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Recommendation No. 46: Enhancing Traceability and Transparency of Sustainable Value Chains in the Garment and Footwear Sector

Summary

Improving traceability and transparency has become a priority for the garment and footwear industry. Consumers, governments, and civil society are demanding responsible business conduct and are calling upon the industry to identify and address actual and potential negative impacts in the areas of human rights, the environment, and human health.

The objective of this recommendation is to establish a mechanism that enables governments, industry partners, consumers, and all other relevant stakeholders to make risk-informed decisions, overcome information asymmetry, communicate, and achieve accountability for sustainability claims (including those for regulatory compliance) and anchor business models to responsible business conduct.

It does so by providing industry actors with a set of internationally agreed practices for the harmonized collection and transmission of data for tracking and tracing materials, products, and processes across an entire value chain, including all involved facilities and intermediaries, and includes related information about the sustainability performance of these value chain participants. While specifically developed for the garment and footwear industry, such internationally agreed practices for advancing traceability and transparency have applications in cross-industry value chains, thus contributing to the achievement of several goals of the United Nations 2030 Agenda, and particularly Sustainable Development Goal (SDG) 12 on responsible consumption and production.

The recommendation includes implementation guidelines to assist policy and decision makers in better understanding tracking and tracing while also providing a framework for implementation by all stakeholders in garment and footwear value chains. The accompanying Call to Action (ECE/TRADE/C/CEFACT/2020/6/Rev1) provides a mechanism to monitor and keep track of implementation of the recommended measures, and to facilitate the exchange of good practices and lessons learned.

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I. Recommendation No. 46: Enhancing traceability and transparency of sustainable value chains in the garment and footwear sector

A. Introduction

1. Improving traceability and transparency has become a priority for the garment and footwear industry. Consumers, governments, and civil society are demanding responsible business conduct and are calling upon the industry to identify and address actual and potential negative impacts in the areas of human rights, the environment, and human health.

2. By creating enhanced visibility in value chains, companies are better equipped to manage such impacts, and address financial, operational, and reputational risks. Also, traceability in value chains allows companies to respond more effectively to unforeseen disruptions, conform with applicable laws and regulations, ensure product quality and safety, combat counterfeits, and protect cultural and industrial heritage.

3. On the other hand, greater transparency empowers consumers to make better-informed consumption choices, as they have more reliable information about the sustainability and circularity claims about products and processes. As a result, traceability and transparency have great potential to build trust among all industry actors.

4. High, low, and middle-income countries, as well as those with economies in transition, are deeply involved in the global garment and footwear trade, and all have a key role to play in advancing the industry's sustainable production and consumption patterns in line with the 2030 Agenda for Sustainable Development and, particularly, Sustainable Development Goal (SDG) 12 on responsible consumption and production.[1]

5. At the same time, their roles tend to be differentiated. High-income countries tend to operate more in the downstream part of the value chain where there is greater capital investment and more consumer-linked activities such as design, branding and retailing, consumption, and post-consumption activities. Low-, middle-income and transition-economy countries tend to mainly intervene in the upstream part of the value chain, where there are more labour-intensive activities such as farming, harvesting, ginning, spinning, dyeing, weaving, stitching, tanning, cutting and finishing.

6. Because of their nature and socioeconomic context, it is in these upstream manufacturing activities that most sustainability hotspots are concentrated, and where industry actors face most of the challenges in identifying, preventing and mitigating them. On the other hand, it is the downstream actors that often set the parameters and the financial incentives for upstream actors. Indeed, it is the design, product specifications, contract clauses related to payment terms, and withdrawal conditions that determine the room for manoeuvre that upstream actors have for providing decent working conditions and respecting the environment.

7. As a result, effectively addressing risks to responsible business conduct depends on all the links in the value chain and requires the active and effective engagement of both upstream and downstream actors. The latter, who make the final decisions about which materials are used and which products are placed on the market, also are expected – and at times, legally required – to identify and mitigate risks that might result in harm to humans or the environment throughout their entire value chain.

8. In this context, downstream actors must increase their knowledge of where their fibres, materials and all product parts and components come from, as well as how they are sourced, processed and traded. At the same time, there is clear evidence that their current capacity to perform and manage activities in support of enhanced traceability and

[1] Details of SDG 12 and its targets can be found in *Transforming our world: the 2030 Agenda for Sustainable Development* (A/RES/70/1), p.22. Available at (https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (accessed on 22 April 2020).

transparency is limited, and that their digital skills and capabilities to collect and elaborate data need to be further developed. To be effective, optimize scale and create efficiencies, actions to improve traceability and transparency in garment and footwear value chains must be sector-wide and encompass globally scattered actors. Traceability and transparency are important to ensure that value chain participants comply with relevant policies and regulations.

9. Moving beyond production and marketing activities, traceability and transparency are enablers that can support circularity claims. As such, they can support the shift from linear economic models that take resources, make products, and dispose of waste (take-make-waste models), towards circular economic models that Reduce the use of new resources, Reuse products and parts, and Recycle waste (the 3Rs model). The aim is to obtain the maximum value from resources, leveraging zero-waste design, product-life extension, resource efficiency, and repairing and remanufacturing services.

The following definitions of key concepts are used in this policy recommendation:

Traceability is understood as "the ability to trace the history, application or location of an object" in a value chain.[2] In this context, it is defined as the ability to "identify and trace the history, application, location and distribution of products, parts and materials to ensure the reliability of sustainability claims in the areas of human rights, labour (including health and safety), the environment and anti-corruption";[3] and "the process by which enterprises track materials and products and the conditions in which they were produced through the supply chain".[4]

Transparency relates directly to relevant information being made available for all elements of the value chain in a harmonized way, which allows for common understanding, accessibility, clarity and comparison.[5]

Sustainability[6] in the context of garment and footwear value chains means that all activities, throughout a product's life cycle, take into account their environmental, health, human rights and socioeconomic impacts, and their continuous improvement.[7]

Due diligence is understood as "the process through which enterprises can identify, prevent, mitigate and account for how they address their actual and potential adverse impacts"[8] as an integral part of business decision-making and risk management systems.

Circularity of a production process refers to the ability of this process to retain the value of products, materials and resources in the economy for as long as possible and to minimize, to the extent possible, the generation of waste along all the steps of the value chain.[9]

[2] ISO 9001:2015.
[3] United Nations Global Compact Office, *A Guide to Traceability A Practical Approach to Advance Sustainability in Global Supply Chains* (New York, 2014). Available at: https://d306pr3pise04h.cloudfront.net/docs/issues_doc%2Fsupply_chain%2FTraceability%2FGuide_to_Traceability.pdf.
[4] Organisation for Economic Co-operation and Development (OECD), *Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector* (Paris, 2018). Available at: http://dx.doi.org/10.1787/9789264290587-en.
[5] European Commission, *A Background Analysis on Transparency and Traceability in the Garment Value Chain* (2017).
[6] "Sustainability" refers to the ability of an activity to support "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This implies that the activity also takes into account the needs of "People, Planet, Prosperity, Peace and Partnership", as outlined in the United Nations Sustainable Development Goals (see A/RES/70/1).
[7] UNECE, *Accelerating action for a sustainable and circular garment and footwear industry: which role for transparency and traceability of value chains?* Policy Paper (2020).
[8] OECD Due Diligence Guidance (see above).
[9] European Commission, *Closing the loop – An EU action plan for the Circular Economy* (COM(2015) 614 final).

10. This policy recommendation responds to the increasing demand for policy and legislative action for responsible business conduct in global value chains. It seeks to support measurable sustainability efforts and targets in order to identify, prevent and mitigate adverse impacts on people and the planet resulting from corporations through their operations and third-party business relations. Thus, this recommendation aims at reducing the imbalances between upstream and downstream actors, as well as enhancing the human dignity, quality of life and the empowerment of garment and footwear workers.

11. The measures and approaches recommended here are aligned with the relevant Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda for Sustainable Development; the United Nations Guiding Principles on Business and Human Rights;[10] the International Labour Organization (ILO) Declaration on Fundamental Principles and Rights at Work, relevant ILO conventions and recommendations, and the ILO Tripartite Declaration on Principles concerning Multinational Enterprises and Social Policy;[11] the Paris Agreement on Climate Change; the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises,[12] the OECD Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector,[13] and the OECD/Food and Agriculture Organization (FAO) Guidance for Responsible Agricultural Supply Chains.[14]

B. Scope

12. This policy recommendation is relevant for all countries and companies participating in global garment and footwear value chains from raw materials production and processing, through manufacturing to finished product branding and retailing, consumption and post-consumption activities.

13. Areas where action to advance the traceability and transparency of value chains is needed include the following:

- Awareness of the indispensable role that traceability and transparency play in the identification, prevention, mitigation, and remediation of potential and actual adverse environmental, social, and ethical risks to responsible business conduct by companies and their global business partners throughout the entire value chain. This also applies to suppliers that are more at risk of remaining hidden, like subcontracted, informal and small producers.
- Development, implementation, and enforcement of supporting government policy, legislation, and practices, including the integration of traceability and transparency information into public purchasing practices in order to better inform the work of buying and compliance offices.
- Incorporation of traceability and transparency into the analysis supporting risk-based management of value chains, and into the reporting on efforts to address sustainability risks based upon relevant norms and standards.
- Engagement of enterprises in long-term relationships based on their mutual adherence to the United Nations SDGs, and adoption of a more proactive vision by value chain

[10] United Nations Guiding Principles on Business and Human Rights (HR/PUB/11/04). Available at https://www.ohchr.org/Documents/Publications/GuidingPrinciplesBusinessHR_EN.pdf.
[11] ILO, Tripartite Declaration on Principles concerning Multinational Enterprises and Social Policy, fifth edition, (Geneva, March 2017). Available at https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---multi/documents/publication/wcms_094386.pdf.
[12] OECD Guidelines for Multinational Enterprises, 2011 edition. Available at www.oecd.org/daf/inv/mne/48004323.pdf.
[13] OECD Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector, available at https://www.oecd.org/publications/oecd-due-diligence-guidance-for-responsible-supply-chains-in-the-garment-and-footwear-sector-9789264290587-en.htm.
[14] OECD-FAO Guidance for Responsible Agricultural Supply Chains (2016). Available at https://www.oecd.org/daf/inv/investment-policy/rbc-agriculture-supply-chains.htm.

leaders for the implementation of incentives to encourage continuous improvement in traceability and transparency for sustainability in sector activities.

- Promotion of sustainable consumption encouraging consumers to better understand their role and take action based on product information that comes from traceability and transparency activities. This should apply during the purchase, (re)use and disposal of products in order to reduce potential negative impacts and effects on society, human health and the environment, and to support the circular economy.
- Development and promotion of a common supporting framework across the entire sector and of guidance on the implementation of traceability and transparency for all industry stakeholders.

14. The last of the above needs to support the design of traceability and transparency systems for rapid and effective information exchange that allow value chain actors to take targeted actions based on their goals for supporting sustainable development and related, risk-based priorities.

15. At the same time, such systems need to be underpinned by a set of common, agreed rules which take into account their implementation costs, the capacities of all actors involved, and the importance of building the trust needed for sharing data. They also need to be practical and allow for the use of appropriate implementation technologies by facilities of varying sizes and technological capabilities, including farmers and small businesses.

C. Target audience

16. This recommendation offers a basis for action by both public-sector policymakers and private-sector decision makers who wish to advance due diligence, sustainability, and circularity approaches.

17. The recommendation can also serve as a reference for other industry stakeholders in their efforts to support the uptake and implementation of the recommended measures. These industry stakeholders include:

- Business and industry associations
- Consumers and consumer associations
- Intergovernmental organizations
- Investors/shareholders
- Local authorities
- Non-governmental organizations (NGOs)
- Scientific and technological community
- Workers and trade unions

D. Purpose and benefits

18. This recommendation responds to the call from industry stakeholders for government action in support of the following:

- Greater awareness by government, industry and the public of the benefits of traceability and transparency for due diligence, sustainability and circularity
- A level playing field where industry actors will benefit from a competitive advantage when they invest and take action to enhance traceability and transparency in their value chains in support of due diligence and sustainability
- More efficient ways for workers and consumers to access remedies for human rights violations and value chain disruptions

- A globally recognized and harmonized approach for collecting, exchanging, and validating information for traceability and transparency in the sector's value chains
- The use of standard data definitions and codes to facilitate the exchange of information (semantic interoperability) between IT systems that support traceability and transparency in the sector's value chains
- The fight against product counterfeiting, fraud, and illegal trade in protected species through the identification of origin (which means provenance and location of all products, parts, components, processes, and factories) and local content

19. The final objective of this recommendation is to establish a mechanism that enables governments, industry partners, consumers, and all other relevant stakeholders to make risk-informed decisions, overcome information asymmetry, communicate and achieve accountability for sustainability claims (including those for regulatory compliance) and anchor business models to responsible business conduct.

20. It does so by providing industry and other relevant stakeholders with a set of internationally agreed practices for the harmonized collection and transmission of data for tracking and tracing materials, products and processes across an entire value chain, including all involved facilities and intermediaries, as well as related information about the sustainability performance of these value chain participants. This will help to ensure the reliability of sustainability claims in the areas of human rights, fair labour practices, the environment, consumer interests and anti-corruption, while also allowing for simplification, cost-efficiency and improved organizational processes, especially for small and medium-sized enterprises (SMEs) and industry actors in less-advanced economies.

21. This recommendation includes implementation guidelines to assist policy and decision makers in better understanding tracking and tracing while also providing a framework for implementation by all stakeholders in garment and footwear value chains. The accompanying Call to Action provides a mechanism to monitor and keep track of implementation of the recommended measures, and to facilitate the exchange of best practices and lessons learned.

E. Challenges

22. Tracking and tracing in garment and footwear value chains is a multifaceted effort and a challenging task due to the organizational and technological complexities of the business networks in this industry, which often make it difficult for companies to track a product's history and attributes back to its origin.

23. Closing the circle after sale to the consumer to achieve circular economy goals is particularly challenging. This is due to a current lack of infrastructure for collecting and processing post-consumer textiles and leather; missing or inaccurate information about the composition of goods; limited life-cycle analysis information; and technical barriers to creating post-consumer traceability for enough products, in large enough volumes, to make traceability useful.

24. Compliance with data privacy and security principles and regulations is a critical aspect, and is of particular concern for brands, traders, and companies in the high-value segment of the market who often consider information about specialized providers to be an important competitiveness factor. In addition, there are challenges around ensuring that data systems are secure for all users.

25. Quality data and controls have associated costs. At the same time, the credibility (and legal acceptability) of claims depends on the accuracy, reliability, and authenticity of shared data; the strength of the controls validating materials, products, and production processes; and the proofs showing compliance with sustainability requirements. As a result, value chain actors need to carefully balance costs, data quality and controls to keep them all at acceptable levels.

26. The implementation of traceability and transparency requires substantial investments in systems and technologies for data entry, product labelling, and for performing various

levels of verification of processes, products, parts and components at all stages of the value chain. In this connection, technological barriers are a concern. Technologies such as blockchain and distributed ledger technologies, bar codes and RFID tags offer an opportunity, but mastering these technologies may be difficult due to geographical and language barriers as well as costs, available infrastructure, and environmental impacts. In addition, coordination between different value chain actors requires time and willingness on all sides. These costs are a concern for many actors pursuing traceability, and especially for non-vertically integrated companies, brands, and SMEs.

