SDG Plans 1

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This reference introduces algorithms that address IPCC (2018), USGCRP (2018), and UNEP (2018, 2019) global climate change recommendations, and IPBES (2019) global biodiversity and ecosystem services advice, at local community and business scale. The Social Performance Analysis 1 (SPA1), 2 (SPA2), 3 (SPA3), and CTA-Prevention (CTAP) references introduce the background context for this reference and should be read first. This reference expands that context, grounded in an RCA (Resource Conservation Value Accounting) Framework, to introduce Sustainable Development Goal (SDG) Plans. These plans employ more comprehensive planning and decision support that may lead to more effective and efficient local and global (**2***) SDG target accomplishment.

SPA3 used the following statement to introduce the overall purpose of these algorithms –to achieve equitable and sustainable development.

"In particular, [these algorithms] demonstrate harmonizing national statistical office (NSO) data systems, which document SDG accomplishment, with this reference's emphasis on drilling down to explore the why and how behind the accomplishments –specifically, 'what factors caused sustainability to change for different groups of stakeholders? How will sustainability change for particular groups of stakeholders? How did investors, businesses, consumers, communities, and public agents contribute to these accomplishments?'"

These examples also follow up on 2 recommendations raised in SPA3 to use SDG Accounting Scorecards to rate companies, products, and communities for their contribution to "societal quality of life". In this reference, the Scorecards correspond to local, landscape-wide, SDG Reports that are completed using new Social Sustainability Media Platforms. Informed stakeholders use these scorecards to make production and consumption choices and to help improve local and global society (see UNEP, 2015, for a formal policy overview of what is meant by sustainable production and consumption).

A video tutorial explaining this reference can be found at:

The Social Performance Analysis tutorial on the DevTreks home page.

A. Introduction to Sustainable Development Goals (SDG) Planning

Examples 1 to 8 in the Social Performance Analysis references demonstrate how Resource Conservation Value Accounting (RCA) supports SDG-related planning and decision making. The examples gloss over several important aspects of more comprehensive socioeconomic and ecosystem planning:

- **Sustainability Accounting Networks and Clubs and Social Sustainability Media Platforms.** Have new sustainability accounting networks and clubs replaced existing record keeping networks and clubs? Can the new networks and clubs determine stakeholder preferences by aggregating sustainability accounting records? Have consumers and producers replaced existing social media platforms with new sustainability accounting platforms? Can the new platforms automatically discern stakeholder preferences that support targeted sustainability efforts, such as reducing GHGs? Do stakeholders understand the full consequences of advertisement-centric platforms versus quality of life-centric platforms?
- **Impact Pathways, Stocks and Flows, Scenarios, and Transition States, Development**. Have overall "shared socioeconomic pathways" (IPCC, 2018), documenting alternative scenarios and temporal transition states, been developed that can be used to understand the risk drivers, alternative stakeholder perspectives, SDG priorities, population epidemiology, location and temporal scales, business development, and mitigation and adaptation (M&A) action portfolios, needed for SDG target accomplishment? Have these pathways been codified in concrete tools that document the relation between community capital stocks and flows? Do these pathways help sustainability workers to understand causal attribution among risk drivers, stocks and flows, portfolios, SDG target accomplishments, and impacted stakeholders? Are these pathways being updated to reflect changing circumstances dictated by a changing climate?
- **Stakeholder System Boundary and Stakeholder Engagement**. How did sustainability workers identify the parts of the business and community supply chains to include in SDG planning? How has the overall SDG of improving the quality of life for

stakeholders actually identified those stakeholders and gained their participation? Are they taking responsibility for their own SDG Plans? If not, are they at least participating in local outreach attempts to apply the SDG to improve their quality of life? Example 5 targets Low, Medium, and High Poverty households. What if the most vulnerable stakeholders are other socioeconomic groups such as children, the elderly, the disabled, minorities, or women?

- **Risk and Impact Identification**. How were decisions reached about selecting the final subset, or nexus, of SDG risks and impacts confronting a community or business? How was their priority determined? Did these risks address the underlying causal reasons, or direct and indirect drivers, laid out in social impact pathways? If not, did the risks address carefully defined goals and targets for societal improvement? How were Indicators selected to measure risks and impacts? Can the Indicators be aggregated at national and international scale? Can the marginal costs associated with increases in these risks be quantified?
- **Mitigation and Adaptation (M&A) Action Feasibility Assessment**. How were the M&A Actions first proposed and then chosen? Do the M&A Actions reduce exposure and sensitivity, and increase the adaptive capacity, of impacted stakeholders to SDG-related risks? How do formal Feasibility Assessments of SDG and M&A Action interactions address the impact pathways that are the basis of Resource Conservation Value Accounting? Which stakeholder groups have taken responsibility for, or participated in, the SDG Performance Monitoring and Impact Evaluation accounting system? What incentives do businesses perceive for adopting these actions (see KPMG, 2018, for more comprehensive "business questions")? Can the marginal benefits associated with decreases in these risks be quantified?
- **Identification of Synergies, Tradeoffs, and Stakeholder Equity**. What criteria was used to determine how well the identified SDG risks and impacts and chosen M&A Actions actually meet the needs of impacted stakeholder groups? What consideration has been given to the positive and negative interactions among proposed M&A Actions, SDG

results, and stakeholder impacts? Are the SDG tradeoffs among impacted stakeholders being handled in a way that satisfies the diverse stakeholders?

- **SDG Plan Selection**: How were alternative M&A Action Portfolios built that allowed decision makers to choose a specific SDG Plan? Do these plans support equitable and sustainable development for impacted stakeholder groups? How do the plans support the financial performance goals of targeted businesses?
- **Monitoring and Evaluation and Adaptive Management of SDG Plans**. What formal processes did businesses and communities follow to adjust their M&A Actions to eliminate ineffective activities and adopt better ones? What digital evidence proves these adaptations? Is a formal, digital, M&E accounting system in place that supports (USGCRP, 2018) a "well-structured implementation, including the identification of parties responsible for each step, explicit timelines, explicit and measurable goals, and explicit provisions and timelines for monitoring and updating the plan"? Is the M&E accounting system adequately funded?
- **SDG Reporting and Communicating**. What local evidence did local sustainability workers collect from local companies, consumers, and communities and report to subnational and national SDG reporting systems? Was the evidence taken from active SDG Plans or automatically taken from the new sustainability platforms? How was this evidence communicated to local stakeholder groups, local communities, and local businesses? Have existing social media users switched to the new social sustainability media platforms? Have consumers used the "SDG scorecards" to make consumption choices? Have producers used the reports to take production actions? How is this information being passed down to the next generation of sustainability workers? Specifically, what digits will the next generation have available to them to assist with SDG planning?
- **SDG Plan Machine Learning**. Have individual SDG plans been aggregated to support machine learning approaches to answering Impact Evaluation questions, such as: What factors in SDG Plans caused sustainability to change for different groups of stakeholders?

How will sustainability change for particular groups of stakeholders?

How did businesses, consumers, communities, and public agents contribute to these accomplishments?

What are the likely societal consequences of alternative SDG Planning scenarios?

- **SDG Institutional and Policy Context**. What local institutional support exists for improved SDG planning? Which policies have been put into effect to require local sustainability goal planning? Which specific people have overall responsibility for administering SDG planning? How are the executives and institutions responsible for SDG planning being held accountable for effective and efficient SDG results? If the institutional context for SDG planning does not exist or is bad, what local alternatives can be developed to get around the deficiencies? Can local civil society groups assume responsibility for SDG planning without being coopted by powerful interest groups?

This reference introduces SDG planning and decision support algorithms that begin to tackle these planning concerns.

B. SDG Risk Management Planning

This section introduces several conservation planning concepts that address Section A's planning concerns. Most of these concepts derive from IPBES (2019), IPCC (2018), USGCRP (2018), and UNEP (2018) because those references summarize the most recent science on this subject completed by several hundred scientists who have spent years on their development.

RCA Framework and Social Budgeting. The Resource Conservation Value Accounting Framework that underlies this reference maintains that sustainability is best measured for impacted stakeholders as changes over time to their quality of life as measured using stocks of Human Capital, Social Capital, Physical Capital, Natural Capital, Institutional Capital, Cultural Capital, and Economic Capital. SPA1 used the following conceptual frameworks (IPBES, 2019, TEEB, 2018) as overall contexts needed to understand how to preserve and enhance these capital stocks.

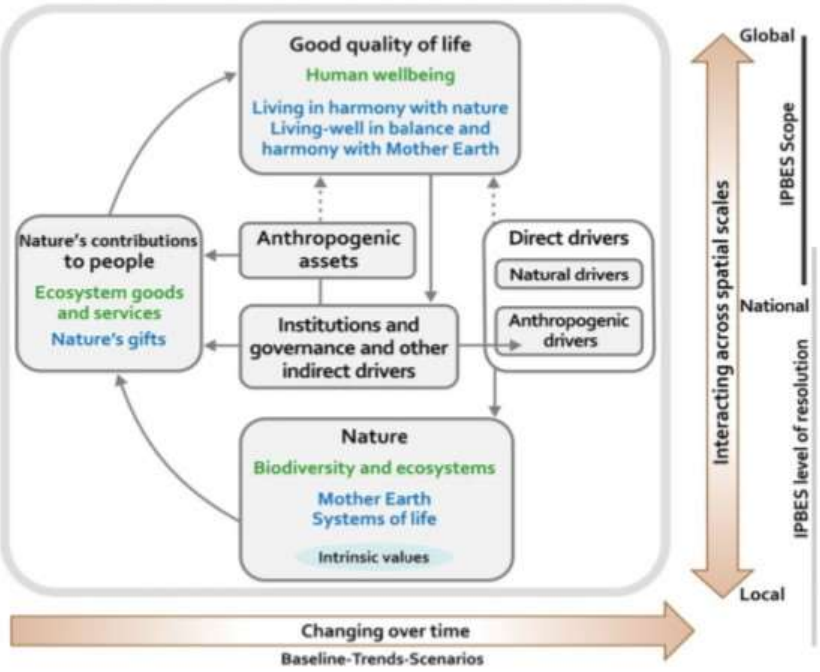
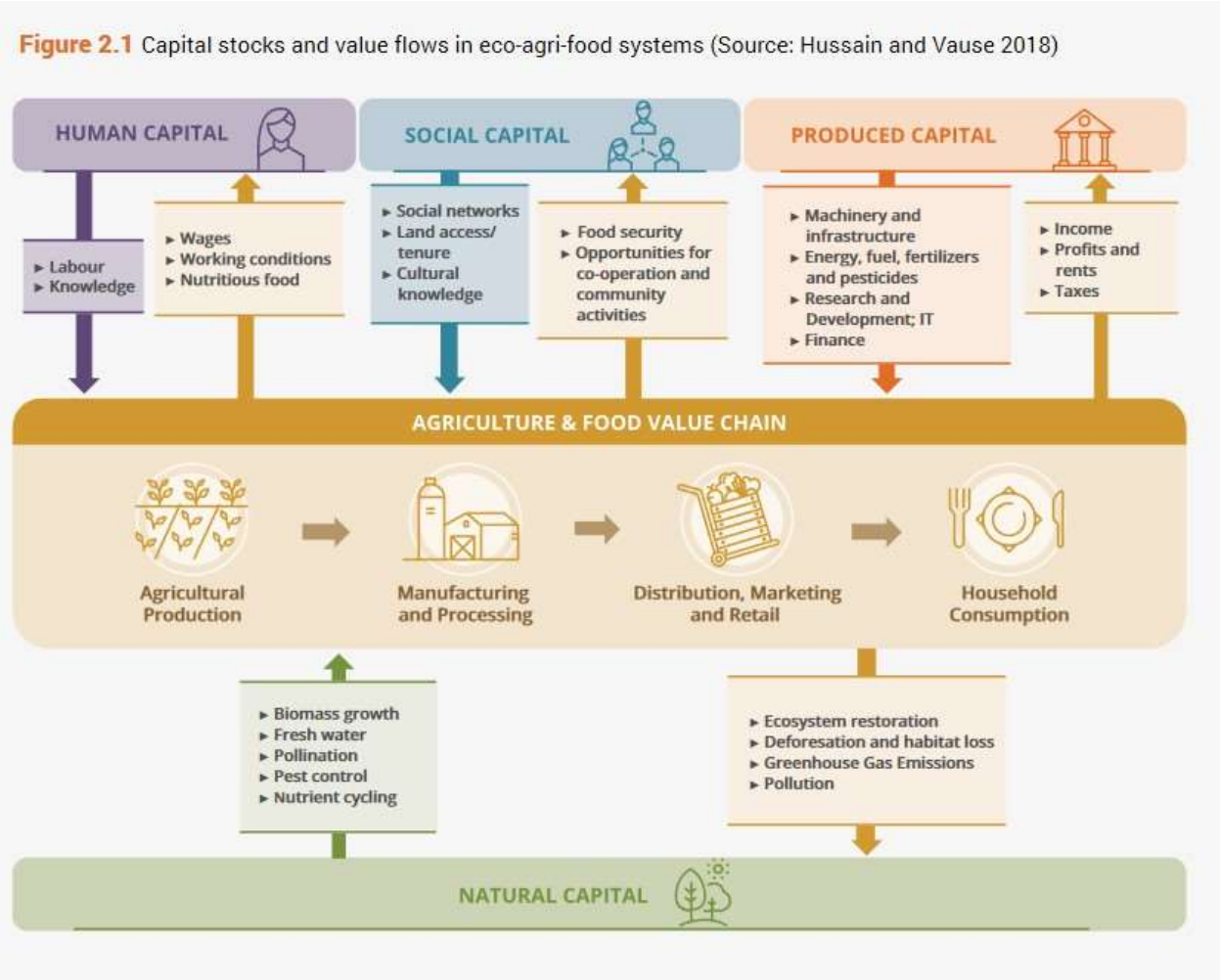


Figure X. **The IPBES Conceptual Framework is a highly simplified model of the complex interactions between the natural world and human societies.** The model identifies the main elements (boxes within the main panel delimited in grey), together with their interactions (arrows within the main panel), that are most relevant to the Platform's goal. "Nature", "nature's contributions to people" and "good quality of life" (indicated as black headlines and defined in the box) are inclusive categories that were identified as meaningful and relevant to all stakeholders involved in IPBES during a participatory process, including various disciplines of the natural and social sciences and the humanities, as well of other knowledge systems, such as those of indigenous peoples and local communities. Text in green denotes the concepts of science; and text in blue denotes those of other knowledge systems. . Solid arrows in the main panel denote influence between elements; dotted arrows denote links that are acknowledged as important, but are not the main focus of the Platform. The thick coloured arrows below and to the right of the central panel indicate different scales of time and space, respectively. This conceptual framework was accepted by the Plenary in decision IPBES/2/4 and the Plenary took note of an update presented in IPBES/INF/24 in decision IPBES/5/1. Further details and examples of the concepts defined in the box can be found in the Glossary and in Chapter 1



Stiglitz et al (2009) concurred with these authors about basing the measurement of these capital stocks on indicators that are directly tied to the quality of life, and well-being, of households. Stiglitz et al use the following statement to assert that quality of life measurements include both short term measurements (i.e. household operating budgets that measure income and current well-being), and longer term assessments of their sustainability (i.e. capital stock budgets that measure how household wealth and well-being changes over time).

“The report distinguishes between an assessment of current well-being and an assessment of sustainability, whether this can last over time. Current well-being has to do with both economic resources, such as income, and with non-economic aspects of peoples’ life (what they do and what they can do, how they feel, and the natural environment they live in). Whether these levels

of well-being can be sustained over time depends on whether stocks of capital that matter for our lives (natural, physical, human, social) are passed on to future generations."

The authors use the following image to demonstrate the difference between the short term flow measurements and long term stock measurements.

Report by the Commission on the Measurement of Economic Performance and Social Progress

Small set of sustainable development indicators proposed by the UNECE/OECD/Eurostat working group on sustainability measurement

Indicator domain	Stock indicator	Flow indicator
Foundational well-being	Health-adjusted life expectancy	Index of changes in agespecific mortality and morbidity (place holder)
	Percentage of population with post-secondary education	Enrolment in post-secondary education
	Temperature deviations from Normals	Greenhouse gas emissions
	Ground-level ozone and fine particulate concentrations	Smog-forming pollutant emissions
	Quality-adjusted water availability	Nutrient loadings to water bodies
	Fragmentation of natural habitats	Conversion of natural habitats to other uses
Economic well-being	Real *per capita* net foreign financial asset holdings	Real *per capita* investment in foreign financial assets
	Real *per capita* produced capital	Real *per capita* net investment in produced capital
	Real *per capita* human capital	Real *per capita* net investment in human capital
	Real *per capita* natural capita	Real *per capita* net depletion of natural capital
	Reserves of energy resources	Depletion of energy resources
	Reserves of mineral resources	Depletion of mineral resources
	Timber resource stocks	Depletion of timber resources
	Marine resource stocks	Depletion of marine resources

Source : UNECE/OECD/Eurostat (2008)

In the following table, TEEB (2018) relates these stock and flow measurements to impact pathways (i.e. Stocks -> Flows -> Change in Capital Stock Outcomes -> Value Added Impacts) that can increase the sustainability of specific industries (i.e. agriculture and food systems). Note the authors' emphasis on valuing changes in Capital Stock Outcomes in terms of value added Impacts.

Table 4.1 Examples of outcomes and impacts, as expressed by value addition (Source: Obst and Sharma 2018)

Example of a Flow	Example of one Outcome from the Flow	Example of one related Impact (in Value Addition terms)
GHG emissions from wheat, rice, beef, etc	Natural Capital Outcome: Higher GHG concentrations	Productivity & infrastructure losses through increased droughts, flooding, etc
Land Use Change from forests to farms	Natural Capital Outcome: Deforestation	Loss in relevant ecosystem services inputs, leading to productivity losses
Watershed repair & restoration expenditure	Natural Capital Outcome: Higher water yields	Improved crop yields due to increased water availability
Subsidy to grow farm-edge vegetation	Natural Capital Outcome: Improved condition of tree belts and hedgerows	Increased amenity values, pest control & pollination values
Excess N & P flow from fertilizers	Natural Capital Outcome: Eutrophication of water ways	Reduced income from fish catch
Investment flow to farmland aggregation	Social Capital Outcome: Loss of access to land/ displacement	Reduced income and qualitative indicators concerning equity, including gender equity
Investment flow to small farms in fragile lands	Social Capital Outcome: Increased access to food	Assessed health benefits and qualitative indicators concerning equity
Micro-credit flow to rural Self-Help Groups	Social Capital Outcome: opportunities to employ more women in rural areas	Qualitative indicators on equity and community networks
Pesticide use on farms	Human Capital Outcome: Ailments due to pesticide poisoning	Increased health costs due to higher disease burden
Subsidy for farm equipment	Produced Capital Outcome: Investment in agricultural machinery	Improved farm incomes and productivity
Declaration of a new Protected Area	Produced Capital Outcome: Loss of road infrastructure	Increased transportation costs and higher consumer prices

In a similar fashion, OECD's (2017) Better Life Initiative, "which featured a scoreboard of headline indicators to monitor progress across 11 dimensions of current well-being in OECD countries", incorporated the Stigler et al. (2009) recommendations. OECD explains how that initiative has now evolved into measuring progress with achieving the SDG throughout the European Union. They demonstrate the close relationship between these early efforts at measuring societal well-being and the quality of life, policy-oriented, measurements embodied in the SDG's 17 goals, 169 targets, and 232 indicators.

One of these authors' primary recommendations is to base sustainability measurements on stakeholder, specifically household, quality of life. A major, potential, drawback to measuring the SDG is the abstraction of their goals, targets, and indicators, from actual households. As this

reference will make clearer, many SDG-related accounting and reporting systems use proxy measurements that don't easily correspond to the concrete people whose quality of life is being measured. The greater the degree of this abstraction from concrete people, the less likely of actually improving the quality of life for the impacted stakeholders, and the greater likelihood that the stakeholders won't understand, or support, the efforts being taken to improve their quality of life (**15*, 19***). [Version 2.2.0 added Example 12 to address this issue more directly and digitally.]

SDG Policy Context. Using the context of sustainable consumption and production (SCP) policy support, UNEP (2015) use the following image to introduce a background policy framework for achieve sustainability goals (i.e. in this case, SDG 12, Ensure sustainable consumption and production patterns). The authors further explain the importance of a using a mix of policy options –ranging from regulations to sustainability reporting, to achieve those goals.

Table 4:1 The four stages of the SCP policy cycle

Stage in the policy process	Steps to be taken in each stage
Problem framing: The policy community and general public debate the issues related to SCP, gather information and agree on the nature of a policy problem.	• Discussion and identification of relevant social goals. • Identification and monitoring of topicality (public concern). • Identification of environmental degradation and social inequality. • Understanding of underlying causes of environmental degradation and social inequality. • Assessment of risk, uncertainty and ignorance. • Assessment of existing policy and institutional settings. • Definition, framing and scaling of policy problems.
Policy framing: Guiding policy principles are identified, a policy position is developed and policy goals are defined.	• Development of guiding policy principles. • Construction of general policy statement. • Definition of measurable policy goals.
Policy implementation: Policy instruments are selected, resources allocated, communication and enforcement activities undertaken and monitoring mechanisms established.	• Selection of policy instruments and options. • Planning of implementation. • Planning of communication, education and information strategies. • Progression of statutory, institutional and resourcing requirements. • Establishment of enforcement and compliance mechanisms. • Establishment of policy monitoring mechanisms.
Policy monitoring and evaluation: Ongoing monitoring and evaluation of a policy are undertaken to enable learning and enhance performance.	• Ongoing policy monitoring and routine data capture. • Mandated evaluation and review process. • Extension, adaptation or cessation of policy and/or goals.

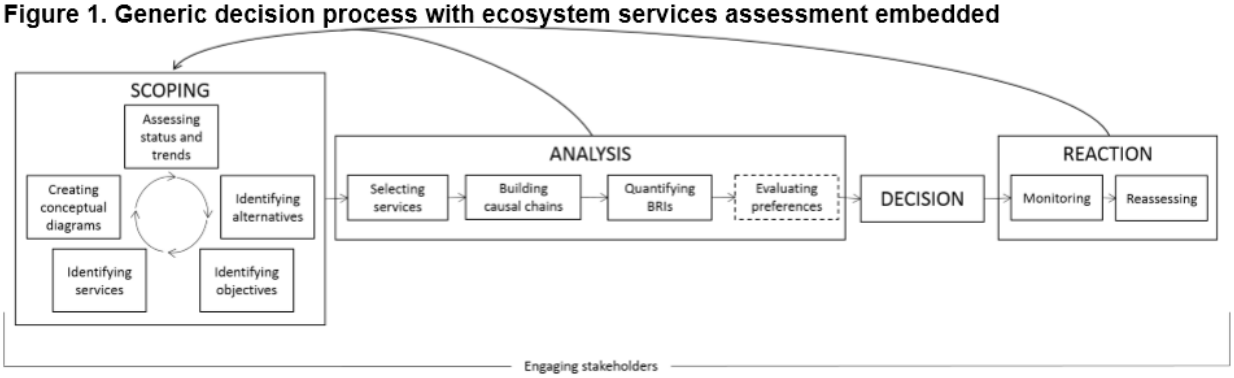
The SDG Planning introduced in this reference requires this type of overall policy environment. The policy context first identifies the need for SDG Plans and then allocates the funding and resources needed to carry out the Plans.

SDG Decision Support Planning. SPA1 introduced several decision planning processes that support the RCA Framework. Examples included EU Ecosystem Assessment, IPBES Conceptual Framework, “Principles, Requirements and Guidelines”, “Ecosystem Services Assessment”, and the “Natural Capital Protocol”. The following image (see the NESP, Section 3, 2017 reference in SPA1) illustrate the Ecosystem Services Assessment approach.

Ecosystem Services Assessment in Decision Processes

This guidebook organizes the ecosystem services assessment methods around an example planning process using four general stages: (1) scoping, (2) analysis, (3) the decision, and (4) reaction (Figure 1). These stages also occur in other comprehensive decision-making approaches, such as economic valuation and structured decision making, elements of which are included in this framework.

Figure 1. Generic decision process with ecosystem services assessment embedded



Note: Integrating ecosystem services considerations into the decision making process—that is, translating ecological changes into implications for people—requires changes throughout the decision process, particularly in the scoping and assessment phases. Stakeholder engagement continues through the full decision process.

The following image (see the Groffman et al, 2014 reference in the Resource Stock Analysis reference) represents a stylized conservation planning framework for applying these decision support frameworks for local adaptation planning.

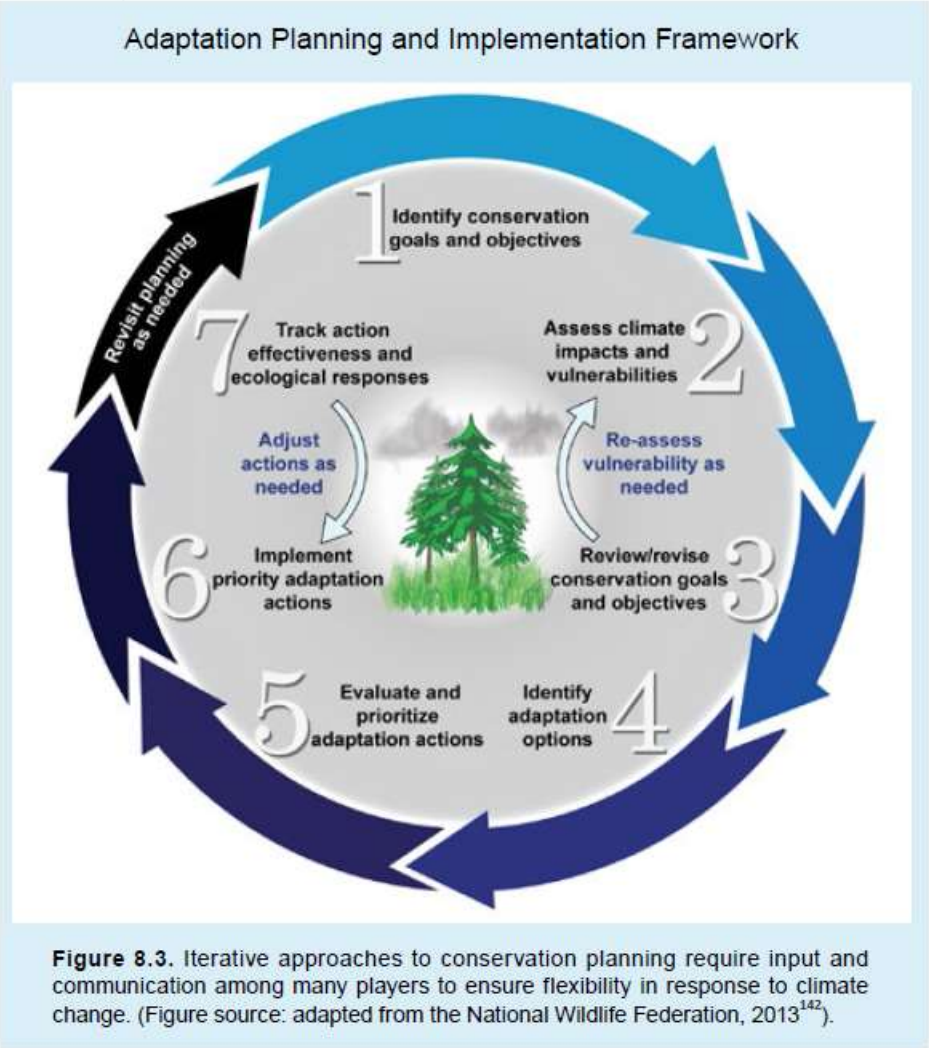


Figure 8.3. Iterative approaches to conservation planning require input and communication among many players to ensure flexibility in response to climate change. (Figure source: adapted from the National Wildlife Federation, 2013[142]).

