

ADVANCING TRANSPARENCY AND TRACEABILITY
OF SUSTAINABLE VALUE CHAINS
IN THE GARMENT AND FOOTWEAR INDUSTRY

LEATHER VALUE CHAIN

REPORT 1

OVERVIEW OF PROCESSES AND ACTORS WITH USE
CASE DIAGRAMS

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Introduction:

This is the first of three reports on the processes and actors in the leather value chain for livestock and exotic hides and skins. It is developed to support the implementation of transparency and traceability for sustainable value chains in the leather goods sector, with livestock more often being a complex value chain, and exotics more often a controlled value chain, particularly when owned by brands.

The three reports are:

1. **A brief overview of the processes and actors within the leather value chain with two use-case diagrams showing first the more complex value chain common for livestock leathers and, second, the more controlled value chain common for exotic leathers.**
2. A Business Process Analysis Report with detailed descriptions of the value chain processes and their sustainability risks.
3. Report on the information/data requirements for transparency in the leather value chain and traceability systems and tools that offer full or partial solutions

The purpose of this document is to offer a starting point for understanding the leather production landscape, by providing an outline of the processes necessary to convert the hides and skins from livestock and exotic animals into leather. Although this report does not look in detail at the risks and sustainability issues arising from leather production processes, it does introduce key topics such as *Animal Welfare*¹, *Hazardous Chemicals Use*², and *Biodegradability*³. These sustainability elements, as well as to related legislation and certification (i.e. CITES), will be covered in the detailed Business Process Analysis (BPA) in Report no. 2.

This report attempts to encompass the broad variability within leather production processes. In order to reduce the complexity of the model being described, we have created a generic value chain model

¹ **Animal Welfare** – OIE World Organisation for Animal Health, is the World Trade Organisation (WTO) reference organisation for standards relating to animal health. The OIE publishes 2 codes (Terrestrial and Aquatic) and 2 manuals (Terrestrial and Aquatic) as principle reference for WTO members. The codes aim to assure to sanitary safety of international trade in terrestrial animals and aquatic animals, and their products.
<https://www.oie.int/en/animal-welfare/an-international-network-of-expertise/#A>
https://www.oie.int/en/standard-setting/terrestrial-code/access-online/?htmlfile=titre_1.7.htm
https://www.youtube.com/watch?time_continue=186&v=VCfG_Mt2KtY&feature=emb_logo
RSPCA Animal Welfare Standards: <https://science.rspca.org.uk/sciencegroup/farmanimals/standards>
World Animal Protection Index: <https://api.worldanimalprotection.org/>

² **Chemicals, including risk of Chrome VI** – UNIDO's Framework for Sustainable Leather Manufacture (second edition), pages 106-107 give useful guidance on this subject:
https://leatherpanel.org/sites/default/files/publications-attachments/the_framework_for_sustainable_leather_manufacturing_2nd_edition_2019_f.pdf
Leather Dictionary reference: https://www.leather-dictionary.com/index.php/Chrome_VI_-_Chromium_VI
SATRA article: <https://www.satra.com/spotlight/article.php?id=478>
REACH Annex XV11, Entry 47 Chromium VI Compounds: <https://echa.europa.eu/documents/10162/1f775bd4-b1b0-4847-937f-d6a37e2c0c98>

³ **Biodegradability** – The International Standards Organisation (ISO) standard: ISO 2016:2020 Leather – Determination of degradability by micro-organisms: <https://www.iso.org/obp/ui/#iso:std:iso:20136:ed-2:v1:en>
System for biodegradability evaluation on leather used in the footwear industry:
https://www.researchgate.net/publication/289052625_System_for_biodegradability_evaluation_on_leather_used_in_the_footwear_Industry

that shows all processes once – even though not every manufacturer of leather will use every process nor will they follow the processes below in the same sequence. The reader should consider the “direct” processes shown in the Use Case Diagram to be “modular” with the manufacturer having the ability to change their sequence or even to repeat them, according to the needs of the product and participating actors.