27. Identification of common tools, as proposed in this recommendation and its accompanying guidelines, helps to reduce costs for individual actors. When leadership is present and collaboration is widespread, there is greater incentive for actors to work together, which improves results and lowers overall costs, thereby helping to address the above challenges.

F. Recommendation

28. The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) of the United Nations Economic Commission for Europe (UNECE), at its twenty-seventh session, agreed to recommend that governments take the actions listed under the areas shown below.

Policy actions, norms and standards

(a) Establish harmonized policies and regulations that support the implementation of traceability and transparency, in order to achieve higher environmental and social standards, economic viability and circularity in garment and footwear value chains by:

(i) Encouraging responsible business conduct, which addresses actual and potential adverse impacts resulting from companies' decisions;

(ii) Ensuring the reliability of non-financial reporting and sustainability claims about materials, products, processes and facilities;

(iii) Contributing to international policy coherence, thereby addressing the challenges for producers and consumers that are created by a proliferation of similar, but different, policies and regulations, while also establishing a more level playing field for companies operating in this industry.

(b) Define minimum levels of traceability across garment and footwear value chains (from raw materials sourcing to consumption and post-consumption activities) and the minimum data that need to be collected in order to show due diligence and transparency in support of claims regarding the origin, composition and other characteristics, including the sustainability performance of products, processes and facilities.

(c) Encourage companies' efforts to embrace higher transparency in value chain operations, for example by disclosing the names and addresses of suppliers' factories and sharing relevant information on their sustainability performance with stakeholders who are impacted, or potentially impacted, by enterprise decisions. This should be done in a timely, culturally sensitive, open and accessible manner, in line with international data protection norms and standards.

(d) Reduce the implementation burden on businesses and support SMEs by promoting the use of international standards, such as the UN/CEFACT standards for traceability and transparency of sustainable value chains in garment and footwear[15] or the equivalent, and by encouraging the use of existing data.

Incentives

(e) Provide economic and fiscal incentives (positive and negative) for establishing and implementing value chain traceability and transparency systems, especially in support of

[15] See https://unece.org/trade/uncefact/brs for the list of business requirement specifications (BRSs).

SMEs, small farmers and producers, and other vulnerable groups such as women, young workers, home-based workers and migrant workers.

(f) Provide non-financial incentives, including measures to facilitate access to markets; fast-track processes; public procurement criteria that are green and socially responsible; specialized managerial and workforce training; public visibility; peer-learning and non-financial reporting requirements.

Research and development

(g) Support research and development, and identify and scale-up innovative solutions for:

(i) Advancing the sustainability and circularity of production and consumption processes;

(ii) Tracing and verifying products' authenticity and provenance;

(iii) Increasing the lifespan of products;

(iv) Creating more sustainable materials;

(v) Recycling, reusing and redesigning garments and footwear.

Awareness and education

(h) Provide education in order to:

(i) Allow consumers to make informed choices;

(ii) Create awareness of the shared responsibility of all stakeholders, including both business and consumers, to take an active role in preserving our planet;

(iii) Increase the demand for materials, products and processes that are more responsible and sustainable.

Multi-stakeholder collaborative initiatives

(i) Stimulate and support multi-stakeholder, collaborative initiatives that seek to achieve industry-wide change and create shared value for all industry actors. These should be inclusive, benefitting especially SMEs and vulnerable groups in developing and transition countries while, at the same time, addressing garment and footwear value chains' sustainability risks and impacts. Such initiatives could include:

(i) A global, open-source knowledge platform to make guidance available and ensure that industry actors receive appropriate training and information;

(ii) Multi-stakeholder policy dialogues for the sharing of good practices and lessons learned at the international, regional and national levels;

(iii) Pilot projects to experiment with innovative approaches and advanced technologies in traceability, including blockchain technology, artificial intelligence (AI), the internet of things (IoT), and biotechnology markers to ensure an effective connection between digital and physical assets.

29. When deciding upon specific actions to be taken, multi-stakeholder consultations are recommended in order to strike a balance between the different interests at stake, and to identify targeted implementation support for vulnerable groups. Special attention needs to be given to SMEs, smallholders, farmers, and other groups affected by unfair practices in this sector, including (as appropriate) women, young workers, home-based workers and migrant workers.

30. To monitor and keep track of the implementation of this policy recommendation, stakeholders are requested to report on commitments to the recommended measures starting in 2022, and thereafter every two years. Such pledges are to be expressed in accordance with the Call to Action (ECE/TRADE/C/CEFACT/2020/6/Rev.1), which is open to all industry stakeholders and actors embracing transformational change for a responsible and sustainable garment and footwear industry of the future.

II. Guidelines for Recommendation No. 46 on enhancing traceability and transparency of sustainable value chains in the garment and footwear sector

A. Introduction

31. These guidelines aim to assist policy and decision makers who wish to put in place or encourage recommended approaches for enhancing the traceability and transparency of sustainable and circular value chains in the garment and footwear industry.

32. *Traceability* is an essential requirement for creating transparency. It allows to identify where "assets" have been as they move through a value chain. As a result, when there is a final product, all the "assets" that were used to make that product can be identified, as well as their origin, characteristics and the way they have been processed and transformed.

33. *Transparency* requires companies to know what is happening upstream in the value chain and to communicate this knowledge to both internal and external stakeholders. This knowledge includes where, by whom, how, with what inputs and when the product was made. Indeed, more and more consumers are insisting upon value chain transparency for the products they buy, and they also tend to be willing to pay more for brands that provide this information.[16]

34. The surrounding *ecosystem* includes supporting policies, norms and standards, incentives, promotion, capacity building, and collaborative initiatives.

35. A *traceability system*, together with its surrounding *ecosystem*, forms a *traceability framework*.

36. This recommendation and its guidelines look at the planning and design of *traceability frameworks* across the entire value chain – from the production and processing of raw materials, through manufacturing, to finished product branding and retailing, consumption and post-consumption activities. It covers

(a) the *guiding principles* for effective and efficient traceability in garment and footwear value chains;

(b) the *key components* of a *traceability system*, encompassing all the practical processes, procedures and technology that make up a functional system;

(c) *cost allocation and incentive systems* as well as *creating inclusiveness*, because the success of a system depends upon having the participation of all value chain partners;

(d) *the supporting role of advanced technologies*, because they can improve the cost structure, operational effectiveness, and inclusiveness of traceability frameworks.

37. Annex I provides a complementary *roadmap* which presents a step-by-step approach for developing and implementing, from a practical standpoint, a traceability framework in support of sustainability from both the industry and government perspectives.

38. Annex II provides a *glossary* which establishes a common understanding of the terms used across all these documents.

B. Traceability principles

39. To develop and implement an efficient and effective traceability framework in the garment and footwear industry, several guiding principles should be taken into consideration:

[16] Alexis Bateman and Leonardo Bonanni, "What Supply Chain Transparency Really Means", *Harvard Business Review* (20 August 2019). Available at https://hbr.org/2019/08/what-supply-chain-transparency-really-means (accessed on 16 May 2020).

(a) **Awareness**: Key stakeholders and industry actors need to be aware of the benefits of traceability systems in terms of enhanced regulatory compliance and corporate value.

(b) **Knowledge**: A clear understanding of the purpose of a traceability system, its scope, and the information needed to promote sustainability and circularity in production and consumption processes. This includes the information which should be collected and exchanged about the traceable asset (what), and how it has been transformed, moved or stored – in other words, by which actors (by whom), at which locations (where), in which processes (why), and at which time (when).

(c) **Risk-based analysis**: To maximize impact and make the best use of limited resources, traceability systems should be focused on where there is the greatest likelihood of, and the greatest consequences from, non-sustainable practices and other risks the value chain participants may need to address. These risk areas differ between products, value chains and geographic areas, so an in-depth risk analysis is needed at the start of planning and implementation processes.

(d) **Commitment**: Policy and decision makers need to commit to traceability in the entire industry value chain – from the production and processing of raw materials, through manufacturing, to finished product branding and retailing, to consumption and post-consumption activities, and such commitment must be embedded into policy and legal frameworks, corporate strategies and key performance indicators for sustainability and circularity.

(e) **Engagement**: Traceability in the industry value chain requires a consensus approach and, therefore, engagement, buy-in and cooperation from a wide range of actors. To this end, the identification of their roles and the establishment of effective cooperation and collaboration mechanisms are essential. Due consideration should also be given to measures for supporting the participation of small actors, especially in emerging economies.

(f) **Structured implementation**: The implementation of traceability systems requires a high level of organization in the value chain for assets or groups of assets to be identified (tagged), traced, and related information made available, preferably in an electronic format.

(g) **Norms and standards**: Traceability systems are of greatest value if they are implemented using relevant norms and standards, including for the data to be collected and exchanged. Therefore, implementation should be based on available, recognized norms and standards for data, implementation, and certification of traceability in order to favour the harmonization of concepts, approaches and terminology, as well as the interoperability of systems.

(h) **Appropriate technology**: Tools and infrastructure to support effective traceability are key enabling factors. Digital technologies should be interoperable, and support for their use must come from all actors along the value chain and, when required, assistance should also be given to actors so that all value chain participants have access to the required technologies.

(i) **Inclusiveness**: Traceability systems need to be inclusive in order to integrate all stakeholders, including small and medium-sized companies, disadvantaged groups (such as minorities and women) and low and middle-income economies. Acceptance and support for a traceability system depends on its capability to integrate these stakeholders.

C. Key traceability-system concepts

40. *Traceability system* refers to all the practical processes, procedures, data and technology needed to create a functional system.

41. Value chain actors in the garment and footwear industry need to perform due diligence and exercise responsible business conduct to ensure that their products or services are made or provided in a way that does not harm the environment or result in unacceptable social conditions including human rights violations. Traceability systems are an effective way to

monitor and report on the sustainability of garment and footwear products throughout the value chain.[17]

42. Traceability systems can support **claims** about the characteristics of a product, a process, or an organization by collecting data to validate these claims based upon defined **verification criteria**.

43. To do this, a system needs to:

- Identify the **claim(s)** and the related **verification criteria** which will define the traceability information to be collected, exchanged and verified
- Identify the **traceable assets** for supporting the claim – which could range from raw materials through to final products
- Select the most appropriate **traceability models** for organizing the value chain's processes
- Track/identify traceable assets when they are transported in **logistics units**
- Consider the needs of post-consumption processes when identifying **verification criteria**
- Mark/tag each traceable asset and logistics unit with a unique **identifier (ID)**
- Record and link these IDs to **information** that will support the verification criteria
- Identify the **events** where data must be collected as the traceable assets move between the **entry and exit points** for traceability in the value chain
- **Have a verification process,** preferably carried out by third parties, which verifies that the data collected are accurate, aligned with the verification criteria and support the claims

Table 1
Summary of key traceability-system concepts

1. Claim *Why traceability? What is its objective?*	A claim is a high-level statement about **a characteristic of a product, or about a process or an organization associated with that product** (traceable asset). In order to show that the characteristic is true**, it is necessary to trace the asset as it moves through the value chain**.[18]
2. Traceable asset *What is being traced?*	The claim should be linked to a traceable asset, which is the material or product to be traced. It can be defined at different levels: • Individually (for example a single garment) • In batches from raw material production or manufacturing processes (for example a bale of cotton, one machine load of dyed fabric, or all of the products produced by one machine during a specified period such as a work shift or a day) • In trade units, which are quantities used for buying and selling (for example a package of shirts or a container-load of thread). In textile and leather value chains, **traceable assets are frequently transformed** (for example from cotton to thread to fabric). They **can also be aggregated/disaggregated** (into trade or logistic units) along their path. **Traceability is maintained from the farm to the final product through a "chain" of unique IDs.** For example, the output from each transformation process should be given a unique ID which is linked to the ID(s) of its input(s). **Unique IDs** are therefore vital in order to trace an asset back and forward along its path in the value chain.

[17] UNECE, *Traceability for Sustainable Trade: A Framework to Design Traceability Systems for Cross Border Trade* (ECE/Trade/429). Available at http://www.unece.org/index.php?id=43763.
[18] Ibid.

Which traceable assets to use will depend upon the objective(s) of a traceability system and the selected traceability model, as well as the processes in the value chain and the capabilities of value chain partners.

3. Logistics unit

Which package(s), pallet(s), container(s) are my traceable assets being transported in?

Logistics units contain traceable assets for transport and/or storage.

Most often they contain aggregated traceable assets (for example, multiple fabric rolls in a container), but logistic units may also contain disaggregated traceable assets (for example, one batch of thread spindles that is packaged onto multiple pallets).

Logistics units are given IDs in order to follow the traceable assets they contain. This is done by recording the IDs of the traceable asset(s) and linking them to the ID of their logistics unit. As a result, if a logistics unit is lost, the sender or receiver will be able to immediately identify the traceable assets it contained.

The majority of transport operators already have traceability systems and when a customer ships goods, the transporter provides the customer with a unique shipment ID. Complicating matters, the types of shipment IDs given vary across transport modes and even across operators. In addition, a customer may aggregate their traceable assets into logistics units which a transporter may combine into a still larger logistics unit (like a container) and give their customer a single shipment ID for various logistics units. With few exceptions, it is also unlikely that a company will be able to link their traceability system into that of their transporter(s).

Therefore, the easiest way to maintain traceability is for the customer to register the shipment ID from the transporter in their system and link it (within their own system) to the IDs of the logistics units and traceable assets that are in the shipment. They can then send to the receiving party the shipment ID with the IDs of the logistics units and traceable assets it contains. This should allow the receiver to verify receipt and maintain the traceability link across the transportation process.

Sometimes this chain of IDs can also be used for detecting fraud (for example if 6 fabric rolls from a weaver are loaded onto a container and 7, or 5, are unloaded). In addition, because logistics providers track only logistics units (and not what they contain), if there is a need to calculate CO2 emissions, then the information from the logistics provider about transportation routes and modes for a logistics unit needs to be linked to the traceable assets contained in the logistics units.

4. Identifiers (IDs)

How do you know what happens to what is being traced?

The path of a traceable asset (e.g. material, product, product batch) consists of a collection of information linked directly or indirectly to the traceable asset. To follow this path, the traceable asset must have a unique identifier (ID).

IDs are also required for all the entities (i.e. enterprises, locations, logistics units, etc.) and processes that information is collected about.

Whenever possible, IDs should be based on open, non-proprietary standards in order to support interoperability (for example, ISO/IEC 15459).

Many IDs are attached directly to individual traceable assets (products, batches or trade units) or a logistics unit. This is best practice, but is not always possible, especially during transformation processes.

For transformations, the IDs and quantities of inputs are recorded, the quantity of output is measured (to be sure it matches the input quantities) and a new ID is given to the output which is linked to its input IDs.

How these and other practices result in a “chain of IDs”, from the start of traceability through to its end, is explained in more detail below.

5. Traceability models

How should I organize processes to be sure that traceability is preserved?

There are three basic models for organizing the flow of traceable assets within a value chain to support a claim:

- Product segregation
- Mass balance

- Book and claim

These are applicable across a value chain from the raw materials stage through to finished products and are explained in more detail below.

6. Events

At which points are data collected in the value chain?

Events are those significant activities where data need to be collected. Depending upon the activity/event, data collection may take place just before or just after the event, or at both times. It is important to identify events in order to put in place the infrastructure for collecting data. The most common classification of events is explained further below.

7. Entry and exit points

When does traceability take place?

