved in a research project to develop an innovative and resource-efficient sorting plant for textile waste, in collaboration with the textile industry, the Red Cross, second hand shops, municipalities and the university (Wargön, 2016).

In Denmark, the company REALLY has developed acoustic boards from recycled textiles, in collaboration with the Danish professional textile service industry. The boards have proven very efficient in reducing in-door noise. A recent survey has also showed that the 120 tons of textile waste generated amongst Danish professional textile service companies every year would be enough to ensure a continuous material supply for REALLYs production, and the company launched the first collection of the product at the furniture fair in Milan, in April 2017 (Really, 2017).

The Finnish textile service company Lindström is since many years collaborating with Stormiepoodle, a Swedish child-clothing company, with focus on reuse of textiles. Through this collaboration, old textiles are given new lives, the overall environmental impacts from the textile industry are reduced and emissions from waste treatment are avoided (Lindström, 2015).

The laundry service industry is actually presented as an inspiring role model and example by the Ellen McCarther Foundation of how shifting to a circular business model can enabled a company to enter a market, and provide sustainable services to their clients. The foundation presents the case of the small Danish company Vigga, that wanted to sell high quality organic clothes for babies. To make the clothes more accessible for clients with lower incomes, they decided that switching from selling clothes to *selling access to the clothes.* This was only possible through a close collaboration with a textile service company, guaranteeing high quality laundry of the high quality clothes produced by Vigga (Ellen McCarth Foundation, 2017).

FBT, the Belgian Association of Textile Care, is member of the Green Deals (an initiative of the Flemish Government which stimulates organizations and companies to think in the spirit of circular economy starting with the public procurements. This project is supported by several different companies and non-profit organizations through the whole textile supply chain). Project will be initiated and partly subsidized, with the aim of working together in this field of circularity and learning from each other.

4 Social sustainability

The textile service industry is increasingly demonstrating their social engagement through participation in initiatives such as the UN Global Compact. Participation in Global Compact means that the organization supports the ten principals of sustainable

business and that activities performed to make sure that the organization complies with these principles. The two German business associations (WIRTEX and DTV) and Swedish business associations are members of the initiative, together with several larger textile service companies, such as Berendsen, as well as ETSA, the European umbrella organization for textile service business associations. Both WIRTEX and DTV have recently started to collect and analyze KPIs on sustainability from their member companies, increasing the incentives for member companies to improve their sustainability.

One of the most important parts of the social engagements of the textile service industry is the creation of jobs. Professional textile service companies create thousands of jobs in Europe. In Germany, around 69 000 persons work in the textile service industry (including dry-cleaning and laundering). Of these, 67.5% are women. In Belgium 7.000 persons work in the textile service industry (both dry-cleaning and laundering) of which at least 75% are women. In Sweden, the industry employs around 3000 persons and in Denmark around 2700 persons.

The professional textile service industry has also played an important part in the integration of many newly arrived in Europe. The main reason is a limited need for advanced language skills. In Sweden, 40% of the workers within the professional textile service industry are born outside of Sweden. This demonstrates that the industry can present an important door-opener to the new society, providing work-opportunities while language skills are improving and networks are growing. The types of jobs offered by the professional textile industry can also be relevant for creation of jobs for persons with short education and special needs. Several examples exists of persons with special needs finding meaningful jobs within the industry, where they have become respected and appreciated colleagues.

However, in order to reach actual integration, language training and possibilities to advance professionally, it is important not to separate work-places for people with any kind of special needs or language necessities from other parts of the industry. An example of such risks is seen in Sweden, where some municipalities currently are investigating the possibilities to open municipal textile service institutions with the primary aim of creating jobs for immigrants and disabled people (Landskrona Direkt, 2016). In addition, these institutions are intentionally planned to be “low-tech”, with a large amount of manual activities, with the intention of increasing the number of workers needed per ton textile.

Such initiatives will not only run the risk of being un-successful in creating integration, improving language-skills and expansion of networks in a new society for immigrants, but also create problematic working-environments. In addition, participants will not benefit from such programs in terms of gaining adequate training and working experience, which can help them finding jobs in the “reality”, which is increasingly high-tech.

