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Discussion paper on an organizational and management perspective towards business model of Traceability and sustainable chemicals in the Leather Supply Chains

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Abstract

The production of leather goods requires different chemicals. To align with sustainable consumption and production standards, these chemicals should have no negative effects on the environment and people who are producing and consuming these products. The proliferation of more sustainable chemicals across the leather industry is partially driven by novel mandatory regulations like EU REACH, and partially by the emergence of new voluntary industry standards. At the same time, there are barriers, which can keep companies from becoming more sustainable such as the orientation towards more short-term goals or limitations of the industries' existing infrastructures. Another barrier is a lack of data on current chemical use, which is needed to identify where and how chemicals must be exchanged.

While extending efforts to enable traceability can generate this data, a change towards more sustainable chemicals must be supported through a business case to succeed. Without a business case, companies involved will not put in the required additional effort. This paper illustrates that such a business case is difficult to create because of challenges emanating from the complexity of global leather supply chains and its regulatory environment. To understand what bottlenecks exist, this paper made use of a qualitative approach and interviewed 10 different actors in the leather supply chain.

Through an interview series, it could be identified that an interest in full chemical traceability and the uptake of more sustainable chemicals exists. However, to realize this uptake there should be harmonized standards and tools on sustainability reporting. In addition, more traceability and changes in chemicals might more likely apply if supply chain partnerships are based on long-term relationships, in which financial support for changes and reporting efforts or the longevity of a business case can sustain. Simultaneously, more discussions and communication should take place between all actors in the supply chain. That is because most changes seem to be demanded by brands, which tend to give little say to other actors and their needs i.e., hide, leather and chemical producers.

Table of contents

1 Problem-driven impulse

Sustainable consumption and production processes play an important role, because most existing processes are linked to environmental and social degradation. This also applies to the leather industry, which has been linked to causing environmental and social harm by using unsustainable chemicals and their leakage into the environment among other problems. For the industry to become more sustainable, it needs to transition to more sustainable practices such as the utilization of more sustainable chemicals while phasing out those that are harmful. To do so, knowledge needs to be created on the chemicals used in the supply chain. Currently such knowledge tends to be lacking, which serves as a barrier for sustainable transition in the leather industry.

While there are efforts to implement sustainable chemical standards and traceability schemes, their implementation is faced by a range of challenges. First, leather production processes are segregated and involve a wide range of actors. These typically include hide producers, tanneries, traders, and brands. Other actors involved in leather production processes include chemical suppliers and chemical producers themselves. Because these actors often work in different supply chains, the supply and (compliant) use of chemicals and products is difficult to follow.

Because of the range of different actors involved in processing and production, the traceability of chemicals used is challenging. Different actors may utilize different chemicals in different processing stages and are unaware of the chemicals used in prior processes. Such a lack of knowledge leads to difficulties in the implementation of proper traceability schemes and the implementation of sustainable chemical standards. Because the implementation of sustainable chemical standards can affect preceding or subsequent processes, chemical data needs to be available. In addition, a lack of data makes it difficult to verify where and how changes towards more sustainable chemicals and the processing of it must occur or could be improved. A lack of data also makes it difficult to verify the environmental impacts of existing or more sustainable chemicals used.

While these complex problems present challenges to establish traceability, once traceability is established the problems originating from this complexity would cease. Growing regulations, brand initiatives or voluntary standards which focus on the implementation of environmental and ecological standards in production processes (i.e. EU REACH, LWG, ZDHC) drive efforts for more traceability and the use of more sustainable chemicals. These standards aim to ensure that chemicals used are safe and to verify that processes are conducted accordingly. They may also ensure that the consumption of a good does not bear a threat to the consumer. In addition, traceability for more sustainable chemical standards can support that the end-of-life disposal of a product does not lead to environmental harm.

Because extending traceability schemes and changes in production standards requires commitments from all actors in the supply chain, changes in standards and the adaptation of traceability schemes depend on business incentives. These incentives must enable the use of more sustainable chemicals and support actors in their supply chain operations. Because traceability schemes may imply additional costs, a business model or different business model incentives need to exist and have to be implemented by the range of actors in the supply chain.

1.1 Research question

Shifts to more sustainable production processes depend on the use of more sustainable chemicals. To ensure that sustainable chemicals are used, knowledge of the chemicals present in processes and

products is required. To that end, traceability can be an important factor. At the same time traceability can strengthen the demand for more sustainable chemicals. However, traceability schemes can be difficult to implement if they are not supported with a business model perspective.

The main research-question for this document therefore is: “What business incentives and barriers exist for the implementation of a chemical traceability scheme? “

1.2 Methodological approach

To answer the main question, the first part of the paper provides an analytical framework for analyzing all actors in the leather supply chain and their relations to each other. It includes political developments such as changes in law and regulations that affect all actors. It also includes additional needs that stakeholders in the supply chain must consider to be able to implement changes towards traceability and more sustainable chemicals.

Drawing on the framework, stakeholders in the supply chain are identified that play a role in the processing of leather and therefore traceability. Criteria are then defined as the foundation for empirical research. This research aims to inquire how industry actors perceive these criteria and wither they agree or disagree with them. These different stakeholder perceptions are important, because accounting for different stakeholder interests and needs is crucial for facilitating changes in chemicals and their traceability.

To understand these different perspectives, 10 qualitative interviews with 10 actors in global leather supply chains were then conducted. Actors were chosen based on their different roles in the supply chain and their expertise in working in the leather industry, such as in the field of chemicals, consulting for leather and their work in the processing and selling of leather goods. The interview outline can be found in Appendix I. It is based on the criteria that were deducted from the analytical framework. Because the actors worked in different fields related to leather, the interview outcomes cannot be generalized but serve as indicators towards sustainable chemical and traceability transition.

The interview outcomes were then analyzed and described accordingly to each of the criteria and actors. Lastly, these outcomes were then used to answer the main research question in the form of business model incentives for sustainable chemical traceability.

2 Policy Framework Conditions

Sustainable consumption and production patterns and the important role of traceability and the sustainable use of chemicals feature prominently in contemporary sustainability agendas. Because of the differences in existing sustainability agendas, there are different drivers and incentives to implement traceability schemes and sustainable chemicals between regions and actors involved. Therefore, the following sections illustrate what type of agendas exist and what goals they set out to achieve. Goals defined serve as orientation for business models for traceability and more sustainable chemical use but also as ideal to strive towards. Therefore, the following section lays out existing legal frameworks, incentives for cooperation and business, and requirements for the sharing of information between supply chain partners. Based on this section, assessment criteria are formulated that are used for further analysis in section 3.1.

2.1 The Sustainable Development Agenda and the role of business

Sustainable Development plays an important role for the well-being of todays and future generations' social, economic and environmental well-being. It seeks to reconcile the needs of the present with the goal of not compromising the ability of future generations to meet their own needs. (Brundtlandt, 1987). Thereby, Sustainable Development is not limited to a specific region or context, because it affects all sectors of the economy and society globally. To formalize and support the concept of Sustainable Development, the Sustainable Development Goals (SDGs) were adopted by the UN Member states in 2015 and serve as political framework to tackle the world's most pressing social, economic, and environmental challenges by 2030 (Kim, 2016).

To do justice to the versatility of Sustainable Development, the SDGs are divided into 17 different goals, 167 action targets and 230 indicators. Although the SDGs consider a shared responsibility in achieving sustainable development, the private sector plays an important role in their achievement. The role of the private sector is emphasized because of its contribution to many of today's unsustainable production processes and because of its ability to change these processes towards more sustainable ones (Kopnina, 2021). In comparison to other sectors the private sector is associated with having more "rich financial assets, sector-specific expertise and knowledge, managerial and enforcement capacities" (Berrone et al., 2019).

Because there is no strict definition as to what constitutes as "ideal" sustainable development for businesses and how it should be implemented, sectors must define and implement it themselves. This also applies to the private sector in which companies should define and then determine how they can integrate the concept into their business logic. Companies can either focus on integrating social, environmental, and organizational values into their business practices (Bocken, Shrot, Rana and Evans, 2014) or they may use the overall concept of sustainable development as a point of orientation for strategic change (Wicky & Hansen, 2019).

