

Valuing the impact of food:

Towards practical
and comparable
monetary valuation
of food system
impacts

A report of the Food System Impact
Valuation Initiative (FoodSIVI)

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GLOBAL
ALLIANCE
FOR THE
FUTURE
OF FOOD



FoodSIVI

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INTRODUCTION AND GLOSSARY

By conventional financial reckoning the food sector is a highly efficient and valuable sector. It produces high volumes of food at historically low costs to consumers with increasingly lower marginal inputs. However, a barrage of scientific reports from the Intergovernmental Panel on Climate Change (IPCC) in August 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services in March 2018 (IPBES), the Global Burden of Disease in April 2019 (GBD), The Economics of Ecosystems and Biodiversity (TEEB) for Agriculture and Food in 2018, Food and Land Use Coalition (FOLU) in September 2019, and the EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems in January 2019, provide significant evidence that this financial position is underpinned by a global net consumption and degradation of natural, social and human capital¹. They are culminations of over a decade of escalating calls for food system transformation.

By conventional financial reckoning the food sector is a highly efficient and valuable sector... account for social costs from impacts on natural, social and human capital and it becomes expensive, inefficient, and an economic, and potentially existential, risk to society.

The social costs of the impacts to natural, social and human capital identified by the scientific community are currently not costed into the activity of the food sector. Account for the social costs and the financial position of the current food system is transformed. It becomes expensive, inefficient, and an economic, and a potentially existential, risk to society. As part of the TEEB Business Coalition initiative, the consulting company TruCost found that the food sector was responsible for over 40% of the total economic cost of the global top 100 business environmental externalities². A similar analysis by KPMG estimated the food sector's externalised environmental costs over 200% of sector profits³. With an estimated 12% of the globe's land surface being used for crop production and

¹ "Consumption" here means a reduction in the quantity of capital, while "degradation" here means a reduction of quality. There are a range of these terms for diminishing flows of capital services depending on the type of capital. To simplify this we later refer to changes in quantity and quality of capital, or just capital change. IPCC, *IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems*, Intergovernmental Panel on Climate Change (2019), <https://www.ipcc.ch/report/srccl/>. IPBES et al., *The IPBES assessment report on land degradation and restoration*, Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (Bonn, Germany, 2018), <https://doi.org/10.5281/zenodo.3237392>. A. Afshin et al., "Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017," *The Lancet* 393, no. 10184 (2019), [https://doi.org/https://doi.org/10.1016/S0140-6736\(19\)30041-8](https://doi.org/https://doi.org/10.1016/S0140-6736(19)30041-8). TEEB, *TEEB for Agriculture & Food: Scientific and Economic Foundations*, UN Environment (Geneva, 2018). FOLU, *Growing Better: Ten Critical Transitions to Transform Food and Land Use*, *The Global Consultation Report of the Food and Land Use Coalition.*, Food and Land Use Coalition (New York, 2019), <https://www.foodandlandusecoalition.org/global-report/>. W. Willett et al., "Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems," *The Lancet* 393, no. 10170 (2019), [https://doi.org/https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/https://doi.org/10.1016/S0140-6736(18)31788-4).

² "Externality" meaning an economic cost or benefit arising from the transactions of a set of economic actors, e.g. costs of climate change to society not paid for in the transaction between producer and consumer when GHG emissions occur during production (or consumption). A glossary is on p. 8. The proportion of 48% of the cost of the global top 100 business externalities due to the food sector, and only 25% due to energy sector, with a ratio of economic costs of impacts to revenue of 180%, is calculated from Table 7.1 of TruCost, *Natural Capital at Risk: The Top 100 Externalities of Business*, TruCost PLC (London, 2013), <https://www.naturalcapitalcoalition.org/wp-content/uploads/2016/07/Trucost-Nat-Cap-at-Risk-Final-Report-web.pdf>.

³ KPMG calculated, using TruCost data on food producers within 800 companies, the figure of 224% economic costs of impacts to EBITDA: p.10 KPMG, *A new vision of value*, KPMG International

26% used for livestock grazing, the scale for biodiversity loss, soil degradation and nutrient pollution from land use alone is immense⁴. Health impacts valued by annual preventable costs of malnutrition (obesity, diabetes, stunting, etc.) range in conservative estimates from 1 trillion US 2014 dollars in the United States to 5 trillion US 2014 dollars globally (over 6% of global GDP in 2014)⁵. The 2019 Food and Land Use Coalition (FOLU) *Growing Better: Ten Critical Transitions to Transform Food and Land Use* report estimated the environmental, social and health costs of the global food sector at approximately 11% of global GDP⁶. This outweighs the market value. The FOLU report also highlighted the opportunity for leading companies in reducing those costs.