Entry and exit points are **the events (activities)** at the start and the end of the traceability process within the value chain. At each of these two points the traceable asset needs to meet specified criteria. For example, if the entry point is "harvesting cotton", the entry point criteria could be that "the cotton must have been raised according to an organic standard".

8. Verification criteria

Why should anyone believe the claim?

What is the information that needs to be collected in order to verify the claim?

Verification criteria define the **information to be collected** about the traceable asset, and the **scope of the verification process**. Verification criteria should be objective. These criteria are set by the verification requestor. The following description is in line with the ISO definition.[19] Criteria should include:

- A definition of the claim to be verified, including tolerances (for example, 50 per cent organic cotton with a tolerance of 5 per cent)
- The applicable process for verification (for example, which data need to be collected, which control methods should be used etc.)
- The standards and normative documents against which the claim is verified (e.g. ISO or industry standards/guidelines)

9. Verification process

How do you prove that your traceability process is working? Who is checking to be sure that the data are accurate, and also that no one is cheating?

Verification is "confirmation of a claim, through the provision of objective evidence, that specified requirements have been fulfilled".[20] In the context of traceability, the verification process is carried out by a verification body that analyses traceability events and validates the information about them against the verification criteria and any other transparency system rules.

Based upon risk analysis, independent verification may only be needed for selected stages of the value chain.

An independent verification agency could be from: (i) The public sector, such as a ministry; (ii) The private sector, such as an inspection service or industry association, or (iii) A public private sector partnership (PPP), such as an inspection agency appointed by the government.

The role of the verification process is to:

- Request from stakeholders selected traceability data from the relevant entry/exit points and from business processes between the entry and exit points (i.e. traceability events)
- Ensure that the data recorded for traceability purposes reflect what is actually happening in the value chain (for example through field inspections)
- Monitor and safeguard traceability by ensuring that assets meet entry/exit conditions and verification criteria (rules) are applied correctly[21]

[19] See ISO/IEC 17029:2019, Conformity assessment – General principles and requirements for validation and verification bodies.
[20] See ISO/IEC 17029:2019, Section 3.3.
[21] UNECE, *Traceability for Sustainable Trade: A Framework to Design Traceability Systems for Cross Border Trade* (ECE/Trade/429).

1. Sustainability claims

44. A claim is a high-level statement about a characteristic of a product, or about a process or an organization associated with that product (traceable asset).

45. A sustainability claim is a claim that covers one or multiple sustainability dimensions (economic, environmental, social).

46. Sustainability claims should be selected based on a value chain risk analysis, corporate objectives, and a company's commitment to responsible business conduct and due diligence.[22] The aforementioned value chain risk analysis should identify sustainability hotspots, taking into consideration the entire product life cycle – from raw material production to consumption and post consumption. When selecting claims to be made, these hotspots should be taken into account and the benefits from the claims clearly identified vis a vis both sustainability hotspots and life-cycle phases.

47. The contents of the claim should be easily understandable and may need to comply with legal requirements. Also, organizations that develop sustainability standards and guidelines often have rules about how they can be referenced in claims.

48. A claim should contain the following elements:

- **A clear objective** which sets out the **purpose** of tracing, and the sustainability requirement(s) to be met to achieve the purpose.
- **A description of the traceable asset** for the proposed claim.
- **A description of the proposed claim** which supports the objective and should be understandable, clearly stated and defined in terms of the physical characteristics or process(s) connected to the traceable asset.
- **The defined verification criteria** should be objective and measurable. They can be from a standard, a guideline or other document which describes the sustainability characteristics that a product, process or organization must have in order to conform to the claim. The criteria are what an auditor compares information against to determine if due diligence has been followed in ensuring a claim.

49. A suggested general format for claims is the following: [traceable assets] comply with [claimed state] in accordance with [verification criteria] for/to support [objective].

#1 Example of a sustainability claim (From brand X): The cotton in this shirt is at least 95% organic certified by Y certification body (which is a third party) in accordance with (XYZ) standard for ensuring responsible business conduct.
#2 Example of a sustainability claim (From company Y): This denim is made of 40% recycled cotton certified in accordance with (XYZ) standard and is finished with a new process that uses 60% less water than our previous process in accordance with (XYZ) standard for reduced environmental impact.
#3 Example of a sustainability claim (From company Z): These shoes were manufactured in factories free of gender discrimination which have been audited as compliant with (XYZ) standard for the prevention of discrimination and sexual harassment in the workplace.

50. Sustainability claims should go beyond the regulatory requirements of the production and consumption countries. When feasible, they should also encourage consumers to have a more active role in reducing the negative impacts of products on the environment and society.

51. To protect consumers from misleading claims, and to ensure a level playing field for businesses, sustainability claims should be accurate, relevant to the sustainability

[22] See ISO/TS 17033:2019, Ethical claims and supporting information – Principles and Requirements.

performance of the product and provide information that allows consumers to make more sustainable purchasing decisions.

52. With the exception of confidential business information and other legally restricted information, the documentation supporting sustainability claims should be easily available to all stakeholders, including consumers, and be presented in a way that allows them to assess the quality of the information.

2. Traceable assets

53. A traceable asset is any product or material (individually, in batches, or in trade units) that needs to be tracked along a value chain.

(a) Granularity of the traceable asset

54. When deciding which traceable assets to use, the **granularity of the traceable asset** needs to be decided upon.

55. Granularity determines the physical size of the traceable asset, including how aggregated it is. For example, options for the allocation of unique IDs include every individual product, shipping carton of products, production batch, container of goods, etc. In addition, a "production batch" can be defined at different levels of granularity. For example, a yarn manufacturer can typically choose whether they assign a traceable asset ID to a new production batch every day, every shift (e.g. 2-3 times per day) or to every bobbin in a particular ring-frame machine.

56. Granularity needs to be in line with the type of traceability model that is being implemented, i.e. product segregation, mass balance, or book and claim (for more information, see section C.5 on traceability models).

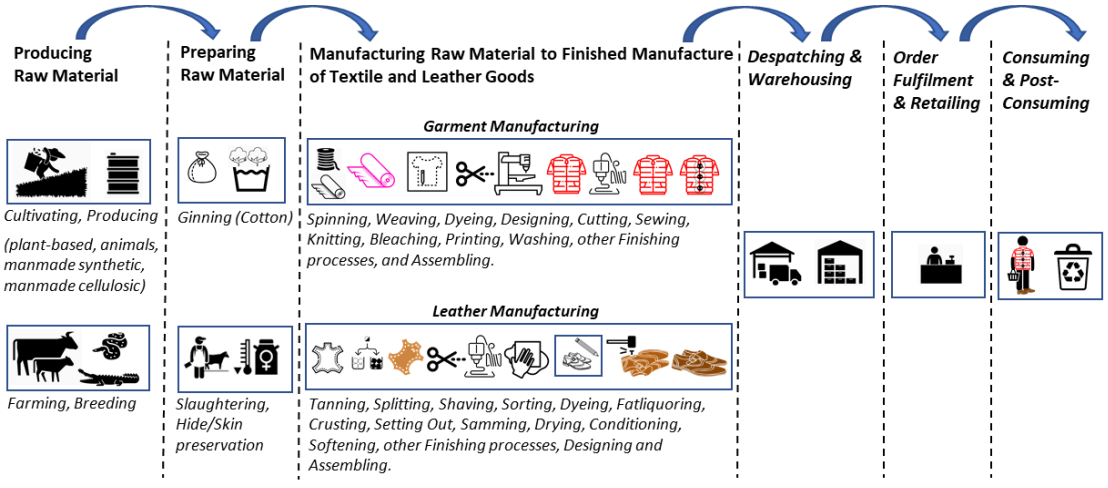
57. Higher granularity, while it provides greater accuracy, also means higher complexity (more IDs to be used and tracked) and higher costs, both internally and along the value chain (in transformation processes and shipments).

(b) Traceable assets and product transformations

58. Within the garment and footwear value chains, traceable assets are periodically used as inputs to processes that transform them into outputs which are new and different traceable assets. These outputs must also be traced and linked to their inputs so that when the customer receives a final product, all the inputs can be identified – by following the links of the chain back to the beginning.

59. Traceable assets need to be defined for each stage in the value chain, and the relationship between traceable assets that are inputs and traceable assets that are outputs needs to be clearly defined and recorded.

Figure 1
The main value chain stages for textile and leather products, parts and components



60. This can become complicated because there is often no one-to-one correspondence. For example, 1 batch of spooled thread might contain 3.5 bales of cotton – of which 0.3 bales came from a bale that was partially used in a previous batch. As a result, there are 3 bales allocated entirely to this batch, and then 0.3 and 0.2 (one left over from the previous batch and one that is not completely used in this batch) from bales that will need to be shown as input to two batches.

(c) Traceability information and data collection methodologies

61. Many points in these guidelines focus on the information related to identifying traceable assets (unique IDs) and identifying the locations and events that the traceable asset passes through along the value chain. In other words, they are related to establishing traceability.

62. Only after traceability has been established and all the key assets, participants, facilities and processes have been assigned unique IDs is it possible to go to the next step: transparency on sustainability. This requires the collection of information on the sustainability performance of products, processes and organizations in the main value chain stages outlined above (Figure 1). This information is linked to the unique IDs established for traceability and can be located by going back through the links in a value chain's traceability system.

63. The specific information to be collected is determined by the sustainability claim and careful thought needs to be given to the points in the value chain where this information should be collected (and linked to unique IDs). Efforts should be made to minimize the amount of data collected and to identify existing sources for the data. Risk-based analyses of a value chain's impacts are a valuable tool for identifying key sustainability data and their collection points within a value chain.

64. In addition, for business reasons, it may be useful to collect other information as part of a traceability system. Information related to product, processes, facilities/organizations and transport may be used by companies to improve the management and efficiency of their value chains, thus creating operational savings that could help pay for the collection of sustainability data. Some examples of where traceability information can improve operations are greater stock rotation, enhanced management of suppliers, reduced inventory shrinkage and distressed product sales, less waste, better management of targets (and rewards for reaching them) as well as improved service levels.

65. The Table 2 gives an overview of the types of information that are collected as part of a traceability and transparency system. The specific data to be collected will vary depending upon both the sustainability claims to be supported and the value chain management and sustainability objectives of the implementing parties. Some of this information can be obtained through either certifications or inspections.

Table 2
Traceability information

Product-related information	*Process-related information*	*Facility-related information*	*Transport-related information*
Origin: - Country and/or region and/or other origin criteria **Composition**: - Materials components - Product components	**Process inputs and outputs:** - Input volumes/weights - Output volumes/weights **Process events occurrence:** - Data - Time	**Economic-operator details:** - Supplier - Manufacturer - Subcontractor **Facility's value chain activity** (spinning, tanning, etc.) **Location:** - Main production unit(s)	**Economic-operator details:** - Transport or freight forwarding company - Owner/operator of the means of transport **Location:** - For picking up logistics units

Technical specifications:
- Materials specifications
- Product specifications

Product identification (IDs):
- Individual product/material
- Product/material batch
- Product/material trade unit

Quality:
- Characteristics
- Inspections
- Certificates/audit reports (product / materials)

Other management information:
- Cost(s)
- Sales data
- Surplus or damaged materials / product

Sustainability:
See table below on sustainability data

Process identification (IDs):
- Process (product) inputs
- Process (product) outputs
- Type of process
- Equipment (machine)
- Machine operator

Sustainability:
See table below on sustainability data

- Subordinate production unit(s)
- Address
- Physical coordinates

Facility & economic-operator identification (IDs):
- Economic Operator
- Main facility
- Subordinate facility

Sustainability:
See table below on sustainability data

- For delivering logistics units

Transportation (IDs):
- Logistics units
- Conveyance means (truck, railcar, ship, container if applicable)

Sustainability:
See table below on sustainability data

Sustainability-related information[23]

Environment-related information	*Human rights and labour-related information*	*Health and safety-related information*
Hazardous chemicals	Child labour	Unsafe workplaces and work practices
Pesticide and fertilizer use	Forced/compulsory labour	Inadequate personal Protective equipment (PPE)
Water use	Trade unions and collective bargaining rights	
Water pollution and wastewater management	Discrimination (women and minorities)	*Ethics-related information*
Waste production and management	Sexual harassment	Bribery and corruption
End-of-life: - Durability - Recyclability - Reusability	Exploitation of home workers	Land rights and community welfare
	Working conditions: - Wages	Animal welfare

[23] For more information, see the following: OECD, *Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector*; the ITC Standards Map; UNEP Report, Sustainability and Circularity in the Textile Value Chain: Global Stocktaking (2020); SA8000® Standard by Social Accountability International (SAI); Sustainable Apparel Coalition; Global Reporting Initiative (GRI), Sustainability Reporting Standards; Global Fashion Agenda and Boston Consulting Group, *Pulse of the Fashion Industry.* Report (2018); UNECE, *Accelerating action for a sustainable and circular garment and footwear industry: which role for transparency and traceability of value chains?* Policy Paper (2020).

Air pollution	- Working times - Contracts (with workers and/or subcontractors) - Temporary employment
Greenhouse Gas (GHG) emissions: - Direct GHG emissions - Transport CO2 emissions	Recruitment practices
Energy consumption	Lack of social security
Soil degradation	
Deforestation	
Biodiversity and ecosystem depletion	

Sustainability certificates or inspection reports
Certificate type
Certificate ID
Issue and expiry dates
Issuing agency ID (optional: name and address)
Standards certified/inspected for
Claim, and if claim is approved or not
Additional data (may include copy of actual certificate or inspection report)

3. Logistics unit

66. Giving IDs to logistics units is important for preserving chain-of-custody information across transport activities. There is, however, nothing more to add to their description than what is found in the table at the beginning of this section.

4. Unique identifiers (IDs)

67. Traceability requires information about traceable assets, including information about their what, where, when, who and why. To specify the asset and link it to events, each of the following six data components of a traceability system, that are related to an event, must have a unique identifier (ID) if a system is recording information about that component.

- **Party** (company or individual – farmer, tanner, ginner, weaver, subcontractor...)
- **Traceable asset** (raw material, intermediate or finished product, production or product batch, or trade unit)
- **Facility** (farm, manufacturing site, etc.)
- **Process** (harvesting, spinning, dyeing, etc.)
- **Location** (farm, production site, etc.)
- **Transport** (means of conveyance for goods and **logistics units** used for transporting traceable assets).[24]

68. Each event that affects the traceable asset should be registered and linked to the relevant ID(s).

69. The uniqueness of IDs for traceable assets should be ensured by whoever assigns the ID, which could be a party within a company (i.e. for production batch IDs) or a trading partner in the value chain (i.e. for trade-unit numbers such as packages), etc. It is also

[24] If the transporter is not a full participant in the traceability system, the company shipping goods may only be able to link the logistics unit that they give to the transporter to the shipment ID provided by the transporter (see the explanation in Table 1 under logistics unit).

important, to the maximum extent possible, that IDs be selected and attached to traceable assets in a way that prevents the ID from being counterfeited or lost.

70. Because value chains include multiple partners, interoperability (the ability to exchange data with a minimum amount of transformation) is important. The best way to achieve interoperability is to agree upon a common standard for both IDs and the format of the data to be exchanged. There are many options for ID standards, some of which are free and available under open licence. Examples of some ID standards are shown in Table 3. For operating purposes, it is important that each value chain participant have control over their own IDs, within the context of the agreed standard.

