



TEEB FOR AGRICULTURE AND FOOD: OPERATIONAL GUIDELINES FOR BUSINESS

PUTTING NATURE AND PEOPLE AT
THE CENTRE OF FOOD SYSTEM TRANSFORMATION

Draft report for consultation
August 2020







**CAPITALS
COALITION**



Funded by the
European Union

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Foreword by Mark Gough, CEO, Capitals Coalition

Transforming our food system is one of the most important challenges we face in the 21st century. Providing food security for a growing population and restoring the natural systems that food production depends upon, while ensuring social equality and equity requires a systems-based approach.

Developed to support businesses in implementing the TEEBAgriFood Evaluation Framework, these Guidelines provide a practical way for businesses to understand and act upon their impact and dependency on natural, human, social, and produced capital.

The Guidelines reference and build on the internationally accepted harmonized business frameworks for identifying, measuring, and valuing your relationship with nature and people: the Natural and Social & Human Capital Protocols (hereafter the Protocols). The Protocols provide important additional support and context when applying these Guidelines.

Thanks to generous funding by the European Commission, the Guidelines will be piloted in seven countries with different agriculture approaches and traditions (Brazil, China, India, Indonesia, Malaysia, Mexico, and Thailand). Through strong in-country collaborations, businesses will apply, challenge, and build upon these Guidelines over the next three years. Your feedback is welcomed and will contribute to the development of the final Guidelines due to be published in November 2022.

These Guidelines go beyond existing guidance for business by considering the interdependencies between nature and people in the food value chain. This an important next step towards mainstreaming capitals into decision making and will inform work in other value chains and geographies.

The efforts made by businesses to apply these Guidelines will be integrated through a broader systems-based project run by the United Nations Environment Program (UNEP) which aims to connect all relevant actors.

I would like to thank everyone who has been involved in inspiring, evolving, and developing this work. This is a significant stepping stone and provides a strong platform for future integration of all forms of capital into the way that we think and work.

Orientation

Introducing the TEEBAgriFood Evaluation Framework and the Capitals Protocols and how they come together in these Operational Guidelines for Business.

The Economics of Ecosystem and Biodiversity (TEEB) is a global initiative focused on “making nature’s values visible.” Its principal objective is to mainstream the values of biodiversity and ecosystem services into decision making at all levels. TEEB aims to achieve this goal by following a structured approach to valuation that helps decision makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and, where appropriate, capture those values in decision making.

In 2018, TEEB published a seminal document (TEEB for Agriculture and Food (**TEEBAgriFood**)) addressing the challenges within the food system and recognizing the importance and interaction of a systems approach through different “capitals”—natural, human, social, and produced (defined in action 1.2.1). The TEEBAgriFood Evaluation Framework (Figure O.1) shows the progression and iteration through stocks, to flows, to outcomes, to the impacts upon human well-being.

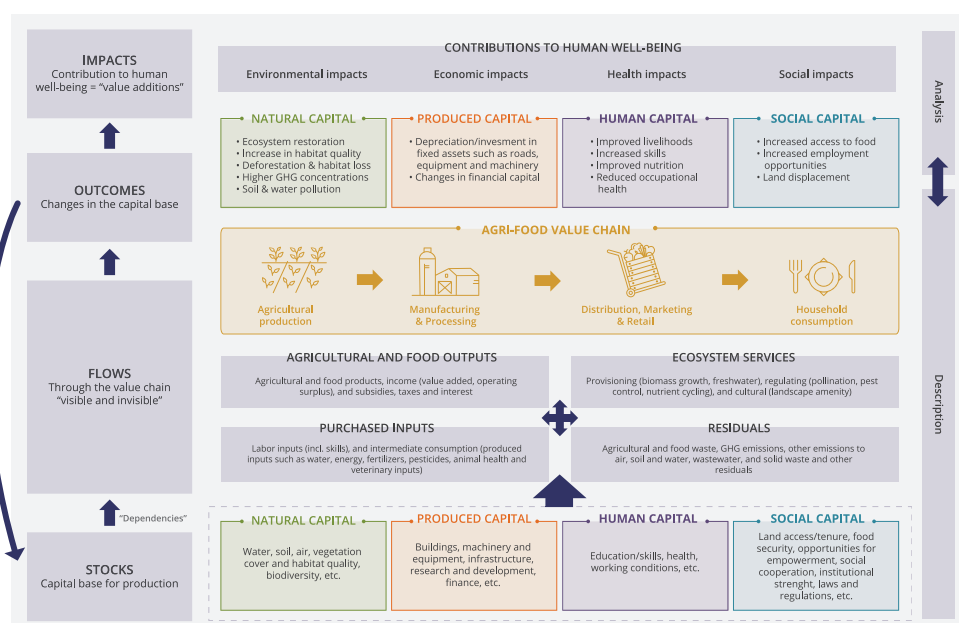


Figure O.1
Elements of the TEEBAgriFood Evaluation Framework

Intended Audience

The original TEEBAgriFood Framework is set out to be an overarching framework for policy, business, farming, and civil society. It provides key definitions, measurement concepts, and boundaries to describe and understand the complexity of the food system in its entirety. It does not explain how to carry out an assessment and these Guidelines fill this gap.

The Guidelines are specifically written for businesses in the food sector but can also be used by businesses in other sectors as they follow a structured approach to application and are designed to be accessible and user-friendly.

Structure

The Guidelines build upon and follow the structure of the Protocols following the same four stages of a standard decision-making process, “Why,” “What,” “How,” and “What Next.” The Stages are broken down into nine Steps, which contain specific questions to be answered when carrying out a capitals assessment as shown in Figure 0.2.

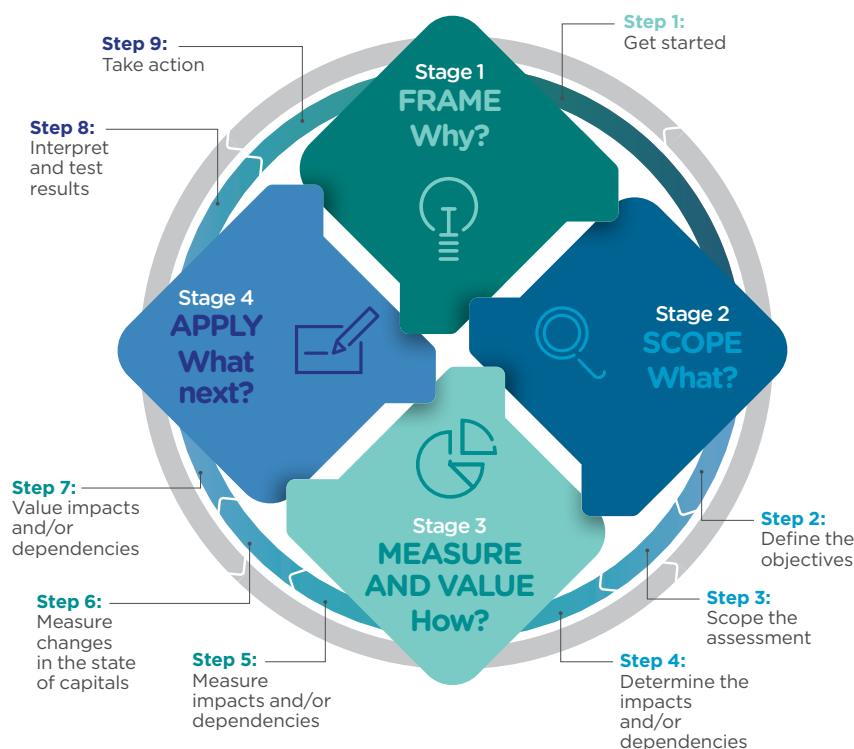


Figure 0.2
The TEEBAgriFood Operational Guidelines for Business Structure

The Stages and Steps are iterative, and you should expect to revisit previous Steps as necessary. For example, after identifying your most material impacts and dependencies in Step 04, you may need to go back and change the objective or scope of your assessment in Steps 02 and 03.

Each Step follows the same structure. Steps begin with an overarching question to be addressed and a brief introduction, followed by a detailed description of the actions required to complete the Step, together with guidance on how to proceed, and a template for outputs. Useful definitions of key terms are provided when they are first introduced.

You should complete all four Stages and nine Steps when carrying out an assessment. You can find a template for application in the [Coalition's webpage](#) that will help you to confirm that you have completed all Steps and actions of your assessment.

More specifically, the Guidelines:

- Provide context on why capitals are relevant to any business in the food system and how businesses benefit from them.
- Develop the business case for integrated capitals assessments in the food sector.
- Identify material impacts and dependencies on different capitals relevant to businesses across the value chain of the food sector.
- Use practical examples to demonstrate sector-specific business applications.

Why an integrated capitals approach?

Businesses impact and depend upon multiple capitals (natural, human, social, and produced) and there are critical interdependencies between the capitals that affect how they are used, impacted, or invested in by businesses.

The Protocols, in setting out how to conduct single capital assessments, recognize multiple capitals but do not attempt to fully integrate them.

These Guidelines support an integrated capitals approach which explicitly assesses all the capitals together and takes into account the interconnections between them. The Guidelines add value to existing guidance by focusing on the relationships between capitals and their relationships to business. By taking an integrated approach we can better understand risks and opportunities.

Principles

Principles of ethics protect, maintain and where possible enhance people's rights, skills, experience, knowledge, and health as well as societies' shared values.

Recognition of logical thresholds and limits should also be included as a fundamental principle of any capitals assessment.

In addition, these Guidelines are underpinned by four principles to make sure your results are credible and fit for purpose.

| |
|--|
| Relevance |
| Ensure that you consider the most relevant issues throughout your capitals assessment including the impacts and/or dependencies that are most material for the business and its stakeholders (Adapted from original in CDSB 2015, WRI and WBCSD 2004). |
| Rigor |
| Use technically robust (from a scientific and economic perspective) information, data, and methods that are also fit for purpose. |
| Replicability |
| Ensure that all assumptions, data, caveats, and methods used are transparent, traceable, fully documented, and repeatable. This allows for eventual verification or audit, as required (Adapted from GRI, 2013). |
| Consistency |
| Ensure the data and methods used for an assessment are compatible with each other and with the scope of analysis, which depends on the overall objective and expected application (Adapted from WRI and WBCSD 2004, IIRC 2013). |

Note: Whereas **Relevance** is a principle to adhere to throughout the application of a capitals assessment, **Materiality** is covered in Step 04, "Determine the impacts and/or dependencies."

Although it is recommended that the Principle of **Consistency** be adhered to throughout your assessment, the Protocols do not propose that outputs be consistent and comparable between companies as they are context specific. Comparability of results is something that will be addressed at a later date.

Definition of the food sector and its value chain

These Guidelines define the agri-food sector (hereafter the food sector) as the complete range of activities required to deliver a product through the different phases of production to end consumers (Figure 0.3).

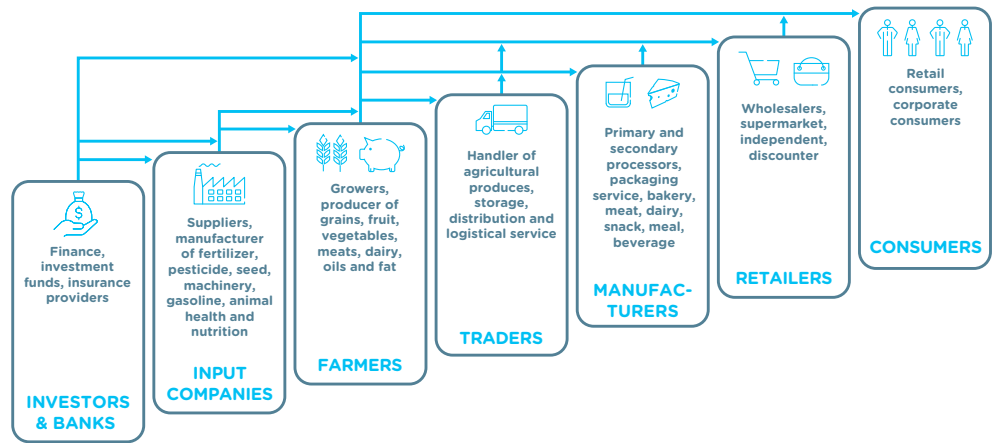


Figure 0.3
The food value chain

The traders stage of the value chain includes all intermediary stages not covered elsewhere, such as sourcing, logistics, and trading. Recycling, reuse, and other end-of-life options are considered within every stage of the value chain and can be a critical mechanism for reducing impacts and dependencies.

The hospitality/food service sector and non-food purpose sector (i.e., energy and beauty) are both beyond the scope of these Guidelines and not included here. Although fisheries were not included in TEEB AgriFood and are not the focus of these Guidelines, the Guidelines can be used to support fisheries-based assessments.

Finally, it is worth noting that supply chains vary in length and complexity, with long international and global supply chains existing beside short, local or national ones. There is a high degree of variability in vertical integration for industry participants with some companies operating farms, processing facilities, and storage and distribution networks all the way through to the consumer.

Hypothetical examples

To help you navigate through the Guidelines, hypothetical examples are included at the end of each Step. These are illustrative and are simplified to demonstrate how each Step works. The examples are based upon the three organizations set out in Table 0.1.

Table 0.1

Hypothetical examples running through the guidelines

| | Blossom Foods | VitaCrisp | Evolve Crops |
|--|---|--|---|
| <i>Organization</i> | Global food processing conglomerate including confectionery, flavorings, and canned goods. | International food manufacturer. | Medium-sized company involved in commodities production, distribution, and retail. |
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>Capitals assessment undertaken (Business application)</i> | The company conducted a monetary assessment of the natural, human, and social capital changes over 4 years compared to a baseline of the legal minimum. (Estimate total value and/or net impact – see Step 01) | The company carried out an assessment to value the natural and human capital impacts of SuperOats production, compared to wheat. (Compare options – see Step 01) | The company conducted a quantitative and monetary assessment of their natural, human, and produced impacts and dependencies to improve their traceability and understand their global risks. (Assess risk and opportunities and communicate internally and externally – see Step 01) |
| <i>Business benefit</i> | Better understanding of impacts across the value chain enabled a more efficient management of risks, reputational benefits and potential long-term increase in competitiveness. | Better understanding of impacts improved decision making by identification of material areas and informed the long-term strategy of the company to focus production on market segments with highest value creation. | An improved traceability and assurance system of products provided reputational opportunities and benefits to the company and, therefore, an increased market share. |
| <i>Business decision</i> | Blossom Foods decided to scale up their responsible sourcing programs to cover all areas of their business after the evident gains were made clear. | VitaCrisp decided to scale up their production and disclose their assessment to the public to encourage others to follow. | Evolve Crops decided to work with a farmer association to optimize fertilizer application, increase farm-price, apply a fair-trade certification, invest in the organic brand, and communicate to customers. |

FRAME STAGE WHY?



What is the Frame Stage?

The Frame Stage helps you to frame why you would undertake a capitals assessment.

| Step | Questions that this Step will answer | Actions |
|-----------------------|---|---|
| 01 Get Started | Why should you conduct a capitals assessment? | 1.2.1 Familiarize yourself with the basic concepts of capitals 1.2.2 Apply the concept of capitals to your business context 1.2.3 Prepare for your assessment |

Additional Notes

This Stage helps you to understand the foundational concepts and terms and how to relate them to your particular business and circumstances.

01 Get Started

1.1 Introduction

Completing Step 01 of the Guidelines will help you answer the following question:

Why should you conduct a capitals assessment?

Step 01 will help you identify which natural, human, social, and produced capital impacts and/or dependencies are relevant to your business. This Step also describes the risks and opportunities that a capitals assessment can help address, and some potential uses of assessment results. These are important inputs for more detailed scoping in Steps 02–04 and can help to build support for undertaking a capitals assessment in your company.

Note: Even if you already have a good understanding of how your business impacts and depends on capitals, we recommend that you read this Step as it introduces new terms and concepts related to how capitals can be integrated.

1.2 Actions

This Step will help you undertake the following actions:

- 1.2.1** Familiarize yourself with basic concepts of capitals
- 1.2.2** Apply the concept of capitals to your business context
- 1.2.3** Prepare for your capitals assessment

1.2.1 Familiarize yourself with the basic concepts of the capitals

This action introduces the basic concepts and definitions that you will need to advance through the Steps of these Guidelines.

a) The foundational concepts of natural, human, social, and produced capitals

A capital is the stock of an asset that combines to yield a flow of benefits or “services” to people. When invested in and managed responsibly, the asset creates value. If we “draw down” on the capital stock itself we limit its ability to provide value to people and the economy, and if we degrade it too much, it can stop providing value all together.

Although many things can be considered as a capital stock, there are four that are commonly used: natural, human, social, and produced (Box 1.1).

Box 1.1 The four capitals

- Natural capital: The stocks of renewable and non-renewable natural resources that combine to yield a flow of benefits to peoples.
- Human capital: The knowledge, skills, competencies and attributes embodied in individuals that contribute to improved performance and well-being.
- Social capital: The networks together with shared norms, values and understanding that facilitate cooperation within and among groups.
- Produced capital: The man-made goods as well as all financial assets that are used to produce goods and services consumed by society.

Glossary

Ecosystem

A dynamic complex of plants, animals, and microorganisms, and their non-living environment, interacting as a functional unit. Examples include deserts, coral reefs, wetlands, and rainforests (MA 2005a). Ecosystems are part of natural capital.

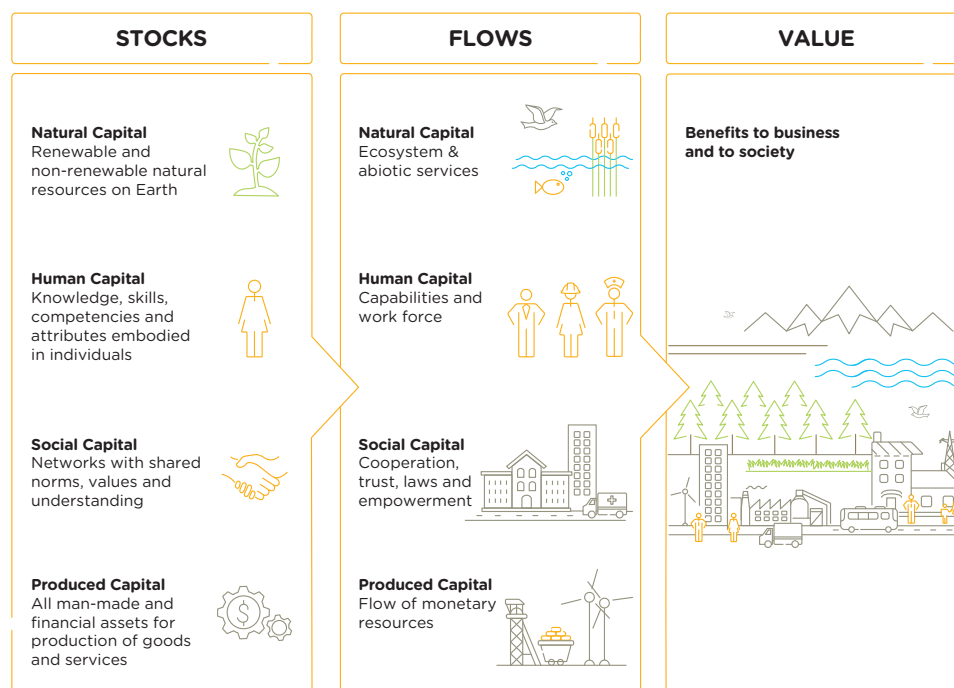


Figure 1.1
Capital stocks, flows and values

b) Interactions between business and finance with the capitals

Businesses depend upon natural, human, social, and produced capital to operate, directly or indirectly, through their value-chain supply or relationships. Businesses cannot succeed without natural capital such as land, raw materials, ecosystem services, energy; human capital such as workforce, knowledge, skills; social capital and structures; and produced capital such as equipment and financial resources. These capitals are all interconnected and are, ultimately, underpinned by natural capital.

Businesses also impact and change capitals as a consequence of their operations. Capitals may be degraded and depleted or restored and regenerated, with each change impacting other forms of capitals. All impacts and dependencies on capitals have consequences, both to business and to society. These consequences are expressed as costs or benefits to both. For example, some businesses include increases in costs from material scarcity or reduction in productivity from low safety standards. Business and societal responses to these effects can create additional risks and opportunities for business, as well as for the financial sector as these are transferred through their services to business.

Glossary

Ecosystem services

The most widely used definition of ecosystem services is from the Millennium Ecosystem Assessment (MA 2005a): "the benefits people obtain from ecosystems."

The MA further categorizes ecosystem services into four categories:

- Provisioning: Material outputs from nature (e.g., seafood, water, fiber, genetic material).
- Regulating: Indirect benefits from nature generated through regulation of ecosystem processes (e.g., mitigation of climate change through carbon sequestration, water filtration by wetlands, erosion control and protection from storm surges by vegetation, crop pollination by insects).
- Cultural: Non-material benefits from nature (e.g., spiritual, aesthetic, recreational, and others).
- Supporting: Fundamental ecological processes that support the delivery of other ecosystem services (e.g., nutrient cycling, primary production, soil formation).

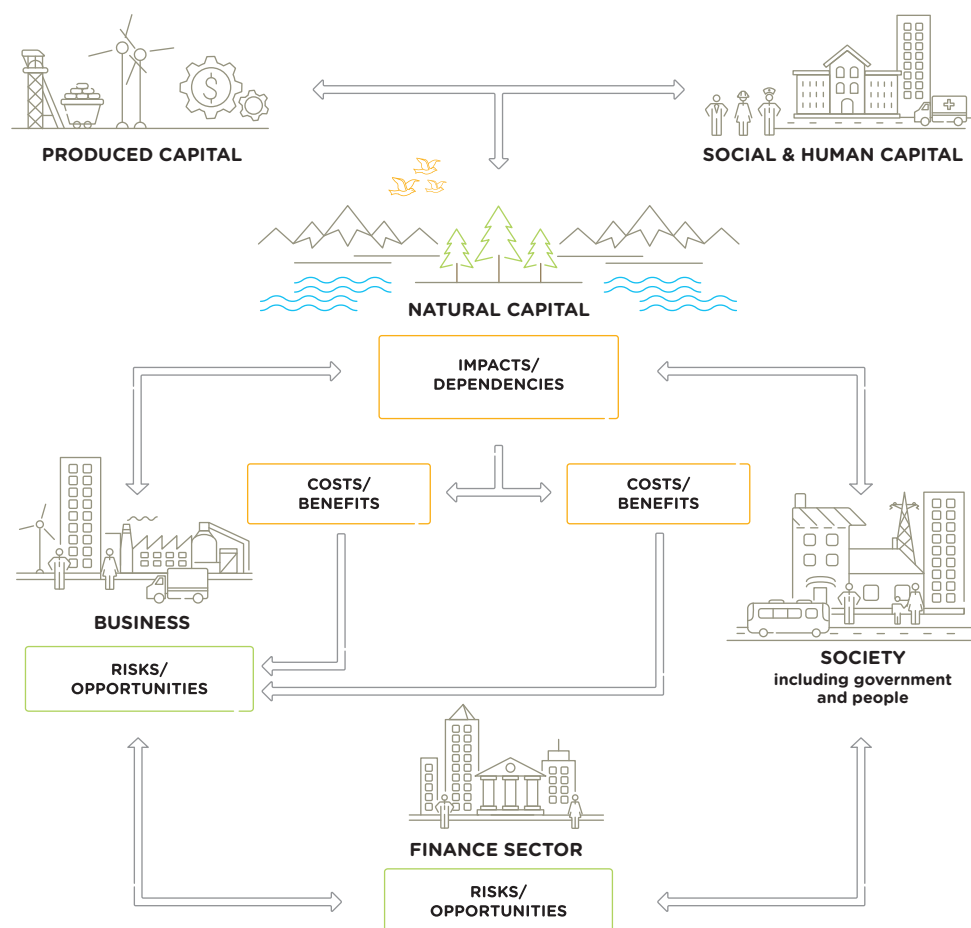


Figure 1.2

Capitals impacts and dependencies: conceptual model for business

Interdependencies also exist between different capitals. Natural capital underpins the rest of the capitals: without natural capital, other capitals cannot exist. As all capitals are interconnected, any impact or dependency on one capital will cause changes in the other capitals. For example, deforestation by a business can reduce the quantity of natural capital, which can affect the human and social capital of indigenous communities that rely on the forest for their livelihood.

To help set the context for your assessment, the interactions between natural, human, social, and produced capitals, business, and society are depicted in Figure 1.2. This also illustrates the approach used in these Guidelines to measure and value impacts and dependencies on the different capitals, in terms of risks and opportunities for the business and finance sectors.

When planning a capitals assessment you will have to consider which capitals you will take into account. If this is your first assessment, you might start by considering your impact and dependencies on just one capital in relation to your business operations. This is called a “single capital assessment.”

A more complete assessment will take into account all the capitals, listing their impacts and dependencies on your business side by side, but not considering how they interact. This is a “multi-capital assessment.” If you are considering several but not all capitals this is a “partial multi-capital assessment.”

The most complete capitals assessment will measure and value the impacts, dependencies, and interrelations within and between each capital. This “integrated capitals assessment” makes visible the entire system in which the business operates, allowing decisions to be made with the understanding of how the change in one capital will affect another. Particularly in the food sector, where supply chains can be long and complex, this can be the most effective approach, but it should be noted that it also will require the most resources and time to complete.

Although the value of each capital can be compared, values should not be combined into a single figure and disaggregated results should always be visible and available. It is important to report on each capital separately, to avoid hiding the impact that one capital has on another. For example, the social capital value of a decision may be high, but at the expense of natural capital. If these values are combined, it may show a benefit for people but ignore the impact on nature. The point of an integrated capitals assessment is to understand and make decisions based upon these interrelations.

1.2.2 Apply these concepts to your business context

This action builds on the concepts of capitals and shows how they relate to your business model, supply chain, operations, etc. This action aims to ensure that your capitals assessment considers all potential impacts and/or dependencies that may be important or material to your business and its stakeholders (covered further in Step 04).

a) Describe your context

When framing your assessment, start by completing a preliminary identification of your main activities and describe your business model and context. Describing the location, surroundings, stakeholders, and other factors affecting your activities will help you gain an overall picture of the context in which your assessment will be carried out. Some questions you might ask are:

- Spatial: How extensive is your value chain? National, international, global? In what countries and which landscapes and habitats are you operating, and how?
- Political: What are the power relationships that exist across your value chain?
- Institutional: What regulatory and policy frameworks apply in the context of your business? Who are your key stakeholders?
- Historical: What historical trends are relevant to your assessment?
- Temporal: What time period is your assessment set within?
- Demographical: What are the demographic trends and population density in your context?

Answering these questions will provide a screening to inform the context and objective of your assessment. You will find further guidance in Step 04 on how to identify and list your material impacts and dependencies.

b) Dependencies that are potentially relevant to your business

All businesses depend on the capitals and associated services, directly or indirectly (see Figure 1.3). For example, businesses from the food sector not only depend on produced capital, such as machinery or fertilizers, but also on the supply of essential provisioning natural services, such as food, water, and fiber. These provisioning services (or “goods”) are also important natural raw materials for many manufacturing and processing operations. Regulating services such as natural pollination and pest control are critical in agriculture. Businesses from the food sector also depend on stocks of human capital within their workforce such as their expertise and knowledge. Similarly, businesses depend on social capital through the existence of networks, trust, land access, and tenure security.

Glossary

Capitals assessment

An assessment considering more than one capital. This includes multi-capital assessments and integrated capitals assessments.

Stakeholder

Any individual, organization, sector, or community with an interest or “stake” in the outcome of a decision or process.

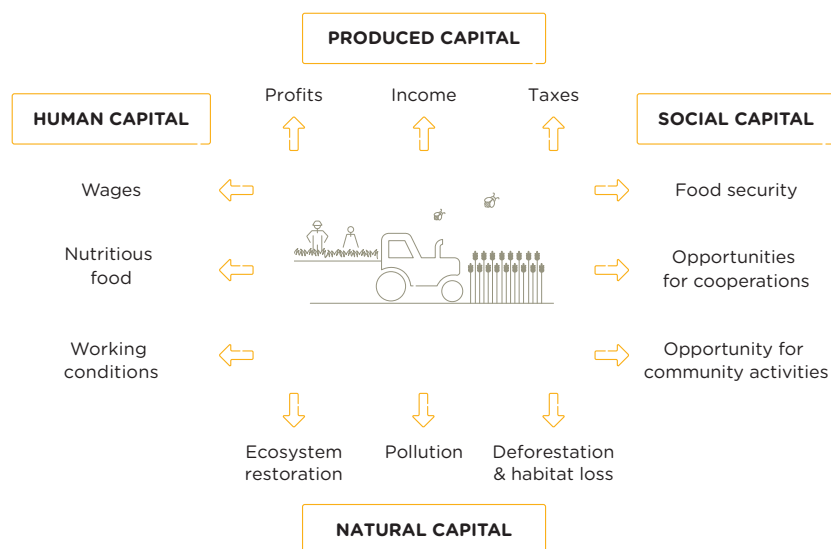


Figure 1.3

Examples of food business dependencies on capitals

Dependence on capital flows will vary according to the role of a business in the value chain, and the geographic location of their operations.

For instance, most actors in the food system recognize that water is an essential input to all primary production systems. However, the geographic location of a farm will determine if water is a limiting factor. In drier climates water can be a material issue and the use of water in the dry season can be particularly problematic. If the business decision is to import water from other basins, that will subsequently cause financial consequences (e.g., high prices), social consequences (e.g., social tensions between regions), or natural consequences (e.g., salinization and aridification of the donor region).

c) Impacts that are relevant to your business

A business impact is a positive or negative effect of a business activity on human well-being.

Impacts on capitals can arise directly from business operations or indirectly from the use of products and services. Impacts may occur at any point in the value chain. Impacts will also vary depending on the stage of the supply chain, and the geographic location of operations.

Impacts on capitals may be negative, for example land degradation or overexploitation of water resources, or forcing an employee to work long hours increasing stress and fatigue and thus the chances of injury or fatality when managing heavy machinery or dangerous equipment. Impacts can also be positive such as changing the planting regime resulting in higher soil water content, less soil erosion, and greater farm productivity, or introducing a living wage for employees, which leads to increased health for the employee and their family and increased productivity for your business.

Figure 1.4 provides examples of how business can impact different capitals.

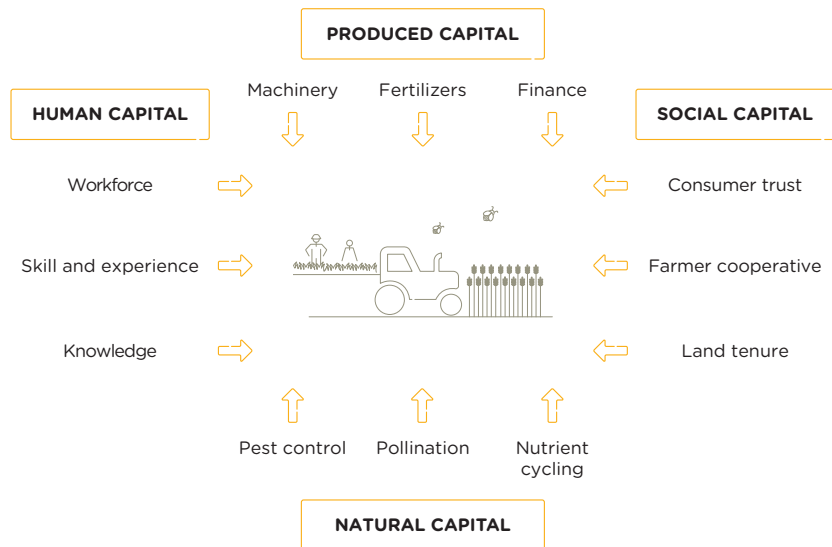


Figure 1.4
Examples of food business impacts on capitals

Impacts on one capital often result in indirect impacts on other capitals. For example, you can decide to restore an ecosystem with the aim of reducing flood risk and this may result in the improvement of pollination services. This activity then leads to improvements in the health of people (e.g., due to cleaner air), reduction of inputs (e.g., irrigation), and improvement of social cohesion (e.g., through improved access to restored areas for recreational activities). The same is true for any capital; for example, providing a training program on sustainable agricultural practices may improve incomes and provide opportunity for professional advancement. It will also enhance the potential for social networking among local farmers and this can lead to a reduction of eutrophication of local rivers, through greater acknowledgement of shared assets.

Therefore, when conducting a capitals assessment, you should consider how your activities impact all other capitals, either directly or indirectly. If you have previously carried out a capitals assessment it is likely that you have identified, measured, and valued the impacts and dependencies of one capital. To frame an integrated capitals assessment, you need to identify: (i) your direct impacts and dependencies on the four capitals, in the diagonal cells, and (ii) the indirect impacts and dependencies of your actions on the rest of the capitals, represented by the cells outside of the diagonal in each row of Table 1.1.

Table 1.1

Framing an integrated capitals assessment: direct and indirect impacts on capitals

| Capital assessed | Capital returns | | | |
|------------------|-----------------|---------------|----------------|------------------|
| | Natural capital | Human capital | Social capital | Produced capital |
| <i>Natural</i> | Direct | Indirect | Indirect | Indirect |
| <i>Human</i> | Indirect | Direct | Indirect | Indirect |
| <i>Social</i> | Indirect | Indirect | Direct | Indirect |
| <i>Produced</i> | Indirect | Indirect | Indirect | Direct |

Figures 1.5-1.7 provide practical examples of interactions between capitals.

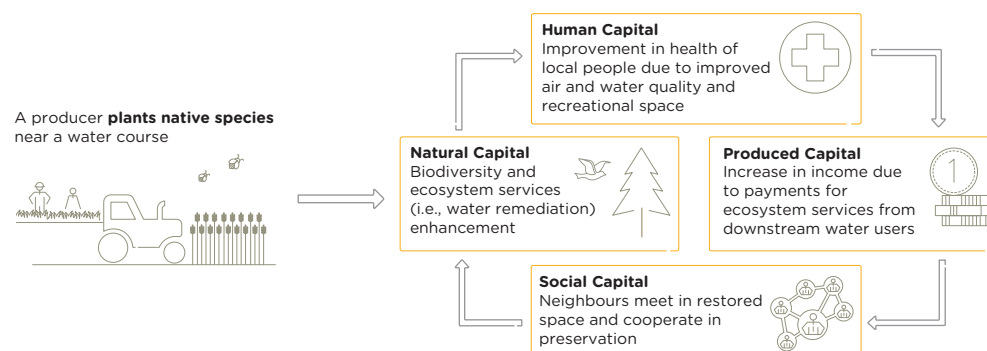


Figure 1.5

Example of interactions between capitals: ecosystem restoration activities

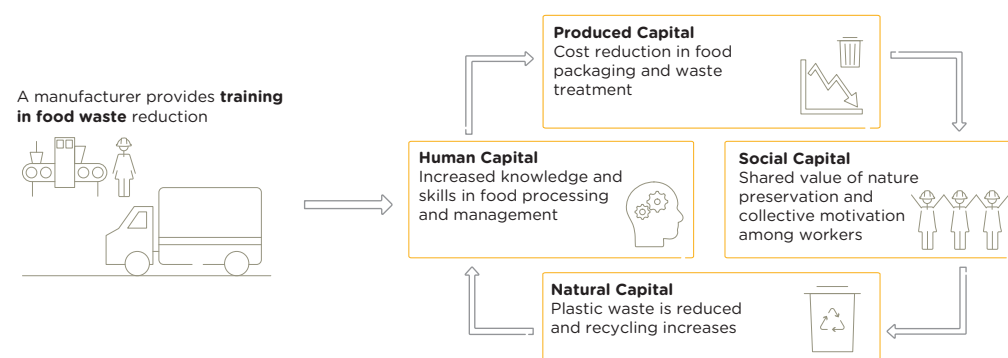


Figure 1.6

Example of interactions between capitals: training activities

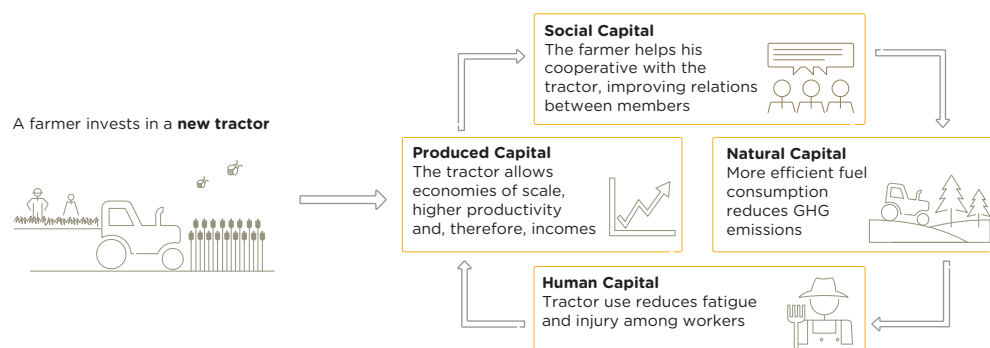


Figure 1.7

Example of interactions between capitals: equipment renovation

Business impacts and dependencies on capitals are interconnected. For example, a company that depends on water will also create impacts from their use of water. Similarly, a company that has a dependency on the knowledge of its workforce can also have an impact in increasing staff knowledge by conducting training sessions.

d) Risks and/or opportunities that are potentially relevant to your business

The business case for undertaking a capitals assessment is based on identifying the risks and opportunities that arise from impacts and/or dependencies on different capitals that might be invisible, overlooked, misunderstood, or undervalued. Once you have identified these and can start to measure and ultimately value them, you can consider how best to integrate them into your business decisions.