The evidence is that the value loss created by the food system will likely be greater than the financial value produced and be borne by those that benefitted little from the value created. It becomes an imperative to set in motion private and public levers to reduce the external costs of food systems. Impact valuations provide an estimate of the costs, and benefits, from food system activities. They account for externalities not costed into market transactions. Economic valuations which include externalities, so that markets can internalise

Value loss created by the food system will likely be greater than the financial value produced... Valuations that account for externalities not costed into market transactions are a key component of change.

Cooperative (Netherlands, 2014), <https://assets.kpmg/content/dam/kpmg/pdf/2014/10/a-new-vision-of-value-v1.pdf>.

⁴ J. Bruinsma, *World agriculture: towards 2015/2030: an FAO perspective* (London: Earthscan, 2003); P. Conforti, "Looking ahead in world food and agriculture: perspectives to 2050," (2011), <http://www.fao.org/docrep/014/i2280e/i2280e.pdf>; H. Steinfeld et al., *Livestock's long shadow: environmental issues and options* (Rome: Food and Agriculture Organization of the United Nations (FAO), 2006); FAO, *The state of food and agriculture 2009 : livestock in the balance* (Rome: Food and Agriculture Organization of the United Nations, 2009). IPCC, *IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems*. IPBES et al., *The IPBES assessment report on land degradation and restoration*, Key Message B6.

⁵ p. 38 Credit Suisse Research Institute, *Sugar consumption at a crossroads*, Credit Suisse AG (Switzerland, 2013), http://archive.wphna.org/wp-content/uploads/2014/01/13-09-Credit_Suisse_Sugar_crossroads.pdf, US\$1 trillion as 30% of 3.3 trillion, coming from the estimate 30-40% of the US\$3.3 trillion spent annually on US healthcare goes toward obesity and diabetes, see also US\$660 billion from US obesity alone (which is 20%) on p. 18 of R. Dobbs et al., *Overcoming obesity : an initial economic analysis*, McKinsey Global Institute (Washington, D.C., 2014), http://www.mckinsey.com/insights/economic_studies/how_the_world_could_better_fight_obesity. The McKinsey and Credit Suisse sources give the same estimate of US\$1 trillion for obesity and diabetes. A 2014 reference to US\$3.5 trillion and 11% global GDP is on p. 50 of IPES-Food, *Unravelling the food-health nexus: addressing practices, political economy, and power relations to build healthier food systems*, 2017, Global Alliance For The Future of Food and IPES-Food. World GDP (nominal) in 2014 was approximately US\$75 trillion according to CIA, *The CIA World Factbook 2014*, Central Intelligence Agency (New York, 2013), making US\$3.5 trillion in 2014 about 4% of Global GDP. Estimates on the economic costs of undernutrition are US\$1.4-2.1 trillion on p. 5 of the 2013 report FAO, *The State of Food and Agriculture 2013* (Rome: Food Agriculture Organization of the United Nations, 2013). <http://www.fao.org/3/i3300e/i3300e.pdf>. Adding global obesity costs of US\$2.8 trillion from Dobbs et al., *Overcoming obesity : an initial economic analysis*. p. 1 and diabetes costs give an estimate of around 2014 US\$5 trillion. See also M. Tremmel et al., "Economic Burden of Obesity: A Systematic Literature Review," *International journal of environmental research and public health* 14, no. 4 (2017), <https://doi.org/10.3390/ijerph14040435>. Malnutrition valuations in FOLU, 2019, based on Afshin et al., "Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017." result in a figure of 5–6% nominal global GDP.

⁶ FOLU, *Growing Better: Ten Critical Transitions to Transform Food and Land Use, The Global Consultation Report of the Food and Land Use Coalition*. <https://blogs.worldbank.org/voices/do-costs-global-food-system-outweigh-its-monetary-value>

them and incentivise a sustainable food system producing healthy nutritious food, are a key component of change. Regulation, market, investment...all the mechanisms that exist, that are already highly developed for rapidly responding to financial gain and loss of value, could and should be brought to bear on reducing food impact.

Further argument for the case for true-cost, or full-cost, accounting for the food sector is made in the TEEB AgriFood Scientific and Economic Foundations Report⁷. Existing impact frameworks such as the Natural, and Social & Human, Capital Protocol and TEEB AgriFood Evaluation Framework use a natural, human and social capital approach to capture external costs⁸. They describe monetary and non-monetary valuation of changes to capital due to the activity of business, government, and society. This report provides specific background and recommendations on advancing the practice of comparable monetary valuation of food system impacts. The existing impact frameworks are aligned. They are designed for universal application and describe steps for valuation such as setting the scope and acquiring data. They are not specific on comparable monetary valuation, however. The Protocols place no emphasis on comparability since they focus on internal decision-making within companies. This report does not focus on universal application of valuation methods. The emphasis is on comparable valuations of the major external costs introduced by the food system for a limited number of uses aimed at contributing to food system transformation.