A separate glossary is published with definitions of the technical terms used in these three leather value chain reports as well as other outputs supporting the UNECE Policy Recommendations and Guidelines on Transparency and Traceability of Sustainable Value Chains in the Garment and Footwear Sector for Leather and Textiles.

Livestock Hides and Skins:

The leather value chain for livestock hides and skins is complex because leather manufacturers (tanneries) can provide different sets of production processes. Some tanneries perform the entire transformation process from the raw hide/skin through to the finished material while others will only perform a part of the process. This results in a range of “supporting” actors that may vary from one value chain to another, even for the same product.

These actors include: Agent Traders who buy and sell material at different stages; Brand Agents who act on behalf of the brands to buy material from a number of sources to fulfil product manufacturing needs; Subcontractors who perform transformation processes on behalf of a tannery (they don’t own the material but do participate in the production). These “supporting” actors add a level of complexity to achieving full transparency and accountability from a sustainable production perspective.

For the purposes of this project, sheepskin and hair-on-hide are recognised as livestock hides and skins.

Exotic Skins:

Some value chains for exotic skins function in a manner similar to those for livestock hides/skins, but, generally, exotic skins have more controlled value chains. This is primarily due to additional sensitivities and legal issues, but also because exotic skins are more prevalent in luxury items and the luxury brands are more likely to manage their value chain from farm to product. It is also more frequent for luxury brands to own their own farms, slaughtering facilities and tanneries for exotic leather production.

Due to the increased consumer sensitivity and regulatory requirements when manufacturing leather from exotics, luxury brands are under stronger pressure to provide clearer mapping of value chains and tighter control. However, it should be recognised that good value chain mapping is also demonstrated by tanneries working with livestock hides/skins.

This report consists of:

Part A: Identification and brief descriptions of leather value chain processes. *(This is a brief overview of the processes and is not intended to be a comprehensive technical guide to leather manufacturing. As mentioned earlier, a comprehensive glossary of technical terms is published separately.*

Part B: Identification and brief descriptions of the actors in the leather value chain

Part C: Use Case Diagrams – Leather Value Chains – Complex and Controlled

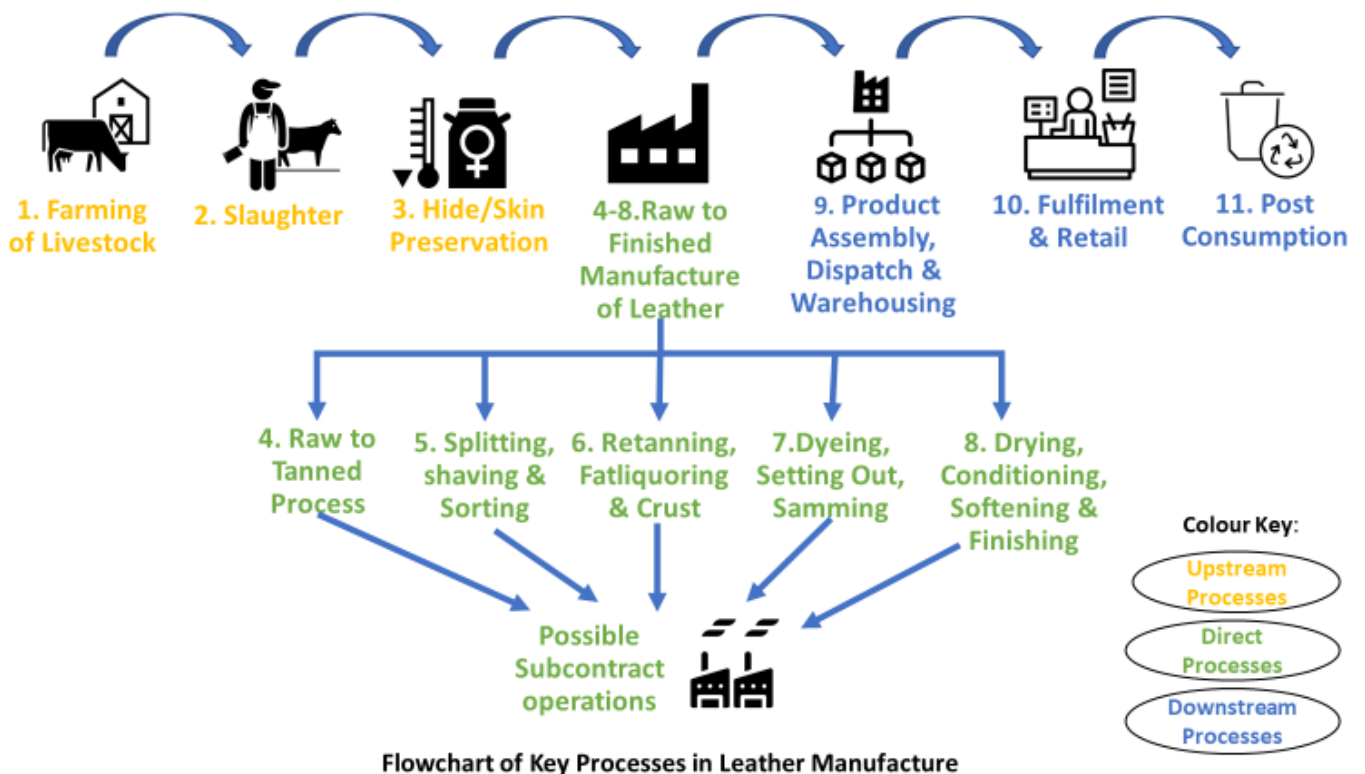
PART A – DESCRIPTION OF LEATHER VALUE CHAIN PROCESSES

