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International Resource Panel

CATALYSING SCIENCE-BASED POLICY ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION:

The value-chain approach & its application to food, construction and textiles

UN environment programme

Acknowledgements

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CATALYSING SCIENCE-BASED POLICY ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION:

The value-chain approach & its application to food, construction and textiles

A report of the joint Task Group of the International Resource Panel and the One Planet network

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International Resource Panel

UN environment programme

This report responds to the request made at the 4th United Nations Environment Assembly, in its resolution on ***'Innovative pathways to achieve sustainable consumption and production'***, operative paragraph 12 (UNEP/EA.4/Res.1). It is the report of the task group composed of the One Planet network and the International Resource Panel. The task group aims to catalyse science-based policy action on sustainable consumption and production, thereby creating the conditions to provide actionable insights on the management of natural resources in relation to the 2030 Agenda for Sustainable Development.

FOREWORD

UNITED NATIONS ENVIRONMENT PROGRAMME

The science is crystal clear that we are putting extreme pressures on the planet. For decades scientists have been laying out how humanity is driving the three planetary crises: the climate crisis, the biodiversity and nature crisis, and the pollution and waste crisis. The common thread that runs through these three planetary crises is unsustainable production and consumption. The International Resource Panel has consistently reminded us that our relentless extraction of resources from the Earth is having a devastating impact on the natural world, propelling climate change, destroying nature, and raising pollution levels.

Yet this evidence does not always reach key decisions makers in a way that is relevant to them and actionable by them. This publication produced by the joint task group of the International Resource Panel and the One Planet Network examines how we can deliver science that can truly strengthen policy making and guide actions for environmental sustainability.

Established in response to a resolution at the Fourth UN Environment Assembly on sustainable consumption and production, the task group brings together experts on natural resources from the International Resource Panel, and the practitioners from the One Planet Network including government, business, civil society and international organisations. The aim is to bridge the science on natural resources and action on sustainable consumption and production by taking a value chain approach. This involves identifying key intervention points in priority sectors including food, construction and textiles and implementing corresponding actions that can move these sectors to more sustainable consumption and production patterns.

The United Nations Environment Programme, the International Resource Panel and the One Planet Network will continue to take forward this approach in the three prioritised sectors and beyond. We hope this report will encourage governments, businesses and citizens to engage with these initiatives and to replicate this approach in other areas.

Inger Andersen
Executive Director
United Nations Environment Programme

UN environment programme

PREFACE

The COVID-19 pandemic has posed an unprecedented challenge to humankind. It also provides a window of opportunity to explore more inclusive and equitable development models underpinned by sustainable consumption and production. A revitalized global movement to promote science-based policy solutions for sustainable consumption and production could trigger action for and by all countries, big or small, developed or developing, as more systemic, collective, and ambitious actions are urgently needed.

SDG 12 could be a vehicle to integrate -in a balanced manner- other sustainable development goals and their targets. On one hand, the 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP) has served as the anchor of the SCP agenda within the UN and a catalyzer for multi-stakeholder cooperation through its One Planet network. On the other, the International Resource Panel (IRP) has shed light on the consequences of increasing pressures on our natural resource base; on the unequal distribution, availability, and use of these; and on the unequal exposure to environmental risk factors across regions and within countries and cities. Bridging the work of these two key groups in a more systematic and pragmatic manner will allow us to collectively build knowledge-based solutions on SCP that can shift current unsustainable trajectories.

This report, requested by countries at the Fourth meeting of the United Nations Environment Assembly, provides an overview of how the value chain approach has been applied to the information of the International Resource Panel and the One Planet network. Its application to the three prioritized sectors of food, construction and textiles provides a practical illustration of the benefits of the value chain approach to define SCP action that is informed by science. It has also provided the interface for effective communication between the scientists on natural resource use and the practitioners in government, business and civil society implementing SCP.

The report lays important groundwork for a more systematic approach of collaboration between the IRP and the 10YFP to identify hotspots, prioritize effective action, and build common agendas on SCP. More importantly, this work marks the beginning of a new era of proactive collaboration and collective engagement on SCP. One that provides guidance to SCP actors based on scientific evidence that is clear, focused, and actionable. And one that leads to the structural shifts needed to overcome the current planetary and human crisis.

A strong partnership between the International Resource Panel and the One Planet network will be essential as both initiatives embark in their respective strategic planning efforts. As Chair of the 10YFP and Co-Chair of the International Resource Panel, we are committed to leveraging the recommendations from the report and facilitating a continued two-way communication between IRP scientists and SCP practitioners.

We hope that this report will assist governments, the scientific community and other organizations in illustrating an effective participatory process, built on science and practice, that could help translate global findings into concrete SCP policies and tools at the national level.

Izabella Teixeira
Co-Chair, International Resource Panel

Rodrigo Rodriguez Tornquist
Chair, 10YFP Board

Secretary of Climate Change, Sustainable Development and Innovation, Ministry of Environment and Sustainable Development, Argentina

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EXECUTIVE SUMMARY

CATALYSING SCIENCE-BASED POLICY ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION

The science is clear on the need to decouple economic growth from natural resource use and environmental impacts. Yet this evidence does not always reach key decisions makers in a way that is relevant and actionable.

To address this challenge, and as requested by the 4th UN Environment Assembly, the International Resource Panel and the One Planet network established a task group bringing together the experts on natural resources and the practitioners implementing sustainable consumption and production.

The task group aims to catalyse science-based policy action on sustainable consumption and production, thereby providing actionable insights on the management of natural resources in relation to the 2030 Agenda for Sustainable Development. To achieve this, the task group took a sectoral focus and applied the value-chain approach.

> A sectoral focus and a value-chain approach underpins the interface between the science on natural resources and the action on sustainable consumption and production

THE VALUE-CHAIN APPROACH

The value-chain approach anchors natural resource use and environmental impacts within the socio-economic reality of production and consumption, and uncovers actionable insights on how the management of resources is connected with the 2030 Agenda for Sustainable Development.

Critically, the approach goes beyond an understanding of where along the value chain resource use and environmental impacts occur. By applying a systems lens, the value-chain approach identifies the drivers and barriers that cause the value chains of different sectors to operate as they do, taking into account the complex drivers and feedback loops that determine and influence the operations and behaviours of actors along the value chain. By engaging all actors along the value chain, the value-chain approach identifies the most promising solutions and defines a common agenda for concerted actions that can transform the system.

In this way, the value-chain approach identifies where the greatest opportunities for improvement occur and shapes corresponding actions by building on existing knowledge and available data.

The approach analyses and discusses data and information in three steps:

1. understand the value chain and identify hotspots;
2. consolidate existing action and identify opportunities to address the identified hotspots; and
3. define a common agenda and prioritise through a participatory process.

The task group demonstrates the benefits of using the value-chain approach to define SCP action informed by science by applying it to three prioritised sectors: food, construction and textiles.

APPLYING THE VALUE-CHAIN APPROACH TO FOOD, CONSTRUCTION AND TEXTILES

CONSTRUCTION

The **majority of natural resource use and environmental impacts takes place at the material production stage, the construction stage and the operation stage** of the value chain. However, there is limited scope at these stages to make the needed changes for several reasons, including the informality, fragmentation, complexity and availability of options.

The most influential actors along the construction value chain are governments, international organisations, financial institutions and major market players, who are primarily acting at the **financing stage and the planning and design stage of the construction value chain. The key decisions made at these stages largely shape the activity along the rest of the value chain.**

Construction is integral to achieving the SDGs, but direction is needed to ensure actual balance between sustainable development and the transition of the sector to resource efficiency, circularity and a smaller environmental footprint.

Governments exert significant influence along construction value chain as 1) regulators of financial markets, 2) investors in the construction sector, and 3) urban and territorial planners, and regulators of the construction sector. Governments have a strong opportunity to ensure sustainability of the construction sector through these three key levers.

Key challenges to be addressed:

1. **What types of construction is built and used, and where** – balancing their differing contribution to SDGs and their environmental footprint.
2. **how much is being built:** ensuring that the growth of construction market better follows demand.
3. **how they are built:** addressing resource use in materials, operation, construction and demolition.

FOOD

While the **majority of natural resource use and environmental impacts takes place at the primary production stage,** primary producers have a limited ability to shape food systems and change their production practices.

The middle stages of the food value chain - comprising food companies, retail and food services - are structurally powerful and to a large degree **shape both what food farmers produce and sell and what food consumers buy and eat.**

Key challenges to be addressed:

1. **what types of food we produce and consume:** addressing the vast differences in resources and environmental impacts to produce different types of food.
2. **how much food we produce and consume:** reshaping the food environment to reduce food waste
3. **how we produce food:** shifting primary production practices, including with mid-stream and down-stream actors.

Most policy measures, captured through the official reporting on SDG indicator 12.1.1, **address either primary production or individual consumption stages.** This leaves a continued gap in measures that address the middle stages of the food value chain.

Policy measures include a good mix of regulatory and voluntary measures, while economic and financial measures are limited. Tools and solutions are required to support the implementation of voluntary measures.

Tools and solutions are available across the One Planet network to address the key challenges along the food value chain. While many activities are at primary production or individual consumption stage or are holistic; there is an **opportunity to build on ongoing initiatives at the food processing, retail and food services** – in particular through the sustainable tourism, sustainable procurement and consumer information programmes.

TEXTILES

Environmental and socio-economic hotspots identified along the entire textile value chain:

- Wet processing at textile production, synthetic fibre production and laundering in the consumer use phase are particularly important regarding the impact on climate.
- Natural fibre production and the consumer use phase are particularly important regarding impacts on water scarcity.
- The use and release of hazardous chemicals in wet processing lead to water pollution and impacts on human health and ecosystems.
- The release of microfibres is associated mainly with the use phase, however emerging evidence points to its importance across textile manufacturing and at end-of-life.
- Social risks are particularly high in natural fibre production, followed by yarn and fabric production and garment assembly.

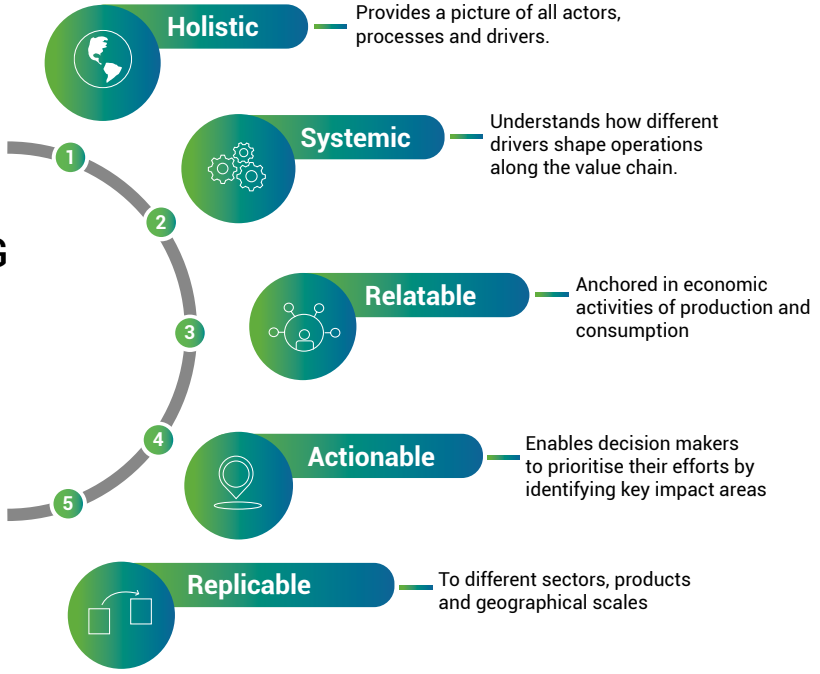
A number of initiatives have made headway in addressing the most pressing social and environmental challenges, nonetheless, improvements need to become mainstream to evolve from an industry producing large volumes of disposable items, to one producing valuable items that remain in use for a long period before being repurposed or recycled.

The common vision is to shift away from the traditional "take-make-dispose" linear textile value chain towards a circular system, where materials are not lost after use but remain in the economy, circulating as long as possible at the highest possible value.

Achieving systemic changes will require coordinated actions by all stakeholders and across regions. Priority needs to create a sustainable and circular textile value chain include: 1) **stronger governance and policies** to drive change, 2) **collaboration and financing** to enable industry-wide action, and 3) **changes in consumption habits.**

Key conclusions from the application of the value-chain approach in the three sectors (references of all sources are provided in table 1)

FIVE VALUE-ADDING FEATURES OF THE VALUE-CHAIN APPROACH



1. Holistic

The value chain approach provides a holistic picture of actors, processes and drivers. For example, UNEP's work on sustainable and circular textiles is based on a holistic approach, requiring changes at each stage in the value chain and involving players of all sizes and from all market segments. It implies that strategic interventions across the textile value chain need to be undertaken by all actors, such as national and local governments, brands and industry, and civil society – and across regions.Looking at the textile value chain holistically has helped to identify that the priority needs include stronger governance and policies to drive change, collaboration and financing to enable industry-wide action, and changes in consumption habits.

2. Systemic

Understanding how the value chain operates within a system enables moving beyond a siloed and disconnected analysis, and toward understanding how different drivers of the sector shape the operations along the value chain. Each of the drivers contribute to shaping the system and influencing the behaviour of the actors along the value chain and determining what options are available to them. Equally, each of these drivers are all possible points of intervention to positively shape both the way systems work as well as the behaviour of actors along value chains.The systems analysis of the food value chain highlights several important features at the different stages of the value chain, specifically for the food companies present in the middle of the value chain, for farmers and fishers at the primary production stage, and for individual consumers downstream in the value chain.

3. Relatable

Anchoring natural resource use and environmental impacts in economic activities of production and consumption - through the prioritisation of economic sectors and by drawing knowledge on the political economy, sociology and anthropology beyond natural sciences - provides the opportunity to ensure a balance between sustainable development and the transition of the sector to resource efficiency, circularity and a smaller environmental footprint.

4. Actionable

The value-chain approach also enables decision makers to prioritise their efforts by identifying key impact areas. For instance, UNEP research for textiles shows that 36% of the global apparel's climate impact comes from the bleaching/ dyeing and finishing phase of the value chain, closely followed by the use phase, which accounts for 24%. This shows that the most effective actions to decrease the industry's climate impacts are extending the useful life of textiles and changing laundry practices.

5. Replicable

The value-chain approach is a framework methodology applicable to different sectors, products and geographical scales.

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INFORMING STRATEGIC PLANNING FOR THE INTERNATIONAL RESOURCE PANEL AND THE ONE PLANET NETWORK

This report informs the strategic planning exercises that both the International Resource Panel and the One Planet network have recently launched. It provides guidance on how each initiative could adopt the value-chain approach systematically to guide their planning and prioritisation according to their mandate and role, it also highlights the value of a continued collaboration between scientists and practitioners to define knowledge needs or common agendas for action.

For the International Resource Panel, a value-chain approach will help focus research priorities and respond to the knowledge needs of practitioners towards providing actionable, high-impact knowledge. Furthermore, the data gaps identified can also be further discussed by the Panel to strengthen availability and usability of data on stocks, flows and status of natural resources. These will benefit from continued and long-term engagement of the 'users' of International Resource Panel generated knowledge.

For the One Planet network, there are clear opportunities presented by this approach towards a strengthened relevance and a renewed mandate beyond 2022. The value-chain approach provides a basis to define a common agenda on specific sectors, across stakeholder groups and areas of expertise. Further to this, as the multi-stakeholder network implementing SCP, its actors can play a key role in implementing the common agenda and in implementing the prioritised actions.

STRENGTHENING THE SCIENCE-POLICY INTERFACE TO INFORM AND GUIDE ACTION

A strengthened science-policy interface would highly benefit from the systematic application of approaches, such as the value-chain approach, which provides the practical interface for the experts (International Resource Panel) and the practitioners (One Planet network) to organise information in a way that it is understandable and relatable to both groups.

Aspects of particular relevance to strengthening the science-policy interface that emerged in the application of this approach are the need to:

- ensure a multi-stakeholder participatory process to define knowledge needs, identify solutions and define a common agenda;
- structurally re-organise data and information analysed for and presented by scientific assessments so that they are relatable by practitioners;
- re-think which information is highlighted when scientific assessments are promoted and disseminated,
- integrate data from social sciences, the humanities, and practical knowledge, beyond data on natural sciences.

BRIDGING THE GAP BETWEEN THE SCIENCE ON NATURAL RESOURCES AND THE SOCIO-ECONOMIC FEATURES OF CONSUMPTION AND PRODUCTION

Natural resources are at the centre of the Agenda 2030 for Sustainable Development. The application of the value-chain approach to economic sectors demonstrates how natural resource use and environmental impacts are embedded within, and shaped by, socio-economic systems.

By bridging the gap between the science on natural resources and the socio-economic features of production and consumption, the value-chain approach provides actionable insights on the management of natural resources in support to the implementation of the Sustainable Development Goals.

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INTRODUCTION

MANAGEMENT OF NATURAL RESOURCES IN RELATION TO AGENDA 2030

Natural resources are at the centre of the Sustainable Development Goals and the 2030 Agenda for Sustainable Development. They underpin human consumption and production systems and are intertwined with climate change, biodiversity loss, and pollution. Resource extraction and processing account for approximately half of global climate change emissions, 90 per cent of global biodiversity and water stress impacts, and about one third of human health impacts. Changes in consumption and production patterns can help promote decoupling of economic growth and human well-being from resource use and environmental impacts. It can also trigger the transformations envisaged by global commitments on biodiversity, climate and sustainable development at large. Modelling undertaken by the International Resource Panel shows that by 2060, resource efficiency, sustainable consumption and production, emissions reductions and carbon removal policies could decrease global resource use by 25 per cent, increase global gross domestic product by 8 per cent and cut greenhouse gas emissions by 90 per cent, compared with projections under business as usual.

Sustainable resource management, captured by target 12.2 of the Sustainable Development Goals, is however on a long-term trend in the wrong direction (United Nations [UN] 2019a). Indicators under SDG targets 12.2 and 8.4 on material footprint (materials extracted throughout global supply chains to meet the importing country's demand) and domestic material consumption (materials being used within a country) continue to rise at the global level, showing that the rate at which materials are being extracted globally is outpacing both population and economic growth (UN 2019b).

Globally, we continue to use ever-increasing amounts of natural resources to support our economic activity and the efficiency with which resources are used remains unchanged (UN 2019). While specific actions have been undertaken to improve the efficiency of resource use in a specific industry or area, this has not resulted in their widespread adoption across sectors and industries. Combined with increased demand for products and services, this means that we have not yet seen decoupling of economic growth from environmental degradation. In a business as usual scenario, global GDP will continue to grow at an average rate of 2.2% per year to reach US$ 216 trillion by 2060. This would require a 110% increase in global resource extraction to 190 billion tonnes (International Resource Panel

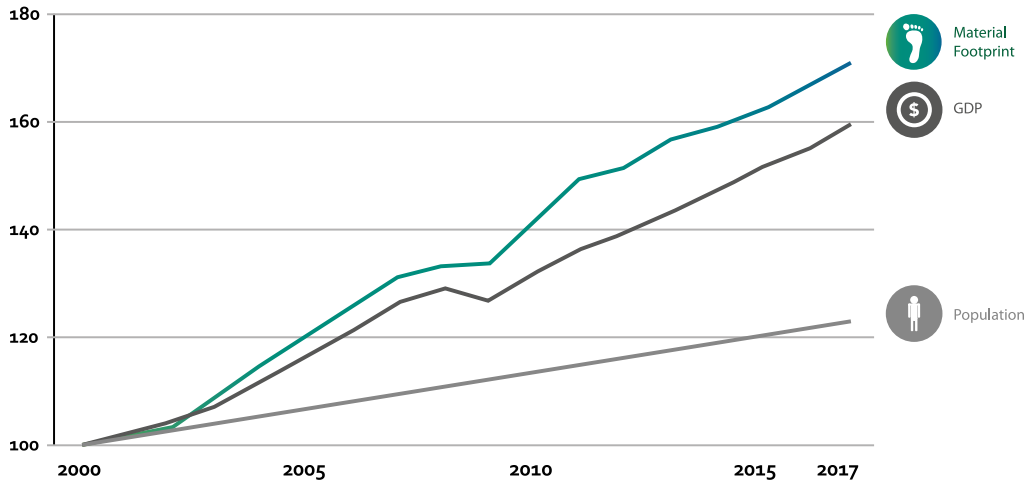

Figure 1: Population, material footprint and GDP growth index, 2000-2017 (baseline 2000= 100). (Source UN 2020 p.5)

[IRP] 2019; Organisation for Economic Cooperation and Development [OECD] 2018). In addition, the use of natural resources and the related benefits and environmental impacts are unevenly distributed across countries and regions. Perpetuating current modes of production and consumption, and the current levels of inequality associated with them, threatens the achievement of the entire 2030 Agenda.

The science is clear on the need to decouple economic growth from natural resource use, and so are the global trends on SDG 12. Yet this evidence does not always reach key decisions makers in a way that is relevant and actionable. The complex data on material flows and footprint, and the globalised framing of their dynamics, inhibits its use and application. The implications of this evidence are not always available to the relevant stakeholders in clear language, neither in a way that relates to their needs, nor contextualised to their sectors and countries (UN 2020). Stakeholders, whether governments, businesses or civil society, need comprehensive and tailored information to help identify priorities, implement strategies, and monitor impacts around the sustainable management of natural resources.

BRINGING TOGETHER THE SCIENCE ON NATURAL RESOURCES AND THE ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION

To address the challenge, and as requested by the 4th UN Environment Assembly's resolution on *Innovative pathways to achieve sustainable consumption and production* (UNEP/EA.4/Res.1), a task group comprising of the International Resource Panel and the One Planet network has been established. The aim of the task group is to catalyse science-based policy action on sustainable consumption and production, thereby providing actionable insights on the management of natural resources in relation to the 2030 Agenda for Sustainable Development.

The task group brings together the experts on natural resources of the International Resource Panel and the practitioners implementing sustainable consumption and production of the One Planet network. It establishes a two-way communication between the available science and the requirements to turn this science into action. On the one hand, it provides experts with the opportunity to share information with practitioners and support the identification of priorities. On the other hand, it provides practitioners with the opportunity to share existing action with experts and support the needed tailoring and contextualisation of scientific information.

Figure 2: The complementarity between the International Resource Panel and the One Planet network

To reflect the interface between experts and practitioners, the task group includes representatives of all stakeholder groups involved in the International Resource Panel and the One Planet network: Government, Business, Civil Society, Academia and International Organisations. In addition to stakeholder group representation, its composition also considered regional balance and diversity of expertise. Accordingly the composition includes: four Government representatives (International Resource Panel and/or One Planet network), two business/private sector representatives (One Planet network), two civil society representatives (One Planet network), three experts (International Resource Panel), three representatives of international organisations (One Planet network), as well as the co-chair of the International Resource Panel and the chair of the Board of the 10-year framework of programmes on sustainable consumption and production. The full overview of the task group composition is provided in Annex to this report.

Composition of the task group:

Government representatives -4

Argentina · The Netherlands · Finland · South Africa

(International Resource Panel and/or One Planet network)

Business/private sector representatives -2

CRB · المنتدى السعودي للأبنية الخضراء SaudiGreenBuildingForum

(One Planet network)

Civil society representatives -2

WWF · World Resources Forum

(One Planet network)

Experts -3

ETH zürich · USDA

(International Resource Panel)

International organisations -3

UN environment programme · UN-HABITAT FOR A BETTER URBAN FUTURE

(One Planet network)

Initiative Chairs

International Resource Panel

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Task group members are members of the International Resource Panel or the One Planet network

The International Resource Panel

The International Resource Panel provides science-based, policy relevant information on the sustainable management of natural resources. It aims to provide independent, coherent, authoritative, and policy-relevant scientific assessments on the sustainable use of natural resources and, in particular, their environmental impacts over the full life cycle; and contribute to a better understanding of how to decouple economic growth from environmental degradation. The Panel consists of eminent scientists with expertise in resource management issues. It studies key questions around global resource use and produces assessment reports that distil the latest scientific, technical and socio-economic findings to inform decision-making. It has published more than 30 assessments showing opportunities for governments, businesses and wider society to promote sustainable consumption and production.

www.resourcepanel.org

The One Planet network

The One Planet network implements the 10-year framework of programmes on sustainable consumption and production (10YFP) and is a formally designated implementation mechanism for Sustainable Development Goal 12. As a global multi-stakeholder partnership, it comprises of governments, civil society, businesses, scientific organisations and international organisations. The One Planet network leads the shift to sustainable consumption and production by setting the agenda, and providing tools, knowledge and solutions to deliver on SDG 12. Through its six accelerator programmes and the active participation of its stakeholders, the network fosters collaborative and systemic approaches for the implementation of sustainable consumption and production. The six programmes are as follows: Sustainable Public Procurement, Sustainable Buildings and Construction, Sustainable Tourism, Sustainable Food Systems, Consumer Information, and Sustainable Lifestyles and Education.

www.oneplanetnetwork.org

CATALYSING SCIENCE-BASED POLICY ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION

From its initial meeting, the task group identified the need for recommendations that are specific and actionable by stakeholders and practitioners in order to achieve successful, science-based action. The task group members' review of a set of International Resource Panel reports (listed in Annex 2) highlighted that while the reports are useful for awareness raising and engagement, the recommendations are typically too general and high level to guide the implementation of specific measures. They also indicated that the reports introduce important concepts and principles (for example on decoupling and targets) with a lot of relevant data and analyses. However, they identified a difficulty in relating these concepts and principles to their work as practitioners implementing sustainable consumption and production (SCP). Finally, the task group identified that reports addressing a specific sector tend to be more helpful and relatable (such as the reports on food systems and on 'the weight of cities'), but overall the reports remain relatively complex in the presentation of the issues at stake. There is thus a clear need to translate the information derived from International Resource Panel reports so that they are accessible and relatable for SCP practitioners to implement.

Following this initial assessment, the task group decided to focus on practical approaches to catalyse the science-policy action on SCP that can simplify the information and organise it in such a way that key areas of intervention can be identified to shape corresponding action.

> A sectoral focus and a value-chain approach were therefore adopted to underpin the interface between the science on natural resources and the action on SCP

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This report provides an overview of how the value-chain approach has been applied through mainly using information made available by the International Resource Panel and the One Planet network. The practical illustration of the benefits of the value-chain approach to define action that is informed by science is demonstrated by its application to the three prioritised sectors of Food, Construction and Textiles. These are prioritised in accordance with the sectors highlighted by the 4th UN Environment Assembly (UNEP/EA.4/Res.1) by the 10-year framework of programmes on sustainable consumption and production to the High-Level Political Forum on Sustainable Development (UN 2020). The report concludes with insights into the benefits of the value-chain approach to strengthen the science-policy interface and to understand management of natural resource in relation to the 2030 Agenda on Sustainable Development.