The term valuation in this report will mean an economic valuation – a monetary estimate. The term is used more broadly in both the TEEB framework and the Protocols⁹. The report chapter [Alignment with Impact Frameworks](#) discusses alignment between impact frameworks. Monetary estimates are contentious. The report discusses a range of ethical considerations and sources of uncertainty in valuations. Monetary estimates do not imply ownership rights and amounts for exchanging ownership rights or responsibilities. For example, valuing changes to a river basin, positive or negative, does not imply that rights to any financial value produced by the river basin can be purchased for that amount or that an actor can pay that amount elsewhere in the economy in compensation for damaging the basin.

The practical challenges of impact valuation are not academic. They can lead to significant underestimation, or overestimation, of [the cost of impacts].

The ability to compensate value loss and gain across capital stocks using money is a feature of financial capital but is limited for non-financial capital. This is one of the challenges that need to be addressed for comparable impact valuations. The practical challenges of impact valuation are not academic. They can lead to significant underestimation, or overestimation. In the case of underestimation of long-term and major issues as climate change and generational health impacts, society would find it has not abated enough impact. When the social costs increasingly start to be revealed, society receives a bill for a cost

it thought it had covered with less time to pay the outstanding amount. For overestimation, society has incentivised alternative economic trajectories along with their opportunity costs that are not optimal. The result is a loss to livelihoods and economic development.

⁷ TEEB, *TEEB for Agriculture & Food: Scientific and Economic Foundations*.

⁸ NCC, *Natural Capital Protocol*, Natural Capital Coalition (London, 2016). S&HCC, *Social & Human Capital Protocol*, Social & Human Capital Coalition, World Business Council for Sustainable Development (Geneva, 2019), https://docs.wbcsd.org/2019/02/Social_and_Human_Capital_Protocol.pdf. S. Whitaker, "The Natural Capital Protocol," in *Debating Nature's Value: The Concept of 'Natural Capital'*, ed. V. Anderson (Cham: Springer International Publishing, 2018).

⁹ TEEB, *TEEB for Agriculture & Food: Scientific and Economic Foundations*. Chapter 7

Ambiguity in a valuation, non-disclosure, or a financial and accounting error, parallel for non-financial positions as the same issues would for financial positions. A financial balance sheet claiming revenue in place of profit would lead to significant error in the financial position of a company. Claiming positives without subtracting the underpinning cost or service provided by nature or society, or overvaluing offsets of negative externalities, lead to significant differences accounting for impact. Ambiguity and errors lead to an inability of parties to subscribe to and use valuations to discriminate company or product performance. Accounting and reporting developed throughout the 20th century to counter fraud and create a baseline of trust and comparison on which financial markets could operate and accelerate. Non-financial accounting must do the same, otherwise it becomes another corporate responsibility exercise.

Accounting developed to counter fraud and create a baseline of trust and comparison on which financial markets could operate and accelerate. Non-financial accounting must do the same, otherwise it becomes another corporate responsibility exercise.

Potential ideological positions on either side of the uncertainty, or error, in an impact valuation add to the recipe for lack of confidence and use. The side against overestimation of the impact would usually be established business, laissez faire approaches, conservative governments and vested capital. The side against underestimation of the impact would usually be civil society, progressive governments and business, precautionary approaches, and advocates for food system transformation. Ideological positions combine with the inherent uncertainties in valuations of changes in non-financial capital to further the lack of confidence¹⁰. Monetary valuation raises additional ideological divisions on what can be valued and by whom.

Reports such as present one, with both business and civil society sponsors, argue for a common basis for valuations within specific uses. The aim is to increase confidence and use.

The ethical choices implicit in impact valuation and the large uncertainty lead the report to recommend a footprint protocol, formalising impact pathways, and a process for setting and updating marginal social and abatement costs with estimates of their uncertainty. A model is suggested utilising marginal social or abatement costs, with the potential for risk-based corrections using the estimates of uncertainty.

The need for comparable and agreed monetary impact valuations lie in material issues with society as stakeholder. These issues are where the largest opportunities exist, both for change in impact on society, and for those leading companies positioned for fundamental change within the sector.

A process for performing impact valuation and an examination of that process, in the chapter [Food System Impact Valuation in Practice](#), applies to any set of material issues. A material issue in the private sector is a valuable aspect to specific stakeholders which are impacted by the activities of the food system actor. However, most of the challenges, and most of the need for comparable and agreed monetary impact valuations, lie in material issues for society as a whole as the stakeholder (Table 1 in the chapter [Economic Theory of Change](#)). These issues are where the largest opportunities exist, both for change in impact on society, and for those leading companies positioned for fundamental change within the sector. These issues

¹⁰ The array of estimates for the social cost of carbon illustrate: J. C. J. M. van den Bergh and W. J. W. Botzen, "A lower bound to the social cost of CO₂ emissions," *Perspective, Nature Climate Change* 4 (2014), <https://doi.org/10.1038/nclimate2135>. R. S. J. Tol, "On the Uncertainty About the Total Economic Impact of Climate Change," *Environmental and Resource Economics* 53, no. 1 (2012), <https://doi.org/10.1007/s10640-012-9549-3>.

indicate the major external costs introduced by the food system. Most of the emphasis in this report is on impact on society.