The professional textile service industry is already today providing jobs which offer the qualities municipalities are looking for. In order to further increase the collaboration between municipalities and private companies in tackling common challenges in the society, introduction of social requirements in contract could be a way forward. Such requirements can include employment of a set number of immigrants or disabled people, trainee placements etc.

Taif Hasan came to the Rimbo, Sweden, from Iraq in 2003. The year after, he was employed as a summer-trainee at Textilia. Since then, he has worked his way upwards in the company. Since 2012, he is now head of department at the same facility where he started of eight years earlier (Svenskt Näringsliv, 2016).

Berendsen Textil AB in Ockelbo, Sweden, creates important jobs for persons with special needs. Their trainee-program linked to training demonstrates a high degree of pathos within the organization, according to the local mayor (Ockelbo, 2015).

Berendsen AS in Denmark is involved in a governmental initiative to facilitate integration of immigrants in the country. The initiative “Sammen om integration” brings socially concerned companies together with immigrants with relevant profiles for internships followed by employment (Jobservicedanmark, 2017).

Since June 2016, the Danish textile service company De Forenede Dampvaskerier has provided 13 weeks of internship to immigrants with little previous formal education. The program has turned out well and many of the participants are now employed by the company (Service DI, 2017).

The professional textile service industry is also an important tax payer. As an example, Swedish professional textile service companies payed almost 10 million euros together in social fees (taxes) in 2012 (SCB, 2014). The social fees payed by the much larger amounts of German professional textile service companies reached 182 million euros in 2014 (Statistisches Bundesamt, 2016).

4.1 Safety and occupational health

Professional textile service includes several moments which can be connected to safety risks if employees are not correctly informed and trained and if safety routines are lacking. Therefore, experience and know-how regarding risk identification and minimization has an important place in the authorization process within the authorization processes of the Swedish and Danish business associations. This means that member companies are controlled yearly in relation to aspects such as adequate lightning, air quality and work positions, and that machinery is controlled regularly to minimize risks. The working environment is also controlled by authorities on a regular basis in many European countries, such as Germany, Switzerland, Sweden, Belgium and Denmark. The DGUV has developed a manual for handling textiles with a risk of infection (DGUV, 2016). The manual includes, amongst other, routines for vaccinations of workers

who are in contact with potentially contaminated textiles, as well as stitching and cutting items.

4.2 Hygiene

In textiles service, hygiene is always the core and a key issue. More and more professional textile service companies are engaging in hygiene quality standards, making sure to have structured methods to assure highest quality in relation to hygiene. Several standards for hygiene management co-exists on the European market. Assuring impeccable hygiene is also an important part of the authorization processes of members amongst European textile service industry interest organizations.

Most European countries are currently facing an aging population. This means increased pressure on elderly care and healthcare in the coming years, and an increased number of hospitalized persons and persons living in care centres. A high density of vulnerable groups increases the need for great hygiene precaution, in order to minimize the risk for multi-resistant bacteria and spreading of conterminous diseases in general. Thus, educated staff, adequate equipment and routines to avoid recontamination of textiles is becoming increasingly important.

A previous survey from 2011 amongst 200 Austrian hoteliers, restaurateurs and nursing homes have shown that more than half of the establishments have chosen to contract professional textile service for linen, table and terrycloth clothes as well as the workwear of employees. Hygienic safety was seen as one of the main motives behind the choice (WIRTEX, 2017).

German laundries and textile service providers, which process textiles from the hospital sector, have to meet the requirements developed by the Robert Koch Institute (RKI). The requirements are commonly met by the implementation of a hygiene management system according to DIN EN 14065 (Risk Analysis and Biocontamination Control – RABC). Use of a quality management system is an acknowledged manner to structure daily routines, document incidents, identify improvement potentials and organize strategies to assure constant enhancements. Many professional textile service companies have structured their hygiene controls according to the standard EN 14065. This European Standard describes a management system ensuring the microbiological quality of laundry processed textiles used in specifically defined sectors in which it is necessary to control biocontamination. The standard describes a RABC system to enable laundries to continuously assure the microbiological quality of the laundered textiles. It applies to textiles processed in laundries and used in specific sectors, e.g. pharmaceuticals, medical devices, food, healthcare and cosmetics. The German business associations DTV and WIRTEX together with the research institute WFK has published a handbook for the validation of washing procedures as a support for textile service companies in implementing the RABC requirements (ISO 14065). This facilitates the implementation of hygiene management systems in professional textile service industry. At the same time,

a recent survey performed in the Netherlands show that amongst the OPLs investigated in the study, none had implemented a quality management system (CINET, 2016).