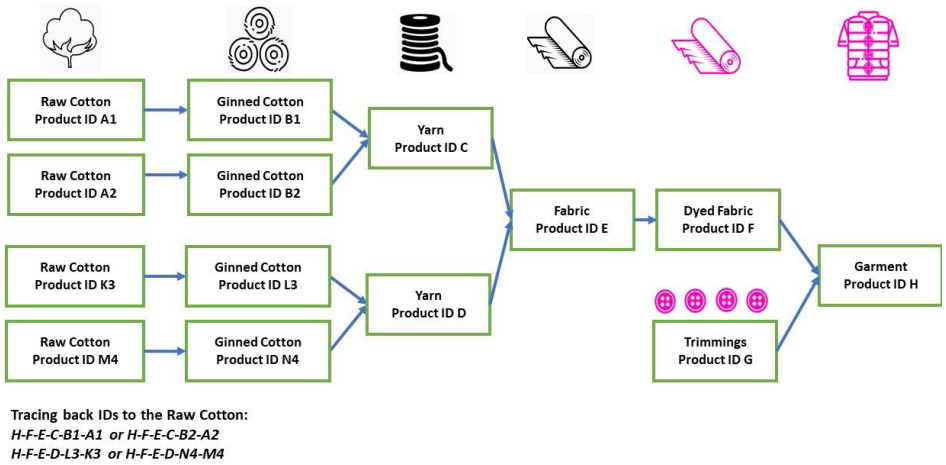
(a) Maintaining traceability information across product transformations in the value chain

71. The majority of traceable assets are transformed as they move through a value chain. Therefore, the effectiveness of a traceability system depends upon maintaining accurate links to information about materials and products as they move through various transformations.

72. For example, at the beginning of the value chain, the traceable asset may be a bale of cotton, which is transformed into thread, then into cloth and, at the end, it may be a shipping carton of cotton shirts. Each of these traceable assets (cotton bale, thread, fabric, carton of shirts, etc.) must have a unique ID that is linked to the unique IDs of the input(s) used for its creation.

73. In other words, all the transformations a given traceable asset passes through should be recorded in a way that will enable it to be associated with its "ancestors" (i.e. the IDs for the inputs to the traceable asset), and with its "progeny" (i.e. the IDs of the outputs where the traceable asset was an input). Because value chains can be quite complicated this can result in different scenarios for the splitting, joining, and merging of traceable assets.

Figure 2
Tracing product origin using product IDs



74. Maintaining accurate links between IDs across the value chain is called *referential integrity*. To monitor the referential integrity of identifiers for traceable assets along the value chain, and to verify other traceability information, links must be established between identifiers for traceable assets, identifiers for companies and identifiers for physical places. A range of options exist for IDs, some of which are given in the Table 3 below.

Table 3
Examples of IDs

ID	*Type of ID*
United Nations Location Code (UN/LOCODE)	Location
Global Legal Entity Identifier (LEI)	Organization

ID	*Type of ID*
Open Apparel Registry ID (OAR ID)	Facility
Global Trade Item Number (GTIN)	Product
National tax IDs for companies	Organization

75. The information linked to IDs depends upon what the "requestor of traceability" has asked for and what is needed to perform due diligence in support of the claim. There are a wide range of options, including test or audit results, the IDs for inputs, the certification status of value chain participants and/or the certification of specific locations, production lines or processes within a larger company, etc.

76. In addition to changing when there are transformation events, IDs for traceable assets may change based on aggregation or disaggregation events. To give a simple example, aggregation could be the placing of multiple products in one box for sale as "a box" and disaggregation could be the removal of products from a box for the purpose of sale as individual items. If the custody and/or location of goods is being traced, it is also important to record unique IDs for logistics units. A logistics unit is created when traceable assets are aggregated (put together) or disaggregated for the purposes of transport. The size of logistics units can range from boxes to pallets to containers.

77. Information about the possession of the goods (for example by processors, subcontractors, transporters and/or warehouses), is also known as the "chain of custody" (see box "Traceability or chain of custody?" below). This can be used for inventory management, for locating goods and for identifying who possessed the goods when negative events occurred such as damage or "contamination" with goods from outside of the traceability network (i.e. with goods that may not conform with the product claim).

Traceability or chain of custody?

An often-used definition of **traceability** is found in the ISO standard 9000:2015, which defines it as: "The ability to trace the history, application or location of an object." In another example traceability is defined as "The ability to access any or all information relating to that which is under consideration, throughout its entire life cycle, by means of recorded identifications".[25]

A "traceability system" is one that implements traceability as described in one of the very similar definitions given above.

Chain of custody in value chains has its origin in the legal term which refers to "a chronological documentation of the handling of evidence throughout a criminal investigation. [...] When a trial takes place, the prosecution and defence use evidence to prove the facts of the case. [...] A primary means of authenticating an item involves analysing the chain of custody for evidence. This refers to the chronological documentation of who handled it, what they did with it, and where they stored it."[26]

If you substitute "product" or "traceable asset" for "it" in the last sentence, then you also have a good definition for chain of custody in value chains.

This illustrates that the concepts of "traceability system" and "chain of custody" are very close and, at least in some cases, appear to be synonymous (when traceability starts at the moment of creation of a traceable asset). Unfortunately, in the literature on traceability and chain of custody there does not appear to be a consensus on the difference, so one can find different texts that give almost the same definition for traceability as for chain of custody and vice versa.

[25] Olsen, P., and Borit, M., "How to define traceability", Trends in Food Science & Technology (2012), available at https://fishwise.org/wp-content/uploads/2017/12/081314_OlsenBorit_HowToDefineTraceability.pdf.
[26] See https://legaldictionary.net/chain-of-custody.

Therefore, in these guidelines

- "Traceability" is defined as "the ability to trace the history, application or location of an object" in a value chain.[27]
- "Traceability system" means the practical system of processes, procedures and information exchanges that implements traceability.
- "Chain of custody" refers to the documented chain of parties who had possession of the goods at every moment between the entry and exit points in the value chain where traceability took place.[28]

78. Successive links in a value chain between traceable assets, and between traceable assets and logistics units, should be recorded. For this to happen a traceability system should do the following:

- Ensure a secure integration between the physical product levels (represented by the unique IDs for traceable assets) and the information associated with IDs at each level.
- Ensure an accurate history of traceable assets[29] throughout the transformation, shipping, and storage processes. This history includes: i) the links between IDs (i.e. between input and output IDs and between logistics-unit and traceable-asset IDs) and ii) the links between traceable-asset IDs and associated information about some or all of the traceability components listed at the beginning of this section.
- Predefine, in line with company objectives and the product claim(s), the information to be recorded during transformation, aggregation and disaggregation processes throughout the entire value chain.
- Ensure continuous monitoring and periodic validation of the data recorded at each process stage.
- Associate the flow of information with the physical flow of the products by registering departures and arrivals.

79. In summary, implementors will need to put in place two types of identifiers:

(1) Unique identifiers for categories or types of entities. For example, types of garments (SKUs), machines, materials, etc. For many of these categories, for example, type of package or type of transport mode, there are existing standards in the form of code lists. Some of these are maintained by industry bodies, some by standards bodies such as UN/CEFACT.

(2) Unique identifiers for individual entities. For example, products with serial numbers, companies, production batches, shipping containers, etc.

80. For some entities both types of identifiers will be needed, for some only one.

81. Which IDs need to be implemented and when will depend upon the claims being made, the products, processes, etc. Following is a list with some of the entities for which IDs, of both types are frequently implemented.

[27] ISO 9000:2015.

[28] ISO 22095:2020.

[29] In the case of "book and claim" based traceability systems, the certificates used for "booking" the claims must be firmly linked to the traceable asset that the claim is being made about. For example, if the claim is about use of organic cotton, and certificates are purchased to claim 100% of the cotton in bale A as organic, as that cotton goes through the value chain, and is mixed with cotton for which no certificates were purchased, it is important to ensure that the "claimed" organic cotton content does not exceed the amount of cotton that comes from bale A.

Table 4
Entities for which IDs are frequently implemented

Parties	Materials	Transport means (i.e. trucks)	Location (for any entity, but frequently for facilities, storage, transport pick up or delivery, etc.)
Organizations	Products	Transport containers	
Production facilities	Product batches	Logistic units	
Production units	Production processes		

5. Traceability models

82. "Traceability model" refers to the organization of a value chain in order to ensure that traceability can be implemented. There are different traceability models whose usefulness depends upon the type of product and the claims being made. The most appropriate model may also change along the value chain. Therefore, value chains may need to implement more than one traceability model. Examples of traceability models which can be applied to products throughout the entire value chain are product segregation, mass balance, and book and claim.

83. The most appropriate traceability model will depend upon factors such as:

- The nature of the traceable asset: for example, the smallest unit of raw cotton from a farm that can be traced is probably a bale of cotton; or from a slaughterhouse, a single-leather hide.
- The claim: for example, if the claim says, "this is a real brand X product and not a counterfeit", then the traceable asset will be the finished product and not, necessarily, its components. There are also significant differences in the traceability required for claims about materials (for example type of cotton) and the traceability for claims about processes or organizations (for example, no use of child labour).
- The capacities of value chain participants: for example, if a value chain partner's production facilities are located in areas with poor (or very expensive) Internet access, it would not be realistic to expect them to participate in a system which requires them being constantly connected to the Internet.

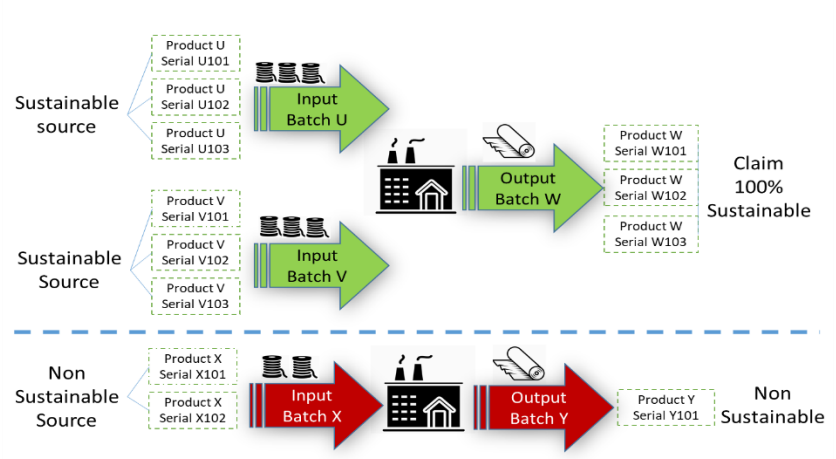
(a) Product segregation (the preferred and most demanding model)

84. The preferred model for a traceability system is product segregation. The objective is to ensure that:

- Products produced according to the same sustainability standard are strictly separated from other products
- Bulk raw materials which are certified are strictly separated from non-certified materials (but can be mixed with certified materials from different producers)
- Material which is certified is strictly separated from the non-certified materials throughout the value chain to provide traceability from a specific plantation to the final consumers (identity preservation)

85. With product segregation there is a physical separation of certified materials and products from non-certified materials and products at each stage in the value chain. This ensures that certified and non-certified materials and products are not mixed and that the end product comes from a certified source.

Figure 3
Product segregation



86. There are two product segregation approaches: "bulk commodity" and "identity preservation". Whenever sellers are required to be able to identify the supplier of the traceable asset, identity preservation is required. For example, in the European Union this is the case for timber and fish and in the United States of America for timber and conflict minerals.

- The **bulk commodity model** separates certified raw materials from non-certified materials but allows the mixing of certified materials from different producers. All producers must comply with the certification standards. This model is often used for organic raw materials such as organic cotton or vegetables.
- The **identity preservation (IP) model** also requires segregation of the certified material from the non-certified material, but it **does not** allow mixing of certified materials from different producers in the value chain. The IP model enables the traceability of products back to the originating farm, forest, or production site. The IP model is sometimes criticized for being cost and resource intensive and requiring advanced technology since all material sources must be strictly separated, controlled, and monitored at each stage of the value chain. To implement the IP model, companies must know all their suppliers and collect and verify data at all levels throughout the value chain.

87. Product segregation requires well-defined administration and process design in order to be implemented.

(b) Mass balance (a moderately demanding method)

88. It is not always feasible to segregate sustainable and non-sustainable products and materials from the perspective of efficiency and/or production processes. In the "mass balance" model, products from both sustainable and non-sustainable sources are mixed, but as they move through the value chain an exact account is kept of the volume ratios. The purpose is to guarantee that the amount of sustainable content claimed is equal to the amount of sustainable products or materials used. As is the case for product segregation, implementing a mass balance model requires a well-defined administration and process design.

Figure 4
Mass balance

89. This model is commonly used for products and raw materials where segregation is very difficult or impossible to achieve, such as for cocoa, cotton, sugar, and tea.

(c) Book and claim (the least demanding model)

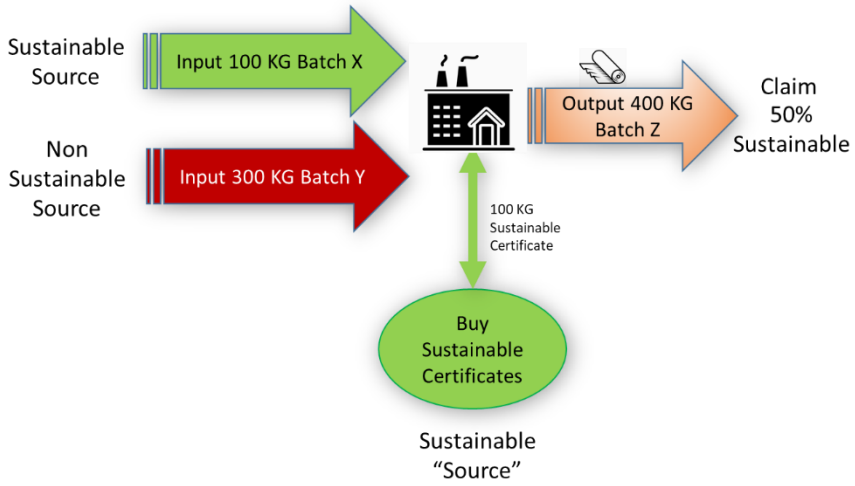
90. If product segregation is impossible (e.g. green electricity) or the registration of the volume ratios of sustainable and non-sustainable products and materials is impossible, a "book and claim" model can be applied.

91. When non-sustainable and sustainable physical products or materials are mixed and sold, the right to claim sustainable sourcing is traded in the form of sustainability certificates. A central authority monitors the sustainability claims by brands and retailers and compares these with the number of certificates issued and traded.

92. In the book and claim method there is a free flow and mixing of certified and non-certified assets, with no segregation of assets, so it is actually a mixed product that is sold. Instead, a producing company can obtain sustainability certificates for the volume of goods that it puts into the value chain which are certified as following a good practice. These certificates are then sold via a platform, or by the certifying organization, to companies who use the type of goods in question as inputs to their products. The purchaser of the certificates can then claim that their product supports the sourcing and production of raw materials grown or processed according to the good practice in question – even if it is not certain that their product actually contains certified material.

93. The earnings from the sale of certificates is used to make payments to the producers whose goods were certified as using the good practice, thus providing an incentive for other growers to be certified.

Figure 5
Book and Claim



94. Under the book and claim model there is no physical relationship between the amount of sustainable inputs included in a product and the amount of sustainable content that is

claimed. Instead, the producer of the goods purchases sustainability certificates to cover the difference between the amount of actual sustainable input in the product and the amount that the producer wants to claim. These certificates are then used to reward farmers who produce an equivalent amount of sustainable inputs (which will be used to produce other products).