Scope of the report

To summarise, the focus of the report is on a narrower scope within the setting of impact frameworks:

- Monetary valuation of changes in natural, social and human capital due to the activities food system actor, or the costs of avoiding those changes (an impact valuation).
- Comparable and agreed impact valuation associated to the major external costs introduced by the food system.

Table 1 in the chapter [Economic Theory of Change](#) lists a set of issues likely to represent the major external costs associated to the food system. This report recommends using valuation factors, or shadow prices, for spatial and contextual footprints linked to external costs. It argues for a spatial and contextual resolution to footprints that balances practical calculation with error in estimating impacts. It argues for a process to set and update valuation factors. Providing a list of recommended valuation factors or footprint metrics is beyond the scope of the report. Presently, without the process described and the resources to enable it, listing recommended valuation factors would result in no different outcome in terms of agreement and comparability than the array of valuation factors already in use.

This report is designed to complement two other reports within a broader initiative on true cost of food systems. The first, by IDEEA Group, is guidance for a general TEEB AgriFood evaluation without the emphasis on monetisation. The second, by TMG-ThinkTank for Sustainability and Soil & More Impacts, serves to inventory methods, databases, and case studies for true cost analysis within the TEEB AgriFood Evaluation Framework. The review of case studies in the chapter [Case Studies of Food System Impact Valuation](#) and an inventory of methods in the chapter [Inventory and Development of Methods](#) focus on monetised and comparable valuations.

Users of the report

The report can assist the present and potential user groups of comparable and agreed monetary impact valuations:

Companies (food retailers, food manufacturers, agricultural producers, agricultural input suppliers)

Presently there are no standards [for impact reporting]. Companies develop their own format, their own methodology, or engage consultants, making it very difficult to compare between their non-financial positions.

- Impact valuations are used in reporting non-financial positions. They are monetary estimates of the impacts of changes in natural, social and human capital due to the annual operation of a company, usually in comparison to their financial position. The reports are variously called Impact statements, Impact reports, Integrated Profit & Loss, etc. For example, the Olam Integrated Impact Statement and Eosta's pilot IP&L¹¹. Presently there are no standards. Companies develop their own format, their own methodology, or engage consultants,

¹¹Eosta's pilot IP&L: Eosta et al., *True Cost Accounting for Food, Farming & Finance*, Soil & More International (Hamburg, 2017). Olam Integrated Impact Statement is not yet publicly available. See https://www.olamgroup.com/content/dam/olamgroup/investor-relations/ir-library/annual-reports/annual-reports-pdfs/olam-annual-report-fy18_strategy_report.pdf#page=112

making it difficult to compare between their non-financial positions¹².

- Internal risk assessment. Companies use internal carbon prices and scenarios to stress test their operations against potential introduction of legislation on carbon pricing in the economy¹³. Pricing from food impact valuation enhances similar risk assessment for the food sector.

Governments

- External costs of the food sector pose significant risk to society. Valuations, such as the social cost of carbon, estimate the non-optimality of economic performance and growth if the externalities are not internalised¹⁴. National governments subsidise foods that they, or other governments, pay for again in additional national healthcare costs. Valuations inform decision making¹⁵. They enable mechanisms for internalisation and indicate where correction is required.
 - Fiscal intervention to correct optimality of a national economy. The amount of correction is informed by valuations. For example, Pigovian style taxation, and adjustment of tariffs and subsidies according to impact. Sugar taxes and meat taxes are fiscal interventions¹⁶.
 - Regulation and incentives. For example, the proposed UK Environmental Land Management Scheme replacing EU basic farm payments where farmers who provide the greatest (environmental) benefit will receive the largest public funded payments¹⁷.
- Appraisals and evaluations, e.g. UK Treasury Green Book and the UK Social Value Act. Comparisons of policy options, tenders, and major project spending, that require consideration of environmental and social benefits and costs.

National governments subsidise foods that they, or other governments, pay for again in national healthcare costs

¹² SDSN and BCFN, *Fixing the business of food: the food industry and the SDG challenge*, Barilla Center for Food & Nutrition (Parma, Italy, 2019), <https://www.fixing-food.com/media/pdf/Fixing-the-Business-of-Food---Report.pdf>. Reporting standards such as GRI and IIRC do not require comparable impact statements, e.g. “the primary thrust of <IR> [is] to enable each organization to tell its own value creation story” p. 23 IIRC, *Capitals Background paper for <IR>*, International Integrated Reporting Council (IIRC). Association of Chartered Certified Accountants (ACCA). Netherlands Institute of Chartered Accountants (NBA). (London, 2013), <https://integratedreporting.org/wp-content/uploads/2013/03/IR-Background-Paper-Capitals.pdf>.