Most members of the German service industry interest organization (DTV) have RAL 992/1 and/or 2 certificates. The RAL 992/1 (commercial linen) and 2 (healthcare linen) certification is built on unannounced visits by the Independent Textile Research Center at the Hohenstein Institute. The inspection covers, for example, cleanliness and freedom from stains, the degree of whiteness and the dryness of the linen (RAL, 2017).

Within the authorization process developed by the Danish textile service industry interest organization (BVT), hygiene is the most important area. BVT has developed separate protocols to be used by member companies to guarantee hygiene standards in different parts of the textile service cycle (transports, sorting, washing and after treatment/delivery) (BVT, 2017).

As a part of the authorization within the Swedish textile service industry organization (Tvätteriförbundet), random tests of the presence of bacteria on washed laundry is analyzed in authorized laboratories. All members of the organization are also required to demonstrate how dirty textiles are separated from clean ones within in the premises and how transport vehicles are kept free from potential contaminations (Tvätteriförbundet, 2016).

A recent study built on interviews with 236 German elderly care institutions with OPL shows that only 57% of OPL use professional/hygienic washing machines. The use of home washing machines in elderly case is problematic, as the temperature commonly not reaches the levels needed for efficient killing of germs. The same study showed that only 30% of the responding organizations have a division of transport equipment for clean and unclean laundry, implying direct risks for re-contamination after washing (Hygiene Waschen 360, 2016).

The Belgian Association for Textile Care (FBT) started in 2016 with Care4Quality, a quality management system for industrial laundries working for food industry and health care, based on NEN-EN 14065 and controlled by external certified partners. Except for the demands related to microbiologically clean linen, the Care4Quality standards also relate to sensory/visual clean aspects (i.e. no visual spots or damages and pleasant odor and touch.

In a survey amongst 1 600 households in Poland, Germany, Belgium and the UK, it was seen that 58% of survey participants do not wash their work clothes and their personal clothing separately and only 1 in 4 are concerned that the work clothes might contaminate personal clothing. 1 of three respondents wash their workwear and private clothes in the same washing machine and more than 90% use the same dryer for both. In handling of clean working cloths, only 25% reported to disinfect hands prior to contact, which increases the risk for recontamination. Finally, the study shows that in

many cases, low-temperature washings are preferred in home washing (GfK, 2012)[2]. The reasons might be that washing in lower temperatures can be faster, and will contribute less to the personal electricity bill. However, this habit might risk the hygiene of the process.

Apart from textiles used as clothing and linen, mops can be a very important source of spreading of germs and viruses (Gimpert, 2017). To minimize the risks, such textiles should be handled separately from other materials. This is commonly done in professional textile service plants, where the volumes are large enough to ensure efficient washing of special items flows. However, in OPLs, there is a risk of mixing of this type of highly contaminated textiles with other flows in order to fill machines. Another possibility is that mops are washed separately, but that machines are far from filled. The result is either an increased risk for spreading of contaminating agents, or inefficient use of machinery, chemicals, water and energy.

5 Economic sustainability

When discussing economic sustainability, it is important to use system boundaries that consider costs in a wider perspective, considering the whole lifecycle of equipment, costs for work related health problems amongst staff, alternative use of capital and time etc. This means that cost-comparisons between different textile service alternatives are complex and rare. One of the few ones made in later years is presented in the below.