The process steps in the manufacture of leather are broadly the same whether dealing with livestock hides/skins or exotic skins. Not all process steps are followed in every value chain, but they are all included here in order to cover the broad remit of leather production.

Presently, there is no specific process that is mandatory or widely recognised for traceability as part of the leather manufacturing process. As a result, within the processes described there are various points where identification for traceability could be applied to individual hides/skins, batches of material, product batches or even individual products. There are a number of different identifiers which are used in different parts of the value chain, including: ear tagging of livestock coupled with computerised or manual record systems at slaughterhouses, branding of livestock, physical stamping at the slaughterhouse or at receiving tannery, DNA marking, ceramic marking and laser marking of hides/skins at the tannery, etc. It is worth noting though that identifiers still pose challenges in terms of cost-effectiveness and scalability.

There is also no standard system or approach for tracking of chain of custody or for the collection of information that could be linked to identifiers (for example, on sustainability).

The process descriptions, as illustrated in the flowchart below, are numbered to correspond with the descriptions and the numbered processes in the Use Case Diagrams in Part C and the value chain production processes are separated at points where a change of ownership or custodianship could occur, i.e. in the case of sale of the goods or subcontracted operations.



Process 1:

Birthing and Raising of the livestock

Leather is manufactured from the hide or skin of an animal. There are various farming models:

- Farms that raise animals from birth to end of life
- Private or family small holdings
- Industrial systems that start with birthing farms, before moving livestock to rearing/raising farms and then moving the livestock to finishing yards (sometimes known as feedlots).
- Exotics systems that combine egg breeders/collectors, hatchling farms and finishing farms

Different factors affect the type of farming undertaken: socio-economic conditions, dairy & meat industry practices, exotics farming practices, consumer expectations, geographic & regional limitations/restrictions/legal requirements.

If identification of livestock during farming takes place, this is generally achieved through the use of ear tagging or branding upon entry of livestock to the value chain (birth) and movement is monitored by computerised or manual tracking of the identification number/code on the ear tag/brand mark. Where these methods are utilised, livestock can be traceable from birth to slaughter. Without ear tagging or branding there is the possibility of manual tracing through batch identification, paperwork and invoicing, but even this does not always happen in some less-developed regions and the movement of animals can make it difficult to undertake tracing based upon paperwork alone.

Process 2:

Slaughter

The slaughter of livestock commonly takes place in an industrial slaughterhouse or abattoir, where the animal is slaughtered with the meat (from livestock) going to be butchered and the hides/skins sent for leather making or other by-product manufacturing.