For transnational and larger companies (Mio, 2020) which are focused on the production of goods they may consider the integration of SDG12 sub-targets into their business logic. SDG12 focuses on more sustainable consumption and production processes and categorizes them into 8 sub-targets (see table 1: SDG12 Sub-Targets and their goals). It takes into account the sustainability of entire value chains, from the raw materials used to consumers on a local and global level (Gardetti & Muthu, 2020). It also puts emphasis on the more sustainable management of resources and the use of more environmentally friendly chemicals and their management. Because a change in business practices also requires organizational change, companies are encouraged to act more responsible, to produce more sustainable and to consider sustainable public procurement (SDG Sub-Target; 1;6&7). Companies are also encouraged to provide and collect information to verify that product content is safe to use and to provide information on how and where products were produced (SDG12:8: Information and Awareness for Sustainable Development).

SDG12 Sub-Target	**Goal**
12.1	Sustainable Consumption and Production Pattern
12.2	Sustainable Management of Natural Resources
12.3	Reducing Food Losses
12.4	Environmentally Sound Management of Chemicals
12.5	Reducing Waste Generation
12.6	Responsible Companies
12.7	Sustainable Public Procurement

12.8	Information and Awareness for Sustainable Development

Because these sub-targets are partially interdependent, each of these targets should be achieved to promote transformative change in production processes. At the same time, changes in these processes can be associated with various risks. Therefore, companies dedicated towards becoming more sustainable need to have the willingness to invest time and money and to accept associated uncertainties of business outcomes (Bocken, Boons, Baldassarre, 2019). Businesses also need to develop an understanding of how they define their sustainable values, how they can be measured and how they can be integrated into their business vision (Wicki &Hansen, 2019).

Such a business vision may be translated into entire business practices, including supply chain operations with existing partners and other relevant actors. For more sustainable chemicals and traceability schemes this may imply for the SDGs to be an integrated part of the firm's voluntary strategy for sustainable development. Because the business implementation of SDGs is not mandatory, but rather serve as soft-law with hard law characteristics, businesses should have the proper incentives to implement them. In an ideal setting, business would have incentives to switch towards sustainability because switching provides new and continued revenue streams, a sustainability of a business case while realizing sustainable development goals with a particular focus on SDG sub targets 12.1, 12.4, 12.6 and 12.8.

2.2 The EU Green Deal

The concept of Sustainable Development also finds common appraisal within the European context. Within the European Union, the European Green Deal aims at integrating the SDGs and places sustainability and the wellbeing of citizens at the heart of the EU's policymaking and actions. Its roadmap seeks to design a set of "deeply transformative policies" with two of them focusing on more sustainable consumption and production patterns. These are the circular economy and zero pollution for a toxic-free environment.

2.2.1 Circular Economy Action Plan

The Circular Economy Action Plan (CEAP), with a focus on SDG12, sets a roadmap in which economic growth is decoupled from resource use. It aims at reducing pressure on natural resources and serves as a precondition for achieving a climate neutral target by 2050. Its vision is to make sustainable products the EU norm. This implies that under the EU policies, products placed on the EU market are designed to last longer, are easier to reuse, repair and recycle. Single-use materials or goods will be restricted and premature obsolescence curbed and the destruction of unsold durable goods banned.

To support the latter the sustainable product initiative (SIP), which is part of the CEAP will be put into place. It aims at revising the Ecodesign Directive, proposes additional legislative measures and makes products placed on the EU market more sustainable. Its vision is that consumers, the environment and the climate will benefit from products that are more durable, reusable, repairable, recyclable, and energy efficient.

However, currently many products cannot be re-used or recycled, because their chemical content is unknown or because chemicals used in production are rated as unsafe. For products to be reused or recycled means that the chemicals used in them must be verified as safe or that chemicals, which are not allowed for production have not been used. If chemicals are being used that are not safe to use

or that do not confirm to existing chemical standards, products and materials will not be able re-enter existing waste streams and therefore, likely be disqualified for the use in circular production systems.

To verify what type of chemicals have been used, data needs to be made available on their content. Therefore, the CEAP integrates a shared strategy, where measures are formulated in order to achieve a "cooperation with industry to progressively develop harmonized systems to track and manage information on substances identified as being of very high concern and other relevant substances, in particular those with chronic effects, and substances posing technical problems for recovery operation present along supply chains".

Because the substitution or ban of chemicals can affect the production of goods, more sustainable chemicals or materials will have to be identified by industry practitioners so that new and existing products can continue entering or circulating in the EU market.

2.2.2 Green Deal Chemical Plan

Next to CEAP, there is also the Green Deal Chemical Plan. "It aims at ensuring that the most harmful chemicals for human health and the environment are avoided for non-essential societal use, in particular in consumer products and with regard to most vulnerable groups, but also that all chemicals are used more safely and sustainably. (…) The Strategy draws the attention of Member States to the possibilities of the Recovery and Resilience Facility to invest in the green and digital transition of EU industries, including the chemical sector. "(European Commission, 2020).

For the future, the strategy states that products are being phased out, that are made of chemical components that affect the immune and respiratory systems, and persistent substances. Among others these can include toys, childcare articles and textiles. Therefore, the strategy aims at putting into place practices, that support a minimization or substitution of substances of concern in products. It also wants to address the combination effect of chemicals, to better evaluate their risks on human health and the environment through daily exposure. Chemicals used should only be those, for which there is no substitute and they still must be acceptable for the environment and health of workers and consumers.

The strategy aims to ensure that consumers and producers have access to the information on chemical content and safe use, by introducing information required in the context of the sustainable product policy initiative. To support that the EU Chemical strategy for sustainability aims to establish a EU-wide safe and sustainable by-design support network to promote cooperation and sharing of information among sectors and value chains, to provide technical expertise and joined work in the development of alternatives and substitutes.

While both the CEAP and the Green Deal Chemical plan seem comprehensive, further goals for supply chain cooperation and better business practices for such a transition have to be laid out. This particular applies to actors and their cooperation in supply chains within and outside of EU boarders (European Union, 2022).

2.3 Additional operational requirements

In the following section, requirements are listed that are deemed likely to be necessary for an effective transition towards sustainability and traceability in supply chains.

2.3.1 Cooperation for resilient supply chains

To make products more sustainable and meet EU requirements for sustainable materials, different actors in a supply chain have to comply and implement new production standards. To implement changes in chemical standards and their traceability, supply chain actors must be able to deal with changes. Such a change is feasible, if the infrastructure is put into place and partnership and cooperation enable supply chain resilience. Resilience can be referred to the supply chain's ability to be prepared for unexpected risk events (Hohenstein, Feisel, Hartmann & giunipero, 2015).

How resilient a supply chain is, depends on how flexibly actors in a supply chain can adjust, deliver on or implement new production standards, and therefore changes. The implementation of such changes are easiest achieved where an ideal infrastructure exists, whereas the physical infrastructure should guarantee that physical resources such as machineries, technologies and material exist to execute processes (Spotswood, Chattenton, Tapp & Williams, 2015). The firms' soft infrastructure should guarantee that the physical infrastructure is managed well, that procedures are followed and that communication systems are functioning (Mehmood, Katib and Chlamtac, 2020). It also means that a firms' culture and leadership style support organizational efficiency and change (Omer, Mostashari & Lindermann, 2014) within the organization and outside of it.

Because changes can be enabled or hindered by an actor's infrastructure, cooperation is important for the implementation of new chemical standards and their traceability. Cooperation should promote benefits by having a common goal or a shared vision (Czinkota, Kaufmann and Baasile, 2014), for example for sustainability or by gaining competitive market advantages. Ideally partnerships and cooperation can also enhance a firms' reputation, promote a continued business case or help to capture new forms of value. Lastly, partnerships should also have a supporting function, like when actors face difficulties in implementing new standards or traceability schemes.