95. This is shown in the illustration above where a production plant receives inputs, of which 25 per cent (100 kilos) have been sustainably created. Because the producer wants to claim that 50 per cent of their product is sustainable, they purchase (book) certificates for another 25 per cent (i.e. another 100 kilos). The money paid for the certificates is then paid to a farmer who proves that he has created 100 kilos of sustainable inputs (for use in other products. This creates a financial incentive for producers to make sustainable inputs and sell them at prices that are competitive vis-a-vis non-sustainable inputs.

96. This model is typically used when the production and market conditions make it impractical to sell certified product that has been segregated from non-certified product. At the same time, this model requires careful accounting and audit trails in order to demonstrate that for every certificate sold, certified growers have been compensated for the associated quantity of certified goods. This model is used for soy and palm oil.

97. In summary, product segregation requires advanced information and communication technology (ICT) implementations, in which the farmers and micro, small and medium-sized enterprises (MSMEs) participate. It is used for high-risk and delicate products, such as fresh food, high-value products and products where regulations require that the specific origin of the product be known. Mass balance and book-and-claim models, on the other hand, require less advanced ICT systems. This is because they are based on a set of rules and require only periodic auditing by stakeholders. As a result, one factor that must be taken into account when selecting a traceability model is the ICT capabilities of participants in value chains – which vary greatly.

6. Events

98. Events are those activities where data are collected. Depending upon the activity/event, data collection may take place just before or just after the event, or at both times. This is determined, in large part, by the type of traceability event. Traceability systems usually collect, for each event, data for the 5Ws: who, what, where, why (how) and when. It is important to know when something related to the product happened in order to establish continuous visibility of all activities at all stages of the product life cycle. The “when” can be expressed as the date and time at which the event took place and can also include the applicable time zone. EPCIS, an ISO standard[30] for traceability information, also uses the “when” to indicate if an event occurred after the time of the last request for information.

99. The most common classification of traceability events is as follows:

- Aggregation [disaggregation] events: traceable assets are put together into a logistical unit or other traceable asset or are removed from a logistical unit or other traceable asset. For example, assets 1, 2 and 3 are packaged onto pallet C [aggregation] and, later, asset 1 is removed from pallet C [disaggregation].

  In the case of aggregation, there are input IDs (for assets being aggregated) and a unique ID for the aggregated total. In the case of disaggregation, the ID(s) of the input(s) removed from the aggregation total (with its ID) need to be registered.

- Transformation events: Traceable assets are often inputs to a process that transforms them into a new traceable assets.

  For example, spools of thread that were assets with the IDs 1, 2 and 3 are inputs to a process that weaves a new traceable asset: a fabric roll that has an ID X.

- Transaction events: The traceable assets are associated with a trade transaction.

  For example, assets with IDs 1, 2 and 3 are used to fulfil a purchase order (or contract) with the ID X.

[30] ISO/IEC 19987:2017, Information technology — EPC Information Services (EPCIS) Standard.

- Object events: These are where traceable asset(s) participate in an event that is not an aggregation, transformation or transaction event.

  For example, assets with the IDs 1, 2 and 3 are transported by a truck with the ID A, or they are stored in warehouse that has the ID B.

100. It is important to identify events in order to put in place the infrastructure for collecting data.

7. Entry and exit points

101. Entry and exit points are the events (activities) at the start and the end of the traceability process within the value chain. At each of these points the traceable asset needs to meet specified criteria.[31]

102. **The primary factor in deciding upon entry and exit points should be the identification of what must be traced, and when, in order to support the claim.**

- Keeping in mind the claim, it is important to clearly establish the authorized activity(ies) or locations where the traceable asset enters and exits the **traceability** system.
- Based on the verification required for a specific claim, the transformation and logistics processes that take place between the entry and exit points in the value chain should be visible. Visibility at each node (activity or event) consists of providing a minimum set of information, including a location ID; a timestamp[32] for entry and one for exit from the event; the ID for the traceable asset coming out of a process; and the ID(s) for its ancestors (the inputs). This is greatly facilitated when there are information systems for data interchange, and standards for determining the types and formats of the data elements to be recorded.

103. This means the first step in developing the traceability solution is identifying the entry and exit points (value chain activities/events) which mark the start and the end of the value chain that the traceability system will trace. Good choices for entry and exit points are locations where business processes are well controlled, i.e. where there is a high level of automation, and business processes are well documented and enforced.[33]

104. The traceable asset is assumed to have specific and defined states at the entry and exit points. An example of typical entry and exit points are landing zones in ports, customs control points, inspection points, etc. For example, one system for sustainable furs uses a certification system for farms who have an ID that is registered with a third party, and each fur has a unique ID tied to the farm it came from. As a result, auction houses can trace a pelt back to its origin. Therefore, the auction house could be a good entry point for a traceability system that supports a claim about good animal welfare practices at fur farms.

105. Another example is for tracing organic cotton used in the manufacturing of garments where an entry and exit point could be defined as follows:

- Entry point: Cotton farms in Egypt that are certified in accordance with an organic cotton standard by an authorized verification body/inspector
- Exit point: Traders of cotton garments in Italy whose garments are certified in accordance with an organic cotton standard for each transaction as products are shipped or received

8. Verification criteria

106. Verification criteria are the standards and key performance indicators that traceable assets are supposed to meet and the rules for the supporting traceability process. These

[31] The document ECE/TRADE/429 provides guidelines to take into consideration when deciding upon, reporting and monitoring traceability systems' entry and exit points.
[32] The event time, and optionally the time zone, for all relevant activities through all stages of the product's life cycle.
[33] For further detailed, see document ECE/TRADE/429.

criteria are the basis upon which verification processes are carried out by auditors or other verification agencies in order to prove that the traceable assets have complied with relevant claims.

107. As discussed above, for the success of a traceability system it is important to have well-defined states at the entry point and the exit point as these are among the verification criteria.

108. Other verification criteria that may be useful include the following:

- Defined governance options and mandates that assign responsibilities for the coordination, implementation and distribution of traceability tasks and their verification
- Procedures for organizing, recording, and reporting **product conditions** at entry/exit points and at transformation, aggregation, and disaggregation event points (see the section on traceable assets above) as well as the beginning and end of shipment processes in line with regulatory guidelines, standards or certificates or other sustainability criteria

109. Verification criteria should be developed through inclusive multi-stakeholder involvement to ensure the greatest transparency and credibility of the resulting sustainability claims to consumers and businesses. This process is described in more detail in Annex 1. Harmonized, common verification criteria, for example, across an industry, can reduce overall costs and provide a better basis for equal and fair trade in the marketplace, especially when claims are related to regulatory requirements or established industry norms for sustainability.

9. Verification processes: the role of audit and certification

110. A traceability system can be imagined as a filing cabinet because it requires the systematic identification, storing and retrieving of data. However, neither a traceability system nor a filing cabinet are concerned with what types of data are being stored.[34] Fraud and errors can falsify records or render them incomplete; thus, there is a need to verify data using comprehensive verification methods including audit, certification, chain of custody information, and testing for physical markers.[35] The level of verification and the methods used depend upon the requirements defined by the traceability requestor.

(a) Audit

111. To create confidence in a claim, an audit process should take place in order to confirm that the predefined rules for the traceability process have been followed, and to prove that the traceable assets comply with the defined sustainability requirements and their performance indicators.

112. Audits protect the integrity of the claim and may include audits of management systems. Auditors collaborate with relevant value chain partners and government agencies. They receive data on relevant events in the value chain transactions and evaluate the information against the defined conditions and rules.

113. The role of the audit is to:

- examine data from the relevant entry/exit points in the value chain
- examine data on the business processes recorded between the entry and exit points (i.e. traceability events)

[34] Olsen, P., and Borit, M., "How to define traceability", *Trends in Food Science & Technology* (2012), available at https://fishwise.org/wp-content/uploads/2017/12/081314_OlsenBorit_HowToDefineTraceability.pdf.

[35] Kelly, S., Brereton, P. Guillou, C., Broll, H., Laube, I., Downey, G., Rossman, A., Hozl, S. and van der Veer, G., "New approaches to determining the origin of food", in *Food chain integrity. A holistic approach to food traceability, safety, quality and authenticity*, J. Hoorfar, K. Jordan, F. Butler and R. Prugger, eds. (Woodhead Publishing, 2011).

- ensure that the data recorded for traceability are consistent with what is actually happening in the value chain
- monitor and safeguard traceability by ensuring that assets meet entry/exit conditions and rules are applied correctly.

114. The auditors could be from the public sector, connected to a ministry; from the private sector (for example an industry association or a private inspection agency); or from a public/private sector partnership (PPP) such as an inspection agency appointed by a government.

(b) Certification

115. Certification of sustainability practices can be an important tool as part of a company's due diligence. At the same time, it is worth mentioning that it is a complementary tool and not sufficient as the only due-diligence mechanism because it needs to be undertaken following best practices and implemented in conjunction with robust traceability. Certification plays a similar role to that of independent audits (third party validation of sustainability claims), as its role is primarily for verification. Certification can provide trust and facilitate the collaboration process among value chain actors. At the same time, it imposes additional administrative and organizational costs, and when it is used best practices should be followed. Certifications for sustainability processes follow these best practices; they:

- are independent
- are aligned with internationally recognized standards for sustainability and circularity of value chains in garment and footwear (e.g. ILO fundamental labour standards, OECD due diligence guidelines, etc.)
- evaluate criteria on a scientific basis
- follow a risk-based approach
- verify full chain of custody with an eye to avoiding fraudulent mixing of non-certified materials
- are easy to use and understand
- are affordable and scalable
- make training available to small value chain actors on how to follow the standards and practices upon which the certification is based.

116. Certification bodies should document the governance of their certification process, as well as the criteria and methods used, in a transparent and clear manner.

D. Cost allocation and incentive systems

117. Estimating the implementation cost of a traceability and transparency framework, and making decisions on cost allocation, are key factors in its uptake and implementation. A key role is also played by effective and efficient systems of both public and private incentives, as well as by accountability mechanisms.

118. Costs related to traceability and transparency exist in two forms: the first is the cost linked to the development of the system; the second is the cost for its ongoing implementation, including for data collection, supporting data exchange between systems, inventory management and labelling. In addition, there may be costs associated with meeting sustainability verification criteria such as certification or audit. It is important to highlight that development costs also include identifying and implementing a standardized dataset for information exchange among partners. The use of such standardized datasets is key to ensuring that everyone is "speaking the same language" and that shared data are interpreted consistently and correctly. The decision about which information exchange standards to use should consider not just the costs on a short-term basis, but also the longer-term efficiency gains from having common data standards used by all actors across the whole value chain.

The UN/CEFACT information exchange standard for traceability and transparency of sustainable value chains in the garment and footwear industry serves this purpose.

119. When deciding the cost allocation for value chain partners, criteria that could be taken into consideration are as follows:

- How the profit margins are distributed
- The relative price of partners' outputs
- Partners' product volumes
- Partners' needs
- The allocation of benefits from the traceability system

120. When it comes to incentive systems for value chain partners, two main types of **incentives** can be identified: financial and non-financial.

121. **Financial incentives** include economic and fiscal incentives, both positive and negative, that **governments** can adopt to support value chain traceability and transparency. Among these possible incentives are the following:

- Financial support to digital technological innovation
- Investments in physical and digital infrastructure
- Direct incentives for the development of interoperable solutions and digitalization
- Preferential financing loans and grants on the base of traceability and transparency criteria
- Funding of feasibility studies and pilot projects, particularly in value chains with a high concentration of SMEs

122. Governments, financial institutions, and donors (for developing countries), should consider supporting projects that create shared value for a large number of stakeholders and value chain actors, giving priority to SMEs and small suppliers in emerging countries.

123. On the other end, **industry actors** such as brands and retailers, could consider implementing private financial incentive schemes for suppliers of traceable fibres and materials; or suppliers with harmonized or interoperable systems; or small suppliers needing assistance to cover part of the initial implementation cost.

124. **Non-financial incentives** are complementary to financial incentives. On the **government** side, such incentives could include the following:

- Measures to facilitate market access
- Fast-track processes and expedited customs clearance for products with higher traceability and transparency
- Specialized managerial and workforce training
- The development and nurturing of open-source (see box "Definition of open source" below) and open-licence tools and data
- Traceability and transparency criteria for green and socially responsible public procurement
- Cradle to cradle criteria as part of an overall policy for waste management supported by government procurement
- Public visibility, both positive and negative

125. In addition, **industry actors** could encourage participation through user-friendly interface designs for the apps used for data entry (to make it as simple as possible) and through free training for SMEs in their value chains.

126. The underlying principle behind the use of incentives is to lighten the burden for actors such as SMEs, women-led firms and value chain participants in developing countries.

127. Regarding responsibility, a **shared accountability** principle is suggested. Every actor in the value chain should be held accountable for any lack of traceability and transparency within their "link" in the chain. The role of governments is to adopt and enforce regulatory systems (in particular, norms) that create a level playing field both within their country and at an international level. Intergovernmental organizations and international non-governmental organizations can help by supporting the alignment of initiatives and legislation around a model regulation for traceability and transparency, both in developed countries where value chains are often "designed" and in developing countries where manufacturing and labour-intensive activities are predominant. Legislation should enable accountability and identify remediation mechanisms and mediation actors.

Definition of open source

"Open source" describes resources that are free, thus facilitating access by SMEs, developing countries and academic institutions and allowing large organizations to make better use of their resources. The term originated with open-source software and, over the years, has also taken hold in engineering and other fields. A definition of open-source software can be found on the website of the Open Source Initiative (OSI) at https://opensource.org/osd. The open-source model is based upon the granting of licences, and a variety of standard licences meet this definition. The most frequently used are listed at https://opensource.org/licenses.

A summary of the OSI open-source definition is below. It is, generally, also applicable to open-source applications in other fields – if one substitutes relevant equivalents for the terms "source code," "program(s)" and "software". Places where there is additional text in the definition are marked with "…"

"**The distribution terms of open-source software must comply with the following criteria:**

1. **Free redistribution**....

2. **Source code** – The program must include source code, and must allow distribution in source code…

3. **Derived works** – The licence must allow modifications and derived works….

4. **Integrity of the author's source code**... The license must explicitly permit distribution of software built from modified source code. ….

5. **No discrimination against persons or groups** – The licence must not discriminate against any person or group of persons.

6. **No discrimination against fields of endeavour** – The licence must not restrict anyone from making use of the program in a specific field of endeavour...

7. **Distribution of licence** – The rights attached to the program must apply to all to whom the program is redistributed...

8. **Licence must not be specific to a product...**

9. **Licence must not restrict other software**... that is distributed along with the licenced software

10. **Licence must be technology-neutral..."**

E. Supporting role of advanced technologies

128. Global value chains pose great challenges for risk management, particularly in the area of sustainability. To address these challenges, an increasing role is being played by advanced technologies such as distributed ledgers (blockchains), artificial intelligence (AI), machine learning, the internet of things (IoT), and physical tracer technologies (such as DNA marking), to name just a few.

129. Among the key challenges in value chain risk management are the need to collect large amounts of trustworthy data across many participants and geographic areas as well as the need to analyse these data in a timely manner. Advanced technologies have an important role in these areas and can help stakeholders to comply with due diligence, implement traceability and transparency requirements in support of sustainability, and improve their operations.