However, other kinds of slaughter take place, among these smallholdings or individuals who slaughter their own animals. This can, in some cases, result in poor animal welfare practices and cruelty to animals. This is an ongoing, sensitive issue in the meat industry, and it is considered that traceability and transparency of value chains can enhance the visibility of such practices and therefore allow more informed choices for producers and consumers. The leather industry can only influence the meat industry through dialogue and purchasing decisions, however, examples do exist of supply chain co-operation, that works to make sure that the source of meat as well as hides/skins comes from farming systems that have the highest animal welfare standards.

The slaughterhouse is the exit point for the animals' life and the entry point for hides/skins into the leather production process. The animal identification number/code will be recorded to complete the farming requirements, where they exist, via either an electronic or manual system. Some slaughterhouses physically mark hides/skins with codes that denote the place and date of slaughter before sale to the tannery and this information could, in theory, be passed to the tannery when the hides/skins are sold. The onward preservation, integrity and usefulness of the physical marking of hides and skins remains challenging though, during the subsequent transformation phases and also in consideration of commercially sensitive information.

Identification can be applied to hides/skins at many of the entry or exit points in the processes outlined below, either by a permanent mark that will stay with the material throughout the process or by individual identification/batch identification which is recorded or applied at the different manufacturing sites. Tracking of identifiers can be electronic or manual (through invoices, despatch notes, bills of lading, etc). However, since there is no current standard method or requirement for this identification, from this point forward, it is not detailed as an existing routine process and will be addressed in Reports 2 and 3.

Process 3:

Hide and Skin Preservation

Some slaughterhouses have tanneries attached to them, for example some of the larger meat packing companies or integrated cooperatives have a production process that integrates slaughter, meat packing and leather making. In this case, the hides are generally processed as “fresh” hides where no preservation is necessary, or “refrigerated” hides where ice is used within insulated containers for up to 3 days transportation/storage before transformation processes begin. This can be extended to 5-7 days if refrigerated trucks or containers are used for transportation.

However, for the majority of hides there is a longer transportation/shipping time from the slaughterhouse to the purchasing tannery and, therefore, it is necessary to “preserve” the hide/skin from breaking down and deteriorating.

The most common form of preservation for hides and skins is “salting”, however, other methods used include: “drying”, “bactericides”, “brine curing” and “lowering water activity” (reducing water content to inhibit bacterial activity). “Pickling” and “tanning”, which are also used in intermediate stages in leather manufacture, can also be used for preservation. These last two methods are detailed further in the following processes.

During the preservation stage, some initial sorting and grading of the hides/skins will also take place. This process allows for the material to be grouped according to quality and size, and this can be repeated at various production stages.

Process 4:

This process groups a number of activities which, combined, form the first transformation stage from a raw hide/skin to tanned material. Usually, these activities take place in one facility.

Soaking, Liming and Fleshing

The first transformation step in a tannery is to rehydrate the hide to the optimum state for tanning. The procedure followed will vary slightly depending on the preservation method used. Once optimum hydration through soaking is reached, the hides/skins are “unhaired” (unless sheepskin or hair-on-hide) and “limed” where a combination of chemicals are used to open up the fibre of the hide and to remove the hair and epidermis. It is important that the liming process is carried out with care in order to (a) maximise the surface yield without over relaxing the structure of the hide/skin or damaging the grain and (b) prevent excessive pollutants in the effluent. The liming process is crucial to the end quality of the leather.

Fleshing, where any residual tissue, fat or remnants are removed by manual or mechanical knives, takes place after liming, however, this could be carried out in advance (in between the soaking and

liming) particularly when processing sheepskin or hair-on-hide material where the unhairing process is not required.

At this stage the hides/skins can also be split (see Process 5) where the hide is put through a mechanical blade to split the material into two pieces – the top split will be processed for leather and the drop (bottom) split can be used for the production of by-products such as gelatine and medical ingredients for ointments, etc

Deliming and Bating

The residual lime must then be removed/neutralised, and this is generally done using ammonium salts, weak acids or other deliming agents. Carbon dioxide can be used to minimise the amount of chemicals required for deliming.