Risks and opportunities from natural, human, social, and produced capitals can arise in many forms: operational, legal, regulatory, financing, reputational, marketing, and societal. Table 1.2 presents examples of these risks and opportunities and will help you to consider which might be most relevant to your business, and therefore to develop a business case for undertaking a capitals assessment.

Table 1.2

Example of capital risks and opportunities

| | Natural capital | Human capital | Social capital | Produced capital |
|--|--|---|---|--|
| <i>Operational: Regular business activities, expenditures, and processes</i> | | | | |
| <i>Risk</i> | Increased cost of raw material leads to deterioration of supply chain | Increased illness and absenteeism in workforce due to poor healthcare checks | Loss of social license to operate due to poor relationship with local community | Increased number of injuries resulting from irregular maintenance of machinery |
| <i>Opportunity</i> | Improved revenue and higher yields resulting from responsibly managed lands | Increased efficiency of workers owing to on-site health check services | Strengthened value chain through enhancing trust with traders | Lowered costs due to improved efficiency of equipment |
| <i>Legal and regulatory: Laws, public policies, and regulations that affect business performance</i> | | | | |
| <i>Risk</i> | Increased compliance cost for achieving standards as regulation becomes more stringent | Increased penalties due to delays in adoption of new regulation on housing standards for seasonal workers | Income losses from changes in agricultural practices resulting from a shortened land tenure contract | Loss of license to operate due to high fatality rate resulting from lack of investment in up-to-date machinery |
| <i>Opportunity</i> | Reduced fines, penalties, compensation, or legal costs (e.g., by anticipating and avoiding negative impacts) | Competitive advantage as business preempts change in legislation related to human well-being such as health and safety requirements | Increased brand value for leading the implementation of certain public policies, for example effluents treatments | Increased savings from following energy-use regulations through energy efficient equipment |

| | Natural capital | Human capital | Social capital | Produced capital |
|---|--|---|--|---|
| <i>Reputational and marketing: Company trust and relationships with direct business stakeholders, such as customers, suppliers, employees</i> | | | | |
| <i>Risk</i> | Reduced market share due to reduced demand for product perceived to be linked to unsustainable farming/forestry | Reduced productivity due to lack of professional development opportunities leading employees to lose motivation at work | Loss of customer trust as business promotes organic produce but is found to use pesticides at a hidden point in the supply chain | Loss of brand value due to negative media coverage about lack of investment in safety equipment |
| <i>Opportunity</i> | Increased sales due to certification recognizing sustainable management practices | Increased efficiency in processes as employees are given opportunity to rotate across different business units | Increased quality of produce as producers feel respected, and well remunerated by traders | Extended license to operate as business adopts advanced technology machinery reducing water consumption, leading to increased resource availability for local community |
| <i>Financial: Costs of and access to capital including debt and equity</i> | | | | |
| <i>Risk</i> | Increased financial costs due to lack of transparency and environmental metrics | Reduced options for financing due to high content of toxic substances in business' final consumer products | Increased costs of financing a new production line due to previous cases of corruption in which business had been involved | Higher interest rates of a loan for the purchase of new equipment due to lack of guarantee that the equipment is well adapted to the local conditions |
| <i>Opportunity</i> | Increased funding access to green funds, preferential rates based on public payments for public goods resulting from the zero-budget natural farming business strategy | Increased access to funding due to gender equality ratios in management positions | Lower interest rate offered by local financial cooperatives due to the business policy on benefit sharing with indigenous people | Increase interest from investors as business displays full understanding and transparency of supply chain |
| <i>Societal: Relationships with the wider society (e.g., local communities, NGOs, government agencies, and other stakeholders)</i> | | | | |
| <i>Risk</i> | Delay in the supply of inputs due to cuts in roads made by local communities protesting business' pollution of local water resources | Lack of workforce availability due to sharp rise in property prices forcing workers to move to other locations | Rejection of loan applications by local finance cooperatives after expansion of business operations results in restricted access to areas previously used for community gatherings | Increase in expenses to protect company's installations when the use of new equipment results in redundancy of workers, causing unrest of local community |
| <i>Opportunity</i> | Partial exemption from council taxes as a result of business' restoration of local wetland | Increased social license to operate as worker gets elected to local council | Reduction in permitting delays through partnering with a local NGO to enhance dialogue with local groups | Government tax cuts favoring clean and low-emission technology lead to accelerated progress towards emissions targets |

1.2.3 Prepare for your capitals assessment

Preparing for your capitals assessment requires knowing how you will apply the results, securing internal support, and planning the process.

a) Identify potential applications of your assessment results

Building on your review of potential business risks and opportunities (described in action 1.2.2.d), next identify the business application—the intended use of the results of your capitals assessment—to help inform decision making.

Most capitals assessments are designed to inform business strategy, management, or operating decisions. This may involve one-off inputs to project design, or the integration of capitals into standard business processes, such as raw material procurement, option appraisal, or estimating “net positive impact.” Some applications may also be relevant to external audiences, such as revaluation of assets for company valuations, demonstrating net impact to regulators, stakeholder analysis for damage or compensation claims, or public reporting.

Table 1.3 presents a list of possible business applications. These are neither mutually exclusive nor exhaustive and may not match the terminology used in your company, but the examples provide an idea of the potential scope of applications. Although there may be more than one relevant business application, try to focus your assessment on the most appropriate one.

Table 1.3
Potential business applications for your capitals assessment

| Type of business application | This business application is relevant if you need to |
|--------------------------------|--|
| Assess risks and opportunities | <p>Assess the nature and magnitude of your impacts and/or dependencies, and their associated business risks and opportunities.</p> <p>You might use the Guidelines to screen or identify the most material capital impacts and dependencies to help you answer, for example:</p> <p>Could your business earn more revenue by exploring different types of land uses, workforce training or new socially conscious markets?</p> <p>Is there a certain level of business activity at which impacts and/or dependencies on natural, human or social capitals pose a serious risk?</p> |

| <i>Type of business application</i> | This business application is relevant if you need to |
|---|--|
| <i>Compare options</i> | <p>Compare, contrast, and select from a range of alternative options, while considering their relative impacts and/or dependencies on capitals.</p> <p>Prioritizing is relevant for informing many business decisions, and can help you answer, for example:</p> <p>What procurement sourcing options have the lowest natural capital risk?</p> <p>Which potential site selections present a greater opportunity to provide work to local people?</p> <p>When targeting investments, where you need to assess a portfolio of activities, the Guidelines can help you answer, for example:</p> <p>Which companies or assets should your portfolio favor or exclude when considering their exposure to natural, human, or social capital risks or opportunities?</p> <p>Is wetland restoration a more cost-effective investment option for flood control of agricultural land, compared to a conventional cement infrastructure option considering all potentials capitals impacts?</p> |
| <i>Assess impacts on stakeholders</i> | <p>Ascertain which stakeholders are affected by changes in natural, human, or social capital due to your business activity, and to what extent. This can help you answer, for example:</p> <p>Do compensation claims for a recent incident accurately reflect the natural, human, or social values of the affected stakeholders?</p> <p>How can you engage with affected communities to prioritize your investments and activities, as well as secure your license to operate in those communities?</p> |
| <i>Estimate total value and/or net impact</i> | <p>Determine the total value of capitals linked to your business activities. This may be useful for valuing landholdings or managing property or other assets owned by the business and can help you answer, for example:</p> <p>Does the change in total value of the relevant human capital justify your investments into workforce training and skills development?</p> <p>Is agriculture, forestry, tourism, etc. the highest and best use of your property, from a total value perspective?</p> <p>Assess net impact to determine whether a business activity creates net positive or net negative impacts across nature, people, and society. This will involve trading off different types of impacts and can help you answer, for example:</p> <p>How can you develop a facility or product that has a verifiably net positive impact on natural capital?</p> <p>What is the overall “environmental integrated profit and loss” of your company or operation?</p> |
| <i>Communicate internally or externally</i> | <p>Communicate capital impacts and/or dependencies to internal or external stakeholders. For example, marketing to external stakeholders or attracting investors and customers may require you to provide information on the achievements of the business in reducing risky impacts or dependencies and can help you answer, for example:</p> <p>How can you maintain and enhance your social “license to operate”?</p> <p>How can you attract new investors by presenting a capitals assessment as part of your environmental, social, and corporate governance (ESG) systems?</p> <p>Reporting and disclosure is typically undertaken at a company level, although increasingly also applied at a product and project level; a capitals assessment can help you answer, for example:</p> <p>How can you benchmark and compare your natural, human, and social capital performance against other businesses?</p> <p>How has the natural, human, and social capital performance of your business changed over time, and is this in line with your goals and targets?</p> |

Glossary

Business application

The intended use of the results of your capitals assessment, to help inform decision making.

b) Secure internal support

Engagement at a senior level in the company is often necessary to build support for a capitals assessment. Involving senior management can provide valuable perspectives on core business concerns and ensure that these are reflected in the design of your assessment.

Input reflecting a range of operational and management functions can likewise help you develop a more rounded business case for conducting the assessment. This will help when interpreting and embedding assessment results into business decisions and processes, as discussed further in the Apply Stage. Internal engagement is critical when defining the business objective and application as it provides integrated thinking and strategy adding real value to your business decisions.

Support from key external stakeholders is also essential and is covered further in action 2.2.2.

c) Plan your capitals assessment process

Before beginning a capitals assessment, it is important to have an idea of what will be involved at each Stage. Table 1.4. provides a rough indication of the resources that may be needed to carry out each Stage of an assessment.

Table 1.4

Indicative resources needed throughout your assessment

| Stage | Skills | Internal/external inputs | Duration of work |
|-------------------|--|---|--|
| Frame | Knowledge of the business | Mainly internal | Potentially weeks or months |
| Scope | Business strategy and leadership knowledge of the business. Project management. Expertise (e.g., ecologists, economists, health experts) may be needed, particularly for the materiality assessment in Step 04. | Significant internal input (which may be complex to organize in a large business). Experience and results of similar exercises, particularly for the materiality assessment in Step 04. Knowledge of stakeholders' relationships. | Potentially weeks but more likely one or two months, depending on iteration. |
| Measure and Value | Project management. Expertise (e.g., ecologists, anthropologists, economists, social scientists) for measurement, modeling, valuation, and analysis. | Internal knowledge of methods at least sufficient to specify and manage work, external work likely needed to conduct and review specialist inputs. | One or more months depending, for example, on extent of data collection. |
| Apply | Interpretation, requiring expertise from economists and data analysts. Business strategy and leadership. Communications. Knowledge of the business and its current environmental and social management. | Significant internal input. Potential for external inputs from those with experience in similar decision making. | Potentially weeks but more likely one or two months—longer if business processes are adjusted. |

Other factors to bear in mind when identifying necessary resources include:

- An integrated capitals assessment will involve more iteration than a single capital assessment. As you understand more about the impacts and dependencies on one capital, this could have significant implications for the other capitals and cause you to go back and review the scope and measurement and valuation several times.
- You will need to consider the trade-off between investing in skills and institutional knowledge within internal staff and hiring external specialists with significant technical expertise.
- The range of potential resources required to apply economic valuation techniques will vary.
- How you will communicate the results to the decision maker and other stakeholders. Think about the implications for timing (e.g., an upcoming board meeting for which assessment results are required) and factor in the typical time necessary to agree on key messages and to finalize reports, articles, or newsletters, whether for an internal or external audience, or both (see action 9.2.2).

1.3 Outputs

The outputs of Step 01 are:

- An understanding of the concept of capitals and of stocks, flows, and values
- An understanding of the interactions between capitals
- Identification of your business applications
- Support for the assessment from key business stakeholders
- An initial understanding of the resources needed to carry out an integrated capitals assessment

These outputs will establish a solid foundation for later Steps in your assessment.

It is important to document the decisions you have made and the process you have followed for all Steps. This provides a record for validation or verification and supports consistency and improvement in future assessments.

Table 1.5 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including completion of all required actions.

Table 1.5
Hypothetical examples (following Table 0.1) – Step 01

| | Blossom Foods | VitaCrisp | Evolve Crops |
|---|--|--|---|
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>Which risks and opportunities might a capitals assessment help to address?</i> | Operational opportunities as supplying from sustainable sources provides higher security of supply. Similarly, better water management reduces crop failure and extraordinary costs of water during drought season. Reputational and financial opportunities from being recognized as a brand avoiding deforestation. | Reputational and societal opportunities as placing human health as a key indicator of success for the business distinguishes the company from competitors. Legal and regulatory opportunities as products shown to have positive human health consequences could gain preferential rates. | Operational opportunity as transitioning to natural pest control leads to better water quality and could avoid operational costs. Similarly, organic production leads to improvement in resilience and long-term production. Reputational and societal opportunity as organic farming provides better livelihoods conditions for workers and increases their productivity. |

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SCOPE STAGE WHAT?



What is the Scope Stage?

The Scope Stage details considerations for setting the specific objective of your capitals assessment.

The Scope Stage involves three linked Steps:

| Step | Question each Step will answer | Actions |
|---|---|---|
| 02 Define the objective | What is the objective of your assessment? | 2.2.1 Identify the target audience 2.2.2 Identify stakeholders and the appropriate level of engagement 2.2.3 Articulate the objective of your assessment |
| 03 Scope the assessment | What is an appropriate scope to meet the objective? | 3.2.1 Determine the organizational focus 3.2.2 Determine the value-chain boundary 3.2.3 Specify whose value perspective 3.2.4 Decide on assessing impacts and/or dependencies 3.2.5 Decide which type of values you will consider 3.2.6 Consider other technical issues 3.2.7 Address key planning issues |
| 04 Determine impacts and/or dependencies | Which impacts and/or dependencies are material? | 4.2.1 List potentially material capital impacts and/or dependencies 4.2.2 Identify the criteria for your materiality assessment 4.2.3 Gather relevant information 4.2.4 Complete the materiality assessment |

Additional notes

Businesses operating in the food sector should address all of the actions associated with each Step in the Scope Stage. The Guidelines provide additional insights for some of the actions where most appropriate.

02 Define the objective

2.1 Introduction

Step 02 of the Guidelines provides additional guidance for answering the following question:

What is the objective of your assessment?

2.2 Actions

In particular, the Guidelines will help you undertake the following actions:

- 2.2.1** Identify the target audience
- 2.2.2** Identify stakeholders and the appropriate level of engagement
- 2.2.3** Articulate the objective of your assessment

2.2.1 Identify the target audience

Identifying the target audience and understanding what drives them is key in defining your objective as it will influence the way the assessment is conducted, the type of outputs to be delivered, and the desired outcomes. The target audience is defined here as the main users of the assessment output (i.e., the people who will read and use the output to make decisions). The target audience is likely to be an internal stakeholder or decision maker, although it may be an external audience such as shareholders if the objective is to provide output for a company report.

Linked to this target audience are those stakeholders who may need to authorize or fund the assessment at the outset. Quite often these will be the same as the target audience. It will be important to develop a strong case to justify the need to carry out the assessment.

The following list of potential internal and external target audiences acts as a potential stakeholder checklist. The more specific you can be about the target audience the better. Think carefully about whether the assessment is for an internal or external audience, or both, as this may influence whether validation and/or verification are necessary and how you communicate your results (see actions 8.2.4 and 9.2.2).

Table 2.1
Potential target audiences

| Internal target audiences may include: | External target audiences may include: |
|---|--|
| Shareholders (if applicable) | Shareholders (if applicable) |
| Senior executives and directors (i.e., board members or “C-suite” managers) | Investors |
| Heads of sustainability, corporate social responsibility, environment, health and safety, and due diligence departments, site managers, and operations managers | Suppliers |
| Departments such as finance, strategy, procurement, marketing and communications, reporting, public or government affairs, investor relations, safety, human resources, auditing and compliance, and enterprise risk management | Civil society (NGOs, labor unions, etc.) |
| Employees and contractors | Community/other affected stakeholders (e.g., local residents, schools, other businesses, special interest groups, farmers, fishermen, tourists, etc.). |
| | Institutional partners |
| | Governments |
| | Regulators |
| | Customers |
| | Indigenous people |
| | Professional bodies |
| | Insurers |

Source: Natural Capital Coalition 2016, Social and Human Capital Coalition 2018

2.2.2 Identify stakeholders and the appropriate level of engagement

Your assessment is likely to be more relevant, reliable, and useful (e.g., for embedding capitals assessments into your business strategy) if you are able to consult and involve the right internal and external stakeholders from the outset. In addition to your target audience, this may include identifying and engaging with other stakeholders who may be affected by the results, including people who can:

- Provide information to help undertake the assessment
- Influence the assessment, in terms of their viewpoints and behaviors
- Help verify, validate, and interpret the assessment (e.g., experts)

Stakeholders internal and external to the company can contribute significant insights into the assessment and its results. Internal stakeholders may be able to provide considerable insight, for example procurement staff will have detailed knowledge of the value chain.

External stakeholder input can also provide greater robustness and credibility to results and is certainly to be encouraged. However, bear in mind that you may have to provide some background on the basic concepts of a capitals assessment before stakeholders are able to contribute.

The scope of the assessment will also influence the appropriateness and feasibility of engaging with particular stakeholders. For example, if your assessment is project-based and concerning direct operations in a specific location, then local stakeholder engagement is highly recommended. However, if you are a company closer to the end stages of the value chain (e.g., processing) and your assessment is looking at upstream impacts or dependencies, you may be several steps removed from the raw material production site (or you may not know the exact location of the production site). In these cases, local stakeholder engagement may be unfeasible and less appropriate. Even so it is important to understand any issues associated with land tenure or ownership that could result in more significant impacts or dependencies (see the materiality criteria in action 4.2.2).

As well as local stakeholders, there may be communities living on agricultural concession land. In these cases, meaningful consultation with local communities and indigenous people should be properly undertaken.



There may also be key stakeholders who are not geographically close to the company or operations. For example, environmental or social NGOs may not be local but may be interested in specific issues in products or areas where a food company is operating.

To help complete this action you should undertake a stakeholder analysis. This involves identifying potential stakeholders, analyzing their characteristics, and then mapping them in order to prioritize the preferred nature and level of engagement. If your business or your industry peers have already mapped out the most important stakeholders, you could use this as a starting point but make it specific to your assessment. You should include the relative importance of stakeholders and their relative influence such as whether they are primary stakeholders (i.e., they depend on the resources affected) or secondary stakeholders (i.e., they are not directly affected but interested), and their legitimacy, willingness, and ability to engage and contribute.

2.2.3 Articulate the objective of your assessment

In Step 01, you started to think about how you intend to use the results of your capitals assessment—your potential business application. In Step 02, you develop and articulate the objective, or why you are doing it. It is important to articulate the anticipated benefits that your business stands to gain from undertaking an assessment. This defines criteria for success and keeps the assessment focused on information pertinent to decision making.

Ideally the objective should be SMART (specific, measurable, attainable, relevant, and time-bound).

Table 2.2 lists business applications, objectives, and benefits for the food sector of completing an integrated capitals assessment. The list is not exhaustive and you may use different terms within your company.

| |
|-------------------------|
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Table 2.2

Examples of business applications, objectives, and benefits of a capitals assessment in the food sector

| <i>Business application</i> | Example objectives | Example benefits |
|---|--|---|
| <i>Assess risks and opportunities</i> | An overarching assessment is a good starting point to understand the implications of your company's impacts and dependencies on natural, human, social, and produced capitals. It helps you to inform decisions regarding strategy development and risk mitigation. For example, a food and beverage company that has never previously valued natural or social and human capitals may choose to assess its entire value chain to identify elements of potential risk to determine where targeted improvements can be made and better managed. | Improved decision making; improved risk management |
| <i>Compare options</i> | Option appraisals can help compare the trade-offs of alternative options in natural, human, social, and produced capital terms when presented with various scenarios. This can be used to inform business decisions relating to the use of innovative practices or new technologies, or for prioritization. For example, a landowner may choose to compare the consequences of different cropping systems to determine which land use is the best considering soil fertility (natural capital) and health of workers (human capital). In addition, option appraisals can be used to inform investment decisions by identifying potential solutions which increase the total return from natural, human, social, and produced capitals. | Improved decision making; increased competitive advantage; enhanced reporting and communication |
| <i>Assess impacts on stakeholders</i> | Ascertain which stakeholders are affected by a change in capitals due to your business activity. For example, chemical discharge from sugarcane farming pollutes soil and groundwater used by local communities, as well as workers of the business as they are part of these communities. | Improved decision making; improved risk management |
| <i>Estimate total value and/or net impact</i> | A means to assess the total value and net impact of natural, human, and social capitals generated by a system. For example, a food company assessed the total net impact on natural, human, social, and produced capitals at company level. An alternative business strategy offers higher economic performance and positive impacts on customers, society, and environment. This kind of analysis informs strategic planning and decisions on capital investment and management. | Improved decision making; increased competitive advantage; enhanced reporting and communication |
| <i>Communicate internally and/or externally</i> | Reporting of capitals assessments, such as the publication of Integrated Profit and Loss accounts, can help inform decision making, communication strategies, and target setting across the food sector. Capitals valuation could be integrated within traditional financial accounting for an in-depth understanding of context-based business activities. Besides the support to inform business decisions on communications strategies, it also enhances engagement with stakeholders, such as investors. | Increased competitive advantage; enhanced reporting and communication |

Step 02 of these Guidelines provided additional guidance to help you develop and articulate the objective of your assessment.

2.3 Outputs

The output of Step 02 is your objective for the assessment which you will have defined by taking into account:

- Your audience
- A stakeholder list and appropriate level of engagement
- The specific benefits you anticipate from the assessment

Table 2.3 illustrates the completion of this Step for each of the sector specific hypothetical examples, including the completion of all actions required for this Step.

Table 2.3
Hypothetical examples – Step 02

| | Blossom Foods | VitaCrisp | Evolve Crops |
|--|---|--|---|
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>What is the intended business application?</i> | Compare options and assess risk and opportunities | Compare options and assess impacts on stakeholders | Compare options and estimate total value |
| <i>Who is the targeted audience?</i> | Internal management | Both external and internal | Internal: Senior directors, finance, strategy & marketing departments |
| <i>Who are the right stakeholders and what is the appropriate level of engagement?</i> | Community and employees | External – downstream public health and upstream wheat farmers | Employees and retailers, customers, farmers and intermediate suppliers |
| <i>What specific benefits do you anticipate from the assessment?</i> | Gaining an overall comparative picture of responsible versus normal commodity sourcing, including impact on community and natural capital will support the decision to expand this practice in other value chains. | Understanding the overall relative impact on capitals between two options: conventional wheat and SuperOats. | Capturing financial opportunities in sales by communicating positive impacts of the entire value chain on nature and people. |
| <i>What is the specified objective?</i> | To measure the extent to which the responsible sourcing program benefits communities and long-term business profitability. This will inform corporate strategy across multiple supply chains. | To decide whether to scale up production of SuperOats. | To review the strategy and explore feasibility of a fair-trade label. |

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03 Scope the assessment

3.1 Introduction

This section of the Guidelines provides additional guidance for answering the following question:

What is an appropriate scope to meet the objective?

3.2 Actions

In particular, these guidelines will help you undertake the following actions:

- 3.2.1** Determine the organizational focus
- 3.2.2** Determine the value-chain boundary
- 3.2.3** Specify whose value perspective
- 3.2.4** Decide on assessing impacts and/or dependencies
- 3.2.5** Decide which types of value you will consider
- 3.2.6** Consider other technical issues
- 3.2.7** Address key planning issues

3.2.1 Determine the organizational focus

Organizational focus refers to the part or parts of a business to be included in a capitals assessment. For simplicity, there are three general levels of organizational focus, namely:

- **Corporate:** assessment of a corporation or group, including all subsidiaries, business units, divisions, different geographies, markets, etc.
- **Project or site:** assessment of a planned undertaking or initiative for a specific purpose, and including all related sites, activities, processes, and incidents.
- **Product:** assessment of particular goods and/or services, including the materials and services used in their production.

There are important similarities and differences between these three levels in terms of how an assessment is undertaken.

Determining an appropriate organizational focus will likely depend on the business application you have chosen. Table 3.1 provides some additional considerations for choosing an appropriate organizational focus.

Glossary

Organizational focus

In the Guidelines, the part or parts of the business to be assessed (e.g., the company as a whole, a business unit, or a product, project, process, site, or incident). For simplicity, these are grouped under three general headings:

Corporate: assessment of a corporation or group, including all subsidiaries, business units, divisions, different geographies or markets, etc.

Project: assessment of a planned undertaking or initiative for a specific purpose, and including all related sites, activities, processes, and incidents.

Product: assessment of particular goods and/or services, including the materials and services used to produce these products.

Table 3.1

Considerations when determining the organizational focus of your assessment

| Corporate | Project or site | Product |
|---|---|---|
| Likely to require more effort and consolidation of information across the business. | Good for comparing alternative options. | Good for comparing alternative options. |
| May need to define which subsidiaries to include. | Need to decide which projects/sites to assess. | Need to decide which product(s), material(s), and/or related services to assess. |
| May highlight material issues that were not anticipated. | May involve assessing an extension of an existing facility or a new build. | High volume, fast growing, or most profitable products may not have the most material issues. |
| May be bounded geographically to a country, or even a single location. | New builds are likely to require significant data collection, especially on the baseline situation. | Narrow scope may allow for detailed assessment of impacts and/or dependencies. |
| May imply a broad but shallow assessment of impacts and/or dependencies. | May need to define specific aspects or alternative options (i.e., scenarios) to assess. | |
| | Narrow scope may allow for detailed assessment of impacts and/or dependencies. | |

3.2.2 Determine the value-chain boundary

As well as choosing your organizational focus, you need to identify which part(s) of the value chain will be assessed. The Guidelines consider three major parts of the value chain:

- **Upstream:** (cradle-to-gate): covers the activities of suppliers, including purchased energy or contracted labor.
- **Direct operations:** (gate-to-gate): covers activities over which the business has direct operational control, including majority-owned subsidiaries.
- **Downstream:** (gate-to-grave): covers activities linked to the purchase, use, re-use, recovery, recycling, and final disposal of the business's products and services.

While the obvious choice is to start with the direct operations of your business where you have control, the most material issues may be found upstream or downstream (see Step 04). Alternatively, your assessment could conduct a full value-chain assessment which considers all three parts.

Table 3.2 shows how the nature of your impacts and dependencies may vary depending on the chosen value-chain boundary. More guidance on the key considerations when determining a value-chain boundary can be found in Table 3.2 of the Natural Capital Protocol.

Table 3.2
Example of how capitals issues can act along the entire value chain

| <i>Example impacts and dependencies</i> | Upstream | Direct operations | Downstream |
|---|--|---|---|
| <i>Health and safety impact</i> | Your supplier struggled to provide enough safety equipment for its employers this year, resulting in a number of workplace injuries associated with your order. | Some of your safety equipment is old, overused, and no longer fully effective. You risk a possible long-term impact on your workforce's health due to agrochemical inhalation. | Packaging for your products is revealed as potentially unsuitable for the humidity levels in some of your target markets, causing health risk. This might cause health-related issues and legal claims in the future. |
| <i>GHG emissions impact</i> | You source from a cooperative that uses wind power. This reduces strain on local energy supplies (harvested fuel wood). Upstream emissions are lower than expected. | You have invested in new, more efficient lighting and heating for your storage warehouses (produced capital). This reduces the GHG emissions of your direct operations, as well as your energy bill. | You have chosen to switch your logistics provider to one that has more distribution hubs in your target market. This makes road travel to retailers more efficient, therefore reducing downstream GHG emissions. |
| <i>Water availability dependency</i> | You are sourcing sugarcane from a region that has experienced rainfall shortages in recent years, threatening the reliability of your contract. Your upstream dependency on water availability becomes a strategic priority. | Your direct operations have anticipated the effects of climate change and have been investing in technology to monitor water use smartly, such that you can predict and manage your dependency on water better than other industry peers. | Your processed sugarcane is sold exclusively to a confectionery manufacturer in a nearby city, who relies on groundwater for production processes. Groundwater is depleting fast, putting your biggest customer and your revenue at risk. |

Glossary

Natural Capital Protocol

A standardized framework to identify, measure, and value direct and indirect impacts (positive and negative) and/or dependencies on natural capital.

Social and Human Capital Protocol

A standardized framework to identify, measure, and value direct and indirect impacts (positive and negative) and/or dependencies on social and human capital.

3.2.3 Specify whose value perspective

A key action in your assessment is deciding whose value perspective to consider. You may focus your assessment on the value to business (i.e., business value) or on the value to society (i.e., societal value). An integrated capitals assessment implies a complete assessment should be undertaken and include both value perspectives, as they are integrally linked. However, there can be benefit in initially considering value perspectives separately so you can focus on how the results of the assessment can be communicated.

If you are focusing, for example, on the financial implications to your business of water shortages, you would start from the business value perspective. For an integrated capitals assessment you need to consider potential implications on, say, social capital beyond the border of the business. This more complete understanding would consider how impacts to society may affect your business, both now and in the future.

For example, while your business may have enough water, shortages could result in nearby stakeholders having insufficient water, which might lead to indirect impacts to your business (e.g., reputational costs from stakeholder protests resulting in loss of your license to operate). Your impacts on society may result in changes in business values. Understanding the nature and magnitude of societal values can shed light on potential risks (and opportunities) to your business. For example, societal values may affect your social license to operate, or raise the risk that some natural capital impacts may be “internalized” through new regulations or environmental markets. Alternatively, your company may be able to create an additional or greater revenue stream through providing wider societal benefits (e.g., by habitat restoration that enhances water quality).

3.2.4 Decide on assessing impacts and/or dependencies

Your assessment may cover your impacts, your dependencies, or both. This will in part depend on the business application and your objective. A complete assessment considers both impacts and dependencies to gain a full understanding of your company’s risk and opportunity related to natural, human, and social capitals.

It is important to note that impacts and dependencies are interrelated. For example, business dependencies typically result in impacts such as when water use by a company (the dependency) results in less water, or lower quality water, available for other stakeholders (causing an impact).

Impacts and dependencies are explained further in Step 04 where the concepts of impact pathways and dependency pathways are introduced. In that Step, you will be guided in how to select which specific impacts and dependencies your assessment will cover.

Both impacts and dependencies can be relevant to any organizational focus and value- chain boundary. They can be considered in the three Components of a complete capitals assessment:

- **Impacts on your business** (as a result of your impacts on natural, human and social capitals)
- **Your impacts on society** (as a result of your impacts on natural, human, and social capitals)
- **Your business dependencies** (benefits that your business receives from natural, human, and social capitals)

It is recommended that all three Components be included within an assessment as all three are generally relevant to all potential business applications.

Note: It is important to recognize the limitations in cases where all three Components are not assessed.

Glossary

Value perspective

The perspective or point of view from which value is assessed; this largely determines which costs or benefits are included in an assessment. Business value: The costs and benefits to the business, also referred to as internal, private, financial, or shareholder value. Societal value: The costs and benefits to wider society, also referred to as external, public, or stakeholder value (or externalities).

a) Impacts on your business

“Your impacts on society” refers to impacts on stakeholders or people’s well-being. These impacts can result from natural, human, social, or produced capital. They can come from your direct operations or indirectly from somewhere else in your value chain, including suppliers and consumers (see action 3.2.2 on value-chain boundary). Note that you may want to understand the scale of these impacts, even if you are not directly responsible for them. Analyses that consider your impacts on society include:

- Wider changes felt by the community, the sector, the economy, etc. as a result of your business impacts on natural, human, social, or produced capital.
- Societal costs and/or benefits associated with the company’s activities.
- Costs or benefits associated with both direct and indirect (e.g., supply chain) impacts and/or dependencies.

Limitations:

- Assessing impacts on your business will not reflect your dependence on natural, human, or social capital.
- The estimates of value obtained will not reflect the external costs and/or benefits to society associated with the impacts of your business on natural, human or social capital. In many cases, the direct financial consequences for a business that arise from its impacts will be lower than the costs borne or benefits secured by society.

Resources and stakeholder engagement considerations:

- Typically, more resources are required to assess impact on society and you may need to consult external sources including specialist expertise from environmental and welfare economists.
- Stakeholder engagement is likely to be important when considering local issues and decisions that may significantly alter local sites/resources or access to them. Stakeholder engagement is less relevant for broad assessments covering many geographies and diffuse impacts (e.g., a whole supply chain assessment).

Glossary

Components

The three elements of a complete capitals assessment: impacts on your business, your impacts on society, and your business dependencies.

b) Your impacts on society

“Your impacts on society” refers to impacts on stakeholders or people’s well-being. These impacts can result from natural, human, social, or produced capital. They can come from your direct operations or indirectly from somewhere else in your value chain, including suppliers and consumers (see action 3.2.2 on value -chain boundary). Note that you may want to understand the scale of these impacts, even if you are not directly responsible for them. Analyses that consider your impacts on society include:

- Wider changes felt by the community, the sector, the economy etc. as a result of your business impacts on natural, human, social or produced capital
- Societal costs and/or benefits associated with the company’s activities
- Costs or benefits associated with both direct and indirect (e.g., supply chain) impacts and/or dependencies

Limitations:

- Assessing your impacts on society will not reflect your dependence on natural, human, or social capital.
- Impacts felt by stakeholders rarely translate directly into financial costs and benefits to the business, even when they are expressed in monetary terms. This is because these societal costs and benefits can rarely be imposed on or captured by companies precisely. For example, the financial costs (e.g., mitigating expenditures) imposed by environmental legislation are typically lower than the societal costs of the impacts avoided. Equally, the financial costs of reputational damages associated with impacts on social capital may be greater than the societal costs of the impacts themselves.

Resources and stakeholder engagement considerations:

- Typically, more resources are required to assess impact on society and you may need to consult external sources including specialist expertise from environmental and welfare economists..
- Stakeholder engagement is likely to be important when considering local issues and decisions that may significantly alter local sites/resources or access to them. Stakeholder engagement is less relevant for broad assessments covering many geographies and diffuse impacts (e.g., a whole supply chain assessment).

c) Your business dependencies

“Your business dependencies” applies whether you depend on natural, human, or social capital for your direct operations or indirectly in your value chain, including suppliers and consumers. Note that you may want to understand the scale of these dependencies even if you cannot directly influence them. Analyses that consider your business dependencies include:

- The benefits (i.e., value) to your company from using natural, human, and social capitals.
- Current financial costs (e.g., amounts paid for water, agricultural inputs, labor, and care of the workforce).
- Potential future financial costs (e.g., if you expect the prices of natural capital inputs to rise or become more volatile, or if minimum living wage is predicted to increase).
- Costs associated with both direct and indirect dependencies (e.g., dependencies in the supply chain).

Limitations:

- If you have particularly significant capital dependencies (e.g., you are a major user of fresh water), these may also create major impacts on external stakeholders which you will not capture without looking at the impacts felt by external stakeholders (Component b). If these impacts on external stakeholders are sufficiently severe, they may in turn result in impacts on your business (e.g., reputational damage or loss of social license to operate), which you will miss if you choose only to look at your business dependencies.

Resources and stakeholder engagement considerations:

- May require specialist environmental/natural resource modeling expertise to assess external drivers of change in natural capital on which your business depends.
- May require social scientists and macroeconomists to assess external drivers of change in social and human capital on which your business depends.
- The importance of stakeholder engagement will vary depending on the objective of the assessment, but as other stakeholders may also depend on the same natural, human, and social capitals, engagement is often important.

You can now review how the Components of impacts and dependency relate to your business application (from Step 01) to identify which are most relevant for your assessment. More guidance on how to do this can be found in Table 3.4 of the Natural Capital Protocol.

3.2.5 Decide which types of value you will consider

The value of impacts and dependencies can be provided in three ways: qualitative, quantitative, and monetary.

- **Qualitative valuation:** Valuation that describes natural, human and social capitals impacts or dependencies and may rank them into categories such as high, medium, or low.
- **Quantitative valuation:** Valuation that uses non-monetary units such as numbers (e.g., in a composite index), area, mass, or volume to assess the magnitude of natural, social, and human capital impacts or dependencies.
- **Monetary valuation:** Valuation that uses money (e.g., \$, €, ¥) as the common unit to assess the values of natural, social and human capital impacts and/or dependencies.

Assessments typically start with a qualitative review, then proceed to quantitative measurement, and finally to estimation of monetary values as required, each potentially contributing to the next. The important thing is to choose based on the decision you are attempting to inform.

In some cases, a qualitative or quantitative valuation may be sufficient to meet your needs. In other cases, you may need a mix of all three types of valuation, for example where certain impacts are not easily monetized, or when reliable data are unavailable for some variables. More information on the types of valuation can be found in the Protocols and their application explored through case studies.

Glossary :

Valuation

The process of estimating the relative importance, worth, or usefulness of capitals to people (or to a business), in a particular context. Valuation may involve qualitative, quantitative, or monetary approaches, or a combination of these.

Qualitative valuation

Valuation that describes natural capital impacts or dependencies and may rank them into categories such as high, medium, or low.

Quantitative valuation

Valuation that uses non-monetary units such as numbers (e.g., in a composite index), area, mass, or volume to assess the magnitude of natural capital impacts or dependencies.

Price

The amount of money expected, required, or given in payment for something (normally requiring the presence of a market).

Glossary

Baseline

In the Guidelines, the starting point or benchmark against which changes in capitals attributed to your business's activities can be compared.

3.2.6 Consider other technical issues: baseline scenarios, spatial boundaries and time horizon

a. Baseline

The baseline is the starting point against which the change in capital can be compared. When undertaking an assessment which covers a determined period of time you will need to consider how the baseline and capital stock would have changed over the same period with and without your business intervention.