5.1 Overall cost comparison

The overall costs for OPL and professional textile service has been compared in a Swiss perspective, based on data from four institutions with OPL (two elderly care institutions, one hospital and one hotel) and five professional textile service companies. The comparison was made on a per kg and year basis, including both investments, fixed and fluctuating costs (Fawer, 2006). It is one of few examples of comparative studies trying to reflect true costs for both types of textile service (in-house and outsourced). According to the results, professional textile service would result in lower costs per kg of textile and year in all cases but one (a hotel, where the outsourcing would be around 4% more expensive). In all cases, costs for work-force made up of 50-67% of total costs, and investments (including construction of the areas needed for textile service) to 12-30% of total costs. Thus, the salaries payed to working force together with premises available for installation of textile service activities are of vast importance for overall costs (Fawer, 2006). One of the main reasons for the professional alternative to be more cost efficient relates to the overhead costs being lower per kg laundry when costs for administrative

[2] GfK survey on "consumer behavior in the private cleaning of work clothes" conducted by the European Textile Services Association (ETSA), was conducted between July and November 2012 in Belgium, Germany, Poland and the United Kingdom. In each country about 400 participants were interviewed by means of an online questionnaire and in personal interviews. The survey participants work in the following sectors and sectors: construction industry, public service, health sector and medicine, mechanical engineering, food industry, retail / food market, agriculture / horticulture, chemical / petrochemical industry, road construction and fishing. The detailed study results are available on the ETSA website www.textile-services.eu.

tasks (including routines and fees needed to fulfill with safety and environmental legislation) are divided between a higher number of customers.

5.2 Delivery pledge

One of the advantages of professionalizing textile services is a reduced risk for delivery failures due to technical problems. OPL will commonly result in smaller machine parks, where technical problems with one or two machines can have vast effects on the overall capacity to deliver clean textile on time – not to mention what happens in case of a black-out. There is a similar risk in opting for home wash. Technical problems can in worst case result in reduced work force if spare workwear not is available. The economic risks of such events should not be neglected. In professional textile service production plants, the machine park is commonly larger and the sensitivity to technical problems thereby lower.

5.3 Optimization of investment capital

Instead of investing large amount of capital in new stocks of garment, tablecloths, linen or workwear, it is possible to rent on a monthly basis and spread these upfront investment costs over several years. This makes it possible for companies to invest in their core activities rather than textiles that just as well can be rented. Rentals can also provide a higher grade of flexibility for the companies contracting the service, in case of increase/decrease of work-force, clients etc.

5.4 Optimization of lifetime of textiles

With professional textile service, contracts can be developed in order to continuously repair smaller damages in textiles and exchange more damaged textiles with new ones. Thus, renting services enables expansion of the lifetime of textiles, while large investments create a risk of exchanging all textiles at the same time – independent of their individual status. This type of contracts will also stimulate use of high quality textiles, rather than textiles of lower quality which might be a more attractive solution in case of ownership, in order to minimize investment costs.

5.5 Considering hidden costs

Large scale textile service is a complex sector. It involves several highly regulated areas, such as use of chemicals, emissions to air and water, working environment, solid and liquid waste management, transports of waste and hazardous waste, safety controls of equipment, tax- and environmental regulations on fuels and vehicles amongst others. In addition, industry-specific know-how of machinery, textiles and chemicals and how to combine these in order to reach highly qualitative results is of course necessary. Thus, management of textile-service companies requires know-how that commonly takes several years to build-up to ensure cost-efficient and qualitative services. In OPL, it is many times described as a benefit that persons with training in areas which are very distant to the laundry service area, will be in charge of the textile service. This has been described by one of the larger producers of OPL-machinery: “Existing housekeeping and

maintenance employees can handle the laundry during the slower parts of the day" (MILNOR, 2017). The result of such choices can be sub-optimized washing service, resulting in hidden costs for the companies involved, as a result of stressed staff, un-satisfactory washing results, repairs and delivery problems in case of technical break-downs or black-outs. In addition, owners of OPL will surely have to dedicate more time on ordering chemicals and new textiles, maintenance and repairs of machinery and administration in order to make sure to comply with legislations in relation to environment and working environment, compared to a company with a contract for renting of textiles and textile service. Another hidden cost is the use of space for textile service, which, if professional service is used, could be used for other purposes, and thus generating alternative incomes.