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CHAPTER ONE

OVERVIEW OF THE VALUE-CHAIN APPROACH:

An interface between science on natural resources and action on sustainable consumption and production

VALUE CHAINS: AN INTERFACE BETWEEN SCIENCE ON NATURAL RESOURCES AND ACTION ON SUSTAINABLE CONSUMPTION AND PRODUCTION

For insights on management of natural resources and raw materials to support pathways towards sustainable consumption and production and delivery of Agenda 2030 for Sustainable Development, it is necessary to understand natural resources in relation to economic activities and its related cycle of consumption and production.

The value chain offers the lens required to reach this understanding, by including all activities that provide and receive value throughout the life cycle of a product or a service, from supply to disposal after use and including aspects such as business models, investments and stakeholders.

The value-chain approach considers the entire value chain of economic activities, by understanding what is happening at different stages of the value chain as well as how the value chain operates as part of a system (Figure 4).

Adopting a value-chain approach helps to identify strategic intervention points and shape corresponding actions that improve natural resource management and achieve multiple sustainability objectives simultaneously.

By being specific (type of resource, type of impact, stage of the life cycle) and by engaging all stakeholders, this approach also generates solutions that are actionable at different levels by different actors.

As such, the value-chain approach provides a practical interface between the science and data on natural resource use and environmental impacts, and the actions that stakeholders can take towards SCP and Agenda 2030.

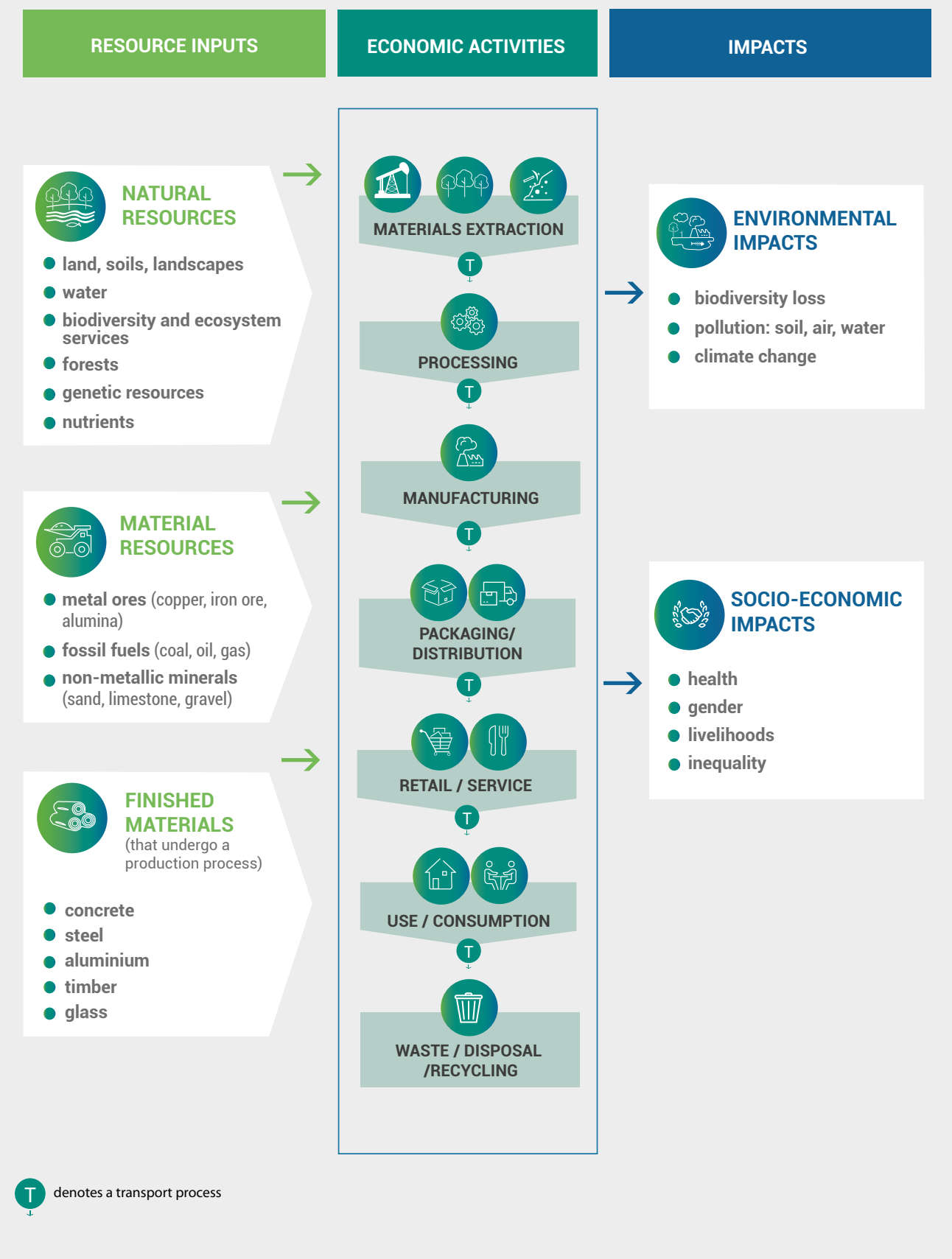


Figure 3: Economic activities of production and consumption in relation to natural resources and the environment (acknowledging that this visualisation is a simplifcation).

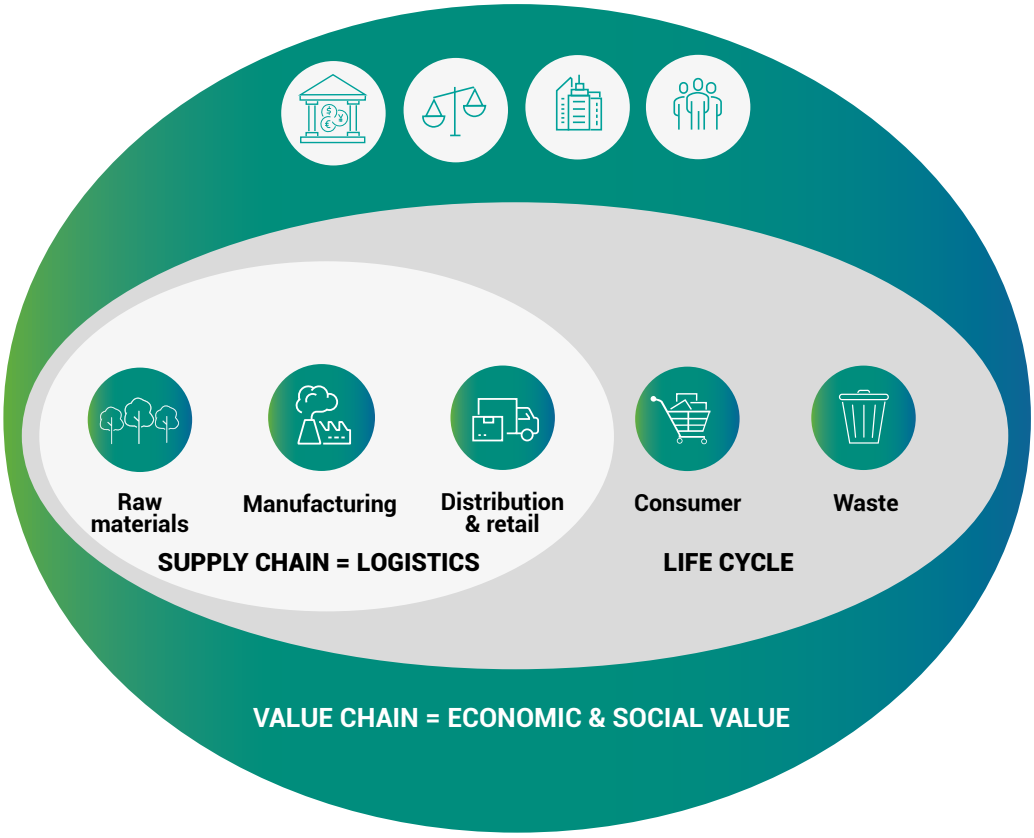


Figure 4: The value chain, in relation to supply chains and lifecycle. (Adapted from UNEP 2017a p.16)

Definition of value chains

(United Nations Environment Programme [UNEP] 2020a):

"The value chain is comprised of all the activities that provide or receive value from designing, making, distributing, retailing and consuming a product (or providing the service that a product renders), including the extraction and provision of raw materials, as well as the activities that are involved with the textile after its useful service life. In this sense, the value chain covers all stages in a product's life, from supply of raw materials through to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation. At all stages in the value chain, and in the transport of intermediate and finished products between the value chain stages, raw materials and energy are required and emissions to the environment are produced. In addition, the value chain is also comprised of the actors undertaking the activities and the stakeholders that can influence the activities. The value chain thus incorporates not only the physical processes, such as farms and factories, but also the business models and the way products are designed, promoted and offered to consumers."

THE VALUE-CHAIN APPROACH: A METHODOLOGY TO ORGANISE INFORMATION AND DATA TO SHAPE IMPACTFUL ACTION

The value-chain approach aims to identify hotspots and shape corresponding actions built on existing knowledge and available data. It provides a framework applicable to different sectors, products and geographical scales. As an action-oriented approach, its key outcomes are: identifying where the greatest opportunity for improvement occurs, which actions need to be promoted to take advantage of these opportunities, what enabling conditions are needed and which stakeholders should lead such actions.

Whereas no standard or formal methodology currently exists for this approach, extensive knowledge material and guidance is available from a variety of sources. In particular, from the work undertaken in this area by UNEP and the Life-Cycle Initiative (including for example UNEP 2017a and UNEP 2017b). This guidance enables an overall framing of the value-chain approach, while ensuring the needed flexibility to cater for the complexity of the sectors addressed by the task group and the overall request of the Resolution to provide insights on natural resource management in the context of Agenda 2030.

For the work of this task group on catalysing science-policy action, the source of data and information is primarily the International Resource Panel and the One Planet network, complemented by other sources. While many data sources exist and a number of key global sources have been considered by the task group, a detailed review of all relevant information available is beyond the scope of this task group. This information is analysed and discussed under three key steps: 1) Understanding the value chain and identifying the key hotspots, 2) Consolidating existing action and identifying opportunities to address the identified hotspots, 3) Defining a common agenda and prioritising action to address identified gaps. As indicated by the International Resource Panel achieving sustainable transitions will not happen spontaneously, but rather requires well-designed and concerted policy packages (IRP 2019).

Photo by Christopher Burns on Unsplash

The ambition is that the common agenda will guide all actors in a holistic way towards the desired sustainability, including through structural shifts and circular models. For this common agenda to be truly holistic it is however necessary to undertake all other steps of the value-chain approach to inform its definition. **An overview of the different steps to be undertaken in applying this methodology is provided on the next page.**

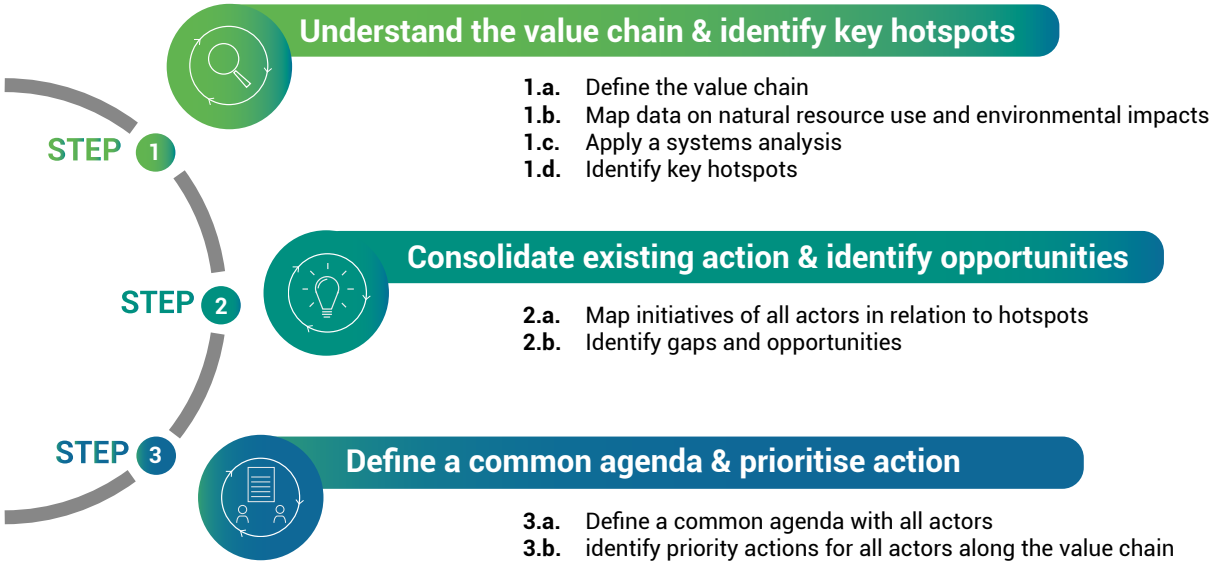


Figure 5: Overview of key steps of the value-chain approach

STEP 1.a.
Understand the value chain and identify key hotspots

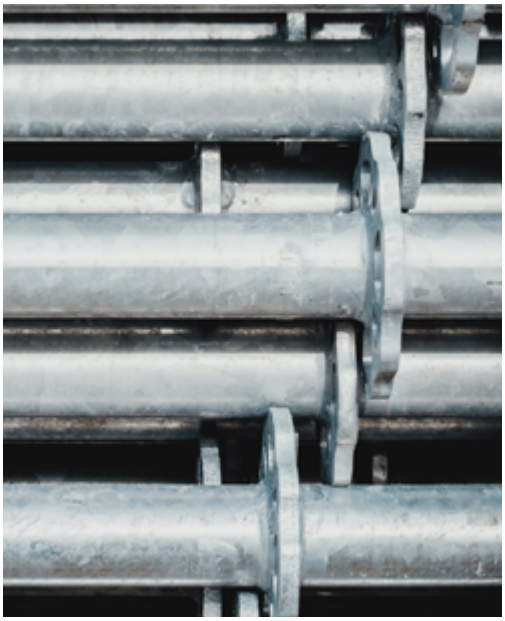
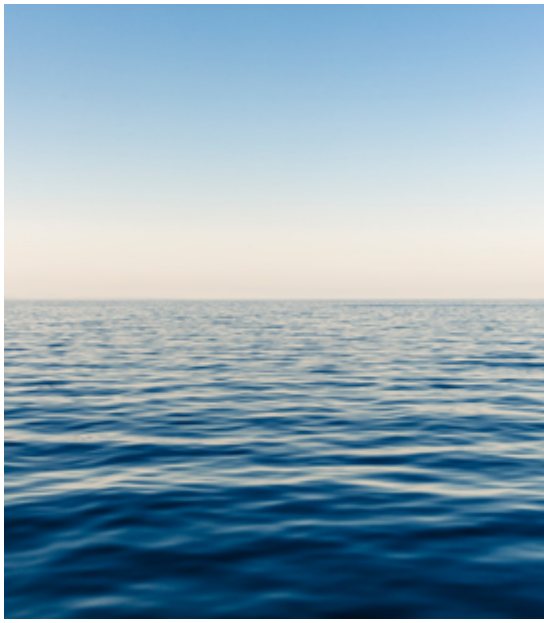
Define the value chain, its key stages and key actors

The value chain covers all stages in a product's life, from supply of raw materials through to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation. In addition, the value chain is also comprised of the actors undertaking the activities and the stakeholders that can influence the activities. The value chain thus incorporates not only the physical processes, such as farms and factories, but also the business models and the way products are designed, promoted and offered to consumers.

The value chain will typically include the following stages: natural resource extraction, production, processing/manufacturing, packaging, distribution, marketing, sale (retail & other), consumption, waste management, disposal and after use. However, there may be important variations between sectors, products and geographical locations.

It is therefore important for the next steps of this approach to ensure that the key stages of the value chain and their actors are captured. For the purpose and scope of the review of global value chains, simplification and generalisation on the stages of the value chain is necessary while acknowledging that these may vary between and within countries and regions.

Primary sources of information in this task group: multiple

Photos by: (above left) Markus Spiske on Unsplash; (middle) Bernard Hermant on Unsplash; (right) Yacar Fotografik on Unsplash

STEP 1.b.

Understand the value chain and identify key hotspots

Map data on natural resource use and impacts to the stages of the value chain

This identifies what is happening.

The mapping of available data and information to key stages of the value chain allows to filter and distil large volumes of information to identify where the greatest opportunity for improvement occurs. The mapping focused mainly on natural resource and material use, and environmental impacts, as well as known socio-economic impacts. The mapping of data and information included the following:

Natural resources: land, soils, landscapes, water, biodiversity and ecosystem services, forests (natural or commercial), genetic resources, nutrients.

Material resources: metal ores (copper, iron ore, alumina), fossil fuels (coal, oil, gas), non-metallic minerals (sand, limestone, gravel). Several significant limitations to the use of biomass as a metric have been identified (see chapter 3) and as such it is not mapped in this work.

Finished materials (that undergo a production process): concrete, steel, aluminium, timber, glass.

Environmental impacts: Data and information on the following environmental impacts were mapped: deforestation, biodiversity loss, water: reduced availability and pollution, soil: degradation and pollution, air pollution, greenhouse gas emissions

Known socio-economic impacts: When available, socio-economic impacts have also been mapped to the different stages of the value chain.

Primary sources of information in this task group: IRP data; other data as needed (e.g. UNEP, UN, LCA)

STEP 1.c.
Understand the value chain and identify key hotspots

Apply a systems analysis to the value chain to map feedback loops and interconnections

This identifies why it is happening.

While the mapping of resource use and impacts along the value chain shows "what" is happening at different stages of the value chain, applying a systems analysis to it shows "why" it is happening. By integrating an understanding of the systemic barriers and drivers along the value chain within the analysis, it is then possible to understand how to change the "what is happening". For instance, the mapping of data will have identified stages of the value chain where the majority of the natural resource use and impacts occur. However, it does not automatically follow that the solutions are only to be found at those stages of the value chain.

It is necessary to apply a systems lens to the analysis of a sector to move beyond a siloed and disconnected analysis, toward understanding how different drivers of a given sector shape the operations along the value chain. Drivers such as institutions, regulation, technology demographics, markets and other socio-economic and cultural factors shape the operations along the value chain. The drivers and the structure of the value chain determine the level of influence and power of certain actors, and thus their ability to contribute to the solutions. Each of the drivers contribute to shaping the sector and influencing the behaviour of the actors along the value chain and determining what options are available to them. Equally, each of these drivers are possible points of intervention to positively shape the way the sector works and the behaviour of actors along the value chain.

The findings of natural sciences are complemented by drawing on social sciences and the humanities - including political economy, sociology and anthropology - to understand the drivers and barriers along the value chain and to anchor natural-resources use in socio-economic reality.

Primary sources of information in this task group: IRP data; other data as needed (e.g. global reviews of UN, World Bank, private sector associations, etc)

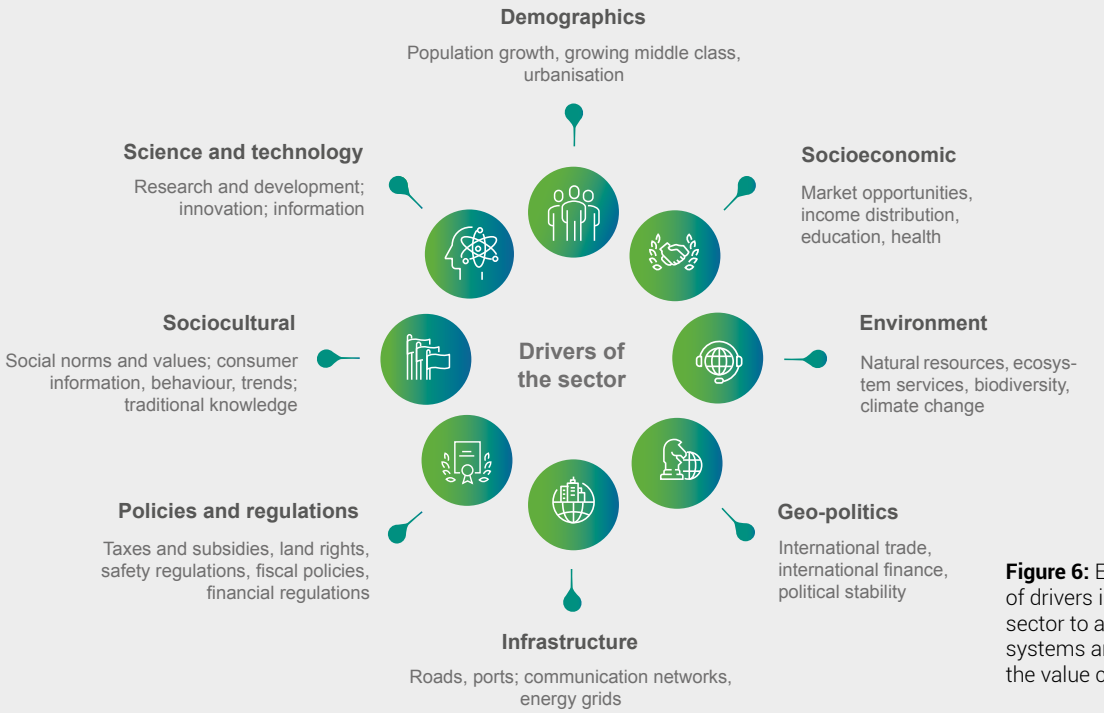


Figure 6: Example of drivers in a given sector to apply a systems analysis to the value chain.

STEP 1.d.

Understand the value chain and identify key hotspots

Identify key hotspots of natural resource use and environmental impacts

This identifies where to act.

The mapping of natural resource use and environmental impacts along the value chain and application of a systems lens in steps b and c provide an overview of what is happening and why it is happening in a given sector. This forms the evidence-basis to pose the question "Where to act?" thereby identifying key intervention points or hotspots along the value chain. A hotspot is regarded as a component of the system that directly or indirectly contributes to natural resource use and its associated impacts either as a driver of unsustainable practices or a barrier to sustainable practices, and that can be acted upon to mitigate it (UNEP 2020b).

The question "Where to act?", in the context of natural resource management, can be split into: What resources are being used and/or causing impact? Where are they being used (which stage of the value chain, which location, or which actors?) How are they being used? Why are they being used?

The overview in a given sector of data and information on the value chain and system may also highlight key information gaps, that are equally important to take into account in the formulation of priority actions.

Primary sources of information in this task group: Conclusions derived from the sources above

STEP 2.a.

Consolidate existing action and define opportunities to address the identified hotspots

Map initiatives from all actors of the value chain in relation to identified hotspots

This identifies who is acting on what.

Different initiatives by different actors along the value chain are taking place in any given sector. The mapping is undertaken of available information on existing action of all actors along the stages of the value chain and in relation to the identified hotspots; these may include changes in practices, tools or resources, and initiatives. It will also include a mapping of the existing policies, in relation to their implications for key stages and actors of the value chain in relation to the identified hotspots.

Primary sources of information in this task group: One Planet network data; consultations

STEP 2.b.

Consolidate existing action and define opportunities to address the identified hotspots

Analyse mapping to uncover gaps and opportunities

The mapping of initiatives (policies, activities, resources) from all actors of the value chain addressing key hotspots provides a basis to identify a) what initiatives are already addressing key hotspots and that can be leveraged and further coordinated for greater impact, and b) major gaps in addressing or understanding key hotspots and trade-offs that deserve particular attention.

Primary sources of information in this task group: One Planet network data; consultations

STEP 3.a.

Define a common agenda and prioritise action to address gaps

Define a common agenda that enables alignment of all actors

This identifies a shared vision for change.

The common agenda aligns all actors to a shared vision for change, that includes a common understanding of the problem and a joint approach to solving it. This will be undertaken through a participatory process engaging different stakeholders across the value chain.

Moving towards the desired sustainability, including through structural shifts and circular models, requires a holistic approach involving players of all sizes and from all market segments. The participatory approach ensures tapping into the bodies of lay and practical knowledge that are collectively held among SCP practitioners, as well as ensuring their crucial buy in for the implementation of the common agenda.

Primary sources of information in this task group: consultations

STEP 3.b.

Define a common agenda and prioritise action to address gaps

Identify priority actions for value-chain actors based on the hotspots, opportunities, gaps and trade-offs identified

This identifies what to do, by whom and how

Based on the common agenda and the key hotspots which require further attention, multi-stakeholder consultations with actors across the value chain will enable prioritisation of actions for value-chain actors to implement. The value-chain approach will allow those recommendations to be specific (to the stage of the value chain, to the actor, etc) while having visibility of the consequences of such actions in other parts of the value chain and thereby considering trade-offs and avoiding burden shifting. While the co-creation of a common agenda and common solutions is encouraged, key priority actions will also be specific to a stakeholder group or a stage of the value chain whereby co-creation may not always be possible or advisable. Further to the specificity of stakeholders and stages of the value chain, the Life-Cycle Initiative recommends considering both what actions to take (i.e. interventions) and how these actions can be practically implemented (i.e. instruments) (UNEP 2020b).

Primary sources of information in this task group: consultations

The implementation of the holistic solutions and prioritised actions is the main expected next step following the analytical and consultative process outlined in this methodology. While implementation is outside the scope of this report, it is envisaged that their uptake can be further facilitated through consistent advocacy efforts and continued engagement of stakeholders.

Photo by Kira Auf der Heide on Unsplash

The value-chain approach applied by the task group is inspired by and adapted from existing approaches of the United Nations Environment Programme (UNEP) and of the Life-Cycle Initiative

UNEP's Eco-innovation approach:

Eco-innovation is a business approach which promotes sustainability throughout the entire life cycle of a product, while also boosting a company's performance and competitiveness. UNEP provides guidance for the implementation of eco-innovation within small and medium sized companies in developing and emerging economies. This includes a methodology to inform, guide and support companies to improve their sustainability performance as a strategy for developing new business models.

www.ecoinnovation.org

UN environment programme

Life cycle assessments and the Life Cycle Initiative:

Life Cycle Assessment studies underpin the hotspots identification in the value-chain approach. The Life Cycle Initiative ensures the best life cycle tools and approaches are applied in key decision- and policy-making context. It also hosts the "Global LCA Data Access" network which provides users with an interface to find and access life cycle inventory datasets from different providers. The Life Cycle Initiative is a multi-stakeholder partnership to foster the enabling conditions for global application of life cycle approaches.

www.lifecycleinitiative.org

Life Cycle Initiative

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CHAPTER TWO

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THE VALUE-CHAIN APPROACH IN PRACTICE:

Applying it to food, construction and textiles

This section of the report on the value-chain approach in practice provides an overview of the application of the value-chain approach in each prioritised sector. It provides a practical illustration of the benefits of the approach, and includes key insights and lessons learnt as derived from its application.

The benefits of the value-chain approach to define action on SCP informed by science are demonstrated by applying the approach to three prioritised sectors: Construction, Agri-food and Textiles. As indicated previously, this prioritisation reflects the sectors by the 4th UN Environment Assembly resolution and reports to the High-Level Political Forum on Sustainable Development (UN 2020).

At the time of developing this report, the application of the value-chain approach had reached different steps in each sector (table 1). It is envisaged that the application of the value-chain approach in these sectors and others will be pursued beyond the issuance of this report and integrated in processes of the International Resource Panel and the One Planet network.