The following image (USGCRP, 2018, Chapter 28) describes the attributes of successful conservation, or adaptation, planning, approaches applied in the public sector. It's not clear why USGCRP's third list item, or "adaptation actions that address multiple community goals, not just climate change", did not mention the most logical set of goals, the SDG (or its predecessor, the Millennial Development Goals). IPCC (2018) devote Chapter 5 to the SDG.

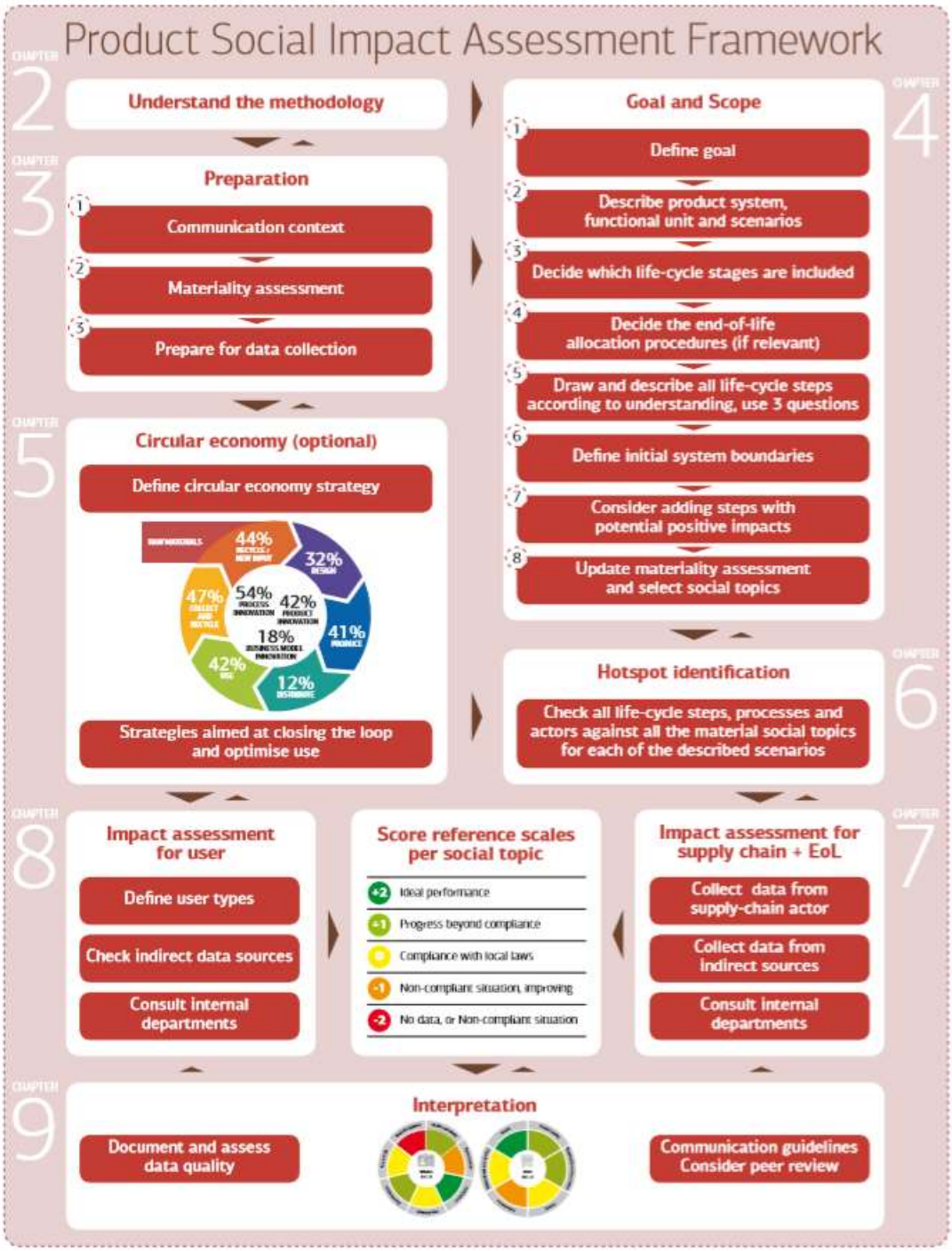
Box 28.3: Common Attributes of Effective Adaptation

Factors that shape or contribute to the successful adoption and implementation of adaptation by public-sector organizations include

- plans written by a professional staff and approved by elected officials;
- community engagement, including the participatory development of plans; the formation of action teams or regional collaborations[138] across jurisdictions, sectors, and scales; and public- and private-sector leaders who champion and support the process;
- adaptation actions that address multiple community goals, not just climate change;
- well-structured implementation, including the identification of parties responsible for each step, explicit timelines, explicit and measurable goals, and explicit provisions and timelines for monitoring and updating the plan; and
- adequate funding for the adaptation actions and for sustained community outreach and deliberation.

(Adapted from Brody and Highfield 2005, Berke et al. 2012, Horney et al. 2012, IPCC 2012, NRC 2009, Cutter et. al. 2012, GAO 2016, Wilhite and Pulwarty 2017, Bassett and Shandas 2010, Berke and Lyles 2013, Lyle and Stevens 2014, Hughes 2015, Highfield and Brody 2012, Mimura et al. 2014[47,60,70,139,140]

Agricultural businesses throughout the USA and the EU have been using formal conservation plans for decades to improve their management of natural resources (**1***). The following image (Goedkoop et al, 2018) shows how private sector firms are beginning to supply proof for some of the missing socioeconomic dimensions needed by many of these existing conservation planning approaches. Example 3B demonstrates a basic application of this Social Life Cycle Assessment (SLCA) approach (i.e. note that the RCA Framework includes the cultural and institutional dimensions that are missing from this Framework). Later sections of this reference will demonstrate how to use this LCA approach with an environmental dimension that derives from existing, uniform, environmental reporting systems (i.e. EC's OEF and PEF).



The following image (KPMG, 2018) shows how business consultants are beginning to provide guidance to their business clients about how to incorporate SDG in their formal financial reporting systems. The authors point out that the large international companies that are currently

leading these types of efforts are usually followed later by most of the business community. IPBES (2019), IPCC (2018), USGCRP (2018), and UNEP (2019) confirm that "later" needs to be "now" (**11***).

KPMG's nine quality criteria for SDG reporting

For the purpose of this study, KPMG professionals established a robust set of nine criteria to analyze and compare the maturity of SDG reporting by large companies (see Figure 1).

The criteria are grouped into three themes:

1 **Understanding**

2 **Prioritization**

3 **Measurement**

They are based on the insights of KPMG Sustainability Services professionals combined with key elements of the SDG Compass[4] and guidance from the International Integrated Reporting Council (IIRC).[5]

Researchers adopted a straightforward assessment process by awarding one point to each company for each of the nine criteria satisfied, resulting in a maximum score of three under each theme and a maximum score of nine in total. This was considered sufficient data to provide a base level view of reporting maturity among the G250 sample.

Figure 1: Nine assessment criteria for SDG reporting maturity

SDG Compass and <IR>

The SDG Compass was developed by the Global Reporting Initiative (**GRI**), the **UN Global Compact** and the World Business Council for Sustainable Development (**WBCSD**), and is widely recognized as a leading strategic tool to guide business action on the SDGs.

Guidance from the International Integrated Reporting Council (**IIRC**) identifies a similar framework for contributing to the SDGs through the integrated reporting <IR> value creation process.

[4] https://sdgcompass.org/
[5] https://integratedreporting.org/tag/sdgs/

The SDG Compass web site (2019) offers companies the following information for integrating the SDGs into their business:

- [A] SDG Compass guide (executive summary as a separate download), explaining the five steps to implementation in more detail.

- A live inventory of existing business indicators from relevant and widely-recognized sources, mapped against the 17 SDGs and their targets.
- A live inventory of business tools mapped against the SDGs.
- A two-page overview for each SDG, covering the role of business, and illustrative examples of business solutions, indicators and tools.

The following image (SAFA, 2014) demonstrates using formal sustainability reporting systems that apply these underlying decision support processes (**9***).

The final output of a SAFA assessment is the Performance Report, which contains both a descriptive and an analytical review of the sustainability of the assessed entities, based on all four steps.

Table 4. **SAFA step-by-step**

STEP 1 MAPPING	STEP 2 CONTEXTUALIZATION	STEP 3 INDICATORS	STEP 4 REPORTING
Description of assessed entities	Sub-themes: review of sub-themes based on boundaries and sustainability objectives	Indicator selection	Polygon at aggregated and broken down level to illustrate sub-theme scores together with contextual issues, including risk areas (hot spot issues), boundaries and data quality, based on Accuracy Score.
Boundaries of assessment (space and time) and visual representation		Irrelevant sub-themes and indicators are not selected	Final report, where all relevant issues and scope are treated and rationale, irrelevant sub-themes and indicators are justified, areas for improvements are identified. See Appendix B: Performance Report Checklist.
What is excluded from SAFA? (cut-off criteria)		Guidance notes for indicators	Critical Review – two levels are outlined – Level 1 for less formal SAFA assessments which involve documenting the results but this is not subject to external 3rd party audit, while Level 2 for more formal applications of SAFA includes a 3rd party audit.
	Indicators: review of default (or replacement) indicators in relevant sub-themes and use of data regarding geographical, environmental, social, political and economic context to determine detailed ratings	Determine Accuracy Score for each indicator	
Relationships of different supply chain members		Documentation of input data and score	
		Rating at indicator level, aggregation of results at sub-theme and theme level	

These decision support, and sustainability reporting, processes supply much of the missing planning ingredients introduced in Section A, including the formal SDG-related Plans, and are the focus of the remaining sections of this reference.

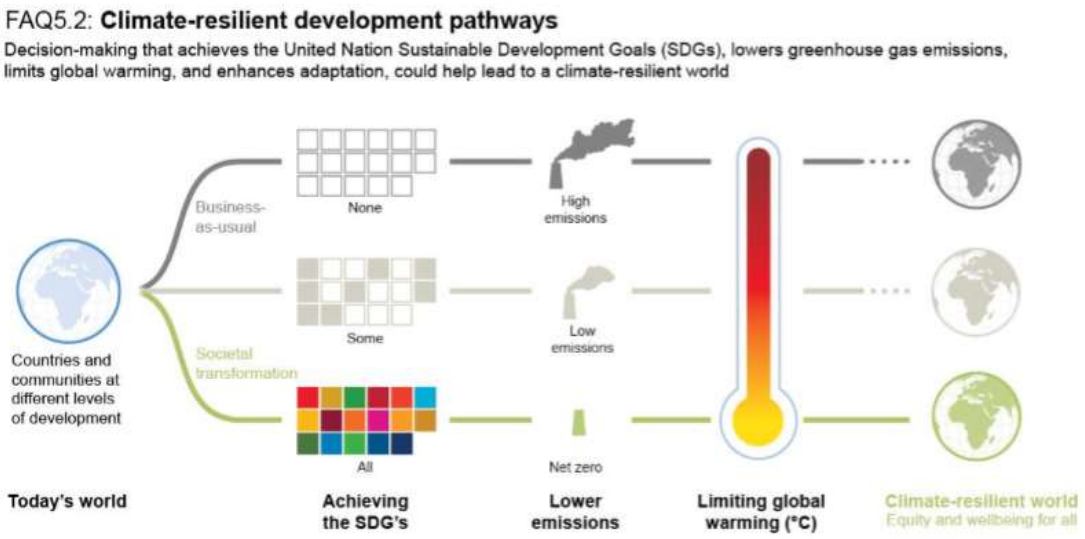
Shared Socioeconomic Pathways, Stocks and Flows, Alternative Scenarios, and Transition States. IPCC (2018) use the following statements to describe the relation between pathways, scenarios, and transition states. In summary, pathways explore alternative scenarios, each of which consists of multiple population and ecosystem transition states that lead to final SDG achievements for impacted stakeholder groups. The SPA3 introduced social impact pathways, global heating scenarios, impact transition states, and cause and effect attribution, for these purposes.

"A 'scenario' is an internally consistent, plausible, and integrated description of a possible future of the human–environment system, including a narrative with qualitative trends and quantitative projections."

"The notion of a 'pathway' can have multiple meanings in the climate literature. It is often used to describe the temporal evolution of a set of scenario features, such as GHG emissions and socioeconomic development. As such, it can describe individual scenario components or sometimes be used interchangeably with the word 'scenario'."

"Society-wide transformation involves socio-technical transitions and social-ecological resilience (Gillard et al., 2016). Transitional adaptation pathways would need to respond to low-emission energy and economic systems, and the socio-technical transitions for mitigation involve removing barriers in social and institutional processes that could also benefit adaptation (Pant et al., 2015; Geels et al., 2017; Ickowitz et al., 2017). In this chapter, transformative change is framed in mitigation around socio-technical transitions, and in adaptation around socio-ecological transitions. In both instances, emphasis is placed on the enabling role of institutions (including markets, and formal and informal regulation). 1.5°C-consistent pathways and adaptation needs associated with warming of 1.5°C imply both incremental and rapid, disruptive and transformative changes. "

IPCC (2018) also explain that pathways (i.e. socioeconomic, mitigation, sustainable development, adaptation, and climate resilient, pathways) focus on exploring the impacts of mitigation and adoption options, or M&A Actions, on SDG and SDRR goal accomplishment. They use the following images to further describe Socio-economic Pathways and related Climate-resilient development pathways (**5***). IPCC (2018) also explains the importance of documenting "counterfactual" pathways that can be used to evaluate impacts more thoroughly (i.e. SSP3. Regional Rivalry as a counterfactual to SSP1. Sustainable Development (**6***)).

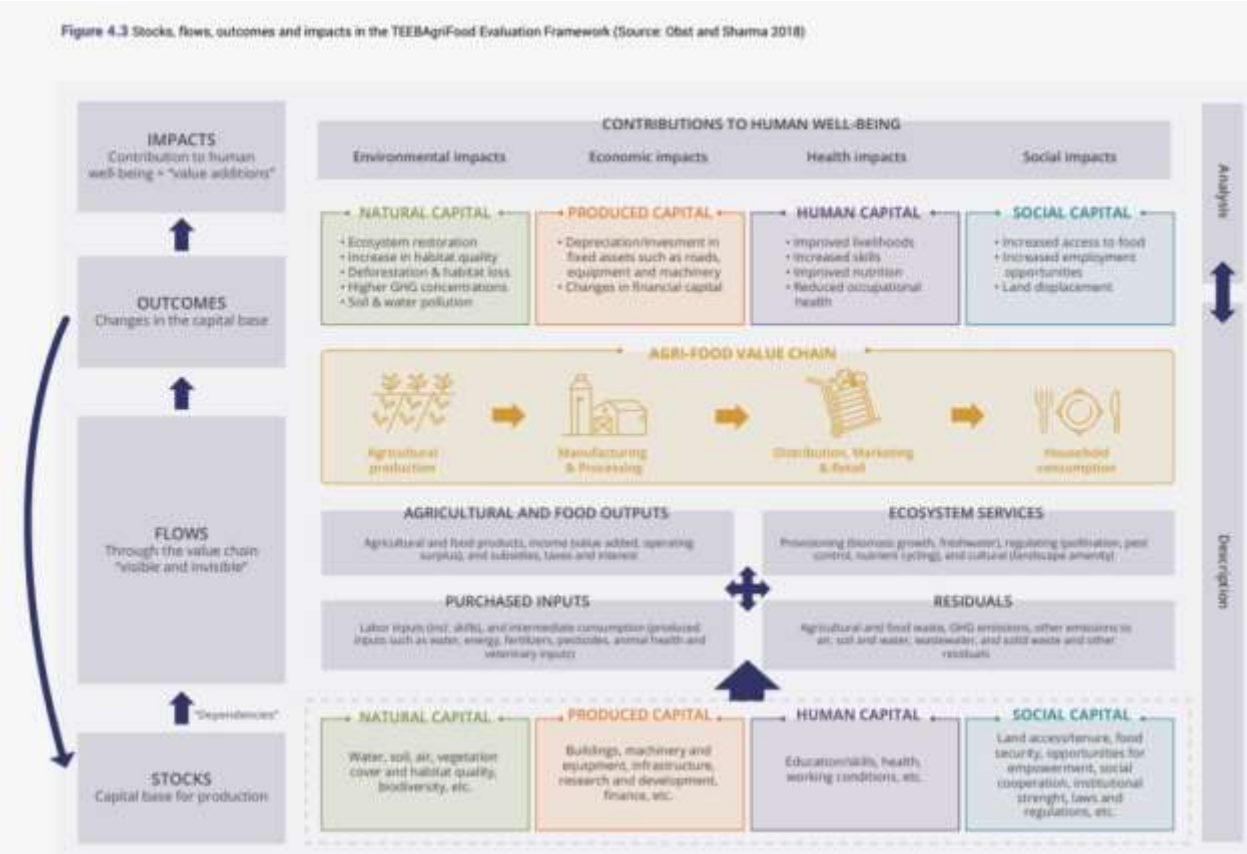


FAQ 5.2, Figure 1: Climate-resilient development pathways (CRDPs) describe trajectories that pursue the dual goal of limiting warming to 1.5°C while strengthening sustainable development. Decision-making that achieves the SDGs, lowers greenhouse gas emissions and limits global warming could help lead to a climate-resilient world, within the context of enhancing adaptation.

Table 2.3: Key characteristics of the five Shared Socio-economic Pathways (O'Neill et al., 2017).

Socio-economic challenges to mitigation	Socio-economic challenges to adaptation		
	Low	Medium	High
High	**SSP5: Fossil-fuelled development** • low population • very high economic growth per capita • high human development • high technological progress • ample fossil fuel resources • resource intensive lifestyles • high energy and food demand per capita • convergence and global cooperation		**SSP3: Regional rivalry** • high population • low economic growth per capita • low human development • low technological progress • resource intensive lifestyles • resource constrained energy and food demand per capita • focus on regional food and energy security • regionalization and lack of global cooperation
Medium		**SSP2: Middle of the road** • medium population • medium and uneven economic growth • medium and uneven human development • medium and uneven technological progress • resource intensive lifestyles • medium and uneven energy and food demand per capita • limited global cooperation and convergence	
Low	**SSP1: Sustainable development** • low population • high economic growth per capita • high human development • high technological progress • environmentally oriented technological and behavioural change • resource efficient lifestyles • low energy and food demand per capita • convergence and global cooperation		**SSP4: Inequality** • Medium to high population • Unequal low to medium economic growth per capita • Unequal low to medium human development • unequal technological progress: high in globalized high tech sectors, slow in domestic sectors • unequal lifestyles and energy / food consumption: resource intensity depending on income • Globally connected elite, disconnected domestic work forces

TEEB (2018) use the following image to tie socioeconomic pathways (i.e. Stocks -> Flows -> Outcomes -> Impacts) to the sustainability of the community capitals (i.e. Natural Capital, Physical Capital, Human Capital, Social Capital) for specific industries (i.e. agricultural and food companies). Importantly, the authors confirm that the flow measurements include the drivers of unsustainable conditions. Furthermore, Outcomes measure changes to the capital stocks which, in turn, get measured in terms of value added Impacts (i.e. including the IPBES, 2016, instrumental, intrinsic, and cultural values introduced in SPA1**).**



IPBES (2019) use the following statement to affirm that society-wide transformative changes are needed to accomplish the SDG.

"The Sustainable Development Goals and the 2050 Vision for Biodiversity cannot be achieved without transformative change, the conditions for which can be put in place now (well established)."

The authors use the following image to further explain how M&A Actions, or Levers, that target prioritized SDG targets, or Leverage Points, can enable the transformative changes needed to fully accomplish the sustainable development, and climate-resilient development, pathways. The image verifies that M&A Actions must address the underlying direct and indirect drivers causing unsustainable conditions. Furthermore, the agents of change need not be restricted to large governmental efforts –"a range of actors", from local community groups to private sector

companies, have critical, and potentially the most important, roles to play in bringing about the transformations.

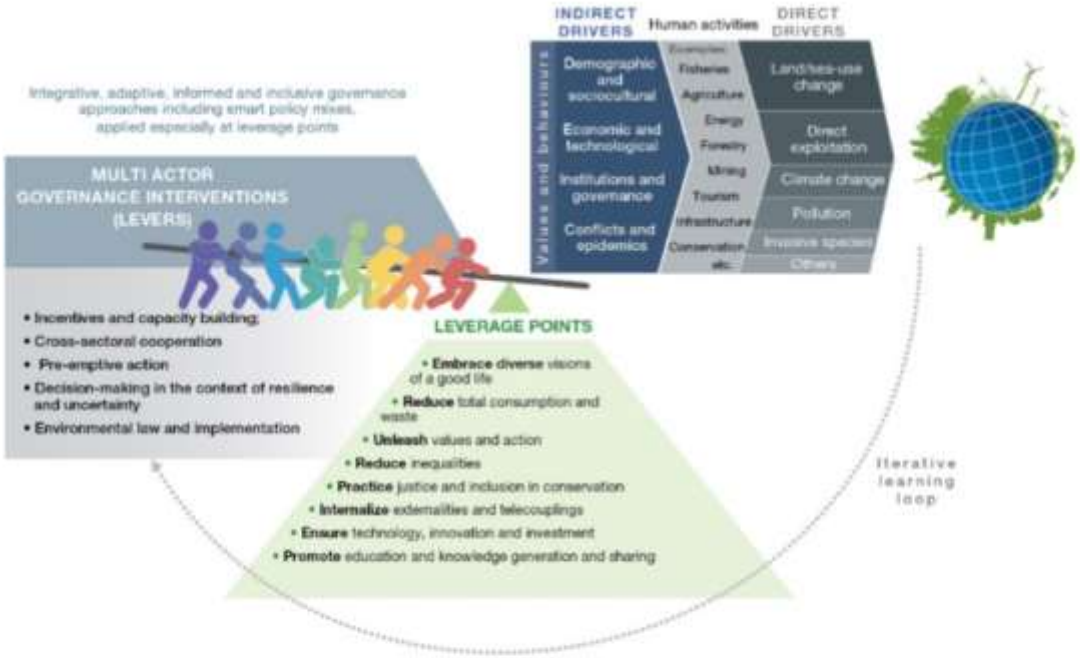


Figure 9. Transformative change in global sustainability pathways. Collaborative implementation of priority governance interventions (levers) targeting key points of intervention (leverage points) could enable transformative change from current trends towards more sustainable ones. Most levers can be applied by a range of actors such as intergovernmental organizations, governments, non-governmental organizations, citizen and community groups, indigenous peoples and local communities, donor agencies, science and educational organizations, and the private sector, at multiple leverage points, depending on context. Implementing existing and new instruments through place-based governance interventions that are integrative, informed, inclusive and adaptive, using strategic policy mixes and learning from feedback, could enable global transformation.

The SPA references verify that these types of sustainable pathways, scenarios, and transition states, seek to understand cause and effect attribution –why do stakeholders adopt or not adopt particular M&A Actions to achieve specific SDG targets? Will this increased understanding of cause and effect lead to the transformative changes needed by a sustainable planet? Unlike standard international SDG and SDRR reporting (covered later in this section), these pathways, scenarios, and transition states, are concerned about drilling down to explore the specific actions and activities, and adoption choices, which cause desired changes in the SDG and SDRR targets.

Stakeholder Boundary Identification. SPA3 introduced supply chain analysis techniques, such as the system boundary illustrated in the following images (FAO SAFA, 2014, http://www.fao.org/sustainable-food-value-chains/what-is-it/en/), to more fully document the sustainability accomplishments of specific companies and communities.