¹³ <https://www.cdp.net/en/climate/carbon-pricing>

¹⁴ Chapter 7 (Box 10) discusses the economic dimensions of climate change and land particularly in the context of agriculture in IPCC, *IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems*. See Table 7.2 and subsequent analysis in the same on policy and intervention options.

¹⁵ M. Adler, "Cost-Benefit Analysis and Social Welfare Functions," in *Oxford Handbook of Ethics and Economics.*, ed. M. D. White (Oxford UK: Oxford University Press, 2019).

¹⁶ S. W. Ng et al., "Did high sugar-sweetened beverage purchasers respond differently to the excise tax on sugar-sweetened beverages in Mexico?," *Public Health Nutrition* 22, no. 4 (2019), <https://doi.org/10.1017/S136898001800321X>. M. Springmann et al., "Health-motivated taxes on red and processed meat: A modelling study on optimal tax levels and associated health impacts," *PLOS ONE* 13, no. 11 (2018), <https://doi.org/10.1371/journal.pone.0204139>.

¹⁷ D. Helm, "Agriculture after Brexit," *Oxford Review Of Economic Policy* 33, no. suppl1 (2017), <https://doi.org/10.1093/oxrep/grx010>.

- Public procurement of food. In the EU-28 about 5% of the food services revenue is for public catering (€25 billion in 2017), similarly about 5% of food production revenue is for public self-catering (€57 billion in 2017)¹⁸.

Civil society

- Valuations bridge communication and advocacy for food system transformation with consumers in terms of costs, and with the governments in terms of economic governance and fiscal and regulatory policy. For example, Sustainable Food Trust's report on "The Hidden Cost of UK Food"¹⁹.
- Comparable impact valuations allow ranking of food companies based on environmental, social and human health performance – a "total impact scorecard". Companies are responsive to ranking initiatives, e.g. WWF Palm Oil Buyers Scorecard.

Investors

Impact valuations are a direct way for investors to compare environmental, social and human health performance of food companies.

- Environmental and Social Governance (ESG) criteria and performance. Comparable impact valuations directly compare environmental, social and human health performance of food companies.
- Portfolio building. Comparable valuations can be aggregated to understand impact performance of a portfolio²⁰.
- Impact performance can be built into bonds. Valuations can be used as criteria, or set levels of return, based on impact performance. If built on comparable agreed valuations, investors could understand the relative value between different impact bonds and have confidence in impact reduction achieved.

Consultants

- Many accounting and economic services firms now perform true value or impact valuations on behalf of companies, governments and civil society²¹.

Offset markets

- Carbon markets allow carbon trading. Trading theoretically increases economic opportunities, economic activity, and overall efficiency of emissions reduction. Carbon as a globally tradeable commodity is possible because of carbon's global impact. One tonne of carbon saved from emission anywhere in the world reduces the impact everywhere in the world. For food systems, CO₂-eq emission is not the only footprint of concern. Offset markets are more complicated and more local for water, for nutrient pollution, for community damage, and for human health. For food system impact beyond CO₂-eq emissions the spatial and contextual footprints and valuation factors recommended in this report have applications in offset markets.

¹⁸ S. Calderia et al., *Public Procurement of Food for Health: Technical report on the school setting*, European Commission and Maltese Presidency (Malta, 2017).

¹⁹ <https://sustainablefoodtrust.org/articles/hidden-cost-uk-food/>

²⁰ p. 23 A. Millan, B. Limketkai, and S. Guarnaschelli, *Financing the Transformation of Food Systems Under a Changing Climate*, CGIAR Research Program on Climate Change, Agriculture and Food (Wageningen, the Netherlands, 2019), <https://hdl.handle.net/10568/101132>.

²¹ KPMG True Value <https://home.kpmg/nl/en/home/services/audit/sustainability/true-value.html>; EY Total Value [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); PWC Total Impact Measurement & Management <https://www.pwc.com/gx/en/services/sustainability/total-impact-measurement-management.html>; Impact Institute <https://www.impactinstitute.com/>; etc.

Chapters 9 and 10 of the TEEB AgriFood Evaluation Framework, *TEEB for Agriculture & Food: Scientific and Economic Foundations*, discuss further uses of impact valuation and true-cost accounting.