As capitals are dynamic, they may change due to other pressures (other businesses, climate change, population increase, etc.) generated by external actors. Considering these trends allow you to compare your business activities in a meaningful way.

Baseline examples:

- **Prevailing conditions or historical situation:** where impacts this year are compared to the average over previous years.
- **Pristine baseline:** for natural capital, impacts are measured relative to what the land would be in its original natural state if the business were not operating at that place.
- **A sector-wide or economy-wide average level** where business impacts are compared with impacts from relevant peers and comparable food business.
- **An optimal landscape management scenario** where changes are measured relative to an estimated optimal landscape management scenario.

You should also consider whether you are assessing changes in “stocks” of capital (water, land, knowledge, skills, shared values, machinery assets) and/or “flows” of goods and services (ecosystem services or training sessions).

b. Scenario

The concept of valuation is based on being able to compare impacts and dependencies across at least two scenarios: the baseline and a chosen scenario that is being valued.

Type of scenario that you may consider (McKenzie et al. 2012):

- **Intervention** scenarios or real alternatives being considered (e.g., for comparing alternative development projects or project locations, or comparing alternative materials used within particular products)
- **Exploratory** scenarios assessing possible unexpected futures (sometimes used in risk assessments)
- **Vision** scenarios describing explicitly desirable or undesirable futures (also used in risk and strategy assessments). Vision scenarios can also be used to inform potential business as usual scenarios.
- A **counterfactual** is a form of scenario that describes a plausible alternative state of the site and its conditions that would result if the company did not operate. More than one counterfactual can be considered, to account for different perspectives (e.g., from stakeholders or experts).

Note: These provide a starting point but are not conclusive and other scenarios may be appropriate for your objective.

Glossary :

Scenario

A storyline describing a possible future. Scenarios explore aspects of, and choices about, the future that are uncertain, such as alternative project options, business as usual, and alternative visions.

Counterfactual

A form of scenario that describes a plausible alternative situation, and the environmental conditions that would result if the activity or operation did not proceed (adapted from Cambridge Natural Capital Leaders Platform 2013).

c. Spatial boundary

Establishing the spatial boundary means deciding what geographic area the assessment will consider. The answer depends on various factors, including the organizational focus, value-chain boundary, and chosen value perspective, which you will have already decided earlier in Step 03.

For project-level assessments, for example, you need to include the “potential area of influence” for each type of impact (i.e., the total area over which each impact may occur). This may involve the following considerations, especially in the case of natural capital impacts:

- Impacts to biodiversity and ecosystem services may extend well beyond the immediate vicinity of a project, due to ecological linkages, wildlife migration, and other landscape-level factors.
- Water pollution and related issues should be assessed at catchment level, taking into account relevant upriver, downriver, and water scarcity issues as appropriate.
- Assessment of air-quality issues should bear in mind the specific area and features likely to be affected as a result of wind and dispersion. In the case of GHG emissions, the relevant spatial boundary is the entire planet.

d. Temporal boundary

Identifying a temporal boundary means determining an appropriate time frame for the assessment (i.e., over how many days, months, or years should impacts and/or dependencies be assessed and compared?). The assessment period should relate to your objective and correspond to the organizational focus and material impacts and/or dependencies under consideration. Some relevant questions include.

- Should the assessment cover past, present, and/or future impacts and dependencies?
- What and when is the most appropriate temporal baseline? Should the company consider changes in capitals relative to conditions when the company took effective control?
- What period should the assessment cover? For example, an assessment may be limited to a snapshot of the situation at a particular point in time. Alternatively, it may cover a particular financial year, or the entire expected project lifespan. You could also consider meaningful milestones in the business’s history, such as a large merger, acquisition, or divestment, which could help to identify significant time periods. Your objective and other scoping questions will influence the extent to which historical (sunk) costs and/or future decommissioning costs need to be included.

Note: You should be prepared to revisit these boundaries, baselines, and scenarios after you have identified your relevant, material issues in Step 04, as this may influence your desired scope.

Glossary :

Spatial boundary

The geographic area covered by the assessment, for example, a site, watershed, landscape, country, or the planet. The spatial boundary may vary for different impacts and dependencies and will also depend on the organizational focus, value-chain boundary, value perspective, and other factors.

Temporal boundary

The time horizon of the assessment. This could be a current “snapshot,” a 1-year period, a 3-year period, a 25-year period, or longer.

3.2.7 Address key planning issues

Your answers to the scoping questions outlined above may need to be adjusted in light of planning and resource constraints (see action 1.2.3) which will determine what scope is achievable. These constraints may also be considered as “critical success factors” and include:

- **Timescale:** How quickly does the assessment need to be completed? Have you factored enough time for the expected duration of work?
- **Funding/resources:** What budget and human resources are available? Are there other sources of funding available from within the business or externally that could help finance the assessment?
- **Capacity:** What skills are available within the business to undertake an assessment? What additional skills, if any, are needed? Depending on the business decision you are seeking to influence, you may need a range of skills and expertise including environmental economics, welfare economics, research, data analysis, mathematical or statistical modeling (from calculating averages and estimations on a spreadsheet, to using complex statistical and econometric packages), stakeholder mapping and engagement, and communications. This list of skills is not meant to be exhaustive but a starting point.
- **Data availability and accessibility:** What constraints on data are anticipated, and/or what requirements are necessary for translation into other languages?
- **Stakeholder relationships:** To what extent do you need to identify and establish relationships with stakeholders to conduct the study, and potentially implement solutions? You considered your desired stakeholder engagement in action 2.2.2.

Note: You should be prepared to revisit the previous actions in this Step, if the key planning issues identified here are likely to affect what is achievable.

3.3 Outputs

The output for Step 03 is a well-defined scope that is appropriate for your assessment and objective. Table 3.3 provides hypothetical examples of how this Step can be carried out in practice.

Table 3.3
Hypothetical examples – Step 03

| | Blossom Foods | VitaCrisp | Evolve Crops |
|---|---|--|---|
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>What organizational focus?</i> | Corporate | Corporate | Product |
| <i>Which value-chain boundary?</i> | Whole value chain (upstream, operational, and downstream) | Whole value chain (upstream, operational, and downstream) | Upstream and operational |
| <i>Will the assessment cover impacts and/or dependencies?</i> | Impacts and dependencies | Impacts | Impacts and dependencies |
| <i>Which value perspective?</i> | Society and business | Society and business | Society and business |
| <i>What types of value?</i> | Quantitative and monetary | Qualitative, quantitative, and monetary | Qualitative, quantitative, and monetary |
| <i>Other technical issues to consider</i> | | | |
| <i>a) Baselines</i> | a) Minimum standards (no conservation, no certification, and no health/sanitation initiatives) | a) Cereal bar produced with normal wheat | a) Current non-organic practice |
| <i>b) Scenarios</i> | b) Two scenarios: (i) both improvement on sanitation and salaries and (ii) improvement on carbon efficiency and deforestation | b) Cereal bar produced with SuperOats | b) Current organic practice |
| <i>c) Spatial boundaries</i> | c) Operations of a supply chain for one commodity in one country | c) A single product line | c) Several product lines (production and transport to import market) |
| <i>d) Time horizons</i> | d) Over four years | d) 10 years | d) Over one year |
| <i>Key planning issues to consider (for example, resource and time constraints)</i> | Resources were assembled internally within the sustainability department, with assistance from external consultant. | Resources were assembled internally by VitaCrisp, who have long-standing databases on health. Natural capital data were collected by an external consultancy. | Internal resources were used to carry out scenario assessments on direct operations. A consultancy company carried out an assessment of upstream operations and relations with suppliers and farmers. |

04 Determine the impacts and/or dependencies

4.1 Introduction

This section of the Guidelines provides additional guidance for answering the following question:

Which impacts and/or dependencies are material?

4.2 Actions

In particular, these Guidelines will help you undertake the following actions:

- 4.2.1** List potentially material impacts and/or dependencies
- 4.2.2** Identify the criteria for your materiality assessment
- 4.2.3** Gather relevant information
- 4.2.4** Complete the materiality assessment.

4.2.1 List potentially material impacts and/or dependencies

There are many different approaches to assessing the materiality of issues affecting a business. Most companies have experience with at least one approach often through their risk, governance, finance, or strategy functions.

These Guidelines do not specify one particular method for assessing materiality, but instead set out the importance of carrying out an assessment through a generic, systematic, and transparent process. The Guidelines do introduce the concept of impact and dependency pathways which should be used to identify what is material to your business. Understanding these terms is fundamental to conducting a capitals assessment.

An impact pathway describes how, as a result of a specific business activity, a particular impact driver results in changes in the capitals, and then how these changes affect different stakeholders. Figure 4.1 provides an example of an impact pathway.

Glossary :

Dependency pathway

A dependency pathway shows how a particular business activity depends upon specific features of natural, human, social or produced capital. It identifies how observed or potential changes in capitals affect the costs and/or benefits of doing business.

Impact pathway

An impact pathway describes how, as a result of a specific business activity, a particular impact driver results in changes in capitals and how these changes in capitals affect different stakeholders.

Impact driver

In the Guidelines, an impact driver is a measurable quantity of a natural, human, social, or produced resource that is used as an input to production (e.g., volume of water used for crop irrigation) or a measurable non-product output of business activity (e.g., a kilogram of CO₂e emissions released into the atmosphere by a manufacturing facility).

Glossary :

Materiality

In the Guidelines, an impact or dependency on natural, human, social or produced capital is material if consideration of its value, as part of the set of information used for decision making, has the potential to alter that decision (Adapted from OECD 2015 and IIRC 2013).

Materiality assessment

In the Guidelines, the process that involves identifying what is (or is potentially) material in relation to the capitals assessment's objective and application.

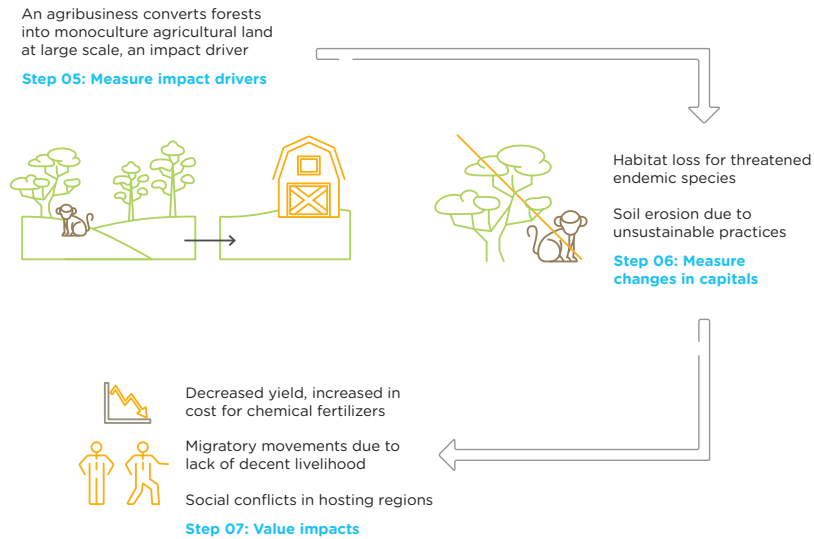


Figure 4.1
Example impact pathway for terrestrial ecosystem use

A **dependency pathway** shows how a particular business activity depends upon capitals through the changes in capitals that affect the business. Figure 4.2 provides an example dependency pathway.

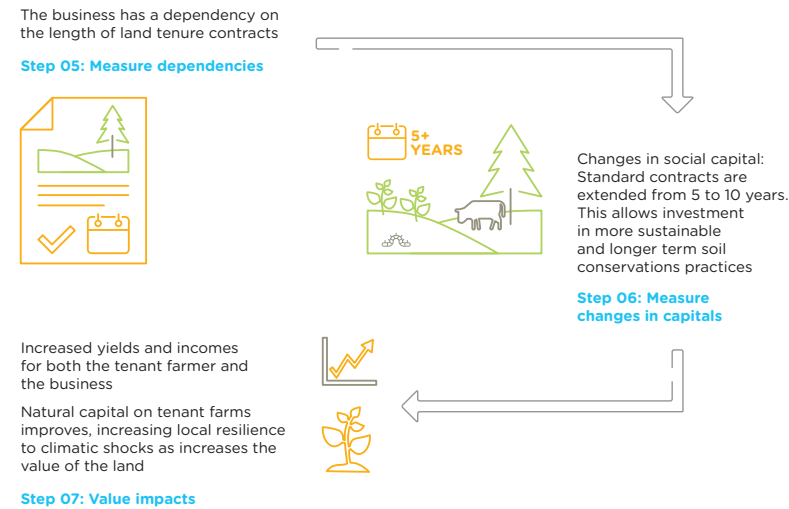


Figure 4.2
Example dependency pathway for length of land tenure contracts

The materiality matrix (Table 4.1) can be used to help identify the most significant impact drivers and dependencies of different business activities. Definitions for each impact driver and dependency category can be found in Table 4.2.

Table 4.1
Indicative materiality matrix for the food sector value chain

Based on FOLU (2019), OECD (2016), UNEP (2018), WBCSD (2018) and SASB (2018)

Table 4.2
Definition of some indicative material impact drivers and dependencies for the food sector

| <i>Capital</i> | Dependencies | Definition |
|-----------------|--|---|
| <i>Natural</i> | Water availability | Amount of water available for business use |
| | Water quality | Quality of water available for business use |
| | Regulation of physical environment | Capacity for physical environment to respond and adapt to pressures |
| | Regulation of biological environment | Capacity for biological environment to respond and adapt to pressures |
| | Regulation of waste and emissions | Adaptive capacity of environment in the face of waste and emissions |
| <i>Human</i> | Skills and knowledge | Capabilities and understanding of workforce |
| | Experience | Amount of time spent by workers in similar occupation |
| | Workforce availability | Number of workers available in the market |
| | Health of workers | Mental and physical health condition of workers |
| <i>Social</i> | Social networks and cooperation | Presence of collective networks, trust and reciprocity, such as in cooperatives |
| | Property rights | Rights of people and companies to own and use land or other resources, such as genetic material found in nature |
| | Social acceptance and trust | Recognition and belief in the contribution of a business to stakeholder interests |
| | Law and order | Respect and obedience to the rules of a society |
| <i>Produced</i> | Accessibility to infrastructure and technology | Capacity to use the infrastructure and technology needed for an effective provision of goods and services |
| <i>Capital</i> | Impact drivers | Definition |
| <i>Natural</i> | Water use | Amount of water used by business |
| | Terrestrial ecosystem use | Land and habitat used by business |
| | GHG emissions | Greenhouse gas emissions of business activities |
| | Pesticide and herbicide use | Pesticides and herbicides used by business |
| | Fertilizer use | Fertilizer used by business |
| | Soil use | Use of soil structure, function, and quality |
| | Solid waste | Solid waste generated by business such as plastic, glass and recyclable materials |
| | Livestock conditions | Conditions of farmed animals |

Introduction

Frame stage

Scope stage

Measure and value stage

Apply stage

References

| Capital | Impact drivers | Definition |
|---------|---|---|
| Human | Nutritional content of food | Quantity of components in food (e.g., saturated fats, refined sugar) that potentially drive diet-related diseases in consumers (e.g., diabetes, obesity) |
| | Use of substances harmful to consumers | Content of substances in food (e.g., antibiotics, pesticides) that potentially drive food-related diseases in consumers (e.g., antibiotic resistance, neurodevelopmental disorders) |
| | Food safety practices | Use of practices (e.g., irradiation, unsafe handling) that can result in food-related diseases in consumers (e.g., cancer, foodborne infections) |
| | Employee health and safety conditions | Capacity to create a healthy and safe workplace, free of injuries, fatalities, and illness |
| | Salaries and benefits | Remuneration of workforce |
| | Workers' living conditions | Access to affordable, safe and secure housing for workforce |
| | Labor rights | Rights of worker in relation to the workplace |
| | Gender rights | Rights to ensure equal treatment of men and women in the workforce |
| | Workers' representation | Integration of workforce into business decision making |
| Social | Food security | Economic and physical availability and access to healthy and safe food for workforce and surrounding population |
| | Food loss or waste | Food loss is food that has become unfit for consumption before reaching the consumer. Food waste is the discarding of food that is fit for consumption, either before or after it spoils |
| | Integration of workforce into communities | Acceptance and integration of workforce by surrounding communities and vice versa |
| | Benefit sharing with indigenous communities | Sharing a portion of the benefits derived from the access and use of genetic resources with indigenous communities that provide traditional knowledge associated with the genetic resources |

A note on human health

Food companies can impact on, and/or depend on, human health in many ways both directly and indirectly.

For instance, a direct impact could be an agricultural business applying high levels of chemical fertilizers to crops, resulting in the health of the workforce being affected from exposure to endocrine-disrupting chemicals. Similarly, poor working conditions can lead to stress and mental health issues, which in turn will affect workforce productivity.

It is also possible to impact the health of people indirectly through the contamination of the environment (e.g., via pollution of water sources), resulting in disease in the wider community (such as waterborne infections). There are many examples of how a business's reputation has been affected following such occurrences.

Further down the supply chain, food companies can also impact the health of their consumers, for instance through:

- The delivery of contaminated, unsafe, and altered food that results in food-related diseases. For example, the use of antibiotics and growth promoters can lead to antibiotic resistance in consumers.
- The nutritional and caloric content of final products (e.g., content of salt, sugar). These could increase the incidence of diet-related diseases (e.g., obesity, cardiovascular disease, high glucose) in consumers. While the impact on consumers depends on the dietary habits of consumers, business decisions and actions (e.g., labeling, reducing salt and sugar content) can help to reduce impacts.

Food companies can also impact on food security, especially in relation to hunger and undernourishment. Some business decisions, such as pricing or geographic distribution of products, can impact people's access to food. Other decisions, such as biofortification of products and diversification of crops, can significantly contribute to reduce undernourishment levels.

4.2.2 Identify the criteria for your materiality assessment

Once you have compiled a short list of potentially material issues, you should identify whom the impacts and dependencies are most significant for. This will be affected by your choice of value perspective (business impacts, societal impacts, or dependencies) and by the stakeholder mapping. Other criteria to decide which impacts and dependencies are most significant may include:

- **Operational:** the extent to which the natural, human, or social capital impact or dependency may significantly affect business operations, project implementation, or the value of existing or new products.
- **Legal and regulatory:** the extent to which the natural, human, or social capital impact or dependency may trigger a legal process or liability (e.g., emission fees or extraction quotas, costs of health and safety requirements, compensation for discrimination claims).
- **Financing:** the extent to which the natural, human, or social capital impact or dependency may influence "cost of capital" or your access to capital, investor interest, or insurance conditions.
- **Reputational and marketing:** the extent to which the natural, human, or social capital impact or dependency may affect the product portfolio, company image, or relationship with customers and other stakeholders (e.g., changing customer preferences).
- **Societal:** the extent to which the natural, human, or social capital impact or dependency may generate significant impacts to society (i.e., external stakeholders). For example, interaction with indigenous communities might automatically increase the scale of some impacts, positive or negative.

4.2.3 Gather relevant information

Based on the materiality criteria you have selected, you should next gather the necessary information to assess the potential material significance of each impact and/or dependency.

The type of information you collect might include:

- Type of impact and/or dependency
- Scale of impact and/or dependency
- Consequence of impact and/or dependency (on business, society, or both)
- Time scale (short-, medium-, or long-term)

Collecting this information may involve:

- Seeking expert opinion and/or analysis, or leveraging existing information (e.g., results of an environmental or social impact assessment) and local knowledge of key issues
- Consulting stakeholders (internal and/or external) (e.g., interviews, workshops, questionnaire surveys)
- Compiling publicly available information on specific issues (e.g., case studies from relevant locations, civil society reports, land-use maps, species threat assessments, census data)
- Conducting a rapid assessment of value (e.g., what proportion of total sales revenue depends upon a specific ecosystem service? What is the financial value of the production asset involved?)

External consultation can be helpful but is not always required, as long as an appropriate method and/or expert judgment is used along with adequate qualitative and/or quantitative research (see action 2.2.2 for more guidance on identifying stakeholders and appropriate levels of engagement).

Note: When identifying information to collect it is important to also identify who will provide the information, who will collate it, when it will be collated, and where it will be held.

4.2.4 Complete the materiality assessment

Based on the information you have gathered it should now be possible to assess the relative materiality of each impact and/or dependency based on the criteria in action 4.2.2. and identify those that are most significant to your business and/or society.

It is recommended that you establish a panel of relevant people with a broad range of skills to complete the materiality assessment, and to ensure the panel is consistent throughout the assessment. When ranking, it is good practice to set a threshold above which issues are considered significant and to consider your ability to influence your impact and/or dependency.

Once you have assessed and ranked potentially material impacts and/or dependencies across natural, human, and social capitals, you should be able to identify those that are material, not material, or still uncertain. The result is a short list of material impact drivers and/or dependencies that you will include in your assessment.

Where uncertainties remain, further information gathering or consultation may be necessary to judge materiality. You may find it helpful to plot the impacts and/or dependencies on a matrix (see some illustrative examples in Figure 4.3).

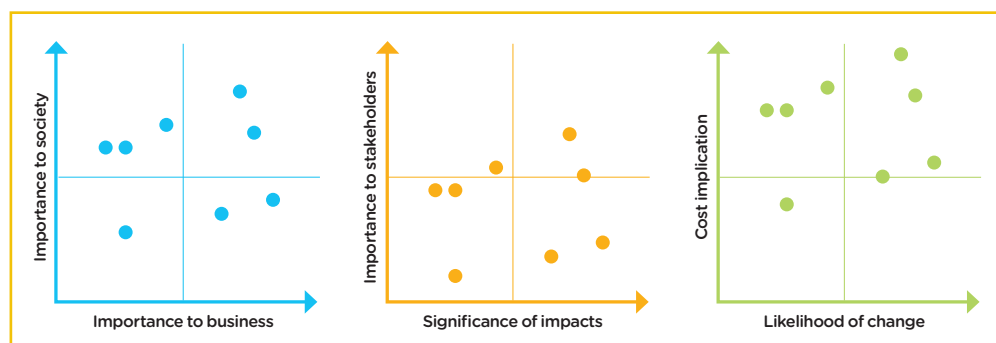


Figure 4.3
Examples of materiality matrices

Source: Natural Capital Coalition, 2016

4.3 Outputs

The output for Step 04 is a prioritized list of material impacts drivers and dependencies and their pathways to include in your assessment and to inform Steps 05 to 07. This may consist of a list, ranked according to your chosen criteria.

Table 4.3 provides hypothetical examples to help explain how this Step can be delivered in practice.

Table 4.3
Hypothetical examples – Step 04

| | Blossom Foods | VitaCrisp | Evolve Crops |
|---|---|---|---|
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>Summarize the key decisions on the materiality process, including who was involved</i> | <p>What stakeholder engagement was carried out?</p> <p>External NGO with experience carrying out sanitation and community health initiatives was consulted. Natural capital-related dependencies were mapped internally.</p> <p>What criteria were used to compare relative materiality?</p> <p>Societal and operational materiality assessment of impacts and dependencies were incorporated to understand how they impact the company's bottom line.</p> <p>What data were gathered?</p> <p>An external consultant was hired to appraise the social impacts of the responsible sourcing program. Operational benefits including carbon efficiency and gains from healthy ecosystem services were collected in-house.</p> | <p>What stakeholder engagement was carried out?</p> <p>An external consultation with farmers in the supply chain was carried out to assess the feasibility of replacing wheat with oat production.</p> <p>What criteria were used to compare relative materiality?</p> <p>Societal materiality assessment to understand and communicate the extent of positive impact delivered by SuperOats.</p> <p>What data were gathered?</p> <p>Data on health outcomes were taken from EU databases.</p> <p>Pricing from past EU research.</p> <p>Company's own producing and sourcing data informed natural and social capital assessment.</p> | <p>What stakeholder engagement was carried out?</p> <p>An internal consultation was carried out with employees to determine material impacts and dependencies, especially related to direct operations. A consultancy company was hired to assess human capital and enable dialogue with farmers and suppliers.</p> <p>What criteria were used to compare relative materiality?</p> <p>Societal and operational materiality assessment to understand and compare the product-level profit and loss (P&L) for organic and non-organic products</p> <p>What data were gathered?</p> <p>The consultancy company gathered data related to land, water, and energy consumption on the upstream value chain. Operational data were provided by staff at the different levels of direct operations.</p> |
| <i>List the material impact drivers and/or dependencies that will be brought forward to the Measure and Value Stage</i> | <p>Clean water and sanitation provision for local community</p> <p>Deforestation carried out by external organizations</p> <p>Consumer demand for responsibly-sourced commodity</p> | <p>Carbon emissions, considering the full life cycle process</p> <p>Health of consumers (lower cholesterol and blood glucose)</p> | <p>Energy use</p> <p>Water use</p> <p>Soil use</p> <p>GHG emissions</p> <p>Expertise/knowledge</p> |

MEASURE AND VALUE STAGE HOW?



What is the Measure and Value Stage?

The Measure and Value Stage introduces how impacts and/or dependencies can be measured and valued.

The Measure and Value Stage involves three linked Steps:

| Step | Questions each step will answer | Actions |
|--|--|---|
| 05 Measure impact drivers and/or dependencies | How can your impact drivers and/or dependencies be measured? | 5.2.1 Map your activities against impact drivers and/or dependencies 5.2.2 Define which impact drivers and/or dependencies indicator you will use 5.2.3 Identify how you will measure impact drivers and/or dependencies 5.2.4 Collect data |
| 06 Measure changes in the state of capitals | What are the changes in the state and trends of capitals related to your business impacts and/or dependencies? | 6.2.1 Identify changes in capitals associated with your business activities and impact drivers 6.2.2 Identify changes in capitals associated with external factors 6.2.3 Assess trends affecting the state of capitals 6.2.4 Select methods for measuring changes 6.2.5 Undertake or commission measurement |
| 07 Value impacts and/or dependencies | What is the value of your capitals impacts and/or dependencies? | 7.2.1 Define the consequences of impacts and/or dependencies 7.2.2 Determine the relative significance of associated costs and/or benefits 7.2.3 Select appropriate valuation technique(s) 7.2.4 Undertake or commission valuation |

Additional notes

You should address all of the actions associated with each Step in the Measure and Value Stage.

Before you start this Stage you should familiarize yourself with Step 08 in the Apply Stage which covers interpreting and using assessment results as there may be implications for Steps 05–07 depending upon your objective.

This Stage includes guidance on a diverse set of methods ranging from simple environmental, human, and social data collection through to sophisticated modeling (ecological, toxicological, nutritional) and advanced econometric analysis. This Stage is intended to provide sufficient information for you to understand the key features of the various techniques discussed but to complete the Steps you may need the support of people with the following skills: Life Cycle Analysis (LCA) and Life Cycle Impact Analysis (LCIA) experts; biodiversity, nutritional, safety specialists; economic, health and safety or ecological modelers; or environmental and health economists. If you do not have these skills internally, you may need to find external support.

The Guidelines do not attempt to provide detailed instructions on how to apply specific measurement or valuation methods. It refers instead to the extensive academic, practitioner, and policy literature on these methods.

Table MV.1

Relationship between business applications and the Measure and Value Steps

| Business application | Relationship to specific Measure and Value Steps and actions |
|---|--|
| <i>Assess risks and opportunities</i> | All Steps and actions are potentially relevant. Step 06 may be of particular importance here because risks will be greater in proximity to significant ecological and health thresholds or where there is potential for irreversible changes. |
| <i>Compare options</i> | In Step 07, qualitative valuation may be sufficient for initial high-level screening and prioritization of options. Monetary valuation will help you to compare different impacts (or dependencies) associated with each option in more detail and to assess the aggregate impacts using a common currency. |
| <i>Assess impacts on different stakeholders</i> | To allow for effective distributional analysis, the affected populations will need to be segmented by stakeholder group in Step 07. |
| <i>Estimate total value and/or net impact</i> | In Step 07, monetary valuation enables the aggregation of varied impacts using the same currency. In this way you can determine whether the subject of your assessment is net positive, either from a business value or societal value perspective. Quantitative approaches may be preferable if net impact in a single impact area is the focus, as long as the context is adequately taken into account. |
| <i>Communicate internally and/or externally</i> | Communication of qualitative and quantitative information of capitals of the kind described in Step 05 has a long history and is relatively commonplace in sustainability reporting. Communication of capitals valuation results (business or societal) (Step 07) is a more recent trend but is becoming increasingly common. |

Although the actions in this Stage can apply to all three Components introduced in Step 03 (impacts on your business, your impacts on society, and your business dependencies), there are differences in their relative importance and the applicability of certain methods.

How should you plan for this Stage?

Throughout the Measure and Value Stage of your capitals assessment, keep the following questions in mind:

- What is the availability and quality of data? Where time or budget do not allow for the collection of primary data, you will need to consider the implications of relying on secondary, potentially proprietary data. Alternatively, you may need approval to start collecting new internal data.
- Do you have people with appropriate expertise and capacity within your business to undertake the assessment? If not, what skills are needed and who could provide them?
- Are there budget or time constraints that may affect what is achievable? Although there are many free-to-use statistics and other resources, you may need to use databases or models that are proprietary, costly, or require a long time to deploy, particularly for assessments upstream or downstream in the value chain.
- Are there dynamic aspects of your business (such as seasonal changes in product range, output volumes, or ongoing efficiency drives) that may affect the consistency of data over time?
- How stable are the relevant regulations of impacts and/or conditions of access to capital resources on which your business is dependent, and how will you track changes over time?

Glossary :

Life Cycle Assessment

Also known as Life Cycle Analysis. A technique used to assess the environmental impacts of a product or service through all stages of its life cycle, from material extraction to end-of-life (disposal, recycling, or reuse). The International Organization for Standardization (ISO) has standardized the LCA approach under ISO 14040 (UNEP 2015). Several Life Cycle Impact Assessment (LCIA) databases provide a useful library of published estimates for different products and processes.

Monetary valuation

Valuation that uses money (e.g., \$, €, ¥) as the common unit to assess the values of capital impacts or dependencies.

Before you get started with the Measure and Value Stage

Before you get started with this Stage, it is important to consider planning requirements, including your internal capacity to complete the assessment and the availability of data.

There are also a wide range of sector-specific frameworks, initiatives, and datasets that can be leveraged to provide context and to support your assessment.

Annex A sets out a non-exhaustive list of some of the main published resources available, explains how they could be used in a capitals assessment, and highlights which capitals and which Steps of these Guidelines they are relevant to.

05 Measure impact drivers and/or dependencies

5.1 Introduction

This section of the Guidelines provides additional guidance for answering the following question:

How can your impact drivers and/or dependencies be measured?

Step 05 sets out how to select appropriate measures for your impact drivers and/or dependencies and provides examples of a range of potential indicators and methods for analysis. By the end of this Step you should have measured (in qualitative and/or quantitative terms) each material impact driver and/or dependency.

In some cases, it may not be practical to measure your impact drivers and/or dependencies directly and you will need to make informed estimations instead.

Note: Unless specified in the text all actions are relevant to all three Components: Business impacts, Societal impacts and Dependencies).

5.2 Actions

In particular, these Guidelines will help you undertake the following actions:

- 5.2.1** Map your activities against impact drivers and/or dependencies
- 5.2.2** Define which impact driver and/or dependency indicators you will measure
- 5.2.3** Identify how you will measure impact drivers and/or dependencies
- 5.2.4** Collect data

Glossary :

Measurement

In the Guidelines, the process of determining the amounts, extent, and condition of natural capital and associated ecosystem and/or abiotic services, in physical terms.

5.2.1 Map your activities against impact drivers and/or dependencies

In order to complete this action, you will need to identify all of the relevant activities associated with your assessment and map these against material impact drivers and/or dependencies. The materiality matrix presented in Step 04 can assist you with this process. Figure 5.1 provides an example of a map for a mango juice producer.

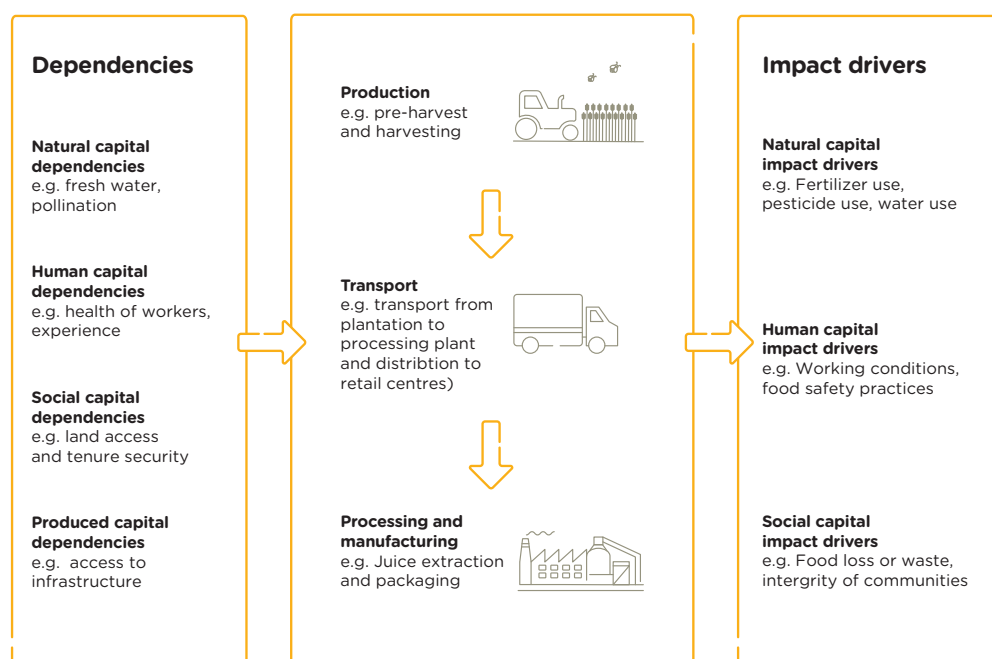


Figure 5.1

Example of a process diagram showing impact drivers and dependencies associated with the production of mango juice

The materiality matrix presented in Step 04 can assist you with this process as you identify relevant business activities across the food value chain and the material impact drivers and dependencies associated with them. Table 5.1. revisits the materiality matrix to provide some simplified examples of how you might start to map business activities to material impacts and dependencies for your assessment.

Table 5.1
Examples of activity mapping

| Company undertaking assessment | Organizational focus | Value chain element | Material capitals impacts and dependencies |
|--------------------------------|----------------------|---|---|
| Mango juice producer | Corporate | Upstream (raw materials) | Impact drivers: water use, labor rights, pesticide use, occupational conditions, fertilizer use, workers' living conditions, integration of communities Dependencies: water availability, land access, access to infrastructure and technology, health of workers, regulation of biological environment, skills and knowledge |
| | | Operations | Impact drivers: water use, GHG emissions, labor rights, solid waste, food waste, nutritional content of product Dependencies: water availability and quality, law and order, health of workers, skills and knowledge of workers, energy |
| | | Downstream (distribution, retail and consumption) | Impact drivers: GHG emissions, solid waste, nutritional content of food, use of harmful substances harmful for consumers, food safety practices, employee health and safety conditions, salaries and benefits, labor rights, workers' representation, food security, food loss or waste Dependencies: Energy, regulation of waste and emissions, health of workers, social acceptance and trust, law and order, accessibility to infrastructure and technology |
| Chicken producer | Product | Operational (chicken farming including chicken feeding, egg collection, and distribution) | Impact drivers: water use, GHG emissions, fertilizer use, soil use, livestock conditions, antibiotic use, labor rights, food loss and waste, safety practices Dependencies: water availability and quality, regulation of waste and emissions, health of workers, social acceptance and trust, access to infrastructure and technology, experience |

5.2.2 Define which impact drivers and/or dependencies indicators you will use

This action involves determining what you will be measuring (the indicator) and the type of data needed.

Measurement of the material impact drivers and/or dependencies can be either qualitative or quantitative.

- Qualitative indicators may be based on professional judgment and can be informed by the opinions of stakeholders. Qualitative measures may involve a subjective assessment of high, medium, or low, or other defined criteria.
- Quantitative indicators are typically in physical units, such as amount of different pollutants emitted (e.g., tons), the amount of resources consumed (m³ water, hectares of habitat), or the number of hours of training provided to workers (h/year). In some cases, estimates derived using modeling techniques are needed to obtain these indicators.

You may find that the data required to measure impact drivers and dependencies are frequently the same. For example, data on the use of water can be used to identify dependency on water and/or to identify the scale of the impact, otherwise known as the impact driver. Or employee training can be used to identify dependency on training and/or the scale and impact of training (the impact driver). For simplicity we discuss the data for impact drivers and dependencies separately in this Step.

An indicator is the form of measurement used to gauge the state or level of the impact driver and/or dependency. Indicators are used to track the performance of a business over time, or for comparison across business units and with other companies.

It is equally important that the indicators chosen are suitable for measuring changes in capitals (Step 06) and for valuation (Step 07). For this reason, the selection of indicators should be coordinated with the selection of measurement and valuation methods in other Steps.

In an ideal situation, an impact driver or dependency can be measured or estimated directly (e.g., the volume of water consumed or number of hours of health and safety training). In other cases, intermediate or proxy indicators are required. These provide a useful shortcut which must then be combined with other information to measure or estimate the impact driver or dependency. For example, fuel use data can indicate the volume of GHG and other emissions to air. Various published guides are available which provide emission factors (or conversion factors) to translate the liters of fuel used into grams of emissions.

Table 5.2 presents examples of quantitative indicators for different impact drivers. This is relevant for impacts on your business and your impacts on society and follows the relevant impact categories identified in the materiality matrix (see Step 04). The indicators should be expressed for a given location and for a given period of time.