STEP OF THE VALUE-CHAIN APPROACH	VALUE CHAIN		
	Construction	Food systems	Textiles
STEP 1: Understand the value chain & identify key hotspots	Analysis of the construction value chain[1]	Analysis of the food value chain[2]	Overall report 'Sustainability and circularity in the Textile value chain – global stocktaking'[3] (UNEP 2020b)
STEP 2: Consolidate existing action & identify opportunities	Ongoing	Policies and activities along the food value chain – Analysis across the One Planet network[7]	An expert multi-stakeholder consultation workshop[4] convened by UNEP in 2019, available.
STEP 3: Define a common agenda & prioritise action		Ongoing	Panels and roundtables held at the 4th United Nations Environment Assembly[5] and the World Circular Economy Forum[6] in 2019

Table 1: Overview of application of the value-chain approach in three prioritized sectors (at December 2020).

Photo by Youssef Abdelwahab on Unsplash

CONSTRUCTION

APPLICATION OF THE VALUE-CHAIN APPROACH

Key messages:

The majority of natural resource use and environmental impacts takes place at the material production stage, the construction stage and the operation stage of the value chain. However, there is limited scope at these stages to make the needed changes for several reasons, including the informality, fragmentation, complexity and availability of options.

The most influential actors along the construction value chain are governments, international organisations, financial institutions and major market players, who are primarily acting at the financing stage and the planning and design stage of the construction value chain. The key decisions made at these stages largely shape the activity along the rest of the value chain.

Key challenges to be addressed: 1) What types of construction is built and used, and where – balancing their differing contribution to SDGs and their environmental footprint; 2) how much is being built: ensuring that the growth of construction market better follows demand; 3) how they are built: addressing resource use in materials, operation, construction and demolition.

This section of the report provides an overview of the application of step one on 'understanding the value chain and identifying the key hotspots'. It also provides insights on keys to success in applying step one of the value-chain approach as derived from its application to the construction sector

1. OVERVIEW OF THE VALUE CHAIN

This value-chain analysis for construction is informed by various reports of the International Resource Panel that address aspects of construction, complemented by other sources. Based on these sources the construction value chain can be visualised as below.

For illustration purposes, the stages of the value chain are reported as a linear sequence. However, some stages can take place simultaneously or with a different order (e.g. property market and construction) and involve a mix of processes and actors in different parts of the world (e.g. for the production and supply of construction materials) or may include circular economy approaches. Simplification and generalisation on the stages of the value chain is necessary while acknowledging that these may vary between and within types of construction, countries and regions.

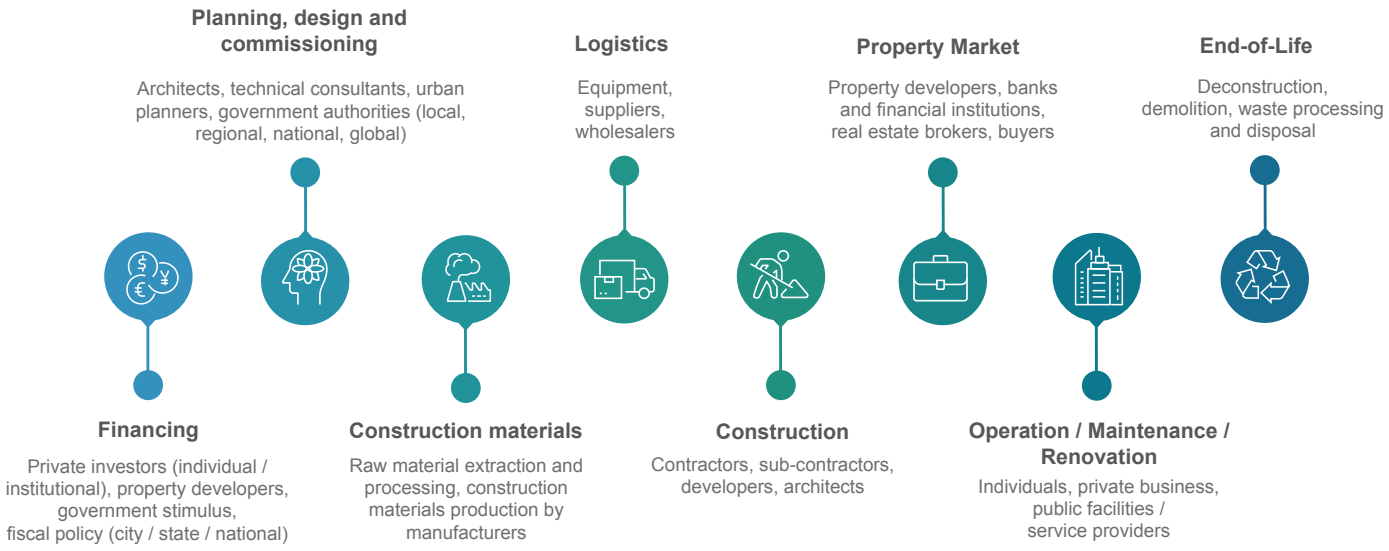

Figure 7: Stages of the construction value chain

2. NATURAL RESOURCE USE AND ENVIRONMENTAL IMPACTS ALONG THE VALUE CHAIN

2.1. Use of construction materials in the value chain

Construction materials are usually manufactured using a combination of natural resources. The following materials are of particular relevance to construction:

- **Concrete:** is a key product used for buildings and consists mostly of aggregates, including gravel (40.8%) and sand (31.1%), cement (10-15%), water, and burnt lime as binder.
- **Cement:** is key ingredient of concrete; it is made of limestone, clay, shells, chalk, shale, slate, silica sand, and sometimes even blast furnace slag or iron ore.
- **Asphalt (or bitumen):** main material used for the construction of transport infrastructure (e.g. roads) and is mostly composed of petroleum and aggregates;
- **Metals (steel, aluminium, copper);**
- **Timber and wood-based products;**
- **Earth:** nearly 30% of the population of the world and more than half of the population of developing countries live in earth construction.
- **Chemicals, Glass, Plastics and Stones.**

Furthermore, alternative construction materials can also be sourced locally, depending on their availability, for example wood recovered from pallets, sugar cane bagasse, bamboo and typha.

There is limited overarching information available on material flows and stocks, as well as on the usage of materials along the global construction value chain. Different pieces of information are available from individual sources, often at a material-specific level such as on steel, or cement. This is related to the general focus on energy-efficiency over material use in construction sustainability.

2.2. Use of natural resources

A large amount of natural resources are used along the construction value chain to varying degrees at the different stages. The following table 2 provides an overview of where, how and for what purpose natural resources are used along the value chain. While all stages of the value chain utilise natural resources to some degree, the table indicates that **their use is most intensive during the production of materials, the construction and the operation stages compared to other stages along the value chain.**

Photo by Macau Photo Agency on Unsplash

	Financing	Planning, design, commissioning	Production of Construction materials	Logistics	Property market	Construction	Operation	End-of-Life
Land, soils, landscape			●●●			●●●●●	●●●	●●
Water			●●			●●●	●●●	
Biodiversity, Ecosystem Services			●●●●					
Genetic resources			●●					
Minerals & nutrients			●●●●●			●●●●●		
Fossil fuels			●●●●	●●		●●●●	●●●●●	●

Table 2: Indicative mapping of the main resources used along the construction value chain (The dots in each square represent the intensity of use of the specific resource at each stage of the value chain. Blanks may indicate low significance of resource use or lack of data)

Natural resources of particular importance to the construction value chain, include land, water, minerals and fossil fuels. Land is required to extract and manufacture materials, and for new construction to be built upon. In most areas, new urban expansion is developed in the most fertile areas (IRP, 2014), thereby creating competition between land use for construction and agriculture. Twenty-five per cent of water and 12% of potable water used globally are associated with buildings (IRP 2017a; IRP 2017b), mainly for construction processes and occupation of buildings. Non-metallic minerals and metals are the main natural resources used in the construction sector (IRP 2019). On a global scale, the construction sector uses about 65% of non-metallic minerals, 15% of ferrous metals and 3% of non-ferrous metals (OECD 2018). Non-metallic minerals are mostly used for buildings and in construction they include sand, gravel and limestone (IRP 2016a; IRP 2019).

2.3. Environmental Impacts

In addition to using natural resources efficiently, natural resources must also be used sustainably, meaning that the use of these resources does not cause harmful consequences to the environment such as biodiversity loss, global heating or reduced air, soil and water quality. **Pollution and greenhouse gas (GHG) emissions are among the most documented environmental impacts in construction.** Pollution of air, water and soil is generally associated with the extraction and processing of natural resources and the manufacturing of construction materials, as well as logistic activities and construction (Table 3). The construction sector is responsible for 39% of global GHG emissions, which are mainly associated to the operation of buildings, as well as from the production and supply of construction materials. The conversion of land to be used for construction also contributes to biodiversity loss, deforestation and reduced carbon sequestration. The major environmental impacts caused along the construction value chain include:

IMPACT	Financing	Planning, design, commissioning	Construction materials	Logistics	Property market	Construction	Operation	End-of-Life
Deforestation and land-use changes			Land conversion; use of timber; mining			Land conversion	Occupation of land over time	
Biodiversity loss			Land conversion; use of timber			Land conversion		
Water - scarcity and pollution			River sand extraction				Wastewater	
Soil pollution and run-off			Mining; material extraction and production			Land conversion	Day-to-day waste and wastewater	Demolition, landfills, unmanaged waste
Air pollution			Material extraction and production			Dust emissions during the construction	Indoor air quality;	Landfills
GHG emissions			Embodied in construction materials	Transport		Construction activities; land conversion	Energy use	Waste

Table 3: Indicative mapping of main environmental impacts along the construction value chain (Impacts may more marginally occur also in other stages. Data gaps may exist)

Photo by Jeriden Villegas on Unsplash

The data presented above demonstrates that the **majority of both natural resource use and environmental impacts** that take place along construction value chain **occur at the manufacturing of construction material, the construction and the operation stages** of the value chain.

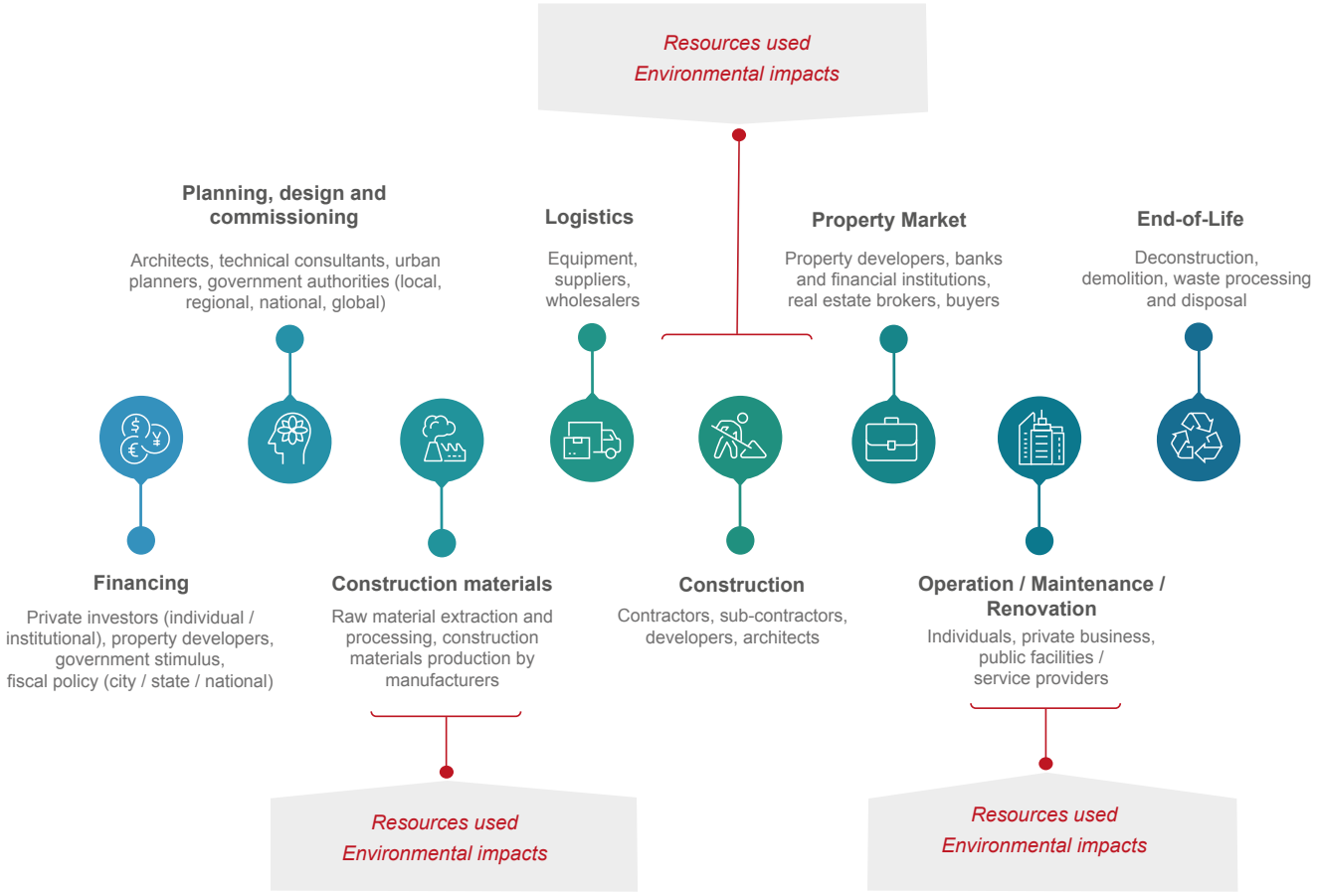

Figure 8: Stages of the construction value chain in which most natural resource use and environmental impacts occur

3. APPLYING A SYSTEMS ANALYSIS TO THE CONSTRUCTION VALUE CHAIN

Even though natural resource use and environmental impacts occur at the manufacturing of construction material stage, the construction stage and the operation stage of the value chain; the solutions can be found at many different stages. The interactions within the systems mean that the operations and behaviours of actors at different stages of the construction value chain can have a significant influence on the operations and behaviours of actors at other stages of the value chain.

Construction as a sector globally has the highest material consumption footprint, consuming almost 50% of the total material footprint across the global economy (SCP-HAT 2020). As outlined, this involves the use of a range of natural resources and results in many environmental impacts. However, the construction sector also contributes in a variety of ways to socio-economic outcomes and to meeting the Sustainable Development Goals, in particular SDG 11 which calls for safe and affordable housing; sustainable and affordable transport systems; and inclusive, gender responsive and sustainable urbanisation. It is therefore essential to analyse the socio-economic outcomes of the construction sector alongside the associated natural resource use and environmental impacts, to be able to balance any trade-offs. In order to undertake such an

analysis and consider these trade-offs, three questions must be applied to understanding natural resource use and environmental impacts along the construction value chain: 1) What is being built and where, 2) How much is being built; 3) How it is being built.

The discussion on sustainability in the construction sector often focuses on the third question of how things are being built, with an emphasis on circularity of materials, energy efficiency, material substitutes and innovation, as well as safety and resilience to natural disasters and to the impacts of global warming. By changing how we build through sustainable materials and practices, the associated natural resource use and environmental impacts of the sector can be reduced.

While this is a critical question, it is also necessary to ask what is being built and where? For example, is it residential, commercial, industrial or public infrastructure? Is the sector working on new builds or renovations of existing construction? Is the housing being built affordable or in cities and regions that have the greatest need for development? What land is being used for new construction? (e.g. is it fertile land converted from agricultural purposes, or land already occupied by informal settlements.) Depending on what type of construction is being built and where, this can have different levels of impact on natural resource use and environmental impacts, as well contribute in varying degrees to meeting the SDGs, thereby influencing how trade-offs are balanced.

The other question that must be asked is how much is being built? The overall volume of construction is a key determinant of the volume of natural resources that the sector is using as well as the degree of environmental impacts that are caused by the sector. The volume of construction activity is also connected to the different social and economic development pathways of countries.

The answers to the three questions above are shaped by a range of drivers along the different stages of the construction value chain, with much interaction and many feedback loops between stages. The following section applies a systems analysis to the construction value chain to highlight several important features at the different stages of the value chain.

3.1. Key observations along the construction value chain

A variety of construction projects involve different actors

At a global scale, residential buildings hold the largest portion of construction. In relative terms, residential buildings constitute the major part of construction in North America and Europe. Infrastructure dominates in Asia-Pacific, Latin America, Africa, and the Middle East; while non-residential buildings makes the strongest contribution in Eastern Europe (IHS 2013).

	Residential buildings	Institutional and commercial buildings	Specialized industrial construction	Infrastructure and heavy construction
Examples of type of use	Apartments, houses, dormitories, sheds, etc	Schools, hospitals, offices, shopping centres, retail stores, stadiums, etc	Chemical industry plants, power plants, etc	Roads, tunnels, bridges, railways, sewage systems, pipelines, etc
Design	Architects, engineers	Architects, engineers	Specialized engineers	Government, architects, engineers
Execution	Construction companies, builders	Construction companies, builders	Industrial corporation or specialized companies	Government agencies and construction companies
Management	Individuals, real estate company	Retail: company / private owner. School, hospitals: local / national government	Industrial corporation	Construction companies

Table 4: Main types of construction and indicative key players in their design, execution and management

Photo by Youssef Abdelwahab on Unsplash

Construction activity does not necessarily correspond with development

Global construction has been on an increasing trend over the last century (IHS 2013), to a large extent due to growing populations, increasing Gross Domestic Product (GDP) and economic development, as well as growing rates of urbanisation across the world, that have taken place since the end of the Second World War. However, while emerging markets are today growing in importance in the construction sector, advanced economies continue to make up a significant proportion of global construction activity:

- Emerging markets have grown from a 35% share of the global construction market value in 2005 to 54% in 2014.
- As of 2017, 31% of the emerging market share was comprised of just four countries (20% China, 5% India, 3% Russia, 3% Indonesia 3%).
- At the same time, just six high-income countries comprised 29% of the global market (12% USA, 5% Japan, 3% Germany, 3% UK, 3% France, 3% Canada).

These figures demonstrate that, while increasing GDP, population growth and urbanisation in developing countries can result in increased demand for homes, buildings and infrastructure, these socio-economic factors only partially explain the volume of activity in the global construction market. With just ten countries accounting for 60% of the global construction market, the majority of countries in the world, (most of which are developing and in need of buildings and infrastructure) are under-served by just 40% of current global activity in the construction sector. Despite the growing volume of construction activity taking place around the world, developing countries face a US $1-1. 5 trillion gap in financing the infrastructure necessary for social and economic development (United Nations Inter-Agency Task Force on Financing for Development [UN IATF] 2020).

3.2. Decisions by governments and investors largely determine activity along the construction value chain

Financing: Financial flows shape the construction value chain

The construction sector is one of the largest and most important economic sectors in the global economy. About US$ 10 trillion is spent on construction-related goods and services every year (McKinsey Global Institute 2017). The construction sector also accounts for around 10% of jobs and 10% of GDP in many countries (IRP 2017b). This contribution to GDP and employment makes construction a strategic and important sector for many national economies. Particularly during times of economic crisis or downturn, the construction sector is often a focus for governments when planning economic recoveries. This is due to the 'multiplier effect'

that construction spending can have, increasing activity and incomes that flow on throughout other parts of the economy.

Government stimulus to the construction sector can be an opportunity to direct construction activity towards achieving the 2030 Agenda in countries (International Institute for Sustainable Development [IISD] 2020). However, stimulus packages and programmes can sometimes prioritise short-term economic metrics over meeting the longer-term socio-economic needs of countries. For example, it may not include social or environmental criteria to ensure that the housing is affordable, that it is built in the locations where the need is greatest, and that it is built in a way that is resource efficient with as few environmental impacts as possible. This can result in harmful socio-economic consequences such as greater levels of housing unaffordability, increased inequality, and property price inflation which can be associated with economic instability.

One of the major influences on the construction sector is financialisation, which sees property, especially housing, as an investment asset rather than an essential service and a human right. Property market speculation sees financial capital invested in housing with a view of making a short-term profit from increasing house prices, or as a safe way to store capital, especially in more stable or higher growth markets abroad. According to the UN Special Rapporteur on the Right to Adequate Housing "through legislative measures, policies and programmes, many States have treated housing as a commodity for trading and speculation, rather than as a social good and a human right" while "international financial institutions and development banks have (…) imposed deregulation, the liberalisation of housing markets and austerity measures, including the selling of social housing, and required mortgage finance programmes that do not assist the lowest-income households" (United Nations High Commission for Refugees [UNHCR] 2019). This finding is supported by the International Resource Panel, which states that "governance arrangements at global, national and local levels have, in most countries, tended to facilitate financial instruments and property speculation to drive short-term growth" while "more equitable new wealth creation via innovation and skills development in the manufacturing and agricultural sectors became less important than returns from financialisation and urban property development" (IRP 2018a).

Government: a big investor in the construction sector

Governments can have major influence in the volume and type of activity in the construction sector not only indirectly through regulation of the financial and property markets, but also directly through their role as procurers of major infrastructure projects. The majority of global infrastructure project investments in 2017 (83 percent of a total US $0.5 trillion) came from the public sector including investment by government entities and state-owned enterprises (World Bank 2017). At a global level, international organisations and multilateral development banks also play a significant role in financing infrastructure, as do individual countries via their overseas development finance. In 2018, the total overseas development finance spent on infrastructure projects was US $77.6 billion, both from countries and multilateral development banks (OECD 2020). Governments also often play a role in supporting the financing of private infrastructure projects either directly or indirectly, as way of attracting investment. According to the World Bank "when governments seek private investment in infrastructure projects, they usually find themselves asked to provide grants, guarantees, or other forms of fiscal support." (World Bank 2003).

Construction value chain shaped by territorial planning and regulation

Urban and territorial planning aims to support economic, social, cultural and environmental goals through developing visions, strategies and plans and applying policy principles, tools, institutional and participatory mechanisms, and regulatory procedures (United Nations Human Settlements Programme [UN-Habitat] 2015). The construction value chain is heavily shaped by practices of urban and territorial planning, as well as regulation such as building codes, which are applied primarily by governments and public authorities at national, regional, local and neighbourhood levels, and are also influenced by business and civil society. These planning practices and regulations have a significant impact on what is built and where, how much is being built, and how it is built, therefore effecting the associated levels of natural resource use and environmental impacts along the construction value chain. However, the existence of such regulation, as well as its quality and degree to which it is effectively implemented, is influenced by a number of factors and interests across different countries. For example, of the new buildings expected to be constructed to 2060, more than two-thirds of these will be built in countries that do not currently have mandatory building energy codes in place (World Green Building Council [WGBC] 2017). As a result, urban planning practices and regulation of the construction sector are not always consistent or effective.

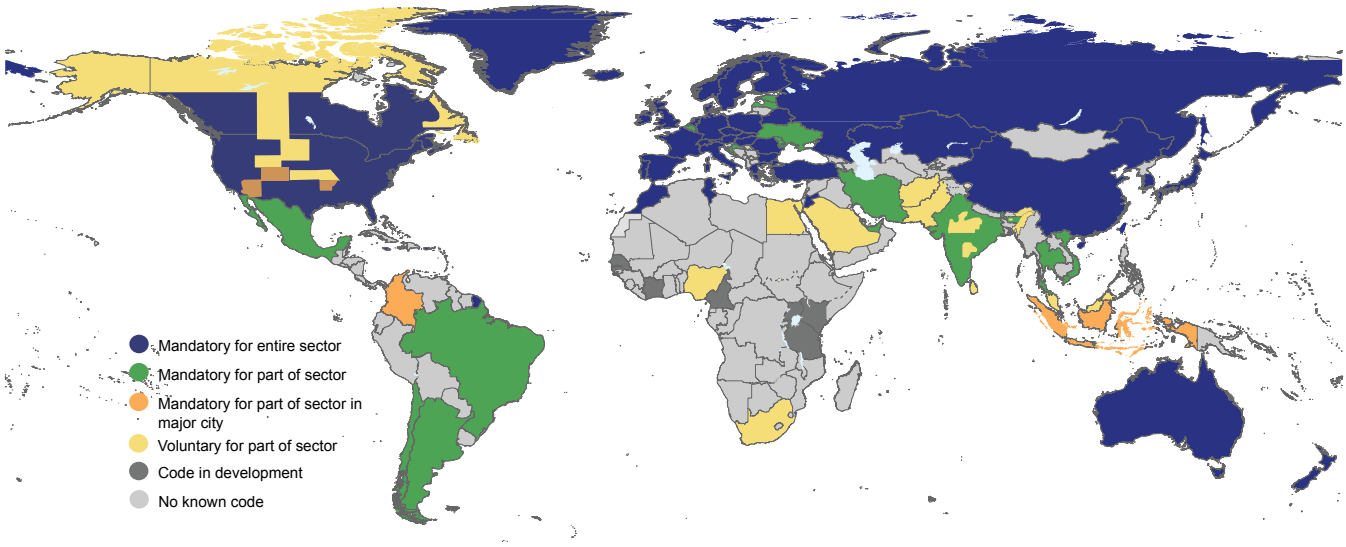

Figure 9: Existence of mandatory building energy codes across countries (adapted from: Global Alliance for Buildings and Construction [Global ABC] et al. 2019 p.20).

3.3. Limitations at key points of resource consumption inhibit sustainability

Material extraction and production: a growing demand

As the total amount of construction activity grows year on year, this requires an ever-increasing source of materials which in turn drives the growth of activity at the material extraction and production stage of the construction value chain.

- This increase in total volume of materials is especially noteworthy in the construction activity in China that consumed more cement between 2011 and 2013 than the United States of America (USA) did in the whole 20th Century (IRP 2018b).

- Sand, gravel, limestone and crushed rock, primarily used in construction, account for one-third of all materials consumed today in gigatonne terms, and this amount is set to more than double by 2060 (OCED 2018).

- In the USA, the amount of sand and gravel used in construction is almost exactly ten times the amount of final cement produced. If this were extrapolated to the rest of the world, the total sand and gravel used for construction would be 41 billion tonnes per year (UNEP 2019a).

Emerging economies are responsible for a growing share of resource extraction, partially reflecting their increase in construction activity but also exporting these to other countries where the construction is taking place. Material extraction and production stage of the construction value chain has in recent decades been increasingly relocated and outsourced to poorer countries where production costs and environmental standards are lower (IRP 2019). Especially when it is taking place in developing countries, it is often informal and unregulated, and can be associated with negative social and environmental consequences including poor working conditions and labour exploitation (Infrastructure & Cities for Economic Development [ICED] 2018). As global construction activity grows and demand for construction materials increased, ensuring governance, oversight and regulation of materials extraction and production will be crucial to reducing natural resource use and environmental impacts.

Photo by Tim Umphreys on Unsplash

Construction: Complexity, informality and fragmentation

Construction companies deal with many competing obligations, drivers and barriers, many of which can limit the ability to transition to more sustainable activities and mean that environmental considerations are often at the bottom of the list.