2.3.2 Trust as driver for information sharing and supply chain resilience

Regardless of the type of resources and forms of cooperation that support the use of more sustainable standards, trust plays an important role in their realization. Trust in supply chains can be referred to as, "an attitude displayed in solutions where a person is relying on another person, a person is risking something of value, and/or a person is attempting to achieve a desired goal" (Bialaszewski and Giallourakis, 1985). It may also be referred to the belief that a party's word or promise is reliable and that a party will fulfil his/her obligations in an exchange relationship" (Schurr and Ozanne, 1985).

Traceability and the use of sustainable chemicals requires some level of trust when it comes to the reliability of the information shared such as on chemical content in products used. Secondly, trust should also exist because it supports the cooperation itself and the ability to rely on one another for support in the case of chemical changes and traceability. For example, disclosing information like information on chemicals can threaten a business case for chemical producers or reveal a lack of compliance with existing standards. However, ideally trust is manifested in cooperation to such an extent that information is shared correctly and without fear of losing a business case.

Because there are different actors and not all actors may be able to comply to new standards and different forms of traceability, an ideal state should encourage that the sharing of information regarding a lack of data or the disclosure of outdated chemicals used or difficulties in following procedures does not threaten a business case (Kumar, Hallgvist, and Ekwall, 2017). Instead, the sharing of such information should encourage that a business case continues, whereas the disclosure of such information should encourage cooperation as a means to be resilient towards changes in supply chains including those coming from new regulations.

2.4 Actor Constellation and Description

The supply chain of leather involves different actors and chemical processes. In this section, the actors are listed that are commonly taking part in the production of leather goods and chemical processing. Because the use of chemicals depends on the simultaneous production and processing of leather goods, actors are listed that can have an influence on the realization of traceability and the use of more sustainable chemicals.

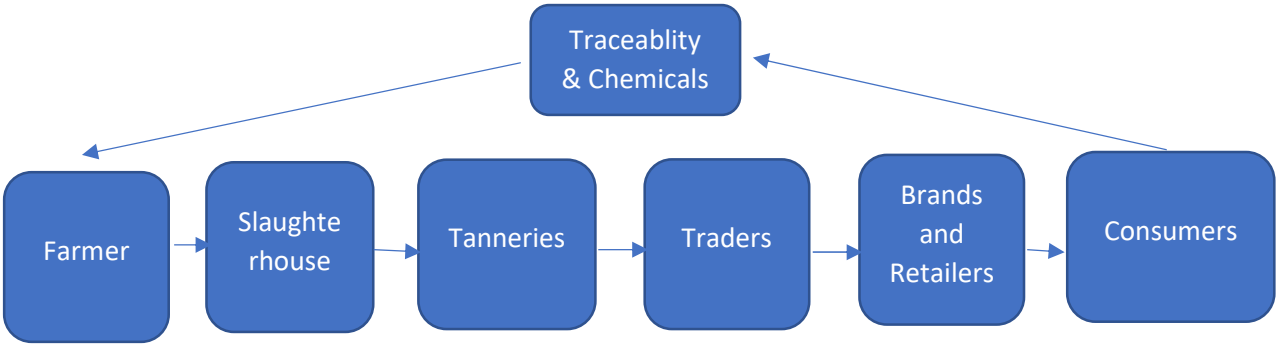

Figure 2: Actors constellation and supply chain stages.

Actor Description

Farmers

Farmers raise cattle and have an influence on the cows and therefore skin quality. Because of this influence on the hide and later on the chemicals used, they should be included in traceability schemes.

Slaughterhouses are the first stage in which the hide comes into contact with chemicals like when hide is conserved to protect it from degradation. Therefore, slaughterhouses are relevant in terms of more sustainable chemicals and the provision of their composition data. They also provide a link between farmers and traders, which means they must be included to avoid gaps in the traceability scheme.

Chemical suppliers/producers

Chemical suppliers are those who produce chemicals and sell them to different actors such as tanneries. Because they produce the chemicals, they have an influence on their content and their chemical information disclosure. As there are different chemical suppliers and processes, different chemicals might be used.

Tanneries

Tanneries are the places, where most chemicals are used for the processing of the hide. They are able to change production standards and can assess what type of chemicals are used. Because tanneries are the places, where hide is processed into different types of leather, they are also the places, where knowledge on chemicals used needs to exist and does exist. In addition, they are also the places, where chemicals are bought, and changes can take place.

Traders

Traders either trade the raw hide, or processed leather as well as leather goods. They play an important role, when it comes to the traceability when purchasing and selling processed hide, semi-

finished and finished products. Because there are different tanneries, different tanneries may have different infrastructures put into place, that allow for a different processing of hides.

Brands and Retail

Brands tend to be responsible for purchasing decisions including what type of materials used and later sold into the market. Therefore, they have an influence on production processes, including their sustainability and demand for traceability and also their forms of collaboration with different actors.

2.5 Explorative criteria for sustainable chemicals and their traceability

Currently empirical research on how different actors in global leather supply chains perceive sustainability standards and the transition towards more sustainability is limited. There is also little research on how new sustainability standards affect different actors. Therefore, this section lists criteria that may impact chemical traceability and their sustainability. They are based on the policy framework and do not serve as definitive criteria, but as provisional criteria to be explored through the interviews.

Assessment and their Sub-Criteria
1. Sustainable Chemicals and Traceability are an integrated part of the firms' business vision and logic
1.1. A firm business logic includes sustainable development. 1.2. A firms' sustainability vision includes aspects of more sustainable chemicals and traceability.
2. A firms' supply chain complies with sustainable chemical standards and traceability
2.1. Supply chain actors have an infrastructure put into place to implement more sustainable chemicals and traceability tools. 2.2. Supply chain actors have the management skills to implement sustainable chemical standards and traceability tools.
3. Cooperation enables that changes in chemical management and traceability are implemented
3.1. Cooperation is demanded. 3.2. Cooperation creates benefits. 3.3. Cooperation is based on trust.
4. The information shared can be trusted.
4.1. Information shared is reliable. 4.2. Information shared are safe.

3 Actor Perception towards framework criteria

The following section lists the perception of different actors about the uptake of more sustainable chemicals and their traceability. The format of actor descriptions was chosen because it provides a

saturated view on the different roles of actors in regard to their impact and responsibilities towards chemical changes and traceability. This format was also chosen, because of the interdependencies of different processes and their impacts on supply chain changes in regard to leather and product chemicals.

3.1 Farmers

Farmers play an important role when it comes to the provision of hides with higher quality. It means that they are for example free of scratches or other insect bites. If hides are of lower quality, more chemicals might be used to achieve a specific product feature later on. This increased use, is then a barrier for the use of more sustainable chemicals. Hide quality varies because farmers apply different standards prevent in their respective regions resulting in different hide qualities. This could be avoided if cattle are raised in accordance with higher standards, which implies increased cost for the raising of cattle and currently these costs tend to not be covered. A consequence is that the quality of the hide can be insufficient for the use of more sustainable chemicals.

At the same time, there seems to be a difficulty in communicating what type of needs or demands tanneries have for the hide quality to farmers so that there is a lack of incentive to raise them differently. For instance, there may be important demands on the hide for the use of specific chemicals and product end use, but often required changes cannot be communicated to the farmers. That is because there tends to be a lack of communication channels between tanneries and farmers and therefore also a lack of cooperation. Secondly a lack of traceability makes it difficult to follow which farmers supply what type of cattle to what market. This leaves farmers with a potential lack of knowledge on how to better raise the cattle so that the hide qualifies for the use of more sustainable chemicals or a specific set of chemicals.

Another challenge is that most farmers operate alone and not in the form of a farmer cooperation. Because tanneries and brands depend on a specific quantity of hide to process it into leather, raising standards with one farmer may not suffice. To provide better quality hide in large quantities, more farmers have to follow better farming standards.

3.2 Slaughterhouses

Slaughterhouses are the places, where hides are being purchased and where hides are stored using chemicals. Slaughterhouses also stay in direct contact with the farmers and because of that can communicate demanded changes and requirements concerning the skin hide. This also turns slaughterhouses into places that are able to verify the origin of the skin hide.