Table 5.2
Example of quantitative indicators for different impact drivers

| <i>Capital</i> | Impact driver category | Example quantitative indicator |
|----------------|--|--|
| <i>Natural</i> | Water use | Cubic meters of water consumption ¹ , by watershed and month |
| | Terrestrial ecosystem use | Hectares of land occupied, by land-use type and ecoregion |
| | | Hectares of land transformed, by land-use type and ecoregion |
| | GHG emissions | Tons of CO ₂ e |
| | Pesticide and herbicide use | Kilograms of toxic compounds ² in pesticides/herbicides applied |
| | Fertilizer use | Kilograms of phosphorus in fertilizers applied |
| | | Kilograms of nitrogen in fertilizers applied |
| | Soil use | Hectares of land occupied |
| | Solid waste | Kilograms of plastic reaching the ocean |
| | | Kilograms of waste by type (i.e., non-hazardous, hazardous, and radioactive), by material (e.g., lead, plastic, organic matter), or by disposal methods (land fill, sludge sewage, incineration, recycling, specialist processing) |
| <i>Human</i> | Livestock conditions | Number of cattle heads per hectare |
| | | Square meters of individual cubicles |
| | Nutritional content of food | Grams of saturated fats/sugar/refined carbohydrates per 100 grams of final product |
| | Use of substances harmful to consumers | Micrograms of antibiotic by cattle head |
| | Food safety practices | Liters of polluted water used for irrigation |
| | | Kilograms of non-composted organic fertilizer in direct contact with edible parts of plants |
| | Employee health and safety conditions | Number of hours of overtime per week |
| | | Number of hours in difficult working postures per day |
| | | Number of days of workers exposure to severe weather episodes per year |
| | | Average distance of workers from potentially harmful animals/plants |

| Capital | Impact driver category | Example quantitative indicator |
|---------|---|--|
| | | Number of hours of health and safety training |
| | | Number of workers with safety training and measures on hazardous tools and heavy machinery use |
| | | Kilograms of pesticides used/managed by workers per year |
| | Salaries and benefits | Gross salary per employee or contractor |
| | | Gross value of pension or monetary benefits per employee |
| | | Gross value of in-kind benefits such as housing, transport or meals |
| | Workers living conditions | Average size (m ²) of temporary/seasonal accommodations of worker |
| | Labor rights | Number of workers subject of modern slavery/debt bondage |
| | Gender rights | Difference in pay between men and women in same levels |
| | Worker's representation | Proportion of workers involved in union groups |
| | | Proportion on board meetings with worker representation |
| Social | Food security | Ratio of change in price of a basic food basket per change in cost of a product |
| | Food loss or waste | Kilograms of food waste per kilogram of final food product sold |
| | Integration of communities | Number of employees in a position of leadership in community or involved in community activities |
| | Benefit sharing with indigenous communities | Annual contribution of the business to the community fund per year |

1 Water consumption is different to water withdrawal. Water withdrawal does not take into account that significant amounts of water may be withdrawn but released into the same watershed (e.g., turbinized or cooling water), sometimes within a very short time period. Water consumption only considers the portion of water which is no longer available in the same watershed because it has been evaporated, integrated into a product, or released into a different watershed or the sea (Life Cycle Initiative 2016).

2 Some of these compounds include: 2,4-Dichlorophenoxyacetic Acid, Bentazone, Butaclor, Cipermetrin, Clomazone, Propionic acid (proxy for Cyhalofop-butyl), Dalapon, Dazomet, Dimetoate, Fenoxaprop, Furalan, Glyphosate, 2-Thiohydantoin (proxy for Imazapic), Imidacloprid, Bensulfuron methy, Ordram (molinate), Oxadiazon, Oxifluorfen, Pendimethalin, Sulfadimethoxine (proxy for Penoxsulam), Pretilachlor, Propanil, Safaner, Triazofos)

Table 5.3 provides example indicators for different dependency categories. The indicators for dependencies that are business inputs (e.g., water, knowledge) will often be the same as indicators for impact driver inputs. This is relevant if your business dependencies are part of your analysis. In the case of natural capital, selecting appropriate indicators to assess dependence on regulating services is more challenging. Relevant indicators may relate to the area and quality of habitats that provide the service (e.g., 10 hectares of mature forest providing a water filtration service), or they may be more specific to the service itself (e.g., 8 million liters of water filtered per year).

Table 5.3
Example indicators for different dependencies

| <i>Capital</i> | Dependency category | Example quantitative indicator |
|-----------------|--|---|
| <i>Natural</i> | Water availability | Cubic meters of water extracted by company |
| | Water quality | Quality parameters measured at company extraction points: salinity (i.e., electrical conductivity, dS/m or total dissolved solids, mg/l), ionic concentration per liter (sodium, chloride, boron, trace elements), infiltration (sodium adsorption ratio), steroidal estrogens and others affecting susceptible crops (nitrogen, pH or bicarbonate) |
| | Regulation of physical environment | Hectares of vegetation cover |
| | | Hectares of habitats providing water filtration |
| | | Soil pH and organic matter |
| | | Average rainfall per growing season |
| | Regulation of biological environment | Pollinator population density |
| | | Pest population density, such as mealybugs on cassava crops |
| | | Sub-species genetic variation of seeds used by business |
| | Regulation of waste and emissions | Grams of pollutant assimilated per kilometer of river |
| | Energy | Liters of fuel consumed by type of fuel and year |
| <i>Human</i> | Experience | Number of skilled workers from the local area, experienced in local weather patterns and harvest rhythms |
| | | Number of workers knowledgeable of the time required for ecosystem restoration |
| | Skills and Knowledge | Number of workers with knowledge of the role of native species that improve crop resilience |
| | | Number of critical skill gaps within the workforce |
| | Workforce availability | Number of workers needed to maintain business activity levels |
| | Health of workers | Rate of undernourishment in workforce |
| | | Rates of depression and stress within workforce |
| <i>Social</i> | Social networks (cooperatives) | Number of finance cooperatives present in the region |
| | Property rights | Average length of land tenure contracts with tenant farmers |
| | | Percentage of local genetically valuable organisms used by business |
| | Social acceptance and trust | Number of recorded conflicts in house resulting from misinformation |
| | | Number and diversity of representatives at stakeholder meetings |
| | Law and order | Corruption Perceptions Index (CPI) published annually by NGO Transparency International |
| <i>Produced</i> | Accessibility to infrastructure and technology | Number of businesses adopting similar technologies |

Note: You will likely be familiar with indicators identified and measured by your peers, associations, and relevant standard setters. It is important to recognize that many existing indicators do not yet include the change in capital or the value provided, and it is this context that makes the indicator useful in decision making, and moves the indicator away from simply a measure of quantity to your impact and dependency.

5.2.3 Identify how you will measure impact drivers and/or dependencies

Through this action, you will determine how to obtain the data needed to measure your impact drivers and/or dependencies. There are many potential sources of available data and you will need to distinguish which data are available internally, publicly, or commercially and consider the level of confidence you have in the data, which will change depending upon the source.

There are many potential sources of available data which include:

Primary data:

- Internal business data collected for the assessment being undertaken
- Data collected from suppliers or customers for the assessment being undertaken

Secondary data:

- Published, peer-reviewed, and grey literature (e.g., life-cycle impact assessment databases; industry, government, or internal reports; interviews with third parties/proxies)
- Past assessments
- Estimates derived using modeling techniques (e.g., EEIO, productivity models, mass balance)

Although primary data will deliver more precise results and match your business activities most closely, collecting data involves significant effort and specialist skills and primary data are only correct at the time and place of capture. Therefore, most businesses use a combination of primary and secondary data as this is more practical and is sufficient to inform their decisions.

Issues that make primary data more complex to collect include the needs to define a representative sample, develop a survey method that is free of bias, determine the minimum sample size, and allocate the resources for actual data collection, verification, and other tests. Training or specialist assistance may be necessary to ensure that relevant data are collected correctly, and to determine the statistical significance of results. Also, impact drivers vary over time, for example due to seasonal variation in production or where there are significant spatial variations.

In cases where direct measurement of impact drivers and/or dependencies is not practical, you will have to make informed estimates instead. Techniques that rely on secondary data include the direct application of results from other situations, as well as adjusted estimates based on modeling. Use of secondary data requires careful consideration of underlying assumptions, conversion factors, and other procedures to ensure the data used are appropriate for your situation.

For an exploration of primary and secondary data sources and their availability, see WBCSD FReSH (2018).

Having reviewed available primary data and options for using secondary data, identify which impact drivers and/or dependencies associated with each activity are to be measured or estimated.

Note: Unless you have in-house specialists, you may need to seek external support when dealing with secondary data. This is discussed in more detail in Step 07.

Glossary :

Primary data

Data collected specifically for the assessment being undertaken.

Secondary data

Data that were originally collected and published for another purpose or a different assessment.

Table 5.4 shows the data requirements and methods used to estimate intermediate indicators and impact drivers for coffee production. Several different activities are considered, with examples of specific impact drivers for each. In this case, the best available method was selected for each indicator; some are based on measured data and some on surveys. Table 5.6 also shows the methods used to translate the intermediate indicator into the impact driver indicator, including emission factors, risk models, and life cycle impact assessment (LCIA) databases.

Table 5.4
Examples of identifying intermediate indicators

| Value chain/site identifier | Activity / Process | Impact driver category | Intermediate indicator | Method for intermediate indicator | Calculation of indicator of impact driver | Indicator of impact driver |
|-----------------------------|--------------------------------|---------------------------|------------------------------------|-------------------------------------|---|--|
| Coffee manufacturer | Industrial roasting | GHG emissions | Electricity use (kWh) | Collected using survey | Emission factor for grid | CO ₂ e (kg) |
| Coffee manufacturer | Industrial roasting | Water use | Water withdrawal (m ³) | Measured on site | Measured on site | Water consumption (m ³) |
| Coffee logistics | Transport to roasting facility | Non-GHG air pollutants | Diesel fuel use (l) | Calculated from fuel invoices | Emission factor for truck | PM _{2.5} , PM ₁₀ , NO _x , SO _x , VOCs (kg) |
| Coffee bean producer | Farming | Water pollutants | Fertilizer application (kg/ha) | Calculated from fertilizer invoices | Hydrological model | N and P emissions to surface water (kg) |
| Supplier of food to workers | Beef production | Terrestrial ecosystem use | Beef consumed (kg) | Measured on site | Productivity model | Land use (ha) |
| Supplier of tractors | Tractor manufacturer | Solid waste | Number of trucks bought | Measured on site | Life Cycle Impact Assessment database | Hazardous waste incinerated (kg) |

5.2.4 Collect data

The data collection process will depend on the scope and purpose of your assessment. Key points to consider include:

- Collect relevant primary data where practical and appropriate. Note that the collection of primary data often takes longer than anticipated, so plan carefully for this. To make sure that information is gathered correctly, it may be necessary to train data collectors in advance.
- Check the quality of the data and consider validating the data-collection process (Step 08).
- Conduct or commission secondary data collection and/or modeling as needed, based on the methods discussed above. Review and validate the data estimation process and resulting data as this may have implications for testing assumptions and how results from your assessment are being applied, communicated, and/or reported.
- For ongoing data collection, consider using metered data sources.

You can use both primary and secondary data-gathering techniques to collect data beyond a business's own operations—for instance, upstream with suppliers or downstream with consumers in the value chain. This provides an opportunity to engage and can strengthen business relationships. Always try and provide feedback to the data provider so they can see the benefit of providing the data.

Always document calculation methodologies and assumptions:

- **Document calculation methodologies:** Keep a record of (and whenever appropriate disclose) information about the methods employed to calculate an indicator. This can help you in achieving increased convergence and comparability. Not only does this help you to increase accountability and transparency, it also supports your potential to increase awareness about best practices, be recognized as a leader, and inspire other peers.
- **Document assumptions:** Carefully document (and whenever appropriate disclose) the assumptions that you use throughout your analysis and therefore any limitations in the application of your results. This increases credibility among stakeholders and facilitates learning and collaboration.

Box 5.1: Ethical considerations in data collection

Following important ethical requirements and principles for data collection respects the rights of participants and strengthens the accuracy of results.

Informed consent: This is the process of obtaining approval from participants for the sharing and use of their data. To ensure that consent is informed, it must be freely given, with sufficient information provided on all aspects of participation and data use. With regards to indigenous peoples, businesses should abide by specific principles relating to free, prior, and informed consent as specified by the UN (OHCHR 2013).

Cultural norms: Businesses should be sensitive, aware, and respectful of cultural norms when determining appropriate data collection techniques. This could include, for example, being conscious of gender dynamics and whether women will speak freely in front of peers who are men.

Legal requirements: Businesses should review data laws and regulations in the country and locations where they are collecting data to ensure they comply.

Personal data: Many organizations collect and store large volumes of personal data. Businesses should give utmost consideration to how these data are stored and used, particularly in relation to the European Union's General Data Protection Regulation (European Union Publications 2016).

Other factors to be aware of include education and literacy levels, privacy and anonymity, as well as safety in some contexts.

5.3 Outputs

The output of Step 05 is a list of indicators (qualitative and/or quantitative) for each material impact driver and/or dependency associated with the chosen business activities in accordance with the chosen organizational focus and value-chain segment. The data source needs to be indicated for each indicator (primary or secondary data) and available data and data gaps should be identified.

An optional output is the map of the value chain showing material impacts and dependencies.

Tables 5.5, 5.6, and 5.7 illustrate the completion of Step 05 for each of the sector-specific hypothetical examples, including the completion of all actions required for the Step. All values provided in the tables are for illustrative purposes only.

Table 5.5
Hypothetical examples: Blossom Foods

| Blossom Foods | | | | |
|--|---|--|--|----------------------|
| Organizational focus: Compare options | | | | |
| Value-chain boundary: Upstream | | | | |
| Impacts or dependencies: Impacts | | | | |
| Value perspective: Societal | | | | |
| Type of value: Qualitative | | | | |
| Intended business application: Corporate | | | | |
| | Specific impact drivers/dependencies | Quantitative/qualitative indicator | Data sources | Data gaps |
| Impact | Clean water and sanitation for local community | Number of households with access to clean water | Secondary data | No local data source |
| | Deforestation carried out by external organizations | Area of forest cleared per annum | Primary data – NDVI (normalized difference vegetation cover) change calculated from remote sensing imagery | Region-specific only |
| | Consumer demand for responsibly-sourced commodity | Quantitative market share of responsible sources | Secondary data | No gaps |

Table 5.6
Hypothetical examples: VitaCrisp

| VitaCrisp | | | | |
|--|--------------------------------|--|---|---------------|
| Intended business application: Compare options | | | | |
| Organizational focus: Corporate | | | | |
| Value-chain boundary: Upstream and downstream | | | | |
| Impacts or dependencies: Impacts | | | | |
| Value perspective: Societal | | | | |
| Type of value: Monetary | | | | |
| | Specific impact/ dependency | Quantitative/ qualitative indicator | Data sources | Data gaps |
| Impact | Carbon emissions | Tons of GHGs | Secondary: Life Cycle Impact Assessment | No downstream |
| | Health of consumers | Grams of saturated fats and sugar per 100 grams of final product | Primary data | EU only |

Table 5.7
Hypothetical examples: Evolve Crops

| Evolve Crops | | | | |
|---|-------------------------|--|---|--|
| Intended business application: Compare options | | | | |
| Organizational focus: Product | | | | |
| Value-chain boundary: Upstream and operations at retail level | | | | |
| Impacts or dependencies: Impacts and dependencies | | | | |
| Value perspective: Societal and value to business | | | | |
| Type of value: qualitative, quantitative and monetary | | | | |
| | Specific dependency | Quantitative/ qualitative indicator | Data source | Data gaps |
| Impacts | Soil use | Quantitative: hectares of terrestrial ecosystem use for production | Aggregate data from National Geographic Information System at a large scale (accuracy 100x100m) | High resolution geographical data (10x10m) |
| | GHG emissions | Tons of GHGs | Secondary: Utility bills | N/A |
| Dependencies | Energy use | Quantitative: amount of energy consumed | Secondary: Utility bills | N/A |
| | Water use | Quantitative: m ³ of water used per year | Secondary: Utility bills | Water stress maps |
| | Expertise/ knowledge | Qualitative: knowledge of farmers to produce vegetable efficiently. Knowledge of employee to process, pack and transport vegetable | Semi-structured interviews led by consultancy company | N/A |

06 Measure changes in the state of capital

6.1 Introduction

This section of the Guidelines provides additional guidance for answering the following question:

What are the changes in the capitals related to your impacts and/or dependencies?

To assess the value of impacts and dependencies it is usually necessary to measure changes in the capitals. In addition, you should consider how trends in capitals may alter the costs and benefits of your impacts and dependencies over time.

This Step provides an overview of the relevant considerations when:

- i Selecting and applying methods, or commissioning work, to measure changes in capitals resulting from your impact drivers, and
- ii Understanding how external factors are affecting the state and trends of capitals. These factors will influence not only the extent of your impacts, but also the capitals on which your business depends.

There may be situations when it is not practical to measure changes in capitals explicitly, and you will have to use informed estimations instead.

This Step presents various methods for measuring and estimating changes in capitals and methods to assess the likelihood of these changes, along with examples and guidance for selecting appropriate methods or commissioning specialist work.

Note: All actions and their descriptions are relevant to all three Components of a capitals assessment.

When completing this Step, note that:

- Even if measuring changes in capitals is not necessary (e.g., if you decide to use value transfer methods in Step 07), conducting Step 06 at a high level helps to ensure that the changes in capitals implied or assumed by your simplified approach are appropriate.
- You can use the impact pathways and dependency pathways identified in Step 04 to structure your work, considering the various changes in capitals resulting from each impact driver, or affecting each dependency, in turn.
- Where multiple methods are used in a single assessment, check that they are consistent and compatible. Different methods may involve different geographic or temporal scopes or use different indicators and metrics; they may treat extreme observations (outliers), or attribute changes in capitals to business activity, in different ways. While a range of capital measurements can and often must be used to assess business impacts and dependencies, you will need to consider and allow for methodological differences that could affect your results.
- Where there are multiple actors who together contribute to changes in capitals it will be necessary to identify the portion of the change resulting from the impact drivers associated with your business activities.
- The extent of change in capitals resulting from different impact drivers will depend partly on the status of that capital, which varies in different locations. Local or regional variations in the condition of capitals must be considered explicitly, particularly if your assessment focuses on local activity and decisions.
- For more sophisticated assessments it is likely that you will require input from external specialists in different capitals (e.g., hydrologists, ecologists, nutritionists, anthropologists) unless you have these skills in-house.

6.2 Actions

In particular, these Guidelines will help you undertake the following actions:

- 6.2.1** Identify changes in capitals associated with your business activities and impact drivers
- 6.2.2** Identify changes in capitals associated with external factors
- 6.2.3** Assess trends affecting the state of capitals
- 6.2.4** Select methods for measuring change
- 6.2.5** Undertake or commission measurement

6.2.1 Identify changes in capitals associated with your business activities and impact drivers

This action considers the changes in capitals that are likely to result from the impact drivers measured or estimated in Step 05. The Protocols present some generic examples of changes in different capitals for a range of impact drivers.

Note: You can skip this action and move on to 6.2.2 directly if:

- The impacts on your business are independent of the magnitude of your impacts on society (e.g., many regulations and taxes are not set based on the societal value of your impacts), OR
- You are using other studies, including value transfer, that have already estimated the link between the impact driver and the change in capitals (e.g., many published LCIA data have the change in natural capital implicitly included).

Where value transfer or published impact factors are used to assess changes in capitals resulting from your business activities, it may be possible to adjust for differences between your business/site of interest and the location or context of the original source study. In such cases, completing this Step can help you make those adjustments. Even if no adjustments are needed, you should consider changes in capitals at a high level. This will enable you to check that the type and extent of capital changes described in the source study is comparable to what occurs at your site(s). The selection of specific changes in capitals to include in your assessment will also depend on the scope of the assessment and on available data, the cost of sourcing or modeling additional data, suitable methods, and the time and other resources available for your assessment.

Table 6.1 presents some sector-specific examples for the impact drivers that were introduced in Step 05 of the Guidelines. As described in the Frame Stage, one impact driver can result in changes in several capitals. All capitals that experience a change should be identified when developing the impact and dependency pathways in Step 04. Table 6.1 shows one-to-one capital relationships with the aim of illustrating the logic of the pathway in a simple manner, but it is important to measure all capital changes resulting from each impact driver or dependency.

Glossary :

Value transfer

A technique that takes a value determined in one context and applies it to another context. Where contexts are similar or appropriate adjustments are made to account for differences, value transfer can provide reasonable estimates of value.

Table 6.1

Sector-specific examples of relevant changes in capitals for different impact drivers

| Capital | Impact driver category | Example quantitative indicator | Example of changes in capitals resulting from the impact driver |
|---------|-----------------------------|--|---|
| Natural | Water use | Cubic meters of water consumption, by watershed and month | Change in water availability in same watershed (m ³) |
| | Terrestrial ecosystem use | Hectares of land occupied, by land use type and ecoregion | Change in global/regional potential species loss (potentially disappeared fraction, PDF – see box 6.1) |
| | | Hectares of land transformed, by land use type and ecoregion | |
| | GHG emissions | Tons of CO ₂ e | Change in global mean temperature and change in number of terrestrial and marine species |
| | Pesticide and herbicide use | Kilograms of pesticides applied | Change in human intake of potentially harmful chemical substances in pesticides/herbicides (i.e., endocrine disrupting chemicals OR 2,4-Dichlorophenoxyacetic Acid, Bentazone, Cipermetrin, Dimetoate) |
| | | | Change in number of species loss (i.e. pollinators) |
| | Fertilizer use | Kilograms of phosphorus in fertilizers applied | Change in number of species in water ecosystems due to changes in nutrient level in water (eutrophication) |
| | | Kilograms of nitrogen in fertilizers applied | Change in number of marine species due to changes in nitrogen concentration in coastal water |
| | Soil use | Hectares of land occupied | Change in soil organic carbon |
| | Solid waste | Kilograms of plastic reaching the ocean | Change in number of species affected by plastic reaching marine environment due to: (i) physical impacts (e.g., mammals' suffocation) or (ii) chemical impacts (i.e., ingestion of persistent bioaccumulative toxic substances) |
| | | Kilograms of waste by type, by material or by disposal methods | Change in capitals due to GHG emissions, land use, water consumption, and air, land, and water pollution emissions associated with disposal of waste (by waste type) via landfill, incineration, or recycling |
| | Livestock conditions | Number of cattle heads per hectare | Change in frequency of cattle infections |
| | | Square meters of individual cubicles | |

| Capital | Impact driver category | Example quantitative indicator | Example of changes in capitals resulting from the impact driver |
|---------|---|--|--|
| Human | Nutritional content of food | Grams of saturated fats/sugar/refined carbohydrates per 100 grams of final product | Change in daily human intake of saturated fats/sugar/refined carbohydrates |
| | Use of substances harmful to consumers | Micrograms of antibiotic by cattle head | Change in daily intake of antibiotics by people |
| | Food safety practices | Micrograms of pathogens per 100 g of final product | Change in daily intake of pathogens by people |
| | Employee health and safety conditions | Number of hours of overtime per week | Change in risk of occupational illness and injuries/fatalities due to fatigue and stress |
| | | Number of hours in difficult working postures per day | |
| | | Number of days with exposure to severe weather episodes by workers/year | |
| | | Average distance of workers from potentially harmful animals/plants | |
| | | Number of hours of health and safety training | |
| | | Kilograms of pesticides used/managed by workers per year | |
| | Salaries and benefits | Living wage salary for workers in lowest pay band | Change in workers' family caloric intake |
| | Workers living conditions | Average size (m ²) of temporary/seasonal accommodations by worker | Change in risk of occupational illness and injuries due to fatigue |
| | Labor rights | Number of workers subject to modern slavery/debt bondage | Change in number of incidents of forced labor reported |
| | Gender rights | Difference in pay between men and women in same levels | Change in female employees' motivation at work |
| | Worker's representation | Proportion of workers involved in union groups | Change on in the sense of ownership of the workforce |
| | | Representation of employees at board meetings | Change in number of decisions taken with employee input in consideration |
| Social | Food security | Ratio of change in price of a basic food basket per changes in price of a product | Change in individuals calorie intake |
| | Food loss and waste | Kilograms of food waste per kilogram of food product | Change in global food security levels |
| | Integration of workforce into communities | Number of employees in a position of leadership in community or involved in community activities | Change in number of migrant workers with feeling of exclusion |
| | Benefit sharing with indigenous communities | Annual contribution of the business to the community fund per year | Change in number of people reached through community engagement |

Introduction

Frame stage

Scope stage

Measure and value stage

Apply stage

References

Box 6.1 Potentially Disappeared Fraction of Species

The Potentially Disappeared Fraction (PDF) is one of the existing metrics used to measure impacts on biodiversity or changes in an ecosystem's quality. The Potentially Disappeared Fraction measures the fraction of species that potentially disappear when a substance is introduced into a given environment (i.e., the atmosphere or the marine environment). This provides an indication of the loss of species richness resulting from different activities.

6.2.2 Identify changes in capitals associated with external factors

You should also identify external factors that could result in major changes in the state of the capitals, as these may directly or indirectly affect the significance of impacts on your business, your impacts on society, and/or your business dependencies.

- **Impacts** (business or societal) – identify external forces already affecting, or that could result in changes to, your business impacts. For example, a small food processing business may have relatively minor impacts on fresh water today, due to moderate water consumption, but development of irrigated farming in the region could mean the company's water use becomes much more significant in a local context, due to changing supply and demand conditions. Identifying external factors is especially important when you are conducting an integrated capitals assessment. If several organizations have the same impact drivers, the magnitude of your shared impacts, especially your impacts on society, can be significantly high, even triggering systemic social conflicts. There are many examples of this, such as climate change, deforestation, or soil degradation, which are already forcing people to migrate or move to find ways to improve their livelihoods, particularly in some areas of the world. The lack of integration, and sometimes rejection, of migrants often results in social conflict. Without a transformational change across the entire economy and society, the situation will only worsen. You will find indications in this Guidelines about how to assess and inform decisions at an actionable level (your business) but it is important to also understand your impacts in the larger context in which your business operates.
- **Business dependencies** – identify external factors already affecting, or that could result in changes to, your business dependencies. For example, if a nearby forest is degraded, this could reduce the protection from fire and flooding that your business benefits from. Table 6.2 presents some sector-specific examples of changes in capitals influencing the dependencies that were introduced in Step 04. The table also presents some examples of how the change in capitals may vary according to location-specific external factors.

External factors potentially leading to changes in natural capital include both natural forces and human activities. This is particularly important when considering your business dependencies. The factors can be described as follows:

1. **Natural change:** All environments, habitats, and species are in a dynamic state. For example, rivers change their routes due to fluvial erosion and deposition processes, while populations of certain species can vary dramatically based on predator-prey cycles or on mortality due to harsh weather conditions.
2. **Human-induced change:** Capitals are changing as a result of human activities (e.g., land-use change, increased water use, pollution, sociopolitical changes, educational policies). Impact drivers resulting from the activities of other businesses, government agencies, and individuals can all affect capitals, with potentially significant consequences for your business.

In the case of natural capital, one of the most significant changes that many of us are now aware of is climate change and the more frequent occurrence of extreme weather events such as major storms, flooding, and droughts. This is likely to have consequences for business, particularly regarding its dependency on natural resources, accessible and affordable energy, and compliance with climate regulations. An understanding of the magnitude of such changes will increase the ability of business to assess risks and opportunities, as well as to adapt and increase resilience to climate change.

Glossary :

Biodiversity

The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (UN 1992).

Note: It is helpful to map the relevant indicators chosen in Step 05 to their dependencies and identify the likely subsequent changes in capitals (as shown in table 6.2).

When many different actors contribute to a change in capitals (for example, a training program funded by multiple parties), you should acknowledge that you cannot directly attribute the whole of the impact to your business. In some instances, acknowledgment that you have enabled the change, or played an indirect role in this, without claiming attribution, may be enough. There is ongoing work to develop a hierarchy for attribution.

Some of the approaches you might consider using to measure changes due to *external factors* include:

- Business-as-usual projections based on historic baseline data. Such projections use what has happened previously to project forward what might happen without a new intervention;
- Randomized controlled trials. This is where you apply your intervention to a specific set of employees or location and not to another similar group or location and monitor each over time to assess differences in behaviors and outcomes;
- Stakeholder surveys (including e-surveys, face-to-face surveys, focus groups, and one-to-one interviews). This explores the situation before and after outcomes and questions what alternative outcomes might have come about without your intervention;
- Delphi expert elicitation (in relation to causality). A Delphi expert elicitation is used to solicit the opinions of experts via an iterative questioning process. After each round of questions, you summarize and circulate responses for discussion in the next round. This enables the development of a consensus on the issue while taking into account common trends and outliers;
- Case studies with a cohort of individuals or locations affected by your business's actions that explore the changes resulting from your activities in their lives or the environment.

Table 6.2
Sector-specific examples of relevant changes in capitals for different dependencies

| Capital | Dependency category | Example quantitative indicator | Example of relevant changes to capitals |
|---------|------------------------------------|---|---|
| Natural | Water availability | Cubic meters of water extracted by company | Local aquifers fall due to company's increased extraction |
| | Water quality | Quality parameters measured at company extraction points: salinity, ionic concentration per liter, infiltration | Upstream intensive agriculture, results in worsening water turbidity |
| | Regulation of physical environment | Hectares of vegetation cover | Deforestation to make space for farmland results in greater soil run-off and eutrophication of rivers |
| | | Hectares of habitats providing water filtration | Change in water level in aquifers |
| | | Soil pH and organic matter | Removal of harvested material decreases organic matter in soil |
| | | Average rainfall per growing season | Global climate change makes rainfall less predictable |
| | | | Higher temperatures and heavier rainfall cause more frequent and severe locust swarms |

| Capital | Dependency category | Example quantitative indicator | Example of relevant changes to capitals |
|---------|--------------------------------------|--|---|
| | Regulation of biological environment | Pollinators' population density | Neighboring farms use of pesticide, or climate change, causes a loss of natural pollination |
| | | Pest population density, such as mealybugs on cassava crops | Global trade has increased the prevalence of mealybugs on Asian cassava crops |
| | | Number of native plant species suitable for farming | Decrease of genetic diversity due to extensive hybridization of seeds |
| | Regulation of waste and emissions | Grams of pollutant assimilated per kilometer of river | Reduction in water level due to climate change results in higher levels of pollutant concentration in river |
| | Energy | Liters of fuel consumed by type of fuel and year | Scarcity levels of fossil fuels is expected to increase in coming years due to higher global consumption than discovery in new reservoirs |
| Human | Experience | Number of skilled workers from the local area, experienced in local weather patterns and harvest rhythms | Migration of youth to nearby cities means locally experienced farmers are less available for employment |
| | | Number of workers knowledgeable of the time required for ecosystem restoration | Local farmer networks and seminars increase experience sharing, growing the total stock of experience in the region. |
| | Skills and Knowledge | Number of workers with knowledge of the role of native species that improve crop resilience | Loss of biodiversity (natural capital) over generations means the knowledge of ecosystem functioning is lost |
| | | Number of critical skill gaps within the workforce | With new skills in the workforce, the company is able to explore crop processing activities |
| | Workforce availability | Number of workers needed to maintain business activity levels | The availability of local workers is expected to decline due to migration of people from rural to urban areas |
| | Health of workers | Rate of undernourishment in workforce | Undernourishment trends are expected to decline in the coming decade |
| | | Rates of depression and stress within workforce | Depression and stress cause higher turnover of staff |
| | | | |
| Social | Social networks (cooperatives) | Number of finance cooperatives present in the region | The presence of financial cooperatives provides sustainable finance locally, increasing access to credit for farmers to renew machinery and equipment |
| | Property rights | Average length of land tenure contracts with tenant farmers | Longer tenure contracts (5+ years) enhances long-term soil conservation practices, resulting in improved soil quality |
| | | Percentage of local genetically valuable organisms used by business | Increase in protest by local communities when overuse of genetically valuable organisms results in insufficient resources for local community |
| | Social acceptance and trust | Number of recorded conflicts in house resulting from misinformation | Lack of transparency leads to failure to reach out to all relevant parties and results in a minor problem escalating into a large conflict |
| | | Number and diversity of representatives at stakeholder meetings | Reduced opposition and protest against business activities and improved trust among stakeholders |

| Capital | Dependency category | Example quantitative indicator | Example of relevant changes to capitals |
|----------|--|---|---|
| | Law and order | Corruption Perceptions Index (CPI) published annually by NGO Transparency International | Agricultural input company sells their products to government agencies at a higher price to provide public officials with a share of the profit |
| Produced | Accessibility to infrastructure and technology | Number of businesses adopting similar technologies | Business innovates in line with country culture, so that any technological and methodological innovation can be scaled in surrounding community with ease |

6.2.3 Assess trends affecting the state of capitals

Having identified any external factors that may influence the state of natural, human, and social capital, you now should determine the trends associated with these factors.

Understanding trends in external factors is especially important where changes in capitals are non-linear, cumulative, or approaching critical thresholds. The effect of your impact drivers may be accentuated (or moderated) by external factors. This information may also be required for valuation (see Step 07).

It is not strictly necessary to distinguish natural from human-induced environmental change. Nevertheless, the distinction can be helpful as it may influence your choice of assessment methods, as well as the actions you take based on your assessment.

For changes in natural capital resulting from natural processes, the methods used will focus on ecological patterns and processes, while for human-induced changes the methods used will consider changes arising from emissions, resource use, and waste production (i.e., impact drivers). For changes in human and social capital occurring directly from human induced pressures, methods are likely to be focused on demographics, salaries, health condition, etc.

In some cases, it may be necessary to quantify the state and trends of capitals through direct measurement; in other cases, this can be done through estimation. For example, site-level analysis of ecosystem and/or abiotic services may require that you model current conditions in order to understand pre-existing pressures on the system. The additional impacts of your business are then introduced to the model, in order to determine the portion of change in the system that can be attributed to your business activities.

In other cases, it may be sufficient to consider the state and trends of capitals in qualitative terms, in order to validate the assumptions implied by your choice of assessment method. For example, some air pollution models assume that the ambient level of pollution is already above the threshold where health impacts occur and use a linear relationship to assess the impacts of additional pollution. In this example, you need only confirm your belief that the assumption is reasonable, rather than attempting to quantify the level of external pressures. Taking into account both natural and human-induced trends relevant to the capitals is essential for assessing scenarios, including “business as usual” and any other alternative options being considered.

Glossary :

Abiotic services

The benefits arising from fundamental geological processes (e.g., the supply of minerals, metals, oil and gas, geothermal heat, wind, tides, and the annual seasons).

Natural resources

Natural resources encompass a range of materials occurring in nature that can be used for production and/or consumption.

Renewable resources: These may be exploited indefinitely, provided the rate of exploitation does not exceed the rate of replacement, allowing stocks to rebuild (assuming no other significant disturbances). Renewable resources exploited faster than they can renew themselves may effectively become non-renewable, such as when over-harvesting drives species extinct (UN 1997).

Non-renewable resources: These will not regenerate after exploitation within any useful time period. Non-renewable resources are subdivided into reusable (e.g., most metals) and non-reusable (e.g., thermal coal).

6.2.4 Select methods for measuring change

Select the most appropriate method(s) for measuring or estimating relevant changes in the capitals for different impact and dependency pathways. In addition, where relevant, you may need to determine the likelihood of external factors affecting different changes in the capitals, particularly when assessing dependencies.

Measuring can be challenging and costly. Measuring impacts in the technical sense is difficult due to (among other factors) the length of time it can take for impacts to materialize, influences beyond business activities that affect the impacts measured, and the need for data outside of the scope of business operations. Businesses often focus on measurement at an earlier stage along the impact pathway as a proxy for impact and use data modeling techniques to understand what their longer-term impacts might be (WBCSD 2013). Businesses must be careful in their use of proxy indicators as proxies are no guarantee that businesses will deliver impact as anticipated.

a. Methods to assess changes in the capitals

There are different methods available for measuring and estimating changes in the capitals. The methods for measuring change can be classified in three main categories:

- a) Direct measurement,
- b) Standardized modeling methods, which are applicable to any context and therefore less detailed and low-resolution
- c) Bespoke modeling methods, which are developed for a specific context and therefore more detailed and high-resolution.

The appropriate choice will depend on the level of detail required, practicability within the available time and resources, and/or the geographic scope under consideration. Table 6.3 provides an overview of the standardized modeling methods that you could use. These are widely available and based upon well-established approaches such as life cycle impact assessment (LCIA) (Box 6.2) and can provide you with a first estimate and help you understand the limitations and convenience of using direct measurement approaches or more bespoke modeling methods.

Specific bespoke modeling methods can also be used on a case-by-case basis to supplement standardized modeling methods. For example, when measuring the change in water availability, a hydrological model could offer a simplified view of a system adapted to a location. Predictive models may be used in scenario analysis, displaying pollinator abundance in response to location-specific conditions. Where limited data exist, databases can be used to model response to certain impact drivers—for instance denitrification-decomposition models can indicate the soil organic carbon storage and distribution over a large land area with limited data. Changes in human populations are more challenging to model and rely on publicly available longitudinal data sets. For instance, it is possible to forecast future obesity rates using a multi-state life table model which outlines the probability of moving from one body mass index (BMI) to another over time, based on past data.