130. Advanced technologies, such as those listed in Table 5, can support improved value chain traceability and transparency by:

- Making standardized information about product origin and other characteristics, such as those for sustainability, available in a transparent and standardized way
- Facilitating the real-time sharing of reliable, up-to-date information
- Assigning reliable digital identities to products, parts, and components
- Collecting and storing information about these identities
- Analysing large volumes of data in support of improved risk and operations management.

131. As discussed in the section on inclusiveness, it is important to ensure that the use of advanced technologies is an inclusive process and not one that ends up excluding participants. At the same time, advanced technologies have a catalytic role to play in creating higher connectivity between value chain partners and creating incentives for stakeholders to invest over the long term. They can turn challenges into new opportunities for a responsible industry, building confidence that facilitates trustworthy and efficient data collection and verification as well as improved analysis.

132. There are several policies and practices that can support the use of advanced technologies. For instance, access is facilitated by support for training in new technologies, open innovation, open data, open-source software (see box "Definition of open source" above) and the development of information infrastructure such as affordable Internet access and an active ICT services sector.

Table 5
List of advanced technologies that can support traceability and transparency

Advanced technologies	*Supporting role in traceability and transparency*
Artificial intelligence (AI) and machine learning systems	Can use the data from traceability systems for risk analysis, for optimizing value chains and operating processes and for tracking textile waste.
Blockchain technology	Provides enhanced data reconciliation and tracing; trustworthy, real-time data updating; access to the same information by multiple stakeholders (thus providing the same "truth" for everyone); and improved confidence in the trustworthiness of data. Box "Blockchain pilot projects" below describes two recent blockchain initiatives in the textile sector.
Internet cloud services	Allow multiple parties to share common software services and to access and update the same data sources.
Distributed databases and data pipelines	Allow access to data stored in multiple locations using tools like those for accessing a single source of data; thus avoiding some of the problems of central database administration while offering an experience that is similar to the user.
Internet of things	Increase automation in data collection. In addition, as low-energy and sensor technologies for IoT devices advance, they also allow for the automated collection of

Advanced technologies	*Supporting role in traceability and transparency*
	new data (such as the temperature inside of containers and other logistics units or the use of water/chemicals by manufacturing machinery).
Advanced product labelling: - Quick response (QR) codes - Physical tracer technologies - Radio frequency IDs (RFID) - Near-field communications (NFC) labels	Allow the "attaching" of additional data to traceable assets and the automated collection of higher-quality track-and-trace information. These labelling technologies, which include both digital and physical markers, when used together with other technologies such as blockchain and AI, can also provide: - Greater accuracy in physical raw material tracing through multiple product transformations (i.e. from raw cotton to fabric) - Higher speed and automation - Lower costs in tracking data that are attached to products

Blockchain pilot projects

Among recent pilot projects supported by public funding is the "**Blockchain for Made in Italy Traceability**". Launched by the Italian Ministry of Economic Development, and developed in collaboration with IBM, this project will assess the use of blockchain technology to implement traceability as a tool for promoting Made in Italy claims and anti-counterfeiting. The public support was financial and organizational, the latter being especially relevant given the consultation activities needed to guarantee an inclusive approach.[36]

The UNECE **blockchain traceability pilot for organically farmed Egyptian cotton** is supported by European Union financing and implemented in partnership with industry actors.[37] It aims to show the possible use of blockchain technology to support increased connectivity, increased cost-efficiency, strengthened due diligence, and the technology's ability to support sustainable sourcing for retailers, brands, and manufacturers along the cotton value chain. It also aims to demonstrate the capacity of firms operating in the cotton value chain to make risk-informed decisions and use a set of internationally agreed traceability and sustainability standards.

The pilot will cover traceability of sustainability characteristics across all the production steps of the value chain and includes the identification of relevant business and sustainability data as well as of key hotspots in the cotton value chain and related sustainability criteria and verification tools. When completed, a stakeholder group will assess the pilot's scalability to other textile fibres. The pilot will also test the use of DNA markers to preserve the connection between the physical and digital assets (identifiers) being traced with the support of blockchain technology.

133. Given the large variety of available technology-based solutions for supporting traceability and transparency, it is important to have appropriate criteria for evaluating and selecting them. Some suggestions for possible best practice criteria are given in the table below.

[36] Source: https://www.mise.gov.it/images/stories/documenti/IBM-MISE-2019-INGLESE.pdf.

[37] The pilot is implemented in collaboration with brands Hugo Boss, Stella McCartney, Vivienne Westwood and Burberry; raw material providers Alba Group, Albini Group and Filmar Network; standards-setting bodies and technology providers GOTS, OEKO-TEX, ZDHC; and in collaboration with Organic Cotton Accelerator, Textile Exchange, Cittadellarte fashion B.E.S.T, the Italian Ministry of Economic Development and the United Nations Industrial Development Organization.

Table 6
Matrix of criteria for selecting technology-based solutions tools for traceability

Criteria/need for selecting technology-based solutions	*Impact*
Ease of use (“user friendliness”)	A key factor in the uptake of technology and its correct application by users is the ease with which it can be used.
Interoperability with a wide range of systems, platforms, and technologies for the purposes of data collection, validation, and publication	Interoperability is a key element in collecting and sharing data across multiple stakeholders and systems.
The use of existing international standards such as UN/CEFACT standards, for data acquisition, transmission, and exchange	Data standards greatly facilitate interoperability and the exchange of data across systems.
The ability to use automatic rules in a system, and to efficiently change those rules as the environment evolves	This provides greater efficiency and the ability to modify a system based on experience and changes in the environment. The ability for implementing organizations to change decision parameters also reduces IT maintenance costs and reduces the risk of vendor “lock-in”.
Virtual and physical training is available to support the use of technology solutions	Good quality training encourages actors’ engagement and good uptake.
Simple, lean, and accessible processes	Such processes are more cost-effective because of the reduced time and effort to achieve organizational goals and they are also more likely to be correctly implemented.
Technology solutions (such as IoT) that provide direct access to real-time information on sustainability in manufacturing processes, such as water, chemical and energy use	These solutions provide better, more accurate information about processes, both for sustainability reporting and operations management.
Differentiated information access rights, allowing the existence of a central data source but giving system owners the ability to give “reading and updating” rights according to the roles and interests of stakeholders	This allows for more open and transparent sharing of information and efficient changes in the “sharing” status of data. For example, one NGO could be given information about current working conditions and another information about current water usage (but not working conditions).
Quick and efficient scaling solutions and partnerships	This enables cost-effective implementation in systems where growth may lead to large numbers of stakeholders.
Support for SMEs	Traceability can be extended further up the value chain to include SME suppliers.
Technology solutions that do not create “lock-ins” which make it difficult to change systems or suppliers	This provides the ability to be more flexible and change systems in light of evolving technology or needs, or if a given technology solution does not perform as promised.

134. The above can be used as input into the specifications for a system. When developing purchasing (procurement) specifications and/or developing regulations that require technology, it is best practice to define the requirements in a technology-agnostic way. This means defining the performance parameters that must be met and **not** specifying the use of any particular technology(ies). For example, one system performance requirement could be the processing of X number of transactions in Y time and with a maximum error rate of Z, or the ability to track goods back through five supplier tiers and eight product transformations (for example the transformation from raw cotton into cotton thread). Specifications linked to a particular technology or version of a standard should be avoided to mitigate the risk of rapid obsolescence or irrelevance of systems and regulations.

135. It is also important to keep in mind that while technology may provide useful tools, data quality and, therefore, system reliability can be impacted by a number of non-technological factors. These include what information is captured, when and by whom as well as data-quality controls that are in place. Therefore, when designing traceability systems, regardless of the technology used, data accuracy and neutrality need to be a priority as well the auditability of the system.

F. Creating inclusiveness in traceability systems

136. To implement a resilient traceability framework and create shared value, policymakers and industry actors must be inclusive. This means addressing the digital divide, ensuring gender equality, supporting SMEs and taking into consideration the special needs of developing countries. How to approach inclusiveness in each of these areas is addressed in the sections below.

137. In addition, when designing a traceability framework, to be inclusive, it may be necessary to take a differentiated approach to implementation. This means tailoring requirements to the capacity of value chain partners based on “steps” which may go from a basic, manual record-keeping process to one that is highly automated.

138. Policymakers can play a catalytic role by supporting coordinated action through the establishment of multi-stakeholder and multisectoral initiatives, including to facilitate the sharing of good practices and lessons learned in other high-risk sectors such as agrifood, timber and minerals.

1. The digital divide

139. Most of the technologies used in traceability and transparency systems are based upon the digital revolution and therefore pose the risk of deepening the digital divide between urban and developed country stakeholders and rural, low-income and developing country stakeholders. In global trade, smaller actors who fail to keep up with the pace of digitalized processes could be undermined, which can result in substantial socioeconomic impacts.

140. From the outset, it is critical to consider several potential impediments to the use of technology, keeping in mind that the most important are often cost and access, followed by language and a lack of available training.

141. Some actions that can, at least partially, address these concerns include making available low-cost devices and user-friendly data collection tools to ensure that smaller actors (at the farm and factory levels) in producing countries can provide the required information. To have efficient and effective tools, their design should take into consideration the language of users, communication channels and the provision of content. This will build the confidence needed to support widespread use.

142. Lastly, engagement and participation are important prerequisites for enabling technology. For all stakeholders, these can be strongly supported by solutions that are as simple as possible, easily accessible, cost-efficient, and flexible in their implementation. In addition, it is essential to keep in mind the potential of capacity-building for promoting the use of technology-based solutions.

143. To have a successful implementation of tracking and tracing across an entire value chain, it is important that an evaluation of stakeholders' technological readiness be done, and that preliminary actions taken to alleviate any issues highlighted by these evaluations.

144. Policymakers and key industry actors also have a key role to play in scaling up innovative solutions to these problems, as well as spurring coordinated action, collaborative approaches, and partnerships to ensure the accessibility of technology at a global scale for all stakeholders.

2. Gender considerations

145. The search for flexibility, higher productivity, and low prices have had two main results: (1) the outsourcing of textile and apparel work to developing countries and, (2) in all geographic regions, the prevalence of women in the workforce – undoubtedly influenced by both the image of the sector and the generalized practice of paying lower wages to women.[38] The clothing industry directly employs 60 to 75 million[39] people worldwide, of which about 75 per cent are women, which is a substantial share of the industry's workforce and of the resources required for the industry's economic growth. Despite this, an exceedingly small percentage of women reach management and supervisory roles.[40]

146. As emphasized in the OECD Due Diligence Guidance for Responsible Business Conduct,[41] gender-issues are a key element when implementing due diligence. As a result, activities need to have tailored approaches for evaluating adverse impacts (human rights, environment, health, etc.) which are specific to women in an industry where employment is often precarious, informal or irregular.

147. Supporting gender equality with traceability systems depends upon the claims being made regarding gender and how these will be validated and registered in the traceability system. Therefore, it is important to work with local partners to identify measurable indicators.

148. When deciding upon actions in support of gender equality it is essential to assess how impacts may differ for women depending upon their circumstances, which may include accumulated vulnerabilities (e.g. women who are also home-based workers, migrants, minorities, etc.) and to consider women's specific positions at all stages of the production chain.[42]

149. To create real change will require supporting women's economic empowerment and their promotion into leadership positions along value chains. Traceability and transparency can have an impact by measuring the results of measures taken to reach these goals.

3. Small and medium-sized enterprises

150. Traceability can be a costly activity and, when this is the case, it puts enterprises on an unequal footing depending upon their size, available resources and human capacity. On the other hand, systems for improved traceability and transparency can be beneficial to smaller actors, particularly SMEs, if they simplify the procedures, bring cost-efficiencies, add value, and help SMEs to upgrade their practices. One core principle for widespread

[38] United Nations Environment Programme, *Sustainability and Circularity in the Textile Value Chain: Global Stocktaking* (Nairobi, Kenya, 2020).
[39] UNECE, *TEXTILE4SDG12: Transparency in Textile Value Chains in Relation to the Environmental, Social and Human Health Impacts of Parts, Components and Production Processes* (ECE/TRADE/439). Available at https://unece.org/DAM/trade/Publications/ECE-TRADE-439E-TEXTILE4SDG12.pdf
[40] European Commission, "Sustainable garment value chains through EU development action". (SWD(2017) 147 final). Available at https://ec.europa.eu/transparency/regdoc/rep/10102/2017/EN/SWD-2017-147-F1-EN-MAIN-PART-1.PDF (accessed October 2020).
[41] OECD (2018), OECD Due Diligence Guidance for Responsible Business Conduct. Available at https://www.oecd.org/investment/due-diligence-guidance-for-responsible-business-conduct.htm.
[42] OECD, *Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector* (Paris, 2018). Available at: http://dx.doi.org/10.1787/9789264290587-en.

uptake and participation in a traceability system is flexibility in its implementation and the avoidance of a one-size-fits-all approach. The goal of traceability is not to overwhelm actors in the value chain; it is to improve their sustainability footprint over the long term and to create a responsible and resilient industry.

151. Small and medium-sized enterprises account for a large share of companies in the industry, thus it is essential to consider their limited human and financial capacity prior to designing and implementing a traceability framework. To support this approach, UNECE-UN/CEFACT is proposing that the implementation of traceability take into account the different capacities of smaller actors and larger enterprises. SMEs can be better integrated into a traceability system through a combination of financial and non-financial incentives such as increased market access, facilitated payments, specialized managerial and workforce training, infrastructure investment, fast-track processes and public visibility. Specific support also should be given to SMEs on technical and organizational aspects.

152. When developing a traceability system there are also some specific actions needed to enhance the trust between value chain partners, such as in-person meetings and in-the-field visits, in order to have a clear view of what data are collected and by whom. Longer-term, stable contracts also ensure confidence by helping to reassure participants about the purpose of the data being collected.

153. Civil-society organizations such as non-governmental organizations and trade unions also can play a key role in empowering actors by guiding and training local small stakeholders, not only to collect and register the data needed to meet the core requirements of a traceability framework, but also to showcase the added value of enhanced traceability and transparency to the local community in terms of social (labour conditions) and economic aspects (marketing and competitive assets).

4. Integrating developing countries

154. Global value chains in garment and footwear sector are scattered globally, and upstream value chain activities (from farming/cultivation and raw materials processing to manufacturing) are mainly undertaken in low and middle-income countries. When implementing traceability, low and middle-income countries' concerns must be considered. Much of what is said about inclusion for SMEs, also applies to low and middle-income countries, in part because the majority of their enterprises are SMEs. For example, just as for SMEs, to assure the effective functioning of a traceability and transparency solution, before implementation an evaluation needs to be made of a solution's feasibility for actors located in the affected low and middle-income countries.

155. Enhanced traceability and transparency can support efforts by developing countries to implement due diligence and to identify and mitigate adverse impacts related to sustainability hotspots such as pollution, excessive energy use and poor labour practices.

156. It is also important to showcase, to national authorities, customs and industry associations, the added economic value of traceability, transparency and sustainability as tools for facilitating global market access and fostering domestic economies. For example, traceability and transparency can highlight and prove a product's origin, content and quality in order to attract a higher and fairer price. They also have the potential to support further market access by showing compliance with international and regional standards. For instance, being able to prove that a product meets the European Union rules of origin may enable the product to be exported tariff-free. In addition, there is an increasing competitive advantage for producing and exporting countries if they can prove that they have taken action to support improved environmental sustainability and working conditions through the enforcement of internationally acknowledged standards in social and labour sectors.