Figure 8. **Example of boundaries in a supply chain**

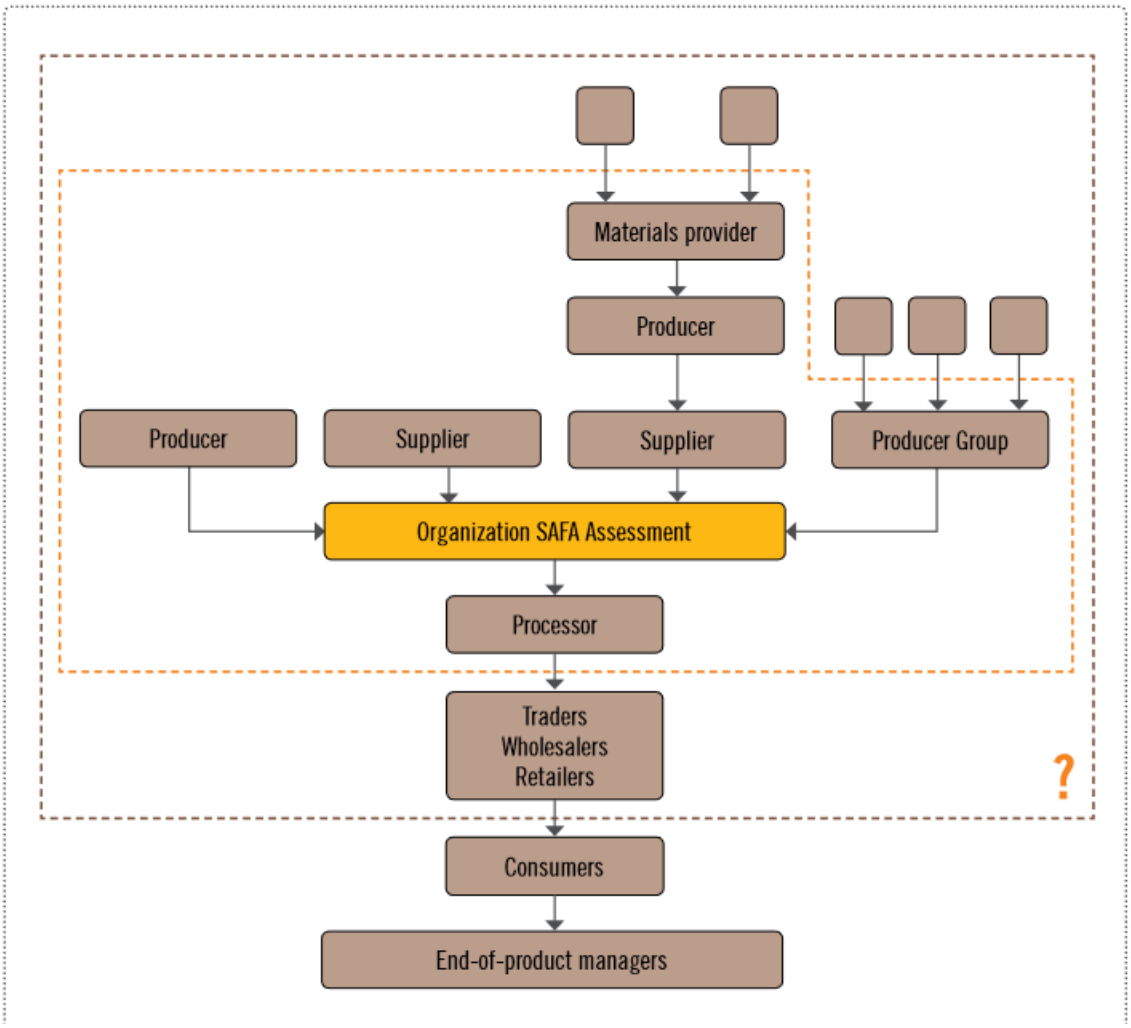
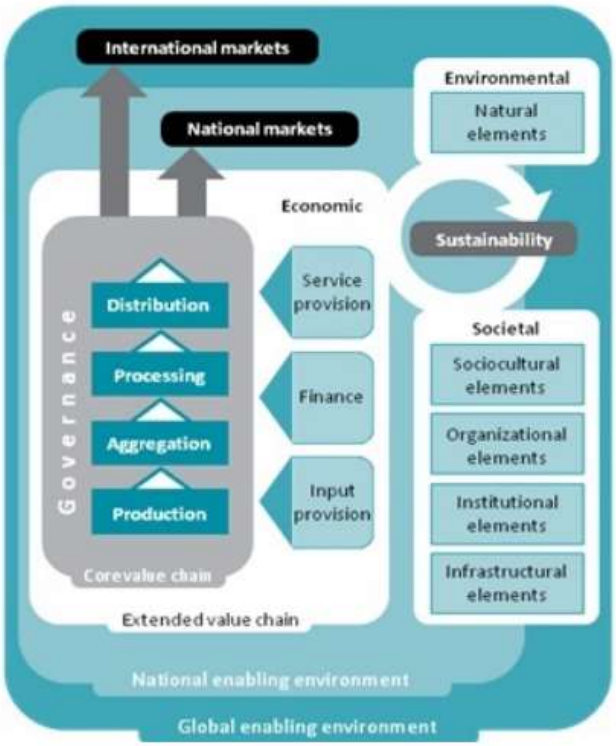


Figure 3 – The Sustainable Food Value Chain framework



Source: FAO, 2014

The **core FVC** comprises the value chain actors who produce or procure products from the upstream level, add value to these products and then sell them on to the next level. These actors carry out four functions: production (farming, fishing, forest harvesting or agroforestry), aggregation, processing, and distribution (wholesale and retail). The aggregation step is especially important to FVCs in developing countries, where efficiently aggregating and storing small volumes of produce collected from widely dispersed smallholder producers is often a major challenge.

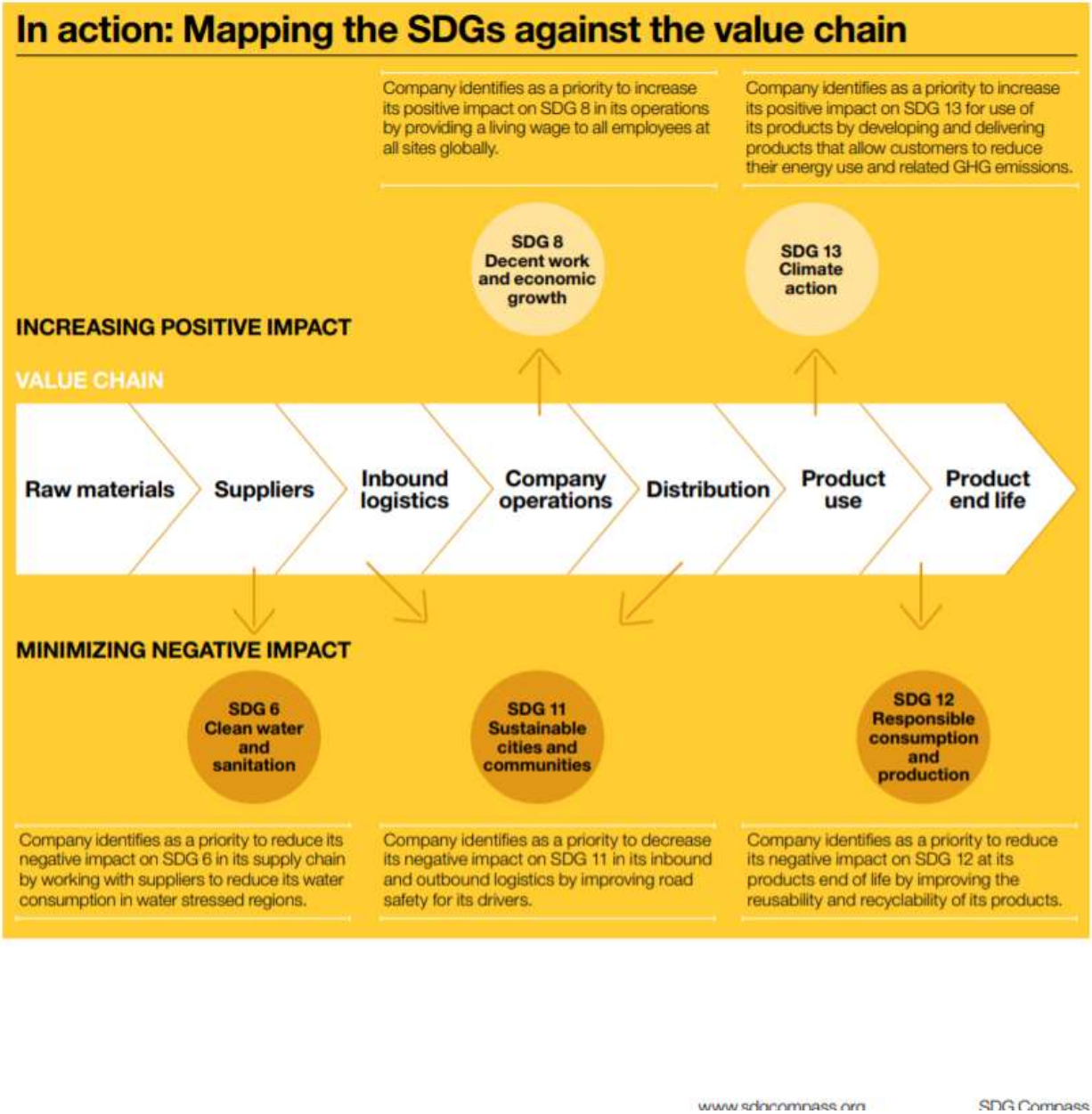
FVC actors are linked to each other and to their wider operating environment through a **governance** structure. There are horizontal linkages among the actors at a particular stage of the chain, for example farmers organizing themselves into cooperatives; and vertical linkages within the overall chain, for example farmers providing their produce to food companies through contracts.

FAO (2014) uses the following statement to define sustainable food value chains. These chains help to more thoroughly identify the stakeholders whose livelihoods are a major focus of SDG planning. Although this statement focuses on food supply chains, similar definitions can be developed for all supply chains.

"The full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products

that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society, and does not permanently deplete natural resources."

The following (GRI et al., 2015) image shows some of the relationships between supply chains, company actions, and the SDGs.



The following image (World Resources Institute, 2018) explains why stakeholder boundaries must include time as a third dimension, especially in economic sectors that are expected to change significantly in the next few decades. Increasing populations will be consuming more and more products and services, which in turn will impact many of the SDG. This image suggests the specific goals affected in the agricultural sector will be No Poverty, No Hunger, Climate Change, Gender Equality (i.e. most farm work in many countries is carried out by women), and all of the natural resources-related targets (i.e. agriculture causes extensive externalities).

Achieving these goals requires closing three great "gaps" by 2050:

- **The food gap**—the difference between the amount of food produced in 2010 and the amount necessary to meet likely demand in 2050. We estimate this gap to be 7,400 trillion calories, or 56 percent more crop calories than were produced in 2010.
- **The land gap**—the difference between global agricultural land area in 2010 and the area required in 2050 even if crop and pasture yields continue to grow at past rates. We estimate this gap to be 593 million hectares (Mha), an area nearly twice the size of India.
- **The GHG mitigation gap**—the difference between the annual GHG emissions likely from agriculture and land-use change in 2050, which we estimate to be 15 gigatons of carbon dioxide equivalent (Gt CO_2e), and a target of 4 Gt that represents agriculture's proportional contribution to holding global warming below 2°C above pre-industrial temperatures. We therefore estimate this gap to be 11 Gt. Holding warming below a 1.5°C increase would require meeting

the 4 Gt target plus reforesting hundreds of millions of hectares of liberated agricultural land.

This report explores a 22-item "menu for a sustainable food future," which is divided into five "courses" that together could close these gaps: (1) reduce growth in demand for food and agricultural products; (2) increase food production without expanding agricultural land; (3) exploit reduced demand on agricultural land to protect and restore forests, savannas, and peatlands; (4) increase fish supply through improved wild fisheries management and aquaculture; and (5) reduce greenhouse gas emissions from agricultural production.

Stakeholder Identification and Engagement. IPCC (2018) uses the following statement to explain the importance of engaging impacted stakeholders to participate in SDG planning and decision support. They also warn about the danger posed by privileged and powerful stakeholders coopting the decision making process at the expense of marginal and poor stakeholders (**3***). This statement explains why the IPCC's Integrated Assessment Model approach, this reference's SDG Plan approach, and SDG-related corporate reporting (see KMPG, 2018), need to be used cautiously and warily for local SDG planning (**5***).

"A narrow view of adaptation decision making, for example focused on technical solutions, tends to crowd out more participatory processes (Lawrence and Haasnoot, 2017; Lin et al., 2017), obscures contested values, and reinforces power asymmetries (Bosomworth et al., 2017; Singh, 2018). A situated and context specific understanding of adaptation pathways that galvanises diverse knowledge, values, and joint initiatives, helps to overcome dominant path dependencies, avoid trade-offs that intensify inequities, and challenge policies detached from place (Fincher et al., 2014; Wyborn et al., 2015; Murphy et al., 2017; Gajjar et al., 2018). These insights suggest that adaptation pathway approaches to prepare for 1.5°C warmer futures would be difficult to achieve without considerations for inclusiveness, place-specific trade-off deliberations, redistributive measures, and procedural justice mechanisms to facilitate equitable transformation (medium evidence, high agreement)."

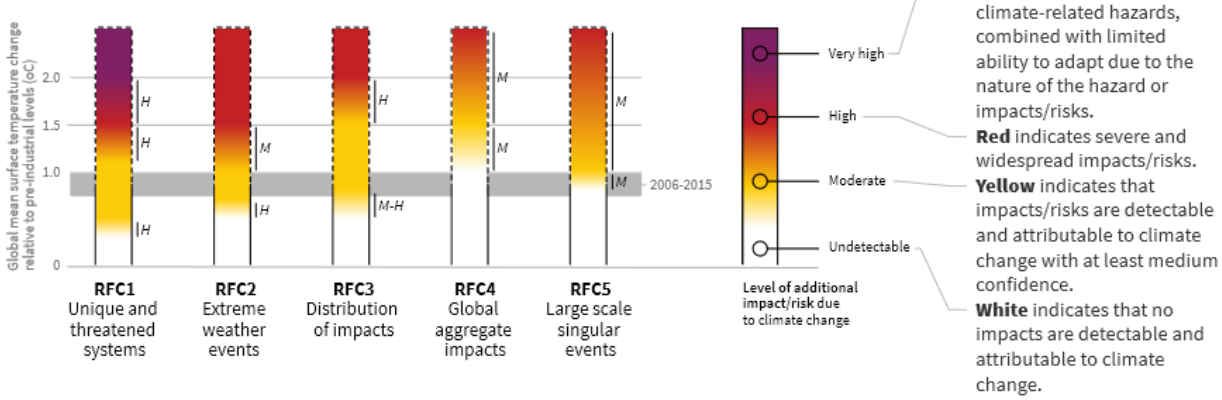
Biehl et al (2018) make a similar point about the need to employ the mixed methods analytic techniques introduced in SPA1, while engaging with local communities and forming local partnerships.

"Community engagement will draw on qualitative and quantitative methods. To understand and shape responses to climate change, it will be increasingly important to use federal datasets along with strategies for enhancing partnerships across federal, state, local, and organizational boundaries. As climate-change effects are often harshest in remote locations with underserved populations such partnerships will be central to community planning efforts. Successful planning will rely on the inclusion of community inputs and perspectives at all stages. In advance of data collection, using social-science perspectives to help understand different modes of communication and the availability of diverse communication resources will improve the reliability of the data collected and the likelihood that it reaches all corners of the country. Integrating ethnographic techniques and data derived from other qualitative and quantitative methods can provide insight into the roles of social identity and local context and meaning."

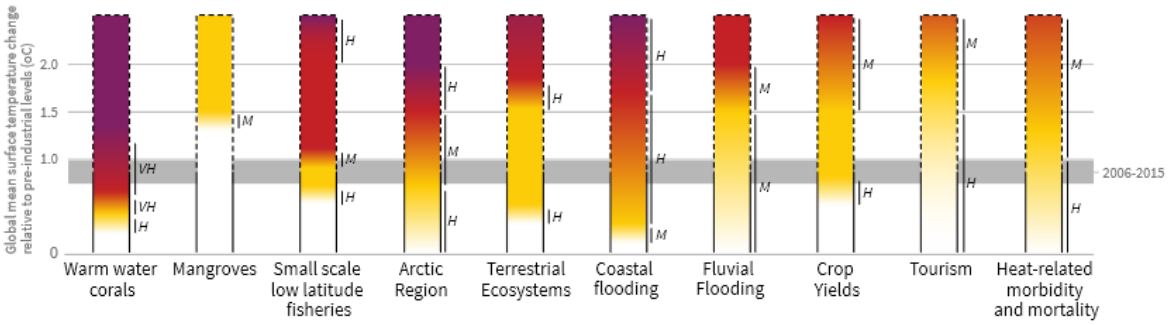
Risk and Impacts Identification. IPCC (2018) use the following image to explain why more comprehensive planning approaches, flawed though they might be, may be needed to keep global heating under a 1.5ºC temperature increase while achieving goals for sustainable social, economic, and environmental development. The reason for the SDG is that similar risks can be defined for most SDG targets.

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

Impacts and risks associated with the Reasons for Concern (RFCs)



Impacts and risks for selected natural, managed and human systems



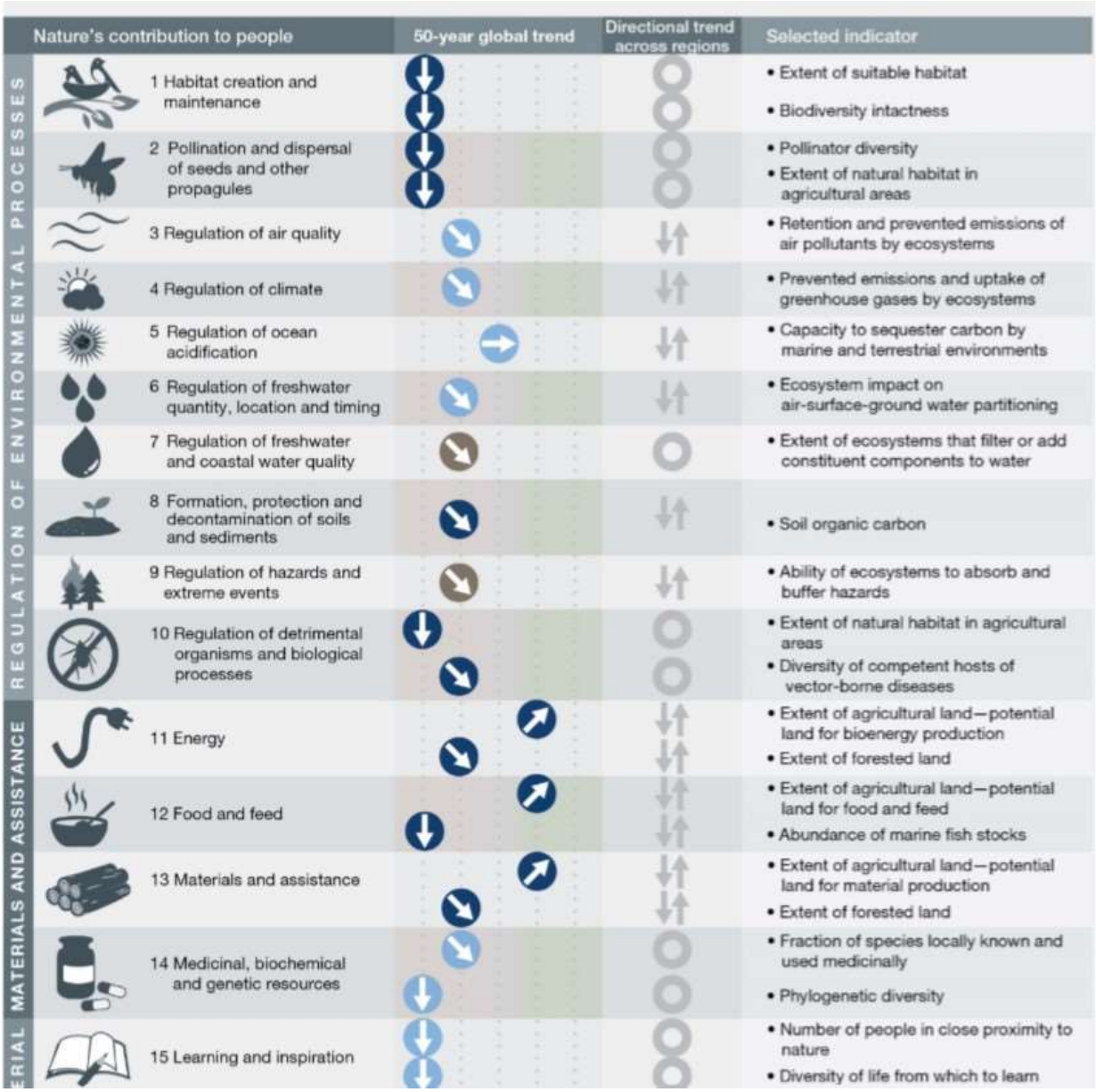
Confidence level for transition: *L*=Low, *M*=Medium, *H*=High and *VH*=Very high

The following table (IPCC, 2018) quantifies the specific impacts associated with an extra 0.5ºC increase. The table verifies that even small temperature increases have disproportionately higher risks, impacts, and costs on significant numbers of people and ecosystems. It's not clear whether or not similar "marginal risks" can be quantified for each SDG target. SPA3 identified "poor and marginalized people" as the most likely victims of these higher risks. These unfair and costly risks justify serious planning that figures out how to mitigate and adapt to their impact.

Table 5.1: Sustainable development implications of avoided impacts between 1.5°C and 2°C global warming

Impacts	Chapter 3 section	1.5°C	2°C	Sustainable development goals (SDGs) more easily achieved when limiting warming to 1.5°C
Water scarcity	3.4.2.1	4% more people exposed to water stress	8% more people exposed to water stress with 184-270 million people more exposed	SDG 6 water availability for all
	Table 3.4	496 (range 103-1159) million people exposed and vulnerable to water stress	586 (range 115-1347) million people exposed and vulnerable to water stress	
Ecosystems	3.4.3 Table 3.4	Around 7% of land area experiences biome shifts	Around 13% (range 8-20%) of land area experiences biome shifts	SDG 15 to protect terrestrial ecosystems and halt biodiversity loss
	Box 3.5	70-90% of coral reefs at risk from bleaching	99% of coral reefs at risk from bleaching	
Coastal cities	3.4.5.2	Less cities and coasts exposed to sea level rise and extreme events	More people and cities exposed to flooding	SDG 11 to make cities and human settlements safe and resilient
	3.4.5.1	31-69 million people exposed to coastal flooding	32-79 million exposed to coastal flooding	
Food systems	3.4.6 and Box 3.1	Significant declines in crop yields avoided, some yields may increase	Average crop yields decline	SDG 2 to end hunger and achieve food security
	Table 3.4	32-36 million people exposed to lower yields	330-396 million people exposed to lower yields	
Health	3.4.7	Lower risk of temperature related morbidity and smaller mosquito range	Higher risks of temperature related morbidity and mortality and larger range of mosquitoes	SDG 3 to ensure healthy lives for all
	Table 3.4	3546-4508 million people exposed to heatwaves	5417-6710 million people exposed to heatwaves	

The following image (IPBES, 2019) shows that GHG emissions must be understood as one risk driver out of many that are leading to of an overall decline in the services provided by ecosystems that benefit us. Future stakeholders will be less well off than us.


Nature's contribution to people
50-year global trend
Directional trend across regions
Selected indicator
REGULATION OF ENVIRONMENTAL PROCESSES
MATERIALS AND ASSISTANCE
1 Habitat creation and maintenance
• Extent of suitable habitat
• Biodiversity intactness
2 Pollination and dispersal of seeds and other propagules
• Pollinator diversity
• Extent of natural habitat in agricultural areas
3 Regulation of air quality
• Retention and prevented emissions of air pollutants by ecosystems
4 Regulation of climate
• Prevented emissions and uptake of greenhouse gases by ecosystems
5 Regulation of ocean acidification
• Capacity to sequester carbon by marine and terrestrial environments
6 Regulation of freshwater quantity, location and timing
• Ecosystem impact on air-surface-ground water partitioning
7 Regulation of freshwater and coastal water quality
• Extent of ecosystems that filter or add constituent components to water
8 Formation, protection and decontamination of soils and sediments
• Soil organic carbon
9 Regulation of hazards and extreme events
• Ability of ecosystems to absorb and buffer hazards
10 Regulation of detrimental organisms and biological processes
• Extent of natural habitat in agricultural areas
• Diversity of competent hosts of vector-borne diseases
11 Energy
• Extent of agricultural land—potential land for bioenergy production
• Extent of forested land
12 Food and feed
• Extent of agricultural land—potential land for food and feed
• Abundance of marine fish stocks
13 Materials and assistance
• Extent of agricultural land—potential land for material production
• Extent of forested land
14 Medicinal, biochemical and genetic resources
• Fraction of species locally known and used medicinally
• Phylogenetic diversity
15 Learning and inspiration
• Number of people in close proximity to nature
• Diversity of life from which to learn

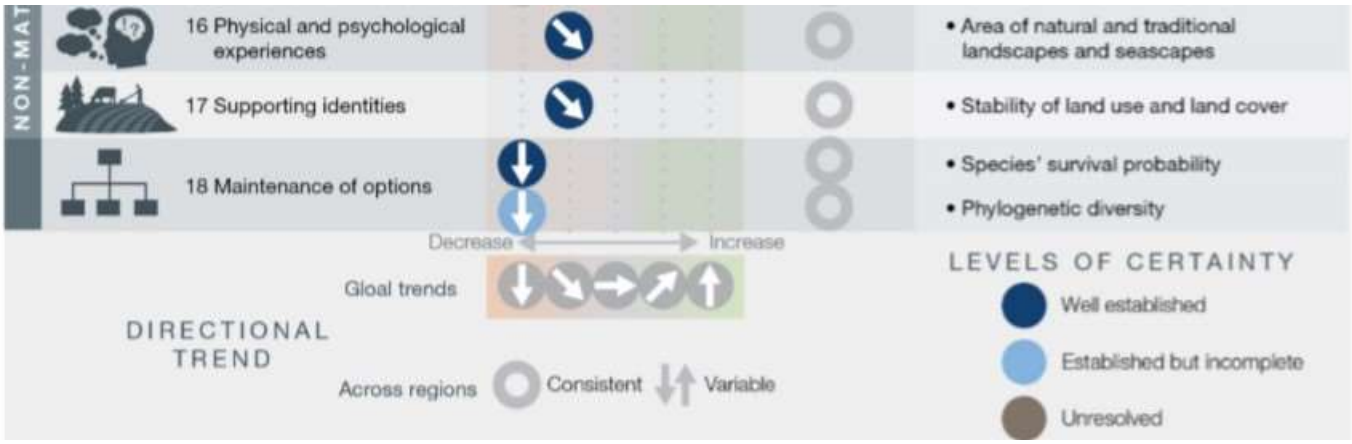


Figure 1. Global trends in the capacity of nature to sustain contributions to good quality of life from 1970 to the present, which show a decline for 14 of the 18 categories of nature's contributions to people analyzed. Data supporting global trends and regional variations come from a systematic review of over 2,000 studies {2.3.5.1}. Indicators were selected on the basis of availability of global data, prior use in assessments and alignment with 18 categories. For many categories of nature's contributions, two indicators are included that show different aspects of nature's capacity to contribute to human well-being within that category. Indicators are defined so that an increase in the indicator is associated with an improvement in nature's contributions.

The following image (Antonopoulos et al, 2016) show how local businesses and communities identify SDG-related risks.