Table 6.3

Examples of standardized modeling methods for measuring changes in the capitals

| Capital | Impact driver category | Changes in capitals | Example of direct measurement | Example of standardized modeling methods |
|---------|-----------------------------|--|--|--|
| Natural | Water use | Change in water availability | Direct measurement of water level change | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | Terrestrial ecosystem use | Change in potential species loss | Measure change in richness and evenness of species between different land uses | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | GHG emissions | Change in global mean temperature Change in number of terrestrial and marine species Change in extreme weather conditions | Measure instances of extreme weather conditions over time | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | Pesticide and herbicide use | Change in human intake of chemical substances | Blood test for a cohort of population | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | | Change in number of species (i.e., pollinators) | Population survey of pollinators | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | Fertilizer use | Change in number of species in water ecosystems due to changes in nutrient level (from phosphorus concentration) in water (eutrophication) | Measure oxygen concentration in surrounding bodies of water | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | | Change in number of marine species due to changes in nitrogen concentration in coastal water | Measure oxygen concentration in surrounding bodies of marine water | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | Soil use | Change in soil organic carbon | Measure carbon content of a sample of soil in a laboratory. | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | Solid waste | Change in number of species affected by plastic littered to marine environment | Use published data on whale beaching to determine proportion of mortality caused by ingestion of plastic waste | For physical impacts: Models do not yet exist but some studies provide global estimates (i.e., the Secretariat of the Convention on Biological Diversity (2012) publishes the number of species with entanglement and ingestion records: 45% and 26% for marine mammals, 0.39% and 0.24% for fish, and 21% and 28% for seabirds) |
| | | | | For chemical impacts: Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |

| <i>Capital</i> | Impact driver category | Changes in capitals | Example of direct measurement | Example of standardized modeling methods |
|----------------|---|---|---|--|
| | | Change in capitals due to GHG emissions, land use, water consumption, and air, land, and water pollution emissions associated with disposal of waste (by waste type) via landfill, incineration, or recycling | | Life Cycle Impact Assessment models and characterization factors (for more detail see Box 6.2) |
| | Livestock conditions | Change in frequency of cattle infections | Direct count of cattle heads affected by infections in one year | Livestock epidemiological studies |
| <i>Human</i> | Nutritional content of food | Change in daily intake of saturated fats/sugar/refined carbohydrates | Dietary study with a cohort of population | Diet/nutritional models |
| | Use of substances harmful to consumers | Change in daily intake of antibiotic by people | Comparative study of antibiotic-resistant humans with meat- versus plant-based diet | Diet/nutritional models |
| | Food safety practices | Change in daily intake of pathogens by people | Number of individuals with bacteria induced diarrhea and vomiting | Diet/nutritional models |
| | Employee health and safety conditions | Change in risk of occupational illness and injuries due to fatigue and stress | Number of workers unable to work due to illness relating to pesticide use | Health and safety models/studies |
| | Salaries and benefits | Change in caloric intake by workers' families | Household survey | Income models (elasticity of demand for food to changes in income) |
| | Workers' living conditions | Change in risk of occupational illness and injury due to fatigue | Household survey | Health and safety modeling tools/studies |
| | Labor rights | Change in number of incidents of forced labor reported | Direct count | Not available |
| | Gender rights | Change in female employees' motivation at work | Survey to employees | Sectoral studies |
| | Workers' representation | Change in sense of ownership of the workforce Change in number of decisions taken with employee input in consideration | Number of decisions made with employee consultation included | Increase in productivity due to satisfactions of employees |
| | | | | |
| <i>Social</i> | Food security | Change in individuals' caloric intake | Household survey | Income models (elasticity of demand to prices of basic products) |
| | Food loss and waste | Change in global food security levels | | Integrated assessment food system models |
| | Integration of workforce into communities | Change in number of migrant workers with feeling of exclusion | Surveys | Sector studies |
| | Benefit sharing with indigenous communities | Change in annual contribution of the business to the community fund per year | Annual reports of the company | Not available |

Box 6.2 Life Cycle Impact Assessment to measure changes in natural capital

The Life Cycle Impact Assessment (LCIA) approach allows measuring changes in the stock of natural capital resulting from different impact drivers. The table below provides a description of the type of life cycle characterization factors. It also provides some examples of sources of Life Cycle Impact Assessment databases and models that you could use to measure the changes in natural capital resulting from different impact drivers on natural capital.

Table B1

Types of life cycle characterization factors and examples of data sources

| Impact driver | Change in the stock of natural capital | Type and scope of life cycle characterization factors to measure change in natural capital | Example of data sources of life cycle characterization factors |
|------------------------------------|--|---|--|
| <i>Water use</i> | Change in water availability | Water scarcity characterization factors describe the change in relative available water remaining as a result of water consumption in that area (m ³ world eq./m ³). These factors range from 0.1 and 100. | Life Cycle Initiative (2016) publishes them by: (i) watershed or country and (ii) month or year. They are published for agricultural and non-agricultural activities. |
| <i>Terrestrial ecosystem use</i> | Change in potential species loss | Global and regional characterization factors describe the change in potential species loss resulting from land use occupation and land use transformation (PDF/m ²). | Life Cycle Initiative (2016) publishes them for: (i) global and (ii) regional potential species loss. They are published for land use and change, by ecoregion or by country. |
| <i>GHG emissions</i> | Change in global mean temperature | Global characterization factors describe the change in global temperature potential in the short term (20 years) and long term (100 years) resulting from GHG emissions. | Life Cycle Initiative (2016) publishes them for all greenhouse gases (GHGs). |
| <i>Pesticide and herbicide use</i> | Change in human intake of chemical substances Change in number of species (i.e., pollinators) | Global characterization factors describe changes in: (i) human intake and (ii) potential species loss, resulting from release of chemical substances. | The USEtox model developed by Life Cycle Initiative provides these factors. |
| <i>Fertilizer use</i> | Change in number of species in water ecosystems due to changes in nutrient level (from phosphorus concentration) in water (eutrophication) | Two types of factors are needed: Freshwater Eutrophication Potential factors that describe the amount of phosphorus with potential to reach freshwater bodies. Global and/or country-specific characterization factors which describe the change in potential species loss from phosphorus discharge. | By end of 2020, global indicators for this impact category will be published by the Life Cycle Initiative. Meanwhile, different Life Cycle Impact Assessment models publish them at country level for agricultural activities (i.e., IMPACT World+ (Bulle et al. 2019), LC-Impact (Verones et al. 2016), and ReCiPe 2016 (Huijbregts et al. 2016)). |
| | Change in number of marine species due to changes in nitrogen concentration in coastal water | Characterization factors describe the change in potential species loss from nitrogen discharge. | |

| Impact driver | Change in the stock of natural capital | Type and scope of life cycle characterization factors to measure change in natural capital | Example of data sources of life cycle characterization factors |
|--------------------|---|---|---|
| <i>Soil use</i> | Change in soil organic carbon | Characterization factors describe the soil organic carbon deficit resulting from occupation and transformation to different land uses. | By end of 2020, global indicators for this impact category will be published by the Life Cycle Initiative. Meanwhile, a comprehensive description of methods and models available is given by Legaz et al. (2017). |
| <i>Solid waste</i> | Change in number of species affected by plastic littered to marine environment | For chemical impacts: Characterization factors describe marine toxicity resulting from harmful substances in plastics released. | Some life cycle impact assessment models such as Recipe and EUSES-LCA. |
| | Change in capitals due to GHG emissions, land use, water consumption, and air, land and water pollution emissions associated with disposal of waste (by waste type) via landfill, incineration or recycling | Most of the previous characterization factors describe changes in natural capital from pollution resulting from waste management. Besides them, characterization factors for other air pollutants (such as fine particulate matter) describe the intake of pollutants by population resulting from pollutant emissions. | Life Cycle Initiative (2016) publishes them for fine particulate matter. |

Box 6.3 shows the overall process for a river example. Meanwhile, box 6.4 highlights a few a few points relevant to different choices in organizational focus and value-chain boundaries that might be applicable to the chosen scope and boundaries of your assessment.

Box 6.3 Example of a business identifying natural capital risks related to freshwater use from a river and assessing these through the Components of impacts on their business and the impact on society.

A business uses fresh water from a river (a) leading to a reduction in water availability. The impact pathways identified key changes in natural capital associated with instream flows of water and associated changes in freshwater ecosystems of the river and riparian areas (b). Water availability is predicted to decrease over the next few years due to climate change and increased demand (c). Hence the business wants to understand both current changes and likely future changes based on predictions of climate change for the region (d).

The figure depicts the impact drivers identified in Step 05 and the associated changes in natural capital that relate to the business's impact drivers and to external factors affecting the state and trends. For each of the relevant changes a method is identified to estimate the change in natural capital and attribute it to the impact driver.

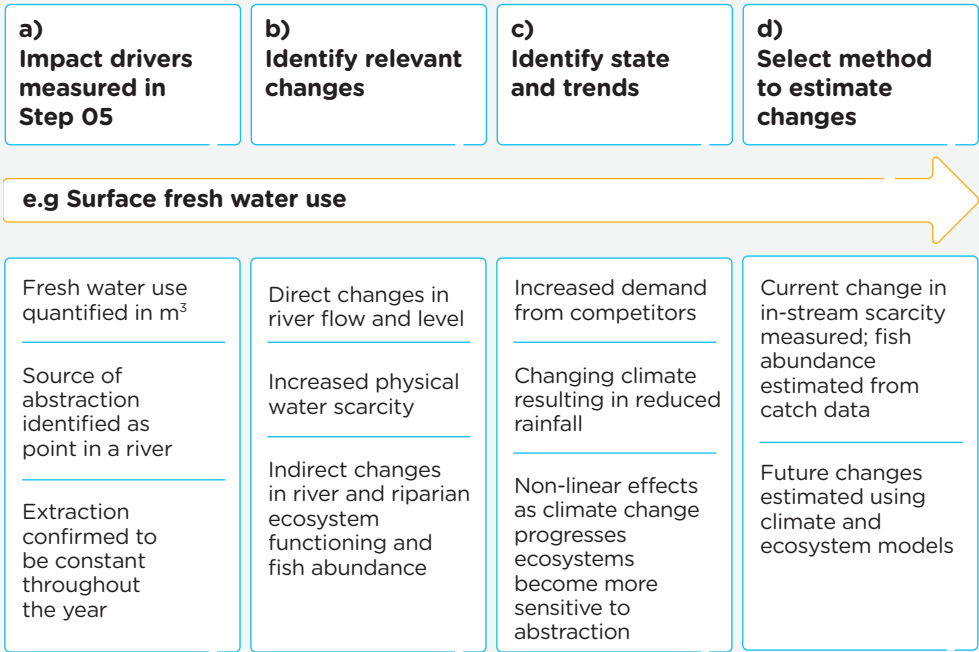


Figure 6.1
Example of how to identify natural capital changes related to impact drivers and external factors

Box 6.4 How your organizational focus and value-chain boundary influence the choice of measurement methods

Your organizational focus and the chosen value-chain boundary are two among many factors to consider when selecting measurement and estimation methods.

In general, a site-level assessment will favor direct measurement approaches, while a broader value-chain boundary often implies more reliance on simulation modeling or indirect estimation methods as direct measurement may not be possible. However, for vertically integrated businesses, or those with strong relationships with suppliers and customers and deep insights into the supply chain, it may be feasible to gather primary data for at least some activities all along the value chain.

A mix of methods may allow the use of the best available data for each part of the assessment. However, mixing different methods requires careful consideration to ensure consistency across different parts of an assessment. For example, if life cycle impact assessment (LCIA) factors are used to estimate changes associated with unobservable activities in the supply chain, while direct measurement methods are used for the business's own operations, it will be important to verify that both methods are based on the same principles and assumptions and therefore comparable to a reasonable degree.

b. Methods to assess likelihood of changes

For each internal and external factor you identify which could lead to a significant change to the capitals on which your business has material impacts or dependencies, you will need to estimate the likelihood of that factor occurring. In addition, you should consider the likely extent or magnitude of change, over what timescale, and at what geographical scale. This is particularly important for assessing dependencies.

A good approach is to develop probability-weighted estimates of changes (see below for reference to calculating this). Such a risk-based approach is especially relevant for dependencies, because many external impact drivers are not under your direct control and therefore their precision is unknown or uncertain; hence the value of interest is “value at risk” or, conversely, the risk-weighted opportunity of increased revenues.

For changes that are directly observed in real time, the relevant probability is 100%. For future or unobserved changes various methods can be used to assess the likelihood of change, including:

- **Probability-based analysis:** Quantitative estimates of likelihood can be derived by testing the statistical significance of relationships. For example, multivariate regressions can be used to identify the key contributors to observed trends, or Monte-Carlo analysis can be used to test the potential permutations of multiple possible data points, assumptions, and judgments, in order to identify the most likely outcome (central tendency).
- **Multi-criteria analysis:** Where multiple factors contribute to the likelihood of a change, multi-criteria analysis can be used to generate informed weightings of the influence of different factors on the overall likelihood of change in capitals. This is similar to multivariate analysis but typically uses judgments and expert opinion, rather than statistics, to produce the weightings.
- **Expert opinion and/or multi-stakeholder assessment:** In some cases, quantitative data will not be available and qualitative judgment or expert opinion is required. For example, the probability of a policy change affecting resource access rights will depend on the political context. In such cases, the views of experts and other stakeholders can help you establish a rough estimate of likelihood.

The likelihood or probability of change is then multiplied by the extent or magnitude of change, giving you an estimate of the probability-weighted change in capitals. Box 6.5 provides the example of a likelihood assessment, again relating to a business depending on fresh water from a river.

Box 6.5 Example of a business assessing business dependencies on freshwater use from a river

The business is dependent on its extraction and use of river water (a). It has identified potential natural changes in the supply of river water and human-induced changes from increased competition and altered access rights to the river (b). To understand the potential costs and/or benefits of these changes, the likelihood (c) and extent of changes (d) for each factor are required to then calculate the probability-weighted change (e).

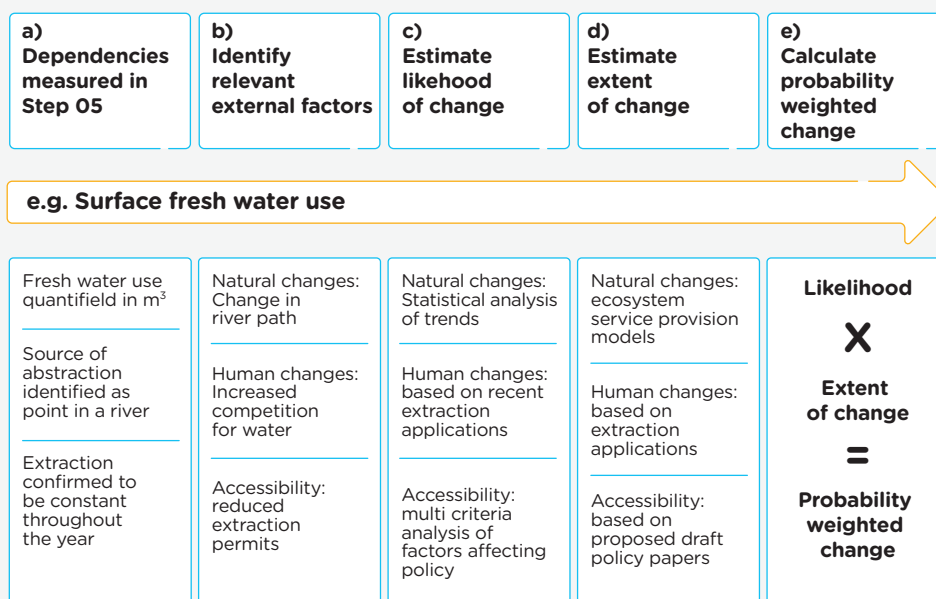


Figure 6.2

Example of how to estimate the likelihood and extent of natural capital changes related to dependencies

Your assessment of likelihood will have an important influence (directly proportionate) on the final results of the capitals assessment. However, assessments of likelihood are inherently uncertain and may be subjective, particularly when qualitative approaches are used to assess risk. Your sensitivity analysis of the final results (see Step 08) should consider a range of alternative values of likelihood, allowing you to identify the threshold level(s) of likelihood at which the assessment would lead to a different decision. It is often easier to judge whether a given level of likelihood is “reasonable” than to *a priori* pinpoint the exact probability for your chosen threshold, so threshold analysis can be a useful method to justify the results of the assessment and substantiate your decisions.

6.2.5 Undertake or commission measurement

The final action is to undertake, or commission an external provider to conduct, measurement or estimation for each capital change associated with each impact driver and/or dependency using the methods selected above. Outputs of this Step should include information on the likelihood of changes in the capitals and, where possible, weighted estimates of the attribution. This information can then be used as an input for sensitivity analysis (see Step 08) to understand how study results may vary based on changes to the assumptions you have made in this Step.

Measure the change in capitals with reference to the baseline scenario that you selected in Step 03. The baseline takes into account that changes in capitals will occur over time, regardless of your business activity. Consider which external factors are contributing to a change in the baseline independent of your activities. For example, to assess the outcome of your training strategy, you could measure the capabilities of your staff, however staff members may also invest in training on a personal basis for the purpose of improving their career opportunities. To measure these kinds of changes in capitals, comparison to a counterfactual scenario is necessary.

6.3 Outputs

The outputs should specify the changes in natural, human, social, and produced capitals associated with your activities, your impact drivers, and external factors. The resulting data may be qualitative and/or quantitative. In addition, where relevant, the outputs should include likelihood-weighted estimates of the attribution of changes. This is related in particular to dependency assessments. Equally, the information on likelihood and extent or magnitude of the changes measured should be retained for subsequent sensitivity analysis (see Step 08). These outputs form the principle input to Step 07, where the consequences of these changes in capitals for the business and society are valued.

Tables 6.4, 6.5, and 6.6 illustrate the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required for the Step. All values provided in the tables are for illustrative purposes only.

Table 6.4
Hypothetical example: Blossom Foods

| Blossom Foods | | | | |
|---|--------------------------------|--|--|---|
| Intended business application: comparing options | | | | |
| Each option has the same three material impacts, the values of which can be compared. | | | | |
| | Options | Specific impact occurring from each option | Quantitative/ qualitative indicator | Method for estimating capitals change |
| Impact | Option 1: Responsible Sourcing | Clean water and sanitation provision for local community | Number of households with access to clean water | Published datasets of improved access to water and sanitation health |
| | Option 2: Baseline minimum | Deforestation carried out by external organization | Reduction in volume of carbon absorbed by forest | Calculated carbon potential of enclave then scaled up. Historical databases collected in-house are also used. |
| | | Consumer demand for responsibly sourced commodity | Market trends of responsible commodity shares | Market analysis of consumer habits |

Table 6.5
Hypothetical example: VitaCrisp

| VitaCrisp | | | | |
|--|---------------------|--|--|--|
| Intended business application: comparing options | | | | |
| | Options | Specific impact occurring from each option | Quantitative/qualitative indicator | Method for estimating capitals change |
| Impact | Option 1: SuperOats | Human health impacts | Change in daily intake of saturated fats and sugar of consumers | Dietary study with a cohort of population |
| | Option 2: Wheat | GHG emissions | Change in global mean temperature and change in number of terrestrial and marine species | Life Cycle Impact Assessment models and characterization factors |

Table 6.6
Hypothetical example: Evolve Crops

| Evolve Crops | | | | |
|---|----------|----------------------------|---|--|
| Intended business application: estimate total value and/or net impact | | | | |
| | Capitals | Specific impact/dependency | Quantitative/qualitative indicator | Method for estimating capitals change |
| Impact | Natural | Soil use | Hectares of terrestrial ecosystem needed for production | GIS mapping |
| | | GHG emissions | Change in global mean temperature and change in number of terrestrial and marine species | Life Cycle Impact Assessment models and characterization factors |
| Dependency | Natural | Energy use | kWh by year | Forecast studies of electricity and oil prices |
| | | Water use | Water risk assessment of the river and ground water | Published hydroecological models |
| | Human | Expertise/knowledge | Local farmer networks and seminars increase experience sharing, growing the total stock of experience in the region | Direct collection of information |

07 Value impacts and/or dependencies

7.1 Introduction

Valuation is the process of determining the relative importance, worth, or usefulness of something in a particular context. Step 07 describes the main valuation techniques and helps you select the most appropriate one(s) for your assessment.

Valuation may involve qualitative, quantitative, or monetary approaches, or a combination of these. Note that in practice the distinctions between each type of valuation may become blurred. For example, in semi-structured surveys, respondents provide their qualitative opinion on a reference scale (the Likert scale, for example) that is immediately converted into (quantitative) scores. Likert scale scores are an example of a semi-quantitative technique as they are a conversion of qualitative information into quantitative data. The Guidelines do not define these differences in detail but rather indicate some of the strengths, weaknesses, and appropriateness of various valuation techniques.

To identify the appropriate valuation technique, select the type of value most suited to the information needs of your audience, the objectives of the assessment, and the time and resources available. Based on these criteria, you can then select an appropriate valuation technique. For example:

- Determine the type of value used: Is the audience interested in qualitative, quantitative, or monetary values, or a mix of these values (Better Evaluation Rainbow Framework) depending on the issue assessed?
- Select a fit-for-purpose valuation technique: Which valuation technique aligns with the chosen scope and anticipated deliverables?

While completing this Step and in preparation for the Apply Stage keep in mind that

- Valuing natural, human, and social capitals can be helpful but is not the only basis for decision making, hence results should be presented as part of a suite of information, including details of the wider socioeconomic, legal, and business context.
- There will always be estimation or uncertainty of some kind involved in your valuation. It is important to identify where this occurs and clearly document the limitations of your assessment. Even rough approximations of value, when combined with a good understanding of the context, can provide relevant information for decision making.
- It is likely that you will need assistance from external experts in economic valuation to undertake many of the methods described in this Step, unless you have access to these skills in-house.

In particular, these Guidelines will help you undertake the following actions:

What is the value of your impacts and/or dependencies?

7.2 Actions

In particular, these Guidelines will help you undertake the following actions:

- 7.2.1** Define the consequences of impacts and/or dependencies
- 7.2.2** Determine the relative significance of associated costs and/or benefits
- 7.2.4** Select appropriate valuation techniques
- 7.2.5** Undertake or commission valuation

Glossary :

Valuation technique

The specific method used to determine the importance, worth, or usefulness of something in a particular context.

7.2.1 Define the consequences of impacts and/or dependencies

Now that you have identified your impact drivers and dependencies (Step 05) and measured the associated changes in the capitals (Step 06), you should identify the costs and benefits for your business (the consequences). We split this into three areas: consequences for your business of your impacts on capitals, consequences for society of your impacts on capitals, and the consequences of your dependency on capitals.

a. Consequences for your business of your impacts on capitals

Impacts can affect your business directly, resulting in changes such as to the cost of production inputs, or increased compliance costs as labor regulations change, and indirectly through reputational damages (or benefits), delays in permitting, and employee attraction and retention.

As our understanding of the relationship between nature and people has increased, the trend in market mechanisms whereby companies must pay for their use of, or their impacts on, natural, human, and social capitals, or are eligible to receive payment for their stewardship of capitals, is growing. For example, the Carbon Pricing Leadership Coalition (2019) reported that there were 57 carbon pricing initiatives implemented or scheduled for implementation in 2019, covering 11 gigatons of carbon dioxide equivalent or about 20% of global GHG emissions. Similarly, payments for ecosystem services (PES) schemes can change a business's relationship with the capitals, as people managing and using natural capital are paid to manage resources to protect watersheds, conserve biodiversity, or capture CO₂ (carbon sequestration) through replanting trees or keeping living trees standing, or through using different agricultural techniques.

If the scope of your assessment extends over several years, you will need to consider not only potential future direct business impacts, but also the possibility that future business impacts may arise indirectly through your company's impacts on society.

b. Consequences for society of your impact on capitals

Your impacts on capitals will also affect society. Societal impacts include all costs or benefits accruing to individuals, communities, or organizations that are not captured through current market systems and are external to your business—these are often referred to as “externalities.” Societal impacts arise from changes in the capitals resulting from the impact drivers of your business and will vary depending on the “receptors” that are affected (for example, people, buildings, or other agriculture activities).

At the agricultural and food production level, societal consequences can be significant. Equity concerns arise when looking at the comparable distribution of productive resources, opportunities of employment and social services, gender and ethnic inclusiveness, and intergenerational opportunity.

Negative externalities from agriculture and food production typically affect human well-being directly, such as through the health impacts arising from the use of agrochemicals. In the European Union alone, exposure to endocrine-disrupting chemicals (mainly found in pesticides) costs approximately USD 174 billion per year in direct medical costs, in addition to indirect costs from lost worker productivity, early death and disability, and loss of intellectual abilities caused by prenatal exposure (Trasande et al. 2015). Indirect, downstream human health costs of agriculture and food production include the production of healthy grains being manufactured into high calorie snacks contributing to reduce societal malnutrition and obesity.

Glossary :

Externality

A consequence of an action that affects someone other than the agent undertaking that action, and for which the agent is neither compensated nor penalized. Externalities can be either positive or negative (WBCSD et al. 2011).

On the other hand, most positive externalities (outputs) from agriculture and food production are visible and generally marketed, such as food and raw materials. It is estimated that there are 500 million family farms globally and that farming employs one-quarter of the globally employed population (Sandhu et al. 2019). Less economically visible positive externalities include enhanced ecosystem services (such as pollination, predation, water purification, and soil formation) and cultural and aesthetic amenities of traditionally farmed landscapes and the provision of habitats for plant and animal species (TEEB 2014).

Further down the food value chain, food processing, marketing, consumption, and disposal have important societal externalities. Produced but uneaten food accounts for close to 30% of the world's agricultural land area. These losses represent USD 2.6 trillion in costs to society because food wastage represents a missed opportunity to improve global food security and to mitigate environmental impacts generated by agriculture (FAO 2014c).

While assessing your company's impacts on society can be more demanding and challenging than assessing impacts on your business, it is more likely to identify risk and opportunities that may be internalized in the future.

c. Consequences of dependencies on capitals

The dependency of your business on the capitals primarily affects the business itself. Dependencies are often addressed within risk analysis and can fall into either the capital stock (natural, human, or social resources) or the services that the stock provides (e.g., ecosystem services, capabilities, cooperation, and trust).

Variations in resource availability will affect costs and benefits and may result in the necessity of identifying substitute resources, which may be more expensive. Potential costs and benefits associated with business dependencies fall into two categories: consumptive—or goods that you rely upon for your business (for example, water and timber)—and non-consumptive—goods or services nature and people provide that are often unseen and unpriced (for example, erosion control and consumer trust). Capitals may decline in size and quality thereby providing reduced benefits (e.g., flood protection or productivity of workers). This may lead to increased risk (e.g., flood risk or loss of market share) or a need to spend money replacing the function of these services from capitals.

Table 7.1 presents some sector-specific examples of the consequences associated with capital impacts that were introduced in Step 01 and Step 06. These capital impacts are presented in terms of their consequences for business and for society. Table 7.2 presents some sector-specific examples of the consequences associated with capital dependencies. These dependencies are presented in terms of their consequences for business.

Table 7.1
Examples of the consequences of capital impacts

| Capital | Impact driver category | Example of changes in capitals resulting from the impact driver | Example of relevant impact on people and society from different impacts drivers |
|---------|--|--|--|
| Natural | Water use | Change in water availability in same watershed | <p>Impact on society: Change in infectious diseases incidence (i.e., diarrhea) due to change in intake of low-quality water or lack of water for hygienic purposes (DALY). For a definition of DALY, see Box 7.1.</p> <p>Impact on society: Changes in food security due to changes in water availability for irrigation and fisheries/aquaculture activities (DALY)</p> |
| | Terrestrial ecosystem use | Change in global/regional potential species loss | Impact on society: Change in ecosystem services provision (USD) |
| | GHG emissions | Change in global mean temperature and change in number of terrestrial and marine species | <p>Impact on society:</p> <p>Change in disease and flooding incidence (DALY)</p> <p>Change in ecosystem services provision (USD)</p> <p>Change in fish stock availability (tons)</p> |
| | Pesticide and herbicide use | <p>Change in human intake of potentially harmful chemical substances in pesticides</p> <p>Change in number of species (i.e., pollinators)</p> | <p>Impact on society:</p> <p>Change in diseases incidence (DALY)</p> <p>Change in ecosystem services provision (USD)</p> |
| | Fertilizer use | Change in number of species in water ecosystems due to changes in nutrient level in water (eutrophication) | <p>Impact on society: Change in ecosystem services provision (USD)</p> <p>Impact on your business: Expenditure of non-absorbed fertilizer (USD)</p> |
| | | Change in number of marine species due to changes in nitrogen concentration in coastal water | |
| | Soil use | Change in soil organic carbon | Impact on your business: Change in yields due to change in water retention capacity of soil (tons) |
| | Solid waste | Change in number of species affected by plastic littered to marine environment | Impact on society: Change in ecosystem services provision (USD) |
| | | Change in capitals due to greenhouse gas emissions, land use, water consumption, and air, land, and water pollution emissions associated with disposal of waste (by waste type) via landfill, incineration, or recycling | Impact on society: Change in human health and ecosystem service provision due to greenhouse gas emissions, land use, water consumption, and air, land, and water pollution emissions associated with disposal of waste via landfill, incineration, or recycling (DALY, USD) |
| Human | Livestock conditions | Change in frequency of cattle infections | Impact on your business: Change in livestock production (tons) |
| | Nutritional content of food | Change in daily intake of saturated fats/sugar/refined carbohydrates | Impact on society: Change in disease incidence, such as chronic and acute disease, especially cardiovascular diseases, diabetes and some cancers (DALY) |
| | Use of substances harmful to consumers | Change in daily intake of antibiotics by people | <p>Impact on society:</p> <p>Change in duration of infectious diseases (DALY)</p> <p>Change in amount of antibiotics consumed to have effective response (USD)</p> <p>Impact on your business:</p> <p>Expenditure on antibiotic used in preventive treatments (USD)</p> |

Introduction

Frame stage

Scope stage

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Apply stage

References

| <i>Capital</i> | Impact driver category | Example of changes in capitals resulting from the impact driver | Example of relevant impact on people and society from different impacts drivers |
|----------------|---|---|---|
| | Food safety practices | Change in daily intake of pathogens by people | Impact on society: Change in disease incidence (e.g., diarrhea, cancer) (DALY) |
| | Employee health and safety conditions | Change in daily intake of/ exposure to endocrine disrupting chemicals from pesticides by workers/ workers' family members | Impact on your business and society: Change in number and severity of injuries and fatalities (lost time injury frequency rate and fatal injury frequency rate) |
| | | Change in fatigue and stress level of workers | |
| | Salaries and benefits | Change in caloric intake of workers' families | Impact on your business: Change in worker productivity (USD) |
| | Workers' living conditions | Change in risk of occupational illness and injury due to fatigue | Impact on your business and society: Change in working fatalities/injuries due to fatigue and stress (DALY) |
| | Labor rights | Change in number of incidents of forced labor reported | Impact on your business: Change in value of the brand (USD) |
| <i>Social</i> | Gender rights | Change in female employees' motivation | Impact on your business: Change in productivity of workforce due to lack of motivation (USD) |
| | Food security | Change in people's caloric intake | Impact on society: Change in productivity of workforce (USD) Change in potential development of future generations (USD) |
| | Food loss and waste | Change in global food security levels | Impact on society: Change in productivity of workforce (USD) Change of health impacts (DALY) and potentially disappeared fraction of species (PDF) due to reduction of food waste generation |
| | Integration of workforce into communities | Change in number of migrant workers with feeling of exclusion | Impact on your business: Change in voluntarily turnover rate (%) |
| | Benefit sharing with indigenous communities | Change in number of people reached through community engagement | Impact on your business: Change in duration of license to operate (years) |

Box 7.1. Disability Adjusted Life Years

The Disability Adjusted Life Years (DALY) is one of the existing metrics used to measure impacts on health. A DALY is equivalent to one lost year of “healthy” life. The sum of DALYs across a population affected by different impact drivers (i.e., air or water pollution) measures the gap between the health status with and without the occurrence of these impact drivers. DALYs for a disease or health condition are calculated as the sum of the years of life lost (YLL) due to premature mortality in the population and the years lost due to disability (YLD) for people living with the health condition or its consequences.

Table 7.2
Examples of the consequences of capital dependencies

| Capital | Dependency category | Example of relevant changes on capitals | Example of relevant impacts on people and business resulting from dependencies |
|---------|--------------------------------------|--|---|
| Natural | Water availability | Due to company's increased extraction, local aquifer falls | Local residents have to comply with a hosepipe ban and launch a legal case against the company (USD) |
| | Water quality | Upstream intensive agriculture, results in worsening water turbidity | Farm loses productivity from irrigating crops with turbid, contaminated water (USD) |
| | Regulation of physical environment | Deforestation to make space for farmland results in greater soil runoff and eutrophication of rivers | The company incurs legal costs and penalties due to health problems caused in local communities downstream (USD) |
| | | Hectares of habitats providing water filtration | Local farmers have to pay for piped water, reducing profit and income (USD) |
| | | Removal of harvested material decreases organic matter in soil | Soils need to be supported with artificial fertilizer to maintain yields, causing expense to farmers and enforcing power structures of fertilizer providers (USD) |
| | | Global climate change makes rainfall less predictable | Commodity exporters move farms to less vulnerable geographies, removing job availability in climate-vulnerable areas (number of jobs) |
| | | Higher temperatures and heavier rainfall cause more frequent and severe locust swarms | |
| | Regulation of biological environment | Neighboring farm's use of pesticide, or climate change, causes a loss of natural pollination | The company needs to import artificial pollinators to its farm, year on year, increasing operational costs (USD) |
| | | Global trade has increased the prevalence of mealybugs on Asian cassava crops | Cassava yields decline, and company is forced to reduce their margins to avoid losing market quota (USD) |
| | | Decrease of genetic diversity due to extensive hybridization of seeds | Disease causes crop failure due to reduced resilience from low genetic diversity of seed (USD) |
| | Regulation of waste and emissions | Reduction in water level due to climate change results in higher levels of pollutant concentration in river | Company experiences an increase in water treatment cost for irrigation (USD) |
| | Energy | Scarcity of fossil fuels is expected to increase in coming years due to higher global consumption than discovery in new reservoirs | Increase in price of fossil fuels (USD) |

| Capital | Dependency category | Example of relevant changes on capitals | Example of relevant impacts on people and business resulting from dependencies |
|----------|--|---|---|
| Human | Experience | Migration of youth to nearby cities means locally experienced farmers are less available for employment | Company suffers a loss of experience in its workforce, which means more money spent on research and trials (USD) |
| | | Local farmer networks and seminars increase the sharing of experience between others, growing the total stock of experience in the region. | Company profits are improved due to an increase in the knowledge levels of workforce (USD) |
| | Skills and Knowledge | Loss of biodiversity (natural capital) over generations means the knowledge of ecosystem functioning is lost | Company resorts to expensive, artificial solutions to improved resilience as the knowledge of biodiversity is lost (USD) |
| | | With new skills in the workforce, the company is able to explore crop processing activities | The company can expand into more value-added activities, sell for higher prices, and pay better salaries (USD) |
| | Workforce availability | The availability of local workers is expected to decline due to migration of people from rural to urban areas | Company must invest in technology to reduce farmer workload, as well as run regional programs to attract younger generations of workers and address their needs (USD) |
| | Health of workers | Undernourishment trends are expected to decline in the coming decade | Company experiences improvements in productivity due to higher levels of nourishment in the workforce (USD) |
| | | Depression and stress cause higher turnover of staff | Company suffers loss of skills and knowledge when workforce leaves due to mental health (USD) |
| Social | Social networks (cooperatives) | The presence of financial cooperatives provides sustainable finance locally, increasing access to credit for farmers to renew machinery and equipment | Increase in yields due to the use of modern equipment (USD) |
| | Property rights | Soil quality (natural capital) and therefore yield tends to be higher on tenure contracts signed for 5+ years | Increase of yields due to better preservation of soil so tenant farmers have an increase in income (USD). Increased resilience to climatic shocks (USD) |
| | | Increase in protest by local communities as overuse of genetically valuable organisms results in insufficient resources for local community | The company experiences an increase in expenditure on security to protect installations and legal processes from the community (USD) |
| | Social acceptance and trust | Lack of transparency leads to failure to reach out to all relevant parties and results in minor problem escalating into large conflict | Increased cost of hiring people due to a reduction on company's ability to attract and retain employees (USD) |
| | | Reduced opposition and protest against business activities and improved trust among stakeholders | The value of the brand increases (USD) |
| | Law and order | Agricultural input company sells their products to government agencies at a higher price to provide public officials with a share of the profit | The company experiences a drop in the value of the brand once the payment of commissions is made public (USD) |
| Produced | Accessibility to infrastructure and technology | Business innovates in line with country culture, so that any technological and methodological innovation can be scaled in surrounding community with ease | The value of the brand increases and the crops yield increases due to enhancement of natural capital (USD) |

7.2.2 Determine the relative significance of associated costs and/or benefits

To identify the most significant impacts and/or dependencies—where you should focus your valuation efforts—you should first reassess the relative significance of each associated cost and benefit from Step 04 now that you have more information from Steps 05 and 06. For example, your materiality assessment may have identified water use as a material issue, but it may not be until you complete Steps 05 and 06 that you are able to identify the associated changes in capitals and the range of accompanying impacts on your business and your impacts on society (e.g., implications for nearby wetlands and recreational impacts).

Note: Depending on the scope of your assessment, you may need to consider the extent of the impacts and/or dependencies both now and in the future, the likelihood of market and/or regulatory change, the geographic area over which impacts occur, and the relevant time horizon of the assessment.