- Despite the existence of very large construction companies with a relatively large share of the global market (Deloitte 2019), construction is prevalently undertaken by small and medium sized enterprises (SMEs).
- Construction companies, especially SMEs, generally work with low profit margins, meaning keeping costs down is of prime importance which can limit the scope for using sustainable practices.
- At the same time, construction SMEs must often abide by complex building codes, leaving them squeezed between regulation and costs.
- The construction industry is characterised by a low labour productivity, with a worse condition for smaller companies.
- A low productivity can mean inefficient use of resources and can be due to factors such as market fragmentation, re-negotiation of contracts and missed transparency on costs, inefficient design that does not take standards into account, insufficient time dedicated to plan how to manage and execute projects, lack of skills and access to innovation, informal and low wage work (McKinsey Global Institute 2017).

The construction industry is also highly complex and fragmented, with a large number of different actors operating at a small-scale. Workers directly employed by construction companies include construction workers, carpenters, electricians and, to a lower extent, managers, architects and engineers, equipment operators, providers of legal and administrative services. Innovation in the construction industry is slow moving because of the time dimension of construction projects and because various actors and experts address different aspects often in isolation.

Informality in the construction sector is also a major problem, especially in many developing countries which lack building codes, formal regulation of the construction sector and effective implementation of labour rights and conditions.

While construction companies are a key actor along construction value chains, the various challenges and limitations faced by these actors reduce its ability to transition to more sustainable materials and practices, and to decrease natural resource use and environmental impacts.

Final users face limited choices and awareness of sustainable construction options

Individual users of buildings, especially occupiers as either buyers or renters, face limited choice in the types of construction available to them, particularly regarding the sustainability of these buildings, their natural resource use and environmental impacts. Few end users of construction have the opportunity to contribute to the design or planning stage of a building, with most needing to choose from the existing building stock that is available or purchase a new building for which the design and planning has already been determined. As such, the influence that users might have on the water, energy and materials consumed in buildings through their lifestyle choices is limited by the decisions made further upstream in the value chain.

Another factor that influences natural resource use and environmental impacts of construction at the operation stage is that a large part of the housing stock is either rented or undergoes regular changes in ownership. Investments that result in long-term benefits are often not a high priority for short-term renters and temporary homeowners (IRP 2017b). While the operation stage of the construction value chain makes a major contribution to natural resource use and environmental impacts along the construction value chain, the actors at this stage of the value chain often lack the ability and awareness to make a change.

3.4. Conclusions

Construction is integral to achieving the SDGs, but direction is needed. Construction is critical to achieving the human right to adequate housing; to building essential infrastructure necessary to provide mobility, energy, drinking water and sanitation; as well as to building the commercial and industrial infrastructure necessary to support economic development, all the while providing opportunities for employment and decent work. The importance of construction to meeting the SDGs means that there may be some trade-offs when it comes to natural resource use and environmental

impacts of the construction sector, though it is also imperative that the sector transitions as much as possible towards resource efficiency, circularity and a smaller environmental footprint. However, the analysis has also shown that not all construction contributes to sustainable development, and some activity in the construction sector can even result in harmful socio-economic consequences, making the natural resource use and environmental consequences difficult to justify.

Key decisions are made far from where natural resources are used. The analysis identifies that the majority of natural resource use and environmental impacts along the construction value chain take place at the material production stage, the construction stage and the operation stage. However, the system analysis highlights that there is limited scope at these stages of the value chain to make changes to reduce natural resource use and environmental impacts for a number of reasons, including the informality, fragmentation, complexity at these stages, as well as limitations in knowledge, awareness and available options. In contrast, the systems analysis demonstrates that the most influential actors along the construction value chain are governments, international organisations, financial institutions and major market players, who are primarily acting at the financing stage and the planning and design stage of the construction value chain. The key decisions made at these stages largely determine what type of construction is built and where, how much is being built, and how they are built, and thereby shape the activity along the rest of the value chain.

Governments exert significant influence along the construction value chain

Compared to other sectors, the role of governments and multilateral organisations in shaping activity along the construction value chain is significant, and occurs in three key ways:

1. As **regulators of financial markets**, the **banking system**, and **tax systems**, governments influence how much and what type of construction are built, especially for housing, particularly at the financing stage and property market stage of the construction value chain.
2. As **investors in the construction** sector through the **public procurement** of buildings and infrastructure, governments can directly influence what is being built and where, how much is being built and how constructions are being built through the procurement criteria they apply and the vendors they choose to engage.
3. As **urban and territorial planners**, and **regulators of the construction sector**, governments also indirectly determine what is being built and where, how much is being built and how constructions are being built. How governments regulate the construction sector through tools such as building codes and zoning laws can influence the operations of actors along the construction value chain, especially at the planning and design stages; the construction material stages; the construction stages; and, as a result, the operation stage.

It is these three levers that governments already use when stimulating the construction sector to boost economic activity or promote recovery during times of economic downturn or crisis. Governments therefore have a strong opportunity to reduce the natural resource use and environmental impacts of the construction sector through using these three key levers to drive resource efficiency in the sector and ensure construction activity is directed towards meeting the 2030 Agenda for Sustainable Development.

While each of the challenges and related opportunities may target other stages along the construction value chain, they can all influence the use of natural resources and the environmental impacts that take place at the material extraction and production stage, the construction stage, and the operation stage.

Further detail on the analysis of the Construction value chain is available at www.oneplanetnetwork.org/scp-task-group

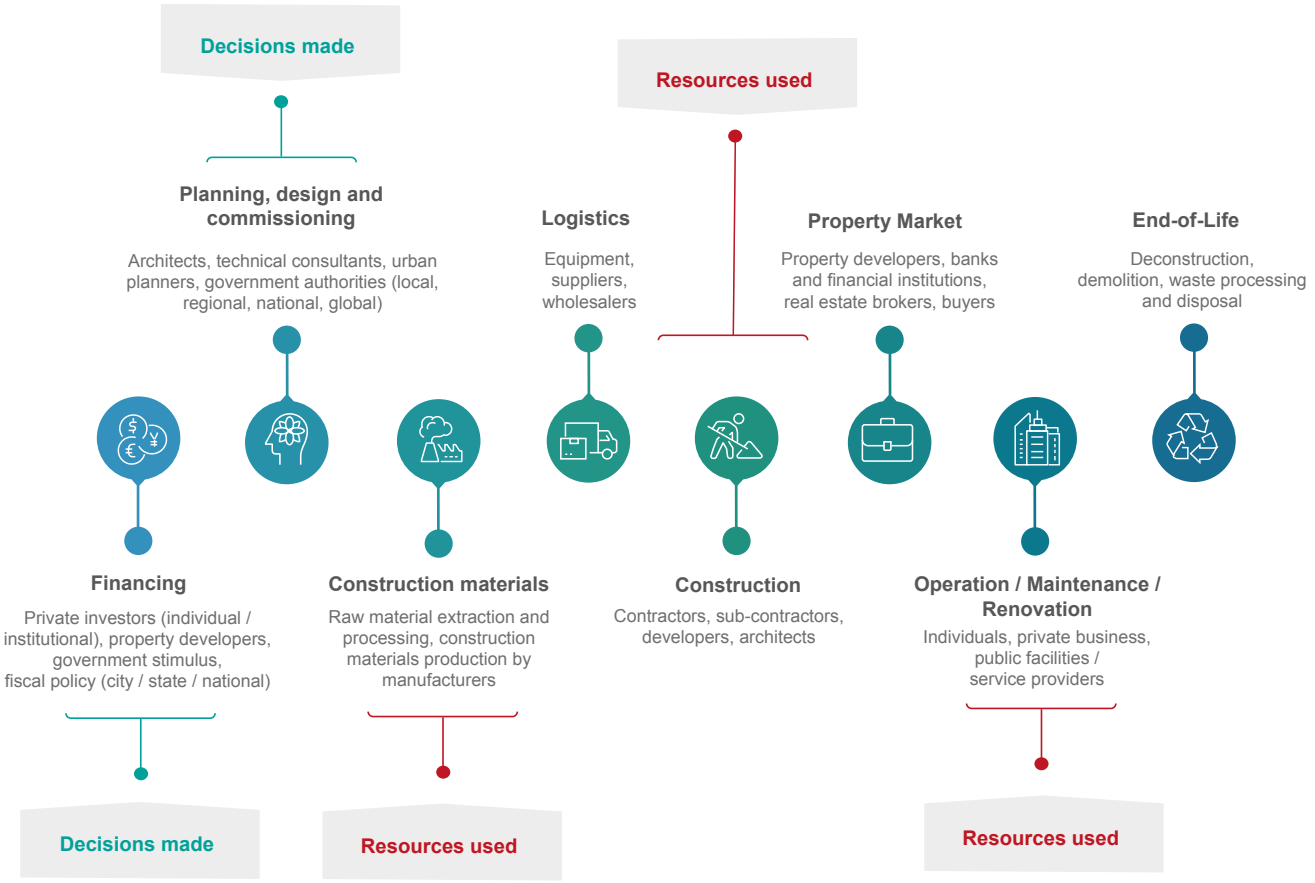

Figure 10: Key stages of the construction value chain where decisions are taken

Photo by Joao Tzanno on Unsplash

4. KEYS TO SUCCESS IN THE APPLICATION OF THE 1ST STEP OF THE VALUE-CHAIN APPROACH

The first step of the value-chain approach focuses on understanding the value chain and identifying key hotspots. This is undertaken by mapping natural resource use and environmental impacts along the stages of the value chain and applying a systems lens to understand how the value chain operates as part of the system. The purpose is to identify key entry intervention points and hotspots along the value chain. These can then be further analysed in relation to existing policies and actions (step 2) and as a basis for defining a common agenda.

Key elements that have been critical to a successful application of this step include:

- **An identified data gap on material stocks and flows in construction to be addressed.** There is limited overarching information available on the use of materials along the global construction value chain. Information on materials used in construction is generally organised separately based on the specific type of material such as steel and cement, and its use across many different sectors. There is little analysis and knowledge to-date that combines an overarching view of the extraction and processing of the many different materials used along the construction value chain specifically. This may also be related to the general focus on energy efficiency over material use in construction sustainability. In order to better understand the consequences of material usage in buildings and construction on natural resource use and environmental impacts, as well as the socio-economic implications, it will be necessary to bridge this knowledge gap around what materials are being used, where these materials are coming from and what the social, economic and environmental implications are of resource extraction to supply the global construction value chain.

- **The importance of understanding the system within which the construction value chain operates.** Construction as a sector globally has the highest material footprint and results in many environmental impacts. However, the construction sector also contributes in a variety of ways to analyse the socio-economic outcomes and to meeting the Sustainable Development Goals. It is therefore essential to analyse the socio-economic outcomes of the construction sector alongside the associated natural resource use and environmental impacts, to be able to balance any trade-offs. Three questions must be applied to understanding natural resource use and environmental impacts along the construction value chain: what is being built and where, how much is being built, and how is it being built.

  Further to this, while natural resource use and environmental impacts occur at specific stages of the construction value chain, it does not automatically follow that the solutions to address this are only to be found at those stages. Historically, the focus has been on construction activities and operation of buildings, as both the source of environmental impacts and the solution to reduce them. However, this focus alone can fail to take into account the complex drivers and feedback loops that determine and influence what is being built where, how much and how. The interactions within the systems mean that the operations and behaviours of actors at different stages of the construction value chain can have a significant influence on the operations and behaviours of actors at other stages of the value chain. For example, the actions of investors and planners can shape the practices of construction companies, which in turn shape the characteristics of buildings and infrastructure available to users. It is therefore necessary to apply a systems lens to the analysis of a sector to move beyond a siloed and disconnected analysis, and toward understanding how different drivers of a given sector - such as institutions, regulation, demographics and economic factors - shape the operations of actors along the value chain. This is the most complex part of the analysis of the value chain, it is however indispensable to truly identify the possible points of intervention to positively shape the way the sector works and the behaviour of actors along the value chain.

The importance of managing information and knowledge to connect data for a clear narrative. While there is no report of the International Resource Panel dedicated to construction, there are multiple sources of information in international organisations and private companies that address aspects of the construction value chain. An overwhelming amount of information exists on construction, the challenge is rather to filter and connect the data in relation to the objective of the analysis. When communicating about a specific value chain, such as construction, we need to ensure that we are consistently making reference to and connecting each of the following four key elements: 1) Considering the whole construction value chain, including stages that influence key actors and business process, to ensure a holistic analysis of operations and outcomes along the length of the value chain, 2) applying a systems lens to ensure the analysis takes into consideration complex drivers and feedback mechanisms; 3) specifically naming and explaining the associated natural resource use and how this can be made more efficient and sustainable; and 4) specifically naming and explaining the environmental impacts associated and how these can be prevented, mitigated and addressed.

CHALLENGES	OPPORTUNITIES
1) What type of construction is built and used, and where? Different types of construction built in different locations and regions. contribute in different ways to meeting needs of societies and achieving the sustainable development goals, and can cause different pressures on use of resources and environmental impact	Promote and enable adequate and sustainable construction
2) How much is being built? The construction market is growing worldwide, which causes pressures on resources and environmental impacts. However, construction does not necessarily follow demand. For example, empty buildings and property speculation is registered in many developed countries, while there is a construction gap in developing countries.	Align development needs with supply of construction worldwide
3) How are they being built and used? The impacts of construction are associated with: type and amount of construction materials used, consumption of resources in the operation of buildings, and construction and demolition processes. Changing design, construction and use practices is fundamental to use resources more efficiently and reducing environmental impacts.	Adopt more sustainable practices relating to the manufacturing of construction products and the design, construction and use of buildings and infrastructure

Table 5: key challenges and opportunities for addressing natural resource use and environmental impacts along construction value chains

Photo by Markus Spiske on Unsplash

FOOD SYSTEMS

APPLICATION OF THE VALUE-CHAIN APPROACH

Key messages:

While the majority of natural resource use and environmental impacts takes place at the primary production stage, primary producers have a limited ability to shape food systems and change their production practices.

The middle stages of the food value chain - comprising food companies, retail and food services - are structurally powerful and to a large degree shape both what food farmers produce and sell and what food consumers buy and eat.

Key challenges to be addressed: 1) what types of food we produce and consume; 2) how much food we produce and consume; 3) how we produce food.

Most policy measures address either primary production or individual consumption stages. This leaves a continued gap in measures that address the middle stages of the food value chain.

Tools and solutions are available across the One Planet network to address the key challenges along the food value chain. While many activities are at primary production or individual consumption stage or are holistic; there is an opportunity to build on ongoing initiatives at the food processing, retail and food services – in particular through the sustainable tourism, sustainable procurement and consumer information programmes.

This section of the report will provide an overview of the application of step one on 'understanding the value chain and identifying the key hotspots' and of step two on 'consolidating existing action and identifying opportunities to address the identified hotspots'. It will also provide insights on keys to success in applying step two of the value-chain approach as derived from its application to food systems.

1. OVERVIEW OF THE VALUE CHAIN

This food value-chain analysis is primarily based on the 2016 report by the International Resource Panel (IRP) 'Food Systems and Natural Resources.' The report data is complemented with research from the UN Environment Programme and the Food and Agricultural Organisations, as well as other sources including the International Panel on Climate Change, the World Resources Institute and the University of Oxford. Based on these sources, the food value chain can be visualised as shown below.

This diagram provides a simplified overview of all the stages of a food value chain. However it should be noted that food value chains exist within each country and region of the world and are diverse in their composition and functioning based on whether the local food system is traditional or modern, or 'intermediate', which is a mix of the two and makes up the majority of food systems. For the purpose of this analysis, a level of generalisation has been necessary.

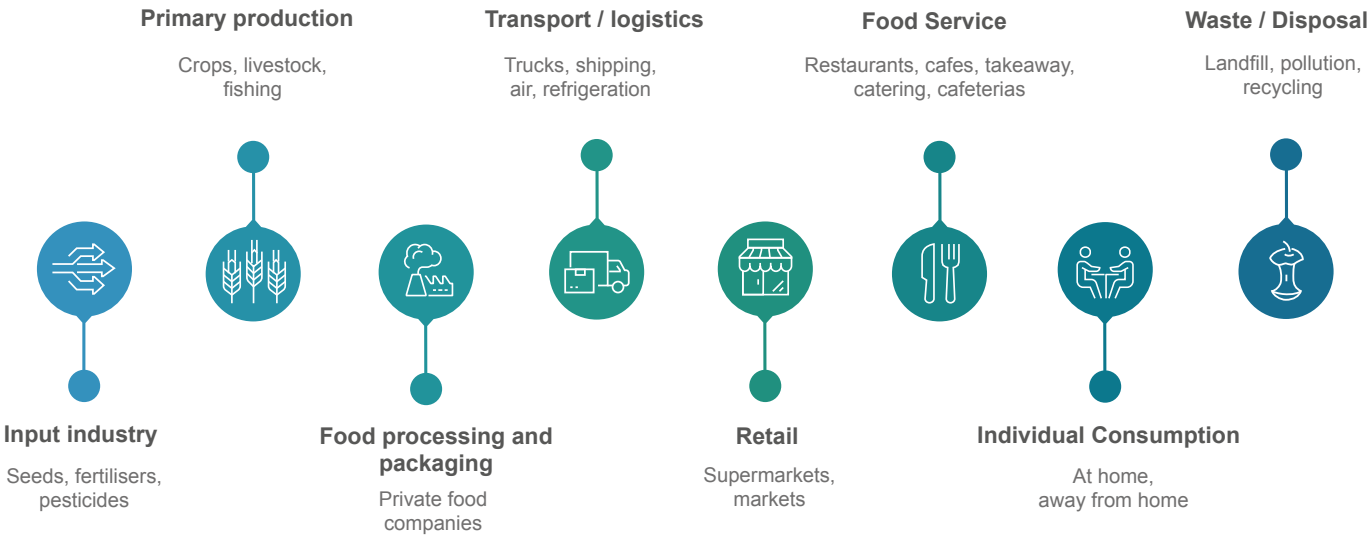

Figure 11: Simplified overview of the stages of a food value chain.

2. MAPPING NATURAL RESOURCE USE AND ENVIRONMENTAL IMPACTS TO THE STAGES OF THE FOOD VALUE CHAIN

2.1. Natural Resources

A large amount of natural resources are used along the food value chain to varying degrees at the different stages. Table 6 provides an overview of where, how and to what extent natural resources are used along the food value chain. While all stages of the value chain utilise natural resources to some degree, the table indicates that for almost all natural resources, the use is most intensive at the primary-production stage compared to other stages along the value chain. The input stage of the value chain is also estimated to use natural resources significantly (in fertilisers, seeds, pesticides), however a comparable estimation of intensity of use is not currently available.

2.2. Environmental Impact

In addition to using natural resources efficiently, natural resources must also be used sustainably, meaning that the use of these resources does not cause harmful consequences to the environment such as biodiversity loss, global heating or reduced air, soil and water quality. The major environmental impacts caused by food value chains are presented in table 7.

Photo by Roya Ann Miller on Unsplash

	Producing food	Processing & packaging food	Distributing & retailing food	Consuming food	Managing waste
Land, soils, landscape	●●●●●	●	●		●
Water	●●●●●	●		●	●
Biodiversity, Ecosystem Services	●●●●	●	●	●●	●●
Genetic resources	●●●●●	●			
Minerals & nutrients	●●●●●	●●	●●	●	●
Fossil fuels	●●●	●●	●●●	●	●

Table 6: Indicative mapping of natural resources needed for food systems (adapted from IRP 2016b p.36). (The dots in each square represent the intensity of use of the specific resource at each stage of the value chain.

Deforestation and land-use changes: agriculture and farming are among biggest drivers of deforestation, as land is converted from its natural state into land for growing crops or grazing livestock.

Air pollution: ammonia emissions, pesticides can contribute to air pollution, as well as burning fuel for energy and burning crop residues left over after harvesting.

Biodiversity loss: when land is converted from its natural state to be used for growing crops, especially monocrops, or grazing livestock, most of the original plant, animal and insect life is removed.

Water reduced water availability for other uses, reduced water quality from pollution, salinization, eutrophication from fertiliser run-off.

Soil pollution and run-off pesticides and fertiliser, as well as animal manure containing copper and zinc, can cause soil contamination. Further, run-off results in top-soil erosion and denudation.

GHG Emissions: the global food sector is estimated to be responsible for one quarter (24%) of all humanmade greenhouse gas emissions that cause global heating.

IMPACT	Producing food	Processing & packaging food	Distributing & retailing food	Consuming food	Managing waste
Biodiversity loss	Land conversion; intensification; hunting & fishing; habitat fragmentation	Biomass for paper and card		Cahrcoal; fuel wood	Pollution
Water - scarcity and pollution	Eutrophication; pesticide pollution; sediment load	Pollution; litter	Emissions from shipping, coastal degradation	Detergents	Pollution' litter. especially plastics
Soil pollution and run-off	Erosion; nutrients; salinization; compaction; soil organic matter decline; biotic decline	Pollution	Pollution		Pollution
Air pollution	Forest burning and pastures; dust; ammonia emissions (mainly from livestock)	Factory exhausts	Truck exhausts	Cooking smoke	Burning residues and waste
GHG emissions	Fertilizer production and use; irrigation; tillage; machinery; livestock; rice land conversion	Cooking; cleaning; machinery	Trucks; cold chain leakages; outlet heating and lighting	Cooking; catering; restaurants	Burning residues; landfil

Table 7: Indicative mapping of main environmental impacts along the food value chain (adapted from IRP 2016b p. 38)

The data presented demonstrates that the **majority of both natural resource use and environmental impacts** that take place along food value chains are **occurring at the primary production stage** through practices such as farming crops, raising livestock and fishing.

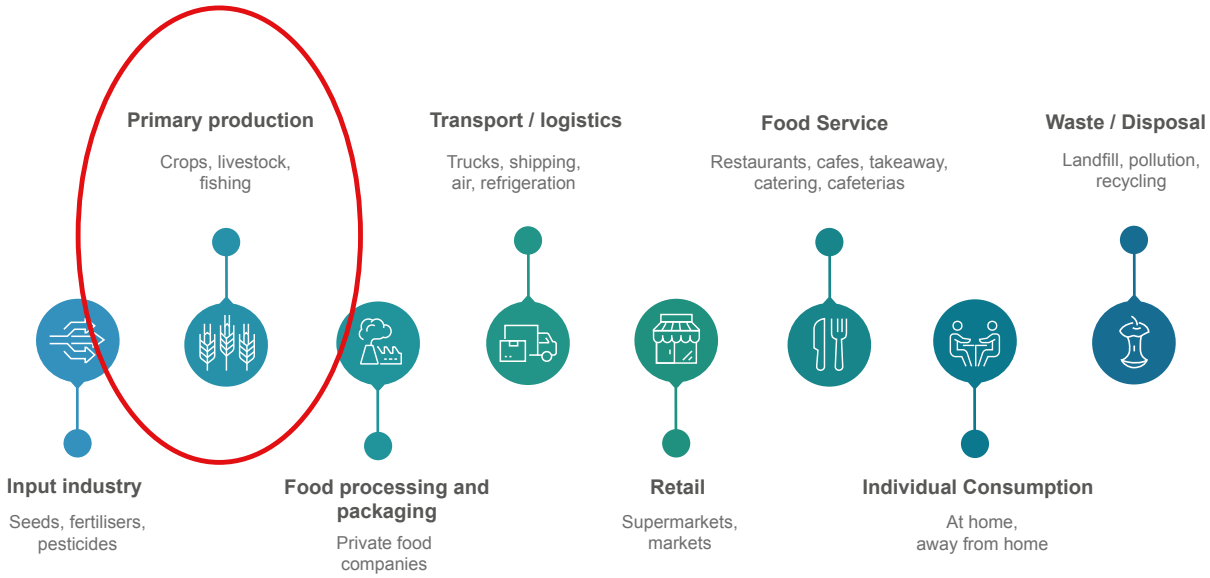

Figure 12: The majority of resource use and environmental impacts along the food value chain occur at primary production.

3. APPLYING THE SYSTEMS ANALYSIS TO THE VALUE CHAIN

Even though natural resource use and environmental impacts mainly occur at the primary production stage, the solutions to address this can be found at many different stages of the value chain. The interactions within food systems mean that the operations and behaviours of actors at different stages of the value chain can have a significant influence on the operations and behaviours of actors at other stages of the value chain. For example, the operations of food processing companies and retailers can shape the production practices of farmers.

It is therefore necessary to apply a food-systems lens to the analysis of food value chains in order to understand how different drivers of food systems such as institutions, regulation, demographics, economic and other factors shape the operations along the value chain. Each of the drivers in Figure 13 contribute to shaping the food system and influencing the behaviour of the actors along the value chain and determining what options are available to them. Equally, each of these drivers are all possible points of intervention to positively shape the way food systems work and the behaviour of actors along the value chain.

The systems analysis highlights several important features at the different stages of the value chain, including:

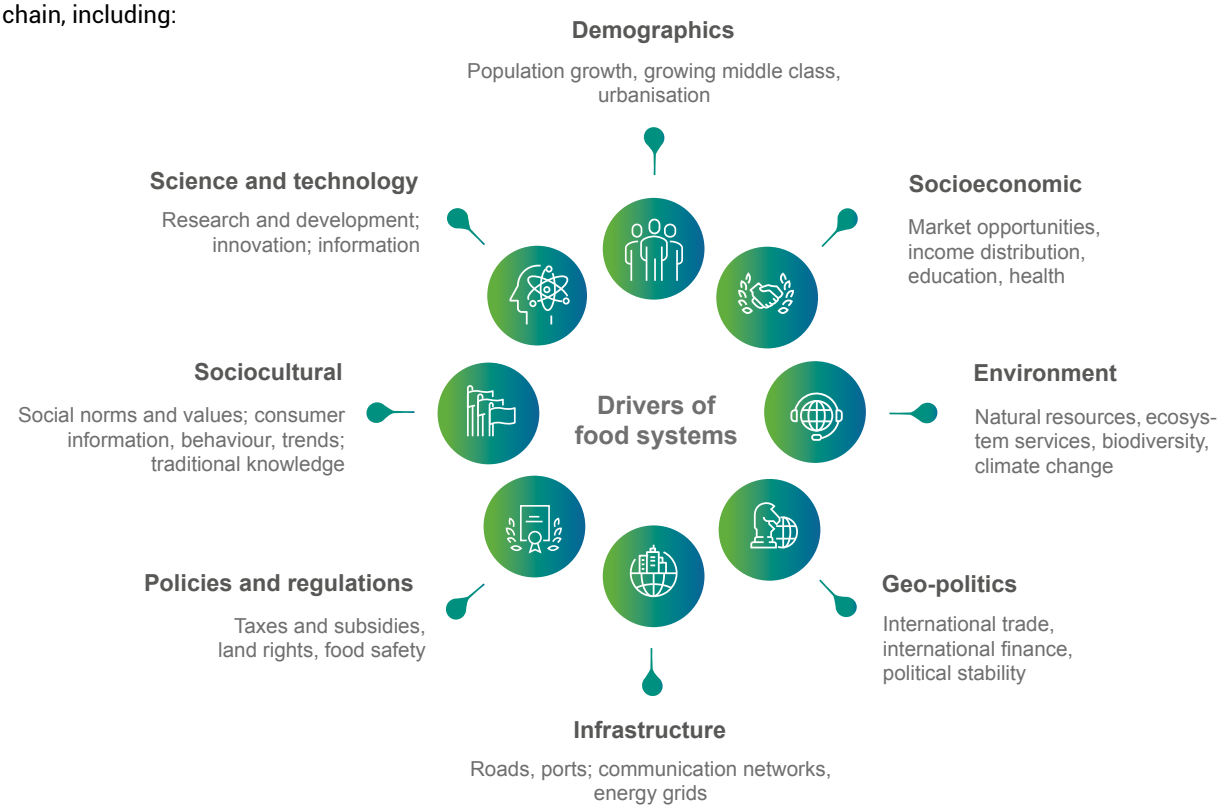

Figure 13: Drivers of food systems (adapted from: One Planet network 2019 p.12)

3.1. The consolidation and vertical integration of food companies

Consolidation and vertical integration: a small number of companies control a significant proportion of the global market – the top 10 retail companies control 10% of the global market, and the top 10 food processing companies control 28% of the global market. Modern food value chains have also seen an increasing amount of 'vertical integration' which sees the same company expand its operations into multiple stages of the food value chain, for example a supermarket retailer that also is a major food processor for its private label range, and also owns the transportation and refrigeration.