157. Enterprises in low and middle-income countries need to be open to implementation and willing to put forth effort for its implementation. In return, the price that the industry in emerging economies receives for their goods needs to reflect this extra effort to support traceability and transparency.

158. Governments and government authorities need to put in place an enabling environment for traceability and transparency which includes not only supporting

regulations, but also technical infrastructure (notably affordable Internet access and ICT services), support for research, open data, open-source technology solutions, and training for policymakers, officials, and smaller stakeholders.

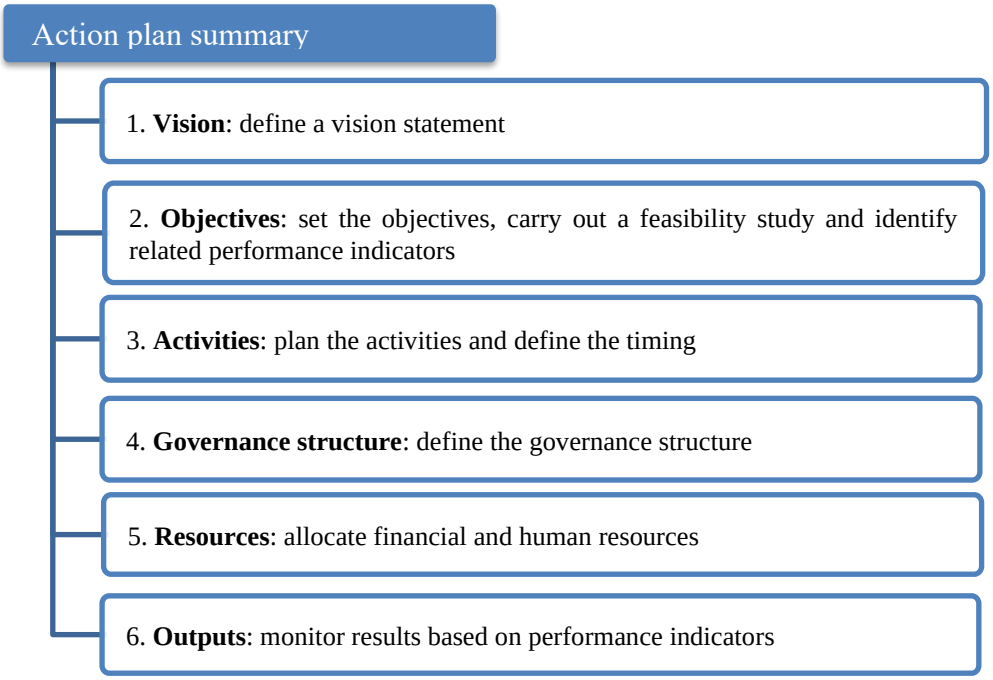
159. Intergovernmental and international organizations, finance institutions and national development agencies have a key role to play in providing financial support for capacity development activities and, in particular, for training on the implementation of international standards. There is a need to empower private sector actors to meet environmental, labour, and other standards, hence allowing developing countries and transition economies to increase exports in high-value segments and reap the benefits of integrating into the global economy. Increasing sustainable trade opportunities for developing countries and transition economies will require a multi-faceted approach, where an enabling regulatory requirement is matched with effective and coordinated support.

Annex I

Formulation and implementation of a traceability and transparency action plan

1. When designing and implementing a traceability and transparency system, companies should consider developing an action plan to define a vision with specific objectives, corresponding activities, and key performance indicators. Such an action plan should also define a governance structure for implementing the foreseen activities, a budget for the needed financial and human resources, and mechanisms for monitoring and communicating progress against the defined performance indicators and timeframes. These steps are summarized in Figure 1 and are described in more detail in the remainder of this annex.[43]

Figure 1
Action plan summary



Source: Adapted from UNECE, Guide to drafting a National Trade Facilitation Roadmap (ECE/TRADE/420).

1. Define a vision statement

2. The vision statement summarizes the objectives of a traceability and transparency system and the benefits for the stakeholders involved. The aim of the vision statement is twofold: it provides guidance and direction, and it serves as inspiration and a source of motivation. It should start from and be consistent with the overall corporate sustainability strategy since traceability and transparency are key enablers of higher sustainability performance and more efficient value chain management.

- Example: *Our vision is to promote the application of the highest social, environmental, and health & safety principles during the creation of products for our customers, throughout our entire value chain.*

[43] UNECE, *Guide to drafting a National Trade Facilitation Roadmap* (ECE/TRADE/420). Available at https://www.unece.org/fileadmin/DAM/trade/Publications/ECE-TRADE-420E.pdf.

2. Set the objectives, carry out a feasibility study and identify related performance indicators

3. The objectives define in more detail the future outcome that needs to be accomplished. Each objective contributes to the achievement of the vision statement. Objectives contemplated in the Traceability and Transparency Action Plan should be specific, measurable, attainable, relevant and time bound (SMART). The plan should be developed based on a gap analysis, identifying the main requirements for a traceability system implementation and related resource needs. It should also set performance indicators to monitor and assess the achievement of the objectives or their results, i.e. key performance indicators (KPIs). The following are some of example KPIs:

- *The number of value chain steps with an identified and verifiable sustainability claim as a percentage of the total number of value chain steps*
- *The number of tracked value chain steps for each material and semi-finished/finished product against the total number of value chain steps*
- *The number of identified and disclosed value chain partners against the total number of value chain partners*
- *The number of value chain business processes covered by the traceability system*
- *The number of suppliers for which information is made available and accessible on the website*

4. When formulating claims for products and their processes, the firm must clearly link them to the traceability and transparency objectives defined in the action plan as well as to their verification criteria, data requirements, and related performance indicators. All these elements are required in order to have a vision of increased sustainability performance through improved traceability and transparency. The following are some example objectives:

- *Attain full traceability for the top 30% of our products by collecting information about products and process characteristics throughout the whole value chain within 3 years.*
- *Achieve full transparency for the top 30% of our products by providing easy access, clarity and regular updates about suppliers' compliance with our company's sustainability goals throughout the whole value chain within 3 years*.

3. Plan the activities and define the timing

5. The action plan needs to define how the objectives will be achieved, in other words, which activities should be implemented. In the context of the action plan, an activity is a specific action or project that will implement a traceability and transparency tool or solution.

6. Implementing a traceability and transparency system shall be considered with a long-term view.

7. Typical decisions concerning activities to achieve a *traceability objective* are about

- the different types of information related to traceability that should be collected and recorded as well as by whom and how;
- which specific information needs to be shared, with whom and how;
- how frequently information will be shared;
- which technologies will facilitate the collection and sharing of information;
- how should information be stored (according to who needs to have access to the data and how often);
- the performance indicators to be monitored;
- when the content of the information should be reviewed;
- how to best communicate information to end consumers to inform their decision-making.

8. Typical decisions concerning a *transparency objective* are the same as for traceability information but are about the information needed to verify claims, so one of the key additional questions for transparency is, "What information do we need in order to verify our claim?"

9. In addition, the following key considerations are important: easy access, clarity, and regular updates. The examples below[44] refer to effective disclosure when publishing value chain information:

- It is important to guarantee easy access to information by making information easily and freely accessible on websites and making information available in formats that are downloadable and enable machine-readable searches.
- It is important to guarantee clarity in the disclosure by (1) clearly stating what precisely is being published and what definitions are being used; (2) clearly stating whether all authorized subcontractors are included, such as those used by cut-make-trim factories for processes to complete a brand's products; (3) indicating the aggregate volume of business that is captured by the disclosure and the percentage of total supplier factories published; (4) indicating exclusions from disclosures, if any, and impending plans to expand disclosures.
- It is important to guarantee regular updates by specifying the date when the information was last updated and how frequently the information is publicly updated. Communicating achievements should not be considered a marginal activity since it is needed to justify the traceability claims, to educate consumers and to inspire other industry players with the final goal of improving garment and footwear sustainability performance.

10. Some examples of related objectives are below:

- *We will invest (amount)EUR in advanced traceability technologies to reduce time and cost, increase the accuracy and speed of data and allow product authentication.*
- *Next year we will conduct (x) number of audits for traceability, which will allow us to identify inefficiencies, enable improved control and monitoring of product quality, have better recall management by identifying the origin of defects, and enhance coordination among actors in our value chains.*
- *Next year we will carry out (x) individual meetings with suppliers in our production clusters concerning specific aspects of traceability in their value chain.*
- *In total, next year (x) suppliers will be provided with training on the subject of traceability and transparency of value chains in collaboration with our sustainability, product development, marketing, and purchasing teams.*
- *By the end of next year, we will make information about (x) suppliers available easily and freely on our website.*

4. Define the governance structure

11. The action plan should include an outline of the governance structure required to manage and implement the activities. The detailed governance structure and the functions and composition of the steering committee will vary from company to company in accordance with a company's organizational charts for sustainability-related functions. In general, a governance structure should report to the top management of a company to ensure that sustainability objectives are integrated into staff responsibilities and the functions of managers and staff at all levels.

12. The ideal structure in a "vertical" organization consists of a steering committee that depends directly on the head of sustainability and includes representatives from each department/function that is involved in the implementation, monitoring and communication of identified activities and achieved results. The ideal structure in a "horizontal" organization consists of an interconnected network of representatives from each department/function,

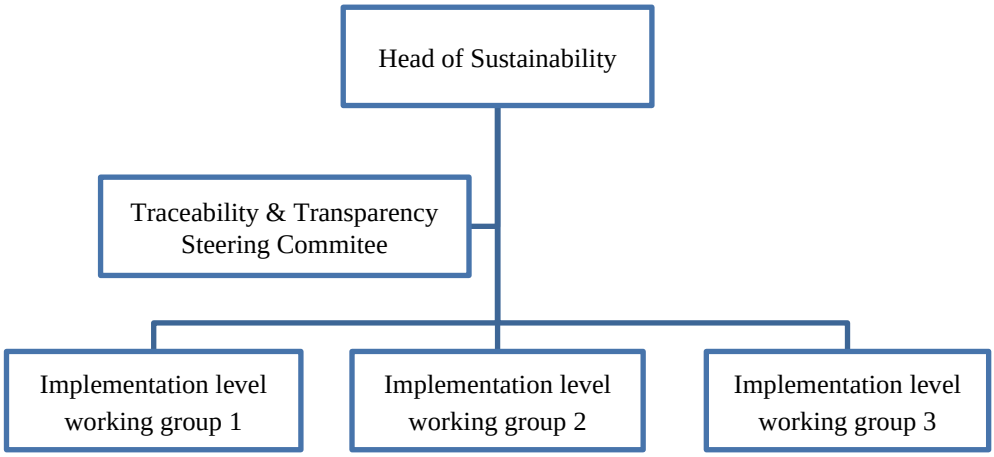
[44] Examples are adapted from the Transparency Pledge available at https://transparencypledge.org.

including the head of sustainability, coordinated by a steering committee. The departments/functions that are involved in the implementation of each activity, such as product development, operations (including quality control), marketing and communication, should be appointed, and the working groups to manage activities and projects should be formed.

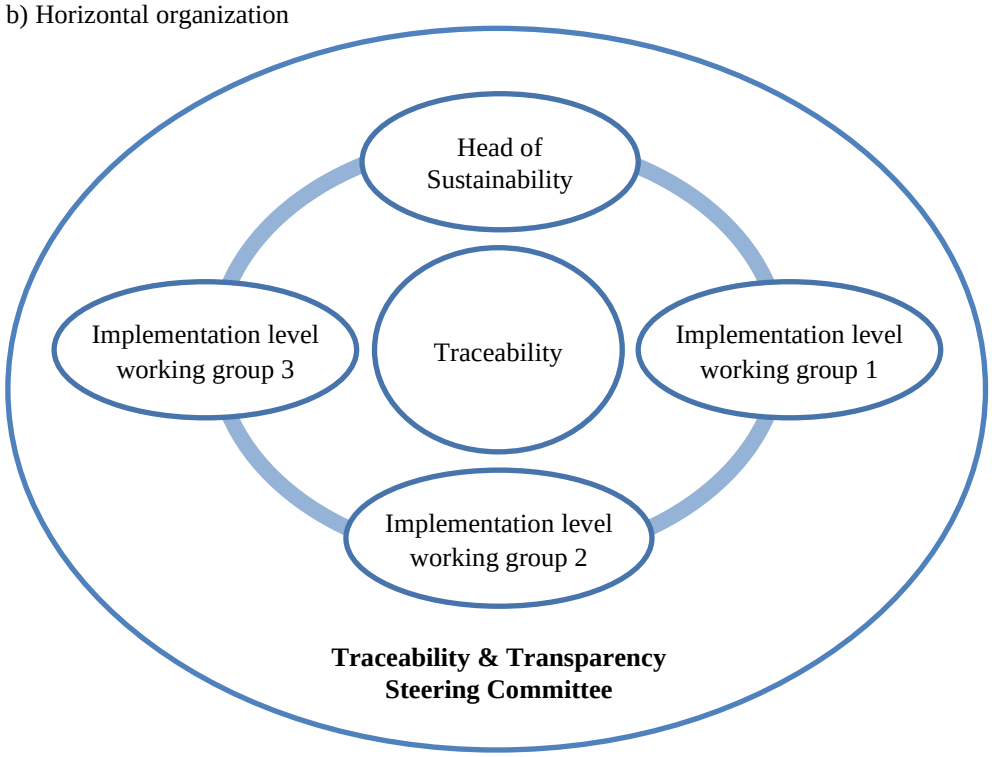
13. Also, from the beginning, it is important to include activities that focus on stakeholder communication and collaboration: this will ensure that all traceability stakeholders understand the common objectives and the scope of the activities in the action plan.

14. Sample governance structures are shown in Figure 2.

Figure 2
Sample governance structures
a) Vertical organization



b) Horizontal organization



5. Allocate resources

15. This section of the action plan should describe the necessary human and financial resources needed for the implementation of the activities, as well as the overhead budget for the management of the action plan. Allocating human and financial resources, with a detailed,

results-based budget, ensures that the action plan is linked to a commitment to allocate the resources needed for its implementation.

- Example*: The financial and human resources in support of the activities will be detailed in an annexed budget.*

6. Monitor results

16. Monitoring and evaluation against predefined performance indicators are core elements of an action plan.

17. Performance indicators to measure progress against expected accomplishments will vary according to the actors and the role they play in the value chain. Setting performance indicators should start from identifying the main traceable assets linked to claims, based on the results of the risk-analysis of the value chain.

18. Traceability-related indicators could measure the level of traceability of selected products, with their parts and components (traceable assets) along the value chain, e.g. number of business processes covered. Transparency-related indicators should cover the disclosure of information about the selected traceable asset, e.g. names and addresses of suppliers' production facilities and information that can be used to verify conformity with sustainability principles (such as certifications and audits or other controls).

- Example: *Through investments in advanced technologies, we were able to increase the accuracy and speed of data exchange by (xx) and allow product authentication across our value chain.*
- Example*: Through the increased number/alignment of audits for traceability we were able to publish verification data for at least 30% of our products.*
- Example*: The meetings with suppliers resulted in an agreement on the design of a joint traceability system.*
- Example*: The increased transparency resulted in higher ranking of (xx) in the transparency index.*

19. Such indicators could be combined in a traceability and transparency index to measure a company's performance in collecting and sharing relevant data and information with key value chain actors and supporting sustainability claims.