Depending on the capacity of a slaughterhouse, varying amounts of cattle can be slaughtered per day. This means that the quantity of skin hide stored can vary per slaughterhouse. Because the hides can have a different quality, slaughterhouses need to have the storage space to store and sort different hides. That can be challenging if the capacity is not there. At the same time this serves as a barrier for the hides' traceability. For instance, in German slaughterhouses, the meat can be separated strictly in accordance with organic and non-organic standards. But because there is a lack of storage and organizational capacities to separate the hides by origin, the hides might be mixed together. This can make it difficult to trace the hide and to utilize more sustainable chemicals for only a certain type of hide that originates from a particular cattle or farmer.

In other instances, there might be little incentives for slaughterhouses to use more sustainable chemicals and to trace the origin of the cattle farm to begin with. That may be because of the extra efforts that go into using a traceability tool or verifying the origin of the hides. One of the interviewees pointed out that the demand for such information requires extra efforts for the butcher and a butcher might sell the hides to a different market if the increased efforts outweigh potential

financial gains. Consequently, hides may not be traced. For example, one interviewee from North Africa mentioned a situation when hides were sold to a food market in a different region, because it resulted in less efforts for the butcher and because it was possible to sell elsewhere.

Other interviewees pointed out that lacking relationships between tanneries and butchers also impacted their willingness to engage in traceability. As a result, hides tend to be sold as cheap as possible without additional efforts. One interviewee mentioned that this would differ if the relationship between farmer and tannery could be improved or be more long-term oriented. Interest in traceability could also improve if tanneries buy a lot from butchers, because then it becomes relevant for the slaughterhouse to engage in traceability. However, most hide, for example in India is collected at many different places, which makes their traceability and keeping hide quality consistent challenging.

> *If you work for bigger tanneries, you still know that the value of hides is low, but because you buy a lot, it becomes relevant for the slaughterhouse, so you can negotiate.*

3.3 Traders – Slaughterhouse to tannery

Because the leather supply chain operates globally, there often are so called traders who acquire hide that is then sold to tanneries. Tanneries often do not buy single hides but tend to acquire different batches that each have a different quantity of hide and also a different quality. Because there are multiple butchers from which hide tends to be acquired, traders might face difficulties in tracing the origin of an individual hide that is part of a hide batch. This can make the traceability at the tannery later difficult. At the same time this makes it difficult to demand changes in hide quality towards butchers and farmers.

> *There is someone who is going from butcher shop to butcher shop and take it to the market place. Because it's not possible for a tannery to go from butchershop to butchershop and collect it. It's not possible. (…) Depending what it is, the tannery will buy it there. There are different middleman. Maybe sometimes we get the hide of cows, from a different area, maybe that is 1000 km away from here sometimes we get hides that is 100 km away. It depends, the area and region we buy it. There are different authorities and middle-man on the whole supply chain.*

At the same time, this may not apply to all regions and places. For example, the traceability from the butcher to the tannery is possible, if the supply chain is small and if the butcher provides a sufficient quantity of the same quality of hide.

3.4 Tanneries

3.4.1 Views on Sustainable Production standards

Tanneries are the places where the hides are processed into leather. Because leather production happens globally, there are different tanneries and there are differences in how they process the hide into leather. There are also differences in what type of chemicals tanneries use at what stage of the processing and there are differences in the total processes followed by tanneries. For instance, there are tanneries, where the processing of the hide into leather, including the finishing, is taking place and there are tanneries that process hides into different stages. Depending on the different processes different chemicals are used.

Different tanneries tend to follow different production standards. For instance, there are Chinese and African tanneries that aim to meet local standards of production and there are tanneries that implement production standards that meet EU import requirements. Because higher production

standards mean higher production costs, not all tanneries may use more sustainable standards, because it implies that the pricing of the leather becomes unaffordable for products that circulate in the local or national markets (i.e. leather shoes). Therefore, tanneries that are targeted towards export may focus more on sustainable production processes. Here EU regulation creates viable business opportunities for tanneries investing in the use of more sustainable chemicals.

In regard to whether sustainability is a main production criterion, there were differing views. Some interviewees mentioned to wanting to follow import requirements like those set by EU REACH and one interviewee highlighted the importance of sustainability in leather production. Reasons for deeming sustainability to be important were a personal interest in sustainability and the market potential of it, for example the potential of harnessing leather waste for circular production processes. However, there was no interviewee who was not interested in sustainability at all, whilst most interviewees were supportive of voluntary standards (i.e. LWG certificates).

At the same time, there was confusion mentioned over the various standards and voluntary schemes for production, which makes it difficult to focus on one in particular. One interviewee mentioned feeling pressured by the wide range of sustainability demands by brands, noting that not all demanded changes could be implemented in the tannery or only those demanded by regulation.

> *We need more people who work in reporting, because the requirements, only in terms of reporting becoming more strict, now every day a brand comes "now you have to report your energy uses in my platform, now you have to input your water usage in my platform" so all those requirements are adding up, now we are almost having , not only in terms of environmental sustainability, in general, we have almost a controller company, besides leather, because you have all those people that you need just to provide information that is also challenging.*

Beyond the pressure to conduct proper reporting stemming from different sustainability standards, there is also the difficulty of how to do so. For example, tanneries may have to fill in the same information in different reporting tools such as excel sheets or different information in different tools. This adds increasing demands on tanneries reporting and decreases the interest for further involvement. This differs from experiences made when there is a standardized reporting mechanism.

> *There a lack of resources to report on the range of standards and there can also be a lack of resources to implement new standards. You need a person just to collect the information, so you have the cost of implementing those improvements and you have the cost of being prepared for an audit or reporting.*

3.4.2. Changes in standards

As tanneries process hides according to different standards, tanneries can be vulnerable towards changes. That is because a change in requested chemicals, means that tanneries likely have to adjust their production processes. Currently there are tanneries who lack the infrastructure but also the finances to implement new standards. This is important, because a change in standards can also imply a change in infrastructure including machinery. However, there were also interviewees that mentioned that a change in standards would not affect their infrastructure a lot, because most leather processing follows similar production criteria. This would apply to around 80% of leather processing, with the remaining 20% of processing like finishing could be oriented towards customer needs.

At the same time, the use of advanced or more sustainable chemicals can require an advanced infrastructure change. Currently that is not demanded by tanneries, because the costs are too high.

Therefore, there is an interest in sustainable chemicals for which the infrastructure can likely be kept, but in which chemicals provide a specific quality for the processing of the leather.

> *Vegetable tanning requires a different setup of a tannery, with much longer processes. It has different characteristics. So it can't fulfill what the people are used to now, it's a different type of product. And vegetable tanning to say, only to say requires a much more complicated after treatments, then chrome tanning.*

In addition, tanneries might have an interest in changes in standards, but they lack the know-how how to implement them. Therefore, one of the interviewees mentioned the need to provide a service- based business model in addition to the provision of sustainable chemicals. As part of the service offering tanneries are consulted on how to utilize the chemicals such as the proper quantity for a specific use-case. This strengthens the quality of the product but also the relationship between tannery and chemical provider. Further service may be provided as part of voluntary initiatives or a sustainable consultancy.

Difficulties to implement changes can at the same time relate to the physical infrastructure too, for example in relation to the actual traceability of chemicals. Currently the size of tanneries varies and depending on the size, different tanneries have different capacities to trace the chemicals.

> *The last I heard there may be 100 to 250 chemicals used in a solid process. Now, with modern ICT, you should be able to support this traceability. But on the other hand a lot of tanneries (…), a lot of family owned midsize to small companies might not have advanced ICT. (…) If you go to the big ones, or the modern ones, wherever in the world, they typically have modern systems, the other ones might not keep data access. Most chemical companies probably do because it's been integrated to your manufacturing.*

3.4.3. Cooperation for supply chain changes

In terms of implementing new standards, it was pointed out that the demand occurs rapidly. Consequently, tanneries face difficulties to implement them in time or they may be required to change standards after the initial order has been made. Therefore, they may not comply and the relationship between tannery and for example the brand does not last. This differs from supply chain relationships in which cooperation and partnership is important. For example, one service provided by an interviewee was to communicate demands between tanneries and brands as a means to establish a form of relationship in which a time-frame for implementing new standards is worked out together. Often that does not happen because of a lack of communication.