Table 1.5. Activities in arable and horticultural production and associated direct and indirect environmental pressures

Service/Activity	Main environmental pressures	
	Direct	Indirect
Tillage/ploughing	Soil C and N loss Erosion Potential water sedimentation GHG emission	Fuel supply chains Machinery manufacture
Fertiliser application	NH_3 emissions N_2O emissions Nutrient losses to water Biodiversity loss Heavy metal accumulation	Manufacturing and transport energy, NH_3, N_2O emissions Resource depletion
Transport	Energy (fuel) consumption GHG emissions NOx and SOx emissions	Manufacturing and transport energy (and associated impacts)
Machinery Use (e.g. harvesting)	Energy consumption, air emissions,	Electricity generation Machinery production
Irrigation	Water stress Salinisation Nutrient losses Energy consumption	Electricity generation (and associated impacts)
Agrochemical application	Ecotoxicity effects Biodiversity loss	Manufacturing and transport energy
Seedling propagation	Disposal of peat Energy consumption	Extraction of peat Electricity generation
Crop protection (plastic/glass)	Disposal of plastic Biodiversity threat	Manufacturing and transport energy Resource depletion

Actual Mitigation and Adaptation Targets and M&A Action Impacts. IPCC (2018) uses the following image to explain the quantitative targets needed to achieve their recommended 1.5ºC target for temperature increase.

Table 4.1: Sectoral indicators of the pace of transformation in 1.5°C-consistent pathways, based on selected integrated pathways assessed in Chapter 2 (from the scenario database) and sectoral studies reviewed in Chapter 2 that assess mitigation transitions consistent with limiting warming to 1.5°C. Values for '1.5C low OS' and '1.5C high OS' indicate the median and the interquartile ranges for 1.5°C scenarios distinguishing high and low overshoot. S1, S2, S5 and LED represent the four illustrative pathway archetypes selected for this assessment (see Section 2.1 and Supplementary Material 4.A for detailed description).

		Energy		Buildings	Transport		Industry
		Share of renewable in primary energy [%]	Share of renewable in electricity [%]	Change in energy demand for buildings (2010 baseline) [%]	Share of low carbon fuels (electricity, hydrogen and biofuel) in transport [%]	Share of electricity in transport [%]	Industrial emissions reductions (based on current level) [%]
IAM Pathways 2030	1.5C low OS	29 (35; 25)	53 (59; 44)	-3 (5; -8)	10 (15; 8)	5 (7; 3)	40 (50; 30)
	1.5C high OS	24 (27; 20)	43 (54; 37)	-17 (-12; -20)	7 (8; 6)	3 (5; 3)	18 (28; -13)
	S1	29	58	-8	NA	4	49
	S2	29	48	-14	5	4	19
	S5	14	25	NA	3	1	NA
	LED	37	60	30	NA	21	42
Sectorial studies 2030	Löffler et al. (2017)	50	78				
	Rockström et al. (2017)	20					
	Kuramochi et al. (2017)						20
	IEA (2017)	20	47	7	16	6	14
	WBCSD (2017)			-11			
IAM Pathways 2050	1.5C low OS	58 (67; 50)	76 (85; 69)	-19 (2; -37)	53 (65; 34)	23 (30; 17)	79 (89; 71)
	1.5C high OS	62 (68; 47)	82 (88; 64)	-37 (-13; -51)	38 (44; 27)	18 (23; 14)	68 (81; 54)
	S1	58	81	-21	NA	34	74
	S2	53	63	-25	26	23	73
	S5	67	70	NA	53	10	NA
	LED	73	77	45	NA	59	91
Sectorial studies 2050	Löffler et al. (2017)	100	100		98		
	Rockström et al. (2017)		100				
	Figueres et al. (2017)						50
	Kuramochi et al. (2017)		100				
	IEA (2017)	29	74	11	59	31	20
	WBCSD (2017)						

IPCC (2018) proceed to identify feasible M&A Actions, gathered from scientific evidence and summarized in the following image, which can help to achieve these targets.

Table 4.8: Examples of mitigation and adaptation behaviours relevant for 1.5ºC (Dietz et al., 2009; Jabeen, 2014; Taylor et al., 2014; Araos et al., 2016b; Steg, 2016; Stern et al., 2016b; Creutzig et al., 2018)

Climate action	Type of action	Examples
Mitigation	Implementing resource efficiency in building	Insulation Low-carbon building materials
	Adopting low-emission innovations	Electric vehicles Heat pumps, district heating and cooling
	Adopting energy efficient appliances	Energy-efficient heating or cooling Energy-efficient appliances
	Energy-saving behaviour	Walking or cycling rather than drive short distances Using mass transit rather than flying Lower temperature for space heating Line drying of laundry Reducing food waste
	Buying products and materials with low GHG emissions during production and transport	Reducing meat and dairy consumption Buying local, seasonal food Replacing aluminium products by low-GHG alternatives
	Organisational behaviour	Designing low-emission products and procedures Replacing business travel by videoconferencing
Adaptation	Growing different crops and raising different animal varieties	Using crops with higher tolerance for higher temperatures or CO_2 elevation
	Flood protective behaviour	Elevating barriers between rooms Building elevated storage spaces Building drainage channels outside the home
	Heat protective behaviour	Staying hydrated Moving to cooler places Installing green roofs
	Efficient water use during water shortage crisis	Rationing water Constructing wells or rainwater tanks
Mitigation & adaptation	Adoption of renewable energy sources	Solar PV Solar water heaters
		Engage through civic channels to encourage or

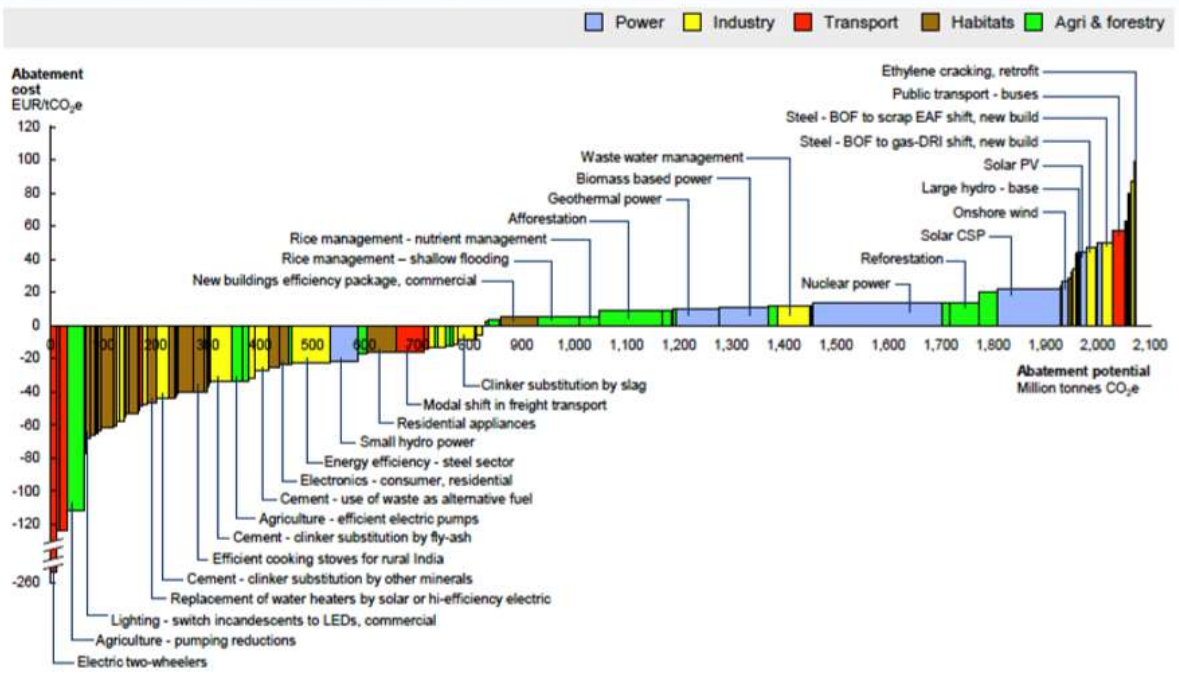
IPBES (2019) list the following M&A Actions to address the transformative changes required to conserve global biodiversity and ecosystem services. These M&A Actions provide greater context for the previous table's global heating actions.

Table SPM.1. Approaches for sustainability and possible actions and pathways for achieving them. The appropriateness and relevance of different approaches vary according to place, system, decision-making process and scale. The list of actions and pathways in the following table is not exhaustive, but rather illustrative, using examples from the assessment report.

Approaches for sustainability	Possible actions and pathways to achieve transformative change Key actors: (IG=Intergovernmental organizations, G=Governments, NGOs =Non-governmental Organizations, CG=Citizen, community groups, IPLC = Indigenous peoples and local communities, D=Donor agencies, SO= Science and educational organizations, P=Private sector)
Enabling integrative governance to ensure policy coherence and effectiveness	• Implementing **cross-sectoral approaches** that consider linkages and interconnections between sectoral policies and actions (e.g. IG, G, D, IPLC) {6.2} (D1) • Mainstreaming biodiversity within and across different sectors (e.g. agriculture, forestry, fisheries, mining, tourism) (e.g. IG, G, NGO, IPLC, CG, P, D) {6.2, 6.3.5.2} (D5) • **Encouraging integrated planning and management for sustainability at the landscape and seascape level** (e.g. IG, G, D) {6.3.2} (D5) • Incorporating environmental and socioeconomic impacts, including externalities into public and private decision-making (e.g. IG, G, P) {5.4.1.6} (B5) • Improving **existing policy instruments** and use them **strategically and synergistically** in smart policy mixes (e.g. IG, G) {6.2; 6.3.2; 6.3.3.3.1; 6.3.4.6; 6.3.5.1; 6.3.6.1} (D4)
Promoting inclusive **governance approaches through stakeholder engagement** and the inclusion of **indigenous peoples and local communities** to ensure equity and participation	• **Recognizing and enabling the expression of different value systems and diverse interests while formulating** and implementing policies and actions (e.g. IG, G, IPLCs, CG, NGO, SO, D) {6.2} (B5, D5) • Enabling the inclusion and participation of indigenous peoples and local communities, and women and girls, in environmental governance and **recognizing and respecting the knowledge, innovations and practices,** institutions and values of indigenous peoples and local communities, in accordance with national legislation {6.2; 6.2.4.4} (e.g. G, IPLC, P) (D5) • Facilitating national recognition for land tenure, access and resource rights in accordance with national legislation, and the application of **free, prior and informed consent and fair and equit**able benefit-sharing arising from their use (e.g. G, IPLC, P) (D5) • Improving **collaboration and participation among** indigenous peoples and local communities, other relevant stakeholders, policymakers and scientists to generate novel ways of conceptualizing and achieving transformative change towards sustainability (e.g. G, IG, D, IPLC, CG, SO) (D5)
	• **Improving documentation of nature** (e.g biodiversity and other inventories) **and assessment of the multiple values of nature, including the valuation of natural capital** by both private and public entities (e.g. SO, D, G, IG, P) {6.2} (D2)

The following image (UNEP, 2015) shows that many M&A Actions have the potential to achieve SDG targets, such as those dealing with energy efficiency, at net negative costs. These types of "marginal abatement cost curves" help planners to use cost and benefit criteria to prioritize the selection of M&A Actions for SDG plans. Later sections of this reference will demonstrate how some types of SDG Plans support this type of decision making.

Figure 14:2 India's abatement cost curve for 2030 (cost below EUR 100/tonne)



Source: (McKinsey 2009)

Energy efficiency can be considered as the keystone to achieve sustainable consumption and production at country level, or eco-efficiency at corporate level. Investment in energy efficiency is extremely attractive as the

IPCC (2018) use the following image to explain IT's potential indirect contribution to mitigation and adaptation Although not listed in the table, the digital SDG Plans and Social Sustainability Media Platforms introduced in this reference can be classified as "ICTs". They use the following acronyms: "General Purpose Technologies (GPTs), consisting of Information and Communication Technologies (ICT) including Artificial Intelligence (AI) and Internet-of-Things (IoT), nanotechnologies, biotechnologies, robotics, …".

Table 4.9: Examples of technological innovations relevant to 1.5°C enabled by General Purpose Technologies (GPT). Note: Lists of enabling GPT or adaptation/mitigation options are not exhaustive, and the GPTs by themselves do not reduce emissions or increase climate change resilience.

Sector	Examples of mitigation/adaptation technological innovation	Enabling GPT
Buildings	Energy and CO_2 efficiency of logistics, warehouse and shops (GeSI, 2015; IEA, 2017a)	IoT, AI
	Smart lighting and air conditioning (IEA, 2016b, 2017a)	IoT, AI, nanotechnology
Industry	Energy efficiency improvement by industrial process optimisation (IEA, 2017a)	Robots, IoT
	Bio-based plastic production by bio-refinery (OECD, 2017c)	Biotechnology
	New materials from bio-refineries (Fornell et al., 2013; McKay et al., 2016)	ICT, Biotechnology
Transport	Electric vehicles, car sharing, automation (Greenblatt and Saxena, 2015; Fulton et al., 2017)	IoT, AI, nanotechnology
	Bio-based diesel fuel by bio-refinery (OECD, 2017c)	Biotechnology
	Second Generation Bioethanol potentially coupled to Carbon Capture Systems (de Souza et al., 2014; Rochedo et al., 2016)	ICT, Biotechnology
	Logistical optimisation, and electrification of trucks by overhead line (IEA, 2017e)	IoT, AI
	Reduction of transport needs by remote education, health, and other services (GeSI, 2015; IEA, 2017a)	ICT
	Energy saving by lightweight aircraft components (Beyer, 2014; Faludi et al., 2015; Verhoef et al., 2018)	Additive manufacturing (3D printing)
Electricity	Solar PV manufacturing (Nemet, 2014)	Nanotechnology
	Smart grids and grid flexibility to accommodate intermittent renewables (Heard et al., 2017)	IoT, AI
	Plasma confinement for nuclear fusion (Baltz et al., 2017)	AI
Agriculture	Precision agriculture (improvement of energy and resource efficiency including reduction of fertiliser use and N_2O emissions) (Pierpaoli et al., 2013; Brown et al., 2016; Schimmelpfennig and Ebel, 2016)	Biotechnology ICT, AI
	Methane inhibitors (methanogenic vaccines) that reduce dairy livestock emissions (Wollenberg et al., 2016)	Biotechnology
	Engineering C3 into C4 photosynthesis to improve agricultural production and productivity (Schuler et al., 2016)	Biotechnology
	Genome editing using CRISPR to improve/adapt crops to a changing climate (Gao, 2018)	Biotechnology
Disaster reduction and adaptation	Weather forecasting and early warning systems, in combination with user knowledge (Hewitt et al., 2012; Lourenço et al., 2016)	ICT
	Climate risk reduction (Upadhyay and Bijalwan, 2015)	ICT
	Rapid assessment of disaster damage (Kryvasheyeu et al., 2016)	ICT

At local business and community scale, Example 3 demonstrated using LCIA to conduct Hot Spots Analysis. SPA2 used the following quote (from UNSETACe) to explain the relation between the SDG and Hotspots Analysis. PRé Sustainability and 2.-0 LCA consultants (2018) and Di Noi et al. (2017) use a private sector perspective to discuss LCA use with the SDG and describe current GPT projects that automate parts of the process.

"The outputs from [S-LCA and Hotspots] analysis can then be used to identify and prioritise potential actions around the most significant economic, environmental and social sustainability impacts or benefits associated with a specific country, city, industry sector, organization, product portfolio, product category or individual product or service."

The following image (Antonopoulos et al, 2016) shows how agricultural firms use Best Environmental Management Practices (BMPs), based on Hotspots Analysis of environmental risks, to identify relevant M&A Actions for SDG-related purposes.

Based on environmental hotspots Table 13.2 maps across the most relevant BEMPs contained in this SRD to 12 major farm types. Simplification is inevitably involved, and farms may include features typical of multiple farm types (mix of intensive and extensive areas, mixed animal and crop production, etc).

Table 13.2: Priority best practices (BEMPs) described in this report for 12 major farm types (dark shading=high priority; medium shading=medium priority; white=not applicable or low priority) [59]

BEMP	Intensive dairy*	Extensive dairy	Intensive eef*	Extensive beef	Sheep	Intensive pigs*	Intensive poultry*	Extensive pig & poultry	Cereals and oils	Root crops	Field fruit & vegetables	Covered fruit & vegetables
3.1												
3.2												
3.3												
3.4												
3.5												
3.6												
3.7												
4.1												
4.2												
4.3												
4.4												
5.1												
5.2												
5.3												
5.4												
6.1												
6.2												
6.3												
6.4												
6.5												
7.1												
7.2												
7.3												
7.4												

In effect, these types of analyses provide evidence of the actual SDG impacts associated with M&A Actions. That evidence, preferably gathered using new Social Sustainability Media Platforms, is needed before the feasibility of M&A Actions can be fully assessed and then recommended to companies and communities for solving their hotspots, or prioritized risks. Importantly, machine learning algorithms may be able to use this evidence to deduce the "pathway-scenario-transition state linkages", or full evidence, needed to understand the causal attribution between stakeholder groups and their institutions, M&A Action Portfolios, and final SDG accomplishment.

Example 6 in SPA3 points out that disaster risk management activities, which are also M&A Actions, focus on increasing the capacity of local communities to prevent undue losses from disasters, which are also SDG targets and indicators (i.e. reduce disaster mortality rate).

SDG and M&A Action Linkages and Stakeholder Equity. IPCC (2018) use the following statement and images to demonstrate using feasibility assessments with SDG reporting systems to investigate the tradeoffs and synergies needed to accomplish SDG and SDRR targets. IPCC (2018) defines tradeoffs as "negative effects on SDG [and SDRR] targets" and synergies as "positive effects on SDG [and SDRR] targets". These techniques supplement SPA3's Stakeholder Impact Assessment techniques with the actual M&A Actions being taken to achieve equitable development.

"Understanding these mitigation-SDG interactions is key for selecting mitigation options that maximise synergies and minimize trade-offs towards the 1.5°C and sustainable development objectives."

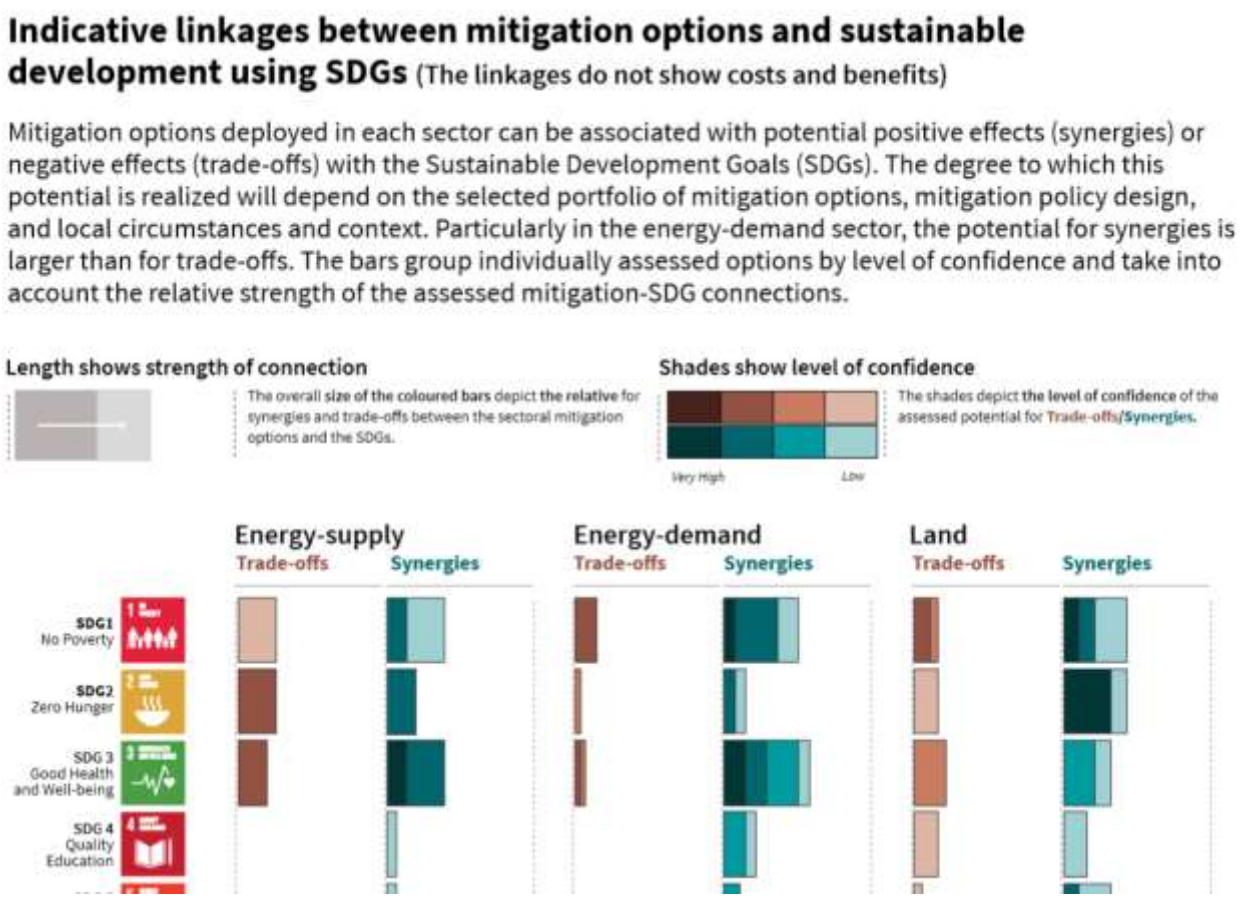
Supplementary Material 4.E Adaptation and mitigation synergies and trade-offs as discussed in Section 4.5.4

Mitigation options may affect the feasibility of adaptation options, and the other way around. Supplementary Material 4.E.1, Table 1 provides examples of possible positive impacts (synergies) and negative impacts (trade-offs) of mitigation options for adaptation. Supplementary Material 4.E.2, Table 1 lists examples of synergies and trade-offs of adaptation options for mitigation.

Supplementary Material 4.E.1 Mitigation options with adaptation synergies and trade-offs

Supplementary Material 4.E.1, Table 1: Mitigation options with adaptation synergies and trade-offs identified

System	Mitigation option	Synergies	Trade-offs
Energy system transitions	Wind energy (on-shore & off-shore)	Resilience can be increased by wind, solar and bioenergy due to distributed grids (Parkinson and Djidali, 2015), given that energy security standards are in place (Almeida Prado et al., 2016). The use of residential batteries can increase resiliency, especially after extreme weather events (Qazi and Young Jr., 2014; Liu et al., 2017). A shift from coal-generated to natural gas-generated electricity could decrease water consumption (DeNooyer et al., 2016).	Renewable energy infrastructure that does not follow security standards can increase vulnerability (Ley, 2017).
	Solar PV		
	Bioenergy		
	Electricity storage		
	Power sector CCS	NE	Some renewable energy technologies, carbon dioxide capture and storage (CCS), and concentrating solar power (CSP) technologies have substantial water demand associated with their operation (Fricko et al., 2016). In particular, lower power plant efficiency due to CCS increases the vulnerability to water constraints in most regions (McCollum et al., 2013; van Vliet et al., 2016)
	Nuclear energy	Increased safety and protection standards can improve the climate risk profiles (Schneider et al., 2017).	Increased safety and protection standards will increase costs making some electricity systems less reliable (Jacobson and Delucchi, 2009; Lovins et al., 2018).
Land & ecosystem transitions	Reduced food wastage & efficient food production	Reducing food loss and waste can decrease pressure of deforestation (FAO, 2013a), pressure on land use for agriculture (Foley et al., 2011; Hic et al., 2016), and provide long-term food security (Bajželj et al., 2014).	NA
	Dietary shifts	Shift from animal- to plant-related diets can significantly decrease land use and biodiversity loss due to a decrease in pressure on land use by livestock production (Newbold et al., 2015; Ramankutty et al., 2018;	Shift from animal- to plant-related diets will require improvement of mixed crop-livestock systems, which are more difficult to manage well and need and higher capital to be



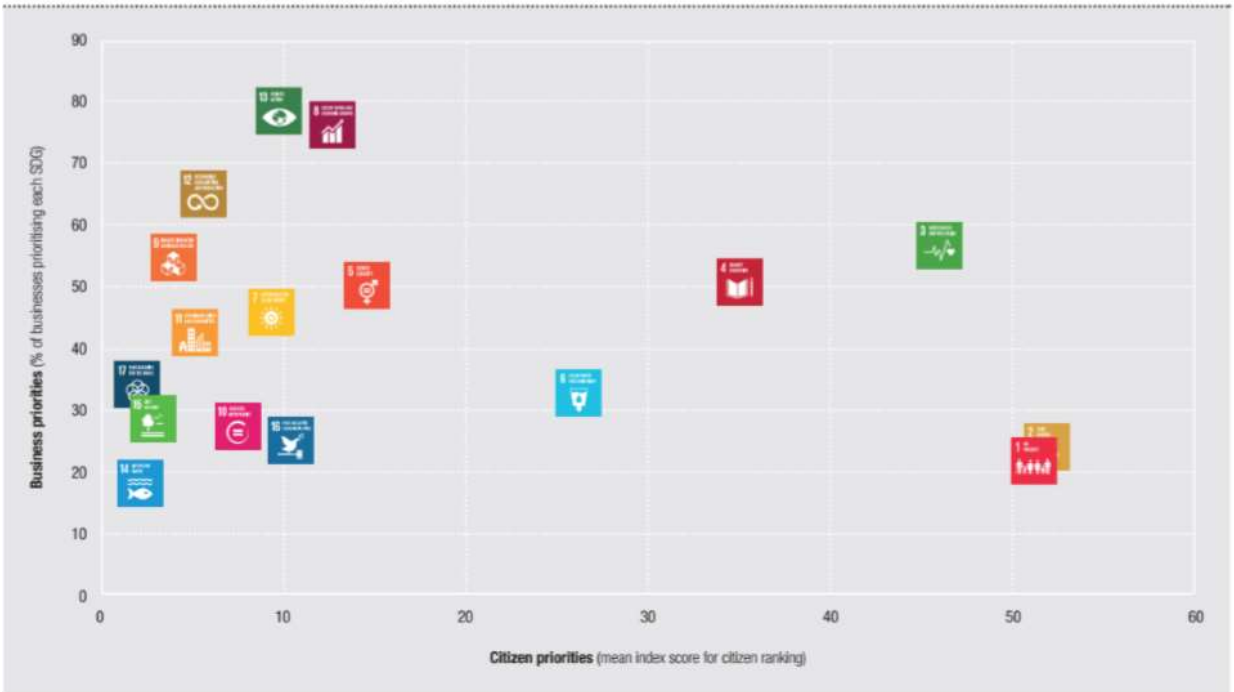
UNEP (2018) introduce several examples of synergies between global heating and general environmental improvement M&A Actions and SDG targets. The following is just one of the examples.