The hides are then “bated” where enzymes are used to remove any residual hair/cells and to soften and improve the elasticity of the hide. Different enzymes create different effects in the leather and can be used to achieve different performance qualities for the end product.

Degreasing and Pickling

Degreasing takes place to remove natural fats that are more prevalent in some types of livestock (for example sheepskin) in order to prevent non-conformity in later processes; for example, dye absorption, spew (formation of white surface deposits on the leather) or to prevent dark or greasy patches in the finished leather.

Pickling is a process using acids and salts to reduce the pH of the pelt to a suitable level for tanning with chromium or other minerals. It is not necessary for vegetable tanning (see more on tanning types below).

Tanning

This is the first full transformation stage from the hide/skin to leather.

There are three main methods used for tanning – “Chrome Tanning”, “Synthetic Tanning” and “Vegetable Tanning”. Each of these methods has different production requirements with varying environmental impacts or considerations, and each can provide different commercial and technical performance results.

- **Chrome tanning** is the quickest and most cost-effective method and can be used to produce any leather type except for sole leather which is made using the vegetable tanning method. Chrome tanning is achieved using Chrome III, a non-toxic chemical, in rotating drum vessels with a relatively quick processing time and results in “wet-blue” material, called this because of its blue-green appearance. It is reported (UNIDO 2019)⁴ that while there is a risk of the formation of Chrome VI in leather (a very low-intensity allergen) when using this tanning method, this only occurs if the tanning process is not carried out correctly.
- **Synthetic tanning** (chrome-free or metal-free) uses a similar process to Chrome tanning but with synthetic substances and vegetable compounds to stabilise the material and this process results

⁴ UNIDO’s Framework for Sustainable Leather Manufacture (second edition), pages 106-107 give useful guidance on this subject: https://leatherpanel.org/sites/default/files/publications-attachments/the_framework_for_sustainable_leather_manufacturing_2nd_edition_2019_f.pdf

in “wet-white” material, so called because of its whiteish colour. This process can be more costly and requires more controls than Chrome tanning.

- **Vegetable tanning** is achieved using natural tannins from wood, leaves, tree bark and fruits, and is the oldest method of tanning leather. This traditional process uses a series of large open vats and can take from 30 to 60 days. Options for use and colour can be more limited and this method is most commonly used for the production of shoe sole leather or other heavy leather applications. Vegetable tanning produces a brown-coloured leather that can be dyed to another colour. The use of drums can also be adopted, and this can speed up the process resulting in a softer or lighter leather for linings and leathersgoods.

Samming

Also referred to as “sammying”, this is the process of passing the tanned material through rollers to remove excess water and reduce wrinkles/folds.

Process 5:

Splitting (if necessary)

Leather can be split at this stage to reduce the thickness of the original hide. This results in a top “grain split” used for shoes, gloves, purses, clothing, and the “flesh split” leather (bottom part of the hide), often known as split suede which can be finished/coated and used for clothing, shoes, gloves, and bags. Whether the leather is split or not depends on the thickness of the original hide/skin and its intended application. With very thick or heavy hides it is also possible to create a “middle split”.

Shaving and sorting

The material is passed through shaving machines with very precise blades to ensure uniform thickness of the material before sorting it into quality grades ready for the next stage.

Process 6:

Retanning/Fatliquoring

This important process varies according to the desired end result. The process is adjusted for different leather types (i.e. split leathers, nubuck, suede) and different leather uses (i.e. shoe uppers, garments, upholstery and bags). Retanning is used to improve or modify the characteristic properties of the material for look, feel, buffing and dyeing, water resistance and colour fastness.

Fatliquoring (or oiling the leather) also occurs at this stage to lubricate the fibres of the material for appearance, feel and durability.

Crust Leather (if necessary)

Some tanneries will not need this stage if they are transforming their material from raw hide all the way into finished product. However, if the tannery is selling the leather to be finished in another tannery, they may dry the material to a “pearl crust leather” state before sale. Tanners may also dry their material to store it until they have order requirements (especially colour) for specific finishes, or it may not be carried out until post-dyeing resulting in a “dyed crust leather”.