Other interviewees highlighted that more cooperation would take place if the sharing of potential issues could be encouraged. Sharing of potential issues was disincentivized for tanneries that fear not to be able to comply with new standards. For example, there are tanneries that tend to not communicate a lack of compliance, because they fear that it can end the supplier relationship, for example between them and brands. While this is a problem for tanneries, not being aware of the problem also keeps supply chain partners from being able to provide the necessary support.

At the same time, changes might also come at a cost. Currently most costs are covered by actors in the supply chain such as tanneries and not by brands. If the supply chain relationship is not sustainable, there is little interest to implemented new standards but rather look for a new market.

> *You have the retail, the brands, they always have the upper hand, they always increasing the requirements, but they don't want any change in price. So it's always the intermediate players who are bearing those cost, which sometimes, it's a bit unfair and sometimes it becomes a business opportunity.*

3.4.4. Trust and information sharing

Although changes in chemicals can be implemented if tanneries have enough time to implement them, there are also the cases in which insufficient time to implement them exists. To avoid losing a business case, tanneries may continue using the same or different chemicals and manipulate information. It makes it appear that more sustainable chemicals have been used or chemicals that meet changing (brand) standards.

To avoid this type of fraud different testing mechanisms on chemicals can be put into place. Testing mechanisms here refer to the inhouse use of chemical tests and testing from external so-called third-party assessors. While the information can still be manipulated, a looming threat is that the relationship quickly ends. To avoid that interviewees mentioned to rely on trust in particular, because it eases the relationship and over time also saves cost on testing. In other cases, tests might be conducted that are then shared to buyers to increase trust.

> *Trust is important on the small level and even on the big levels. From the buyer and supplier side. For other buyers, we are the suppliers. So, we should be good, both sided. Because if you want to do long-term you need to trust. Because if you lie, you know I can catch you with my test reporting and then he loses business for the next 5 or 6 years.*

One interviewee mentioned that because the supply chains are scattered globally, it becomes difficult to trust that all information shared is dependable. To avoid that only one tannery should process the entire hide into leather. This can make chemicals fully traceable. As tanneries work with different brands in different region, this currently is less likely to happen. However, there was also one interviewee who mentioned that if different tanneries would work together as a form of collective network whose values are based on trust, transparency and a certain value system such as avoiding child labor or not using a certain set of chemicals, then this would create multiple long-term benefits. The interviewee also mentioned that this is currently not happening, and most changes occur as a result of changing regulations, or in isolated supply chains.

3.5 Traders – Tannery to Brands and Retail

Next to traders who sell the raw hide to tanneries there are also traders who sell processed leather to product production places or brands and retail themselves. Thereby traders can also relate to those who provide the goods or semi-finished items for other actors in the supply chain. Regardless of their placing in the supply chain, traders must verify the origin of the hide and must verify what type of chemicals have been used in products. This can be difficult if processed leather and leather goods are put on marketplaces, where different types of leather are mixed, for example on Alibaba or other online marketplaces.

> *I do sell leather abroad to the UK, USA, we use Alibaba. It's a very good tool for it. Raw hides are a different segment, etc. tannery is a different segment and manufacturing is a different segment. Tanneries are not manufacturing it. So that is also a different segment. Any type of expertise and marketing is different.*

3.6 Brands

3.6.1. Views on Sustainable Production Standards

Different brands use different leathers in their products and also create different products, which are based on leather or make use of leather parts. They may also not use different leathers if they produce a more narrow product selection like shoes. In addition to that, different brands have

different market sizes and different quality and design criteria for their products. Because of that, brands might have different quality standards on products and therefore differ in demands on the chemicals used in production or not. Because of these differences, there can be a variety of standards the supply chain-network is expected to accommodate. Overall processes are more likely oriented towards sustainability when a brand has an integrated corporate sustainability strategy in which it may incorporate aspects of sustainable chemicals:

> *It's their own entity, and looking at what chemicals are safe to use in country so that the products are safe (..). It's a voluntary scheme, but it's being used by the brands as part of their corporate social responsibility.*

At the same time brands are the ones who place products on the market and tend to decide what standards are being followed, for example brand specific voluntary standards, while there are some standards they must follow like EU REACH. Because sustainability covers a wider spectrum outside of chemicals, brands may not have sufficient resources to trace chemicals in all materials, but those most necessarily such as under EU Regulation or voluntary schemes.

Voluntary schemes are often brand specific so that there is no harmonized sustainability standard for all goods, including leather goods among brands. The purpose might be a competitive market advantage. Simultaneously this can create unrealistic demands on supply chain partners. That can happen if a sustainability expert is placed into a company, that lacks the knowledge on what type of standards are feasible to implement and what that means for the quality and also cost of the product.

> *Some brands, I have the impression, they just want to look good and they have no understanding behind their decisions. So they say, if everybody is asking 100 PPM of certain substances, I am going to ask 50. It becomes, to say the greenest company, but the chemistry is not that simple and then its hard to comply with it. So its dangerous. Just to give you an idea. Yesterday we had a technical meeting, where we discussed physical properties of leather and we were talking about using 0.2 or half percent of a chemical in a product. That of course changes completely the function.*

Too many standards can also feel overwhelming for companies and their supply chain partners. Pressure may come from NGOs, public sector, the companies themselves and laws. On the other hand, this makes it less desirable to implement more standards or follow up on more.

> *There's currently an overload of initiatives, in the leather and textile industry. There's a saturation, there's too many audits and it is putting so much of pressure on companies who are manufacturing textiles or leather. That they just can't handle more initiatives. So I think there's enough for now.*

3.6.2. Views on Changes in standards

Changes in standards may take place because brands must comply with regulation and/or want to support their corporate social responsibility strategy. Brands may encourage a change in chemicals to remain more competitive on the market. At the same time, this can happen rapidly which means that changes demanded on the supply chain network are not communicated timely or the expectations are set too high. Because there can be a lack of communication in the supply chain network, demanded changes might not take place to begin with or are not discussed. The difficulty might be a missing management structure or communication channels to realize such a change.

For example, one interviewee highlighted that for the use of better chemicals, better hide quality needs to be provided. However, often farmers do not know about this and to deliver that message

from the brand to the farmer, it has to be communicated backwards in the supply chain. This is likely not effective and could be done better with direct communication channels between actors. Currently this is difficult, because of lacking supply chain oversight and the lacking traceability of actors themselves for example starting in Tier 3.

To initiate better management structures including communication, an openness from brands including their supply chain partners is required. From a management perspective this requires openness towards discussing benefits and risks pointed out by suppliers as well as to formulation of a common vision that is suitable for the implementation of changes for both suppliers and the brands themselves.

> *It's a business relationship, so sometimes, you may request to change something, and you may not agree with that request. But if you want to continue selling to a company, you need to fulfill their requirements. What happens is that companies that are more prepared for their discussion, you can sit with customers and you can say look what you are requesting is complicated and we believe it's not correct because of b, c, d and you can try to negotiate that. But when the requirements start to over the top, what happens is that a lot of small companies, they say, no we can't make it and they won't make it. (…).*

Aside from overbearing demands, the implementation of changes can also fall short because of the length and complexity of the supply chain. For example, the longer the supply chain the more likely different languages need to be spoken to communicate changes. Because these demands often come from brand themselves, it may be their responsibility to communicate effectively, but also the responsibility of management in the supply chain. This is likely challenging, because of the different languages spoken and how information can get lost in translation too or as a result of a lack of education towards technical vocabulary:

> *I do remember when I first started working at a company as a chemist, some of the technologists actually would get materials experts to talk to me because they didn't understand me. So they didn't like to speak to me. They found that they didn't understand all the chemical terms and that I spoke. And I speak also quite fast, obviously and that's a barrier. When we were giving workshops in China on chemical standards, we had people in the office, who would translate for us. And that's also obviously consecutive translation.*

Brands also need to be aware about whether a physical infrastructure exists to implement changes including schemes on traceability in the supplier network. One brand highlighted that it was often not aware about shortcomings in the supply chain infrastructure. This made it difficult to implement changes or offer support. There were also brands that did not want to offer further support and expected tanneries to deal with providing the needed infrastructure themselves without additional financial aid. In such situations tannery motivation was to comply to changes as a means to continue a business case that otherwise would be lost.