Structure of the report

The sections of the report are outlined below. Progressing from the why of monetised and comparable impact valuations to the practice and the implications:

- Economic theory of change
 - *Why and how impact valuation can create change in the food system*
- Alignment with impact frameworks
 - *“Measure and Value” within the TEEB Agri-Food Framework and the Natural, and Social & Human, Capital Protocols*
- Valuation in practice
 - *Carbon costing as an introduction to marginal social and abatement costing of carbon footprints*
 - *Components of an impact valuation based on footprint, capital changes and valuation of the capital changes, superimposed on the “Measure and Value” steps*
 - *Consideration of marginal social and abatement costing for food system impact valuation, including inherent ethical choices and uncertainty*
- Case studies
 - *Examples of food system impact valuations and an illustration of the variation in marginal social and abatement costs and footprints chosen*
- Methods
 - *A discussion on the development of impact valuation, arguing for the movement toward spatial and contextual footprints and marginal valuations*
 - *An inventory of the data, models and methods mentioned in the report for footprint and impact calculation*
- Implications
 - *Challenges in the practice of impact reporting, being aware of them so they can be covered in the present and addressed in the future*
 - *Equity statistics to be reported alongside impact reporting concerning substitution of economic value*

Glossary

The TEEB AgriFood Evaluation Framework, and the Natural and Social & Human Capital Protocols, consider capitals as a broader notion of resources. Resources which themselves provide goods and services that interact with human production and consumption. Value and social and human well-being have a long history of discussion and conceptual development in economics. Valuations are usually in terms of social and private costs from welfare economics. A few associations are required between terms used in the capitals framework and terms from economics.

Abatement cost: monetary cost to reduce social costs from capital change. Can also refer to the minimal monetary cost to reduce social costs to a certain level given a costed portfolio of actual or potential abatement measures.

(Marginal) abatement cost of carbon (MAC): the minimal cost to reduce social costs from the emission of an additional tonne of CO₂eq over a specified emissions target.

Implies a costed portfolio of actual or potential measures that can avoid or sequester CO₂-eq emission.

Accounting: can relate to physical or inventory accounting, e.g. changes in in the quality and quantity of capital due to actor activity. Can relate to monetary accounting, e.g. the monetary valuation of inventories. Valuation is the step from physical to monetary accounting; it is not immediate for non-financial capital. We keep the conceptual distinction between physical and monetary accounting.

Attribution: capital change due to the activities of a set (an individual or group) of food system actors.

Capital: a source of value having the attributes of quantity and quality.