Essentially crust leather is just the dried state of the tanned/retanned/fatliquored/dyed material.

Process 7:

Dyeing

The leather is dyed using chemical dyes (all colours) and pigments (especially white) to achieve the desired end colour. This relies on a good understanding of how dyes work along with strict controls and processes to ensure that colours between batches remain consistent. Rates of exhaustion (amount of dye taken up by the material divided by the amount of dye used) are also crucial to ensure colour fastness and light fastness (resistance to fading when exposed to light or water).

Setting-out/Samming

Removal of excess water takes place again by passing the re-tanned and dyed material through mechanical rollers.

Process 8:

Drying

There are two main methods of drying leather – air drying where the leather is suspended on racks above the tannery floor (sometimes combined with passing the leather through drying tunnels with controlled temperature and humidity) or vacuum drying where the moisture is removed by heating the leather and suctioning up the water vapor. Other methods include pasting (where the leather is pasted on a smooth surface and heated in a drying tunnel) and toggling (where the leather is stretched and fixed on a metallic frame before heating in a drying tunnel).

Often, Process 8 also is done before Process 6 if a crusting strategy is being used but it then has to be repeated after the dyeing step.

Conditioning and softening (including staking and milling)

After drying, the leather is mechanically staked (a pummelling action) to soften and improve the appearance of the material. The machinery used is either a rotary or vibratory staking machine for staking, or a dry drum for the milling form of softening.

Finishing

During finishing, the leather is given final treatments to suit the end product requirements. This could involve embossing, printing and other techniques including adding a shine or dulling down the appearance of the leather. Further shaving (buffing) could also take place at this stage. The finishing process can involve coating additional surface layers onto the leather to add colour, smoothness, surface protection, durability, or fashion effects. Finishing chemicals can include colourants (e.g. dyes and pigments), film-forming materials (e.g. polymers) and other auxiliaries to create specific characteristics. A heat transferred foil application can also be applied in this finishing stage.

The leather is then sent for quality control, grading, measurement and packaging before despatch to the product producer/manufacturer/brand.

Process 9:

Product Assembly

Transformation into the finished product (apparel, handbags, shoes, belting, accessories) may take place at a brand facility or at an intermediary factory. The product assembly can involve re-finishing the leather to add effects or enhance durability.

The leather is cut out, sewn together, backed, punched, etched, or moulded to take on the shape of the final product.

Process 10:

Fulfilment at retail facilities / outlets or online

Product sale to consumers and end users. The in-life (consumer use) of leather is characteristically devoid of washing cycles. Leather, unlike textiles, does not generally get washed, so avoids water and energy use in-life.

Process 11:

Post Consumption

This could be re-cycling, re-use, re-purposing or waste disposal. Leather is a good example of a material that can be recycled and reused and there are organisations who specialise in transformation and restoration of leather.

Leather has historically been manufactured to provide longevity which is why it is seen as a high-quality, durable material. Some leather may not be suitable for biodegradability success as a result of finishing applications (foils, bonded leather, etc). Innovation and technology is developing leather production methods that result in the material starting to biodegrade after a pre-determined period of time.

PART B – ACTORS IN THE LEATHER VALUE CHAIN

In order to better understand their roles in transparency and traceability, this section provides an overview of the primary actors in the leather value chain as shown in Part C. Not all actors will participate in every value chain.

Farmers:

Breeders, raisers, finishers, small holdings, individuals, and industrial production farmers.

Farm Suppliers:

Suppliers of feed, equipment, animal health products and services.

Transportation Product Guardians:

Transportation companies are involved throughout the value chain as animals are moved, hides/skins are shipped and then moved from manufacturer to manufacturer before final despatch to the consumer. Transportation is also involved in the delivery of chemicals and other supplies to the tanneries, etc.

Slaughterhouse:

The actors within the slaughter process will vary within different regions/countries and can include a mix of slaughterhouses, individuals, meatpackers, and hide/skin collectors/processors.