“Rao et al. (2016) show that combining deep decarbonization with stringent air pollution control policies can decrease the share of global population exposed to high particulate matter concentrations from 21 percent to 3 percent in 2050.”

The following image (PRé Sustainability & 2.-0 LCA, 2018) verifies that the business community may perceive different SDG priorities than consumers. SDG Plans must address the tradeoffs and synergies associated with different stakeholder perspectives in a way that leaves the disparate parties reasonably satisfied. Example 5 illustrated the use of Reference Case ICERS

to study the tradeoffs associated with “Perspectives” specific to private sector, society, and impacted stakeholder, groups.

Figure 4: Business and citizen priorities



Source: PwC, SDG Reporting Challenge 2017

Example 6B in SPA3 introduces more advanced statistical techniques, including correlation analysis, for exploring these interactions. Both of the global reporting systems introduced later in this section explain additional statistical techniques for analyzing correlations between indicators and/or targets and ensuring that the Indicators and Indexes are “well structured and balanced”. SPA3 describe these linkages and interactions as “complex, intersecting patterns” and recommend machine learning algorithm development for their analysis.

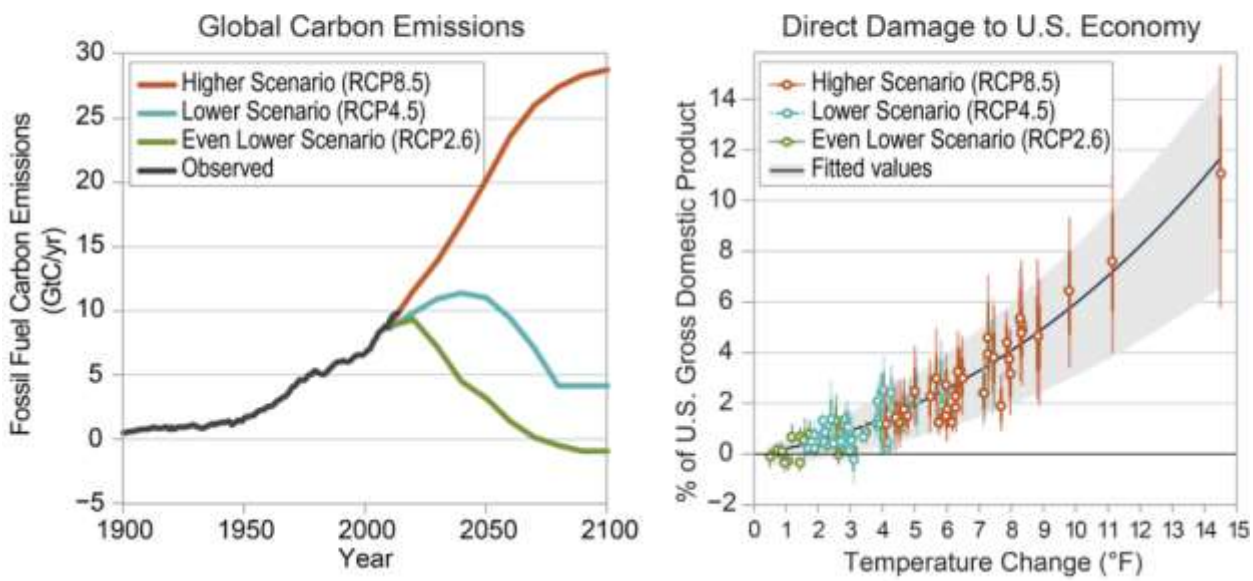
M&A Action Portfolio Selection and SDG Plans. IPCC (2018) introduces Integrated Assessment Models as a global planning technique to address climate change. They do not introduce related local planning techniques, such as SDG Plans, for similar purposes. Examples 1 to 8 do not fully explain how actual M&A Actions are selected by companies and communities

and then used in actual SDG Plans. **Appendix A**, Introduction to SDG Mitigation and Adaptation (M&A) Feasibility Assessments, demonstrates how to use Feasibility Assessments to select the M&A Actions that address the SDG risks and impacts that are core ingredients of SDG Plans.

Monitoring and Evaluation (M&E) of SDG Plans. IPCC (2018) estimates that "Total annual average energy-related mitigation investment for the period 2015 to 2050 in pathways limiting warming to 1.5°C is estimated to be around 900 billion USD2015 (range of 180 billion to 1800 billion USD2015 across six models)". They further document that loosening the temperature increase goal to 2°C increases the required investment in energy-related investments by 12% and the investment in low-carbon energy technologies and energy efficiency by a factor of five (**7***).

The following image (USGCRP, 2018, Chapter 29) verifies that the estimated damage to the U.S. economy alone from global heating range from tens to hundreds of billions of dollars if effective M&A Actions are not taken, and taken now (**6* and 11***).

Figure 29.3: Estimates of Direct Economic Damage from Temperature Change



SPA3 introduce Machine Learning (ML) algorithms to answer the following types of Impact Evaluation questions (OECD, 2015). Successful SDG interventions, that is, interventions that can successfully answer these Impact Evaluation questions, may be expensive (i.e. but necessary to avoid the more costly losses described in the previous 2 paragraphs (USGCRP, 2018, Chapter 29, UNEP, 2018, Chapter 6)). The M&E accounting systems used by these algorithms can help to ensure that the money is well spent.

- **M&E Accounting Systems, Sustainability Accounting Platforms, and Equity**. Have the lives and livelihoods of impacted stakeholder groups actually been improved in an equitable and cost effective manner as a result of the M&A Actions? What evidence, in terms of the outputs from a formal M&E accounting system proves this? Are the accounting systems being applied on new Social Sustainability Accounting Platforms?

Box 3.5. **Key evaluative questions to include for adaptation interventions**

- **Relevance:** Does the policy or intervention address identified areas of likely vulnerability and risk? Are the assumptions or theory of change on which the activity is based logical or sensible in this context at this time? Are outputs consistent with the objectives of increasing resilience?
- **Efficiency:** Are activities cost efficient? Is this the most efficient way to improve adaptive capacity? Compare potential disaster costs vs. the cost of this particular approach to prevention (see e.g. GIZ, 2013b).
- **Impact:** What happened as a result of the adaptation policy? Why? What were the positive and negatives changes produced, directly or indirectly, intended or unintended? Did the intervention impact key areas of risk or affect resiliency factors?
- **Effectiveness:** To what extent were the objectives achieved? What factors contributed to achievements?
- **Sustainability:** Will benefits be maintained after the programme or support has ended? Do locals have ownership of the activity or programme, where possible? Have durable, long-term processes, structures and institutions for adaptation been created?

Source: Adapted from OECD (2008), *Evaluating Conflict and Peacebuilding Activities: Factsheet*, available at: *www.oecd.org/dac/evaluation/dcdndep/39289596.pdf*.

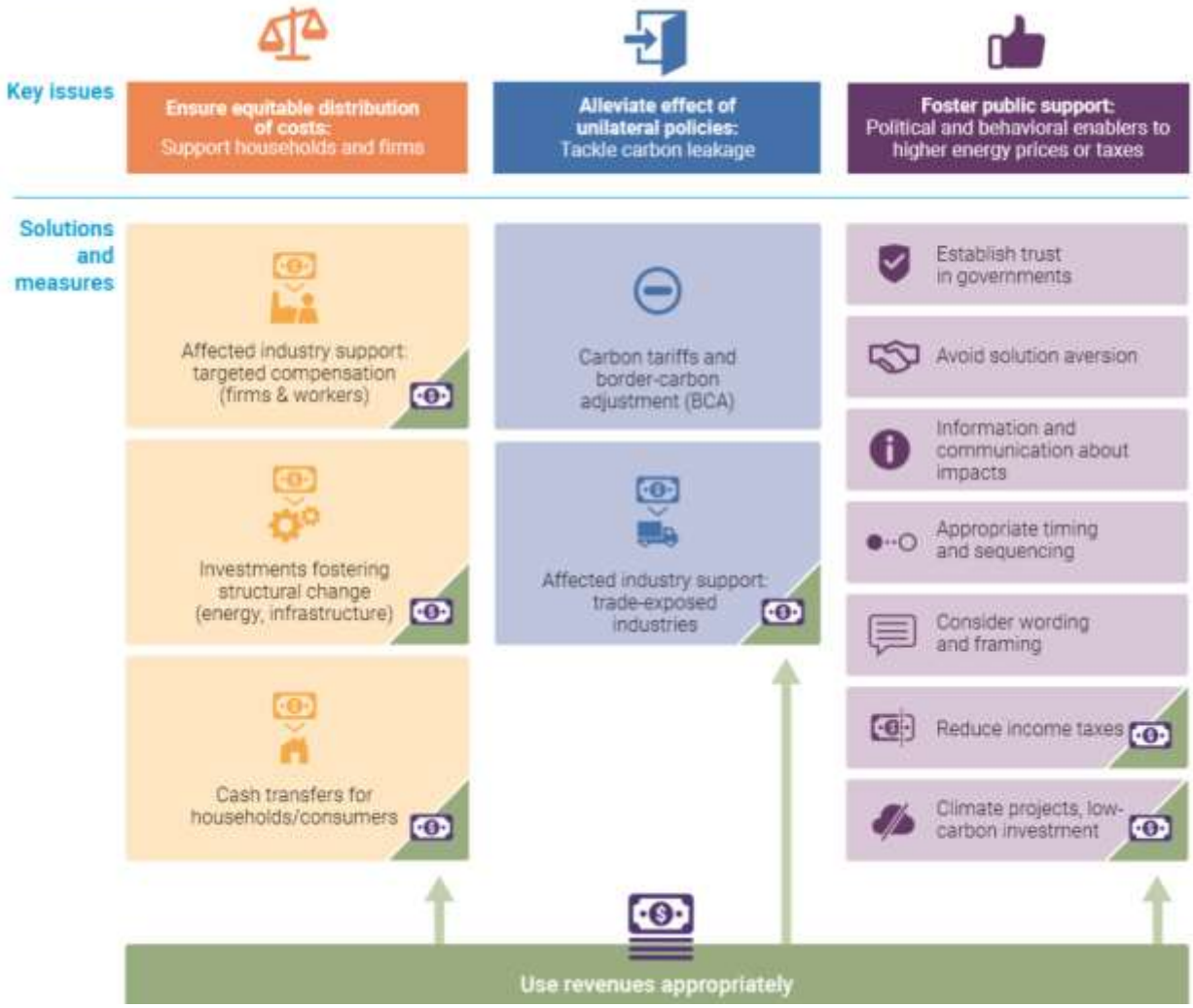
UNEP (2018) uses the following table to confirm that many countries and communities are developing innovative policies that reduce the expense of M&A Actions for impacted stakeholders.

Table 6.1: Behavioural and political success factors.

Success factor	Example(s)
Directly addressing distributional impacts	• LPG price increases in **Brazil** and **Mexico** were combined with existing social welfare mechanisms to mitigate the effects of higher prices (Adeoti *et al.*, 2016; Toft *et al.*, 2016). • Kerosene subsidy reforms in **Indonesia** and **Yemen** were accompanied by measures promoting the use of liquefied petroleum gas (LPG) as a household cooking fuel (Clements *et al.*, 2013). • In **Indonesia**, social assistance programmes enabled the government to reform fossil fuel subsidies in the mid-2000s (Chelminski, 2018), while India and Iran provided some form of cash transfer to compensate households (Rentschler and Bazilian, 2017a; Jain *et al.*, 2018). • **Switzerland**, **Alberta** and **British Columbia** (see table 6.2) have used revenues from carbon pricing to compensate households and, to a degree, firms.
Establishing trust in governments	• Countries with relatively high levels of trust and low levels of perceived corruption, such as **Finland**, **Norway**, **Sweden** and **Switzerland**, tend to have higher carbon prices (Rafaty, 2018). • Subsidy reform in **Indonesia** had previously been difficult due to public distrust in the government; however, more recently, reforms have been accompanied by measures tackling corruption in the oil and gas sector (Chelminski, 2018). • **Jordan's** 2008 subsidy reforms were introduced following consultations with a wide array of stakeholders (Whitley and van der Burg, 2015).
Avoiding solution aversion	• Proposed carbon pricing reforms for the **USA** as a whole, or for individual USA states, are often designed to accommodate less interventionist world views. This is accomplished by minimizing the State's role in the carbon pricing reform, in part by returning a large portion of the revenue to its citizens (Nature Editorial, 2017). Further examples are the **Massachusetts** Bill H.1726—which also features a carbon dividend—that passed the state senate in June 2018 (DeMarco, 2018) or the reform of the **Californian** Cap and Trade system (CAB, 2017) and the 'fee and rebate' proposal in **Washington DC**, both of which are focused to some degree on revenue neutrality (Dysen, 2018).
Information and communication about the impacts	• The successful fossil fuel subsidy reform in **Iran** was carefully prepared by clear government communication through various channels, such as websites and hotlines to answer questions about the reform. The government also proactively consulted the private sector to discuss potential concerns about the policy reform (Atansah *et al.*, 2017). • The Government of **Malaysia** used multiple channels (including a public forum, YouTube and Twitter) to communicate fossil fuel subsidy reform in 2013 (Fay *et al.*, 2015).
Getting the	• Gradual fossil fuel subsidy reform in **Iran** helped with gaining public acceptance and

UNEP (2018) uses the following image to suggest solutions for getting greater political acceptance for taking M&A Actions for impacted stakeholders.

Figure ES.6: Key issues for making fiscal reforms politically viable (upper part) and solutions and measures to address them (lower part).

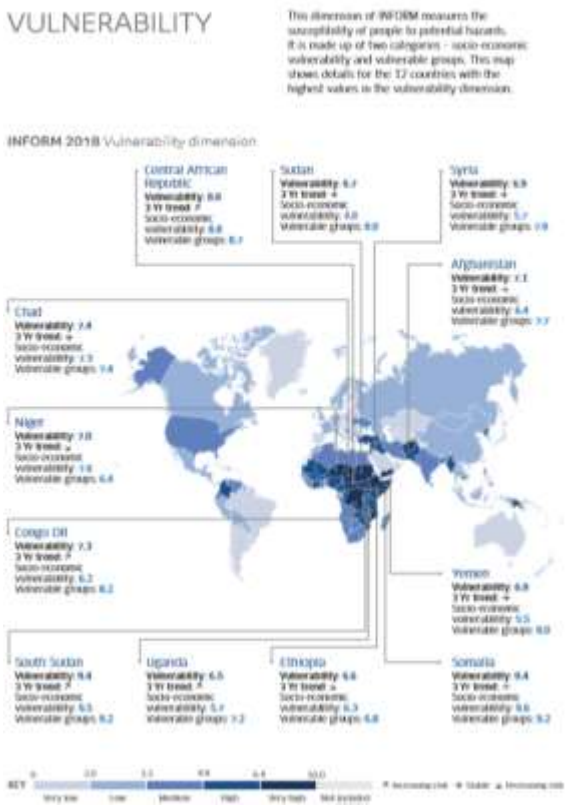


SDG Reporting with Risk Management Indicators and Indexes: The following image (Bertelsmann Stiftung and SDSN, 2018) demonstrates part of an international SDG reporting system, SDG Index and Dashboards Report (SDG Index). This dashboard identifies country-level trends for achieving each SDG. Later sections of this reference will demonstrate using the same report, but replacing the countries with local communities for landscape reports, and local companies for industry reports.

Figure 10 | SDG Trend Dashboard for East and South Asia

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Bangladesh	↑	↗	↗	••	↗	••	↗	→	↗	••	→	••	→	→	↓	→	→
Bhutan	↑	↗	↗	→	↗	••	••	••	••	••	••	••	→	••	→	••	→
Brunei Darussalam	→	↗	↗	→	••	••	↑	••	↗	••	••	••	→	→	↗	↑	••
Cambodia	↑	↗	↗	↗	↗	••	↗	↑	↗	••	→	••	→	→	↓	↓	→
China	↑	↑	↗	••	↗	••	↗	↑	↑	••	→	••	↓	→	→	↓	••
India	↑	↗	↗	••	→	↗	→	↑	↗	••	→	••	→	↗	→	→	→
Indonesia	↑	↗	↗	→	→	↗	↑	↑	↑	••	→	••	→	→	↓	↗	→
Iran, Islamic Rep.	→	→	↗	↗	→	••	↗	↑	↗	••	↓	••	↓	→	↓	↓	••
Korea, Dem. Rep.	→	↗	↗	••	↗	↗	↗	••	••	••	••	••	↑	→	→	••	••
Lao PDR	↑	↗	↗	↗	↗	↑	••	••	••	••	→	••	→	••	→	••	→
Malaysia	↑	→	↗	↗	↗	••	↑	↑	↑	••	→	••	↓	↗	→	↗	→
Maldives	↑	↗	↗	↗	→	↗	••	••	••	••	••	••	↓	→	••	••	↑
Mongolia	→	→	↗	↗	↑	↗	→	↑	↑	••	→	••	↓	••	↗	↗	••
Myanmar	↑	↗	↗	↗	↗	→	→	••	••	••	••	••	→	→	↓	••	••
Nepal	↑	↗	↗	••	↗	••	↗	↗	↗	••	→	••	→	••	→	→	↗
Pakistan	↑	↗	→	→	→	••	↗	↗	↗	••	↓	••	→	→	↓	→	••
Philippines	↑	↗	→	↗	↑	↗	→	↗	↑	••	→	••	→	↗	↓	↗	••
Singapore	→	→	↗	••	↗	→	→	→	↑	••	↗	••	↓	→	••	→	••
Sri Lanka	↑	↗	↗	↗	→	↑	→	↑	↗	••	→	••	→	↗	↗	↓	↓
Thailand	→	↗	↗	→	↗	↑	↗	↑	↗	••	↗	••	↓	↗	→	→	→
Timor-Leste	↑	↗	↗	↗	↗	↗	••	••	↑	••	••	••	→	••	••	↓	••
Vietnam	↑	↑	↗	••	↗	↑	↗	↑	↑	••	→	••	→	→	↗	↓	↗

The following image (INFORM, 2018) demonstrates part of an international SDRR reporting system, Index for Risk Management, or INFORM. This dashboard identifies country-level risks associated with achieving each SDRR-related target (i.e. Vulnerability and Lack of Coping Capacity). Example 6 illustrates how algorithms can be used to generate initial local data that is compatible with, and can be aggregated into, these types of global and subnational reporting systems.

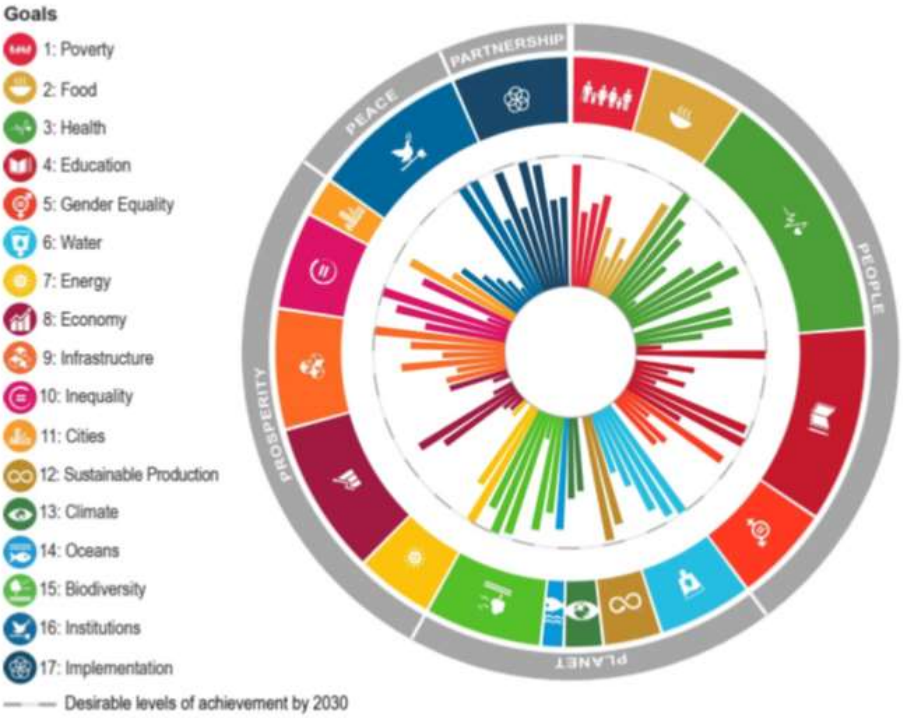


The following image (OECD, 2017) demonstrates an SDG Indicator reporting system used to compare progress in European Union countries. Due to its simplicity, this reference will use this system as a basis for the uniform SDG scores employed in Example 9.

MEASURING DISTANCE TO THE SDGs TARGETS – BELGIUM

Based on the 126 available indicators allowing coverage of 93 of the 169 SDG targets, Belgium has currently achieved 11 of the 2030 targets. The remaining distances to achieve the targets are small in several areas, but challenges remain (Figure 1).

Figure 1. Belgium's current distance from achieving SDGs' 2030 targets



Note: The chart shows how far Belgium has already progressed towards each available target. The longer the bars the shorter the distance is to be travelled by 2030. Targets are clustered by goal, and goals are clustered by the "5Ps" of the 2030 Agenda (outer circle).

These results rely on the best comparative indicators currently available in various OECD and UN databases, in line with the UN global indicator framework. However, a number of important data gaps need to be addressed to enable a more complete assessment. For Belgium, health and education are the only goals with full target coverage while sustainable production, oceans and cities have less than 30% of their targets covered (Figure 2).

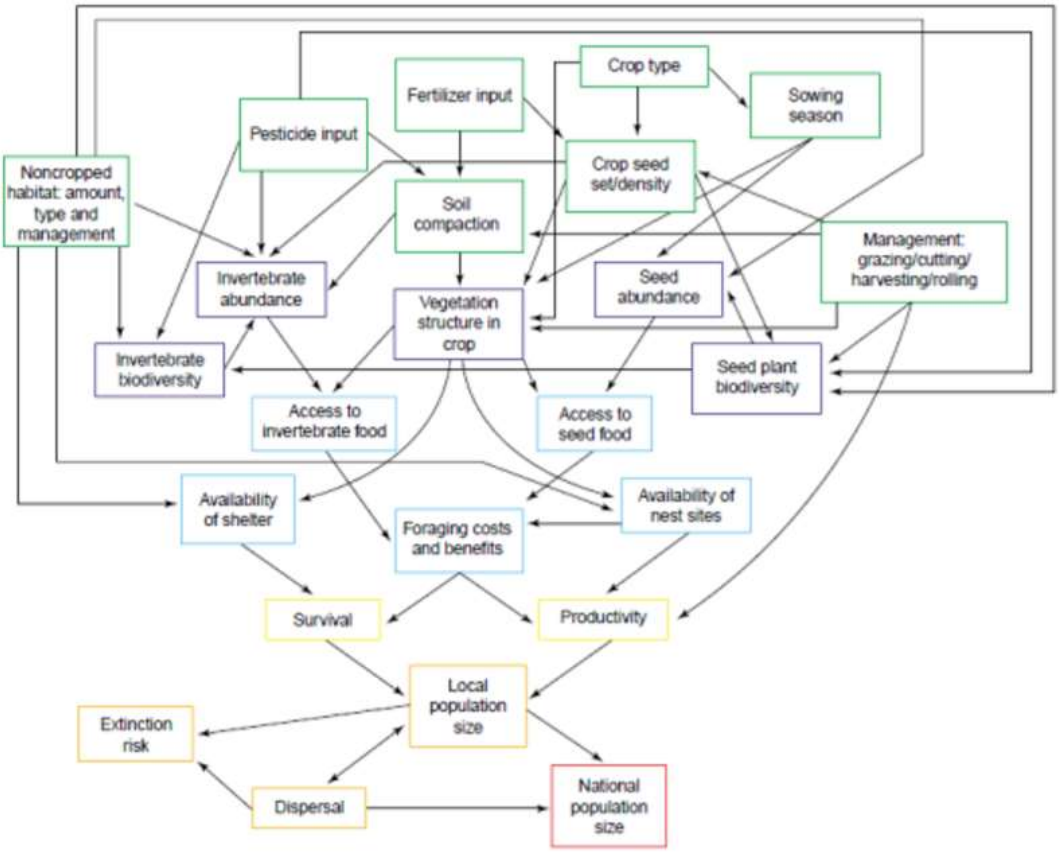
The following image (UNSD, 2017) shows some of the actual Indicators found in the SDG. Most of the Indicators used in the SDG Index, INFORM, and OECD rely on proxy Indicators because global data for the 230+ SDG Indicators is not directly available. The authors of the international reporting systems do not clearly identify how local SDG planning reports can be integrated into the international reports.

Goal 13. Take urgent action to combat climate change and its impacts[2]		
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	C200303
	13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030	C200304
	13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies	C200305
13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	C130201
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula	C130301
	13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions	C130302
13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	13.a.1 Mobilized amount of United States dollars per year between 2020 and 2025 accountable towards the $100 billion commitment	C130a01

Machine Learning and Semantic Web Standards for SDG Planning. The algorithms used in Examples 1 to 8 attempt to use an evidence-first approach for SDG mitigation and adaptation. The behind-the-scenes planning processes that resulted in the selection of SDG targets, impacted stakeholders, and M&A Actions, are not as important as documenting the actual evidence of SDG achievement (i.e. for training machine learning algorithms). Although the algorithms introduced in this reference attempt to increase the transparency of the actual behind-the-scenes planning, most conservation, adaptation, or SDG, planning processes have several flaws that don't necessarily make them better for reaching decisions (**4***).

These flaws derive from the "complex intersecting patterns" introduced in SPA3, the "complex systems" explained by USGCRP (Chapter 17, 2018), and the "eco-agri-food system" approach endorsed by TEEB (2018), and which can be illustrated in the following images (Antonopoulos et al, 2016, TEEB, 2018 and FAO, 2018). That's a major reason why SPA3 introduced Machine Learning algorithms –"black box algorithms" might be invented that can cut through the SDG Planning complexity. The complexity involves dozens of drivers causing risks and impacts for

the 17 SDGs across multiple sectors, hundreds of potential SDG reporting Indicators, hundreds of independent sustainability standards setters using different Indicators and Targets (i.e. EMAS, SASB, GSSB, and B-Lab), poorly understood "impact pathways linkages", dozens of M&A Action feasibility criteria, numerous competing stakeholder value systems with related synergies and tradeoffs, poorly understood location and time dependent interactions, and the reliance on flawed sustainability workers, planning institutions, and decision makers. Short of some Machine Learning magic, these planning approaches and their algorithms must either take shortcuts, or be applied in new Social Sustainability Media Platforms, to deal with the complexities (*5).