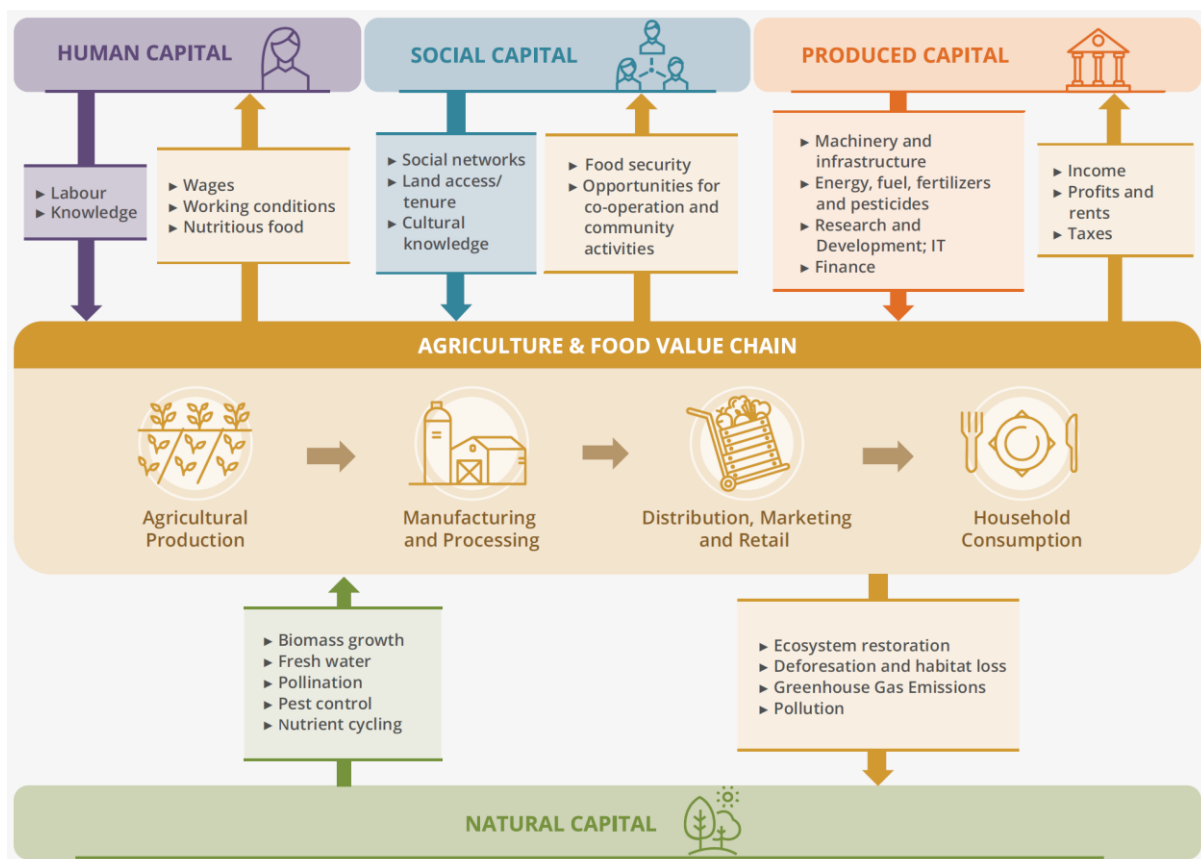


Figure 1: Value flow and capital stock exchanges in the food system (Source: TEEB, *TEEB for Agriculture & Food: Scientific and Economic Foundations* p. 12)

The TEEB AgriFood Evaluation Framework (Figure 1), following the UN Inclusive Wealth Report, Dasgupta (2015), and the International Integrated Reporting Council (IIRC) Task Force²², considers four categories of capital:

natural capital: the limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services;

²² Definitions of the four capitals quoted from TEEB, *TEEB for Agriculture & Food: Scientific and Economic Foundations*. UNEP, *Inclusive wealth report 2018 : measuring progress towards sustainability* (Cambridge: Cambridge University Press, 2018). See also P. Dasgupta, "Disregarded capitals: what national accounting ignores," *Accounting and Business Research* 45, no. 4 (2015), <https://doi.org/10.1080/00014788.2015.1033851>. IIRC, *Capitals Background paper for <IR>*. NCC, *Natural Capital Protocol*; S&HCC, *Social & Human Capital Protocol*.

produced capital: all manufactured capital, such as buildings, factories, machinery, physical infrastructure (roads, water systems), as well as all financial capital and intellectual capital (technology, software, patents, brands, etc.);

social capital: encompasses networks, including institutions, together with shared norms, values and understandings that facilitate cooperation within or among groups;

human capital: the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being.

There is some variability on how to arrange a taxonomy of capitals. If we refer to produced and financial capital together, it will mean we highlight financial capital categorised within produced capital.

Capital change: net change in quantity and quality of capital stock. Also called an outcome in the TEEB AgriFood Evaluation Framework.

CO₂-eq: Carbon dioxide equivalent represents the amount of CO₂ that would have the same global warming potential (radiative forcing) of a given greenhouse gas when measured over 100 years in the atmosphere.

Compensatory transfer: a transfer of economic value (loss) from one set of economic actors to another set (gain) for which the losing actor(s) are willing to accept a financial value in compensation from the gaining actors.

Dependency: private cost or benefit to one set of economic actors from capital changes due to the activities of another set of economic actors.

Dependency valuation: monetary measurement of the dependency of one set of economic actors due to the activities of all economic actors.

Economy: a system of actors producing, exchanging, and consuming goods and services, utilising capital to produce economic value.

Economic efficiency: optimal production of economic value from capital in an economy.

Economic value: that which economies seek to produce. Has a long philosophical history. Associated to welfare in welfare economics in that economic efficiency seeks to maximise welfare of economic actors and society. Welfare is measured in terms of utility of actors and social welfare functions, which are not generally monetary. In a perfect market, prices and quantities resulting from frequent transactions of economic actors in that market result in optimal welfare (First Welfare Theorem). Market failures like externalities means that market prices and quantities may not represent optimal welfare. A wider measure of welfare would include more social and human well-being indicators. Distinct from financial value.

Economic valuation: monetary estimate of economic value. For comparison with financial value. A financial value can be an economic valuation. An amount in an economic valuation cannot necessarily be substituted with the same amount in another economic valuation. This would be equivalent to exchanging economic value (welfare) which may raise or lower total economic value, e.g. the social welfare function is not invariant under the substitution. An implication is that an amount in an economic valuation cannot necessarily be substituted with an amount of financial value. Monetisation of costs and benefits does not necessarily imply substitution of costs for benefits.

Externality (negative): capital change with an external cost due to the activity of a set of economic actors but not borne by them directly (the social costs exceed the private costs to that set of economic actors from capital changes due to their activities). A boundary is implied in an externality, it is external with respect to the set of economic actors.

Externality (positive): capital change with an external benefit due to the activity of a set of economic actors but not received by them directly (the social benefits exceed the private benefits to that set of economic actors from capital changes due to their activities).

Financial capital: ownership of financial value (assets such as stocks, deposits, bonds, etc.) that can produce, of itself, value flows. Some financial assets derive financial value from association to other capitals (stocks represent financial value of produced capital, derivatives are linked to physical commodities, etc.). Quality of financial capital can include return rate and risk. Financial capital changes can result in changes in financial value and, through impact, changes in economic value.

Financial efficiency: optimal production of financial value from capital in an economy.