3.6.3. Views on Cooperation for supply chain changes

One key barrier mentioned for the implementation of standards and traceability is a lack in cooperation between brands and their suppliers and challenges resulting from large and interconnected supplier networks. For example, brands tend to source from tanneries or acquire materials from different marketplaces. This makes a strong cooperation more complicated. Only a few brands have brand owned tanneries, because only a few brands can afford it. Here, brands tend to follow their own standards, for which it becomes difficult to propose different ones. At the same time this gives them an oversight and the ability to focus on the long-term relationships within their supply chain.

Long-term relationships are the exception, which means that demanded changes can lead to the rapid ending of supply chain relationships too. That occurs for example when tanneries cannot comply with increased costs resulting from new standards. This tends to result in brands outsourcing production to a different and cheaper supplier. In the long term this is not sustainable for either suppliers or brands themselves. The interviewees recommended that brands should build trusted partnerships with supply chain actors. It can support the continuation of their business case, an interest in the legitimacy of product information and their compliance to production standards.

A direct benefit mentioned was the saving of costs, for example by reducing the frequency of testing if standards are met. This differs from partnerships that are changed frequently after which material tests or the testing of meeting other standards has to be done frequently.

> *If your supply chain is fairly stable, that's great. You can sort of maybe reduce the frequency of testing, because you have that level of trust. But if you're constantly chopping and changing for different suppliers, different materials, different things, then perhaps you need to do more testing in order to ensure that that the new supply chain is equivalent and giving you the right results.*

Brands also have to look at how to better build trust and to invest maintaining it. For instance, brands might face trade-offs between picking better deals and materials or investing time and effort into building a relationship with the supply chain network. While this might increase cost for brands in terms of time and efforts, it can also result in the sustainability of the relationship and decrease cost over time.

> *We tend to be more in the direction of a partnership relationship, or that was the case in the past. We are also priced a little higher than various other manufacturers and that's why we value it. We are doing product development, which means you definitely need this exchange with our suppliers. That actually works quite well. It goes very well on a personal level then. But in any case, the last few years have also shown a stronger tightening, the price spirals and that is then, unfortunately, that leads to people switching to another place. That's something I'm observing, from my perspective, where I look at sustainability and product safety, I see risks at the same time.*

While most interviewees mentioned that relationships were important to improve aspects such as trust and the sustainability, one interviewee pointed out that control and fear would be better. For example, by pointing out that if trust was broken, the relationship ends immediately. Trust in relationship should also not be a priority, but instead the testing and validation of information.

3.6.4. Trust and information sharing

Most interviewees mentioned that standards are frequently introduced by brands. This bears the risks that suppliers of products may not comply. As a result, suppliers might manipulate the information they provide. To avoid that, interviewees highlighted the need to test materials before they go into production. At the same time, it was also pointed out that tests can be manipulated and different materials enter the supply chain, when being ordered.

> *So what, obviously, if you're testing materials before you go into production, you have that security, knowing that everything goes into production is fine. But if you then test finished product, you know that all the things that have happened to it during production is the same and one thing that you do have to be wary of is that people will send samples for testing as like this is our gold seal sample and we'll send these testing but then the actual production you use a different materials because it's cheaper because I've seen that I've seen before.*

To avoid that, some of the interviewees suggested to focus on the production in the European Union. That is because production there keeps the supply chain shorter, and most production processes have to comply with production norms in the EU context. The further away the production is, the less certainty can be provided on data legitimacy. However, many products often consist of different material components, which makes the full disclosure of the information more difficult or not feasible at this point. To avoid that, it is recommended to have brand owned supply chain (see section 3.6.3. Views on Cooperation for Supply Chain Changes).

> *We have a plant in Europe that processes leather, which is centrally located in Europe. That's 5,000 people sewing and cutting the leather. We also have leather processing companies in England, there are a couple of hundred there, they make these leather things. We have different leather factories all over the world. But there is only one plant, the headquarters in Detroit, and there is a chemical laboratory there that constantly examines all chemicals and they pass on the chemicals, i.e. the recipe, they pass on part number product number related, to the respective plants around the world. What happens here, this recipe means we have a 100% material information. We have 100% material information.*

Currently most supply chains are not brand owned, which makes it difficult to acquire the full information on chemicals used. However, to avoid information overloads, brands might also limit what information they request and focus only on basic reporting schemes such as those that give insights into where the total product material was sourced as opposed to detailed information on chemicals:

> *For example, we have a shoe manufacture in Thailand. Then he gets a query from us, "Where is his production city now?", so that we can document it. And this feedback is very different. It is also a question of the questionnaire, direction of cooperation and what information can be obtained. It's actually very different. So we have some supplier who give us information about their own production facilities, suppliers and subcontractors. That's great, of course, because we can get a lot of information from it. But it is also a tremendous effort to keep up with. Unfortunately we don't have a clever system that technically maps it. For example one product part might be produced in Thailand and another not.*

When it came to the question of how traceability and trust relate, it was also mentioned that the relationship needs to be build first. However, currently relationships between brands and tanneries tend to lack trust which limits the potential upsides of tracking-technologies as well:

> *If you have the trust and relationship, if all partners in the supply chains knows what to expect and working to keep that information, you can make things easier, try to connect and then its when technology comes, you can do it via blockchain, I see people SAP to do it. I believe technology , its not that complicated, I think you see that there are, every day 100 of suppliers, often technology, you receive all those incredible technologies, but when you don't have the trust, when you don't have the relationship, that is the bottom part, you will not get the information, its, they will not pass the information for you, they don't have the information. That's why you got to first create this structure.*

3.7 Chemical suppliers/producers

3.7.1 Views on Sustainable Production Standards

Different chemical suppliers tend to be responsible for the production of different chemicals. The extent to which chemicals are produced sustainable, depends partially on different views of sustainability. For example, one of the interviewees pointed out wanting to use only renewable

resources as a form of sustainable chemical production and another highlighted that chemical content is use- and product quality dependent, which does not necessarily mean that they have to have a renewable resource base. Other interviewees highlighted that they were not aware how chemicals were produced and purchased them based on product needs, but also requirements such as voluntary or mandatory standards.

It was also highlighted that there are different chemical producers that supply chemicals to the same tanneries. Therefore, it is unclear to what extent sustainable and non-sustainable chemicals might be mixed into a product. At the same time, it was mentioned that some tanneries strictly separate chemicals and use mainly chemicals that are demanded by brands in a later processing stage. On the other hand, while the production and use of sustainable chemicals could be demanded, this was mentioned as too cost intensive. One interviewee highlighted that although new forms of sustainable chemicals were produced by his company, they were not purchased, because they were more expensive than standard chemicals used. This made the production of more sustainable chemicals not lucrative. It made it lucrative if a service was provided in addition to that.

When it came to general sustainability standards, it was mentioned that there was an overabundance of initiatives for which chemicals have to be produced accordingly. This makes it challenging for chemical suppliers too. One interviewee highlighted that the issue could be addressed by providing consultancy services to chemical suppliers in which education is provided on the most relevant standards and initiatives to comply to.

> *We play the role of trying to simply and clarify all of the initiatives to our customers, because they do get confused, and there are often not big companies and its difficult to understand or to dedicate people understand what these initiatives are all about. So we try to clarify that for them, without forcing them into one initiative, but we would make certain recommendations, depending on how big they are and what their needs are. So we do play that role of advisor ourselves. (….) my job, is to present and trying to simplify the merit of initiatives that are out there, with each segment that is out there, I mean with chemical compliance there are a lot of initiatives and customers come to us" which one should I do? " So we try to explain the differences between them and allow them to decide of course.*

3.7.2. Views on Changes in standards

The use of sustainable chemicals frequently increases costs. Sustainable chemicals can mean either chemicals with a renewable resource base or chemicals with a specific use case that for example improve the product quality. Because both come with increased cost, they may not be demanded or purchased in later stages of the supply chain. At the same time, the use of better chemicals was highlighted to provide competitive advantage.