Source: Benton et al. (2003)

Figure 1.23. The interacting nature of farming practices and some of the routes by which practices impact on farmland birds

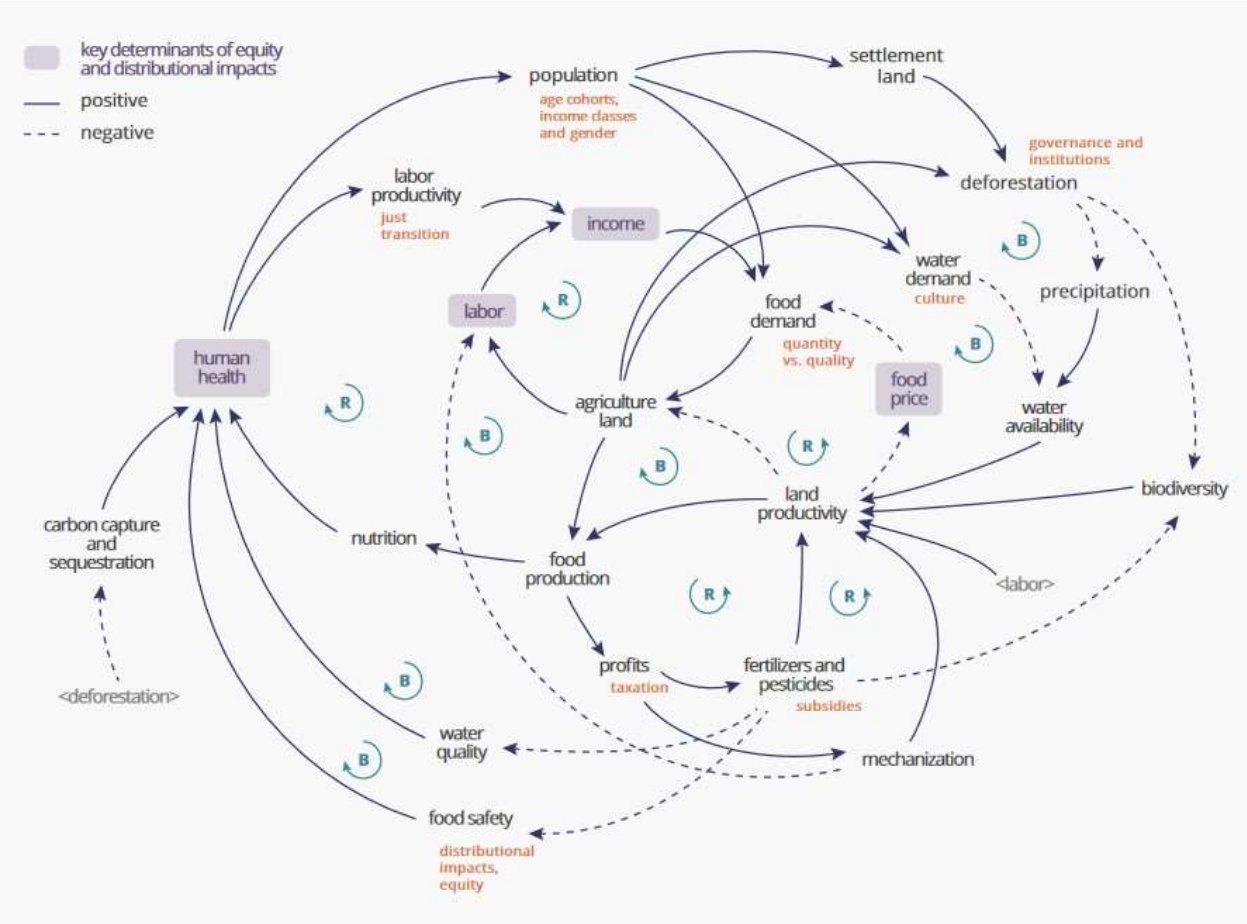
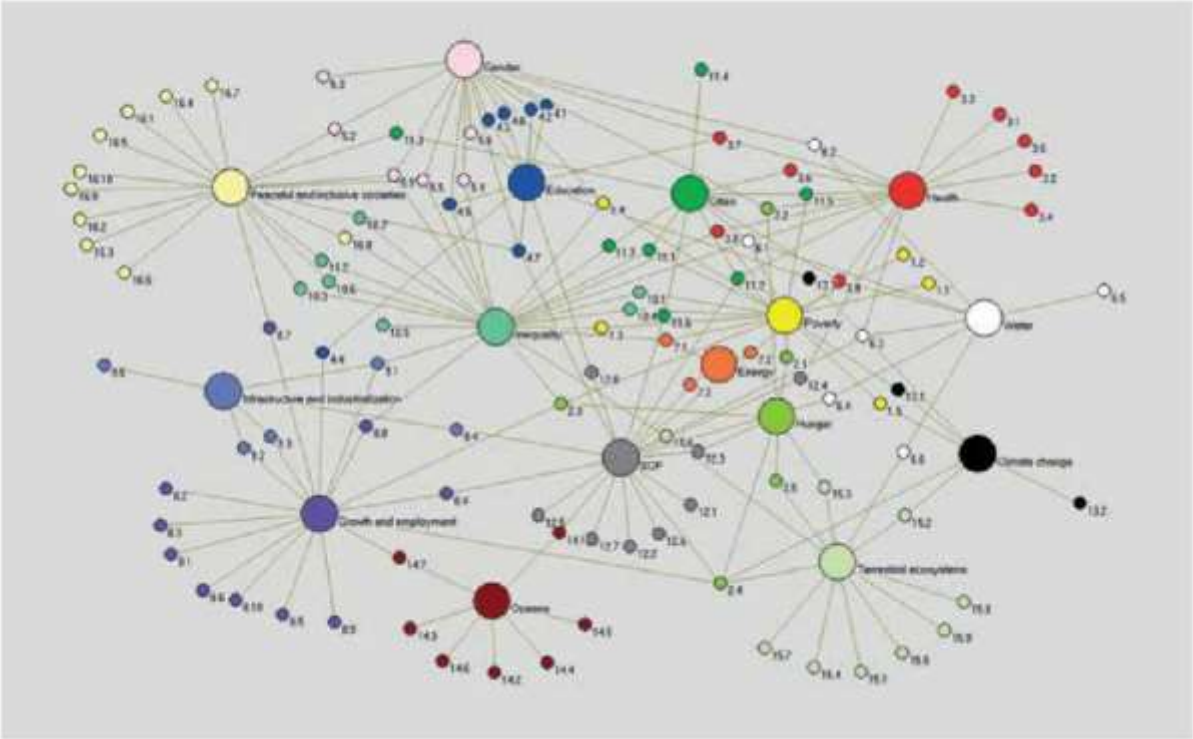
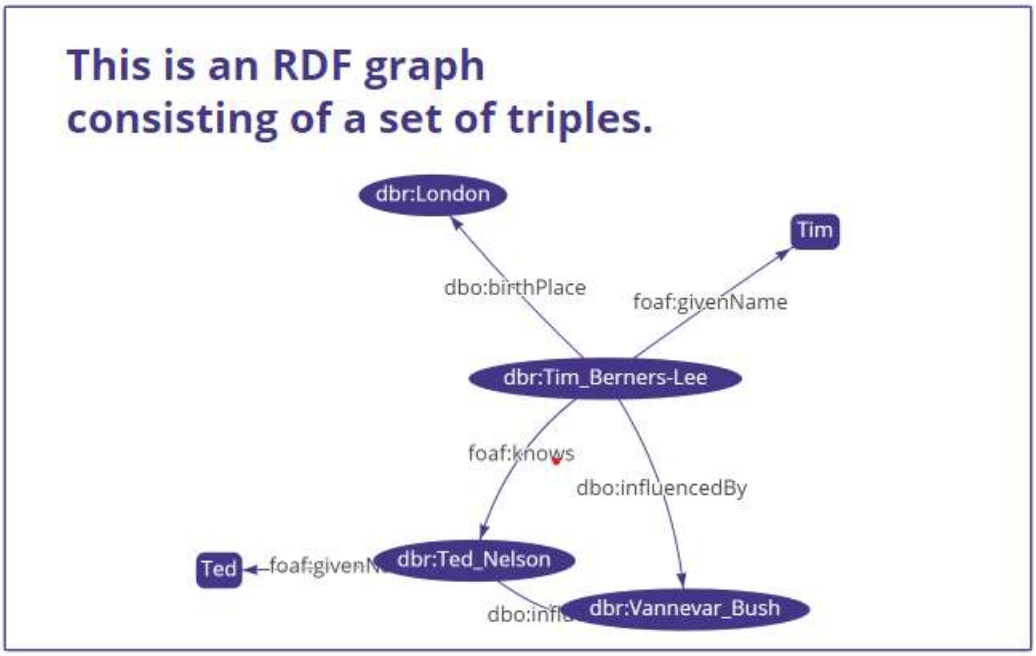

key determinants of equity and distributional impacts
positive
negative
population
age cohorts, income classes and gender
settlement land
governance and institutions
deforestation
labor productivity
just transition
income
water demand
culture
precipitation
labor
food demand
quantity vs. quality
human health
food price
agriculture land
water availability
biodiversity
land productivity
carbon capture and sequestration
nutrition
food production
<labor>
profits
taxation
fertilizers and pesticides
subsidies
<deforestation>
water quality
mechanization
food safety
distributional impacts, equity
R
B

Figure 17: Complexity: the multiple interactions of the sdgs - Source: David Leblanc (2015) "*Towards integration at last? The SDGs as a Network of targets*", DESA Working Paper No. 141



In terms of applied technology, the following image (from the Verborgh background reference in Berners-Lee, 2019), shows that, besides Machine Learning, standard Internet technologies, such as semantic web technologies, can also be used to make SDG linkages. These are among the technological possibilities employed by the new Social Sustainability Media Platforms. A future version will include a new reference**,** Machine Learning and Semantic Web Standards for SDG Planning.



C. Introduction to SDG Plans for Local Communities, Products, and Businesses

Sections A and B introduced decision planning processes that address some of the deficiencies in Examples 1 to 8. This section explains how more formal decision support planning processes, resulting in SDG Plan implementation, can partially address these shortfalls. The RCA Framework is applied using the local SDG Plans introduced in this section (i.e. watershed plans, ecosystem plans, integrated assessment plans, conservation plans, adaptation plans, and business value plans).

Local SDG Decision Support Planning. The following list summarizes parts of a planning process needed for more comprehensive SDG Plan development and implementation. This reference investigates how algorithms can improve this overall planning process.

- **Planning Part 1. Pathways, Stocks and Flows, Scenarios and Transition State Development.** Identifies the shared socioeconomic pathways, scenarios, stock and flows, and transition states, which provide an overall context for SDG Planning.

- **Planning Part 2. Stakeholder System Boundary and Stakeholder Engagement**. Identifies the boundaries for a company's or community's supply chain. Identifies and engages impacted stakeholder groups.
- **Planning Part 3. Risk and Impact Identification**. Identifies targeted and prioritized SDG Risks and Impacts.
- **Planning Part 4. M&A Action Feasibility Assessment**. Assesses the feasibility of targeted M&A Actions to resolve the SDG Risks and Impacts.
- **Planning Part 5. Synergies, Tradeoffs, and Stakeholder Equity**. Identifies synergies, tradeoffs, and the consequences of M&A Actions and SDG impacts on equity.
- **Planning Part 6. SDG Plan Selection**: Submits SDG alternative portfolios to decision makers for final SDG Plan selection.
- **Planning Part 7. Social Sustainability Media Platforms for Monitoring and Evaluation and Adaptive Management of SDG Plans**. Monitors and evaluates the SDG Plan and adjusts the portfolio as needed to achieve the SDG targets. Replaces existing social media platforms with new social sustainability media platforms for this purpose.
- **Planning Part 8. SDG Plan Reporting and Communicating**. Reports progress in SDG target accomplishment to impacted stakeholders, including next generation sustainability workers, in transparent ways. Ensures that consumers can make sustainable consumption choices and producers can take sustainable production actions.

Local SDG Plans (Nexus Planning). Sustainability workers apply the RCA Framework at local scale by developing SDG Plans. SDG Plans are similar to the watershed plans, ecosystem plans, conservation plans, economic development plans, adaptation plans, and business plans, already being completed by many local planning and business groups. The primary difference is their transparent support for the SDG, especially the "missing" socioeconomic SDGs. IPCC (2018) use the term "nexus [plans]" for these types of planning approaches because they address targeted SDG priorities, rather than trying to address all 17 SDGs in one plan. Although a full plan for addressing all 17 SDGs is needed at "subnational" scale (i.e. similar to the national plans used in the global reporting systems), many local planning efforts will focus on subsets, or "a

nexus", of prioritized SDG risks (i.e. see Example 1 in SPA1). IPCC (2018) describe nexus planning approaches as "a sub-set of sustainable development dimensions [that] are investigated together because of their close relationships".

The following list highlights the specific planning concepts that this reference's algorithms must prioritize to support local SDG Plans.

- **Social Sustainability Media Platforms for Overall SDG Planning and Decision Support (SDG Plans)**. The algorithms increases the transparency of the behind-the-scenes planning processes by replacing existing social media platforms with new sustainability accounting platforms. The new platforms replace the advertising focus of existing social media outlets with a new focus on sustainability, or quality of life, accounting.
- **Socioeconomic Pathways, Alternative Scenarios, and Transition States.** The algorithms employ the impact pathways that underlay the RCA Framework. The pathways employ alternative scenarios and impact transition states to understand the cause and effect attribution needed to take actions that can prove impact for stakeholder groups.
- **Stakeholder Impact Assessments and Equity.** SIAs address more comprehensive, generic, socioeconomic characteristics related to "disaggregated reporting" for geography, income, sex, age, race, and disability for specific locations (i.e. rather than SPA3's income-related stakeholder groups). SIAs help planners to understand equity better for multiple, vulnerable, stakeholder groups.
- **SDG Operating Budgets (Flows) and Capital Budgets (Stocks) for Sustainability Scoring.** DevTreks focus on social budgeting carries over to most tutorials, including this one. For consistency and simplicity, this tutorial uses the concepts of operating and capital budgeting to explain SDG planning. Capital budgets measure sustainability as long term changes to the 7 capital stocks, or quality of life inventories, for specific, impacted stakeholders. Operating budgets measure short term changes, or flows, in the capital stocks arising from new or adjusted M&A Actions. The changes to the capital stocks get measured in terms of value added impacts (i.e. often measured using QALYs,

DALYs, and QASY-like metrics). The 7 capital stocks are measured using the SDGs goals, targets, and indicators. Later sections of this reference will show that actual SDG Plans don't require the formal operating and capital budgets demonstrated in other tutorials, as long as they can clearly monitor and evaluate stock inventory and flow relationships, or proxies for those measurements. New sustainability accounting networks and clubs, located on new social sustainability media platforms, may be able to automatically aggregate platform data for this purpose.

- **Interactions among M&A Actions – SDG – Stakeholder Equity for Better Cause and Effect Attribution**. The algorithms address, however imperfectly, the linkages and interactions that explain how actions accomplish targets for impacted stakeholders. For example, Example 9 and 10 demonstrate using simple percentage allocations for the linkages. Example 12 demonstrates using Sustainability Accounting Platforms for making the linkages. A future release will likely introduce machine learning algorithms for this purpose.
- **Local Landscape and Industry SDG Reports**. These algorithms support the SDG reports that help producers to make better production choices, consumers to make better consumption choices, and local citizens to hold their local community officials more accountable for advancing their quality of life. These reports help to directly address an important causal driver behind the SDG -institutional failure associated with special interest groups (**3***).

Antonopoulos et al (2016) use the following tables to explain how specific industries, such as the agricultural sector, use industry-specific plans, such as Integrated Farm Management Plans, as precursors to SDG Plans. They also explain how SPA2's certification standards setters, such as GLOBALGAP, enforce compliance by individual firms with international sustainability standards. Most of these existing standards were set prior to the SDG.

Integrated Farm Management (IFM) is a whole farm policy. You must therefore have appropriate assurance for each enterprise on your holding. For example, if you have potatoes and cereals, you must be a member of the appropriate schemes for both enterprises, such as GLOBALGAP (Cereals) or GLOBALGAP (FV) or other schemes that are benchmarked as equivalent to GLOBALGAP e.g. Red Tractor Farm Assurance - Produce Scheme.
You must have a farm environmental policy that is communicated to all staff. It must be documented and form the basis for the farm's objectives and targets. The policy must: • contain reference to IFM, • meet all regulatory and legislative requirements, • include references to: 1. Effective resource management through reducing and reusing waste; reducing raw material consumption; 2. Eliminating or minimising appropriate polluting releases to the environment i.e. air, water, soil, including 'greenhouse gases' (GHG) mitigation (e.g. ruminant diets); 3. Optimising energy and water efficiency; 4. Minimising adverse environmental effects.
You must develop from your Environmental Policy a documented plan that sets out your short-term and long-term (1 to 5 years) environmental objectives. The plan must include aspects such as energy, water, pollution, 'greenhouse gas' (GHG) mitigation practices and other aspects of the business that impact on the environment. It must also include non-food enterprises that impact on the business. The LEAF Audit 'targets for action' and 'performance profile' can form the basis for this plan. It must also be integrated with the Whole Farm Conservation Plan.
You must set targets, with a timescale, to improve and enhance the environment. This must include a link to your Whole Farm Conservation Plan, but must also include targets on water, soil, air,

'greenhouse gases' (GHG) and energy use. The targets must be measurable and linked to monitoring when appropriate.
You must review your environmental policy and plan to ensure that it is relevant and being implemented. This must be every year and a record must be kept of this review. Following the review any amendments must be made and highlighted.
You must ensure that staff have received and understood the Environmental Policy and plan and asked them to sign / mark to this effect. The policy must be displayed for everyone to read and where staff induction training takes place, be part of it.
You must communicate the environmental policy to key suppliers and contractors who are directly involved in the farming business, especially where they have an impact on the business's environmental performance. They must be made aware of its content and their responsibility to help achieve its aims and objectives.
When purchasing new equipment or establishing new buildings you should look for the best available and appropriate technology. This should include water and energy efficient products/designs; you should justify your decision based on economic and environmental criteria, without forgetting animal welfare issues. A written policy to show your commitment to reduction of energy through proper purchase decisions should be present and can be part of your environmental policy.
Farm staff that has a critical impact on your business (including contractors) must be made aware of your commitment to IFM. There are many comprehensive benefits that result from staff training e.g. increased job satisfaction and motivation. This must be done on a regular basis and at least annually. Regular team meetings can be useful to discuss with relevant members of staff IFM principles and practices employed on farm and identify with them opportunities for improvement and an increased awareness of IFM.
Source: LEAF (2012).

D. Introduction to SDG Reporting for Local Communities, Products, and Organizations (9*)

When actual M&A Actions are taken and the SDG targets start being achieved, local SDG and SDRR achievements must then be aggregated into national data systems that can then support global reporting systems. These types of national and global reporting systems must be understood before any local decision support algorithms can be developed because the data from the local systems serve the same purpose as the national systems, but at local scale. The local reports, similar to the global reports introduced in Section B, need to be at least compatible, and preferably, aggregated, into these national and international reporting systems.

Rating Systems, **Indicator Thresholds, and Scores**. The following table roughly describe the techniques employed by the SDG Index and INFORM global reporting systems introduced in

Section B. OECD (2017) uses much simpler techniques, such as modified z scores for normalized scoring, and will be the basis for one of the SDG scores used by this reference's algorithms.

Rating Technique	**SDG Index** (LaFortune et al, 2018)	**INFORM** (Marin-Ferrer et al, 2017)
Index Score	Censor indicator ratings below 2.5%; rescale using normalization; aggregate indicators for each SDG	Rescale using normalization; clustering
Normalization	0 to 100 point scale; min-max	0 to 10 point scale; min-max; inversion of wrong way indicators
Weights	Equal for Indicator and Score	Varies by component
Score Aggregation	Arithmetic mean	Arithmetic or geometric mean of Indicators and Components; Hazard&Exposure * Vulnerability * Lack of coping capacity
Country Relationships	Absolute and not relative to other countries	Relative to other countries
SDG Target	Absolute quantitative	No direct targets; but an Appendix demonstrates indirect SDG targets
Dashboard Ratings and Indicator Thresholds	3 point scale with 3 thresholds; average 2 worst Indicators for each SDG Target	10 point scale with 4 thresholds;

Dashboard Trends	4 point scale; average of Indicators in SDG Target; linear projection to final SDG target	10 point scale; 4 risk based clusters based on relation to other countries

National and International SDG Report Harmonization. The following table demonstrates the difficulty in harmonizing international reports and their underlying sustainability accounting systems, with actual SDG and SDRR Indicators. Many of these reports, especially at national and global scale, must rely on proxy indicators as shown in the last 2 columns (the U.N.'s SDG database site shows more comprehensive proxy Indicators).

SDG Goal	SDG Indicator	SDG Index	INFORM
1. No Poverty	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)	Poverty headcount ratio at $1.90/day (% population)	Multidimensional Poverty Index
	1.2.1 Proportion of population living below the national poverty line, by sex and age	Poverty rate after taxes and transfers, Poverty line 50% (% population)	Human Development Index
2. No Hunger	2.1.1 Prevalence of undernourishment	Prevalence of obesity, BMI ≥ 30 (% adult population)	5 yr olds who are underweight

	2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)	Cereal yield (t/ha)	Domestic food price level index

Community and Business Local SDG Report Harmonization. Local community and business sustainability accounting systems use Indicator systems, similar to the following 2 images, to harmonize domain-specific Sustainability Targets with implicit SDG Targets (FAO SAFA, 2014 and GRI, 2011). These implicit relationships can be made more transparent by either documenting the previous image's type of relationship, or replacing the local Targets and Indicators with the SDG Targets and Indicators.

Sustainability Dimension E: ENVIRONMENTAL INTEGRITY		
Themes	Sub-Themes	Default Indicators
E1 Atmosphere	E 1.1 Greenhouse Gases	E 1.1.1 GHG Reduction Target
		E 1.1.2 GHG Mitigation Practices
		E 1.1.3 GHG Balance
	E 1.2 Air Quality	E 1.2.1 Air Pollution Reduction Target
		E 1.2.2 Air Pollution Prevention Practices
		E 1.2.3 Ambient Concentration of Air Pollutants
E2 Water	E 2.1 Water Withdrawal	E 2.1.1 Water Conservation Target
		E 2.1.2 Water Conservation Practices
		E 2.1.3 Ground and Surface Water Withdrawals
	E. 2.2 Water Quality	E 2.2.1 Clean Water Target
		E 2.2.2 Water Pollution Prevention Practices
		E 2.2.3 Concentration of Water Pollutants
		E 2.2.4 Wastewater Quality
E3 Land	E 3.1 Soil Quality	E 3.1.1 Soil Improvement Practices
		E 3.1.2 Soil Physical Structure
		E 3.1.3 Soil Chemical Quality
		E 3.1.4 Soil Biological Quality
		E 3.1.5 Soil Organic Matter
	E 3.2 Land Degradation	E 3.2.1 Land Conservation and Rehabilitation Plan
		E 3.2.2 Land Conservation and Rehabilitation Practices
		E 3.2.3 Net Loss/Gain of Productive Land

Environment

Performance Indicators

Aspect: Materials

- CORE **EN1** Materials used by weight or volume.
- CORE **EN2** Percentage of materials used that are recycled input materials.

Aspect: Energy

- CORE **EN3** Direct energy consumption by primary energy source.
- CORE **EN4** Indirect energy consumption by primary source.
- ADD **EN5** Energy saved due to conservation and efficiency improvements.
- ADD **EN6** Initiatives to provide energy-efficient or renewable energy-based products and services, and reductions in energy requirements as a result of these initiatives.
- ADD **EN7** Initiatives to reduce indirect energy consumption and reductions achieved.

Aspect: Water

- CORE **EN8** Total water withdrawal by source.
- ADD **EN9** Water sources significantly affected by withdrawal of water.
- ADD **EN10** Percentage and total volume of water recycled and reused.

Aspect: Biodiversity

- CORE **EN11** Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas.
- CORE **EN12** Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.
- ADD **EN13** Habitats protected or restored.
- ADD **EN14** Strategies, current actions, and future plans for managing impacts on biodiversity.
- ADD **EN15** Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk.

Aspect: Emissions, Effluents, and Waste

- CORE **EN16** Total direct and indirect greenhouse gas emissions by weight.
- CORE **EN17** Other relevant indirect greenhouse gas emissions by weight.
- ADD **EN18** Initiatives to reduce greenhouse gas emissions and reductions achieved.
- CORE **EN19** Emissions of ozone-depleting substances by weight.

Local sustainability workers use the same international reporting techniques introduced in Section B. A key part of those techniques involves the use of existing, locally available, proxy indicators for the SDG Indicators. Local proxy indicators recognize that many of the

international SDG proxy indicators, such as using a $1.90 per day target to define poverty status, must reflect local socioeconomic and ecosystem realities (i.e. earning a minimum wage of $15/hour in the USA).

The following table illustrates the use of local, proxy indicators. Given the hundreds of existing sustainability accounting systems employed by companies and communities, another key technique involves harmonizing those systems for use in uniform landscape and industry reports. Many of these accounting systems developed their targets and Indicators prior to the SDG and many not be able to "upgrade" to direct SDG Indicators. This reference assumes, cautiously, that local communities, industries, and standards setters (SAFA, GRI), recognize this and are starting to employ similar techniques for data harmonization (**8***).

SDG Indicator: 13. Climate Change. 13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development ...		
Local Proxy Indicator	**FAO SAFA**	**GRI**
Percent local energy supply produced by renewable sources Percent local energy supply consumed from renewable sources	E.1.1.1. GHG Reduction Target E.1.1.2 GHG Mitigation Practices	EN3. Direct Energy Consumption by primary energy source EN5. Initiative to provide energy-efficient or renewable base products and services …

For example, the following image (Ruckstuhl et al, 2018) introduces part of an SDG Mapping Worksheet Template that 3 pilot USA cities employed to map local proxy indicators to SDG indicators. The authors provide additional recommendations that communities can follow for harmonizing local indicators with SDG indicators. OECD (2017) explains that proxy indicators are simply not available for many SDG targets in many EU countries, and Greene et al (2017)

makes the same point for USA cities and metropolitan areas. Both authors recommend that local communities invest in more comprehensive data accounting systems. The SAFA references make the same points about company and industry accounting systems. They recommend greater investments in business accounting systems that focus on sustainability accounting and reporting. National data coordination can help ensure that efforts to collect better data avoids the proliferation of hundreds of independent rating systems that don't permit the comparisons and aggregations of communities, products, organizations, and households at national levels. Appendix C introduces Social Sustainability Media Platforms as a modern mechanism for collecting uniform sustainability data.