20. In addition to supporting product claims, enhanced traceability and transparency of the value chain also allows for more informed management decisions about the selection of value chain partners; enhanced compliance with legal, regulatory and reporting requirements; enhanced access to public incentive systems for advancing the green and circular economy; and better management of reputational risk. As a result, related KPIs may concern, for example, reduction of system integration costs; reduction of number of lawsuits or sanctions; reduction of intermediation costs; reduction of number of quality-related issues.

7. Communicating the results and related recommendations

21. Communication supports learning and success internally with value chain partners and customers and also with the public at large. Communication methods can range from incorporating reporting and communication requirements on the implementation of the action plan into the overall sustainability strategy; to the establishment of reporting mechanisms to monitor progress, such as a traceability and transparency index; to the sharing of good practices and lessons learned across relevant multi-stakeholder industry platforms and initiatives.

22. The **drafting process** for an action plan has three major phases (see Figure 3):

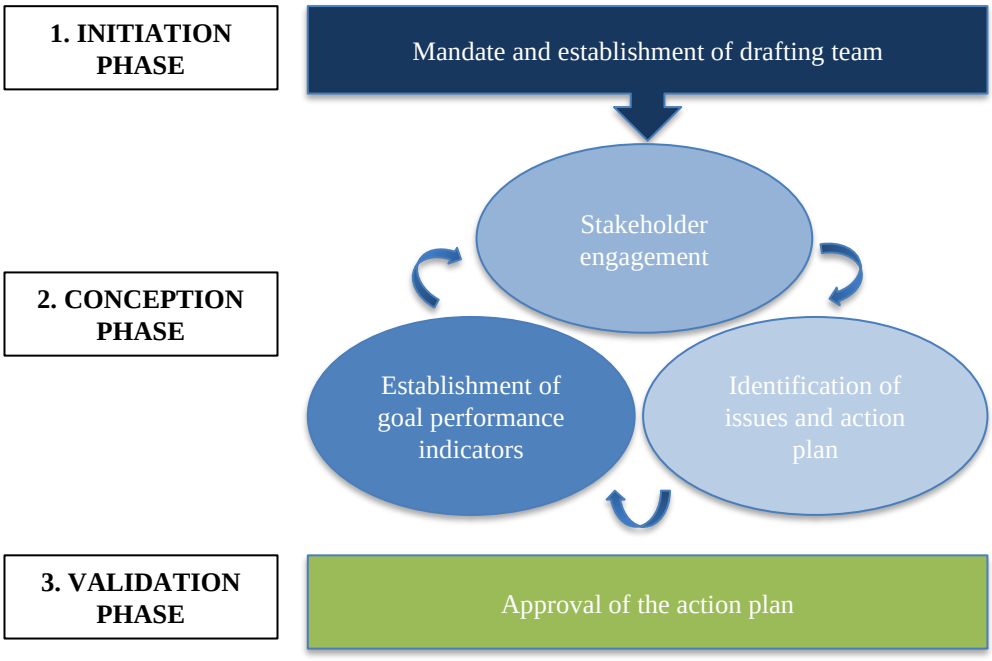
(a) **Initiation phase**, where the head of sustainability needs to request the development of a document that describes the traceability and transparency strategy.

(b) **Conception phase** that consists of drafting the document itself. It includes three stages: (1) engaging stakeholders, (2) discussion with stakeholders on existing issues and possible activities to be undertaken, and (3) defining the performance indicators to

measure the achievements and results of the different activities. The outcome of the second phase is a consolidated draft of the action plan document.

(c) **Validation phase**, where the document is presented to internal decision makers in order to receive formal endorsement to start the implementation of the activities included in the action plan.

Figure 3
Three-phase model for the drafting process of a traceability and transparency action plan



Source: Adapted from UNECE, Guide to drafting a National Trade Facilitation Roadmap (ECE/TRADE/420).

23. "The three phases, 'initiation', 'conception' and 'validation', are sequential, meaning they are only executed once, and in this order. At the same time, the three stages in the conception phase – engaging stakeholders; assessing needs, identifying objectives and activities and conducting a feasibility study; and defining performance indicators – are iterative in nature and may need to be repeated several times. Each stage can unveil further issues in the processes or new proposals for how to address them. Consequently, it might be necessary to revisit previous findings, to redefine the corresponding activity or include new ones, to reconsider the performance indicators and to (re-)engage stakeholders."[45]

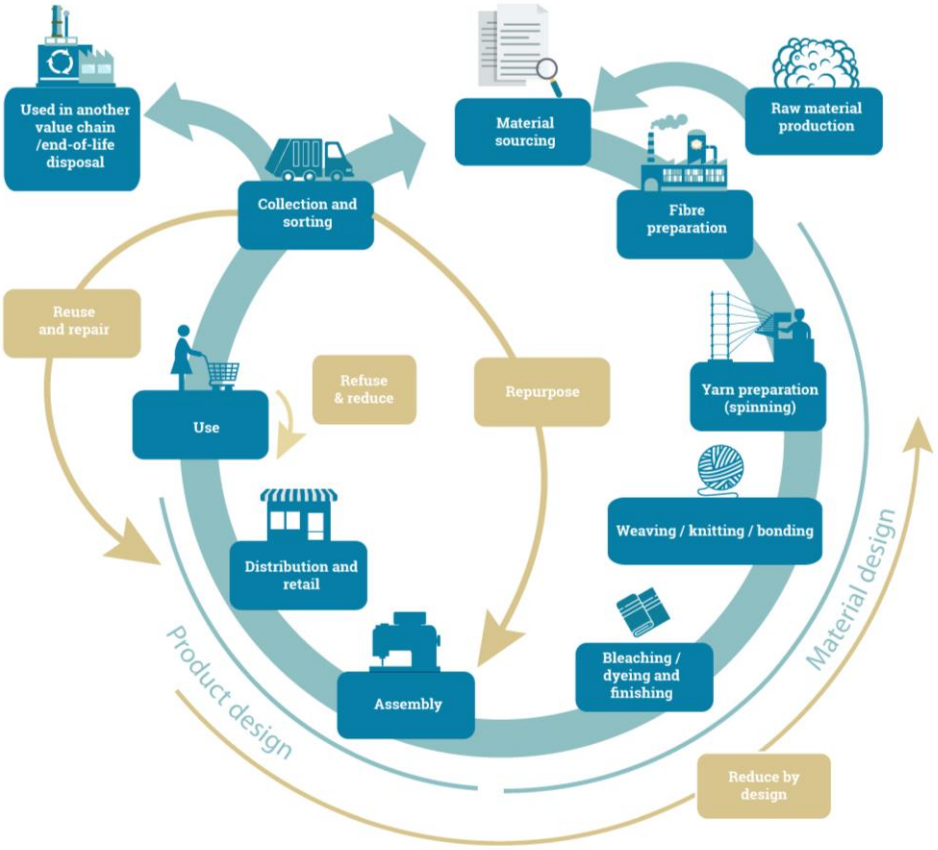
[45] UNECE, *Guide to drafting a National Trade Facilitation Roadmap* (ECE/TRADE/420). Available at https://unece.org/fileadmin/DAM/trade/Publications/ECE-TRADE-420E.pdf.

Annex II

Glossary

Circularity of a production process refers to the ability of such process to retain the value of products, materials, and resources in the economy for as long as possible.

Figure
Circularity in garment and footwear value chains[46]



Source: United Nations Environment Programme, 2020

Claim is a high-level statement about a characteristic of a product, or about a process or an organization associated with that product (traceable asset). To show that the characteristic is true, it is necessary to trace the asset as it moves through the value chain.[47]

Code is a character string (letters, figures, or symbols) that for brevity and/or language independency may be used to represent or replace a definitive value or text of an attribute. Codes usually are maintained in **code lists** per attribute type (e.g. colour).

[46] United Nations Environment Programme, *Sustainability and Circularity in the Textile Value Chain: Global Stocktaking* (Nairobi, Kenya, 2020), Figure 3: Representation of activities taking place in a circular textile value chain, p.14. See also M. J. Rusinek, H. Zhang, N. Radziwill. "Blockchain for a Traceable, Circular Textile Supply Chain: A Requirements Approach", *SQP* vol. 21, No. 1 (ASQ, 2018).
[47] UNECE, *Traceability for Sustainable Trade: A Framework to Design Traceability Systems for Cross Border Trade* (ECE/Trade/429). Available at http://www.unece.org/index.php?id=43763.

Due diligence is an ongoing, proactive, and reactive process through which enterprises can prevent and mitigate adverse impacts related to human rights, labour rights, environmental protection, and bribery and corruption in their own operations and in their supply chains.[48]

Economic operator is a business or other organization which supplies goods, works, or services within the context of market operations. The term is used in public procurement to cover suppliers, contractors, and service providers.

Entry and exit points are the events (activities) at the start and the end of the traceability process within the value chain. At each of these points the traceable asset needs to meet specified criteria.

Logistics units contain traceable assets for transport and/or storage which need to be managed through the value chain. Most often they contain aggregated traceable assets, but logistic units may also contain disaggregated traceable assets. Logistics units are given IDs in order to follow the traceable assets they contain. This is done by recording the IDs of the traceable asset(s) and linking them to the ID of their logistics unit. See also the explanation in Table 1.

Materials are raw, unprocessed substances.

Products are processed, finished items that are offered for sale. That is, they are manufactured combinations of materials and perhaps other products, processed to create items.

Product certification is the process of certifying that a certain product has passed performance and quality assurance tests, or qualification requirements stipulated in regulations.

Sustainability, in this context, is understood as the manufacturing, marketing and use of garments, footwear and accessories and their parts and components, taking into account the environmental, health, human rights and socioeconomic impacts, and their continuous improvement through all stages of the product's life cycle.

Sustainability claims to support sustainable development, objectives should be selected based on a value chain risk analysis, corporate objectives, and a company's commitment to responsible business conduct and due diligence. The contents of the claim should be accessible and may need to comply with legal requirements. Also, some organizations that develop sustainability standards and guidelines have rules about how they can be referenced in claims.

Sustainability criteria can be a standard, a guideline or other document which describes the characteristics that a product or process must have to conform with the "claim". The criteria are what an auditor compares information against to determine if due diligence has been followed in ensuring a claim.

Track and Trace (TT) is the monitoring of the present location and status of the goods whilst in transit (tracking) and the retrieval of information about the history of the movement and status of traded goods, goods items, consignments, transport means or transport equipment (tracing).

Traceable asset is any product or material (individual, in batches or in trade units) that needs to be tracked along a value chain. Within the garment and footwear sector it is "any item (for example an object, a product or other traded item or a service) that needs to be tracked along a supply chain."[49] It can also be thought of as the unit that one wants to trace or record information about in a traceability system.

Traceability is understood as "the ability to trace the history, application or location of an object" in a supply chain.[50] In this context, it is defined as the ability to "identify and trace the history, application, location and distribution of products, parts and materials to ensure

[48] OECD, *Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector* (Paris, 2018). Available at: http://dx.doi.org/10.1787/9789264290587-en.
[49] Ibid.
[50] ISO 9001:2015, Quality Management Systems – Requirements.

the reliability of sustainability claims in the areas of human rights, labour (including health and safety), the environment and anti-corruption";[51] and "the process by which enterprises track materials and products and the conditions in which they were produced through the supply chain".[52]

Traceability framework is the entire ecosystem supporting value chain traceability including policies, systems, support, and promotion. It covers the use of traceability across the entire value chain – from the extraction and processing of raw materials, to finished product branding and retailing, consumption and post-consumption activities.

Traceability model refers to the organization of a value chain to ensure that traceability can be implemented. There are different traceability models, whose usefulness depends upon the type of product and the claims being made. Examples of traceability models which can be applied to products and processes throughout the entire value chain are product segregation, mass balance, and book and claim.

- **Product segregation:** The preferred model for a traceability system is product segregation. The objective is to have products that are produced according to the same sustainability standard be strictly separated from other products. With product segregation there is a physical separation of certified materials and products from non-certified materials and products at each stage in the value chain. This ensures that certified and non-certified materials and products are not mixed, and that the end product comes from a certified source.
- **Mass balance:** In the mass balance model, products from both sustainable and non-sustainable sources are mixed, but as they move through the value chain an exact account is kept of the volume ratios. The purpose is to guarantee that the amount of sustainable content claimed is equal to the amount of sustainable products or materials used. This model is commonly used for products and commodities where segregation is very difficult or impossible to achieve, such as for cocoa, cotton, sugar, and tea.
- **Book and claim:** In the book and claim method there is a free flow and mixing of certified and non-certified assets with no segregation of assets, so it is actually a mixed product that is sold. Instead, a producing company can obtain sustainability certificates for the volume of goods that it puts into the value chain which are certified as following a good practice. This model is typically used when the production and market conditions make it impractical to sell certified product that has been segregated from non-certified product. This model is used for soy and palm oil.

Traceability rules describe "how the business processes between an entry point and an exit point need to be organized so that the claim is met."[53]

Traceability system refers to all the practical processes, procedures and technology needed to create a functional traceability system. It does not refer to the surrounding ecosystem with its policies, incentives, promotion, etc. A *traceability system* together with its surrounding ecosystem of supporting policies, incentives and promotion measures, forms a *traceability framework*.

Trade unit is a unit used in trade; for example, the unit shown on an invoice which could be, among many options, a "package" or a "bale" or a "container" – this depends upon the product and the trading partners.

[51] United Nations Global Compact Office, *A Guide to Traceability A Practical Approach to Advance Sustainability in Global Supply Chains* (New York, 2014).
[52] OECD, *Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector* (Paris, 2018). Available at: http://dx.doi.org/10.1787/9789264290587-en.
[53] UNECE, *Traceability for Sustainable Trade: A Framework to Design Traceability Systems for Cross Border Trade* (ECE/Trade/429). Available at http://www.unece.org/index.php?id=43763.

Transparency relates directly to relevant information been made available to all elements of the value chain in a standardized way, which allows common understanding, accessibility, clarity, and comparison.[54]

UN/CEFACT Core Component Library is a registry/repository in which core components are stored. Core components are data definitions which are structured to be unambiguous and readable by computer systems. The Core Component Library contains definitions for all the core component types: Basic Core Components, Aggregate Core Components, Basic Business Information Entities and Aggregate Business Information Entities.[55] For a more technical description refer to the Core Components Technical Specifications version 2.01.

Unique identifiers (IDs), information collected to follow the path of a traceable asset, that is linked to it. The traceable asset must have a unique identifier (ID). IDs are also required for all the traceability/transparency components that information is collected about; examples include enterprises, locations, processes and transportation units.

Validation is a process to evaluate the reasonableness of the assumptions, limitations, and methods that support a claim about the outcome of future activities.[56]

Verification criteria are the standards and key performance indicators that traceable assets are supposed to meet and the rules for the supporting traceability process. These criteria are the basis upon which verification processes are carried out by auditors or other verification agencies in order to prove that the traceable assets have complied with relevant claims.

Verification process: a verification is "confirmation of a claim, through the provision of objective evidence, that specified requirements have been fulfilled".[57] In the context of traceability, the verification process is carried out by a verification (audit) body that analyses traceability events and validates the information about them against the verification criteria and any other transparency system rules.

[54] European Commission, A Background Analysis on Transparency and Traceability in the Garment Value Chain (2017).
[55] See UNECE Core Component Technical Specification. Available at https://unece.org/core-component-technical-specification.
[56] See ISO/IEC 17029:2019, Section 3.2.
[57] See ISO/IEC 17029:2019, Section 3.3.