From public to private governance: The last several decades have seen the 'rolling back' of the state, with food systems increasingly controlled by large private players setting standards and contracts in terms of size, quantity, and quality of food produced by farmers. The disproportionate buying power of multinationals allows these companies to dominate food value chains through determining the prices that they will pay farmers.

Driven by market dynamics: Private food companies are primarily driven by profit and employ strategies to survive in highly competitive and saturated markets. Food companies strive to be cost-efficient, leading to externalisation of environmental costs and social impacts. E.g. products that are high in calories (from fat and sugar) make more profit, though this leads to obesity and disease.

Big business and big employer: In the EU, food & beverage is the largest manufacturing sector and the largest employer: it contributes 2.1% of gross value added, comprises more than 294,000 companies, and employs 4.72 million people. The retail industry makes more than three times the turnover (US$7,180bn) of primary agricultural production (US$2,175bn).

Photo by Fredrik Ohlander on Unsplash

3.2. The fragmentation and weak position of farmers and fishers

The production practices of farmers and fishers are heavily dependent on their interactions and relationships with actors upstream and downstream in the food value chain, including the companies from whom producers purchase their inputs, as well as the companies to whom producers sell their produce.

One billion farmers: Globally, there are one billion farmers with around 450 million farms, the majority (85%) small-holder farmers with farms less than two hectares.

Low prices and shrinking profit: Farmer share of profit in the food dollar has consistently fallen over recent decades. Low profit margins put farmers in a precarious position, make them dependent on food companies they sell to, and leave little margin to invest in more sustainable practices.

Structurally weak position: Uneven power balance where farmers have few potential customers that they can sell too (due to consolidation), and therefore are in a weaker bargaining position. Farmers are compelled to accept the prices, standards and contract terms offered to them by food companies, with limited capacity to negotiate.

Lack of infrastructure and low productivity: Many farmers in traditional food systems suffer from a lack of infrastructure both physical and institutional to improve both productivity and profitability.

3.3. Individual consumers that are shaped by their food environment

Many of the world's poorest people do not have enough food to eat and undernourishment is an ongoing problem, especially in developing countries. At the same time, non-communicable diseases related to the consumption of food high in calories and low in nutrition are growing rapidly, both in developed countries and developing countries, with well over two billion adults overweight or obese in 2013.

Options determined by the physical environment: The consumption decisions of the billions of individual consumers globally are to a large degree influenced by the food environment in which they live, including the selection of food markets, supermarkets, products, restaurants near where they live, as well as the influence of advertising, cultural norms and demographics (e.g. age and gender). Consumers in urban areas largely purchase processed and packaged food from all over the world. Such processed food uses more natural resources, contributes to greater environmental impacts and often leads to harmful consequences for human health.

Lack of awareness: Individuals have limited information on the consequences of their consumption behaviour for health, the natural environment and farmer livelihoods. Information on food products can be confusing and misleading, causing consumers to think they are making more sustainable or healthy choices than they actually are.

Lack of access and skills: Many people do not have the skills, economic means or time to prepare their own food or learn to use new foods; and rely on processed and pre-prepared options.

Influenced by food companies: Food companies, restaurants, food vendors and retailers actively influence this food environment to tempt people to make certain choices. This occurs in various ways ranging from advertising, packaging, creating aromas and presentation in shops and restaurants.

The analysis demonstrates that, **while the majority of natural resource use and environmental impacts is taking place at the primary production stage, primary producers have a limited ability to shape food systems and change their production practices.**

Photo by Thomas Le on Unsplash

Photo by Paul Einerhand on Unsplash

3.4. Conclusions

While the actors along the middle stages of the food value chain do not use the most resources themselves, they have a huge impact on the activities at either end. **This stage of the value chain, comprising food companies across processing and packaging, retail and food services, is structurally powerful and has a disproportionate influence across both primary production and final consumption and to a large degree shapes both what food farmers produce and sell and what food consumers buy and eat.** The institutions that shape and govern food value chains are also critical in putting in place the physical and regulatory infrastructure to influence food systems actors to use natural resources more efficiently and sustainably, while protecting the environment.

There are a number of key challenges and opportunities for addressing natural resource use and environmental impacts along food value chains, with a significant amount of work already underway in addressing these issues by various organisations. Table 8 outlines some examples.

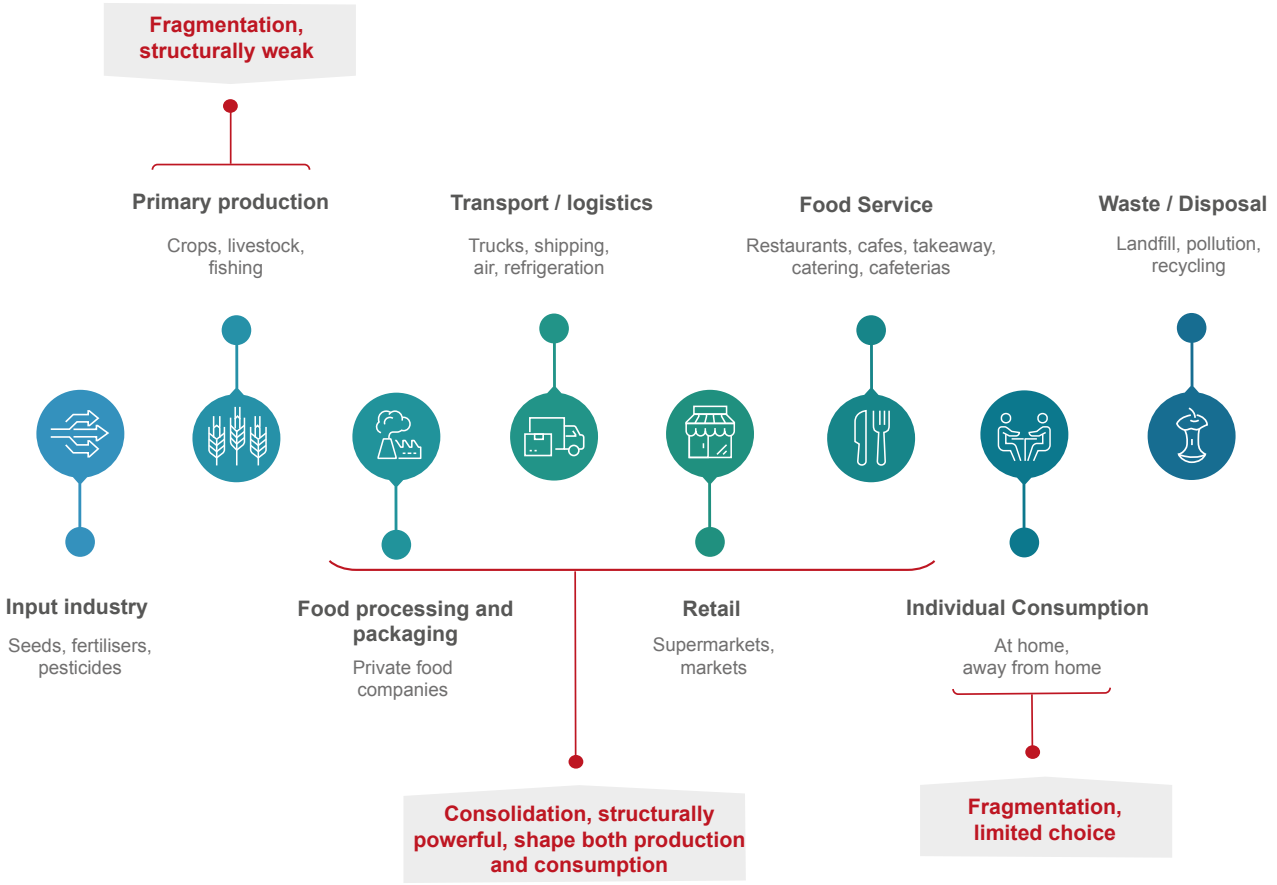

Figure 14: Simplified overview of key features of the food systems analysis

CHALLENGES	OPPORTUNITIES
1) What type of food do we produce and consume? Vast differences in resources and environmental impacts to produce different types of food along stages of the value chain including production, processing, transportation and disposal.	Shifting to sustainable food choices (products, diets, menus) in food companies, retail, food service, individual consumption - working with and influencing primary producers to shift to sustainable practices.
2) How much food do we produce and consume? One-third of all food produced is either lost at the production, transportation or processing stages, or wasted downstream at the retail, food service and consumption stages. A significant share of global population suffers problems of overweight or obesity driven by overconsumption of (high calories) food, among other factors, while under-nourishment continues to be an issue in both developing and developed countries.	Food loss and waste Reshaping the food environment in order to reduce individual food waste in away from home consumption, as well as individual food waste at home.
3) How do we produce food? Most natural resource use and environmental impacts occur during production. Changing practices is critical to using resources more efficiently and sustainably, while causing less damage to the environment.	Sustainable intensification of yields Including the opportunity for mid-stream and down-stream food value-chain actors to support the shift to sustainable primary production practices.

Table 8: key challenges and opportunities for addressing natural resource use and environmental impacts along food value chains

Addressing each of the above three challenges and opportunities can contribute to reducing natural resource use and environmental impacts along food value chains. Importantly, each of these can specifically address natural resource use and environmental impacts at the primary production phase, even though the intervention may take place elsewhere along the value chain.

Further detail on the analysis of the food value chain is available at www.oneplanetnetwork.org/scp-task-group

Photo by Farhad Ibrahimzade on Unsplash

4. ANALYSIS OF EXISTING POLICIES AND ACTIONS OF THE ONE PLANET NETWORK

Current policies and actions of the One Planet network are mapped to the food value chain and are analysed in relation to the identified hotspots, both in terms of what can be leveraged for further impact and where major gaps in addressing the hotspots can be found. The data sources for this analysis are the official reporting on SDG indicator 12.1.1 for the policies and the databases on SCP activities of the One Planet network, collected through the One Planet network annual reporting and complemented by the content on the One Planet network website.

4.1. Policies: Key trends, gaps and opportunities

The official reporting by countries in 2019 for SDG indicator 12.1.1 on the implementation of SCP-related policies, collected 226 policy instruments. Of these, 27 policies were retained for analysis, either specifically about food or policies with a specific section on food. Nearly half (12) were from Europe and Central Asia, followed by Latin America and the Caribbean (6), Africa (4), Asia/Pacific (3), Middle East (1) and North America (1). From the 27 policies analysed, a total of 191 concrete measures were identified, addressing various stages of the value chain, albeit not in equal representation[8]. Table 9 provides an overview of the policies in relation to: 1) the stage of the value chain primarily targeted, 2) the type of policy measure (regulatory and legal instruments, economic and financial instruments, voluntary and self-regulation schemes), and 3) the challenge they primarily address (how food is produced, how much food is produced and consumed, what food is produced and consumed).

A concentration of measures at the two ends of the value chain: Nearly 60% of the measures proposed are either at the input/production stage or the consumption stage. On the production side, the majority of regulatory measures tend to focus on efficiency increases (e.g. reducing water use, decreasing emissions from livestock), or reducing the use of harmful pesticides and increasing organic production. If the size of the farm targeted by a measure is specified, it usually targets smallholder farms. It is less clear if the measures in these policies are aimed at larger-scale industrial agriculture. Regarding the consumption end of the value chain, the observation can be made that the onus of 'being sustainable' is placed primarily on the individual consumer, who does not have the same amount of influence as the players further upstream in the value chain might have. The focus on the ends of the value chain may indicate the difficulty for policy makers to access, regulate and influence the more consolidated stages in the middle of the value chain.

VALUE CHAIN STAGE	Inputs			Production			Processing/ packaging			Transport/ Logistics			Retail			Food Service			Consumption			Disposal		
Type of measure	REG	ECO	VOL	REG	ECO	VOL	REG	ECO	VOL	REG	ECO	VOL	REG	ECO	VOL	REG	ECO	VOL	REG	ECO	VOL	REG	ECO	VOL
How we produce	15	5	10	9	5	10	1	2	2				2	2	3	2			1		2			
How much we produce and consume				2		4	3		4	1		4	1		6	3		6	3		12	2	4	
What we produce and consume	3		3	3		0	3		4	1	1		7	4	5	7	1	7	1	2	12	1		

Table 9: Overview of the number of measures in relation to the stage of the value chain it targets, the type of policy measure and the challenge addressed (Type of policy measures included: Regulatory (REG), Economic and Financial (ECO), and Voluntary (VOL). For ease of reference areas with the highest number of policies are highlighted in light green and areas with no policies are highlighted in orange)

Photo by Rajesh Ram on Unsplash

A mixed approach but a deficit in economic and financial measures: The 191 measures identified present a good mix of voluntary and regulatory measures (respectively 49% and 37%). Economic and financial measures on the other hand, only represent a minor portion of what is being planned to achieve the objectives of the policies (13% of all measures identified). The official reporting on 12.1.1, including all types of policies beyond those targeted at the food value chain, also revealed a general deficit in economic and financial instruments for SCP (UN 2020). Voluntary measures such as information campaigns to raise awareness, training programmes, and access to tools and guidelines are present at all stages of the value chain, although particularly prominent at the level of individual consumption. Regulatory measures are also present throughout the value chain, but more so during the production phase. These include directives on the use of pesticides, setting aside land for certain crop use, and sanctions for non-compliance with waste-disposal procedures, and they often complement the voluntary schemes. The more limited number of economic and fiscal measures, such as the removal of harmful subsidies, are present mostly at the production level and to a certain extent in retail.

Food challenges well captured but not always interconnected along the value chain: In terms of which key question these 191 measures address, 37% look at *how we produce*, 34% look at *what we produce and consume* and 29% look at *how much we produce and consume.* However, these types of measures are not evenly distributed along the stages of the value chain. Measures taken at the input and production stage are almost always meant to rationalize the use of resources or energy, minimize the use of harmful substances such as pesticides and the related environmental impacts, or to minimize emissions of pollutants harmful to the environment and health (*how we produce*). Rarely are there any measures taken at the food company/ retail stage of the value chain intended to influence the contracts and standards these companies apply in their purchases from farmers. On the other hand, most of the measures taken at the consumption stage are looking at issues of food loss and waste and sustainable diets (*how much we produce and consume, what we produce and consume*), independently from how food is produced or processed or from what food is available to consumers in retailers and food service businesses. The relative balance between the key challenges that these measures are addressing is a positive sign, indicating that overall there is not a large gap in terms of policies which look at production processes, food loss and waste, and the types of food being produced and consumed. What is missing is a better understanding of how the different stages of the value chain interact with one another in addressing these challenges. In addition, there is a gap in the

structurally powerful and consolidated middle stages of the value chain, which has the potential to make stronger links between how we produce and how and what we consume.

Food processing almost completely absent; retail and food service reveal gaps and opportunities: At the stage of food processing and packaging, there are a host of measures which focus on the type of packaging, but almost none which look at the transformation and processing of food products. Food processing is a massive industry and the lack of attention in the policies is a major gap. Food processing is also the stage at which the link between what we produce and how we consume is most evident. There are obvious links to human health and well-being as well, and future policies should reflect this. The retail and food service stages of the value chain, compared to processing, actually have a much greater number of measures proposed in reported policies. However, the measures, which are most often voluntary, tend not to target the most influential retail operations with large market share. As the retail stage is a key driver in the value chain, future efforts should be made to address this current lack of attention paid to the largest and most influential players in food-related policies. Reported policies show that procurement regulations can play a key role in supporting sustainability practices along the food value chain, for example by simultaneously promoting local sustainable products and healthy diets. Further measures in private procurement could be envisaged to complement these efforts. The number of procurement measures offer more potential due to their legally binding nature, though they are often also being proposed on a small scale rather than nationwide.

4.2. Activities of the One Planet network: Key trends, gaps and opportunities

The One Planet network reporting from 2013-2019 collected 2,379 activities across the One Planet network. Of these, 401 activities related to food were retained for analysis. This analysis was further complemented by a qualitative analysis of 116 projects on food that are showcased on the One Planet network website.

All six One Planet network programmes[9] have reported activities related to food, most of which relate to the Sustainable Food Systems programme. However, the Consumer Information, the Sustainable Tourism and the Sustainable Lifestyles and Education programmes each have a significant number of activities related to food. All geographical regions, except the Middle East, are covered by the activities from the One Planet network addressing the food value chain. The largest number of activities (26%) were global in their scope, often in the form of

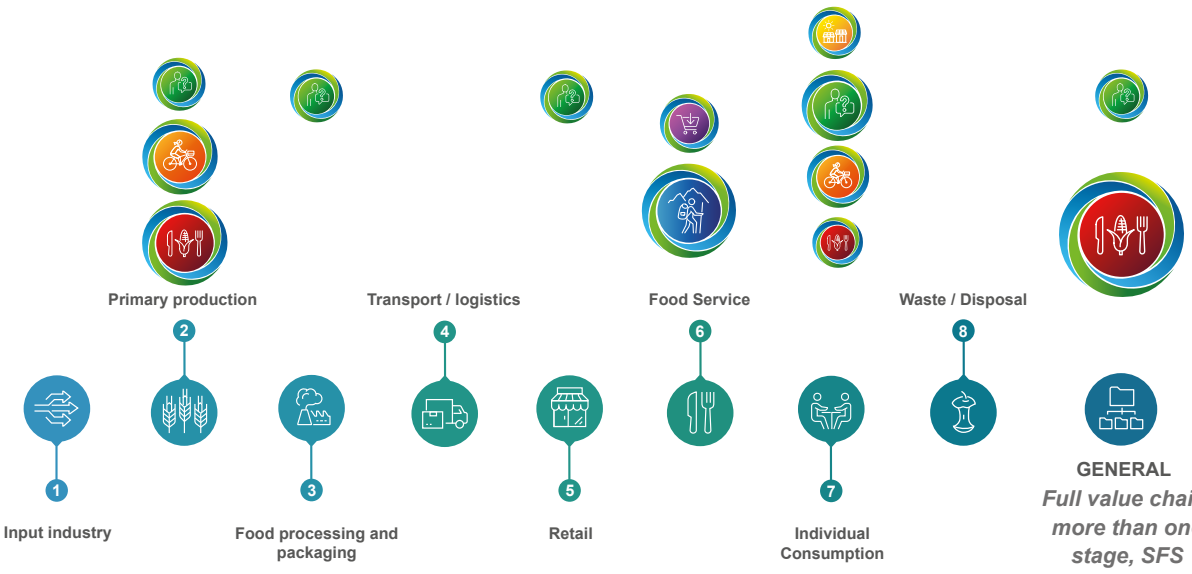

Figure 15: Overview of activities of the programmes in relation to the stages of the food value chain (Legend – Red: Sustainable Food Systems; Green: Consumer Information; Blue: Sustainable Tourism; Orange: Sustainable Lifestyles and Education; Yellow: Sustainable Buildings and Construction; Purple: Sustainable Public Procurement. Size of the dots is proportional to the volume of activities)

tools or resources that could be applied anywhere, or activities implemented by international organisations. The activities of the One Planet network were analysed in relation to 1) the stage of the value chain primarily targeted, 2) the programme under which this activity is undertaken, 3) the challenge they primarily address (how we produce, how much we produce and consume, what we produce and consume), 4) the types of tools and solutions made available through the activities. Key messages derived from this analysis include:

The middle stages of the value chain are underrepresented. Most activities of the One Planet network take place at the primary production (23%) or individual consumption stage (19%)[10]. There is also a significant portion of activities that address the food value chain holistically. The Sustainable Food Systems programme is primarily focused on activities that take a whole-of-value-chain approach (55%), reflecting the conceptualised prioritisation of the programme on 'systems'. This holistic approach is well complemented by the activities of the other programmes at specific stages of the value chain.

The food processing and packaging and the retail stages were identified in the analysis as a pivotal connection between both food production by farmers and food consumption by individuals, and are therefore of particular importance to influencing natural resource use and environmental impacts along the food value chain. They are also big players in terms of value added and employment, especially in developed countries and increasingly also in developing countries due to the trend of supermarketisation. Yet these are two of the least represented stages among activities in the One Planet network, comprising 2% and 6% of total activities respectively. The food service stage is much more represented, with 16% of total activities, mostly driven by the tourism sector. Most activities at the middle stages are connected to sustainable food choices and reducing food waste in hospitality, as well as the application of standards, certifications and labels for food product sustainability.

There is an opportunity to build on ongoing initiatives at the stages of food processing, retail and food services, despite the underrepresentation of these stages in the total number of activities.

Among the programmes of the One Planet network, the Sustainable Tourism Programme dominates the food service stage of the value chain. The food products that tourism companies choose to source and serve to their guests, and the ways in which this food is served and managed, can have a strong influence on natural resource use and environmental impacts along food value chains. Many activities at this level see tourism companies choosing to procure food locally and seasonally, to apply standards, labels and criteria on their food procurement, such as buying Marine Stewardship Council (MSC) certified seafood, as well as undertaking steps to address food loss and waste. Activities that address the food service stage relate to projects led both by major global hotel chains, as well as by small-scale individual tourism providers.

The Consumer Information programme's activities on the development and application of standards, certifications and labels for food are featured in over half the stages of the food value chain. They serve as an example of the systemic nature of value chains, and how the activities at one stage of the value chain can have an impact at other stages. At the food processing, retail and food service stages of the food value chain, the Consumer Information programme activities are focused around how food companies can apply and implement standards, certifications and labels to the products they procure, produce, sell and serve. The application of these standards, certifications and labels can translate into changes at the primary-production stage in farming and fishing practices to use fewer natural resources and cause fewer environmental impacts. Their application also provides individual consumers with information they need to allow them to make more sustainable food choices, as well as ensuring that consumers have sustainable choices available to them. It demonstrates the important way in which the operations of the middle stages of the value chain can influence both production and consumption.

Photo by Liz Caldwell on Unsplash

The opportunity to build on the existing connections between the three key challenges (what type of food we produce and consume, how much food we produce and consume, how we produce food). While the majority of activities address one of the three main challenges, 36% address two or three of the challenges simultaneously. This is especially prevalent in holistic activities and activities at the food-service and individual consumer stages. For example, tourism businesses operating at the food service stage may implement initiatives around sustainable menus that address how food is produced by sourcing organic produce, what food is produced and consumed by offering plant-based menu items, as well as the question of how much food is produced and consumed by implementing measures to reduce food waste, such as smaller plate sizes or guest awareness activities.

Photo by Courtney Cook on Unsplash

- The challenge of 'how we produce food' is addressed mostly by activities at the primary production stage, followed by an even spread along the food value chain. This highlights the need for changes at primary production, while demonstrating that interventions at all different stages can have an influence on how food is produced at the primary production stage. Activities addressing 'how we produce food' at the food processing and retail stages of the value chain are mostly related to standards, certification and labels of food products. The standards and contracts that retail and food processing companies put in place for their suppliers, either directly from farmers or indirectly from upstream food companies, can have a significant influence on the ways in which food is produced and the natural resource use and environmental impacts that occur at the primary production stage.
- The challenge of 'how much food we produce and consume' dominates at the food service and the individual consumption stages of the value chain and is mostly tackled through food loss and waste. However, initiatives on food loss and waste would benefit from making a more explicit connection between food loss and waste and the associated natural resource use and environmental impacts, as well as from a consolidation of the multitude of ongoing efforts. At the retail stage of the food value chain, most activities focus on reducing food waste in-store, without considering the influence that retail can have on food loss and waste upstream with farmers, and food waste downstream with consumers.
- The challenge of 'what type of food we produce and consume' is addressed mostly at the food service stage and individual consumption stage. Activities focus primarily on providing menus sourced from local and seasonal produce and on shifting diets to feature more local and seasonal produce, as well as plant-based alternatives. Public procurement initiatives are also present, reflecting the role of governments in shaping what type of food is sourced for food provision within public services, such as school feeding programmes that emphasise using produce sourced from local farmers.

Tools and solutions are available across the One Planet network to address the key challenges along the food value chain. Partners of the One Planet network have made available tools, resources, trainings, campaigns and solutions to address the three challenges at the different stages of the value chain.

- At the primary production stage, the challenge of 'how we produce food' is being addressed through trainings to smallholder farmers, access to databases and mobile applications, implementation of certifications and standards, and toolboxes for practitioners.
- At the food-processing and packaging, retail, and food services stages, tools and solutions revolve mainly around the application of standards, certifications and labels for food product sustainability, the effective communication of product sustainability information to consumers, and the implementation of measures to reduce food waste by tourism businesses. Solutions to implement concrete 'changes in practice' at the food service stage account for 38% of the total changes in practice, and include the implementation of procurement policies, food waste reduction programmes and sustainable waste management practice.
- At the individual consumption stage, activities focus mainly on 'what type of food we produce and consume', while also addressing the other two challenges. The bulk of the activities at this stage consist of communication campaigns on sustainable and healthy diets, food security, food waste reduction, local and urban agriculture, and consumption of local produce. In addition, existing resources include mobile applications and tools that give consumers access to trustworthy sustainability information, and on responsible consumption.