ALIGNMENT						
SDGs#	SDG Target	Indicators	Target(s) from City Strategy (quantified, if possible)	Target source document	Institution responsible for target	MEA
Goal 1. End poverty in all its forms everywhere	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)				
	1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age				
		1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions				
	1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable				

MEASUREMENT							
Measurement Indicator	Data Source	Institution responsible for target	Baseline Indicator	Baseline Year	Level of Disaggregation	Reporting Frequency	Public/Private

The following image (FAO SAFA, 2014) explains why care must be taken when using local proxy Indicators. The 2nd column's FAO SAFA "Performance" Indicators, from the first image above, directly measure SDG targets, while the 1st column's "Target" Indicators indirectly measure target accomplishment, and the 3rd column's "Target" Indicator (EN5) and implied "Practice" Indicator (EN3) also are indirect measurements. The "sub-theme objective" in this statement is equivalent to SDG targets. The "best management practices" recommendation in the last sentence have been commonly employed in the agricultural sector (see the Antonopoulos et al, 2016, images displayed throughout this reference).

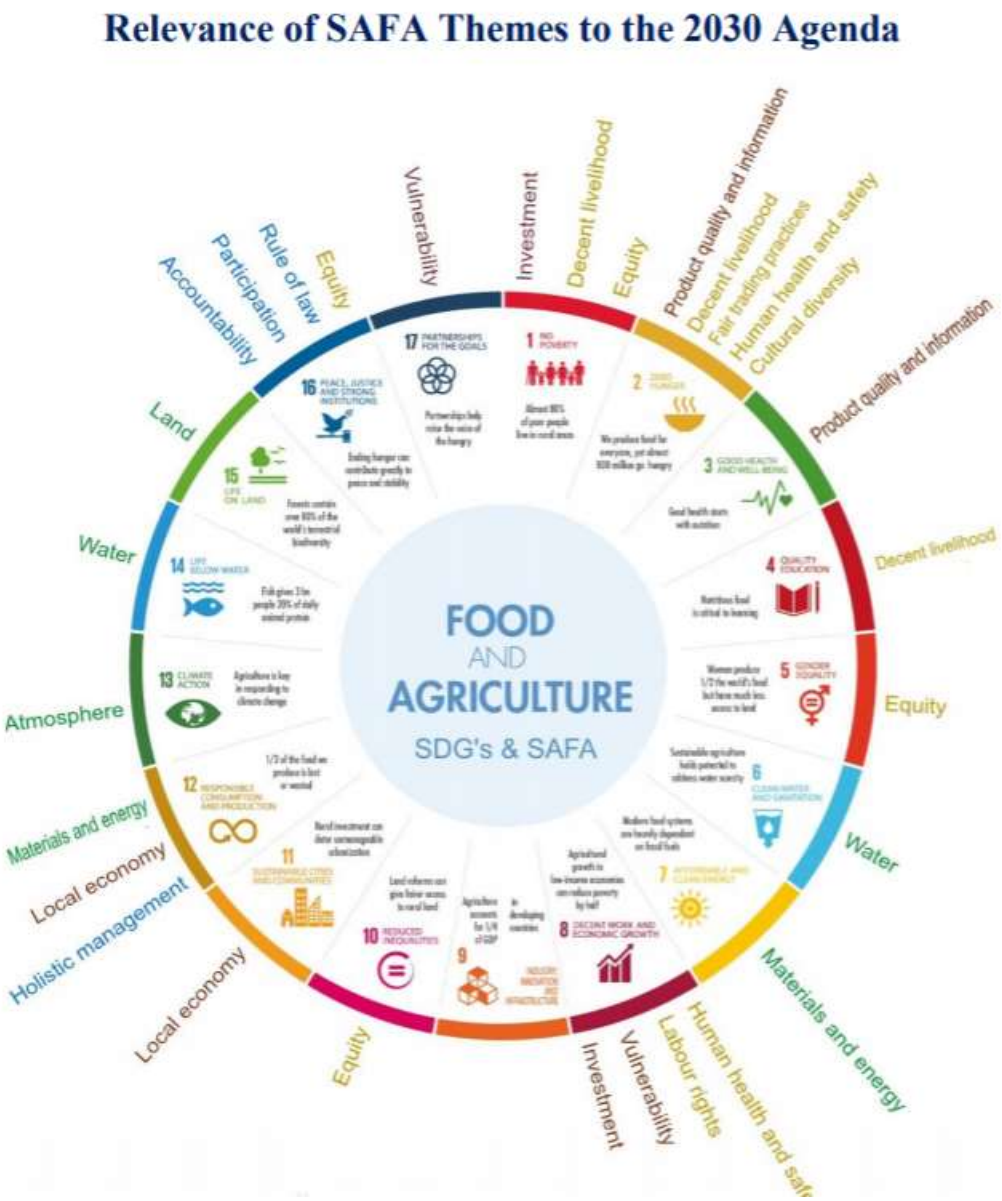
Types of indicators

All indicators are not created equally and provide different evidence depending on the type.

- **Performance-based indicators, also called results-oriented or outcome indicators.** Performance based indicators are focused on the results of compliance with an objective and can measure the performance of an operation, identify trends and communicate results.
- **Practice-based indicators, also called prescriptive or process indicators.** These indicators prescribe that the necessary tools and systems be in place to ensure best practices. These indicators are process, rather than outcome-oriented. For example, these indicators assume that having health and safety management systems in place leads to better management of health and safety issues. The cause-effect between a given practice and a result is however never precise. In fact, there is no science agreement on most important topics, such as the cause-effect of management practices on greenhouse gases and climate change. Thus, one can assume that a practice may yield a desired result but with a substantial margin error.
- **Target-based indicators.** These indicators focus on whether the operation has plans, policies or monitoring, with targets and ratings based on steps towards implementing them.

SAFA default indicators strive to be measurable, verifiable performance-based metrics. These indicators focus on outcomes or results of the entity; do not prescribe certain practices, as what matters is effective delivery of sustainability. In fact, **it is reaching the sub-theme objective that matters**, while a multitude of means is permitted to achieve that objective, including innovations. However, there are sometimes scientific and economic limitations (particularly for small-scale producers) inherent in some types or contexts of performance measurements. In these instances, SAFA proposes default indicators that are practice-based that have been correlated to performance outcomes (best management practices), which are particularly more appropriate for small-scale producers.

As an example of sustainability standards-SDG data harmonization, the following image demonstrates how the FAO, SAFA (2017) standards can be harmonized with the SDG.



The following table illustrates how the proxy indicators are aggregated into local SDG reports that help businesses to take sustainable production actions and consumers to make sustainable consumption choices (see UNEP, 2015). Similar community reports substitute local communities for the companies (i.e. Community 1 … Community 10). Although this report demonstrates the

use of the full 17 SDGs, local nexus reports, applicable to specific communities and industries, may also be appropriate (i.e. see SPA2's COSA and Sustainable Food Lab's smallholder, and WHO's health care, reporting systems). The potential competition, or shared technologies, among companies and communities spurred by these types of uniform reports may be the most important outcome of this reference.

SDG Report - Food Industry in Landscape 1									
SDG Goals	**Overall Score**	**No Poverty**	**Zero Hunger**	**Good Health and Well Being**	**Quality Education**	**Gender Equality**	**…**	**Peace. Justice, and Strong Institutions**	**Partnerships for the Goals**
Goal Number	**10 point Index**	**1**	**2**	**3**	**4**	**5**	**6 to 15**	**16**	**17**
Food Producers									
Company 1	x	x	x	x	x	x		x	x
Company 2	x	x	x	x	x	x		x	x
Company 3	x	x	x	x	x	x		x	x
Company 4	x	x	x	x	x	x		x	x
Company 5	x	x	x	x	x	x		x	x
Company 6	x	x	x	x	x	x		x	x
Company 7	x	x	x	x	x	x		x	x
Company 8	x	x	x	x	x	x		x	x
Company 9	x	x	x	x	x	x		x	x
Company 10	x	x	x	x	x	x		x	x
Food Suppliers									
Company 1	x	x	x	x	x	x		x	x
Company 2	x	x	x	x	x	x		x	x
Company 3	x	x	x	x	x	x		x	x
Company 4	x	x	x	x	x	x		x	x
Company 5	x	x	x	x	x	x		x	x
Company 6	x	x	x	x	x	x		x	x
Company 7	x	x	x	x	x	x		x	x
Company 8	x	x	x	x	x	x		x	x
Company 9	x	x	x	x	x	x		x	x
Company 10	x	x	x	x	x	x		x	x
Food Vendors									
Company 1	x	x	x	x	x	x		x	x
Company 2	x	x	x	x	x	x		x	x
Company 3	x	x	x	x	x	x		x	x
Company 4	x	x	x	x	x	x		x	x
Company 5	x	x	x	x	x	x		x	x
Company 6	x	x	x	x	x	x		x	x
Company 7	x	x	x	x	x	x		x	x
Company 8	x	x	x	x	x	x		x	x
Company 9	x	x	x	x	x	x		x	x
Company 10	x	x	x	x	x	x		x	x
Industry	x	x	x	x	x	x		x	x

Local companies and communities hire sustainability workers to develop, or verify, their SDG Plans and to submit voluntary SDG reports to the landscape, or watershed, reporting systems (i.e. the EC (2017 and 2018) provides examples of the rules that 3rd party "advanced verifiers" must follow for these purposes). They voluntarily cooperate because:

- Enhanced sustainability reporting has allowed existing companies to achieve higher returns, increase employee satisfaction, and burnish their reputations with investors and consumers (Shinwell et al., 2018).

- Their local employees, consumers, producers, supply chain participants, investors, and communities, demand they do so. For example, UNEP (2015) finds that "the literature on [SDG] policy tools does not provide much evidence of voluntary agreements [, such as voluntary sustainability rating reports,] being particularly effective. In addition, there are concerns that such agreements can give undue benefits to large market-leading companies by promoting their business models and technologies." Local planning efforts must address "ineffective voluntary conservation and sustainability plans", or easily manipulated sustainability reporting, through the use of strong, objective, 3rd party, "verifiers" who are backed with strong certification requirements that follow transparent, internationally recognized, standards.

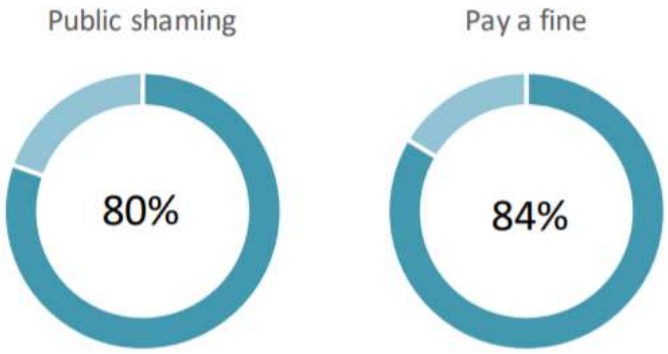
- If they don't, other local sustainability workers may do it for them.

The increasing awareness about how climate change, alone, can lead to catastrophic local consequences (i.e. see Example 6, review any of the climate change References below, or watch fact-based national news) may lead many communities to offer incentives to complete these instruments. These reports can be used flexibly –their most practical initial use may be to identify clear transgressors and spur SDG-related competition among naturally competitive companies and communities (i.e. business to business purposes), rather than to focus exclusively on comparative shopping (i.e. business to consumer purposes) (**10***).

The reports must be used cautiously because the financial consequences on the ongoing transgressors may be severe. Lupiáñez-Villanueva et al (2018) use the following image to

confirm that >80% of European consumers agree that “transgressors” should be punished (i.e. base bias aside).

Figure 60 Study on Certification and Trust - If it is found that a company has intentionally misinformed the public about the environmental performance of a product, which of the following would be most appropriate?

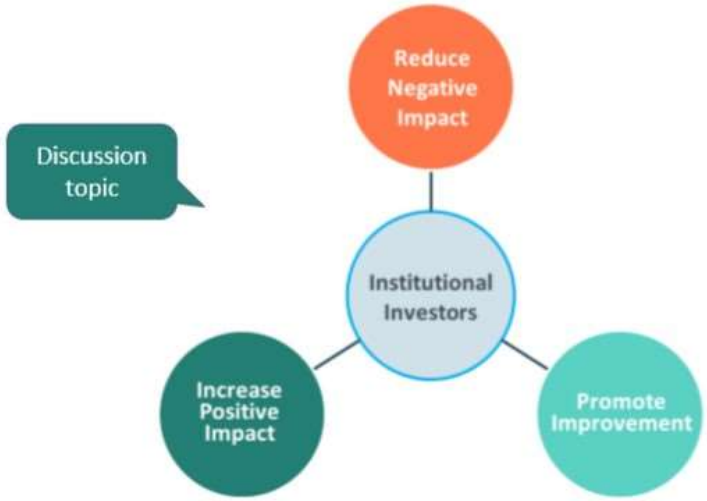


Source: Q8 (n=6,000)

The following image (Eastman et al, 2018) confirms that investors are actively seeking to invest in sustainable companies, and divest from unsustainable companies, and are coming up with innovations that will make these investment decisions easier (i.e. more codified use of Example 12’s sustainability accounting ESG factors).

We believe that a holistic framework for institutional investors to address the SDGs should be rooted in the goal of achieving a gradual large scale shift in capital allocation, the understanding that companies may contribute to the goals in a variety of ways, and the view that any approach to institutional investment needs to include an understanding of the financial implications. In developing a framework to meet these needs, we have identified three components that we view as essential:

Exhibit 1: A Framework for Addressing SDG Challenges in Institutional Investors' Portfolios



1. Reduce Negative Impacts by ***shifting capital away*** from business activities, strategy and operational involvement not aligned with achieving the SDGs

2. Increase Positive Impacts by ***shifting capital towards*** companies that provide products & services that serve needs defined by the SDGs

3. Promote Improvement by ***shifting capital toward*** companies that improve operations, develop long term & forward-looking strategy, and report on progress

Source: MSCI ESG Research

1. **Reduce Negative Impacts:** Shift capital *away* from business activities not compatible with achieving the SDGs

   Examples:

   - Thermal coal (Goal 7: "Reducing the carbon intensity of energy is a key objective")

Rules must be carefully defined that specify the exact meaning of "ongoing transgressor" (i.e. the uniform ratings used by the international reporting systems identify "ongoing laggards" instead). Some type of "reporting czar" may be needed to ensure that unintended side effects don't occur, such as efforts by particular companies and communities to game the reporting system (i.e. as has happened with similar international reports for "ease of conducting business" indexes). IPBES (2019), IPCC (2018), USGCRP (2018), and UNEP (2018, 2019), clearly document how the societal consequences of climate change and biodiversity loss, and the necessity of using comprehensive societal improvement approaches, specifically SDG, justifies the severity. In fact,

the consequences of many SDG violations, such as to human rights, actually justify much more severe penalties.

E. SDG Plans for Communities, Products, Organizations, and General Sustainability Assessment

This section introduces 4 examples that employ new algorithms to illustrate the datasets, rating systems, and reports (i.e. scorecards) used to build and implement an SDG Plan. **Appendix B**. Introduction to SDG Plan Prerequisites, introduces a "why and how to" approach for completing the SDG Plans.

Example 9 demonstrates SDG Plans completed by sustainability workers for communities at landscape or watershed scale. Example 10 illustrates how SDG Plans can be modified to address complimentary purposes, specifically to manage the risks associated with climate change-induced, or human-driven, disasters. Example 11 shows how to use these plans as community-wide guidance and policy support plans that sustainability workers use to develop SDG plans for specific products and businesses within Example 9 and 10's landscapes. Example 12 explains how to use new digital platforms to incorporate the RCA Framework more transparently in these SDG Plans.

Example 9. Applied Local SDG Plans for Communities (and Nations). Scores communities using the basic social budgeting techniques demonstrated throughout the SPA tutorials. Sustainability workers employ an abbreviated version of the planning techniques introduced in this tutorial (i.e. impact pathways, transition states, socioeconomic scenarios, stock and flow measurements derived from PEFs, OEFs, SLCAs, and SIAs) to establish a scientific foundation for community wide SDG policies. These SDG Plans, along with Plans completed at national and subnational scale, establish the proxy measurements, or correlations, between M&A Action-SDG Impact-Stakeholder Group, that sustainability workers use to complete Example 11's product and organization SDG Plans.

Example 10. Applied Local SDG Plans for Disaster Prevention. Scores communities or companies for their capacity to manage disasters. Uses the same algorithm and techniques as

Example 9 but substitutes more comprehensive disaster risk reduction Indicators, such as the INFORM rating system introduced in Section B, for SDG Indicators.

Example 11. Applied Local SDG Plans for Organizations and Products. Scores organizations and their products using BMP-based proxy evidence derived from community and national SDG Plans. The scores use techniques similar to the food safety ratings currently used by many communities to rate restaurants. This reference implies that, for many communities, food safety will be one priority out of many, if unsustainable organizations and unsustainable products cause the overall quality of life to decline for local residents due to worsening community capital stock conditions (i.e. worsening poverty, unsafe water and sanitation, unaffordable health care; excessive damages from disasters, worsening gender inequality, unfulfilling jobs, food shortages; unavoidable deaths from worsening air pollution).

Example 12. Applied Sustainability Accounting Platforms –Household Networks, Clubs, and Members. Scores household quality of life using more comprehensive impact pathways, stocks and flows, and impact or integrated valuations. Supports a variety of sustainability assessments, including those related to communities, organizations, products, households, industries, policies, and general resource accounting systems. Uses community sustainability offices, sustainability accounting networks and clubs, new social sustainability media platforms, and 3rd party sustainability workers, for SDG Planning.

Although these 4 examples cover a lot of ground for sustainability planning and reporting, the 3 principle climate change references (IPCC, 2018; USGCRP, 2018; UNEP, 2018, 2019), and the main biodiversity and ecosystem services reference (IPBES, 2019), make it clear that sustainability reporting is needed for literally any activity or expenditure related to the SDG, particularly, global heating and biodiversity loss. Sustainability assessments are needed for each lifestyle, each field, each woodlot, each investment, each infrastructure, each building, each sports event, each trip, each vehicle, each policy, each meal, each public agent, each executive, and every other interaction that people have with our planet.

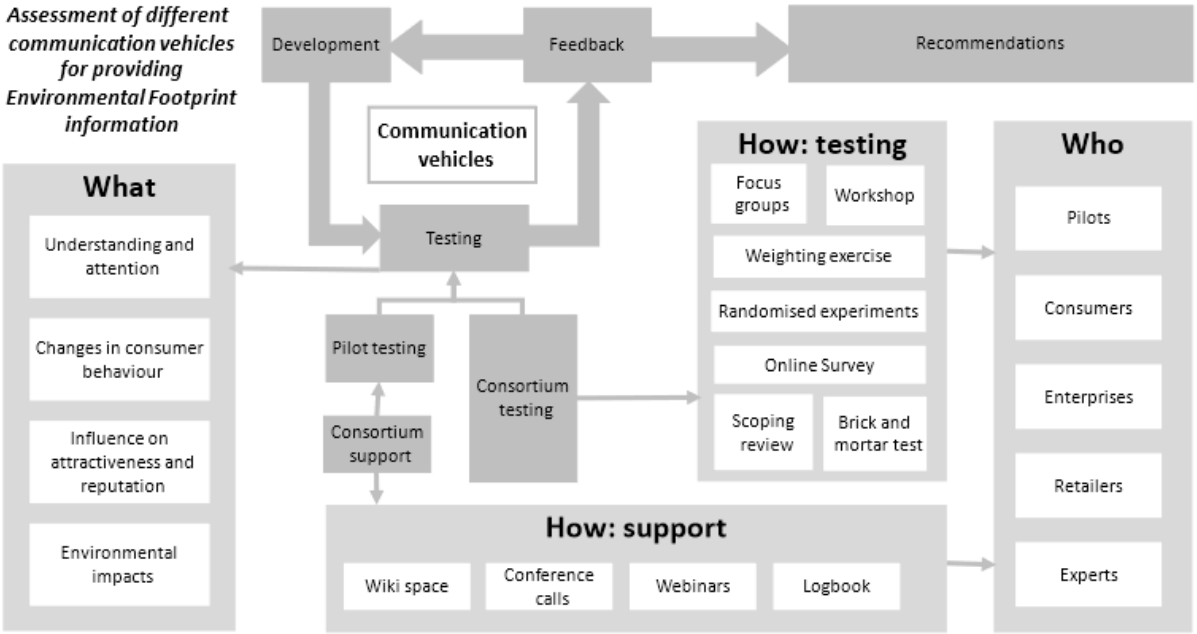
F. SDG Communication

Lupiáñez-Villanueva et al (2018) use the following images to explain the experimental framework they employed to gather evidence about the best approaches for communicating information about the sustainability of products to consumers. Specifically, they were testing the best approaches for communicating Product Environmental Footprint (PEF) and Organization Environmental Footprint (OEF) results to consumers.

1.2 Methodological framework

The following figure depicts the overall framework of the project, and the interactions between the activities carried out, the dimensions under analysis as listed above, the methodologies used, and the stakeholders involved in the overall process.

Figure 1 Overall framework



The development, testing and feedback of the different communication vehicles has been an iterative process aimed at reinforcing the findings as new evidence was generated through the testing activities. In addition to the exhaustive and continuous support and feedback provided to and gathered from the Pilots, a significant portion of the effort throughout the project by the Consortium consisted in carrying out new, complementary studies.

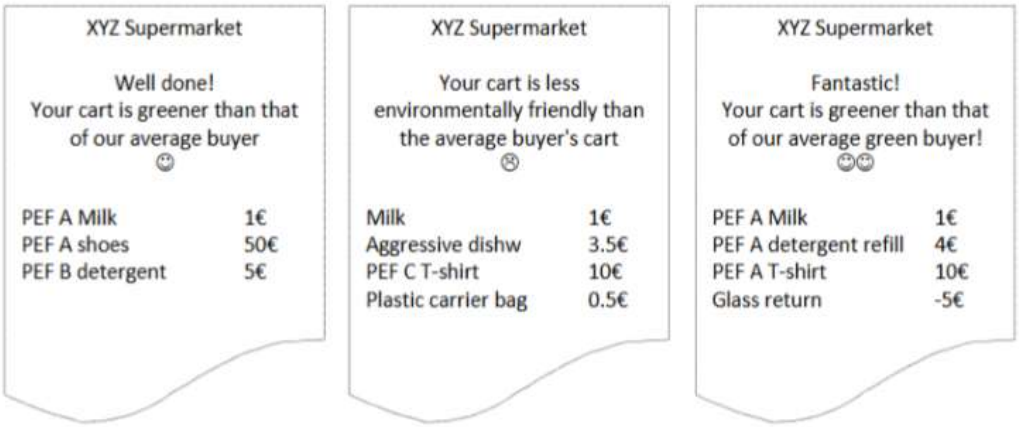
Lupiáñez-Villanueva et al (2018) use the following representative images to summarize the experiments they conducted.

Figure 52 Study on Willingness to Pay – Choice example

Figure 51 Study on Certification and Trust – Choice example

Figure 53 Study on Ecolabel – Choice example

Figure 10 Receipts example



Source: Background document for the testing of communication vehicles in the environmental footprint pilot phase 2013-2016 (page 17)

Figure 13 Website example

Source: Background document for the testing of communication vehicles in the environmental footprint pilot phase 2013-2016 (pp. 26-27)

The authors use the following statement to summarize their conclusions.

"On the design of communication vehicles, the evidence points to the following characteristics to maximise effectiveness.

- An emphasis on clarity, simplicity and transparency.
- Avoiding numeric and scientific terms (e.g. kg CO2-eq / kg), these are too complex.
- Using graphics, bar charts and colour scales
- Emulating the readily understood Traffic light and Energy Labels
- Certification from named, independent and trusted sources
- Offering QR codes, bar codes, links, websites and banners for those who want further information.
- The most effective label is PEF label, A-E rating and an average product score."

Although the authors are cautious about predicting the consequences of these communication aides on actual consumer purchases, and although they only addressed the environmental dimension of sustainability rating systems, their studies took place prior to important recent developments in some countries, such as the release of alarming global heating projections (i.e. IPCC (2018), USGCRP (2018), and UNEP (2018, 2019)) (**11***), systemic biodiversity and ecosystem services losses (i.e. IPBES, 2019), a barrage of disaster reporting (i.e. due to worsening hurricanes, wildfires, droughts, heat waves, pandemics, and socioeconomic calamities, such as assassinations, migration, and war), and violations to fundamental value systems (i.e. weakened environmental rules, voter suppression, and racist violence).

This reference supplements these types of specialized communication vehicles with the following types of more comprehensive, SDG-related, industry and landscape, reports. Communication aids must also be developed to communicate Section E's raw SDG Plan data to decision makers (i.e. SPA3's Business Value Reports). New social sustainability media platforms host these new communication vehicles.

SDG Report - Local Communities in Landscape 1									
SDG Goals	**Overall Score**	**No Poverty**	**Zero Hunger**	**Good Health and Well Being**	**Quality Education**	**Gender Equality**	**…**	**Peace. Justice, and Strong Institutions**	**Partnerships for the Goals**
Goal Number	**10 point Index**	**1**	**2**	**3**	**4**	**5**	**6 to 15**	**16**	**17**
Over 50,000 population									
Community 1	x	x	x	x	x	x		x	x

Conclusions

Local organization, product, and community SDG Plans may help local communities, businesses, and consumers, achieve the SDG targets and thereby improve the lives and livelihoods of local people. Local consumers can be expected to support the local companies that helped with these achievements. Local producers can be expected to adopt the M&A Actions proven to work by their sibling sustainable production practitioners. Local public agents can expect support from the local citizens they assist achieve a higher quality of life. Many non-locals can be expected to support sustainable actors and chasten unsustainable actors, regardless of where they are located (**2* and 13*)**. Local companies and communities can independently assess how these likely behaviors will impact the quality of life for their local, national, and global neighbors (**16***).