5.6 Business-models built on sharing

Professional textile services is initially investment intensive. Machinery, facilities and energy systems require large amount of investment capital. By spreading the cost for these investments over a large number of customers (i.e. tons of textiles), cost-efficient services can be provided. Thus, by contracting a functional service, it is possible for companies to invest more in their core activities. Investments within the textile service industry are shared amongst more users, which makes it possible to invest in high quality equipment.

5.7 Innovations and generation of new services

In Germany, innovations in the field of logistics and digitalisation helps elderly care homes and mobile elderly care companies to identify changes in the level of care needed by the clients. Changes in the need for textile services can many times indicate that special care is needed in different parts of the care. Particularly in cases where several different people are involved in the care of the same person, this information can be difficult to keep track on. With the use of IT, the laundry service company can help care service staff to give adequate care to their clients (Schumacher, 2017).

6 Analysis of sustainability performance

The present report has investigated different options for textile service; professional textile service industry, on premise laundry (OPL) and home washing, from the perspectives of environmental, social and economic sustainability, as well as overall quality. The report is based on a desk-top study, going through previous research results and statistics. In general, it can be concluded that objective comparisons can be difficult to make, due to contextual differences. The following can however be stated:

- The European textile service industry has a strong focus on reducing the environmental impacts from the industry, with average use of water, electricity, chemicals and fuel constantly decreasing.
- Extending the lifetime of textiles is crucial for the environmental performance of textile service. The knowhow, repairing of smaller damages, selective substitution

and use of professional machine parks used in professional textile service companies can increase the life of textiles, thereby decreasing environmental impacts.

- The rental business model commonly used in professional textile service will also stimulate use of high quality textiles rather than textiles of lower quality, which might be a more attractive solution in case of ownership in order to minimize initial investment costs.
- Previous LCAs have demonstrated 20-30% savings of CO_2-emissions from professional textile service compared to home washing. Optimization of the washing process was identified as one of the main reasons to these results.
- These savings can motivate transport distances of up to 1000 km of textiles.
- The textile service industry is an important creator of jobs with limited needs of language skills, which are very important for integration of people newly arrived to Europe. Many companies are already involved in programs providing internships and employments and there is a strong will from the industry to develop this even further, through close collaboration with local and national governments.
- In OPL, textile service is not the core activity. Thereby, tasks that could have been done by persons with developing language skills are done by persons that could focus on other activities where their skills are needed. Thus, using staff trained for other core activities to handle textile service in OPLs or using home washing is a lost chance for integration.
- Professional textile service commonly results in lower costs per kg of textile and year when compared to OPL. One of the main reasons is that investments in machinery and costs for administrative tasks (including routines and fees needed to fulfill with safety and environmental legislation) are divided between a higher number of customers in professional laundries.
- Business models built on sharing is currently a buzz-word, but is, and has been fundamental in professional textile service industry for decades. Through sharing of costs for investments and administration, professional textile service can invest in more efficient technology.
- Externalizing textile service to experienced professionals, presenting high levels of know-how and an inherent incentive to constantly improve quality and reduce environmental impacts, gives private companies, municipalities and hospitals more time to focus on their core activities.

Table 1. Summary of outcomes.

Area	Parameter	Professional textile service	OPL/Home washing
Environment	WECO (use of water, electricity, chemicals and oil/fuel)	WECO data is commonly investigated and presented by companies as a part of benchmark/marketing. Incentives from industry associations and competition between companies result in constant improvements.	WECO data can be difficult to distinguish from other consumption data and difficult to follow up.
	Chemicals	Commonly automatic systems, avoiding over dosage.	Commonly overdosed in home washing. Smaller OPLs might not invest in automatic dosage, increasing risks for overdosing.
	Optimization	Larger possibilities to adjust to appropriate machine capacity.	In home washing as well as smaller OPLs, machines are commonly not filled prior to use, resulting in unnecessary environmental impacts.
	Control from authorities	Professional textile service companies are closely monitored by authorities in relation to environment impacts, but also working environment, payment of just salaries is commonly monitored.	As laundry not is core business in OPLs, controls (if any) are likely to become less rigorous and frequent.
	Transports	Commonly performed according to optimized logistic schemes and more and more often using biofuels. The increased efficiency compared to home washing makes transports worthwhile.	In home washing, risk of contamination of private textiles and/or vehicle during transports.
Social sustainability	Hygiene	Hygiene is a priority, closely monitored in periodic controls, by business associations and through international certification schemes (EN 14065 (RABC) or RAL 992 1/2) or national schemes (such as Care4Quality in Belgium).	Risk of laundry being performed “in between” other tasks in OPL, resulting in re-contamination. Common mixing of clean/unclean textiles and use of inadequate temperature in home washing.
	Working environment	One of the main concerns in the industry. Management systems such as OHSAS 18001.	Risk of inadequate lightning, ventilation, temperatures and ergonomic conditions when laundry is placed in equipment rooms, linen storage rooms or other rooms initially not intended for textile service.
	Workers’ rights	The leading unions organizing workers in the industry commonly have good knowledge about potential risks and for textile service company staff.	Workers in OPLs are commonly not organized in unions with knowledge about the textile service industry.