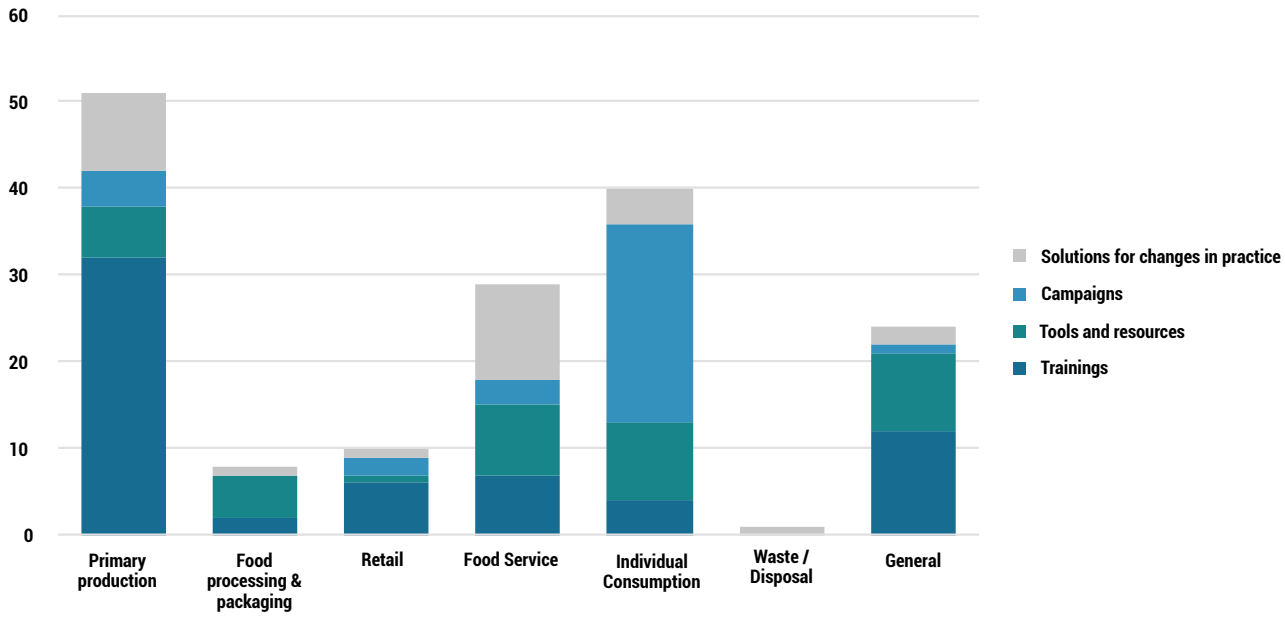

Figure 16: Types of tools and solutions available across the One Planet network to support further actions

Further detail on the analysis of policies and activities of the One Planet network along the food value chain is available at www.oneplanetnetwork.org/scp-task-group

5. KEYS TO SUCCESS IN THE APPLICATION OF THE 2ND STEP OF THE VALUE-CHAIN APPROACH

The second step of the value-chain approach focuses on consolidating existing action and defining opportunities to address key hotspots identified. This is undertaken by mapping the existing action of all actors along the stages of the value chain and in relation to the identified hotspots, including policy measures, tools and resources, best practices and initiatives. The purpose is to provide a basis to identify a) what initiatives are already addressing key hotspots and can be leveraged or further coordinated for greater impact, and b) major gaps in addressing or understanding key hotspots and trade-offs that deserve particular attention.

For the food value chain this consists in understanding the policies and activities of the One Planet network in relation to if and how the three identified challenges (how we produce, what type of food we produce and consume, how much food we produce and consume) are addressed in the middle stages of the food value chain (food processing, retail and food-service). The analysis identified a number of trends, gaps and opportunities that can be useful in guiding the future direction of priorities and/or projects on sustainability across food value chains. The policy analysis provides a general picture of the landscape at the policy level and of the related opportunities and gaps in terms of enabling conditions. These include, for instance, an understanding of the prevalence of voluntary and regulatory measures at the two ends of the value chain which may enable actions by different actors while also acknowledging a potential need for an increased focus in addressing the middle stages of the value chain. In the meantime, the understanding of existing activities and resources is key to build upon in order to address identified gaps as well as to operationalise voluntary measures put forward in policies and beyond. This includes, for example, the opportunity to scale up activities taking place at the food-processing and retail stages on the development and application of standards, certifications and labels as a key interface between producers and consumers.

This understanding of how existing policies and actions address identified hotspots is key to the next step of the approach, which will consist of defining a common agenda and prioritising action through the engagement of actors along the value chain. In the meantime, it has provided the programmes of the One Planet network with a clear overview of their respective strengths and complementarities that can be jointly leveraged for further impact on sustainability along food value chains.

Photo by Tim Mossholder on Unsplash

Key elements that have been critical to a successful application of this step of the approach include:

- **The availability of a robust analysis of the value chain and clear identification of key hotspots (step one) that preceded the consolidation of existing action (step two)**.

  It was only possible to effectively identify trends on existing policies and actions based on an understanding of the food value chain and the related key hotspots. The stages of the value chain and the three challenges to be addressed acted as a filter to organise the vast amount of information available on policies and actions on food across the One Planet network. By mapping all policies and initiatives against the stages of the value chain and against the three challenges, it is immediately clear where the pools of expertise or best practices are available and where gaps in enabling conditions or experience may lie. This provides a clear basis to leverage the key strengths and to consider how best to address key gaps.

  The analysis of the food value chain and identification of hotspots under step one of the approach faced a number of challenges in relation to gaps and weaknesses in data and information available. These are further explained in the dedicated section of this report. Two key elements to retain on the analysis of the food value chain are the importance a) of the depth and specificity of data on stocks and flows of different natural resources, and b) of connecting the data on resources, the value chain and the system.

- **The availability of an established and consistent source of data on existing policies and actions across the One Planet network.**

  The main data sources are the official reporting on SDG indicator 12.1.1 and the One Planet network annual reporting of progress on the shift to SCP. The One Planet network reporting is underpinned by a consultatively-developed framework consisting of an agreed upon set of indicators, associated methodologies and a standardised online process (One Planet network, 2017). Since 2017 when it was first launched, the annual reporting has collected 2,379 activities across the One Planet network in a systematic and consistent manner, enabling the secretariat to track the evolution of efforts on SCP across regions, sectors and stakeholder groups.

  SDG indicator 12.1.1 on 'the number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production' is classified as a tier two indicator by the UN Statistics Division, notably having a 'conceptually clear and internationally-established methodology and standards'. The official reporting on SDG indicator 12.1.1, first launched in 2017 and followed by regular reporting, has identified over 300 policies in 80 countries plus the European Union. The methodologies and process of both reporting efforts is continually being improved and will benefit from the considerations generated by this analysis, including the importance of disaggregating the stages of the value chain.

  This consistent data collection, systematically made available by countries and different stakeholders, has been key in effectively undertaking the analysis of policies and actions. Had these data sources not already been in existence, a manual search and outreach would have been required to identify policies and activities, and as such this analysis could not have been completed within the same timeframe nor with the same level of quality.

- **The importance of managing information and knowledge to connect data for a clear narrative.**

  Data in itself is not sufficient to tell the story of what is happening within the value chain, whether in terms of natural resources or stakeholder actions. It is therefore paramount to delve deep into the information available and turn it into knowledge that can be understood and applied by the different stakeholders involved. This includes illustrating any messages or data with specific examples and, through these examples, connecting what issues are addressed, why, by whom and how, as well as what influences this has on natural resource use and environmental impacts along the value chain.

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TEXTILES

APPLICATION OF THE VALUE-CHAIN APPROACH

The textile industry is one of the largest global industries in terms of environmental and social impacts, and as a result, the textile value chain is becoming an increasingly significant issue. The social impacts of this important and profitable industry have long been an issue of global concern.

UNEP is advancing in applying the value-chain approach in textiles, and results to-date are captured by the recent publication "*Sustainability and Circularity in the Textile Value Chain - Global Stocktaking*" (UNEP 2020a). The report explores key hotspots within the textile value chain, takes stock of existing initiatives and identifies priority actions needed to move towards a more sustainable and circular textile value chain.

The following section on textiles is based on the recent UNEP publication on stocktaking of the textiles value chain (UNEP 2020a) and will provide an overview of the application of all three steps of the value-chain approach in textiles. The work on the textile value chain is also the only sector that has reached step three on 'defining a common agenda and prioritising action'. As such this section will also provide further insights on keys to success in applying this step to textiles.

1. OVERVIEW OF THE VALUE CHAIN

The textile value chain (Figure 17) is comprised of all the activities that provide or receive value from designing, making, distributing, retailing or consuming a textile product (or providing the function that a textile product serves), including the extraction and supply of raw materials, as well as activities involving the textile after its useful life has ended. In this sense, the value chain covers all stages in a product's life, from supply of raw materials through to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation. At all stages in the value chain, and in the transporting of intermediate and finished products between the different stages, raw materials and energy are required and emissions are produced. The activities associated with a value chain are often shown as a linear representation from raw material production to end-of-life treatment, albeit with the potential for the re-use, repair/remanufacturing and recycling of materials adding loops into the picture. In addition to the activities described above, the value chain is also comprised of the actors undertaking the activities, and the stakeholders that can influence those activities. The value chain thus incorporates not only the physical processes, such as farms and factories, but also the business models and the way products are designed, promoted and offered to consumers. These non-manufacturing activities, including design, marketing, retailing, advertising and publishing, to a large degree determine the way textile products are produced and consumed.

300 million
employees along the value chain

Doubled
Clothing production approximately doubled in the last 15 years

Less than 1%
recycled into new clothing

62%
of global fibre production are synthetic fibres (2018)

8%
One source estimates that the industry accounts for 8% of the world's Greenhouse Gas emissions

215 trillion litres
of water consumed per year

9%
of annual microplastic losses to oceans

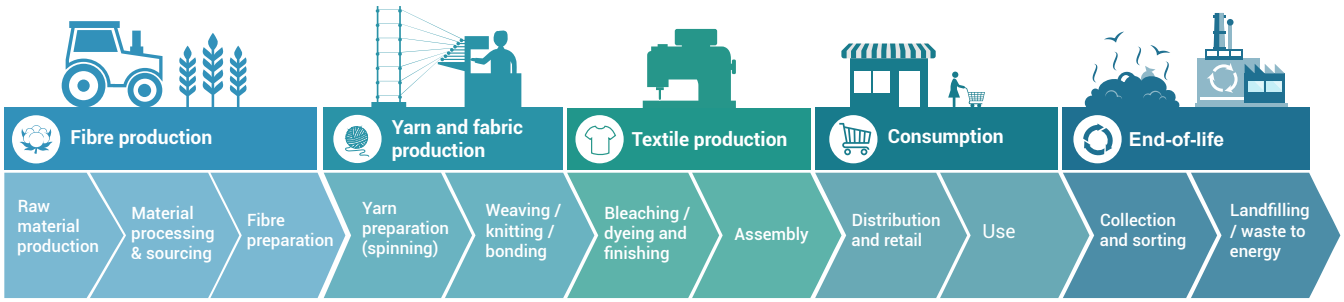

Figure 17: Linear representation of activities along the textile value chain (UNEP 2020a)

The actors and stakeholders of the textile value chain are defined as all individuals and entities that provide or receive value from designing, making, distributing, retailing or consuming a textile product (or providing the function that a textile product offers), including procuring raw materials, as well as the activities and parties involved with the textile after its useful life has ended. While some stakeholders, especially the direct actors, are involved with a particular stage in the value chain, others are more cross-cutting and operate across some or all of the value chain stages (e.g. finance institutions and advocacy organisations). This includes:

- those actors directly involved in value chain activities, such as **cotton farmers, designers, buyers and consumers,** as well as
- stakeholders that can influence the value chain or pass on knowledge to actors in the value chain, such as **government regulators, social and environmental campaigners, innovators and researchers.**

Though the value chain is truly global, the raw material extraction and manufacturing part of the textile value chain is heavily weighted towards Asia and towards developing and transitioning economies (Figure 17). China, in particular, represents a high share of the fibre, yarn and fabric production stages of the value chain, followed by India. The developing textile manufacturing countries are predominantly net exporters of textile products and intermediates, while the developed countries are predominantly net importers of textile products. The main value-chain actors at the later, higher added-value stages of the value chain are institutional buyers and retailers, and/or textile product manufacturers where high capital investment or skills are required. Another notable feature of stakeholders in the textile value chain is the large number of small and medium sized enterprises that carry out the activities. These include small-scale cotton farmers, fibre, yarn and fabric producers, dyeing and finishing facilities, and apparel manufacturers and recyclers. The high proportion of groups such as women and rural migrants, often marginalised in formal employment or typically employed in the informal sector in some production regions, is a particular feature of the workforce in these value chain activities.

The geographical and developed/developing country split across the textile value chain outlined above is particularly notable when it comes to understanding the environmental and social impacts of the textile sector. These are explored in the following section.

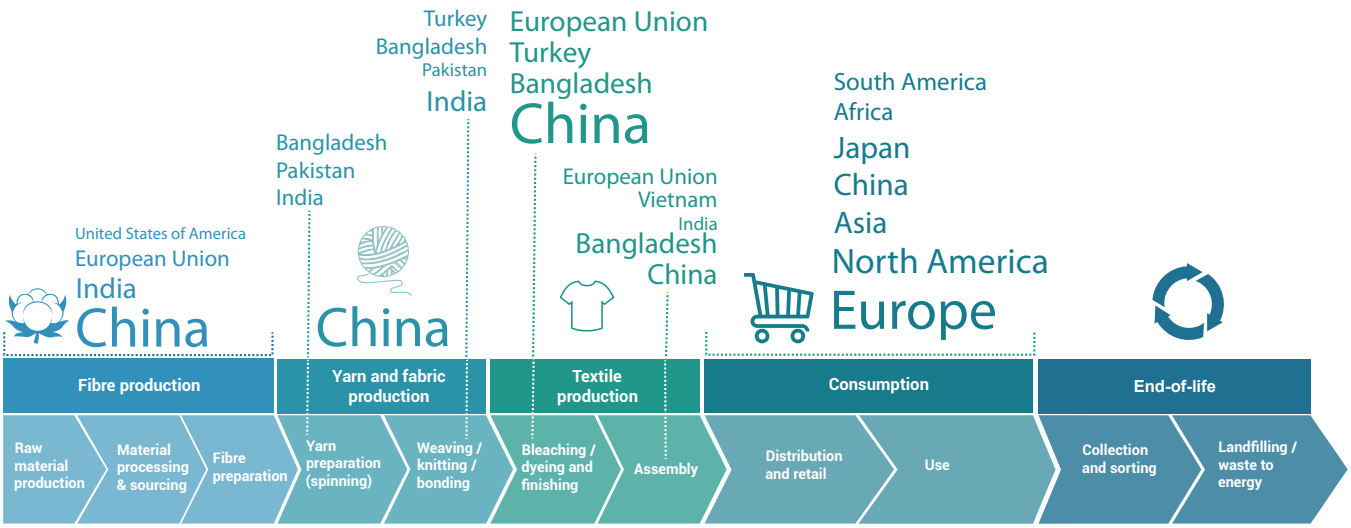

Figure 18: Geographical breakdown of global apparel production and consumption (UNEP 2020a)

2. ANALYSIS TO IDENTIFY KEY HOTSPOTS

The analysis is informed by environmental and social life cycle assessment studies, a study on the environmental impact of fashion (Quantis, 2018) and a mapping of the textile value chain (FICCI 2018).

2.1. Mapping natural resource use and environmental impacts along the textile value chain

The global apparel industry consumes some 215 trillion litres of water per year. For example in Sweden,viewed from the perspective of the consumer, this amounts to some 610 kilolitres per person per year (with water weighted according to the scarcity of water in the country in which it is used).

- Use phase, bleaching/ dyeing and finish, and raw material production stages present the highest levels of freshwater use;
- At the global level, the use phase accounts for the highest level of freshwater use. Looking at this from a water-scarcity footprint perspective, however, shows that the highest footprint is at the raw material production stage, mostly due to cotton cultivation;
- Water-scarcity footprint varies per country, depending on the availability of fresh water and the number of competing users;
- China presents the highest share (34%) of the total water-scarcity footprint of global apparel (due to cotton growth and high share of yarn and textile production), followed by India (12%) and USA (5%).

The global apparel industry consumes some 215 trillion litres of water per year

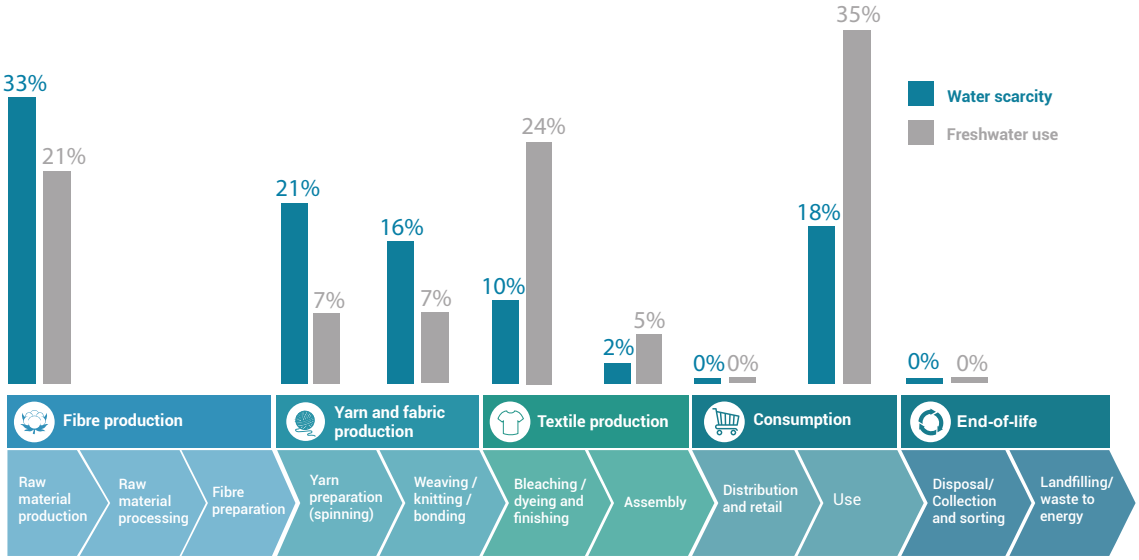

Figure 19: Freshwater use and water scarcity footprint across the global apparel value chain (UNEP 2020a)

The climate impact of the global apparel industry is substantial, with over 3.3 billion metric tons of greenhouse gases emitted across the value chain per year, more than all international flights and maritime shipping combined.

- 36% of the global apparel industry's climate impact originates from the bleaching/dyeing and finishing phase during textile production, closely followed by the use phase accounting for 24%;
- The greatest potential in reduction of climate impact is through extending the useful life of clothes and changing laundry practices.

The land use impacts at fibre production arise overwhelmingly from cotton cultivation, with a small contribution from cellulosic fibres.

- Cotton cultivation uses 2.5% of the world's arable land;
- The fibre production stage has the highest impact (primarily cotton and a small contribution from cellulosic fibres), with natural fibres accounting for 1/3 of global fibre production.

The global textile industry has severe impacts on our ecosystems, with global cotton cultivation requiring an estimated 200 thousand tonnes of pesticides and 8 million tonnes of fertilisers per year – making up 16% and 4% of the total global use of pesticides and fertilisers respectively.

The release of microfibres is an environmental issue of increasing concern, with ongoing research on its harmful effects on biodiversity, and potentially on human health as well. The release of microfibres mostly takes place at the use stage, however emerging evidence points to the importance of their release across textile manufacturing and at textile end-of-life.

Further, **socio-economic impacts** were identified, including health and social risks, and value loss at end-of life. The cost of occupational illnesses due to poor chemical management is estimated at €7 billion per year (by 2030). The fibre production stage contributes to up to 57% of social risks in general and 68% of injury risks. The highest social risks occur during natural fibre production and excessive working time in high risk garment assembly, and are mainly due to 3 common practices: demand for short lead times, demand for flexibility, and a continual search for lower prices. The annual material loss in textiles is of US$100 billion and while re-use of clothes is environmentally positive, it can increase the risk for importers and local textile producers.

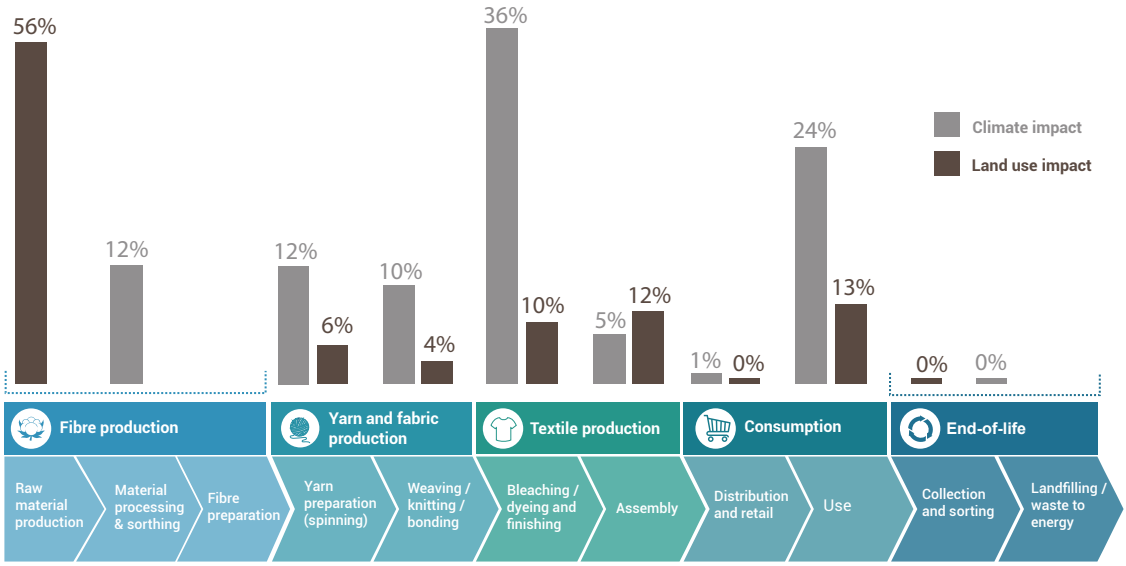

Figure 20: Climate impact and land use impact across the global apparel value chain (UNEP 2020a)

2.2. Summary of key hotspots along the textile value chain

Fibre Production

- High use of fossil fuels to produce synthetic fibres (impacts on climate, health and ecosystems)
- High use of agrichemicals, land and water to produce natural fibres, especially cotton (impacts on biodiversity and ecosystems)
- Unsafe working conditions and fragility of the legal system (impacts on health and social risks).

Yarn and Fabric Production

- No hotspots identified (although there are impacts on climate, health, ecosystem and social risks, the available life cycle data shows yarn and fabric production is not among the top contributors to impacts when the whole value chain is considered).

Textile Production

- High use of fossil fuels for heat and electricity generation in energy-intensive textile processes (impacts on climate, health and ecosystems)
- Use of hazardous chemicals (impacts on health and ecosystems, particularly via water pollution)
- Release of microfibres (impacts on ecosystems and potentially on health).
- Unsafe working conditions and fragility of the legal system (impacts on health and social risks)

Use Phase

- High use of electricity in the care of textiles over their lifetime (fossil fuels used for energy production, leading to impacts on climate, health and ecosystems)
- High use of water and release of microfibres in washing textiles over their lifetime (water scarcity, impacts on ecosystems health).

End-of-Life

- Low rates of recovery of textiles at end-of-life leading to high material value loss and non-renewable resource depletion.

The main findings of this analysis indicate that actions are required throughout the entire textile value chain to reduce pollution and improve resource efficiency, including material engineering, design of product and business models, consumer behaviour, waste management (collection, sorting, recycling and disposal), as well as crosscutting actions. These actions should be planned by following the principles of life cycle thinking and circularity, so that they do not work in fragments, but rather link with each other to amplify the effect to reduce the impacts for the whole value chain.

Further detail on hotspots in the textile value chain is available in the full report (UNEP 2020a).

3. ANALYSIS OF EXISTING POLICIES AND INITIATIVES

Awareness of sustainability and circularity issues and the need for change in the textile industry has never been higher. A number of initiatives have made headway in addressing the most pressing social and environmental challenges, including by developing transparency standards, cotton cultivation guidelines and restricted substances lists. These range from industry initiatives covering all aspects of the textile value chain, such as The Sustainable Apparel Coalition's Higg Index, to civil society and multi-government initiatives covering single issues, such as The Transparency Pledge and the UNFCCC Fashion Industry Charter for Climate. The high social and environmental impacts of cotton farming have resulted in cotton cultivation being a particular focus area of initiatives. The largest initiative is the Better Cotton Initiative (BCI), which brings together actors across the value chain (farmers, ginners, traders, spinners, mills, manufacturers, and brands/retailers), together with civil society and grassroots organizations to develop sustainable cotton into a mainstream commodity. Many initiatives addressing the sustainability of textiles include yarn and fabric production within the scope of their programmes. Poor working conditions and human rights violations have been a particular focus of initiatives in textile manufacturing. These range from international organization-led initiatives, such as the Better Work Programme (a partnership between the United Nations International Labour Organization and the International Finance Corporation), to industry initiatives, e.g. the Initiative for Compliance and Sustainability, and non-profit organization initiatives, e.g. Fair Wear Foundation. Other initiatives also address the care of textiles over their lifetime (such as Clevercare, a garment labelling system created in collaboration between brands and GINETEX, the international association for textile care labelling) as well as promote sustainable living and lifestyles, notably to reduce consumption where there is over-consumption. End of life initiatives include not only actions to prolong the use and increase the re-use, repair/repurposing and recycling of textiles, but also regulatory actions such as extended producer responsibility requirements.

Nonetheless, it is clear that much more needs to be done, and that environmental and social improvements need to become mainstream and not merely niche activities among high-end brands and large players. The definition of a common agenda and priority actions builds on the identification of gaps in existing initiatives. It is also increasingly apparent that it is the underlying nature of the textile industry that needs to change.

Importantly, circularity goes beyond incremental improvements, e.g. increasing resource efficiency, increasing recycling rates and decreasing hazardous chemical use, and requires a system-wide approach, transforming the way textiles are designed, produced, consumed and disposed of. One critical part of achieving circularity, therefore, is to bring together the many initiatives addressing different aspects of textile sustainability to advance the required systemic changes. There are already a number of initiatives and policies aiming to achieve such systemic change, for example, the Ellen MacArthur Foundation's Make Fashion Circular and the Policy Hub for Circular Economy.[11] These illustrate the multi-stakeholder nature of circularity. In addition to textile-specific initiatives, there are a number of initiatives that promote circularity more broadly, and consequently have relevance to textiles, such as the Partnership for Accelerating the Circular Economy (PACE). There are also initiatives aiming to advance circularity at a regional level, such as the African Circular Economy Alliance, the Latin-American and Caribbean Regional Coalition on Circular Economy and the European Circular Economy Action Plan[12].

Awareness of the environmental and socio-economic impacts of textiles has led to a considerable number of actions aimed at decreasing social risks and improving environmental performance. Initially, the focus of these initiatives was social sustainability, but this has broadened to include environmental sustainability, with initiatives particularly focusing on hazardous chemical use in textile production. More recently, the rise in awareness of the unsustainable levels of resource use and volumes of waste arising from fast fashion have led to an increased recognition of circularity and new underlying innovative business models advancing the circular processes key to delivering sustainability and circularity in the textile industry. The profound transformation needed to advance sustainability and circularity in textile value chains will be the outcome of coordinated actions and initiatives undertaken

to address the hotspots at each stage in the value chain. However, it should be noted that single actions and incremental improvements in themselves will never achieve full sustainability or circularity but should rather be seen as part of the co-ordinated value chain actions required.