Tanners:

Different categories of tanneries implement different combinations of leather treatment processes the most common of which include:

- Raw to pickled/pre-tanned
- Raw to wet blue/white/veg (tanned)
- Raw to crust
- Raw to finished
- Wet blue/white/veg (tanned) to crust
- Wet blue/white/veg (tanned) to finished
- Crust to Finished

Tanners own the leather they are treating, otherwise they are subcontractors.

Agents / Traders:

Organisations that buy material from slaughterhouses or tanneries and sell it to other tanneries (sometimes pre-tanned, sometimes part or semi processed and sometimes finished material; or a combination) and Importers/Exporters who buy and sell material. Some agents/traders may carry out a mechanical process (i.e. splitting) on semi processed leather before selling it on; however, if the process is a transformation process or uses chemicals to alter the leather then the agent/trader would be classed as a tanner.

Subcontractors:

Organisations who perform transformation operations on behalf of a tannery but do not own the material (sometimes this can also be another tannery with spare capacity that does work for the owner tannery).

Transformation Suppliers:

Chemical companies, machinery companies and other suppliers who provide materials/equipment to enable the transformation from hide/skin to leather.

Waste Service and Treatment Suppliers:

Waste disposal providers, Common or Municipal Effluent Treatment Plants, Recycling Centres.

Verification / Inspection Suppliers:

Testing houses that test and certify that the leather produced does not contain harmful substances above legislative limits or that chemicals used to perform the transformation do not contain banned substances. Other tests are performed to check colour fastness, physical performance, flammability, disintegration and biodegradability.

Certifiers / Inspectors:

Organisations that audit or inspect and certify compliance with traceability, environmental performance, social good practice and governance good practice, in order for the tanneries and brands/retailers to make sustainability claims about their products.

Garment / Product Manufacturers:

Organisations who transform finished leather into garments and products and despatch them to brands/retailers.

Warehousing Product Guardians:

Storage, packing and despatch of finished goods to retail stores or direct to online consumers.

Brands / Retailers:

Brands and retailers have multiple responsibilities: at the design and product concept step in the value chain, in selecting material and sourcing strategy, and also in the marketing and final sale of goods to consumers. Brands and retailers may also be involved at various stages along the value chain to ensure quality and standards are maintained and can be involved in the collection and recycling of products at end-of-life.

Traceability Requestor:

Many of the actors within the leather value chain, as described above, could be requestors of traceability; farmers (within the farming system model), slaughterhouses, tanners, certifiers/inspectors, product manufacturers and brands. The type and depth of traceability requested will vary, depending upon the purpose.

PART C – USE CASE DIAGRAMS

The following Use Case Diagrams show the flow of interactions within the leather value chain.

The oval descriptions running down the centre of the diagram list **the major processes described earlier**. Running down the left-hand side of those process ovals are **the actors who initiate processes**. The actors that run down the right-hand side are the **service providers/product suppliers** that undertake processes initiated by the actors on the left.

Occasionally, an actor participates on both sides, although they are only shown on one, with an explanatory note. For example, in the leather value chain an Agent/Trader is generally a service provider, but may also, at times, initiate a physical process such as the splitting of material.