	Workers' health	Well known and continuously checked routines for use of protections and giving of vaccines as well as routines in cases of emergencies.	Potential lack of knowledge of adequate precautions to avoid risking workers health (vaccines, protections etc.) in OPLs where textile service not is core business, as well as in washing at home.
Economic sustainability	Hidden costs	Commonly lower overall costs according to objective research.	Costs for administration, service of machines, training of staff etc. are commonly not included in the budget.
	Costs for the society	Lower cost for society when companies have in-house treatment of wastewater – which is common in professional textile service plants, but not in OPLs.	
	Risk management	Reduced risk for delivery failures due to technical problems, due to larger machine parks	Commonly smaller machine parks, making OPL and home washing more sensitive to technical problems, followed by vast economic impacts. Potential "wrong-use" of machinery by unexperienced staff can damage both textiles and machines and become costly.
Quality	Knowhow	Many times persons with decades of know-how in textile care leading positions and continuous training of staff.	In OPL, staff is trained mainly for other tasks than textile service.
	Process and product quality	Professional laundries commonly monitor their processing quality by periodic controls or by becoming members of a quality assurance organization. An increasing number of companies have implemented the ISO 9001 quality management system.	Process and product quality is commonly not monitored. As a result of lack of know-how and experience among the staff, process failures might remain undiscovered for longer periods of time.

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REPORT

APPENDIX

Table 1: *Overview of the main results of the survey performed by ETSA (2014). Table shows weighted average figures for all plants.*

2011 survey, average for all plants	Units	**Workwear, 2011**		**Flat Linen, 2011**	
		Weighted average	*Number of plants*	**Weighted average**	*Number of plants*
Water per kg	l/kg	**14,4**	*96*	**10,6**	*63*
Electricity per kg	kWh/kg	**0,28**	*96*	**0,21**	*63*
Chemicals per kg	g/kg	**37**	*81*	**17,9**	*43*
Oil/gas per kg	kWh/kg	**1,46**	*96*	**1,18**	*63*
Delivery:					
Fuel per kg laundry	l/kg	**0,04**	*26*	**0,02**	*29*
Driving efficiency	l/100 km	**10,8**	*26*	**9,3**	*10*
Delivery distance	km/kg	**0,34**	*49*	**0,20**	*21*

Table 2: *Results from LCA of industrial textile service and home washing (*LCA 2.0 consultant, 2007).

Energy use	MJ/kg workwear
Industiral (ex. transports)	27,0
Home washing	38,9
Savings	**11,9**

Table 3: *Calculation of fuel use per kg transported textiles, using light vehicle (van) based on results from LCA of industrial textile service and home washing (*LCA 2.0 consultant, 2007).

Parameter	Smaller van	Unit	Larger van	Unit
Load	435	kg	1314	kg
Fuel use[1]	4,2	L/100 km	5,7	L/100 km
Fuel use	1,482	MJ/km	2,011	MJ/km
Fuel use	0,0034	MJ/km, kg	0,0015	MJ/km, kg
Transport distance (assuming 50% load)	1747	km	3888	km
Transport one way	**873**	**km**	**1944**	**km**

[1] According to Mercedes Benz (2017a & b), models Citan and Vito (light trucks).