To manage these costs, one of the interviewees works with a service-based business model. As part of the business model, tanneries are advised on how to use the chemicals at what quantity and for what type of purpose. This was mentioned to be important, because often they may not be familiar with the differences in chemicals or their benefits. The interviewee mentioned that such consultancy over time increases profits, improving product satisfaction by providing consistent quality while avoiding losses stemming from not using chemicals correctly.

One reasons for the wrong usage is that most chemical suppliers who do not provide a service receive profits based on a quantity of chemicals sold. A chemical consultancy may address that issue by selling a lower and/or the right quantity of chemicals in addition to a consultancy. This likely also applies to changes needed in the infrastructure or management as well.

Both full leather chemical companies, the business model is you have technicians, or your agents have technicians that help out to sell. Yes, it's a consultancy that you bring along. Even sometimes even more important than the products. (…) One of the major assets that we are having in the eyes of our customers is the ability of our technical team to help them to make the solutions that they want and that is often fine-tuning recipes with a product from us sometimes with a product from a competitor fine tuning recipes to get the best output.

We have been more expensive because we add a lot of services and we provide a service that we hope is better than those from our competitors. Now that service is to provide security to the customers, that we are staying ahead of the game. That we are involved in all these initiatives and that our chemicals will be okay.

However, changes particular in chemical content can negatively affect the product quality. One chemical producer mentioned that it is important to help domestic and temporary production people to ensure that the change does not mean a reduction in smoothness in the process. This can happen if there is close collaboration, which is again important, because changes in a recipe were highlighted to lead to supply chain disruption, which leads to a disruption in trust and reputation. It can also change the leather properties and consequently there can be problems with the customers.

3.7.3. Views on Cooperation for supply chain changes

Regarding the type of cooperation, there was little information given by the interviewees. Most mentioned to work independently and offer their products to tanneries. This was less prevalent if tanneries were brand owned. For example, brand owned tanneries tend to work in fixed contract with chemical suppliers. To introduce new chemicals, brands have to agree to changes in contracts. This was also mentioned to make it difficult to understand what chemicals were used but also to build up a cooperation with tanneries.

A lot of times, the labs who make the certification are part of the same company that sells abroad. So basically, also those brands they will say our own chemical producer make sustainable chemicals. For example, Zara is working late in this line you only can sell to Zara if Zara lab certifies your product.

Furthermore, there also seems to be a lack of cooperation with chemical suppliers, which was viewed negatively because it runs contrary to demands for rapid or costly changes in standards. Therefore, cooperation could be benefit if changes in chemical management were discussed with chemical suppliers too and would not lead to supply chain disruptions.

If we don't supply our chemicals in time, tanneries have a big problem. And they rely on us. And they might get fines. So for them, it's really important that they can rely on us logistically as well. Supply chain secureness and the supply chain reliability is the number one thing for that kind of companies who are in such tight supply chains.

One interviewee pointed out that long-term relationships with chemical-suppliers hold the benefit of providing security to the customers, “to stay ahead of the game”. The added value would be to ensure to consumers that their product and business will stay on the market for the next 10 to 20 years, while products will remain on the market too.

3.7.4. Trust and information sharing

Chemical supplier for products to enter the EU market have to identify their chemical content under EU REACH. At the same time, many chemical suppliers may not disclose all the information on their chemical content, because they may not have to in the producer country or because it relates to

their business secret. They are more likely do so if their information is kept confidential. For example, one of the interviewees set up a traceability tool in which different standards were traceable including chemicals. They were secured in an IT system and not visible to other actors in the supply chain.

> *The process is the know how powerplant, and we cannot share.*

Most interviewees actually mentioned that their chemicals are traceable. However, they are not if tanneries choose to mix their chemicals with other chemicals from different suppliers. This happens because of different demands on the leather and the products. Full traceability is then likely only possible if all chemical suppliers communicate their chemical content.

> *Most chemicals are really traced. I bought a batch from a vendor. It's entered in our system as one that transfers through our factories. And you should be able to track this finished product and follow with what it is made of such as intermediates, raw materials and from which vendor it originates from. So suppose something goes wrong. If you're in the pharmaceutical scene it will say if something's wrong, we can trace back where did it might go wrong. From the bill chemicals we can trace it back on the load when we received something although what you always do you mix it with something that's already in the attack. You are not fully clean about that usually. So that's always an argument but that's in the realm to Balkan culture. But that so yeah, we can't go back a lot to be honest.*

The last and greatest barriers to full traceability was highlighted not to be based on the chemicals, but the entire product system. This is outside of control of chemical suppliers, but often also tanneries.

> *Chemical traceability is a lot easier, then leather traceability, because we don't have any animals behind the chemicals. They can be traced. And you can trace the through log numbers, the chemical industry is highly regulated, much more regulated then the leather or textile industry. Because of its nature, we had a high level of regulations. Our chemicals can be traced. However, what we have seen or heard, discussed in detail with brands, is that the level of traceability still needs improvement. In a sense that it is still quite difficult for a retailer or brand, to quickly get information what chemicals have been used in their supply chain.*

4 Discussion

The following section discusses the different findings in relation to the different criteria that were explored throughout the interviews. Following the discussion, the main research question will be answered laying out what incentives need to be put in place for changes in chemicals and their traceability to occur with a business perspective.

4.1 Sustainability is not thoroughly defined and implemented by all actors in the supply chain and between brands.

Currently sustainability is not a thoroughly implemented concept for each actor in the supply chain, whilst often being associated with different meanings. For example, sustainability can relate to keeping a business case, while sustainability can also relate to product quality and in a broader sense to social and environmental well-being. While this confusion persists, brands tend to demand specific sustainability criteria for production processes. Because these criteria or more specific standards

tend to vary, there seems to be confusion over what constitutes sustainability and how to harmonize standards in ways that drive efforts to strengthen sustainability. At the same time this variety leads to an overabundance of standards and an excessive demand to be compliant with different production standards for producers.

In addition, there is not only one form of sustainability for one product, but different perspectives on what constitutes sustainability for different products including product materials or chemicals. As a result, sustainability tends to be interpreted more narrowly in terms of required standards such as those laid out by legislation, brands or other initiatives. This makes the transition towards more sustainability, for example towards more sustainability of chemical standards more complicated. At the same time, a transition towards more sustainable chemicals also implies increased cost such as for better chemicals and processes including the infrastructure. Often these costs are not covered by producers. They may be covered if the benefit of sustainability manifest in a business case.

4.2 Compliance to changes in standards

One of the key barriers for the implementation of changes in standards is the dispersion of large supply chain networks across different regions. Often that is because changes can only be implemented if the entire supply chain network is traceable. In the absence of traceability across the entire supply chain network, there is also a lacking ability to trace chemicals used, particularly when it comes to actors beyond Tier 3. This then also applies to the difficulties with implementing changes.

At the same time, there are also the challenges of different actor capacities to implement changes or to engage in traceability schemes. These challenges often stem from limitations of existing physical infrastructures that often are needed to produce more sustainable chemicals, or because tanneries themselves lack the infrastructure to make use of them. This applies to both, chemicals and ICT infrastructure for the traceability of chemicals. To compensate for the lacking infrastructure, it can be helpful to provide a service-based business model or consultancy in which tanneries and producers are supported with expertise on how to make use of chemicals and how to make use of ICT services for chemical traceability.

While the physical infrastructure plays an important role for implementing changes, management structures do too. Currently, there is a wide actor network that tends to not collaborate. This applies vertically to actors in the supply chain but also to horizontally to actors from similar industries. For example, brands might only work with one part of their supply chain, but not with other brands who work in the same supply chain. As a result of that and different languages spoken, changes might be difficult to implement and to be communicated to begin with. For example, there were actors who mentioned that technical vocabulary is not always understood, while it can also get lost in translation.

Another challenge for the implementation of changes are differences in the processing and traceability of leather. For example, chemicals might be easily traceable, but often leather is not, because it enters different supply chains for different production processes for different end of life uses. Because leather and chemistry are dependent on another, this makes the traceability of both challenging. For traceability of chemicals to work, traceability of chemicals must be linked to the traceability of leather and its end-of-life use. This includes traceability of leather, for example on online marketplaces such as Alibaba.