Financial value: monetary amount calculated from prices and quantities in a market. Market value is financial value.

Food sector: agri-food sector, and agriculture sector, fisheries and food & beverage sector, are used synonymously.

Food system: A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food with outputs to and inputs from produced, natural, social and human capital (Figure 1). Called eco-agri-food system in the TEEB AgriFood Evaluation Framework.

Footprint: quantities that produce capital changes which then produce impact. Included in the term impact drivers in the Protocols. It is a subset of flows in the TEEB AgriFood Evaluation Framework. The footprint of a food system actor is not the only driver of impact. Impact valuations will differ depending on the footprint of other businesses and society. Impact valuations will also differ depending on exogenous drivers such as population growth, urbanisation, social and political dynamics. For example, the social cost of carbon depends on a choice of emission scenario, biophysical responses, and socio-economic scenario. Footprint accords with familiar terms such as carbon footprint and water footprint.

Impact (on welfare): change in welfare from capital changes. TEEB and the Protocols consider impact on human well-being which is treated as synonymous to a wider sense of welfare.

Impact assessment: as per impact evaluation. Some studies labelled impact assessments refer to impact on capital, meaning measurement of the capital change not the welfare change.

Impact evaluation: measurement of the impact attributable to food system actor(s), not necessarily monetary.

Impact valuation: monetary measurement of the impact attributable to food system actor(s). Equivalently, valuation of the change in economic value from capital changes due to food system actor(s).

Internalisation (of an externality): adjustment affecting the transactions of a set of economic actors (taxes, subsidies, better information, re-allocation of quantities, self-dependencies, etc.) which reflects the external benefits and costs from those transactions before adjustment. The intention of internalisation is that financial efficiency (optimising financial value) in the adjusted market is closer to economic efficiency (optimising economic value).

Investment: utilisation of financial capital to increase quantity or quality of capital stock.

Material issue: a valuable aspect to specific stakeholders which is impacted by the activities of food actor(s). In the TEEB AgriFood Evaluation Framework, a dimension of well-being under impact. Area of protection in lifecycle impact assessment (LCIA).

Material issue for society: globalised impact or material issues of local or regional impact occurring concurrently and with a present or future effect on global value flows. Measuring all the capital changes due to activities of the food system would be difficult and unnecessary in terms of correcting the major market failures. Material issues for society represent beliefs based, in the case of food systems, on scientific consensus about what components of activities in the food system produce the most difference in economic value for society. Concentrating on those issues restricts the measurement of capital changes and footprints to those believed to be causing most of the impact.

Non-compensatory transfer: a transfer of economic value (loss) from one set of economic actors to another set (gain) which is not compensatory.

Parity: a means to compare economies for equivalence of economic or financial value; e.g. exchange rates compare financial capital between national economies, purchasing power parity compares consumption of produced goods between national economies, Ramsay discount rates compare future economies with present economies, etc.

PPP: purchasing power parity, which is the rate at which the currency of one country would have to be converted into that of another country to buy the same amount of goods and services in each country. Based on bundles of good and services set and tracked by the World Bank International Comparison Program.

Private benefit: increase in economic value to a set of economic actors from a capital change. Estimated in monetary terms by an economic valuation of the increase.

Private cost: decrease in economic value to a set of economic actors from a capital change. Estimated in monetary terms by an economic valuation of the decrease.

Self-dependency: private cost or benefit to a set of economic actors from capital changes due to the externalities of that same set of economic actors, e.g. a food company's activities are attributed to obesity and diabetes, which raises health insurance (the externality), which raises the costs of health insurance that the food company pays on behalf of employees. As another example, a food company's emissions create environmental change, lowering yields globally of certain commodities which it uses, which increases price from its suppliers due to reduced global supply.

Shadow price (of a footprint quantity): change in economic value from capital changes due to the addition or subtraction of unit of the footprint quantity. The shadow price from addition and the shadow price from subtraction are not necessarily the same. That is, we use the term shadow price to refer to both marginal social costs and marginal abatement costs.

Social benefit: increase in economic value to society from a capital change. Estimated in monetary terms by an economic valuation of the increase.

Social cost: decrease in economic value to society from a capital change. Estimated in monetary terms by an economic valuation of the decrease.

(Marginal) social cost of carbon (SCC): the social cost resulting from capital changes due to the emission of an additional tonne of CO₂-eq. The social cost of carbon is a marginal social cost, meaning social cost per unit of a quantity, see shadow price.

Stock: a quantity of capital.

Value flow: economic value produced from capital, a combination of its quality and change in quantity.

Values: For the report's purposes values are defined by economic value. Alignment of economic systems with value systems is outside the scope of the report. In the TEEB AgriFood Evaluation Framework value is defined already by conceptual economies and economic and

financial value: “the worth of a good or service as determined by people’s preferences and the trade-offs they choose to make given their scarce resources, or the value a market places on an item”.

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