Further detail on the breadth and focus of the initiatives being undertaken along the textile value chain are provided in the full report and in its Appendix A (UNEP 2020a)

4. DEFINING A COMMON AGENDA AND PRIORITISING ACTION

4.1. Consulting and engaging textile value-chain actors

In January 2019, UNEP convened an expert multi-stakeholder consultation workshop *"Accelerating Actions for a Sustainable Textile Value Chain within a Circular Economy"*. The workshop was the first expert consultation conducted by UNEP in this context. The objective was to create a common understanding of key impact drivers and intervention strategies for a sustainable textile value chain on a policy, business (including brands), consumer and financing level. During the workshop, participants verified findings of a baseline study, mapped ongoing efforts, initiatives and interventions which target the hotspots of the textile value chain, determined gaps in knowledge and action (policy, technology and awareness level), evaluated demand from stakeholders for concrete interventions, and recommended an initial set of priority action points to address the most problematic impact drivers.

Photo by Volha Flaxeco on Unsplash

From this workshop emerged an expert community around sustainable textile value chains in a circular economy, with representatives from the fashion and textile industry, governments, international organisations, advocacy groups and fashion institutes, which UNEP has been convening since. The objective is to share relevant activities and information with each other, to facilitate cooperation and to create knowledge.

Further perspectives from experts and stakeholders were collected through panels and roundtables held at the Fourth United Nations Environment Assembly in 2019 and the World Circular Economy Forum.

4.2. Identifying the common vision and concerted actions that that can transform the system

Circularity requires entirely new ways of doing business and eventually will result in a sector that brings benefits to business, society and the environment. That is, to evolve from an industry producing large volumes of essentially disposable items, to one producing valuable items that remain in use for a long period before being repurposed or recycled.

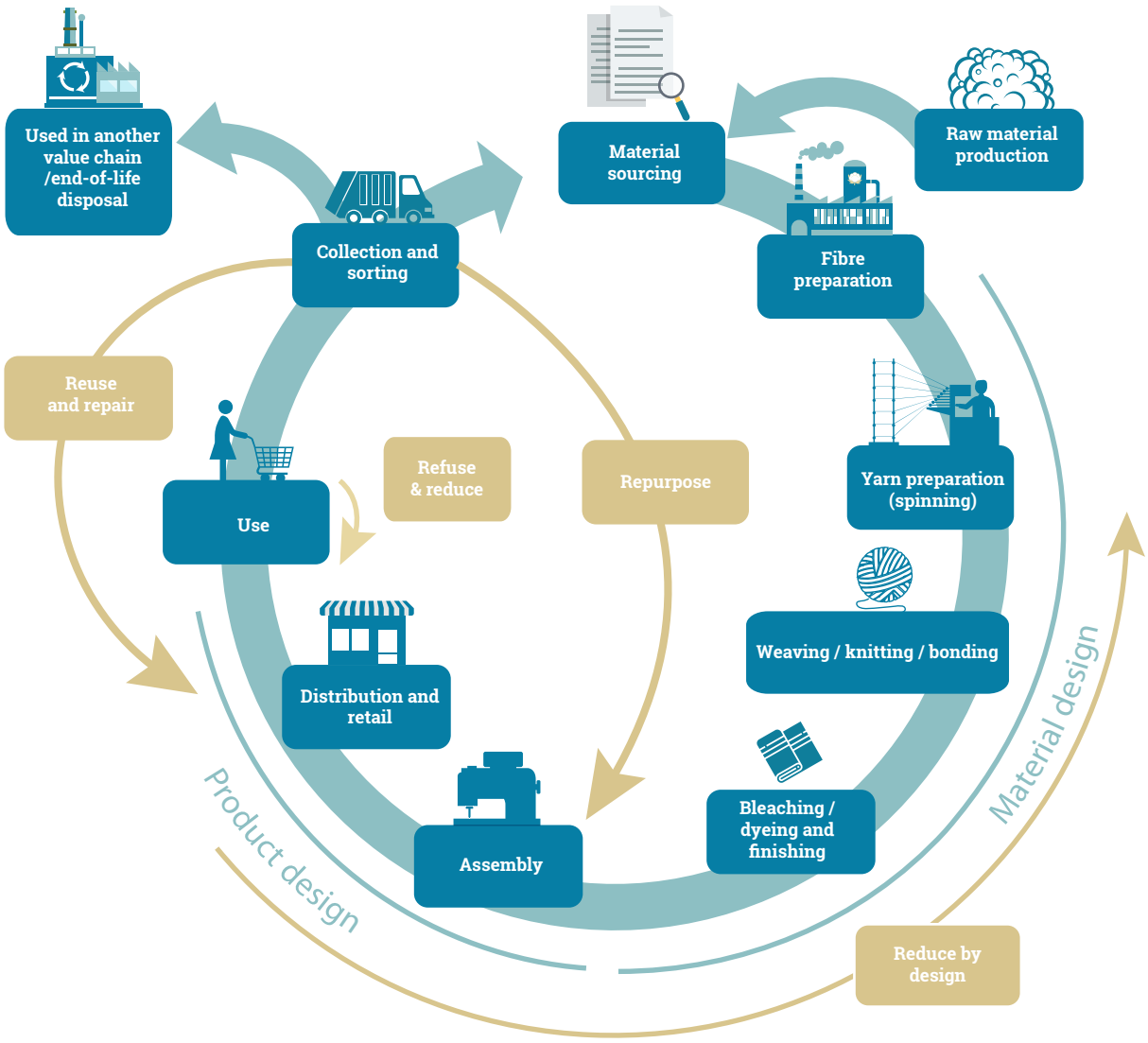

Figure 21: Representation of activities taking place in a circular textile value chain (UNEP 2020a)

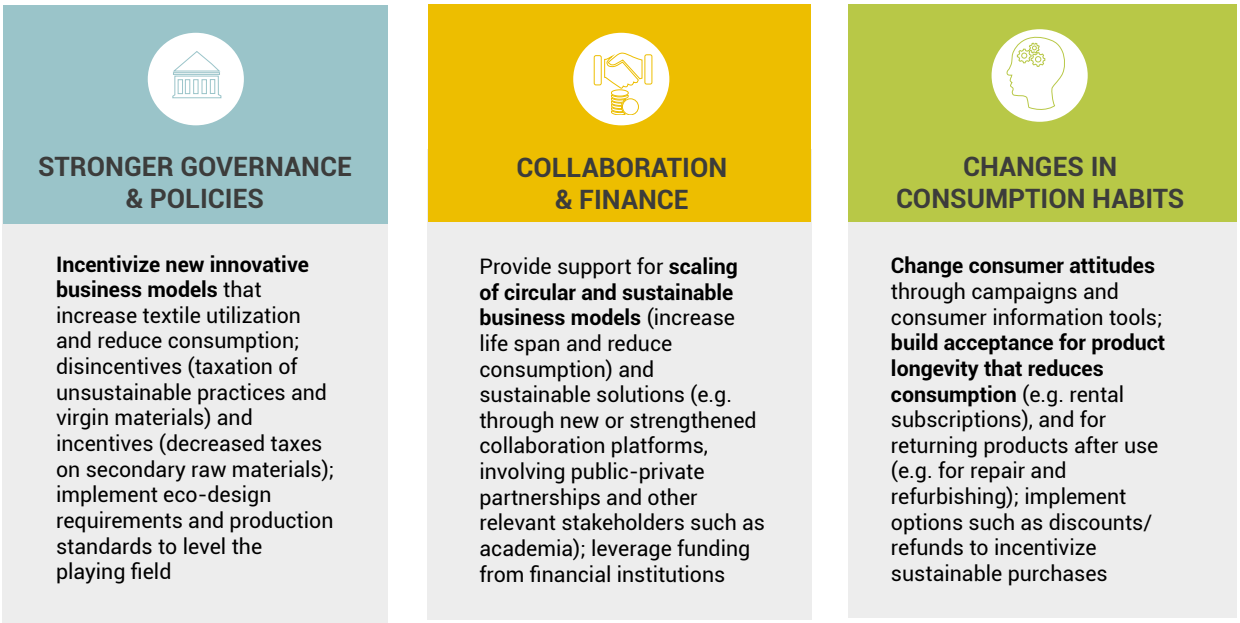

Figure 22: Priority actions required to create a sustainable and circular textile value chain (UNEP 2020a)

Cross-cutting actions deliver the enabling conditions to implement a circular economy, and cover the aspects of knowledge, policy, financing and coordination. Systemic solutions will require all stakeholders to rethink and redesign the entire textiles economic system. A holistic approach with strategic interventions across the textile value chain is needed, with national and local governments establishing appropriate legal frameworks and incentives. Actions by brands and industry to improve design for reuse and recycling and exploring innovative business models, and actions by civil society to create awareness and encourage behaviour change, are greatly needed. Actions need to be implemented at the appropriate local, national and regional scales, adjusting interventions according to the socio-economic conditions of the local context, taking into account the technical and financial circumstances, and tailored to the specific textile product/application sector.

The definition of the concerted actions needed are informed by the identified hotspots and discussed in light of the various textile initiatives that already exist.

How these actions are defined is also informed by the views of multi-stakeholder experts collected through workshops, panels and roundtables. This enables the formulation of balanced recommendations as well as the buy in of stakeholders which results in further uptake and promotion of the findings.

The common vision is to shift away from the traditional "take-make-dispose" linear textile value chain towards a circular system, where materials are not lost after use but remain in the economy, circulating as long as possible at the highest possible value. The shared vision of activities taking place in a circular and sustainable system which emerged from the multi-stakeholder textile consultations is shown in Figure 21.

Three core needs drive the priority actions required to advance sustainability and circularity in textile value chains. These are 1) the need for stronger governance to drive the change; 2) the need for collaboration and financing to implement solutions; and 3) the need to change consumption habits (Figure 22).

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The next step is to undertake a deeper analysis of the identified priority actions in order to develop a roadmap outlining how and by whom these can be addressed to move towards a more circular textile value chain. A subsequent report in this series will provide such a roadmap based on stakeholder consultations. In support of the United Nations Environment Assembly (UNEA)-4 Resolution 1 on "Innovative pathways to achieve sustainable consumption and production" adopted in March 2019, UNEP, in collaboration with the International Resource Panel, will build on these findings to provide evidence and quantitative analyses on the environmental, macro-economic and social impacts of value retention processes and other policy frameworks in the textile value chain.

5. KEY TO SUCCESS IN APPLYING STEP 3 OF THE VALUE-CHAIN APPROACH

The 3rd step of the value-chain approach focuses on defining a common agenda and prioritising action to address the identified hotspots and related gaps in existing initiatives. This is undertaken through a consultative and participatory approach in which the different actors along the value chain are involved. The consultations are informed by the outputs of the analysis of hotspots and existing initiatives along the value chain. The purpose is to ensure the development of an evidence-based and balanced set of recommendations for the vision and prioritised actions.

UNEP's work on sustainable and circular textiles is based on a holistic approach, requiring changes at each stage in the value chain and involving players of all sizes and from all market segments. Through the value-chain approach, UNEP is providing a science-based life-cycle approach to the challenges of the sector and is benefitting from the expertise of partners working in government, fashion institutes, technical organisations, other UN organisations, industry and consumer facing organizations. This engagement, which results in the definition of a common agenda, is key to the next step of defining a roadmap for priority actions to be implemented by specific stakeholders to shift to a circular textile value chain.

Key elements that have been critical to a successful application of this step of the approach include:

- **Consulting and engaging all value-chain actors,** including industry, governments, civil society, and financers is key to identifying the most promising solutions and actions that can help address the hotspots and shift the needle towards a more sustainable and circular value chain. Moving towards sustainable and circular textiles will require a holistic approach and changes at each stage in the value chain, involving players of all sizes and from all market segments.

- **The participatory approach enables the development of a comprehensive analysis and balanced recommendations.** The close involvement of experts in the development of knowledge also ensures their buy in and their uptake and promotion of the findings, to inspire changes in practice.

- **The importance of robust, reliable and transparent data.** A key lesson learned which emerged as UNEP has deployed the full value-chain approach in textiles is the pressing requirement for robust, reliable and transparent access to data on the textile value chain to support the development and implementation of a relevant set of coordinated actions.

The value-chain approach also enables decision makers to prioritise their efforts by identifying key impact areas. For instance, UNEP research for textiles shows that 36% of the global apparel industry's climate impact comes from the bleaching/dyeing and finishing phase of the value chain, closely followed by the use phase, which accounts for 24%. This shows that the most effective actions to decrease the industry's climate impacts are extending the useful life of textiles and changing laundry practices.

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CHAPTER THREE

NATURAL RESOURCE MANAGEMENT AND AGENDA 2030:

Conclusions and way forward

CONSTRUCTION

The **majority of natural resource use and environmental impacts takes place at the material production stage, the construction stage and the operation stage** of the value chain. However, there is limited scope at these stages to make the needed changes for several reasons, including the informality, fragmentation, complexity and availability of options.

The most influential actors along the construction value chain are governments, international organisations, financial institutions and major market players, who are primarily acting at the **financing stage and the planning and design stage of the construction value chain. The key decisions made at these stages largely shape the activity along the rest of the value chain.**

Construction is integral to achieving the SDGs, but direction is needed to ensure actual balance between sustainable development and the transition of the sector to resource efficiency, circularity and a smaller environmental footprint.

Governments exert significant influence along construction value chain as 1) regulators of financial markets, 2) investors in the construction sector, and 3) urban and territorial planners, and regulators of the construction sector. Governments have a strong opportunity to ensure sustainability of the construction sector through these three key levers.

Key challenges to be addressed:

1. **What types of construction is built and used, and where** – balancing their differing contribution to SDGs and their environmental footprint.
2. **how much is being built:** ensuring that the growth of construction market better follows demand.
3. **how they are built:** addressing resource use in materials, operation, construction and demolition.

FOOD

While the **majority of natural resource use and environmental impacts takes place at the primary production stage,** primary producers have a limited ability to shape food systems and change their production practices.

The middle stages of the food value chain - comprising food companies, retail and food services - are structurally powerful and to a large degree **shape both what food farmers produce and sell and what food consumers buy and eat.**

Key challenges to be addressed:

1. **what types of food we produce and consume:** addressing the vast differences in resources and environmental impacts to produce different types of food.
2. **how much food we produce and consume:** reshaping the food environment to reduce food waste
3. **how we produce food:** shifting primary production practices, including with mid-stream and down-stream actors.

Most policy measures, captured through the official reporting on SDG indicator 12.1.1, **address either primary production or individual consumption stages.** This leaves a continued gap in measures that address the middle stages of the food value chain.

Policy measures include a good mix of regulatory and voluntary measures, while economic and financial measures are limited. Tools and solutions are required to support the implementation of voluntary measures.

Tools and solutions are available across the One Planet network to address the key challenges along the food value chain. While many activities are at primary production or individual consumption stage or are holistic; there is an **opportunity to build on ongoing initiatives at the food processing, retail and food services** – in particular through the sustainable tourism, sustainable procurement and consumer information programmes.

TEXTILES

Environmental and socio-economic hotspots identified along the entire textile value chain:

- Wet processing at textile production, synthetic fibre production and laundering in the consumer use phase are particularly important regarding the impact on climate.
- Natural fibre production and the consumer use phase are particularly important regarding impacts on water scarcity.
- The use and release of hazardous chemicals in wet processing lead to water pollution and impacts on human health and ecosystems.
- The release of microfibres is associated mainly with the use phase, however emerging evidence points to its importance across textile manufacturing and at end-of-life.
- Social risks are particularly high in natural fibre production, followed by yarn and fabric production and garment assembly.

A number of initiatives have made headway in addressing the most pressing social and environmental challenges, nonetheless, improvements need to become mainstream to evolve from an industry producing large volumes of disposable items, to one producing valuable items that remain in use for a long period before being repurposed or recycled.

The common vision is to shift away from the traditional "take-make-dispose" linear textile value chain towards a circular system, where materials are not lost after use but remain in the economy, circulating as long as possible at the highest possible value.

Achieving systemic changes will require coordinated actions by all stakeholders and across regions. Priority needs to create a sustainable and circular textile value chain include: 1) **stronger governance and policies** to drive change, 2) **collaboration and financing** to enable industry-wide action, and 3) **changes in consumption habits.**

Key conclusions from the application of the value-chain approach in the three sectors (references of all sources are provided in table 1)

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Natural resources are at the centre of the Sustainable Development Goals and the 2030 Agenda for Sustainable Development. They underpin human consumption and production systems at the global, regional, national and local scales. Natural resource depletion, climate change, biodiversity loss, and pollution are increasing at an unsustainable pace, becoming more intertwined and mutually reinforcing. The application of the value-chain approach to economic sectors demonstrates how natural resources and environmental impacts are connected to the cycle of economic activities and as such highlight how insights on the management of resources address the Sustainable Development Goals.

1. ADDED VALUE OF THE VALUE-CHAIN APPROACH

Turning science into action on sustainable consumption and production

The value-chain approach, as illustrated through its application in the three sectors, is both inspirational and change-provoking. It inspires people and organisations to change and be part of the solution by providing clear entry points to leverage towards sustainability. Not only does it indicate what is happening on natural resources and why it is happening, but it also indicates the type of change needed for the sustainable management of natural resources and the actor(s) in the value chain best placed to undertake such change. By understanding the system in which the value chain operates, it connects natural resources and environmental impacts to the cycle of economic activities and ensures that insights on the management of resources are embedded within sustainable development agendas.

The value-chain approach provides a **science-based life-cycle** approach which enables the translation of scientific information into action on sustainable consumption and production. The value-chain approach helps us to:

1. Identify all actors (i.e. value-chain actors) that can trigger change in this system. It oftentimes also helps identify actors and institutions that are otherwise 'invisible' and yet have significant implications for the SCP agenda.
2. Identify hotspots and key areas of intervention by organising the available scientific knowledge along the different stages of the value chain. Critically, the approach goes beyond an understanding of where resource use and environmental impacts occur and applies a systems lens to identify the drivers and barriers that cause the value chains of different sectors to operate as they do.
3. Identify the most promising solutions and actions that can help address the hotspots and shift the needle towards a more sustainable and circular value chain, by consulting and engaging all value-chain actors - including industry, governments, civil society, financers, etc.
4. Identify the set of concerted actions that can transform the system (starting from upstream actions and complementing these with action in other elements of the value chain). Of particular importance is the opportunity that the value-chain approach offers for concerted and coherent action across the value chain, providing visibility of the consequences of such actions in other parts of the value chain.

An approach replicable to different sectors, products and geographical scales

The value-chain approach provides a framework applicable to different sectors, products and geographical scales. While this report provides practical illustrations of the benefits of the value-chain approach by its application in three prioritised sectors, it is in no way limited to these. Replicating further analyses of this type will depend on the scope and type of results being sought.

A global and sectoral scope is highly relevant to provide insights on natural resource management (and beyond) in relation to Agenda 2030. It places the emphasis on providing a global snapshot of how sectoral value chains are operating to identify hotspots for intervention within a global system of production and consumption.

To shape local action, however, insights into the global system of production and consumption may not be sufficient. An understanding of natural resource flows and hotspots in national economies will support action that is targeted and contextualised to the local conditions. It would enable the establishment of a baseline for benchmarking and tracking progress of interventions at the national, sub-national and local levels.

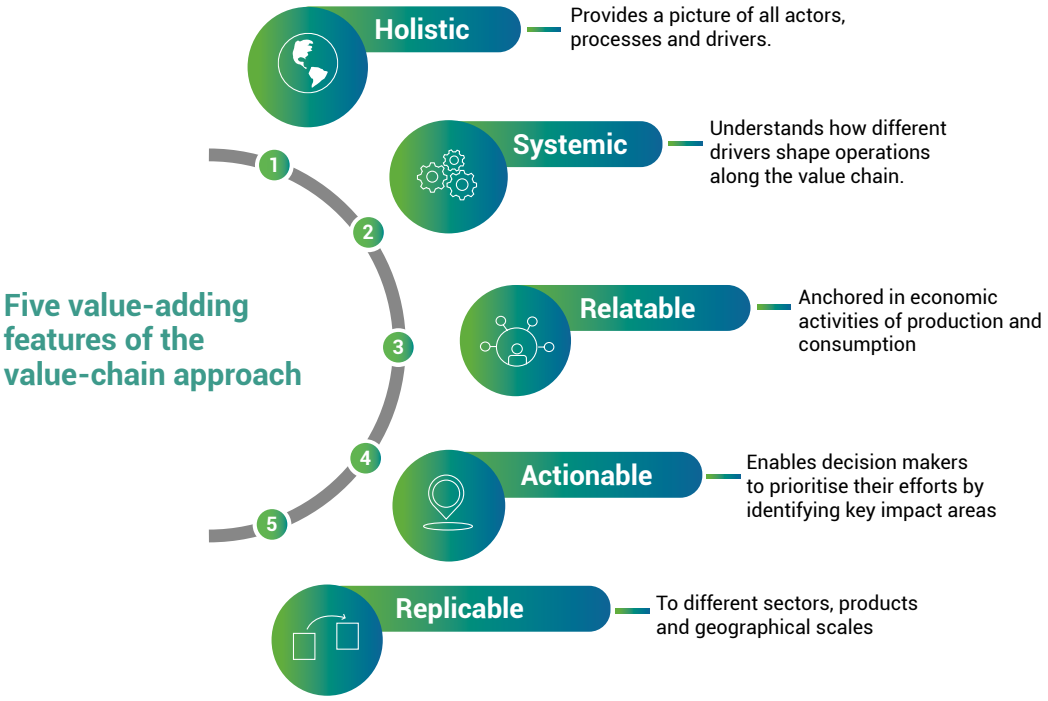
UNEP's work on other value chains:

Plastic value chain:

- Mapping of the global plastics value chain and plastic losses to the environment
- A systemic approach - Recommendations for action
- National Guidance for hotspotting and shaping action

Tourism sector:

- Mapping tourism value chains
- Hotspots analysis of tourism in different countries



1. Holistic

The value chain approach provides a holistic picture of actors, processes and drivers. For example, UNEP's work on sustainable and circular textiles is based on a holistic approach, requiring changes at each stage in the value chain and involving players of all sizes and from all market segments. It implies that strategic interventions across the textile value chain need to be undertaken by all actors, such as national and local governments, brands and industry, and civil society – and across regions.Looking at the textile value chain holistically has helped to identify that the priority needs include stronger governance and policies to drive change, collaboration and financing to enable industry-wide action, and changes in consumption habits.

2. Systemic

Understanding how the value chain operates within a system enables moving beyond a siloed and disconnected analysis, and toward understanding how different drivers of the sector shape the operations along the value chain. Each of the drivers contribute to shaping the system and influencing the behaviour of the actors along the value chain and determining what options are available to them. Equally, each of these drivers are all possible points of intervention to positively shape both the way systems work as well as the behaviour of actors along value chains.The systems analysis of the food value chain highlights several important features at the different stages of the value chain, specifically for the food companies present in the middle of the value chain, for farmers and fishers at the primary production stage, and for individual consumers downstream in the value chain.

3. Relatable

Anchoring natural resource use and environmental impacts in economic activities of production and consumption - through the prioritisation of economic sectors and by drawing knowledge on the political economy, sociology and anthropology beyond natural sciences - provides the opportunity to ensure a balance between sustainable development and the transition of the sector to resource efficiency, circularity and a smaller environmental footprint.

4. Actionable

The value-chain approach also enables decision makers to prioritise their efforts by identifying key impact areas. For instance, UNEP research for textiles shows that 36% of the global apparel's climate impact comes from the bleaching/ dyeing and finishing phase of the value chain, closely followed by the use phase, which accounts for 24%. This shows that the most effective actions to decrease the industry's climate impacts are extending the useful life of textiles and changing laundry practices.

5. Replicable

The value-chain approach is a framework methodology applicable to different sectors, products and geographical scales.

2. STRENGTHENING THE SCIENCE-POLICY INTERFACE: WHAT IS STILL NEEDED

Applying the value-chain approach systematically

In the context of the science-policy task group, the value-chain approach has provided the interface for the experts (International Resource Panel) and the practitioners (One Planet network) to understand each other and align behind a common approach. It has provided the opportunity to organise information in such a way that it is understandable and relatable by both groups.

In consideration of the scope of the task group, the primary sources of information for the application of this approach were originally identified as the International Resource Panel and the One Planet network. However, it is important to recognise that it has required a significant shift in the way this information is usually organised and that it has been necessary to complete the information with other sources. This included a) a structural re-organisation of the data and information along the stages of the value chains; b) the collection and analysis of information from other sources, in particular for the systems analysis but also for entire value chains such as in the case of textiles; and c) the integration of multi-stakeholder consultations in the definition of the common agenda and the prioritisation of actions.

A strengthened science-policy interface would highly benefit from the systematic application of approaches, such as the value-chain approach, when scientific assessments and reports are commissioned, conceptualised and developed. This includes a shared understanding of the need to reorganise scientific information, as well as the need to engage stakeholders and users of this information both in defining what information is needed and in what form it is most useful.

Data gaps to be addressed

Data gaps have been identified as the main limitation of the value-chain approach, in particular data required for the analysis to identify key hotspots along the value chains. For this report, and in the context of the mandate of the task group, data gaps are assessed in relation to the data and information made available by the International Resource Panel while acknowledging that these gaps may be addressed by other sources. Notably

Photo by Scott Graham on Unsplash

global and sectoral assessments by the World Bank, UN agencies, private sector associations and Life Cycle Assessment studies.

The way data and information are captured by the International Resource Panel varies for the three prioritised sectors. Food Systems benefits from a dedicated and comprehensive report (IRP 2016b). However, while the report refers to the different actors along the value chain, it does not provide a value-chain analysis per se. The food systems report is also relatively complex in its presentation of the issues and assumes a pre-existing understanding of the subject matter and issues at stake. On the other hand, construction is not the object of a dedicated report, rather the information on the construction value chain is featured across a variety of reports. Finally, there is no information available on the textile value chain from the International Resource Panel.