7.2.3 Types of valuation techniques

Valuation is the process of determining the importance, worth, or usefulness of something in a particular context. Understanding this context, which can be social, environmental, and/or economic, is essential, as without such understanding you cannot meaningfully estimate value or correctly interpret results. Much of the contextual information you need will have been identified in Steps 01 to 06, but it is important to review this as you proceed.

A popular valuation shortcut is “value transfer.” This involves using the results of previous assessments, rather than collecting primary data for a new analysis. While there are important limitations to the value transfer approach as the results are often less accurate or credible, assessments using this shortcut are often easier and quicker, hence their popularity. You can find more detail about value transfer approaches in Box 7.1 of the Natural Capital Protocol.

For each cost and/or benefit identified, you will need to select an appropriate valuation technique based on whether you intend to assess values in qualitative, quantitative, or monetary terms.

- **Qualitative valuation** techniques are used to inform the potential scale of costs and/or benefits expressed through qualitative, non-numerical terms (e.g., increase in health impacts from fertilizer use, decrease in value of the brand due to corruption scandals). It relies on data and information that can be descriptive in nature and/or convey more subjective perceptions of change. Normally implemented through questionnaire surveys, deliberative approaches, or expert opinions, qualitative valuation may be useful for a preliminary identification of impacts and/or dependencies and is sometimes the only approach possible given the nature of the assessment and/or data available. Qualitative valuation may express relative value using terms such as high, medium, or low, or ranking options using defined categories. The process of developing scales as part of a relative valuation approach is as important and can be as complex as deciding upon measurement metrics (WBCSD 2016b). Qualitative valuation may also take the form of stories, case histories, selected quotations, or expressions of emotional responses to changes in capitals.
- **Quantitative valuation** techniques focus on numerical data which are used as indicators for these costs and/or benefits (e.g., rate of decrease in fish-stock in local river, increase in percentage of people undernourished). Such techniques are used to express the value of impacts and/or dependencies in numerical, non-monetary, terms. It is different from quantitative measurement in that quantitative valuation relates to the importance, worth, or usefulness of the impact and/or dependency by taking into account the context and ideally including affected stakeholders. So, for example, a business creating 1,000 jobs in an area with 15% unemployment may cause an impact of far greater value to stakeholders than a business creating 2,000 jobs in an area where there is a 5% unemployment rate. Quantitative valuations typically require quantitative measures as an input (e.g., the number of jobs created); these quantitative measures are also a prerequisite for monetary valuation.

- **Monetary valuation** techniques translate quantitative estimates of costs and/or benefits into a single common currency. These techniques are used to determine the value of impacts and/or dependencies in a common unit of measure, such as US dollars, euros, etc., for ease of comparison with financial values (e.g., business costs or revenue). Monetary valuation (if sufficient information is available) is best used to provide information on the marginal value/net costs or benefits of an intervention that alters the quality and/or quantity of natural, human, and social capitals, either at a point in time or over a given period. It can also be useful for assessing the distribution of costs and benefits among different stakeholders or the cost-benefit ratio of different interventions. Most monetary valuation techniques aim to measure changes in well-being (see Annex B of the Natural Capital Protocol for more detail on these valuation techniques). The monetary valuation of capital impacts and/or dependencies may require statistical techniques that are best carried out by qualified experts.

For further discussion on advantages and disadvantages of each type of valuation, see Table 7.3 of the Natural Capital Protocol.

Different audiences will have different needs and preferences concerning the information they use to make decisions, including preferences for qualitative, quantitative, or monetary valuation:

- An assessment designed for external stakeholders, such as local communities, might focus on qualitative and quantitative valuation techniques that are transparent and that non-experts can easily understand, such as total injuries avoided or change in antibiotic resistance.
- If governments are an intended audience, they may be interested in the monetary valuation of capitals impacts. Certain forms of monetary valuation can reflect the preferences and priorities of citizens or identify opportunities for governments to save costs as a result of welfare improvements or improved efficiency in resource use. Examples include: a business's direct contribution to reduction of food loss and waste; government savings from avoided health spending due to improvement in safety measures; and well-being changes among communities due to business reduction in pollution levels.
- Internal stakeholders may be more interested in performance against quantitative targets or key performance indicators alongside impacts on departmental budgets.

7.2.4 Select appropriate valuation techniques

The choice of valuation technique depends on which impact drivers or dependencies you wish to assess, the chosen value perspective (i.e., business, societal, or both), the ultimate objective of your assessment, and the time and resources available. There may be trade-offs between different valuation techniques in terms of their relative precision, time, and cost and utility for the desired use. All valuation methods have advantages and disadvantages (TEEB 2010) and generally speaking a sequential, pragmatic approach of identifying and estimating costs and/or benefits qualitatively, followed by quantification and monetization, when possible, is recommended (TEEB 2011). An important valuation limitation can be uncertainty around potential future costs or benefits, particularly in proximity to critical thresholds and potentially irreversible changes. A precautionary approach is therefore advisable in some contexts.

Various factors will influence which valuation techniques are best for your assessment. As well as identifying which techniques are most appropriate for your chosen scope, you will want to take account of data availability, budget and time constraints, the level of stakeholder engagement desired, and the degree of accuracy required for your objective. Qualitative valuation techniques, for example, are good for eliciting contextual detail and intangible values, but do not provide numerical precision, measures of variance within a sample, or results that can be easily compared to financial costs and benefits.

Table 7.1 of the Natural Capital Protocol (p. 84-85) summarizes these factors and will help you select the technique(s) appropriate for your needs. If adequate data do not exist and/or you do not have time or resources for primary research, the most cost-effective approach is to use value transfer and this is a common place to start. Value transfer is not as reliable as primary valuation, so you need to bear this in mind when applying the results. Table 7.1 of the Natural Capital Protocol also gives an indicative time and budget rating on a three-point scale.

Table 7.3 outlines examples of techniques to value consequences those impacts on natural, human and social capitals identified in Table 7.1. The market valuation is the technique that you could use to value the consequences of the dependencies identified in Table 7.2.

Table 7.3

Examples of techniques to value consequences of impacts

| Capital | Impact driver category | Example of relevant impact on people and society | Example of quantitative valuation techniques | Example of monetary valuation approach |
|---------|---|--|--|--|
| Natural | Water use | Change in infectious disease incidence (i.e., diarrhea) due to change in intake of low-quality water or lack of water for hygienic purposes (DALY) | Life Cycle Impact characterization factors which measure the changes in incidence of diseases per cubic meter of water use | DALYs valuation (see Box 7.5) |
| | | Change in food security due to changes in water availability for irrigation and fisheries/aquaculture activities (DALY) | | |
| | Terrestrial ecosystem use | Change in ecosystem services provision (USD) | Life Cycle Impact characterization factors | PDF valuation (see Box 7.3) |
| | GHG emissions | Change in ecosystem services provision (USD) | Integrated Assessment Models (IAMs) | Social cost of carbon (SCC) (see Box 7.4) |
| | | Change in ecosystem services provision (USD) | | |
| | | Change in fish stock availability (tons) | | |
| | Pesticide and herbicide use | Change in disease incidence (DALY) | Life Cycle Impact characterization factors | DALY valuation (see Box 7.2) |
| | | Change in ecosystem services provision (USD) | Life Cycle Impact characterization factors | PDF valuation (see Box 7.3) |
| | Fertilizer use | Change in ecosystem services provision (USD) | Life Cycle Impact characterization factors | PDF valuation (see Box 7.3) |
| | | Expenditure of non-absorbed fertilizer (USD) | Direct measurement or studies | Market valuation |
| | Soil use | Change in yields (tons) | Biophysical modeling | Market valuation |
| | Solid waste | Change in ecosystem services provision (USD) | | Contingent valuation (or value transfer) to assess existence value of marine species |
| | | Change in human health and ecosystem service provision due to greenhouse gas emissions, land use, water consumption, and air, land, and water pollution emissions associated with disposal of waste via landfill, incineration, or recycling (DALY, USD) | Life Cycle Impact characterization factors | DALY valuation (see Box 7.2) PDF valuation (see Box 7.3) Social cost of carbon (SCC) (see Box 7.4) |
| | Livestock conditions | Change in livestock production (tons) | Livestock epidemiological studies | Market valuation |
| Human | Nutritional content of food | Change in disease incidence, such as chronic and acute disease, especially cardiovascular diseases, diabetes, and some cancers (DALY) | Nutritional studies/modeling approaches | DALY valuation (see Box 7.2) |
| | Use of harmful substances for consumers | Change in duration of infectious diseases (DALY) | Toxicological studies/modelling | DALY valuation (see Box 7.5) |
| | | Change in amount of antibiotics consumed to have effective response (gr) | Toxicological studies/modeling approaches | Market valuation |
| | | Expenditure in antibiotic used in preventive treatments (USD) | Toxicological studies/modeling approaches | Market valuation |

| Capital | Impact driver category | Example of relevant impact on people and society | Example of quantitative valuation techniques | Example of monetary valuation approach |
|---------|---|---|---|---|
| | Food safety practices | Change in disease incidence (e.g., diarrhea, cancer) (DALY) | Toxicological studies/modeling approaches | DALY valuation (see Box 7.2) |
| | Employee health and safety conditions | Change in working fatalities/injuries due to fatigue and stress (lost time injury frequency rate and fatal injury frequency rate) | Direct measurement or studies/modeling approaches (see Box 7.6) | Monetary valuation of healthcare costs, productivity/earnings loss, and quality of life loss (see Box 7.5). |
| | Salaries and benefits | Change in worker productivity (USD) | Studies/modeling approaches | Market prices |
| | Workers' living conditions | Change in working fatalities/injuries due to fatigue and stress (DALY) | Studies/modeling approaches | DALY valuation (see Box 7.2) |
| | Labor rights | Change in value of the brand (USD) | Direct measurement approaches | Market valuation |
| | Gender rights | Change in productivity of workforce due to lack of motivation (USD) | Direct measurement approaches | Market valuation |
| Social | Food security | Change in productivity of workforce (USD) | Studies/modeling approaches | Market valuation |
| | | Change in potential development of future generations (USD) | | |
| | Food loss and waste | Change in productivity of workforce (USD) | Studies/modeling approaches | Market valuation |
| | | Change of health impacts (DALY) and potentially disappeared fraction of species (PDF) due to reduction of food waste generation | Life Cycle Impact characterization factors | DALY valuation (see Box 7.2) PDF valuation (see Box 7.3) |
| | Integration of workforce into communities | Change in voluntarily turnover rate (%) | Direct measurement/studies | Market valuation (hiring/adaptation costs) |
| | Benefit sharing with indigenous communities | Change in duration of license to operate (years) | Direct measurement | Market valuation |

Box 7.2 Disability Adjusted Life Years (DALYs) valuation

In several studies across the food sector, DALYs lost have been valued based on global estimates of the value of a life year. By using global median values, ethical challenges associated with assigning a higher value in high income countries compared to low income countries can be avoided. Alternatively, global estimates can be adapted by country using income levels and income elasticity. Please see TEEBAgriFood case studies by Raynaud et al. 2016, Bogdanski et al. 2017, and Balthussen et al., 2017.

Box 7.3 Potentially Disappeared Fraction (PDF) valuation

In a number of studies across the food sector, the monetary value of changes in ecosystem service provision has been assessed by measuring how changes in species richness can result in changes in ecosystem function and therefore the value of the ecosystem services provided.

These studies have focused on establishing the link between PDF and a measure of ecosystem function (such as net primary productivity) for specific ecosystem types and then valuing the resulting change in ecosystem services provided by each ecosystem type. Please see studies by Raynaud et al. 2016, Bogdanski et al. 2017, and Balthussen et al. 2017.

Box 7.4 Social Cost of Carbon (SCC)

Greenhouse gas (GHG) emissions can be valued in monetary terms using an estimate of the social cost of carbon (SCC). The social cost of carbon is an estimate of the monetary value of impacts of an incremental increase in GHG emissions in a given year and reflects the full global cost of the damages caused by GHG emissions over their lifetime in the atmosphere. Integrated Assessment Models (IAMs) are used to translate economic and population growth scenarios, and the resulting GHG emissions, into changes in atmospheric composition and global mean temperature.

The Interagency Working Group on the Social Cost of Carbon provides these estimates (IWGSCC 2013).

Other alternatives are: (i) market prices observed in emissions trading schemes (ETS) and (ii) estimates of the marginal abatement cost (MAC) of GHG reductions.

Box 7.5 Measurement and valuation of injuries and fatalities at work

The measurement of injuries and fatalities at work can be conducted through:

Direct measurement of injuries and fatalities at work. Estimation of recovery due to injuries and/or lost years of life due to a workplace fatality (it can be assessed by, for instance, estimating average workforce age and the average lifespan of individuals in each country).

Studies/modeling approaches. For example, some studies assess the potential increase of illness and injury due to overtime (i.e., Dembe et al. 2005) or the risk of stroke due to overtime (i.e., Kivimäki et al. 2015).

For the monetary valuation of injuries and fatalities at work, various studies on the value of socioeconomic impacts in different sectors (including Trucost 2019) consider three components:

Healthcare costs. This can be done by using national health insurance systems' reference cost of treatments.

Productivity losses /earnings losses during recovery time or time unable to work.

Lost quality of life due to injury and recovery Disability weights (World Health Organization 2017) reflect the severity of a disease on a scale from 0 representing perfect health to 1 representing death. The disability weight for a disease can be interpreted as the fraction of one year of life at full health that is lost, or the number of DALYs lost per annum, due to an illness or injury. DALYs can be valued using the DALY valuation approach outlined above.

When using a mix of techniques and/or measuring different value perspectives, you should ensure that values are consistent with one another—especially if you are going to directly compare or aggregate them. For example, when considering monetary values associated with providing a training course, it is possible to measure in monetary terms both the resource cost to a business of running the course and the well-being benefit to an individual from the increased earnings they can expect as a result of taking the course. The first value represents the value of the impact driver to the business, while the second value represents the value of the impact; therefore, they represent different stages of the impact pathway and should be compared with caution. Only values that represent the same level of the impact pathway and use comparable valuation techniques may be simply aggregated into a total impact figure—apply caution when comparing or aggregating in other circumstances. Also pay attention to the distribution of value between different stakeholder groups.

Level of rigor and granularity: Determine the appropriate level of rigor to apply. Some businesses may decide that relatively broad estimates are sufficient to inform key decisions and will withstand critique from internal and external stakeholders. Other businesses may choose techniques that have higher levels of accuracy and credibility but may be time- and labor-intensive. Whatever the choice, it is advisable to be transparent about the level of uncertainty in the results. You can do this by conducting sensitivity analysis (Step 08) to examine the effect of changes in key data or assumptions on your results.

Techniques to value the consequences of impacts on natural, human, and social capital may be used to assess the value of incremental or marginal changes in capital stocks or flows, which will be relevant for most business applications. The same techniques can be used to assess the total (aggregate) value of capital stocks, although this is rarely necessary and may require additional analysis. Box 7.3 of the Natural Capital Protocol provides an overview of the valuation of natural capital stocks through qualitative, quantitative, or monetary assessments, discussing some of the challenges associated with assumptions required to determine some of these values. For further guidance on using each of the valuation techniques for natural capital assessments, refer to Annex B in the Natural Capital Protocol.

Note: Expert input is likely to be helpful here considering the range of factors that influence the practicality and appropriateness of applying the various techniques.

Willingness to pay (as measured through different valuation techniques) and market price for a good or service are different concepts. Willingness to pay measures the maximum amount someone would be prepared to pay for a good or service. It is determined by an individual's tastes and preferences, and is constrained by their income (i.e., their ability to pay). Market price represents what is actually paid for a good or service. It is determined by market and institutional factors (e.g., market structure and competition, regulatory interventions, and aspects such as property rights). Understanding the difference between WTP and market price gives an insight into the value of your impacts on society.

A key issue for all monetary valuations is to avoid double counting. This can occur, for example, when intermediate costs and/or benefits, rather than only final costs and/or benefits, are assessed. For example, the value of wheels is included in the price of a car sold. So, recording both the price of wheels and the price of cars in a balance sheet is an example of double counting. Note that recent advances in the classification of ecosystem services, such as the Common International Classification of Ecosystem Services (EEA CICES 2016) and Final Ecosystem Goods and Services Classification System (FECS 2012) classification systems, may help to avoid double counting.

Note: Refer back to your planning issues from Step 03, as this may influence which valuation technique is most appropriate.

Box 7.6 Discounting in capitals valuation

Where capitals valuation relates only to private costs or benefits to a business, it is appropriate to use that business's normal financial discount rate to express future costs or benefits in present value terms (i.e., the standard "hurdle rate" used for project appraisal, or the business's weighted average cost of capital (WACC)).

However, it is rare that decisions relating to capitals have purely private consequences attributable only to the decision-maker. It is therefore much more likely that valuation will need to consider costs or benefits accruing to third parties (referred to as impacts on society).

Where these future societal costs or benefits are concerned, it is appropriate to apply a discount rate which reflects the balance of preferences (among all the affected stakeholders) for consumption now versus consumption in the future – this is referred to as a societal or social discount rate (SDR).

Societal discount rates vary but are almost always lower than normal financial discount rates, principally because they attempt to reflect the well-being of future generations as well as generations alive today. This can be particularly important in the context of natural capital which, unlike most other forms of capital, can continue to provide benefits indefinitely if it is managed well.

Typical social discount rates range between 2-5%, but in some contexts higher, lower, and even negative discount rates can be justified. A common approach to address potential debate about the appropriate discount rate is to test the sensitivity of results and conclusions using multiple different discount rates.

A thorough discussion of discounting in the context of biodiversity and ecosystem services is included in Chapter 6 of TEEB's "Ecological and Economic Foundations" report (TEEB 2010).

7.2.5 Undertake or commission valuation

You should now be in a position to either undertake or commission the relevant valuation for your chosen assessment.

Note: Because significant training and applied experience is generally required to apply valuation techniques with confidence, these Guidelines do not give details on application and execution of these techniques.

7.3 Outputs

The output of this Step should include:

- A completed valuation (whether qualitative, quantitative, or monetary) of costs and benefits.
- Documentation of all key assumptions, data sources, limitations, methods used, and resulting values.

Step 07 of the Guidelines has provided additional guidance to help you define the consequences of natural, social, and human capitals impacts and dependencies. Tables 7.4, 7.5, and 7.6 illustrate the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required for this Step. All values provided in the tables are for illustrative purposes only.

Table 7.4
Hypothetical example: Blossom Foods

| Blossom Foods | | | | |
|---|--|---|--------------------------------------|-----------------------------|
| Intended business application: Compare options | | | | |
| Option 1: Responsible sourcing VS | | | | |
| Option 2: Baseline minimum. Each option has the same three material impacts, the values of which can be compared. | | | | |
| | Specific impact driver/dependency | Consequences of impacts/dependencies | Valuation technique | Value |
| Impacts | Clean water and sanitation provision for local community | Disability-adjusted life year due to reduction in cases of diarrhea from sanitation program | Value transfer from previous studies | USD 70/kg of commodity |
| | Deforestation carried out by external organizations | Impacts from global warming | Social cost of carbon | USD 45/kg of commodity |
| Dependency | Consumer demand for responsibly sourced commodity | Increase in sales from higher demand expected on responsible commodity | Market valuation | USD 0.6 billion in revenues |

Table 7.5
Hypothetical examples: VitaCrisp

| VitaCrisp | | | | |
|--|--------------------------------|---|---|----------------------|
| Intended business application: Compare options | | | | |
| Option 1: Super Oats vs Option 2: Wheat. | | | | |
| | Specific impact/ dependency | Consequences of impacts/ dependencies | Valuation technique | Value per product |
| Impact | Human health impacts | Change in disease incidence (DALY) | Life Cycle Impact Assessment (LCIA) models and DALY valuation | USD 1.5 per kg |
| | Carbon emissions | Change in disease and flooding incidence (DALY) Change in ecosystem services provision (USD) Change in fish stock availability (tons) | Social cost of carbon | USD 0.8 per kg |

Table 7.6
Hypothetical example: Evolve Crops

| Evolve Crops | | | | |
|---|--------------------------------|---|--|----------------------|
| Intended business application: Estimate total value and/or net impact | | | | |
| | Specific impact/ dependency | Consequences of impacts/dependencies | Valuation technique | Value per product |
| Impacts | Soil use | Change in yields due to change in water retention capacity of soil (tons) | Biophysical modelling and market valuation | USD \$2 per ton |
| | GHG emissions | Change in disease and flooding incidence (DALY) Change in ecosystem services provision (USD) Change in fish stock availability (tons) | Social cost of carbon | USD \$6 per ton |
| Dependency | Energy use | Increase in the energy bill | Market valuation | USD \$12 per ton |
| | Water use | Increase in the water bill | Market valuation | USD \$8 per ton |
| | Expertise/knowledge | Increase in productivity | Market valuation | USD \$4 per ton |

APPLY STAGE WHAT NEXT?



What is the Apply Stage?

The Apply Stage of the Protocols summarizes the capitals assessment process by helping you interpret and apply your results in your business. It also encourages you to consider how to optimize the value from this and future assessments.

The Apply Stage involves two interlinked Steps:

| Step | Questions each Step will answer | Actions |
|--|--|--|
| 08 Interpret and test the results | How can you interpret, validate, and verify your assessment process and results? | 8.2.1 Test key assumptions 8.2.2 Identify who is affected 8.2.3 Collate results 8.2.4 Validate and verify the assessment process and results 8.2.5 Review the strengths and weakness of the assessment |
| 09 Take action | How will you apply your results and integrate capitals into existing processes? | 9.2.1 Apply and act upon the results 9.2.2 Communicate internally and externally 9.2.3 Make capitals assessments part of how you do business |

Additional notes

Businesses operating in the food sector should address all actions associated with each Step in the Apply Stage. The Guidelines provide practical examples of how capitals thinking can be incorporated within business decision making.

08 Interpret and test the results

8.1 Introduction

This section provides additional guidance for answering the following question:

How can you interpret, validate, and verify your assessment process and results?

Step 08 will help you interpret and test the results of previous Steps, including validation and formal verification.

The overarching question of Step 08 can be unpacked into the following questions:

- What do my results mean? This Step provides practical guidance on how to interpret the results of your assessment.
- How reliable are the assessment process and results? This includes guidance on how to validate the assessment process itself, as well as how to test that your assumptions are correct and determine the level of confidence in your results.
- Does the documentation available provide a comprehensive and accurate representation of the assessment process and results? This includes consideration of whether external verification may be necessary.
- Was the assessment worthwhile? Before exploring what actions you could take as a result of your assessment, consider the value of the assessment you have just completed.

8.2 Actions

In order to interpret and use the results of your assessment with confidence, you will need to complete the following actions:

- 8.2.1** Test key assumptions
- 8.2.2** Identify who is affected
- 8.2.3** Collate results
- 8.2.4** Validate and verify the assessment process and results
- 8.2.5** Review the strengths and weaknesses of the assessment

8.2.1 Test key assumptions

There will always be some estimation or approximation involved in a capitals assessment. You should therefore avoid precision and instead present any numbers in a range or rounded and document your decision to do this. To understand what level of confidence you can have in your results, you will need to carry out a sensitivity analysis. This involves testing how changes in assumptions or key variables affect the results of an assessment (see Table 8.1). Sensitivity analysis may involve simulation modeling to identify critical thresholds, where small changes in the value of assumptions yield large changes in assessment results. Alternatively, it may simply involve reporting a range of potential values for a particular impact or dependency. If value transfer has been used in the assessment, it is essential to conduct a sensitivity analysis to determine if the values used are relevant to your situation.

The potential to undervalue or overvalue costs or benefits exists in any valuation exercise. In the case of natural, human, and social capitals valuation, the likelihood of significant valuation errors can be greatly reduced by involving relevant experts, using recognized methods, and following good practice guidance which has been developed and tested over many years. Generally, it is preferable to follow the most reasonable assumption, rather than defaulting towards best- or worst-case assumptions. Where proximity to a threshold or potential of severe consequences of valuation exist, it is preferable to adopt a precautionary approach to valuation.

Table 8.1

Examples of assumptions to test in a sensitivity analysis

| Assumptions you can test: | How do my results change if... |
|--|---|
| <i>Number of people affected</i> | 15,000 instead of 1,500 people are affected? |
| <i>Magnitude of change in capitals</i> | Training hours on health and safety are doubled? |
| <i>Changes in key prices</i> | Prices of energy or water change (e.g., what if the cost of carbon goes from USD 5 to 75 per ton of CO ₂ e)? |
| <i>Changes to discount rates</i> | A discount rate of 2%, 5%, or 10% is used? |
| <i>Time horizon</i> | The assessment is carried out over a 10-, 30- or 60-year time frame? |

There are different methods of carrying out a sensitivity analysis, many of which require knowledge of statistics. All methods are designed to help you understand the degree of confidence you can have in your results, without overstating their accuracy.

As a starting point, you may apply one of the most commonly used models, “one-at-a-time” or “one-factor-at-a-time” sensitivity analysis. As the name suggests, this involves changing one factor (assumption or variable) at a time to see what effect this produces. The output of this analysis:

- Provides a range of estimates, rather than one single number, which may reflect varying levels of confidence.
- May help to identify “switching values.” These are values that a particular parameter or factor needs to attain in order to switch or flip the outcome, for example by altering the ranking of multiple options, changing a result from negative to positive, or crossing a threshold.

It is critically important to understand and clearly communicate the level of confidence you have in your results, so that this is taken into consideration when applying them to business decisions. For example, when using value transfer for monetary valuation, existing value estimates in the literature can vary greatly, giving vastly different results depending on the reference value chosen. You should make this variation explicit and discuss its implications, especially if using this information alongside other monetary values.

Furthermore, in the case of monetary valuation, the values may be sensitive to changes that are outside the business’s control, such as fluctuations in exchange rate, inflation, and purchasing power parity. This can mean that a business’s impact could change between assessments without the business having changed its actions. Where possible, and particularly in the case of monetary valuation, businesses should carry out a sensitivity analysis to test assumptions and communicate the results of the sensitivity analysis alongside the assessment results.

8.2.2 Identify who is affected

Distributional analysis is used to understand who is affected by a decision, and whether they gain or lose. Use a distributional analysis to identify which stakeholders gain or lose as a result of your natural, human, and social capitals impacts and/or dependencies, and whether they might gain or lose in the future as a result of your anticipated actions or responses following the capitals assessment.

Distributional analysis is not only an important element in the assessment itself, but also influences how your results may be interpreted and used. For instance, to appreciate the impact of increasing wages for one group of workers on wage equality, you need data on the top, median, and bottom wage deciles. Having gender-disaggregated and gender-specific data is also crucial to appreciating potential gender inequalities or discrimination.

Note: Remember that the type of stakeholder affected may influence the type and magnitude of different values. To give an obvious example, recreational or amenity natural capital values for a particular site will vary depending upon whether a person is a local resident or not.

8.2.3 Collate results

In order to interpret your results, you first need to bring the values together in a way that is appropriate to your assessment. This is likely to involve some form of analytical approach or framework such as cost-benefit analysis, multi-criteria analysis, Environmental Profit and Loss Account (EP&L), or Total Contribution (see A4S 2015 and WBCSD 2013). If your assessment is designed to support a “total impact” or “net value” application, or to “compare options” using net present value (NPV) analysis, you will need to use a discount rate (see Box 7.6) and you may need to add up the different values that you measured.

When adding different values you need to be clear about what can and cannot be added together. For example, combining all the values identified from different parts of your value chain (direct and indirect, upstream and downstream) could lead to additional credit and responsibility being attributed to you and/or double counting of results. In this case, direct and indirect values should be reported separately.

If you are using quantitative valuation rather than monetary valuation, you can convert different metrics (e.g., kg and m³) into scores for improved comparison. The comparison can be further enhanced by weighting the scores in terms of their overall importance, as is often done using multi-criteria analysis.

A particular difficulty is that different natural, human, and social capitals impacts and dependencies require tailored approaches and there may be a number of alternatives to choose from. Differences between these alternatives may include their level of precision, their granularity, and the completeness of the value that they represent. You should aim to produce values that are (as far as possible) consistent with one another—especially if you are intending to directly compare or aggregate them.

To interpret and present the results, businesses must collate them in a way that makes sense internally and for other relevant audiences. This is likely to involve some type of analytical framework, such as a cost-benefit analysis, total profit and loss account, or total societal contribution. Some businesses may take a macro picture of their performance across various capitals—social, human, natural, and produced—to identify the relative positive and negative performance for each and, in some cases, for each part of the value chain.

Just because it is possible to value an impact does not, by itself, justify trading one impact off against another that may be valued more highly. Similarly, the value of the impacts from an activity may be positive in a net figure but there may be negative impacts masked within that. For example, there may be situations where employment and wage payments create value for workers but working conditions are unfavorable. It is important to look both at the total value and the individual elements, including different groups and capitals impacted (see distributional analysis), to ensure that you do not overlook any key risks or obligations.

Box 8.1 Comparisons and trade-offs in monetary valuation

Valuing capital impacts and dependencies in monetary terms can be a powerful aid to decision making and can facilitate comparison between diverse categories of impact and dependence. However, exercise caution when interpreting or comparing monetary values because:

- a) different monetary estimates may reflect different value perspectives (e.g., business or societal), and
- b) some monetary estimates will only be partial estimates of the overall value.

Impacts on your business and your business dependencies

When valuing impacts on your business or your business dependencies, the intent of valuation is to estimate actual or potential financial costs or benefits to the business. A general rule here is that values based on observed market prices, taxes, or charges are likely to be more readily comparable, whereas estimates based on other techniques should be carefully assessed in terms of their comparability.

Your impacts on society

When valuing your impacts on society, the intent of valuation is to estimate costs or benefits accruing to society as a whole or to particular groups within it. These costs or benefits are estimated in terms of changes in human well-being (also referred to as human welfare). Societal values derived using methods consistent with the theory of welfare economics are likely to offer better comparability, but this is not guaranteed. A distinction is frequently drawn between financial/market values (often referred to as “exchange values”) and welfare/well-being values. However, this distinction is not always helpful for assessing the comparability of values. Exchange values can be either strong or weak proxies for welfare values depending on the characteristics of the market in which the exchange takes place. Furthermore, there can be at least as much variation between values derived using inconsistently applied welfare-based methods as there is between exchange values and welfare/well-being values. If you’re unsure about comparability in the results of your assessment you should seek independent expert advice.

For example, in an assessment concerned with natural capital impacts on society, it would not be appropriate to apply a societal cost of carbon to GHG emissions and an internal abatement cost to water consumption and then use the results to prioritize the company’s mitigation actions between GHG emissions and water consumption. This is because the internal water abatement cost is not likely to be a good indicator of the societal cost of water consumption.

8.2.4 Validate and verify the assessment process and results

The four Principles of a capitals assessment provide a guide to validating and verifying your results, highlighting the need to check that your assessment was relevant, rigorous, replicable, and consistent. Different types of checks require different levels of effort (e.g., systematic or random, process audits, external validation), so you need to decide what levels of validation and/or verification are required for your assessment, and the desired level of credibility.

Validation and verification may cover either the assessment process or the results or both. The benefits of rigorous validation and verification can be significant:

- **Validation** of the accuracy and completeness of your results may be required by internal colleagues involved in making the decision that your assessment is intended to inform.
- **Verification** can provide confidence to various stakeholders that the data and methodologies used are fit for purpose and that the assessment results are sufficiently robust to be used as a basis for business decisions and/or external communication.

As described in Step 01, capitals assessments can be undertaken for different business applications. Each application may have its own validation and verification requirements, whether company-specific or specified by external parties (e.g., for financial reporting to satisfy the requirements of International Financial Reporting Standards or national Generally Accepted Accounting Principles (GAAP)). The extent to which validation and verification are undertaken depends partly on the proposed use and communication of your assessment. There are two main options:

- **Internal reviews** are “self-checks” that can be carried out within the company, ideally involving colleagues who were not directly involved in the assessment (e.g., internal audit department). This may be sufficient for internal decision making. Internal reviews are often more flexible and easier to conduct but will not deliver the same level of external confidence.
- **External reviews** typically involve people from outside the company. You may want or need to communicate your results to external stakeholders (e.g., for public reporting, to support customer relations, or to demonstrate compliance to regulators). In such cases, verification by independent experts can enhance the credibility of the assessment process and results. External reviews are typically more expensive and time consuming than conducting an internal review.

If an external review is required you will need to:

- Identify an appropriate external party to carry out the review.
- Agree to the scope and timetable for the review.
- Provide documentation of your decisions and processes.
- Inform relevant stakeholders (e.g., data owners) if they will be interviewed as part of the review process.

The completed review should include a summary statement of the level of confidence that may be placed on the assessment process and results, as well as any caveats around the assumptions used and remaining uncertainties. The statement of confidence may be qualitative (e.g., using a scale from “very low” to “very high”).

The review may also highlight actions that could be taken to improve confidence in the results. You will then need to decide if you intend to undertake any of these actions, which may involve revisiting part of your assessment.

Glossary

Validation

Internal or external process to check the quality of the assessment, including technical credibility, the appropriateness of key assumptions, and the strength of your results. This process may be more or less formal and often relies on self-assessment.

Verification

Independent process involving expert assessment to check that the documentation of the assessment is complete and accurate and gives a true representation of the process and results. “Verification” is used interchangeably with terms such as “audit” or “assurance.”

Market Value

The amount for which something can be bought or sold in a given market.

8.2.5 Review the strengths and weaknesses of the assessment

Upon completing a capitals assessment, you and others will want to know what the strengths and weaknesses of the assessment were. This can inform future assessments and help identify what could be improved. This final “assessment of the assessment” will be informed by any structured validation or verification just carried out.

If the assessment fell short of expectations, try to identify how and what could have been done differently. This will be especially important if you plan to undertake more assessments in the future.

You may realize that you have limited confidence in the results. This could be as a result of significant caveats and/or assumptions on which your results are based. Would additional information reduce uncertainty and potentially change your conclusions? This could mean returning to earlier Steps to improve the assessment so that the results can be used as a credible basis to inform your decision. Or you may find that although you are comfortable proceeding based on your results, other stakeholders may require additional information to be convinced of the credibility of the assessment and results. You should be sure to report any relevant caveats and/or assumptions to allow these stakeholders to make this judgment themselves.

As a general rule, if there is uncertainty in the results (e.g., due to lack of data) but you are unable to go back and revisit the assessment (e.g., due to resource constraints), it is recommended to take a precautionary approach. This is particularly important if decisions taken based on the results of a capital assessment might surpass important limits and thresholds (e.g., ecological thresholds). In such circumstances, you may need to postpone making the decision.

You might also have gathered additional information that was not part of the initial objective but can still provide valuable insights. Note: This can be a simple subjective exercise where you list the strengths and weaknesses of the assessment, or you may consider setting up an internal data collection and management system to track this in more detail.

8.3 Outputs

The main output of this Step is a document explaining your interpretation of results. This should include:

- Results collated in a way that makes sense and can be interpreted internally and for other relevant audiences
- Key messages, caveats, assumptions, and uncertainties, including the results of sensitivity analysis if appropriate
- Output(s) from validation and internal/external verification (if appropriate) of the assessment process and results, including an objective acknowledgement of key assumptions and uncertainties around the results
- Notes on the review process itself, including how critical assumptions were tested, what level of confidence was deemed necessary, and why

Table 8.2
Hypothetical examples – Step 08

| | Blossom Foods | VitaCrisp | Evolve Crops |
|--|--|--|--|
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>What key assumptions were tested?</i> | Sensitivity analysis was carried out to assess the implication for results of varying the size of area of forest conserved. Assumption behind improved efficiency of workers was tested by comparing to similar WASH programs. | Assumptions behind the universality of health benefits of SuperOats were tested by comparing to other similar health products. Assumption behind carbon emission of wheat farming was tested for different geographies. | Sensitivity analysis was carried out to calculate how the result will vary according to water scarcity levels. Sensitivity analysis was carried out to determine the impact of variable taxes on carbon emission. |
| <i>Who is affected by the results of the assessment?</i> | The assessment is designed to inform internal decision makers to choose between a responsible sourcing program or business as usual. The result of the assessment and consequent action from the company are likely to affect the local community as negative impacts of operations are reduced, and potential investments in community health are made. | The assessment is designed to internally inform strategy in order to choose which product to focus on. Suppliers are also affected as demand for raw material changes. | The assessment is designed to inform the strategy and marketing department, finance, senior directors, and shareholders. Retail and suppliers are affected if they decide to buy products directly from associations and farmers. Workers' health and livelihoods could be affected and consumers could have access to healthier products. |
| <i>Validation/Verification</i> | External: The review identified that sources of data, methodology, and assumptions made were "fit for purpose." | Internal: The review identified that sources of data, methodology, and assumptions made were "fit for purpose." | Internal: The review identified that sources of data, methodology, and assumptions made were "fit for purpose." |
| <i>Strengths and weaknesses of assessment</i> | The weakness is that it is a highly localized assessment and could not be replicated across other geographies. | The weakness of this assessment lies in the trade-offs of capitals. Comparing natural and social impacts places them on an equal level of importance, though it is clear that nature underpins all other capitals. In contrast, the strength of the assessment is that these capitals were valued separately and then compared, rather than amalgamated. | This capitals assessment includes a broad range of dependencies and impact pathways with a value perspective for both business and society. Weaknesses Qualitative indicators (for well-being) could be subjective according to respondent sensitivity and personal perception. Data availability and lack of credible, comparable, and precise data at local level for farm, water availability, and terrestrial ecosystem was the main issue. |

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09 Take action

9.1 Introduction

This section will provide additional guidance to allow you to answer the following question:

How will you apply your results and integrate the capitals into existing processes?

Step 09 considers how to act upon the results, how to communicate them to inform decisions and engage stakeholders, and how to build capitals assessments into your company's policies and processes on an ongoing basis.