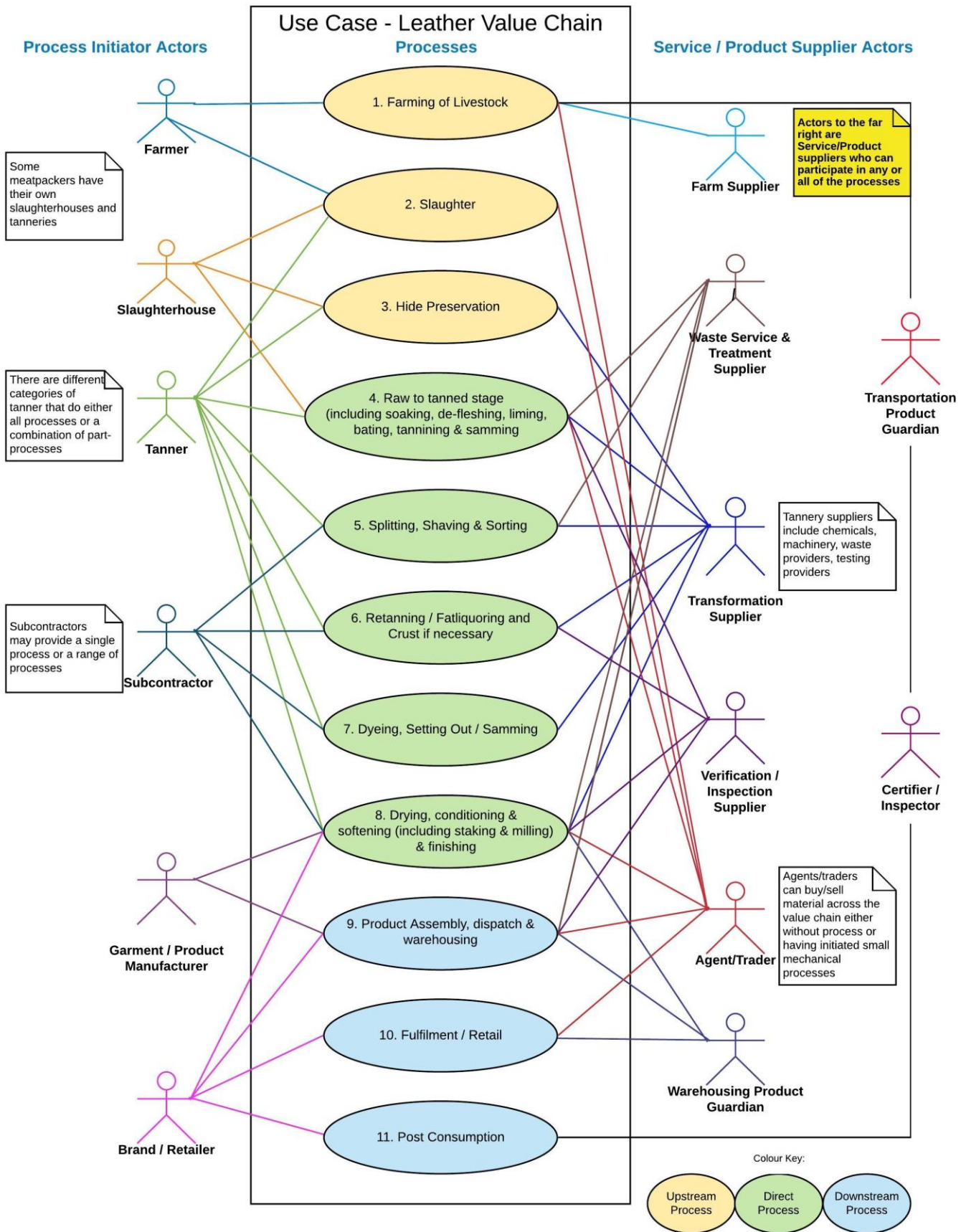
The following two diagrams are designed to cover a complex value chain and a more controlled value chain. The “Transportation Product Guardian” and “Certifier/Inspector” are service providers/product suppliers in the same way as the other right-hand side actors, however, for illustrative purposes (to prevent the use case diagram from containing too many lines), they have been placed on the far right because they can contribute to all the processes in the value chain.

Within the Use Case Diagram for the complex leather value chain example, not all processes will necessarily occur in the sequence shown and some processes may occur more than once. This is an illustrative example given that there are many varied value chain models within the leather industry. The process groupings in this example show where possible transfers of ownership or production could take place (but do not always).

The Use Case diagram processes have been classified and colour coded to represent:

- **Upstream Processes:** Those processes that relate to the raw material production (i.e. farming, slaughter and preservation)
- **Direct Processes:** Those processes that are directly under the control and influence of the tanners / leather manufacturers (i.e. the physical transformation activities from raw hides/skins to finished leather)
- **Downstream Processes:** Those processes that are conducted post-leather manufacture i.e. product manufacturing, product sale, etc.)

USE CASE DIAGRAM 1- LEATHER VALUE CHAIN COMPLEX



USE CASE DIAGRAM 2 - LEATHER VALUE CHAIN CONTROLLED