4.3 Cooperation enables changes in chemical management and traceability to be implemented

Currently there is a lack of cooperation. That is because most changes that are demanded, are often demanded by brands rapidly. As a result, chemical suppliers can feel pressured to rapidly produce certain chemicals to fulfill demands. Often this is not possible because changes need time or the infrastructure to produce and to apply a certain chemical is not available. Because changes are demanded rapidly, this often leads them into risking a business case. It was mentioned that this can be avoided if supply chain actors communicate limitations or challenges to other actors. Such limitations can relate to a missing infrastructure or needed support. However, often these limitations are not shared, because of fear of losing a business case leading to a sense of insecurity.

To better support cooperation one solution proposed was to use consultancy services with the aim to build and improve cooperation in the supply chain. The aim is to have different actors sit together and to talk about their needs for changes in chemicals. Interviewees also highlighted the need to have an actor network that works towards a common vision for specific sustainability standards. Through this network better cooperation can occur and as a result of that, better standards and different forms of traceability could be implemented. Currently that tends to not happen, because most industries tend to be organized competitively. The role of competition might give insights into why cooperation is viewed as a disadvantage, when it can serve as an advantage.

At the same time cooperation was already viewed as something beneficial if it can lead to saving costs over time or for example if a supply chain relationship secures a certain business for the next five to ten years. However, because companies tend to desire to keep production costs low, brands tend to outsource their production to different suppliers with lower costs as opposed to taking to time to build and invest into relationships with existing suppliers. This does not apply to all brands and might differ between brands and supply chain actors. One interviewee also pointed out that shared values, for example over sustainability would also support interest in long term cooperation.

4.4 Trust and information sharing

Currently information like for example on chemical content is shared. However, because changes tend to be demanded rapidly, the information might not be accurate. That is because suppliers might fear to lose a business case. As a result, samples meeting production standards might be provided for testing, while different products including different chemicals might be delivered to go into production and are then sold. To avoid that it was recommended to operate in close supply chains with full actor oversight. This tends to be cost-intensive so that this is not a feasible option for most actors.

On the other hand, information would be more likely shared, if producers feel safe. This means that producers of leather and chemicals feel safe to share information on chemicals used that might currently be unsafe. Chemical producers should feel safe to share the content of their chemicals too. They might not want to do so, because it might mean that they have to disclose their business case. In addition, there are already various demands on sharing information such as for different standards and in different tools so that more traceability might not be viewed as necessary or beneficial by the industry. To address both, concerns about risks for business cases and the reluctancy to share damaging information it was recommended to set up a tool that combines different standards in which the information is kept safe with either the supplier or the supplier network and in which different standards can be integrated.

Full disclosure of information was furthermore linked to increases in trust and the likelihood of continued supply chain relationship and security. Trust should be linked to safety. Safety can be

provided if the information is stored securely in an information tool in a way that is inaccessible to unauthorized actors and is shared with a secure supply chain network only. In addition, missing data, or challenges to deliver on the data should not be viewed as a barrier for cooperation, but as an opportunity for collaboration so that data can be collected and changes can be implemented. Trust generated can itself then play an important role in business sustainability. This can be achieved by frequent testing that reduces over time, because of the trust factor. Over time, this reduces cost for different suppliers.

5 Conclusion

Based on the results from the interview, the following business incentives have been identified that can encourage a transition towards more sustainable chemicals and the uptake of traceability schemes for chemicals in leather supply chains. Because the supply chain networks are complex, these business incentives serve as general recommendations. They serve as general recommendation because the details of business models for traceability likely have to be adapted to specific needs of each actor on a case-by-case basis. That is because of the different challenges faced by different brands and their supply chains and their capacities and connection to different supply chain actors.

1. Harmonized sustainability standards and tools

Currently there are different interpretations of what constitutes sustainability for different products and their materials. As a result, suppliers tend to be overwhelmed so that less interest may exist towards more traceability. To avoid that it is recommended to create an industry standard for sustainable production processes including standards for sustainable chemicals for leather. Because brands work with different product categories, it is recommended to provide an industry standard for all leather-based products that take the quality and end of use case for different types of leather into consideration.

At the same time, these standards should apply to all supply chains that deal with leather and leather chemicals. Furthermore, there should be a harmonized tool that is used by all industry actors. This tool would likely help to reduce the surplus of reporting tools and eases the collection and dissemination of sustainability information. The information should be kept safe so that brands can continue to focus on their own sustainability strategies, whilst also keeping information on product content safe.

2. Improved supply chain cooperation

Most supply chains are reluctant to implement changes because of lacking relationships and therefore cooperation that is based on a long-term vision. Instead of investing into long-term relationships between supply chain partners they tend to change rapidly for example if suppliers cannot directly comply with demanded changes or if the infrastructure from supply chain partners to implement standards does not suffice. To strengthen longevity, it is recommended to invest into sustainable relationships in which changes are openly discussed with the supply chain network. This is important to create room for different perspectives on challenges and opportunities for business and the partnership affected by changes or interest into changes.

If supply chain relationships themselves become stronger, then changes are more likely to be implemented. This also means that supply chain partners should feel safe to trust each other for example to share information on challenges such as current chemicals used in a confidential manner. The last point is particularly relevant for chemical producers whose business model relies on the confidentiality of the chemical content. Therefore, it might be recommended to have a safe supply chain network interested in a common vision.

3. Creating shared value along the supply chain

Lastly, traceability in itself can already be viewed as a business model. Whether it is accepted or not likely depends on the use case and need. It likely finds a suitable use case if it supports actors in the supply chain in being resilient towards changes such as towards changes in regulation or further standards. Because changes often come with increased cost, it is recommended to look at the creation and sharing of value along the supply chain. Currently this falls short such as by instructing certain actors to comply to the demands of other actors. This seems less effective than a form of management or cooperation is supported in which responsibility and support for changes is more equally distributed, for example in bottom-up approaches or approaches in which profits are shared more equally along the supply chain.

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7 Appendix I – Interview Questionnaire

Interview Questions – Chemistry

I. Introduction

1. Can you describe your role?

2. What role does sustainability play in your activities?

3. How is sustainability embedded in relation to the chemicals used in your products/operations?

II. Embedding in the supply chain

5. What is your supply chain like?

6. Who do you work with directly? (Partner..)

7. Who do you work with indirectly? (Contractor..)

8. What role do partnership and cooperation play for you?

10. New regulations requiring the tracing and display of product content information are becoming an important aspect of processing and selling leather goods. How are cooperations in your supply chain affected by changes, e.g. B. new laws on the use of substances?

III. Information sharing across supply chains

[Already has a traceability tool with him] i.e. IMDS

9. How is general information shared in your supply chain?

10. How is chemical/product information shared in your supply chain?

11. How is information about sustainability passed on?

12. How is this information transmitted?

IV Incentives for sharing and engagement

11. What motivates you to share information in your supply chain?

• Financial

• Regulations

• Print

• (…)

12. How does close collaboration affect the shared information (if)?

13. What benefits do you see in terms of sharing information with supply chain partners (if any)?

14. How does information sharing affect effectiveness/profitability?

• Product safety

• Product quality

• Sustainability values

• Profits

15. What advantages do you see for the recipient of such information?

16. What barriers do you face when sharing information (across your supply chain)?

• Contradictory behavior / "freeriding"

• Financial risks

• Cultural issues Intellectual property / knowledge

• Access to communication tools and capacity to use them

Role of the internal organizational aspects: What are the drivers (e.g. internal guidelines) or barriers (information is not in a defined place, but scattered) for communication?

V. Enable cooperation in supply chains / trust

17. What is the role of trust in relation to the exchange of information in your supply chain?

How does trust affect collaboration in your supply chain, e.g. H. in relation to the exchange of information between supply chain partners? (<-better?)

18. Who ensures the quality of the shared information?

19. How to trust this information?

• Partners/buyers in the supply chain

• Consumer

VI. future directions

What needs to be done for more trustworthy communication?

Which structures are required?

Which cooperations?

What regulatory impulses?