The overarching question may be broken down as follows:

- **How will you use the results?** This includes guidance on how your results may be used to inform business decisions, given your objective and scope.
- **What further natural capital assessments are worthwhile?** Do you need to revisit or deepen certain aspects of the assessment just completed? Would your business benefit from attempting new or additional assessments?
- **How should the results be communicated?** A few considerations are provided about how to communicate the results of your assessment, as well as the process you went through, keeping in mind any confidentiality concerns.
- **How can a multi-capital assessment be integrated into your business?** How does the assessment process relate to existing or new decision-making processes within your company, and what resources or decisions would be needed to embed capitals assessments into your business systems?

When undertaking this Step it is worth considering how to:

- Leverage your existing business strategy. The idea is to integrate the capitals into what you already do and not create another way of doing things. This means that the results should not just sit in your sustainability department but be used in strategic and operational decision making. Ultimately a separate capitals approach should not be needed as it will automatically be part of how you do business.
- Establish clear, consistent, and relevant criteria for the success of capitals assessments. This will help you judge the business case for carrying out further assessments.
- Learn from and link to other related assessment processes in your company. Sometimes projects and activities that are closely related to capitals use language that obscures the link. For example, environmental, human, and social risk management can be considered a form of capitals protection but your colleagues may not make the connection.

9.2 Actions

In particular, the Guidelines will help you undertake the following actions:

- 9.2.1** Apply and act upon the results
- 9.2.2** Communicate internally and externally
- 9.2.3** Make capitals assessments part of how you do business

9.2.1 Apply and act upon the results

At this stage in the process, you have framed and scoped your assessment, measured and valued your interaction with capitals according to a specific objective, and interpreted the results. The next Step is to apply the results to inform business decision-making processes using new information. The application of the results is the real measure of success for your assessment and a crucial step.

This section provides examples of business decisions for each of the material impact drivers (Table 9.1) and dependencies (Table 9.2) assessed in Steps 05–07. Some additional practical examples are included to show how to take decisions based on assessments of the interactions of different capitals.

Table 9.1
Examples of business decisions taken based on the assessment of impacts

| Capital | Impact driver category | Example of business decision taken |
|---------|--|---|
| Natural | Water use | Business adopts a human-rights-based approach to water, committing to transparency and accountability of its water use and setting up a scheme to remedy any victims of poor water management. Remedies include direct payments and investment in piping and filtration infrastructure to make accessible safer water |
| | Terrestrial ecosystem use | Business uses assessment to inform science-based targets for land conversion. Business decides to convert from monoculture to polyculture to restore pollination services and therefore reduce artificial pollination costs. |
| | GHG emissions | Business engages in policy discussions to explore options to reduce impacts of emissions through regulation that would most benefit operations and reduce consequent impacts on society. Solutions explored include local cap-and-trade system, emission limits, or mandated technology updates. |
| | Pesticide and herbicide use | Management decides to switch to a more ecologically friendly form of pesticides. This leads to a healthier working environment, a decrease in sick employees, and therefore restored productivity, in addition to a more resilient ecosystem that requires fewer expensive agrochemical inputs. |
| | Fertilizer use | Business carries out further studies to create a strategy for fertilizer application. The time and method of application can significantly reduce runoff leading to less impact on regulating ecosystem service provision. |
| | Soil use | Business adopts a regenerative soil strategy, planning their operations to include a fallow year, cover crops, and adapting machinery to preserve soil structure. |
| | Solid waste | Business invests in R&D of cellulose packaging with the aim of transitioning to a fully circular manufacturing process. |
| | Livestock conditions | Business decides to change the strategy and reduce the density of livestock to obtain better quality of food and access to better market prices. |
| Human | Nutritional content of food | Business decides to diversify their production and focus resources on developing a healthy range of products with the view of phasing out high calorie manufacturing over time. This improves access to an emerging market opportunity for healthier products. |
| | Use of substances harmful to consumers | Business decides to certify itself in animal welfare standards, allowing it to charge a higher export price for buyers from countries with stricter meat quality regulations. |
| | Food safety practices | Business decides to provide employees with basic training about hygiene and food. |
| | Employee health and safety conditions | Business redesigns the work schedules to ensure a maximum of working hours a day per employee. |

| Capital | Impact driver category | Example of business decision taken |
|---------------|---|---|
| | Salaries and benefits | Business offers childcare packages that allow more female employees to stay in work. Employees have more expendable income and the company experiences productivity gains as a result. |
| | Workers living conditions | Company invests in higher quality complementary housing which is more sensitive to local living standards and preferences. |
| | Labor rights | The business changes recruitment provider and brings more hiring processes in-house, to improve transparency of hiring and contracting. Business invests in an internal awareness campaign to report suspected slavery internally and in contracted suppliers. |
| | Gender rights | Business offers equal pay for women and men and reports on its gender pay gap annually. |
| | Workers representation | Business decide to increase workers representation in board meetings. |
| <i>Social</i> | Food security | Business develops strategy to enhance the accessibility of nutritious and diverse food to surrounding area by facilitating access to inputs, technology, and markets, generating employment in downstream activities, and setting up community storage facilities to reduce post-harvest losses and price volatility. |
| | Food loss or waste | Business introduces new product lines made from food that otherwise would have been lost or wasted. |
| | Integration of workforce into communities | Business decides to raise its wages above the national rate to support local workers and strengthen the local community and workforce retention. |
| | | The business looks to source from local businesses where possible to support the local economy. In the long term, this also supports the business's own expansion in the region. |
| | Benefit sharing with indigenous communities | Business establishes a focus group with representatives from local indigenous community, which helps identify and respond to grievances at an early stage. |
| | | Farmer decides to develop training materials and ethnographic reports based on local knowledge to maintain the knowledge for future generations. |

Table 9.2
Examples of business decisions taken based on the assessment of dependencies

| Capital | Dependency category | Management decision made by the company |
|-----------------|--|---|
| <i>Natural</i> | Water availability | Company partners with a nearby non-profit to conduct hydrological research and uses the findings to trial operational changes that coincide extraction with heavier rainfall periods, and/or recycling of water already in the system. |
| | Water quality | Company invests in reforestation to prevent eutrophication, and supports farmer education programs across the catchment. |
| | Regulation of physical environment | Company sets aside land for buffer zones and initiates a payments for ecosystem services (PES) scheme. |
| | | Smallholder farmers collaborate with a local landscape management program to trial alternative soil management practices that maintain healthy organic matter. |
| | | Company forms an alliance across the industry, funding research into climate-related locust swarms, while also supporting farmers in original sourcing geographies which offer better quality produce. |
| | Regulation of biological environment | Company invests in pollinator habitat meadows and works with a local non-profit to agree on minimum standards for all businesses in the landscape. |
| | | Company funds research into parasitic wasps which predate on mealybugs, as a lower cost alternative to pesticides. |
| | | Company opts to use open-pollinated seeds to increase genetic diversity of crops and improve resilience to disease. |
| | Regulation of waste and emissions | Company explores the regeneration of wetlands and marshy swamps which help mitigate pollutant concentrations in the water at lower cost than a processing plant. |
| | Skills and knowledge | Company encourages and supports learning events between its employees at different sites and operating locations to help share information and experience. Local experts on issues like biodiversity are invited to share their research. |
| <i>Human</i> | Experience | Company offers competitive wages and youth employment schemes with attractive training and incentives to help encourage local people to work in the agri-food sector. |
| | Health of workers | The company invests in Water Sanitation and Hygiene (WASH) facilities for local communities, reducing the vulnerability of its workforce to waterborne diseases and therefore reducing productivity losses. |
| | | The company HR department invests in awareness and support for mental health issues, resulting in higher retention rates. |
| <i>Social</i> | Social networks and cooperation | The company funds local finance cooperatives. |
| | Property rights | The company reviews its tenant farmer strategy and starts offering longer tenure contracts in struggling locations. |
| | Social acceptance and trust | The company engages a local community engagement group, who meet with management regularly to voice concerns or emerging issues. |
| | Law and order | The company introduces an anti-corruption and anti-bribery policy and makes regular reports to its board on the topic. Managers are compensated on the actions taken to discourage corruption and bribery appearing and spreading within the company. |
| <i>Produced</i> | Accessibility to infrastructure and technology | The company educates its buyers on local innovation initiatives and therefore attracts more environmentally and socially conscious investors. The company grows this innovation program to other operating regions over subsequent years. |

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Remember that business decisions are rarely based upon objective information alone, and that emotion and relationships often play a part in the decision-making process. It is therefore important to make sure that the people involved in the decision-making process (identified in Step 02) are provided sufficient background information to understand the assessment and to have confidence in the process and its results.

You should of course consider whether and how the assessment met the objective (identified in Step 02) and can inform the decision you need to make. The results of your assessment may have led to a change of activity, or to smaller adjustments in a plan of action or additional mitigations, or they may simply provide further justification for the activities already underway meaning no change is necessary. You may need to measure the contribution of the assessment to your business strategy or targets, for example, the amount of money saved (or lost) relative to an alternative approach. Additional actions that you may consider include:

a. Carrying out another assessment

Applying these Guidelines may already have generated ideas about additional business decisions that could be improved by a capitals assessment. These additional business decisions could be based upon clarifying what is most material (as identified in Step 04) or they might focus on new and unexpected capital impacts and dependencies that were revealed in your first assessment.

Consider if there are other strategic focus areas that could be used as an entry point for further capitals assessments and to secure wider support internally. Some ideas for undertaking further assessments include exploring new business opportunities, expanding the scope of your assessment, or broadening your assessment to include societal values.

b. Internalizing externalities

You may want to consider whether externalities that you have identified could, or would, be internalized in the future as you take action based on the results of the assessment. An example might be the inclusion of an internal carbon or water “shadow” price in your future decisions, or even adjusting your financial books to account for these externalities.

9.2.2 Communicate internally and externally

You now have a completed assessment and can provide decision makers with the necessary information to inform their decision. This should include information to explain the assessment process and results, including assumptions, uncertainties, or limitations that may apply.

a. Providing decision makers with the information needed to inform the decision

In the Scope Stage, you identified the assessment objective and the different people involved in making the decision that the assessment is to inform. For assessment results to most effectively inform the business decision, you will need to provide all relevant parties with the necessary information in a suitable format. Where possible, information should be shared through existing processes within your business. For example, you might add content to existing management board papers, integrate information into your corporate risk process, or build information into a business operations program.

b. Communicating with internal and external stakeholders

Sharing information about your capitals assessment and the decisions informed by it in a clear and transparent way can help to strengthen relationships, build the case for further assessments, and integrate capitals into the way you do business. Depending on your needs, you may wish to consider:

- Who will you communicate with and how?
- Who will the communication come from? Communication that is clearly connected with the core business, and with the business area responsible for the decision informed by the capitals assessment, can often provide the most benefit.
- Will you publish an internal or external report? Will you present the result of your assessment at an industry event? Will you include a news story on your website? Will you refer to other similar studies?
- How much information will you share, and with whom? While some results may be sensitive, external communication could still be possible and beneficial. Rather than report monetary values, for example, you can “anonymize” the most sensitive results using an index or ratios, allowing you to share key outcomes. For example, instead of reporting publicly that “the cost of option 1 was valued at USD 100 million and option 2 at USD 150 million” you might say that the “cost of option 2 was valued at 50% more than option 1.”
- How much did the natural capital assessment inform the decision and how confident are you in the results and the actions that will or have been taken? Transparency is important, and it is often worthwhile to share any assumptions, uncertainty, or limitations upfront.

Communications experts can provide guidance on reaching out internally, including getting your colleagues on board and more familiar with the topic and explaining how assessment results may affect them, and externally, including recommending which messages can be disclosed and how.

External stakeholders may challenge and question not only the assessment process and the results, but also the company’s reasons for carrying out the assessment in the first place. Some questions you may want to think about include:

- Do you already know your key external stakeholders and have relationships with them?
- Are you ready to discuss with, and be confronted by, those who might challenge you?
- Have you got some “critical friends” among conservation bodies or other external stakeholders who can challenge you in a constructive way?

9.2.3 Make capitals assessment part of how you do business

A capitals assessment can and should lead to new ways of thinking about how your business relates to natural, social, and human capital. Consider whether, and how, your assessment might have challenged your existing business model or management processes. For example, it may flag significant dependencies on ecosystem services, workforce, and/or social networks that you were not aware of, or reveal previously unrecognized risks or opportunities associated with the indirect impacts of your business on society, through changes in capital.

Although in extreme cases a capitals assessment may fundamentally challenge or support your business model, it is most likely that it will be one of many factors that will inform your decision and you may not be able to identify exactly how it has supported this.

In general, as you begin to include capitals more systematically in your decisions, more and more of your business will be affected. Specific business applications (see Table 1.3) can be considered more regularly and built into existing or new business processes.

For example:

- Which environmental, human, and social systems and processes are currently used by your company, and how do capitals assessments connect, complement, or integrate with them?
- Does your company already have a strategic environmental, human, and/or social focus (e.g., on water, soil, safety) that could be used as an entry point for further capitals assessments and to secure wide internal support? To make capitals part of how you do business, it is important to not focus only on the Measure and Value Stage (Steps 05–07) but to apply all Steps in the Guidelines.

It may also help to consider:

- Developing a system to track and monitor assessments, preferably built into an existing system, such as the financial reporting system, can aid integration. A review of existing systems and processes currently used and how they might connect, complement, or integrate with capitals assessments is a good starting point.
- Embedding natural, human, and social capitals will only happen if key internal stakeholders see business value and actively contribute to the process. Assessing all capitals must be included in the board agenda and senior leaders need to be involved in developing and implementing these assessments.
- Some of your company's employees, who may already be charged with addressing environmental, human, and/or social challenges, such as GHG emissions or nutrition, could be trained to undertake capitals assessments. They may become your "capitals champions" of the future.

Below, some practical examples show how capitals assessments inform integrated capitals decisions. Table 9.3 outlines some existing processes commonly used in business that could make use of data and results from a capitals assessment.

Practical example 1: Due diligence

A capitals assessment shows that the business' operations affect an indigenous community and their land rights. Any business should respect internationally recognized human rights, such as the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). In cases where consent for business operations is not forthcoming or where indigenous people refuse to engage, material risks to the business and adverse impacts to indigenous people may be generated.

Consenting with an indigenous community about operations and valuing their knowledge could lead to a positive impact on the business. Indigenous knowledge can provide valuable information about how to best make use of local land tenure for a long-term healthy soil strategy.

Relevant business applications: Assess impacts on stakeholders, assess risks and opportunities.

Practical example 2: Risk management

A capitals assessment is included in a risk mitigation plan and a scenario analysis. This enables senior management to take preventive measures.

For example, the assessment showed that one of the supply locations was prone to flooding. The assessment also found that planting local tree species in the stripes of the fields will help avoid flood risk, improve productivity (due to enhancement of pollination services), increase profits (by selling fruits from trees), and strengthen the relationship with local community (by enhancing the landscape).

Relevant business applications: Compare options, assess risks and opportunities

Practical example 3: Product design

Through the capitals assessment a business identified that a lot of fresh produce is wasted through the supply chain due to insufficient cooling. This restricts the flow of goods and decreases margins gained selling the produce.

To support small and marginal farmers to reduce food loss, increase market connectivity, and strengthen the value-chain for farmers, the company supports a program to rapidly deploy integrated pack houses with end-to-end post-harvest management and cold-chains using energy-efficient and sustainable technologies.

Relevant business applications: Compare options, assess risks and opportunities

Practical example 4: Efficient resource management

An integrated capitals assessment is conducted by a large commodity supplier to assess the material impacts on capitals and inform the business strategy. The assessment shows that water and availability of workforce are the most material risks in the medium term. The company decides to invest in water-efficient technologies and use local species resistant to water stress. The company establishes a training program for local farmers on water management. All farmers attending trainings and following the company's protocols receive a higher payment for their products. This increases the attraction and retention of workforce and reduces the consumption of water by the company.

Relevant business applications: Assess risks and opportunities

Table 9.3

Examples of business processes that could leverage capitals assessment

| Existing or new company process | Description | Value of including a capitals assessment |
|---|---|---|
| <i>Cost-benefit analysis</i> | An analysis that compares the costs and benefits of a project or policy. It can be used to analyze net benefits including benefit-cost ratio, Net Present Value (NPV), or internal rate of return (IRR) from a business or societal perspective. | <ul style="list-style-type: none"> Identify which cost savings and/or revenue opportunities are linked to the capitals. Estimate reliable “shadow prices” for impact drivers associated with your business, based on societal values, to help inform decision making. |
| <i>Damage assessments</i> | An approach involving various techniques to calculate environmental, human and/or social damages, remediation requirements, and costs and compensation relating to liability and incidents. | <ul style="list-style-type: none"> Include a value for your associated impacts on society, as well as cleanup and/or restoration costs and benefits to society and business. |
| <i>Strategic target setting and monitoring progress</i> | Companies are increasingly incorporating sustainability targets into their strategies. Capitals assessments can help inform the target-setting process, including to establish baselines, scope assumptions, assess feasibility, etc. Furthermore, they can highlight if progress is on track. | <ul style="list-style-type: none"> Prioritize issues based on materiality. Ensure a sound understanding and definition of scope, impact, and baseline. Establish feasible but ambitious and meaningful targets. Measure success based on reliable data that show positive and negative impacts to the business and/or to society. |
| <i>Environmental, human, and/or management systems</i> | Structured frameworks for managing an organization’s significant environmental, human, and/or social impacts. They include an assessment of activities, products, processes, and services that might affect the environment, people and society and a mitigation or improvement program. Businesses can use the Guidelines process in continuous improvement planning – particularly where real-time data indicators are available. | <ul style="list-style-type: none"> Provide a framework for ensuring consistent and appropriate use of capitals information and analysis. |
| <i>Risk assessment</i> | An analysis of the risks of a company’s products or operations, including impacts on nature and people directly exposed or affected via various media. | <ul style="list-style-type: none"> Add valuation elements to inform decision making, thereby providing richer information to operations, finance, strategy, etc. Introduce a broader range of measures of value to assess risk in context. |
| <i>Impact assessments</i> | Businesses can align their existing impact assessment, or due diligence processes, with capitals measurement and valuation principles. | <ul style="list-style-type: none"> Help to better connect activities to the wider business and provide a more complete view of natural, human, and social capitals performance. |
| <i>Internal audit</i> | Process to provide independent assurance that an organization’s risk management, governance, and internal control processes are operating effectively. The scope of internal audit may extend beyond financial risks to address issues such as growth, reputation, the environment, and labor relations (adapted from the Chartered Institute of Internal Auditors 2015). | <ul style="list-style-type: none"> Assure compliance with natural capital assessment procedures established by the company. Improve the quantification of risks and their impacts. |
| <i>Life Cycle Assessment</i> | Life Cycle Assessment (also known as Life Cycle Analysis) is a structured management tool for quantifying emissions, resources consumed, and environmental and health impacts associated with products over their entire life cycle. | <ul style="list-style-type: none"> Provide a structured approach for valuing and prioritizing environmental impacts to be included in an LCA. Use monetary valuation for aggregating and comparing different impacts in an LCA. |

| Existing or new company process | Description | Value of including a capitals assessment |
|--|--|---|
| <i>Social Life Cycle Assessment</i> | Social Life Cycle Assessment is a structured management tool for assessing the social impacts associated with products over their entire life cycle. | <ul style="list-style-type: none"> • Provide a structured approach for valuing and prioritizing human and social impacts to be included in an LCA. • Use monetary valuation for aggregating and comparing different impacts in an LCA. |
| <i>Company reporting</i> | Reporting of environmental, social, and/or financial information for external use, and in particular for use by shareholders and other external stakeholders. | <ul style="list-style-type: none"> • Provide a structured approach for prioritizing environmental, human, and social impacts to include in company reports. • Enhance corporate reputation and reduce market risk by providing more rigorous, reliable information to shareholders and other stakeholders. |
| <i>Financial accounting</i> | Financial analysis for external or internal purposes. It focuses on costs and benefits with direct financial implications for a company's bottom line. It includes inputs to the profit and loss account and balance sheet of a company or business unit. | <ul style="list-style-type: none"> • Specify which costs, revenues, assets, and liabilities are related to different capitals. • Develop a set of shadow prices or accounts for environmental costs and benefits, based on societal values. |
| <i>Management accounting</i> | Financial analysis for internal company purposes, focusing on costs and benefits with direct financial implications relating to a product line, activity, or investment. Includes, for example: pricing decisions, budgeting, capital investment decisions, discounted cash flows, net present values, internal rates of return, return on investments, payback periods. | <ul style="list-style-type: none"> • Identify which financial costs and revenues are linked to significant natural capital impacts and/or dependencies. • Include a set of shadow prices or accounts for environmental costs and benefits, based on societal values. |
| <i>(Sustainable) product portfolio</i> | A process to assess the products and services of a company against various criteria on a regular basis. | <ul style="list-style-type: none"> • Capitals assessment results can provide a more holistic picture of a company's product portfolio and may justify incremental shifts within the portfolio to improve sustainability performance. • Bring potentially valuable information for design, risk management, and/or strategic decision-making |

Adapted from WBCSD et al. 2011

9.3 Outputs

The outputs from this Step are

- Actions that you will take as a result of the assessment
- A communication plan about results and decisions
- A plan for making capitals assessments part of how you do business

Step 09 has provided guidance and recommendations to help you take action and embed the results of your assessment in business decision making. Table 9.4 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required within the Apply Stage.

Table 9.4
Hypothetical examples – Step 09

| | Blossom Foods | VitaCrisp | Evolve Crops |
|--|---|--|---|
| <i>Context</i> | This international business relies on commodities for its manufacturing but wants to improve its responsible sourcing in line with its corporate sustainability commitments (avoid deforestation and improve livelihoods of employees, suppliers, and local communities). | VitaCrisp produces a natural oat bran (SuperOats) as a substitute for wheat, used in food products such as bread, biscuits, and cereals. The company wants to know the natural, human, and social capital cost of SuperOats production, compared to wheat. | The company specializes in organic and non-organic fruits and vegetables. The company is concerned about carbon, water, and soil footprint of their production, transport, and packaging. Due to consumer pressure and certification demand, the company wants to improve the traceability of fruit and vegetable supply chains and improve farmers' livelihood conditions. |
| <i>Business benefit</i> | Assessing both options gave the company the opportunity to measure and value the gains made from responsible sourcing leading to better decision making. | Assessing both options gave the company the opportunity to measure and value the gains made from SuperOats and focus their efforts on the most impactful section of their business. | Assessing both options gave the company the opportunity to understand their value chain better and focus efforts on the more beneficial brand strategy, ensure long-term stability in value-chain with new farmers and better livelihood conditions, and improve their reputation with customers. |
| <i>Business decision</i> | The business decided to adopt a sustainable sourcing approach in other supply chains in other geographies. | VitaCrisp decided to scale up their production of SuperOats and scale down their production of wheat. | Evolve Crops decided to implement a new management strategy focused on product traceability, scaling up organic brand, and investing in innovative equipment to reduce natural capital impact. |
| <i>Potential future assessments</i> | Assessment could be widened to incorporate more social and human dependencies measurement and valuation. This assessment focused on impacts mostly. It could also be useful to provide evidence to help the company qualify for a certification from a sustainable labelling organization. | The assessment could have been extended to run over a longer time period to see actual adjustment of consumption habits. A further assessment could go beyond impacts and look at dependencies of production on natural capital such as water use, and human capital such as consumer habits. | Future assessments could include considerations about the impact on water quality. Other issues (i.e., child labor and slavery in the supply chain) could also benefit from more attention. |
| <i>Further embedding opportunities</i> | This assessment could be used not only in internal decision making but embedded more in the public image of the company, by making assessments publicly accessible thus encouraging others to follow suit. | Results could be used as a campaigning tool to promote healthier lifestyles. | Results could be used in operations planning on the ground, to secure more efficient production at farm level from improved soil quality. |

You have now completed the nine steps of the TEEB AgriFood Operational Guidelines for Business. The Capitals Coalition warmly welcomes any feedback, experiences, or learning that you can share from your assessment. This information can help us all progress towards the Coalition's vision of a world where business conserves and enhances natural, human, and social capitals.

Annex A: Examples of sector-specific published literature to inform capitals assessments for food sector businesses

| Author | Name | Description | How could it be used in capitals assessments | Capitals | Relevant steps |
|--|--|--|---|----------------------------------|----------------|
| <i>Food and Agriculture Organization of the United Nations (FAO)</i> | Natural capital impacts in agriculture: Supporting better decision making | The framework measures net environmental benefits associated with agricultural management. Dataset of natural capital costs per crop, livestock per country | Guides on impacts and dependencies of farming operation. It presents useful case study findings for specific commodities | Natural, Produced | 04, 05, 06, 07 |
| | Food waste footprint - Full-cost accounting - Final Report | Includes a list of Full-Cost Accounting estimates of food waste under the categories: atmosphere, water, soil, biodiversity, social, and economic | Framework provides quantification, monetization, and methods to calculate environmental cost of food waste footprint on well-being and natural resources | Natural, Social | 05, 06, 07 |
| <i>Sustainable Agriculture Initiative (SAI) Platform</i> | Several different tools and guidance documents | Guidance to support global and local sustainable sourcing, impact and agriculture best practices | Tools and material can diversely support companies, particularly in framing and scoping a natural capital assessment | Natural | 03, 04, 05 |
| <i>The Economics of Ecosystems and Biodiversity for Agriculture and Food</i> | TEEBAgriFood | A comprehensive framework that addresses the core issues and economic valuation of the eco-agri-food-system highlighting biodiversity and externalities including all the capitals | Framework undertakes measurement and valuation of economically invisible interdependencies between humans, agriculture, food systems, biodiversity, and ecosystems | Natural, Human, Social, Produced | 05, 06, 07 |
| | Varied - includes Fairtrade, RSPO, Rainforest Alliance, Alliance for Water Stewardship, RTRS | The most widely established and adopted certification schemes are in agriculture, though they vary in commodities, geographical diffusion, and on capitals issues | The quantitative and monetary data collected by companies and standard-setters to achieve accreditation and certification to these schemes can be leveraged in capitals assessments | Natural, Human, Social | 05 |
| <i>Sustainability Accounting Standards Board (SASB)</i> | SASB Materiality Map | The Materiality Map identifies 26 sustainability issues that are likely to affect financial condition or operating performance | Map provides accounting metrics issues in a matrix with their related level of materiality. It helps to quickly identify material issues to assess | Natural, Human, Social | 04 |
| <i>Cambridge Institute for Sustainable Leadership</i> | E.Valu.a.te: The practical guide | Evidential support around the process of valuation using a step-wise, bottom-up approach | Methodologies, indicators, and practical examples and real case studies from food and beverage companies | Natural, Human | All Steps |

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| Author | Name | Description | How could it be used in capitals assessments | Capitals | Relevant steps |
|---|---|--|--|----------------------------------|----------------|
| <i>The Food and Land Use Coalition</i> | Growing Better: Ten Critical Transitions to Transform Food and Land Use | The report presents essential actions and aggregated financial value on scenarios and opportunities related to a transformative approach | Document provides an overview of the future under business as usual or implementation of needed actions in the agri-food sector | Natural, Human, Social, Produced | 03 |
| <i>Food System Impact Valuation Initiative (FoodSIVI)</i> | OECD-FAO Guidance for Responsible Agricultural Supply Chains | Guidance for agricultural supply chains to enhance labor rights, health and safety, food security, tenure rights, governance and other aspects | Helps business respect existing standards along their supply chain and prevent risk of adverse environmental, social, and human impacts | Natural, Human, Social | 03, 04, 05 |
| UNEP | Guidelines for Social Life Cycle Assessment of Products | Social Life Cycle Analysis (SLCA) framework provides analysis about the effects of a product on social and human component | Framework for business to assess social and human capital using LCA approach | Social, Human | 02, 03, 04 |
| <i>PRé-Sustainability</i> | Handbook for Product Social Impact Assessment | Framework for Social Life Cycle Analysis (SLCA) designed to make the social benefits and burdens of a product visible | Provides practices guidance and examples of indicators that can be used for an assessment related to social and human capitals | Social, Human | |
| <i>Sustainability Accounting Standards Board (SASB)</i> | Varied agricultural products | Disclosure guidance and accounting standard including agricultural products, beverages, processed foods, meat, poultry, retailers, restaurants | Capitals assessments can be enriched using these standards in areas such as materiality, sector-relevant issues, scope, and disclosure | Natural, Human, Social | 03, 04, 09 |
| <i>International Standard. ISO 14008</i> | Monetary valuation of environmental impacts and related environmental aspects | Normative references, definitions, principles, guidance on monetary valuation, requirements, details about procedures and methods | Provides a straightforward explanation about the recognized procedures for monetary valuation (with calculation formulas) and what it should encompass | Natural | 07 |
| <i>International Standard. ISO 14007</i> | Environmental costs and benefits associated with their environmental aspects | Guidelines for organizations on completing the environmental costs and benefits associated with their activities | Provides standardized guidance about cost and benefits values and addresses the dependencies of an organization on natural capital | Natural | 07 |

| Author | Name | Description | How could it be used in capitals assessments | Capitals | Relevant steps |
|--|---|---|--|----------------------------------|----------------|
| <i>UN, EU, FAO, OECD, World Bank Group</i> | System of Environmental-Economic Accounting for Agriculture, Forestry, and Fisheries (SEEA Agriculture) | A standardized framework and statistical system for structuring information on environmental stocks and flows relevant to these sectors, linked to standard measures of economic activity such as GDP and national wealth | The standards and structures of SEEA Agriculture directly complement corporate-level natural capital accounting work. In the first instance, Datasets compiled using the SEEA should provide relevant contextual, benchmarking, information for corporations, particularly for the agriculture sectors. | Natural, Produced | |
| <i>Food and Agriculture Organization of the United Nations (FAO)</i> | FAOSTAT – Food and Agriculture Organization of the United Nations | Country and time-specific data on agricultural production, trade, food security, indicators, food balance sheets, and other updated information | Can be used to identify material natural capital impacts associated with commodities, products, and practices and for estimating impacts and dependencies | Natural, Human, Social, Produced | 03, 04, 05 |
| | Sustainability Assessment of Food and Agriculture systems (SAFA) | SAFA is developed to assess the impact of food and agriculture on the environment and people. The SAFA tool is designed to support the implementation of SAFA Guidelines for assessment of a supply chain | The SAFA Guidelines provide examples of “fit for purpose” assessments and indicators according to business aim and four dimensions of sustainability: governance, environmental, economics, and well-being. The SAFA tool can be used to select relevant metrics and represent graphically the strength and weakness of activities | Natural, Human, Social, Produced | 04, 05 09 |
| | CropWat | Calculation of crop water requirements. Based on soil, climate, and crop data. | Can be used for assessments that list water use as a material impact or dependency pathway | Natural | 05 |
| <i>Natural Capital Project / Stanford University</i> | InVEST | Software that maps and value outputs, locations, and activities of people and values ecosystem services that benefit human life | Can be used to balance environmental and economic goals in a decision-making process to quantify and value trade-offs of alternative scenarios | Natural, Human, Produced | 05, 06, 07 |
| <i>Capitals Coalition, WBCSD, MIT Sloan</i> | Natural Capital Toolkit – Shift | Online platform to search sustainability frameworks and environmental, social, and governance tools | Can be used to find the best tools using filters by sector, resource type, natural, social, or governance issue | Natural, Human, Social | 05, 06, 07 |

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| Author | Name | Description | How could it be used in capitals assessments | Capitals | Relevant steps |
|---|--|---|---|---------------------------|----------------|
| <i>Ecosystem Services Partnership</i> | Ecosystem services valuation database | Database on ecosystem services valuation on a per hectare basis. Continuously updated it currently contains more than 600 studies and 4000 values records distributed across services and regions | Vast repository of case studies and ecosystem services value; datasets can be used to inform decisions about trade-offs or activity affecting ecosystems and biodiversity | Natural, Produced | 05, 06, 07 |
| <i>The Cool Farm Alliance</i> | Cool Farm Tool | Tool for growers to measure carbon footprint, biodiversity, water footprints of crop and livestock products | The tool can feed into the measurement and estimation of impacts related to crop and livestock products at the farm level | Natural | 05 |
| <i>Integrated Modelling Partnership</i> | ARIES – Artificial Intelligence for Ecosystem Services | The modeler chooses appropriate ecological process to connect and value flow between nature and society. Dynamic assessment of how nature provides benefits to people | Can be used to represent and assess capital flows and stocks including natural capital accounting, ecosystem service, food security, poverty, climate adaptation, conservation planning | Natural, Social, Produced | 05, 06, 07 |
| <i>UNEP/ GRID-Geneva</i> | MapX | Online platform for mapping, monitoring, and managing geospatial data on natural resources from 900 public datasets | Applications include chemicals management, disaster risk reduction, biodiversity and land use planning, renewable energy, and security | Natural | 05, 06 |
| <i>The Economist Intelligence Unit</i> | Global Food Security Index | A map presenting country indexes calculated on four issues: affordability, availability, quality and safety and natural resources, and resilience | Helps business to understand the local food (in) security of their activities and how this can be a risk or an opportunity for positive impact | Social | 02, 03 |
| <i>ESU-service</i> | ESU World Food LCA Database | Database includes over 1,600 processes related to agriculture, food processing, and consumption. As far as possible data include information on food waste | Provides information on food waste that can support the end-of-life assessment of a product, meals and household appliances | Human, Social | 05 |
| <i>GreenDelta / UNEP / SETAC</i> | nexus open LCA & open LCA | Search engine for LCA data that allows filtering data sets by database, year, location, sector, product, and price. Wide resource for Sustainability and Life Cycle Assessment | Map and software are useful for LCA assessment. Includes Agri FootPrint database with an inventory of food, feed and beverage ingredients, fertilizers, vegetable oil, and protein meal | Natural | 05 |

| Author | Name | Description | How could it be used in capitals assessments | Capitals | Relevant steps |
|--|--|---|---|----------------------------------|-------------------|
| <i>Trucost</i> | The Trucost Corporate Carbon Pricing Tool | Quantified current pricing schemes in 130 regions together with carbon pricing scenarios. The tool models potential future carbon price | The tool is useful to assess the carbon price for companies that want to model potential financial risk exposures | Natural, Produced | 05, 06, 07 |
| <i>United Nations</i> | UN data explorer | Data service with a variety of statistical resources. The database contains over 60 million data points and covers agriculture | The explorer can provide data on spatial, social, economic, and environmental context. It can be useful for materiality and pathways analysis | Natural, Human, Social, Produced | 03, 05 |
| <i>New Earth B</i> | The Social Hotspots Database | A tool to assess social risks and opportunities. It provides map, risks analyses and comparisons between social hotspot, by country and sector. | Based on Social Life Cycle Assessment, the database offers a model to calculate social footprints. It can be useful to measure human and social impacts and dependencies along the supply chain | Human, Social | 03, 04, 05 |
| <i>Social Value UK</i> | Global Value Exchange (GVE) | The GVE is a useful sources database of interconnected values, outcomes, indicators, and stakeholders | GVE can be used to map activity, monitor social value created, and can help to manage and maximize social value. It can be useful for social impact analysis | Natural, Social, Human | 05, 06, 07 |
| <i>World Bank-led global partnership</i> | Wealth Accounting and the Valuation of Ecosystem Services | The WAVES Knowledge Center is a useful platform with a broad collection of publications on natural capital stock | Platform provides contextualized information to help business in their assessment | Natural | 03 |
| <i>SimaPro</i> | SimaPro | Science-based information tool to collect, analyze, and monitor sustainability performance data of company's products and services | It can be used to model LCA to assess carbon and water footprint. Sima includes the Agri-footprint database and Ecoinvent | Natural | 04, 05, 06, 07 09 |
| <i>Environment and Climate Change Canada</i> | Environmental Valuation Reference Inventory (EVRI) | EVRI is a searchable storehouse of 4,000 valuation studies on the economic value of environmental assets and human health effects | EVRI can support methodological approaches and estimates of monetary values based on real examples | Natural, Human, Social, Produced | 05, 06, 07 |
| <i>Delft University of Technology</i> | Idematapp databases, Idemat databases and eco-cost databases | The databases include monetary values: Eco-costs, a measure to express the environmental burden of a product | Provides monetary value for materials, agricultural and animal products, resource depletion, water scarcity, fair wage, child labor, poverty, health and safety | Natural, Human, Social | 06, 07 |

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| Author | Name | Description | How could it be used in capitals assessments | Capitals | Relevant steps |
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| <i>Zurich University of Applied Science & others</i> | Eaternity Database (EDB) | A CO ₂ equivalent values and unit processes database for food. It includes 550 food items based on seasonality, farming procedure, transportation, conservation, and processing models | It can be used to measure CO ₂ e emissions values and compares those of organic and traditional farming. Contains nutrition values and CO ₂ values for meals and restaurant purchases | Natural | 05 |
| <i>UN Global Compact, CEO Water Mandate</i> | Quantis Water Database | Water footprint of products, services, organizations. Water footprints can be calculated throughout the supply chain | Provides information about water use, consumption, and water pollution of products and processes | Natural | 05 |
| <i>Water Footprint Network</i> | WaterStat - water footprint statistics | Datasets based on the Global Water Footprint Assessment Standard and statistics | Quantitative calculator for water footprint, water scarcity, and water pollution level | Natural | 05 |
| <i>FAO GeoNetwork and partners</i> | GeoNetwork | GeoNetwork provides metadata edition and interactive maps, satellite imagery and spatial databases at global, continental, and regional levels | Includes meta spatial data that can help to understand landscape characteristics of a region | Natural | 03, 05 |

Glossary

NOTE: In writing the Guidelines we have tried as much as possible to use standard English (US) and standard terminology in environmental economics, for which any dictionary or a good textbook (respectively) can supply appropriate definitions. In some cases it was necessary to introduce new terminology specific to the Guidelines. Definitions for these terms are adapted from the scientific literature or based on expert opinion and are prefaced by the phrase “In the Guidelines.”