The main gaps in data and information of the International Resource Panel required to undertake a value-chain analysis include:

- **Political economy analysis of the value chain.** The International Resource Panel emphasises the importance of considering the role of all actors in shaping food systems and construction, and does provide sections and chapters on political economy issues and systems analyses in their reports. However, this information is presented in a way that is not necessarily immediately accessible, including a relatively complex presentation that assumes a detailed reading of the reports and a pre-existing understanding of the issues at stake. Considering the importance of political economy issues to understand the different value chains, there is an opportunity to strengthen its connection with natural resource use and environmental impacts. Moreover, there is an opportunity to re-think what information is highlighted when the reports are promoted and disseminated. For instance, by shifting from purely natural sciences towards the integration with knowledge from the political economy, sociology and anthropology that provide the understanding of the socio-economic system within which natural resource use and environmental impacts occur.
- **Stocks, flows and status of natural resources & environmental impacts**.The actual stocks, flows and status of different natural resources involved in the value chains are difficult to monitor and in many cases these data are not presently available. There are significant differences across countries and within countries, as well as major differences across different types of systems, on how natural resources are used in the value chains and what environmental impacts are caused. Most of the data is at a general or global level or is data from one country or region that is extrapolated to apply more broadly. This leaves a large information gap concerning informal sectors, socio-economic implications, and emerging economies and developing countries.
- **Data at the different stages of the value chain on resource use and environmental impact**.Availability of data at stages of the value chain differs according to the sector analysed.
  - For the food value chain, the report provides an overview of key resources and environmental impacts along the value chain. Despite this, the majority of data and information is focused on the primary production stage of the value chain (which is a logical focus given this is where the largest impacts take place) and there is a lack of detailed information around what natural resource use and environmental impacts are taking place at the other stages of the value chain, including the input industry, processing, transport, retail, food service, and consumption stages.
  - For the construction value chain, different parts of the information are available in different reports. For example, one report focuses on the operation and use of building and related GHG emissions (IRP 2020), while another report provides an overview of materials used in construction (IRP 2019). Information on the use of materials along the global construction value chain is also limited. Information on materials is generally organised separately based on the specific type of material such as steel and cement, and its use across many different sectors. There is little analysis and knowledge to-date that combines an overarching view of the extraction and processing of the many different materials used along the construction value chain specifically. This may also be related to the general focus on energy efficiency over material use in the reports addressing construction.
- **Product-specific data on resource use and environmental impacts.** Products are how non-experts conceive of an economic activity in their own lives. Connecting natural resource use and

Photo by Sharon McCutcheon on Unsplash

environmental impacts with specific products is especially relevant for recommendations on consumption (whether individual or organisational). This includes, for instance:

- types of food and specific food-products. Further detail on the natural resource use and environmental impact of different types of food and food products would support actions related to diets and food consumption. It would allow to measure, quantify and rank different food types and products, based on their resource and environmental footprint. Research in this area is already being undertaken in academia and other organisations, however this is not currently being applied by the International Resource Panel and by international organisations.

- types of materials used in construction. Materials as measured by material flow accounting do not show either the natural resources that people can understand, nor the finished materials that people can understand. They are mostly something in between the two - that is more processed than a natural resource, but not processed enough for a finished material that can be used.

- **Biomass as a Metric.** Biomass is the predominant metric used by the International Resource Panel and other scientific organisations and governments to indicate the material intensity of food, and comprises five sub-categories: crops, crop residues, wood, grazed biomass and fodder crops, and wild catch and harvest. There are, however, a number of limitations to this metric, notably that much of the biomass measured in material flow accounting is already embedded with natural resources input in biomass production. This is because biomass is a measure of agricultural *output* such as wheat, rice, or corn crops, rather than a measure of natural resource *input* such as the land, water and nutrients that are used to produce biomass. This does not provide for accurate measurement of the sustainable management and efficient use of natural resources in food value chains. Key reasons include: natural resources embedded within agricultural output vary significant across different types of food and can also vary depending on different methods and locations in which the same type of food can be produced; as biomass is a measure of agricultural output and not natural resource input, it is unable to capture improvements in resource efficiency and sustainability; and finally, material flow accounting captures only biomass that is produced for economic exchange and does not capture the huge amount of subsistence agriculture that takes place across the world or the associated natural resource use and environmental impacts.

Addressing these data gaps is essential to catalysing science-based policy action on SCP and providing actionable insights on natural resource management in relation to the Agenda 2030 for Sustainable Development.

Connecting data and narrative

The value-chain approach highlights the fundamental importance of connecting data and narrative. When communicating about a sector or value chain, we need to ensure that we are consistently making reference to and connecting each of the following four key elements:

1. Considering the whole value chain to ensure a holistic yet granular and specific analysis;
2. Applying a systems lens to the value chain to understand how actors at different stages can shape and influence operations and outcomes along the length of the value chain;
3. Specifically naming and explaining the natural resource uses associated and how these can be made more efficient and sustainable; and
4. Specifically naming and explaining the environmental impacts associated and how these can be prevented, mitigated and addressed.

For example, in food systems, work on sustainable diets could connect the dots between how sustainable diets can have a positive impact on natural resource use and environmental impacts, while also explicitly referencing the systemic drivers and feedback loops that exist, and explaining how each of the different actors along the stages of the value chain can play a role in the shift to sustainable diets. The connection between these four elements needs to be made using both data and narrative. This connection is essential to ensure that information is accessible and relatable to all stakeholders for the development and implementation of actionable, science-based policy recommendations towards sustainable and circular value chains.

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3. IMPLICATIONS FOR THE INTERNATIONAL RESOURCE PANEL AND THE ONE PLANET NETWORK

Both the International Resource Panel and the One Planet network are currently preparing for their next cycle of strategic planning. The International Resource Panel has launched its strategic planning exercise for the cycle 2022-2025. The One Planet network has launched the consultations on beyond 2022, when its mandate ends. This is a unique opportunity to anchor the value-chain approach in both processes, setting the scene for science-based action on natural resource use to achieve Agenda 2030.

Implications for the International Resource Panel

For the International Resource Panel, there are clear implications in terms of addressing data and knowledge gaps, the way data are organised and presented, and engaging stakeholders in the definition of priorities.

The value-chain approach, as tested in the taskforce on priority sectors like food, construction and textiles, has delivered valuable insights that the International Resource Panel may want to elaborate on. It can guide the International Resource Panel in identifying new research efforts necessary to provide insights on natural resource management that are actionable by actors working in different sectors and at different stages of various value chains. As highlighted by this report, a systematic application of the value-chain approach from the moment scientific assessments are conceptualised would significantly strengthen the science-policy interface. This includes a shared understanding of the need to reorganise scientific information, as well as the need to engage stakeholders and users of this information both in defining what information is needed and in what form it is most useful. This could be discussed during the planning of the new strategic period

(2022-2025). It could, for example, consist of adopting the approach systematically throughout the work of the International Resource Panel, or of defining a High Impact Priority Area on the value-chain approach, where specific priority sectors are targeted. Beyond think-pieces, outputs could also focus on the specific hotspots. Such a High Impact Priority Area would better position sustainable consumption and production as the bedrock strategy to harness the synergies between the three planetary crises at hand: climate, biodiversity and pollution.

Several data gaps have been identified as the key limitation in applying the value-chain approach, which the International Resource Panel may wish to consider. This may include a review of the current limitations which have been identified regarding the available data on stock, flows and status of natural resources, as well as limitations identified in the metrics used for material flow accounting. It is acknowledged that some of the gaps in specific data, such as for instance on natural resources used by different types of food products, may be available in other organisations and sources. The integration of this data in the understanding of natural resource management could include partnerships and collaboration with such organisations.

The value-chain approach also allows the identification of priority stakeholders. This is particularly helpful as the International Resource Panel has a clear ambition to engage with the private sector and civil society, but will need to focus its efforts. The value-chain analysis of the food system is a fine example, showing that the One Planet network's efforts are mostly either on the production side (farmers) or the end consumption side (consumers), where the number of stakeholders is enormous. In the middle of the value chain, the power to influence what producers and consumers do is with a handful of multinational companies in the food sector. Those would be the stakeholders to engage with, not only for the One Planet network but also for the International Resource Panel.

Finally, the value-chain approach and related analytical outputs are useful to better identify the knowledge needs of other stakeholders beyond governments and beyond actors working on environmental issues. Policies are formulated in the public domain as well as in the private domain, and the more we can help businesses to base their strategies and policies on science, the better it is. This includes not only what the assessments are on but also how the information derived from these assessments is promoted and disseminated to stakeholders. This includes what information is highlighted and which is disregarded, what narrative is being used and in what way it is being shared.

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Implications for the One Planet network

For the One Planet network, there are clear opportunities presented by this approach to build upon towards a strengthened relevance and a renewed mandate beyond 2022. It is vital that the activities of the One Planet network show the clear contribution that sustainable consumption and production makes in harnessing the synergies in addressing climate change, biodiversity loss and pollution. For an effective and strong engagement of actors, it is essential that sustainable consumption and production does not remain siloed as 'a standalone priority'. The value-chain approach is an effective way to address this challenge and is instrumental in identifying synergies, trade-offs, actors and hotspots for action. This may also lead to more joint initiatives across the six programmes of the One Planet network. This potential is clearly highlighted, for example, in the analysis of policies and initiatives of the One Planet network on food systems.

Further to any strategic planning, the One Planet network can play a key role in the next steps following the analytical and consultative process in this approach: as a multi-stakeholder network leading the shift to sustainable consumption and production, it can facilitate the uptake of the outputs of the analysis across areas of expertise and stakeholder groups. The implementation of the prioritised actions is ultimately the main expected next step.

While consultations on the common agenda on food systems across the One Planet network are still to take place, certain key actors have initiated some follow-up steps. This includes, for example, the interest of one of the co-lead organisations of the Sustainable Food Systems programme in addressing one of the gaps identified by the value-chain analysis. Notably this may consist of research to better understand the political economic context of food value chains, with specific focus on the middle stages of the value chain that are identified as key in shaping production and consumption.

The type of steps taken to implement the outputs of the value-chain approach can also be illustrated by examples in other value chains. The series of publications "Assessing Marine Plastics: A systemic Approach" (UNEP 2018; UNEP 2019; UNEP 2020a) demonstrated that the majority of plastics in the system are used for packaging and other consumer products (54%) and that the largest losses of plastics occur in the Use (36%) and End of Life stages (55%). It indicates that actions throughout the entire plastics value chain are required to reduce pollution and improve resource efficiency, including material engineering, design of product and innovative business models, consumer behaviour, and waste management. The outcomes of the analysis of the plastics value chain led to a number of follow-up actions and initiatives, such as:

- Engaging all actors across the value chain to commit to specific actions for a circular economy of plastics by establishing the New Plastics Economy Global Commitment which unites all actors behind a common vision and common targets. The signatories include companies representing 20% of all plastic packaging produced globally, as well as governments, NGOs, universities, industry associations, investors, and other organisations. The Global Commitment is led by the Ellen MacArthur Foundation, in collaboration with UNEP. The Global Tourism Plastics Initiative has spun off the One Planet network's Sustainable Tourism Programme as an interface of the Global Commitment with the tourism sector.
- Supporting the prioritisation of action at local level through the development of dedicated guidelines. These provide a clear methodology to map key plastic leakage hotspots in the economies and to shape local action towards resolving the problem at the national level. The development of the national plastic hotspotting methodology is a collaboration between UNEP and IUCN.
- Harnessing the power of consumption choices in triggering upstream changes in the production process through a joint effort of the programmes of the One Planet network. Building on the expertise of the programmes, it focuses on three key areas of intervention: i) information on the sustainability of plastic packaging, ii) changing public procurement practices; iii) understanding triggers for behaviour change – and their application in two sectors: tourism and food systems. This initiative underway is a collaboration between UNEP, the Ministry of ecological transition of France, the Rijkswaterstaat of the Netherlands, Consumers International, Stockholm Environment Institute and the Food and Agriculture Organisation.

The examples on the plastics value chain provide some insight on the types of initiatives that various actors may engage in to implement the outputs of the analysis of the food, construction and textile value chain.

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4. WAY FORWARD

In response to the request made by the UNEA4 Resolution on sustainable consumption and production, the joint task group of the International Resource Panel and the One Planet network identified the value chain as an effective interface between the science on natural resource use and action on sustainable consumption and production. The application of the value-chain approach to the three prioritised sectors of construction, agri-food and textiles further highlights its added value as an approach that is holistic, systemic, relatable, actionable and replicable.

The task group identifies in this report the implications of the value-chain approach for both the International Resource Panel and the One Planet network. This report of the task group should inform the strategic planning exercises that both initiatives have just launched. Further to each initiative adopting the value-chain approach systematically to guide their planning and prioritisation according to their mandate and role, it also highlights the value of a continued collaboration between scientists and practitioners to define knowledge needs or common agenda for action.

Beyond the International Resource Panel and the One Planet network, the systematic application of approaches, such as the value-chain approach, would highly benefit and strengthen the science-policy interface that is much needed for the implementation of Agenda 2030 (UN 2019a). This includes a shared understanding of the need to reorganise scientific information, as well as the need to engage stakeholders and users of this information both in defining what information is needed and in what form it is most useful.

Bringing together the scientists analysing natural resources of the International Resource Panel and the practitioners implementing sustainable consumption and production of the One Planet network has been key to this work. It establishes a two-way communication between the available science and the requirements to turn this science into action. Further to supporting the

identification of priorities on a scientific basis, it has also provided the opportunity to connect different types of knowledge in a way that is relatable and actionable by practitioners by drawing on social sciences, the humanities, and practical knowledge, in addition to natural sciences. This type of collaboration can therefore support both the identification of knowledge needs as well as a re-thinking of which information is highlighted when scientific assessments are promoted and disseminated.

The multi-stakeholder participatory process within the value-chain approach further ensures tapping into the bodies of lay and practical knowledge that are collectively held among SCP practitioners. Engaging all value-chain actors – including government, industry, civils society and financiers – is key to identify the most promising solutions and actions that can help address the hotspots and shift the needle towards a more sustainable value chains. Further to this, moving towards the desired sustainability, including through structural shifts and circular models, requires a holistic approach involving players of all sizes and from all market segments. The multi-stakeholder participatory process is indispensable to define a common agenda that is owned by all actors and to ensure their continued engagement and buy-in for its implementation.

Anchoring natural resource use and environmental impacts in economic activities of production and consumption is one of the reasons for which this approach has been welcomed by the practitioners in the task group. This starts with the prioritisation according to economic sectors (agri-food, construction, textiles) rather than environmental dimensions and continues with the type of information analysed. This is well illustrated by the analysis of the construction value chain. Construction as a sector globally has the highest material footprint and results in many environmental impacts. However, the construction sector also contributes in a variety of ways to socio-economic outcomes and to meeting the Sustainable Development Goals. It is therefore essential to analyse the socio-economic outcomes of the construction sector alongside the associated natural resource use and environmental impacts, to be able to balance any trade-offs.

Critically, the approach goes beyond an understanding of where resource use and environmental impacts occur, and applies a systems lens to identify the drivers and barriers that cause the value chains of different sectors to operate as they do. Focusing solely on the direct source of environmental impacts can fail to take into account the complex drivers and feedback loops that determine and influence the operations and behaviours of actors along the value chain. This is well illustrated by the analysis of the food value chain. The systems analysis of the food value chain demonstrates that, while the majority of natural resource use and environmental impacts is taking place at the primary production stage, primary producers have a limited ability to shape food systems. Comparatively, while the actors along the middle stage value chain do not use the most resources themselves, they are structurally powerful and have a disproportionate influence across both primary production and final consumption and to a large degree shapes both what food farmers produce and sell and what food consumers buy and eat. By bridging the gap between the science on natural resources and the socio-economic features of production and consumption systems, the value-chain approach is embedded within the 2030 Agenda for Sustainable Development.

By bridging the gap between the science on natural resources and the socio-economic featuresof production and consumption systems, the value-chain approach provides actionable insights on the management of natural resources in support of the implementation of the 2030 Agenda for Sustainable Development

ANNEX 1: COMPOSITION AND NOMINATION OF TASK GROUP MEMBERS

Catalysing science-based policy action on SCP
Task Group Composition

The nominations for the task group were received through an open call for proposals launched through the International Resource Panel and the One Planet network. The selection of task group members was finalised by one of the co-chairs of the International Resource Panel and the Chair of the 10YFP Board. Selection criteria included stakeholder group representation, regional balance and diversity of expertise.

Argentina, Chair 10YFP Board
Rodrigo Rodriguez Tornquist
Ministry of Environment and Sustainable Development, Argentina

Finland
Merja Saarnilehto
Programme Manager,
Ministry of Environment

The Netherlands
Arthur Eijs
Ministry of Infrastructure & Water Management

South Africa National Cleaner Production Centre
Ndivhuho Raphu
Director

European Commission
Jesus-Maria Alquezar
Sabadia & Luca Marmo

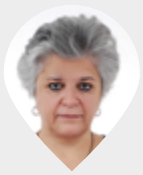
UN-Habitat
Christophe Lalande,
Leader —Housing Unit

UNEP
Ligia Noronha, Director,
Economy Division

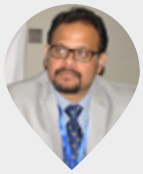
IRP Expert
Ester Van der Voet
Associate Professor,
Leiden University

IRP expert
Jeffrey Herrick, Soil Scientist
USDA, Agricultural Research Services

IRP expert
Stefanie Hellweg
Professor, ETH Zurich



IRP Co-Chair
Izabella Teixeira,
former Minister,
Ministry of Environment Brazil



Centre for Responsible Business, India
Rijit Sengupta
Chief Executive Director

Saudi Green Building Forum, Saudi Arabia:
Faisal Alfadi, Founder/Chief Representative to United Nations

World Resources Forum
Bas de Leew, Managing Director

WWF-International
Martina Fleckenstein,
Policy Manager, Food Practice

ANNEX 2:

KEY REPORTS OF THE INTERNATIONAL RESOURCE PANEL REVIEWED BY THE TASK GROUP

- **Resource Efficiency and Climate Change:** Material Efficiency Strategies for a Low-Carbon Future, 2020.
- **Global Resources Outlook 2019:** Natural Resources for the Future We Want.
- Resource efficiency for sustainable development: **key messages for the group of G20**, 2018.
- **The Weight of Cities:** Resource Requirements of Future Urbanization, 2018.
- **Resource Efficiency: Potential and Economic Implications**, 2017 - commissioned by the G7
- **Assessing global resource use:** A systems approach to resource efficiency and pollution reduction, 2017
- **Global Material Flows and Resource Productivity.** An Assessment Study of the UNEP International Resource Panel, 2016.
- **Food Systems and Natural Resources,** 2016

REFERENCES

Deloitte, 2019. Global Powers of Construction 2018. Accessed 21 October 2020

FICCI. 2018. Mapping the Textile Value Chain, Identifying Key Hotspots at the Global Level and Assessing Trade Barriers and Opportunities: Final Report

Global ABC, IEA and UNEP, 2019. 2019 global status report for buildings and construction: Towards a zero-emission, efficient and resilient buildings and construction sector.

IHS, 2013. Global Construction Outlook: Executive Outlook.

ICED, 2018. Construction Sector Employment in Low Income Countries. Final draft version 2 (5 January 2018)

IRP, 2014. Assessing Global Land Use: Balancing Consumption with Sustainable Supply. A Report of the Working Group on Land and Soils of the International Resource Panel. Bringezu S., Schütz H., Pengue W., O´Brien M., Garcia F., Sims R., Howarth R., Kauppi L., Swilling M., and Herrick J.

IRP, 2016a. Global Material Flows and Resource Productivity. An Assessment Study of the UNEP International Resource Panel. H. Schandl, M. Fischer-Kowalski, J. West, S. Giljum, M. Dittrich, N. Eisenmenger, A. Geschke, M. Lieber, H. P. Wieland, A. Schaffartzik, F. Krausmann, S. Gierlinger, K. Hosking, M. Lenzen, H. Tanikawa, A. Miatto, and T. Fishman. Paris, United Nations Environment Programme. Nairobi, Kenya

IRP, 2016b. Food Systems and Natural Resources. Westhoek, H, Ingram J., Van Berkum, S., Özay, L., and Hajer M. A Report of the Working Group on Food Systems of the International Resource Panel. United Nations Environment Programme. Nairobi, Kenya.

IRP, 2017a. Assessing global resource use: A systems approach to resource efficiency and pollution reduction. Bringezu, S., Ramaswami, A., Schandl, H., O'Brien, M., Pelton, R., Acquatella, J., Ayuk, E., Chiu, A., Flanegin, R., Fry, J., Giljum, S., Hashimoto, S., Hellweg, S., Hosking, K., Hu, Y., Lenzen, M., Lieber, M., Lutter, S., Miatto, A., Singh Nagpure, A., Obersteiner, M., van Oers, L., Pfister, S., Pichler, P., Russell, A., Spini, L., Tanikawa, H., van der Voet, E., Weisz, H., West, J., Wiijkman, A., Zhu, B., Zivy, R. A Report of the International Resource Panel. United Nations Environment Programme. Nairobi, Kenya.

IRP, 2017b. Resource Efficiency: Potential and Economic Implications. A report of the International Resource Panel. Ekins, P., Hughes, N., et al. United Nations Environment Programme. Nairobi, Kenya.

IRP, 2018a. The Weight of Cities: Resource Requirements of Future Urbanization. Swilling, M., Hajer, M., Baynes, T., Bergesen, J., Labbé, F., Musango, J.K., Ramaswami, A., Robinson, B., Salat, S., Suh, S., Currie, P., Fang, A., Hanson, A. Kruit, K., Reiner, M., Smit, S., Tabory, S. A Report by the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya.

IRP, 2018b. Resource efficiency for sustainable development: key messages for the group of G20.

IRP, 2019. Global Resources Outlook 2019: Natural Resources for the Future We Want. Oberle, B., Bringezu, S., Hatfield-Dodds, S., Hellweg, S., Schandl, H., Clement, J., and Cabernard, L., Che, N., Chen, D., Droz-Georget , H., Ekins, P., Fischer-Kowalski, M., Flörke, M., Frank, S., Froemelt , A., Geschke, A., Haupt , M., Havlik, P., Hüfner, R., Lenzen, M., Lieber, M., Liu, B., Lu, Y., Lutter, S., Mehr , J., Miatto, A., Newth, D., Oberschelp , C., Obersteiner, M., Pfister, S., Piccoli, E., Schaldach, R., Schüngel, J., Sonderegger, T., Sudheshwar, A., Tanikawa, H., van der Voet, E., Walker, C., West, J., Wang, Z., Zhu, B. A Report of the International Resource Panel. United Nations Environment Programme. Nairobi, Kenya.

IRP, 2020. Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future. Hertwich, E., Lifset, R., Pauliuk, S., Heeren, N. A report of the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya.

OECD, 2018. Global Material Resources Outlook to 2060: Economic drivers and environmental consequences. OECD publishing, Paris.

OECD, 2020. 'ODF for Infrastructure at a glance by donor,' Organisation for Economic Cooperation and Development, accessed 26 October 2020.

One Planet network, 2017. Demonstrating the shift to sustainable consumption and production: Principles, process, indicators and methodologies. Pilot version 2017; updated version 2020.

One Planet network, 2019. Sustainable Food Systems Programme - Collaborative Framework for Food Systems Transformation: a multi-stakeholder pathway for sustainable food systems. Bortoletti M., Lomax J. United Nations Environment Programme, Nairobi, Kenya.

Quantis. 2018. Measuring Fashion: Environmental Impact of the Global Apparel and Footwear Industries.

UN, 2019a. Independent Group of Scientists appointed by the Secretary-General. Global Sustainable Development Report 2019: The Future is Now – Science for Achieving Sustainable Development. United Nations, New York.

UN, 2019b. The Global Sustainable Development Goals Report 2019. United Nations, New York.

UN, 2020. Progress report on the 10-year framework of programmes on sustainable consumption and production – Note of the Secretary General. E/2020/56. United Nations, Economic and Social Council, New York.

UNEP, 2017a. Hotspots Analysis An overarching methodological framework and guidance for product and sector level application. United Nations Environment Programme, Nairobi, Kenya.

UNEP, 2017b. Mainstreaming Eco-innovation in Sustainable Consumption and Production Policies. United Nations Environment Programme, Nairobi, Kenya.

UNEP, 2018. Mapping of global plastics value chain and plastics losses to the environment (with a particular focus on marine environment). Ryberg, M., Laurent, A., Hauschild, M. United Nations Environment Programme. Nairobi, Kenya

UNEP, 2019a. Sand and sustainability: Finding new solutions for environmental governance of global sand resources. GRID-Geneva, United Nations Environment Programme, Geneva, Switzerland.

UNEP, 2019b. Addressing marine plastics: A systemic approach - Recommendations for action. Notten, P. United Nations Environment Programme, Nairobi, Kenya.

UNEP, 2020a. Sustainability and Circularity in the Textile Value Chain. Global Stocktaking. Notten P. United Nations Environment Programme, Nairobi, Kenya.

UNEP, 2020b. National guidance for plastic pollution hotspotting and shaping action - Introduction report. Boucher J., M. Zgola, et al. United Nations Environment Programme, Nairobi, Kenya.

UN-Habitat, 2015. International guidelines on urban and territorial planning. UN Human Settlement Programme. Nairobi, Kenya

UNHCR, 2019. 'Guidelines for the Implementation of the Right to Adequate Housing: Report of the Special Rapporteur on adequate housing as a component of the right to an adequate standard of living, and on the right to non-discrimination in this context,' United Nations Human Rights Council. Geneva.

UN IATF, 2020, 'Closing the infrastructure gap,' United Nations Inter-Agency Task Force on Financing for Development.

SCP-HAT, 2020. SCP indicators for hotspot analysis. Accessed 8 October 2020.

McKinsey Global Institute, 2017. Reinventing construction: a route to higher productivity. Executive Summary.

WGBC, 2017. 'World Global Building Council, Global Status Report', World Global Building Council.

World Bank, 2003. 'Public Money for Private Infrastructure: Deciding When to Offer Guarantees, OutputBased Subsidies, and Other Fiscal Support,' The World Bank.

World Bank, 2017. 'Who sponsors infrastructure projects? Disentangling public and private contributions'. The World Bank.

ENDNOTES

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1. https://www.oneplanetnetwork.org/sites/default/files/value_chain_analysis_construction.pdf

2. https://www.oneplanetnetwork.org/sites/default/files/catalysing_science-policy_action_on_scp_-_task_group_-_food_value_chain_analysis_-_october_2020.pdf

3. https://www.oneplanetnetwork.org/resource/sustainability-and-circularity-textile-value-chain-global-stocktaking

4. https://www.oneplanetnetwork.org/unep-textile-value-chain

5. https://wedocs.unep.org/bitstream/handle/20.500.11822/29499/Private%20Sector%20Engagement%20at%20the%202019%20Assembly.pdf?sequence=1&isAllowed=y

6. https://media.sitra.fi/2019/02/31195118/finalprogrammewceftextilesidesession03052019.pdf

7. https://www.oneplanetnetwork.org/sites/default/files/food_value_chain_-_consolidating_existing_policies_action_-_trends_gaps_opportunities.pdf

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8. Input industry (36), primary production (33), processing & packaging (19), transport/logistics (7), retail (30), food service (26), individual consumption (33), and waste/disposal (7).

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9. The six programmes are: Sustainable Food Systems; Sustainable Tourism; Consumer Information for SCP; Sustainable Lifestyles and Education; Sustainable Public Procurement; Sustainable Buildings and Construction

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10. Primary production (23%), processing & packaging (2%), transport/logistics (0%), retail (6%), food service (16%), individual consumption (19%), waste/disposal (0%), general/holistic (32%).

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11. Members of the Policy Hub for Circular Economy are the Sustainable Apparel Coalition, Global Fashion Agenda (GFA) and the Federation of the European Sporting Goods Industry (FESI).

12. https://ec.europa.eu/environment/circular-economy/

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One planet handle with care

International Resource Panel

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