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|------------------------------|---|
| <i>Abiotic services</i> | The benefits arising from fundamental geological processes (e.g., the supply of minerals, metals, oil and gas, geothermal heat, wind, tides and the annual seasons). |
| <i>Baseline</i> | In the Guidelines, the starting point or benchmark against which changes in capitals attributed to your business' activities can be compared. |
| <i>Biodiversity</i> | The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (UN 1992) |
| <i>Business application</i> | In the Guidelines, the intended use of the results of your capitals assessment, to help inform decision making. |
| <i>Capitals assessment</i> | An assessment considering more than one capital. This includes multi-capital assessments and integrated capital assessments. |
| <i>Components</i> | The three elements of a complete capitals assessment identified in the Guidelines as a) “impacts on your business,” b) “your impacts on society,” and c) “your business dependencies.” |
| <i>Counterfactual</i> | A form of scenario that describes a plausible alternative situation, and the environmental conditions that would result if the activity or operation did not proceed (adapted from Cambridge Natural Capital Leaders Platform 2013). |
| <i>Dependency pathway</i> | A dependency pathway shows how a particular business activity depends upon specific features of natural, human, social, or produced capital. It identifies how observed or potential changes in capitals affect the costs and/or benefits of doing business. |
| <i>Ecosystem</i> | A dynamic complex of plants, animals, and microorganisms, and their non-living environment, interacting as a functional unit. Examples include deserts, coral reefs, wetlands, and rainforests (MA 2005a). Ecosystems are part of natural capital. |
| <i>Ecosystem services</i> | <p>The most widely used definition of ecosystem services is from the Millennium Ecosystem Assessment (MA 2005a): “the benefits people obtain from ecosystems”.</p> <p>The MA further categorized ecosystem services into four categories:</p> <ul style="list-style-type: none"> • Provisioning: Material outputs from nature (e.g., seafood, water, fiber, genetic material). • Regulating: Indirect benefits from nature generated through regulation of ecosystem processes (e.g., mitigation of climate change through carbon sequestration, water filtration by wetlands, erosion control and protection from storm surges by vegetation, crop pollination by insects). • Cultural: Non-material benefits from nature (e.g., spiritual, aesthetic, recreational, and others). • Supporting: Fundamental ecological processes that support the delivery of other ecosystem services (e.g., nutrient cycling, primary production, soil formation). |
| <i>Externality</i> | A consequence of an action that affects someone other than the agent undertaking that action, and for which the agent is neither compensated nor penalized. Externalities can be either positive or negative (WBCSD et al. 2011). |
| <i>Human capital</i> | The knowledge, skills, competencies, and attributes embodied in individuals that contribute to improved performance and well-being. |
| <i>Impact driver</i> | In the Guidelines, an impact driver is a measurable quantity of a natural, human, social, or produced resource that is used as an input to production (e.g., volume of water used for crop irrigation) or a measurable non-product output of business activity (e.g., a kilogram of CO ₂ e emissions released into the atmosphere by a manufacturing facility). |
| <i>Impact pathway</i> | An impact pathway describes how, as a result of a specific business activity, a particular impact driver results in changes in capitals and how these changes in capitals affect different stakeholders. |
| <i>Life cycle assessment</i> | Also known as Life Cycle Analysis. A technique used to assess the environmental impacts of a product or service through all stages of its life cycle, from material extraction to end-of-life (disposal, recycling or reuse). The International Organization for Standardization (ISO) has standardized the LCA approach under ISO 14040 (UNEP 2015). Several life cycle impact assessment (LCIA) databases provide a useful library of published estimates for different products and processes. |
| <i>Market value</i> | The amount for which something can be bought or sold in a given market |

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| <i>Materiality</i> | In the Guidelines, an impact or dependency on natural, human, social, or produced capital is material if consideration of its value, as part of the set of information used for decision making, has the potential to alter that decision (Adapted from OECD 2015 and IIRC 2013). |
| <i>Materiality assessment</i> | In the Guidelines, the process that involves identifying what is (or is potentially) material in relation to the capitals assessment's objective and application. |
| <i>Measurement</i> | In the Guidelines, the process of determining the amounts, extent, and condition of natural capital and associated ecosystem and/or abiotic services, in physical terms. |
| <i>Monetary valuation</i> | Valuation that uses money (e.g., \$, €, ¥) as the common unit to assess the values of capital impacts or dependencies. |
| <i>Multi-capital assessment</i> | A capitals assessment measuring and valuing all the capitals in terms of a business' impacts and dependencies on them, showing the results for each capital 'side by side' (i.e., in a series). |
| <i>Natural Capital Protocol</i> | A standardized framework to identify, measure, and value direct and indirect impacts (positive and negative) and/or dependencies on natural capital. |
| <i>Natural resources</i> | <p>Natural resources encompass a range of materials occurring in nature that can be used for production and/or consumption.</p> <ul style="list-style-type: none"> Renewable resources: These may be exploited indefinitely, provided the rate of exploitation does not exceed the rate of replacement, allowing stocks to rebuild (assuming no other significant disturbances). Renewable resources exploited faster than they can renew themselves may effectively become non-renewable, such as when over-harvesting drives species extinct (UN 1997). <p>Non-renewable resources: These will not regenerate after exploitation within any useful time period. Non-renewable resources are sub-divided into reusable (e.g., most metals) and non-reusable (e.g., thermal coal).</p> |
| <i>Organizational focus</i> | <p>In the Guidelines, the part or parts of the business to be assessed (e.g., the company as a whole, a business unit, or a product, project, process, site, or incident). For simplicity, these are grouped under three general headings as below:</p> <ul style="list-style-type: none"> Corporate: assessment of a corporation or group, including all subsidiaries, business units, divisions, different geographies or markets, etc. Project: assessment of a planned undertaking or initiative for a specific purpose, and including all related sites, activities, processes, and incidents. Product: assessment of particular goods and/or services, including the materials and services used to produce these products. |
| <i>Integrated capitals assessment</i> | A capitals assessment which explicitly takes into account the interconnections both within and between all of the capitals. |
| <i>Primary data</i> | Data collected specifically for the assessment being undertaken. |
| <i>Price</i> | The amount of money expected, required, or given in payment for something (normally requiring the presence of a market). |
| <i>Produced capital</i> | The man-made goods as well as all financial assets that are used to produce goods and services consumed by society |
| <i>Qualitative valuation</i> | Valuation that describes natural capital impacts or dependencies and may rank them into categories such as high, medium, or low. |
| <i>Quantitative valuation</i> | Valuation that uses non-monetary units such as numbers (e.g., in a composite index), areas, mass, or volume to assess the magnitude of natural capital impacts or dependencies. |
| <i>Single capital assessment</i> | An assessment measuring and valuing a single form of capital (e.g., natural, or human, or social, or produced capital) in terms of a business's impacts and dependencies on it. |
| <i>Social capital</i> | The networks together with shared norms, values, and understanding that facilitate cooperation within and among groups. |
| <i>Scenario</i> | A storyline describing a possible future. Scenarios explore aspects of, and choices about, the future that are uncertain, such as alternative project options, business as usual, and alternative visions. |
| <i>Secondary data</i> | Data that were originally collected and published for another purpose or a different assessment. |
| <i>Spatial boundary</i> | The geographic area covered by the assessment, for example, a site, watershed, landscape, country, or global level. The spatial boundary may vary for different impacts and dependencies and will also depend on the organizational focus, value-chain boundary, value perspective, and other factors. |

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| <i>Stakeholder</i> | Any individual, organization, sector, or community with an interest or “stake” in the outcome of a decision or process. |
| <i>Temporal boundary</i> | The time horizon of the assessment. This could be a current “snapshot,” a 1-year period, a 3-year period, a 25-year period, or longer. |
| <i>Validation</i> | Internal or external process to check the quality of the assessment, including technical credibility, the appropriateness of key assumptions, and the strength of your results. This process may be more or less formal and often relies on self-assessment. |
| <i>Valuation</i> | In the Guidelines, the process of estimating the relative importance, worth, or usefulness of capitals to people (or to a business), in a particular context. Valuation may involve qualitative, quantitative, or monetary approaches, or a combination of these. |
| <i>Valuation technique</i> | The specific method used to determine the importance, worth, or usefulness of something in a particular context. |
| <i>Value perspective</i> | In the Guidelines, the perspective or point of view from which value is assessed; this largely determines which costs or benefits are included in an assessment. Business value: The costs and benefits to the business, also referred to as internal, private, financial, or shareholder value. Societal values: The costs and benefits to wider society, also referred to as external, public, or stakeholder value (or externalities). |
| <i>Value transfer</i> | A technique that takes a value determined in one context and applies it to another context. Where contexts are similar or appropriate adjustments are made to account for differences, value transfer can provide reasonable estimates of value. |
| <i>Value-chain boundary</i> | The part or parts of the business value chain to be included in a capitals assessment. For simplicity, the Guidelines identify three elements of the value chain: upstream, direct operations, and downstream. An assessment of the full lifecycle of a product would encompass all three parts. Upstream (cradle-to-gate): covers the activities of suppliers, including purchased energy. Direct operations (gate-to-gate): covers activities over which the business has direct operational control, including majority-owned subsidiaries. Downstream (gate-to-grave): covers activities linked to the purchase, use, reuse, recovery, recycling, and final disposal of the business' products and services. |
| <i>Verification</i> | Independent process involving expert assessment to check that the documentation of the assessment is complete and accurate and gives a true representation of the process and results. “Verification” is used interchangeably with terms such as “audit” or “assurance.” |

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All weblinks accessed July 2020

A4S. 2015. *Natural and social Capital Accounting: An introduction for finance teams. The Accounting for Sustainability Chief Financial Officer Leadership Network.* Available at: <https://www.accountingforsustainability.org/content/dam/a4s/corporate/home/KnowledgeHub/Guide-pdf/A4S%20Natural%20and%20social%20capital%20accounting.pdf.downloadasset.pdf>

Baltussen, W., Achterbosch, E. Arets, A. de Blaeij, N. Erlenborn, V. Fobelets, P. Galgani, A. De Groot Ruiz, R. Hardwicke, S.J. Hiemstra, P. van Horne, O. A. Karachalios, G. Kruseman, R. Lord, W. Ouweltjes, M. Tarin Robles, T. Vellinga, L. Verkooijen, A. 2017. *Valuation of livestock eco-agri-food systems: poultry, beef and dairy.* Wageningen, Wageningen University & Research, Trucost & True Price, publication 2017-039. Available at: <https://drive.google.com/file/d/0B9AcbUml9f5TdDltdDJhZkpOMnM/view>

Bergman, E., de Groot Ruiz, A., Fobelets, V. 2016. *The True Price of Tea from Kenya.* Available at: https://issuu.com/idhsustainabletradeinitiative/docs/the_true_price_of_tea_from_kenya/3

Better Evaluation (n.d). *Combine Qualitative and Quantitative Date.* Available at https://www.betterevaluation.org/en/rainbow_framework/describe/combining_qualitative_and_quantitative_data

Biodiversity International. 2019. *Agrobiodiversity Index Report: Risk and Resilience.* Rome. Available at: <https://cgspace.cgiar.org/handle/10568/100820>

Bogdanski, A., R. van Dis, Attwood, S., Baldock, C., DeClerck, F., DeClerck, R., Garibaldi, L., Lord, R., Hadi, B., Horgan, F., Obst, C., Rutsaert, P., Turmel, M.-S., Gemmill-Herren, B. Forethcoming. *Valuation of rice agro-ecosystems.* TEEB Rice. Final report. UNEP/FAO, unpublished project report for The Economics of Ecosystems and Biodiversity (TEEB) global initiative for Agriculture and Food. Available at: http://doc.teebweb.org/wp-content/uploads/2017/06/FeederStudy_RICE_report.pdf

Bulle, C., Margni, M., Patouillard, L., Boulay A-M, Bourgault, G., De Bruille, V., Cao, V., Hauschild, M.Z., Henderson, A., Humbert, S., Kashef-Haghighi, S., Kounina, A., Laurent, A., Levasseur, A., Liard, G., Rosenbaum, R., Roy P-O, Shaked, S., Fantke, P., Joliet, O.. 2019. *IMPACT World+: A globally regionalized life cycle impact assessment method.* Intl J Life Cycle Asses. 1-22. doi: 10.1007/s11367-019-01583-0

Cambridge Natural Capital Leaders Platform. 2013. *E.valu.a.te: The Practical Guide.* Available at: <https://www.cisl.cam.ac.uk/resources/natural-resource-security-publications/evaluate-practical-guide>

Chartered Institute of Internal Auditor. 2015. *What is internal audit?* Available at: <https://www.iaa.org.uk/about-us/what-is-internal-audit/>

Church, C.; Rogers, M. 2006. *Chapter 4: Indicators In: Designing for Results: Integrating Monitoring and Evaluation in Conflict Transformation Program*, pp. 43-60. Available at: <https://www.sfcg.org/Documents/dmechapter4.pdf>

Cool Farm Alliance. 2019. *The Cool Farm Tool.* Available at <https://coolfarmtool.org/coolfarmtool/>

De Bruyn, S., Bijleveld, M., de Graaff, L., Schep, E., Schroten, A., Vergeer, R., and Ahdour, S. 2018. *Environmental Prices Handbook EU28 version.* CE Delft. Available at: <https://www.cedelft.eu/en/publications/2191/environmental-prices-handbook-eu28-version>

Delft University of Technology. 2017. *Eco-cost VO.O.* Available at <https://www.ecocostsvalue.com/EVR/model/theory/subject/5-data.html>

Dembe, A.E., Erickson, J.B., Delbos, R.G., Banks, S.M. 2005. *The impact of overtime and long work hours on occupational injuries and illnesses: new evidence from the United States.* Occup Environ Med 2005;62:588-597. doi: 10.1136/oem.2004.016667

Earnst & Young. 2016. *Total Value: Impact valuation to support decision-making.* Available at [https://www.ey.com/Publication/vwLUAssets/ey-total-value-impact-valuation-to-support-decision-making/\\$FILE/ey-total-value-impact-valuation-to-support-decision-making.pdf](https://www.ey.com/Publication/vwLUAssets/ey-total-value-impact-valuation-to-support-decision-making/$FILE/ey-total-value-impact-valuation-to-support-decision-making.pdf)

Eaternity Association. 2020. *Eaternity Database (EDB).* Available at <https://eaternity.org/about/>

- Ecosystem Services Partnership. 2020. *Ecosystem services valuation database*. Available at <https://www.es-partnership.org/esvd>
- EEA. 2016. *CICES. Toward a Common Classification of Ecosystem Service*. Available at <https://cices.eu/>
- Eftec. 2010. *Valuing Environmental Impacts: Practical Guideline for the Use of Value Transfer in Policy and Project Appraisal*. Value Transfer Guidelines submitted to Department for Environment, Food and Rural Affairs. Available at <https://www.cbd.int/financial/values/unitedkingdom-guidelines.pdf>
- Environment and Climate Change Canada. 2020. *Environmental Valuation Reference Inventory (EVRI)*. Available at <https://www.evri.ca/>
- Eosta, Soil & More, Triodos Bank, Hivos. 2016. *True Cost Accounting for Food, Farming & Finance report*. Available at <https://www.natureandmore.com/files/documenten/tca-fff-report.pdf>
- European Union Business, Biodiversity Platform. 2019. *Assessment of biodiversity measurement approaches for businesses and financial institutions*. Available at https://ec.europa.eu/environment/biodiversity/business/assets/pdf/european_B@B_platform_report_biodiversity_assessment_2019_FINAL_5Dec2019.pdf
- European Union LIFE Initiative. 2020. *Biodiversity performance tool and monitoring system for the food sector*. Available at <https://www.biodiversity-performance.eu/>
- European Union Publication. 2016. *General Data Protection Regulation*. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1532348683434&uri=CELEX:02016R0679-20160504>
- Fantke, P., Huijbregts, M., Margni, M., Hauschild, M., Jolliet, O., McKone, T.E., Rosenbaum, R.K., van de Meent, D. 2015. *USEtox® 2.0 User Manual (Version 2)*, <http://usetox.org>
- FAO (Food and Agriculture Organization of the United Nations). 2001. *Contract farming: Partnerships for growth*. Available here <http://www.fao.org/3/y0937e/y0937e00.pdf>
- FAO. (Food and Agriculture Organization of the United Nations). 2014. *Food Wastage Footprint: Full-Cost Accounting. Final Report*. Available from: <http://www.fao.org/3/a-i3991e.pdf>
- FAO (Food and Agriculture Organization of the United Nations). 2014. *SAFA Sustainability Assessment of Food and Agriculture Systems Guidelines version 3.0*. Available at <http://www.fao.org/3/a-i3957e.pdf>
- FAO. (Food and Agriculture Organization of the United Nations). 2015. *Food wastage footprint & Climate Change*. Available from: <http://www.fao.org/3/a-bb144e.pdf>
- FAO (Food and Agriculture Organization of the United Nations). 2015. *Natural Capital Impacts in Agriculture: supporting better business decision-making*. Available at http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Natural_Capital_Impacts_in_Agriculture_final.pdf
- FAO (Food and Agriculture Organization of the United Nations). 2020. *CropWat A computer program for irrigation planning and management*. Available at <http://www.fao.org/land-water/databases-and-software/cropwat/en/>
- FAO (Food and Agriculture Organization of the United Nations), Iiasa, Isric, Iссas, Jrc. 2012. *Harmonized world soil database version 1.2*. Available at: <http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/>
- FAOSTAT Statistics Division (Food and Agriculture Organization of the United Nations). 2019. *Food and Agriculture Data*. Available at <http://www.fao.org/faostat/en/#home>
- FAOSTAT Statistics Division (Food and Agriculture Organization of the United Nations). 2019. *Land use*. Available at: <http://www.fao.org/faostat/en/#data/RL>
- Food and Land Use Coalition. 2019. *Growing Better: Ten Critical Transitions to Transform Food and Land Use*. Available: <https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf>

- FoodSIVI (Food System Impact Valuation Initiative). 2019. *Valuing the impact of food: towards practical and comparable monetary valuation of food system impacts*. Available at https://foodsivi.org/wp-content/uploads/2020/01/FoodSIVI-Report-Valuing-The-Impact-of-Food-1_2019_12_18.pdf
- Geodata. 2020. *Geodata portal*. Available at <http://geodata.policysupport.org/>
- GreenDelta. 2020. *openLCA nexus*. Available at <https://nexus.openlca.org/search>
- Health and Safety Executive. 2001. *Reducing Risks, Protecting People*. Available at <https://www.hse.gov.uk/risk/theory/r2p2.pdf>
- Hoekstra A. Y., Chapagain A. K., Aldaya, M. M., Mekonnen M. M. 2011. *The Water Footprint Assessment Manual: Setting the Global Standard*. Available at https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_waterfootprintmanual_wci_1319577922803
- Huijbregts MAJ, Steinmann ZJN, Elshout PMF, Stam G, Verones F, Vieira MDM, Van Zelm R. ReCiPe 2016. *A harmonized life cycle impact assessment method at midpoint and endpoint level. Report I: characterization*. RIVM Report 2016-0104. Bilthoven, The Netherlands: National Institute for Human Health and the Environment
- Institute for Human Rights and Business. 2011. *More than a Resource: Water, Business and Human Rights*. Available at: https://www.ihrb.org/pdf/More_than_a_resource_Water_business_and_human_rights.pdf
- Integrated Modelling Partnership. 2020. *ARIES – Artificial Intelligence for Ecosystem Services*. Available at <http://aries.integratedmodelling.org/>
- International Integrated Reporting Council (IIRC). 2013. *International Integrated Reporting Framework*. Available at: <https://integratedreporting.org/wp-content/uploads/2013/12/13-12-08-THE-INTERNATIONAL-IR-FRAMEWORK-2-1.pdf>
- International Panel of Experts on sustainable food system, Global Alliance for the future of food. 2017. *Unravelling the food-health nexus. Addressing practices, political economy, and power relations to build healthier food system Executive summary*. Available at https://futureoffood.org/wp-content/uploads/2017/10/FoodHealthNexus_ExecSummary_Digital_FINAL.pdf
- ISO. 2019. ISO 14008: 2019 *Monetary valuation of environmental impacts and related environmental aspects*. Available at <https://www.iso.org/standard/43243.html>
- ISO. 2019. ISO 14007:2019. *Environmental management – Guidelines for determining environmental costs and benefits*. Available at <https://www.iso.org/standard/70139.html>
- IWGSCC. 2013. Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis. Interagency Working Group on Social Cost of Carbon, United States Government.
- Kering. 2014. *Environmental Profit & Loss: Methodology & 2013 Group Results*
- Kivimäki, M., Jokela, M., Nyberg, S., Singh-Manoux, A., Fransson, E., Alfredsson, L., Björner, J., Borritz, M., Burr, H., Casini, A., Clays, E., De Bacquer et al. 2015. *Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603,838 individuals*. The Lancet Volume 286, Issue 10005, p1739-1746, available here [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(15\)60295-1/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(15)60295-1/fulltext)
- Landers, D.H. and A.M. Nahlik. 2012. *Final Ecosystem Goods and Services Classification System (FECS-CS)* EPA/600/R-13/ORD/004914. US Environmental Protection Agency, Office of Research and Development, Washington, DC
- Leclerc, Q., Lindsay, J., Knight, G. 2019. *Mathematical modelling to study the horizontal transfer of antimicrobial resistance genes in bacteria: current state of the field and recommendations*, Royal Society, Available at: <https://doi.org/10.1098/rsif.2019.0260>
- Liu, S., R. Portela, A. Ghermandi, N. Rao, and X. Wang. 2012. *Environmental Benefit Transfers of Ecosystem Service Valuation* In Van Den Belt M. and Costanza R. (eds) Volume 12. 'Ecological Economic of Estuaries and Coasts' In Wolanski E. and McLusky D.S. (eds) Treatise on Estuarine and Coastal Science. Waltham, MA: Academic Press

- Lonsdorf, E. Kremen, C. Ricketts, T. Winfree, R. Williams, N. Greenleaf, S. 2009. *Modelling pollination services across agricultural landscapes*, Annals of Botany, Volume 103, Issue 9, Pages 1589–1600, <https://doi.org/10.1093/aob/mcp069>
- MA. 2005a. Millennium Ecosystem Assessment: Ecosystems and human wellbeing. Biodiversity Synthesis. Washington DC: Island Press
- Mason, H., Jones-Lee, M., Donaldson, C. 2009. *Modelling the Monetary Value of a QALY: A New Approach Based on UK Data* In: Health Econ. 2009 Aug;18(8): 943–40 <https://onlinelibrary.wiley.com/doi/epdf/10.1002/hec.1416>
- Massachusetts Institute of Technology. 2020. *Living wage calculator*. Available at <https://livingwage.mit.edu/>
- McKenzie, E., Rosenthal, A., Bernhardt, J., Girvetz, E., Kovacs, K., Olwero, N. and Toft, J. 2012. *Developing scenarios to assess ecosystem service tradeoffs: Guidance and case studies for InVEST users*. Available at: <https://naturalcapitalproject.stanford.edu/sites/g/files/sbiybj9321/f/publications/scenariosguide.pdf>
- Metro AG. 2017. *Sustainability accounting in action, revealing the hidden costs & benefits of food service distribution*. Available here https://www.metroag.de/-/assets/metro/documents/responsibility/sustainability-accounting-in-action_en.pdf
- Natural Capital Coalition. 2016. *Natural Capital Protocol*. Available at: www.naturalcapitalcoalition.org/protocol
- Natural Capital Coalition. 2016. *Natural Capital Protocol – Food and Beverage Sector Guide*. Available at: www.naturalcapitalcoalition.org/protocol
- New Earth B. 2019. *The Social Hotspots Database*. Available at <http://www.socialhotspot.org/>
- Norris, C. B., Cavan, D. A., Norris G. A. 2012. *Identifying social impacts in product supply chains: overview and application of the social hotspot database in Sustainability* 4(9). Available at https://www.researchgate.net/publication/233777026_Identifying_Social_Impacts_in_Product_Supply_Chains_Overview_and_Application_of_the_Social_Hotspot_Database
- OECD. 2015. *Glossary of Statistical Terms*. Organisation for Economic Co-operation and Development. Available at: <https://stats.oecd.org/glossary/>
- OECD-FAO (Food and Agriculture Organization of the United Nations). 2016. *OECD-FAO Guidance for Responsible Agricultural Supply Chains*. Available at <https://www.oecd-ilibrary.org/docserver/9789264251052-en.pdf?expires=1591780827&id=id&accname=guest&checksum=14EC326753E5587940DB7BAE5C259A31>
- Office of the United Nations High Commissioner for Human Rights (OHCHR). 2013. *Free, Prior and Informed Consent of Indigenous Peoples*. Available at <https://www.ohchr.org/Documents/Issues/ipeoples/freepriorandinformedsent.pdf>
- Open Source Geospatial Foundation. 2020. *GeoNetwork Opensource*. Available at: <https://geonetwork-opensource.org/downloads.html>
- Roundtable for Product Social Metrics. 2018. *Handbook for Product Social Impact Assessment*. Available at <https://product-social-impact-assessment.com/>
- Raynaud, J., Fobelets, V., Georgieva, A., Joshi, S., Kristanto, L., de Groot Ruiz, A., Bullock, S., Hardwicke, R., 2016. *Improving Business Decision Making: Valuing the Hidden Costs of Production in the Palm Oil Sector. A study for The Economics of Ecosystems and Biodiversity for Agriculture and Food (TEEBAgriFood) Program*. Available at: http://www.teebweb.org/wp-content/uploads/2016/12/TEEBAgriFood_PalmOil_Report.pdf
- S&P Trucost. 2018. *The Trucost Corporate Carbon Pricing Tool*. Available at <https://www.trucost.com/corporate-advisory/carbon-pricing-tool/>
- Sandhu, H., Müller, A., Sukhdev, P., et al. 2019. *The future of agriculture and food: evaluating the holistic costs and benefits*. Available at https://www.researchgate.net/publication/335664122_The_future_of_agriculture_and_food_Evaluating_the_holistic_costs_and_benefits
- SASB (Sustainability Accounting Standards board). 2018. *Agricultural products sustainability accounting standard*. Available at <https://www.sasb.org/standards-overview/download-current-standards/>

- SASB (Sustainability Accounting Standards board). 2018. *SASB Materiality Map*. Available at <https://materiality.sasb.org/>
- Secretariat of the Convention on Biological Diversity. 2012. *Impact of marine debris on biodiversity*. In *CBD Technical Serie No. 67*. Available at: <https://www.cbd.int/doc/publications/cbd-ts-67-en.pdf>
- SEEA (System of environmental economic accounting). 2014. *Central Framework*. Available at https://seea.un.org/sites/seea.un.org/files/seea_cf_final_en.pdf
- Shift Project. *HP's Foreign Migrant Worker Standard*. Available at: https://shiftproject.org/wp-content/uploads/2018/08/TheHumanRightsOpportunity_Shift.pdf
- Sigmapro. 2020. *Sigmapro*. Available at <https://simapro.com/>
- Social & Human Capital Coalition. 2018. *Social & Human Capital Protocol*. Available at <https://social-human-capital.org/protocol/>
- Social Value UK. 2020. *Global Value Exchange*. Available at <http://www.socialvalueuk.org/resources/global-value-exchange/>
- Soil and More Impact, Thinktank for Sustainability. 2020. *Inventory Report Consultation draft prepared for the Global Alliance for the Future of Food*.
- Sustainability Initiative at MIT Sloan. 2020. *SHIFT Sustainability, Help, Information, Frameworks/Findings and Tools Platform*. Available at <https://shift.tools/about>
- Tang, H. Qiu, J. Li, H. Li, C. Ranst, E. 2010. *Modelling Soil Organic Carbon Storage and Its Dynamic in Croplands of China*. *Agricultural Sciences in China*, Volume 9, Issue 5, page 704-712. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S1671292709601462>
- The Economic of Ecosystems and Biodiversity (TEEB). 2010. *The Economics of Ecosystems and Biodiversity: Ecological Economics Foundations*. Edited by P. Kumar. Earthscan, London and Washington, DC
- The Economic of Ecosystems and Biodiversity (TEEB). 2011. *The Economics of Ecosystems and Biodiversity in National and International Policy Making*. Edited by P. ten Brink. Earthscan, London and Washington, DC
- The Economics of Ecosystems and Biodiversity (TEEB) 2018. *Measuring what matters in agriculture and food systems: a synthesis of the results and recommendations of TEEB for Agriculture and Food's Scientific and Economic Foundations report*. Geneva: UN Environment Available at http://teebweb.org/agrifood/wp-content/uploads/2018/10/Layout_synthesis_sept.pdf
- The Economics of Ecosystems and Biodiversity for Agriculture and Food (TEEB). 2018. *Scientific and Economic Foundations report*. Geneva: UN Environment. Available at http://teebweb.org/agrifood/wp-content/uploads/2018/11/Foundations_Report_Final_October.pdf
- Trasande, L., Zoeller, R.T., Hass, U., Kortenkamp, A., Grandjean, P., Myers, J.P., DiGangi, J., Bellanger, M., Hauser, R., Legler, J., Skakkebaek, N.E., Heindel, J.J. 2015. *Estimating Burden and Disease Costs of Exposure to Endocrine-Disrupting Chemicals in the European Union*. *J Clin Endocrinol Metab*. 2015 Apr; 100(4): 1245-1255. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4399291/>
- Trucost. 2019. *The Socioeconomic and Environmental Impact of Large-Scale Diamond Mining*. Available at https://www.spglobal.com/marketintelligence/en/documents/the-socioeconomic-and-environmental-impact-of-large-scale-diamond-mining_dpa_02-may-2019.pdf
- Typhoid Vaccine Acceleration Consortium. 2018. *Accelerating typhoid conjugate vaccine introduction*. Available at: https://path.azureedge.net/media/documents/TyVAC_factsheet_6_2018_ENGLISH.pdf
- United Kingdom Treasury. 2018. *The Green Book: Central Government Guidance on Appraisal and Evaluation*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf
- United Nations. 2014. *System of Environmental Economic Accounting (SEEA). 2012 - Central Framework*. New York. https://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf

- United Nations Environment Programme. 2018. *Global Guidance for Life Cycle Impact Assessment Indicators Volume 1*. Available at <https://www.lifecycleinitiative.org/download/5746/>
- United Nations Environment Programme. 2018. *Life Cycle Impact Assessment Characterization Factors Database*. Available at <https://www.lifecycleinitiative.org/download/5737/>
- United Nations Environment Programme (UNEP), Society of Environmental Toxicology and Chemistry (SETAC). 2009. *Guidelines for Social Life Cycle Assessment of Products*. Available at: http://www.unep.fr/shared/publications/pdf/dtix1164xpa-guidelines_slca.pdf
- United Nations Environment Programme (UNEP), Society of Environmental Toxicology and Life Cycle Initiative. 2016. *Opportunities for national life cycle network and creation and expansion around the world*. Available at <https://www.lifecycleinitiative.org/wp-content/uploads/2016/10/mapping-publication-9.10.16-web.pdf>
- United Nations Environment Programme (UNEP). 2019. *Global Guidance for Life Cycle Impact Assessment Indicators Volume 2*. Available at <https://www.lifecycleinitiative.org/download/7485/>
- Verones F, Bare J, Bulle C, Frischknecht R, Hauschild M, Hellweg S, Henderson A, Jolliet O, Laurent A, Liao X, Lindner JP, Maia de Souza D, Michelsen O, Patouillard L, Pfister S, Posthuma L, Prado V, Ridoutt B, Rosenbaum RK, Sala S, Ugaya C, Vieira M, Fantke P. 2017. *LCIA framework and crosscutting issues guidance within the UNEPSETAC Life Cycle Initiative*. J Cleaner Prod. 2017(161): 957-967. DOI: 10.1016/j.jclepro.2017.05.206.
- Vidal Legaz B, Maia De Souza D, Teixeira RFM, Antón A, Putman B, Sala S. 2017. *Soil quality, properties, and functions in life cycle assessment: an evaluation of models*. J Cleaner Prod. 140, Part 2: 502-515.
- World Bank, and Independent Evaluation Group. 2012. *Designing a Results Framework for Achieving Results: A How-to Guide*.
- World Business Council for Sustainable Development (WBCSD). 2013. *Measuring Socio-economic Impact: A Guide for Business*. Available at <https://www.wbcsd.org/Programs/Redefining-Value/External-Disclosure/Reporting-matters/Resources/Measuring-Socio-Economic-Impact-A-guide-for-business>
- World Business Council for Sustainable Development (WBCSD), International Union for the Conservation of Nature (IUCN), ERM, and PwC. 2011. *Guide to Corporate Ecosystem Valuation (Online)*. Available at: <https://www.wbcsd.org/Programs/Redefining-Value/Business-Decision-Making/Assess-and-Manage-Performance/Resources/Guide-to-Corporate-Ecosystem-Valuation>
- World Business Council for Sustainable Development (WBCSD). 2013. *Business Guide to Water Valuation: An introduction to concepts and techniques*. Available at: <https://www.wbcsd.org/Programs/Food-and-Nature/Water/Resources/Business-Guide-to-Water-Valuation-an-introduction-to-concepts-and-techniques>
- World Business Council for Sustainable Development (WBCSD). 2016b. *Social Life Cycle Metrics for Chemical Products*. Available at: <https://www.wbcsd.org/Projects/Chemicals/Resources/Social-Life-Cycle-Metrics-for-Chemical-Products>
- World Business Council for Sustainable Development (WBCSD). 2018. *True Cost of Food: Unpacking the value of the food system*, FreSH Discussion Paper. Available at: https://docs.wbcsd.org/2018/10/FReSH_True_Cost_Discussion_Paper.pdf
- World Economic Forum. 2020. *Our recovery from the coronavirus crisis must have gender empowerment at its heart*. Available at: <https://www.weforum.org/agenda/2020/05/industries-gender-women-coronavirus-covid19-economic/>
- World Health Organization (n.d). *Health Statistics and Information Systems: Metrics: Disability-Adjusted Life Year (DALY)*. Available at: http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/
- World Health Organisation. 2017. *WHO methods and data sources for global burden of disease estimates 2000-2015*. Available at: https://www.who.int/healthinfo/global_burden_disease/GlobalDALYmethods_2000_2015.pdf?ua=1

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| Box 7.5 | Measurement and valuation of injuries and fatalities at work |
| Box 7.6 | Discounting in capitals valuation |
| Box 8.1 | Comparisons and trade-offs in monetary valuation |

Acknowledgments

The TEEB for Agriculture and Food: Operational Guidelines for Business have been developed through a collaborative effort. The Steering Group, which was appointed by the Coalition TEEBAgriFood team to provide guidance and oversight for the project, would like to thank all of the organizations who have dedicated resources to deliver this significant piece of work. We would also like to thank the individuals who have proved that collaboration delivers something more than any of us can achieve alone and have contributed so much of their time, expertise, and passion:

For developing the TEEBAgriFood Guidelines

From the Capitals Coalition: Marta Santamaría, Mark Gough, Isabel Hoffmann, Louise Amand, Martine van Weelden, and Hannah Brooke for leading the development of the Guidelines.

From the Institute for the Development of Environmental-Economic Accounting (IDEEA): Mark Eigenraam, Carl Obst, and Reiss McLeod for their technical input.

For contributing to the development of the TEEBAgriFood Guidelines

Steve Bullock, Trucost; for contributing with his insights, time, passion, and support. Polly Wells, Capitals Coalition, for design and layout and Jennifer Hole for copyediting.

For providing oversight and guidance

Salman Hussain, UN Environment Program The Economics of Ecosystems and Biodiversity (UNEP TEEB).

For funding the development of the TEEBAgriFood Guidelines

The European Commission Partnership Instrument.

Thank you also to the UN Environment Program The Economics of Ecosystems and Biodiversity (UNEP TEEB) who are hosting this collaborative project and to ICAEW for their continued support and hosting of the Coalition.

Special thanks to all those contributed to the development of the Natural Capital Protocol and the Social and Human Capital Protocol, as these two documents has been widely used as input in this Guidelines.

With our thanks, the Guidelines Steering Group:

Lauren Baker, Global Alliance for Future of Food (Chair); Carl Obst, IDEEA (Co-Chair); Tobias Bandel, Soil & More; Scarlett Benson, Food and Land Use Coalition; Chris Brown, Olam International; Nachiketa Das, GIST Advisory; Emily Grady, Food Reform for Sustainability and Health (FReSH) Initiative at WBCSD; Paola Ovando, James Hutton Institute; Rex Raimond, TIFS Initiative; Carolina Starr, FAO; Ruth Thomas, Global Agribusiness Alliance.

Suggested citation

Capitals Coalition. 2020. "Draft TEEB for Agriculture and Food: Operational Guidelines for Business". (Online) Available at: <https://naturalcapitalcoalition.org/wp-content/uploads/2020/07/DRAFT-TEEBAgriFood-Operational-Guidelines.pdf>



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The Capitals Coalition is a global collaboration transforming the way decisions are made by including the value provided by nature, people, and society. Our ambition is that by 2030 the majority of business, finance, and government will include all capitals in their decision making, and that this will deliver a more fair, just, and sustainable world.

You can find a template for application in the Coalition's webpage ([here](#)) that will help you to confirm that you have completed all Steps and actions of your assessment.



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