Footnotes

1. The author has trained and worked with resource conservationists to use applied versions of this reference's tools (i.e. Conservation Effects for Decision Makers and PR&G). The author's primary responsibility was to add socioeconomic dimensions to these natural resources planning processes.
2. The algorithms target global SDG target accomplishment, as required by global problems such as climate change, by supporting local and national production and consumption choices. As stated in several tutorials, the common sense goal is to support sustainable actors and chasten unsustainable actors by purchasing or not purchasing their wares, regardless of where they're located. For example, on a recent camping trip, the author

purchased organic beef jerky from a major USA supermarket chain and discovered later that the beef came from Uruguay. The author assumed the vendor purchased the beef for typical reasons in their supply chain –the quality and cost was better than domestic sources. They correctly assumed that their targeted consumers were more interested in affordable, sustainable production, verified using internationally recognized standards, regardless of whether the origin of the product was national or global. If national producers are being misled into producing unsustainable products, not following internationally recognized sustainability standards, or transparently supporting efforts to weaken these standards, many investors, supply chain participants, and consumers will not support their misinformed production practices (i.e. see Footnote 13).

Vegans, WRI (2018), and TEEB (2018), point out that a sustainable lifestyle eliminates, or at least minimizes, meat and dairy consumption (i.e. the author has transitioned to ~90% vegetarian). UNEP (2015) provides further policy guidance about what is meant by a sustainable lifestyle. Although not all climate change experts agree about the overall impact of sustainable lifestyles, the social norms promoted by individual participation may lead to wider acceptance of more encompassing climate change actions, such as carbon taxes, and reduce future demand for increasingly scarce resources (refer to the WRI, 2018, image in Example 9 and the TEEB, 2018, references).

3. The SPA references mentioned the danger posed by powerful interest groups to capture or coopt these approaches for typically greedy and selfish reasons, such as watering down the QOL ratings for their company's products, goods, and services. Reinforcing the need for objective, evidence-first, 3rd party sustainability workers, to complete the ratings and to be extremely cautious of "unsustainable companies and public agents bearing false gifts [and peddling gross marketing fiction]". Note that the private sector companies listed in the references are, at this stage of development, believed to be making good faith efforts to make improvements in this area, and are not examples of "coopting the process". But 3rd party sustainability workers are still recommended for assurance (i.e. Example 3B's O-LCIA main reference cites the glowing results of an LCA conducted by an auto manufacturer who was later proven to have doctored the data).

4. While this reference suggests the contrary, these references actually endorse mitigation and adaptation actions that don't require formal, institutional, planning approaches, if they address equity. Examples include national policies, like those summarized by UNEP (2015 and 2018) (i.e. carbon fees, emission trading schemes, compensation mechanisms, communication outreach) and the "mixed methods participatory approaches" introduced in Section B, Stakeholder Identification and Engagement. The primary reason is that they don't require flawed planning approaches formulated by flawed sustainability workers in flawed institutional settings [and because the Klamath water basin reference highlights the complexity accompanying full conservation planning]. These algorithms forge ahead and attempt to reduce the flaws because planning, if done correctly, can help to achieve the SDG, especially their focus on equity. Importantly, the SPA3 and a future version will begin to demonstrate how better planning may be able to support Machine Learning and Semantic Web approaches to SDG target accomplishment.
5. Organizations such as the IPCC must use a global perspective to address topics such as the feasibility of mitigation and adaptation options and their relation to the SDG. IPCC recognizes that evidence-based science is the only globally agreed way to tackle societal problems such as climate change. That explains their reliance on academic publishing. Although necessary for laying out a scientific foundation for tackling the problems, the drawback to that approach, especially in the social sciences, relates to the "actual evidence" employed in academic publishing. No real reference datasets can be offered in the SPA series because of data deficiencies, arising from institutional deficiencies. Without reference datasets, new algorithms can't be fully proofed for accuracy (and policies can't be fully proofed for efficiency or effectiveness). The Social Budgeting tutorial refers to this as the "empty box" syndrome. For example, how many of the thousands of academic references (or international organizations) cited in the IPCC (2018) and USGCRP (2018) references allow complete, open source, cross platform, cloud computing, software applications, with reference datasets, to be downloaded (i.e. Any? In a digital age, does that signify "doing it right" or "doing it wrong" (**14***)? [R, Python, Julia, and related open platform, algorithm builders, are excluded from this criticism, of course.]

Although the IPCC (2018) documents that Integrated Assessment Models are getting better at modeling socioeconomic and environmental linkages at global scale, the author doesn't see how these models can understand all "pathway linkages" and "stakeholder perspectives" at local "downscale" (i.e. absent Machine Learning "magic") (**15***). Conventional institutions, or SPA3's new nonconventional "moral accountability institutions", need to make significant investments in nonconventional sustainability accounting teams and sustainability networks and clubs as part of the IPCC's "transition pathways" to a sustainable planet (i.e. the box needs filling and if the resultant content must be described as "grey literature", so be it, as long as solutions emerge).

6. As mentioned or implied throughout this tutorial, given that the conventional institutions in some countries appear to be actively supporting these types of unsustainable pathways (i.e. Regional Rivalry and excessive social, economic, and environmental damages), clubs and networks may need to take independent action.
7. These investments must be paid by taxpayers, who generally dislike tax increases. That explains why most DevTreks tutorials discuss the importance of documenting the costs, benefits, and performance of projects, business practices, and technologies. Companies and communities use Performance Monitoring and Impact Evaluation accounting systems to verify the effectiveness and efficiency of SDG-SDRR target accomplishment. Taxpayers may be more amenable to tax increases when they have proof that their money is being used efficiently for societal improvement and when they accept the scientists' conclusions about the ongoing billion dollar losses that are decreasing their quality of life. Given that climate change and biodiversity loss will impact every single taxpayer in every country, sustainability workers must convince local citizens and companies of the urgency of paying to mitigate and adapt right now at both local and global scale. The SPA references, IPCC (2018), and USGCRP (2018) verify that prevention is much less expensive than post-mortem recovery. UNEP (2018) lists numerous policies that countries have adopted successfully to alleviate taxpayer concerns. Local taxpayers may appreciate learning to use a more comprehensive, "general societal improvement" approach, such as the SDG, to address their specific local concerns about health care

costs, well-paying local jobs, migration, education, crime, affordable housing, clean water, fresh air, and a sustainable planet for their children.

8. A fully functioning and staffed open source software project should attract software developers who contribute specific modules, or algorithms, that focus on harmonizing existing sustainability reports with this reference's uniform reports. For example, the author recently visited a local farmers market and asked the host whether or not they collected any proof from the local vendors about the sustainability of the products being sold. Although the answer was negative, most vendors proudly supplied their own proof. The problem, from a scientific perspective, but not necessarily from the perspective of most of the consumers at the market, is that the transaction costs needed by a consumer to assess all of the different certification standards made actual verification of sustainability impossible (i.e. refer to Annex 2 in European Commission (c). Background document, for background context). The same criticism applies to assessing the numerous certifications employed by the self-advertised, sustainable products being sold in retail stores. The "next generation" needs to experiment to discover the best approaches for open source "SDG development" –they might start with their local farmers markets and the uniform accounting and reporting systems, and algorithm platforms, introduced in this reference.
9. The FAO SAFA references thoroughly explain the planning logic needed for SDG reporting at local community and business scale and should be read prior to the use of this reference's approach. TEEB (2018) further demonstrates the application of SDG planning for specific industries, such as agriculture and food systems. Stiglitz et al.'s (2009) recommendations for measuring household quality of life provide a good introduction to SDG data collection.
10. Although Example 3A, O-LCIA, explains the difficulties in making organization comparisons, Lupiáñez-Villanueva et al, 2018, confirm that the European Union recognized this more than a decade ago and began testing product and organization rating systems, such as the EC's (2017 and 2018) Product Environmental Footprint (PEF or PEFCR) and Organization Environmental Footprint (OEF or OEFSR). The EC confirms that the issue of uniform organization comparisons, based on LCA approaches, has not been fully resolved, so this reference introduces Section E's SDG Plans for this purpose.

At the very least, the SDG Plans and their uniform sustainability scores allow supply chain participants to verify "business to business sustainability assurances" (SAFA, 2014). The OEF initiative suggests they'll continue to evolve to support "business to consumer" purposes as well (or, initially, to at least allow companies to advertise SAFA's "consistency with international [standards] assurances"). Perhaps most importantly, consumers, or more accurately, informed consumers, may decide that current global heating projections necessitate the use of "consumer to business assessments", rather than "business to consumer assurances", and leads them to carefully avoid being influenced by business marketing fiction (i.e. and public agent-generated misinformation) when making and using these assessments (i.e. SDG Plans).

11. UNEP's 2019 Emissions Gap Report summarizes the current state of carbon emissions throughout the world: "This report tells us that to get in line with the Paris Agreement, emissions must drop 7.6 per cent per year from 2020 to 2030 for the 1.5°C goal and 2.7 per cent per year for the 2°C goal". In relation to the SDG, recent USA news reports verify that poverty rates are increasing, life expectancy is decreasing (i.e. aside from a blip in 2020), and record numbers of school children are homeless. Aside from this actual evidence of national disregard for carbon reduction or the SDG, a casual walk around the author's western USA city provides anecdotal evidence that many residents care little about reducing their contribution to GHG or contributing to the SDG. Traffic has worsened, fuel efficient cars are being jettisoned for SUVs and pickups, shoppers appear enamored with glitter and greenbacks not substance and sustainability, the homeless are back to sleeping in their old haunts, and local news reports find that the new "green streets" policies, such as the installation of "green drains", turn out to be the product of haphazard, rather than careful, planning. That makes the overall SDGs even more important –more residents everywhere will be paying for today's excesses. [On a positive note, the author also acknowledges more "green"-oriented stores and buildings, more crowds in the sustainable product isles, more bike lanes and cyclists, and a general "let's figure out solutions" attitude on these matters by the next generation.]
12. The following URL confirms that the UN has 2 initiatives underway to improve SLCA.

https://www.lifecycleinitiative.org/new-project-linking-the-un-sustainable-development-goals-to-life-cycle-impact-pathway-frameworks/

The first is to update the SLCA approach introduced in Example 3B. The second is to integrate the SDG with SLCA approaches (i.e. Examples 5 and 6). Their time horizon looks to be about 4 years, which explains why this reference is proceeding with new algorithms for this purpose right now. The author acknowledges the flaws with DevTreks' independent approach –but several of these footnotes point out greater flaws that need action now (i.e. hence Footnote 13). As stated in SPA3's footnotes, it's not necessary for DevTreks itself to be proven right with these approaches –it's necessary to teach the next generation about alternative approaches that might help them to be right.

13. Informed stakeholders should recognize that scanning a bar code prior to making any purchase will eventually allow investors, producers, and consumers, to identify unsustainable organizations, products, goods, services, and communities, and replace them with verifiably sustainable substitutes. The affordability of the sustainable substitutes by vulnerable populations must be addressed as part of SDG planning (i.e. see Table 6.1 of UNEP, 2018, for a summary of successful policies, such as redistribution mechanisms). Additional machine learning and semantic web algorithms will need development before reliable communication aids are available for every product, good, service, public agent, organization, and community, in every country. In the meantime, Section E's SDG Plans, and Appendix C's Social Sustainability Media Platforms, may supply the basic scores that support the following examples (i.e. the term "uniform" means cross sector, cross purpose, cross product, cross organization, and "compliant with international standards"):
    - adopting and using a uniform sustainability accounting and reporting system (i.e. Section E's SDG Plans),
    - switching from existing social media platforms, with their focus on advertising [and misinformation], to social sustainability media platforms, with their focus on improved quality of life [and scientific evidence]

- petitioning for an objective, 3rd party, uniform, sustainability rating for the products being sold through online shopping apps such as those used by Amazon, Krogers, and WalMart in the USA,
- passing local ordinances that require an objective, 3rd party, uniform, sustainability rating for the food and drinks being sold in restaurants (i.e. see Example 11),
- voting, in local referendums, for an objective, 3rd party, uniform, sustainability rating for the organizations advertising, or posting purported facts, on online social media apps, such as those developed by Google, Facebook, Twitter, and local advertising agencies,
- asking their local public officials to adopt an objective, 3rd party, uniform, sustainability accounting and rating system for their local community,
- contributing to online sustainable reporting systems, such as the food database being developed by the main "slow food" international organization (i.e. slowfoodusa.org),
- requiring an objective, 3rd party, uniform, sustainability rating for the products and companies accessed through the Quick Response codes pioneered by Asian consumers (Lupiáñez-Villanueva et al, 2018). [This reference believes that the current (2020) "traffic light QR codes" used to identify unhealthy persons in some countries, while providing proof of the accuracy of this footnote, must be administered by objective, 3rd party, science-based, organizations, such as WHO.]
- facilitating the use of an objective, 3rd party, uniform, sustainability rating for candidates running for public office
- helping the tourist industry to adopt an objective, 3rd party, uniform, sustainability rating for airplane, hotel, and restaurant reservations (i.e. for tourists who prefer spending their money on sustainable communities and businesses)
- participating in the use of objective, 3rd party, uniform, sustainability ratings, which can be communicated via visual aids (i.e. hourglass, sundial), that local residents, visitors, and store owners can add to their dwellings, vehicles, clothes, and retail stores, to verify progress with their transition to sustainable lifestyles

and retail establishments (i.e. for local residents, visitors, and business owners who want to express their personal and financial support for sustainability and to reestablish shared social norms).

Lots of well-paying, next generation, jobs ahead for sustainability workers, but keep the focus on fighting for equity and the vulnerable (i.e. reestablishing shared social norms).

14. The author went through several of the tools listed by the USGCRP at the following URL: https://toolkit.climate.gov/tools

    One of the tools listed referred to the openLCA, an open source database for LCA reporting. At first glance, the author found the database, software, and final downloaded LCA results, incomprehensible (i.e. no simple, final, summary report). DevTreks recommends that the "next generation" avoid developing these types of domain-specific tools, if they can help it (i.e. a better investigation revealed why openLCA used this EF-compliant approach, but that doesn't change this recommendation). Instead, use generic, TEXT-based, algorithms, as demonstrated in this series. Although we use extremely basic algorithms, more sophisticated algorithms, backed with additional data standards and document databases, can be developed that probably can replace most of the domain-specific datasets backing this URL's tools. The GIS tools will require different types of data standards, metadata calculators, and user interfaces for the algorithms (i.e. algorithm200 refers to GIS Open Source1-based algorithms, algorithm201 refers to GIS Open Source2-based algorithms …). The digital objective, as identified in SPA1 and indirectly addressed by the modeling being carried out by IPCC (2018), and USGCRP (2018), is to standardize on a "mainstreamed [algorithm] platform", while paying strict attention to Footnote 3.

15. Although many of the international and national SDG accounting and reporting systems, and Integrated Assessment Models, introduced in this reference may employ survey-related disaggregated reporting (i.e. based on factors such as income, sex, race, and age), they leave the impression that their relation to stakeholders, themselves, may be left to academic reporting. Even if the reporting leads to better SDG policies, this reference tries to make the case that actual stakeholders may not understand or appreciate being abstracted in this manner and therefore not support SDG planning (i.e. the recent protests

in France over climate change-related policies). A combination of mixed methods qualitative SDG assessments (i.e. case studies, participatory budgets, story development), Section C's stakeholder participatory approaches, and social sustainability media platforms, may help impacted households to understand and support SDG planning.

16. Autarky, or "breaking shared social norms", at local, national, and global scale, may not have a long history of success.
17. This reference agrees with those media companies who have changed their writing style guides to better inform the public about the nature of these crises (i.e. global heating rather than global warming). As of January, 2020, some international organizations, such as UNEP, have reviewed more recent climate change evidence which have caused them to start using the terms "climate emergency" and "climate catastrophe".
18. The datasets developed for this tutorial are not gender neutral, as they need to be, because the author is usually stretched too thin to cover everything, and because it's not the role of this software company to develop content. On a related note, the author doesn't personally use social media (and does not even own a mobile phone) and cares little about political correctness. The author would (i.e. and does) use the new social sustainability accounting platforms proposed (i.e. and demonstrated) in this reference. On another related note, the potential difference between new social media platforms (i.e. Berners-Lee, 2019; new domain-specific platforms: www.healthit.gov; Footnote 13's "traffic light QR codes") and these new social sustainability media platforms (i.e. DevTreks-like) revolves around the latter's focus on science, algorithms, social sustainability accounting, public goods software and community capital improvement platforms (i.e. human capital, rather than healthcare or citizen-monitoring, record keeping).
19. Recent media reports have shown sustainability workers interviewing farmworkers in African cocoa producing regions about the effectiveness of product sustainability labels. The farmworkers were shown certification labels found on certain chocolate bar packages and asked whether the certifications actually helped improve their working conditions. The anecdotal response, no, suggests a serious disconnect between product, or organization, certifications and important "impacted stakeholders". This tutorial

recommends that community, product, and organization "nexus certifications" take place in the context of more comprehensive SDG planning and accounting systems that focuses directly on these types of "highly impacted" households and that evidence of the actual impacts be collected and presented using new, unbiased, social sustainability accounting platforms.

20. The author formally learned these types of approaches while studying aspects of international agriculture in undergraduate and graduate school. He studied International Agricultural Development in graduate school after having worked in rural lending and rural development for 10 years. That work experience included supervising the loss of large amounts of federal agricultural loans (i.e. agriculture experienced hard times in the 1980s; politicians are good at spending money). In graduate school, his primary question to the advocates of these adaptive learning, and experimental, approaches was "who pays?" (i.e. because it better not be me –I've already seen enough money wasted). Now, decades later, after having studied and applied these approaches further, and using that knowledge to build formal monitoring and evaluation tools, he has a better understanding of the inevitability of some tradeoff between "wasted money" and potentially innovative impact achievement. From the author's current technologist perspective, the key is make business, community, and household, accountability much easier, more verifiable, clearly transparent, closely aligned with international standards, and obviously advantageous, by making IT much sounder (i.e. so get busy building new social sustainability media platforms –DevTreks introduces possibilities).

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References Note

We try to use references that are open access or that do not charge fees.

Example 9. Applied Local SDG Plans for Communities

Algorithms:

SDG Capital Budget: algorithm1, subalgorithm19 (new for 2.1.8) or Example 12's algorithm1, subalgorithm20 (new for 2.2.0)

SDG Operating Budget: algorithm1, subalgorithm16 or Example 12's algorithm1, subalgorithm21 (new for 2.2.0)

URLs:

https://www.devtreks.org/greentreks/preview/carbon/resourcepack/SDG Plan Example 9/1564/none

https://localhost:5001/greentreks/preview/carbon/resourcepack/SDG Plan Example 09/551/none

Output Stock Calculator

https://localhost:5001/greentreks/preview/carbon/output/SDG Plan Ex 09/2141223504/none

Input M&E Calculator

https://www.devtreks.org/greentreks/preview/carbon/input/SDG Plan Ex 9/2147397567/none

This example introduces a new algorithm to illustrate the datasets, rating systems, and reports (i.e. scorecards) used to build and implement an SDG Plan. This example demonstrates SDG Plans completed by sustainability workers for specific communities (and by extension, their public agents). This particular example demonstrates how to use these community SDG Plans as policy foundations that support Example 11's SDG Plans. Other typical examples include "aggregate plans" for Example 11's SDG impacts (i.e. a target of 50 improved organization SDG plans in a watershed results in an aggregate improvement in community SDG measurements).

UNEP (2018) use the following statement to explain why uniform SDG reporting is needed by communities. The statement confirms that uniform databases do not exist yet that can verify how M&A Actions effect SDG targets, in this statement, related to global heating.

“Although Non-State Actor Zone for Climate Action (NAZCA) acts as an umbrella for various NSA climate action repositories, no comprehensive database of NSA actions exists, with each NSA adopting various criteria for inclusion that are often unclear or opaque (Widerberg and Stripple, 2016). The reported data are often not suited to calculating emissions impact, estimating overlap, or comparing NSA mitigation potential to the emissions scenarios of other actors, such as national governments.”

FAO (2017) use the following image to explain the relationship between landscapes, industry-specific M&A Actions, in this case, Climate Smart Agriculture (CSA) practices, and SDG impacts on stakeholders.

Managing landscapes for climate-smart systems

Integrated landscape management can be used as an instrument to scale up CSA in a holistic, equitable and inclusive manner. As CSA requires complex, context-specific decision making, it is essential to continue balancing multiple objectives when designing larger-scale CSA interventions. Landscape interventions explicitly consider the multiple functions of ecosystems at multiple scales. For instance, a balance may need to be struck between land-use planning, agricultural production and tourism. By taking into account the social, economic, and environmental dimension, natural resources (including biodiversity) can be conserved while multiplying the opportunities and benefits for diverse stakeholders.

When implementing interventions at the landscape level, an overarching process is necessary for the management of production systems and natural resources over an area large enough to produce vital ecosystem services. This process must be complemented by decentralized mechanisms that can take into account the smaller scales at which the people actually operate. Fostering interactions between groups with different types of knowledge and different levels of expertise is highly beneficial.

As an approach inherently focused on scaling up sustainable practices, integrated landscape management facilitates the targeting and alignment of policies to attain desired results. Because of this, the landscape approach can also be used to improve practices related to land use and management so that they contribute to meeting local, subnational and national development goals, which can in turn support progress towards achieving multiple SDGs.

Antonopoulos et al (2016) use the following statement to explain community-wide SDG planning, including ecosystem services planning, landscape planning, and agricultural planning.

‘EC (2012) described agricultural landscapes as a multi-scale public good that is difficult to describe due to its multidimensional character that encompasses agronomic, environmental, social, cultural and economic dimensions. They propose three scales of landscape planning action to maximise the public good: (i) the management of landscape features at farm level; (ii) farms' coordination towards landscape structure management at landscape level; (iii) the conservation of the diversity of agricultural landscapes in the EU as a global public good.

The ecosystems services framework provides a useful approach for assessing landscape management. In fact, Everard and McInnes (2013) argued that such an approach enables the identification of "systemic solutions" that involve multiple stakeholders (including farmers) and environmental benefits. Importantly, the ecosystems services approach can help to optimise the mix of different services provided by land, and agricultural management of it, rather than maximising any one services (e.g. food production)."

Section B, SDG Policy Context, explains the importance of having a strong policy framework in place prior to any SDG Planning. OECD (2017) describe the relation between the OECD's quality of life ratings and the SDG's policy prescriptions, in the following statement:

"The OECD well-being framework is an analytic and diagnostic tool to assess the conditions of a community, whereas the 2030 Agenda is a list of policy commitments agreed by world leaders. The two therefore differ as the results of a full medical check-up would differ from the list of treatments a doctor might then prescribe."

The policy focus of the SDG explains why this example directly uses the SDG Goals, Targets, and Indicators in Community SDG Plans. Community SDG Plans help to fill in the policy, data, and outreach, gaps needed to achieve subnational and national sustainability accomplishments. Example 12 demonstrates how these plans can be derived from existing sustainability accounting systems.

Datasets for Applied SDG Plans

This section introduces the datasets used for Community SDG Plans. The first dataset uses subalgorithm19 to generate SDG Ratings, referred to, loosely, as the following Capital Budget.

> **SDG, or Capital Budget, TEXT dataset**. This dataset takes a subset, or nexus, of SPA3-like SIA datasets, including socioeconomic and landscape characteristics, and adjusts some of the properties for SDG Plans. The following dataset employs SDG Goals, Targets, and Indicators, with OECD (2017) proxy measurements (i.e. standard deviations and targets).

Level 1 – Average SDG Total Sustainability Score = sum of average SDG Goal Scores divided by number of Goals

Level 2 – Average SDG Goal by Stakeholder Group Scores = sum of average SDG Target Scores divided by number of Targets and allocated among stakeholder groups

Level 3 – Average SDG Target Scores = sum of SDG Indicator Scores divided by number of Indicators

Level 4 – SDG Indicator Scores = normalized SDG Indicator amount; Indicator data is collected using techniques similar to Examples 1 to 3 or from statistical survey data.

The calculated Indicator ratings from the Capital Budget are then added to the following second dataset, or Operating Budget, and used with subalgorithm16 to generate the Cost Effectiveness Ratios introduced in Examples 4A, 4B, and 4C.

M&A Action, or Operating Budget, TEXT dataset. This dataset adjusts Example 4's Budgets to focus on improved M&A Actions (i.e. best management practices) that directly address the 1st dataset's SDG Indicators for specific stakeholder and landscape groups. Appendix A and B demonstrate how to document these Actions more thoroughly. This reference recommends designing M&A Actions to have significant impacts on the 1st dataset's specific stakeholder groups. The incremental changes documented in each impact transition state derive from eliminating ineffective, and adopting effective, M&A Actions for these stakeholders. The transition states serve as temporal scales, while the dataset uses the "locationid" column to identify a proxy for the spatial scale.

Level 1 – Overall Impacts

Level 2 – Impacts on Targeted Stakeholders

Level 3 – Activities (i.e. but Outcomes come from the Capital Budget)

Level 4 – Inputs (i.e. but Outputs come from the Capital Budget)

1st to 2nd dataset Linkages between M&A Actions and SDG Indicators: The following table illustrates the linkages between the capital and operating budgets. Each Capital Budget Indicator can be effected by 1 or more Operating Budget M&A Actions. Allocations must be made for each separate linkage so that each M&A Action (i.e. actually the Action's costs and benefits) can be 100% allocated to the Indicators. Example 4 explains that the Categorical Index.factor6 property can be used as a multiplier to make these allocations. Example 12's budgets include optional URL properties to store these types of one-to-many linkages.

Operating Budget	**Capital Budget**	**Allocation from Operating to Capital Budget**
M&A Action 1	Target 1. Indicator 1	0.40
M&A Action 1	Target 1. Indicator 2	0.40
M&A Action 1	Target 2. Indicator 1	0.20
	Allocation Sum	1.0
M&A Action 2	Target 2. Indicator 1	0.60
M&A Action 2	Target 2. Indicator 2	0.25
M&A Action 2	Target 5. Indicator 2	0.15
	Allocation Sum	1.0

M&A Feasibility Assessments. The following table illustrates the use of a worksheet to make Example 4's allocations and certainty ratings. This worksheet is a simplified

version of Appendix A's M&A Feasibility Assessments, with the SDG Indicators replacing the Assessment's Indicators. In effect, SDG Goals and Targets are proxies for the 7 community capital dimensions explained in the Appendix. In this example, the first column combines the labels from each M&A Action with each SDG Indicator. The underscore used with the 1st column's labels distinguishes Highly Impacted Stakeholders (_1) from Moderately Impacted Stakeholders (_2). In practice, this table is often completed by listing all M&A Actions across the top row and all SDG Indicators down the first row and having experts rate the certainty of the impact of each M&A Action on each SDG Indicator (i.e. Appendix B's certainty of the Stock Flow).

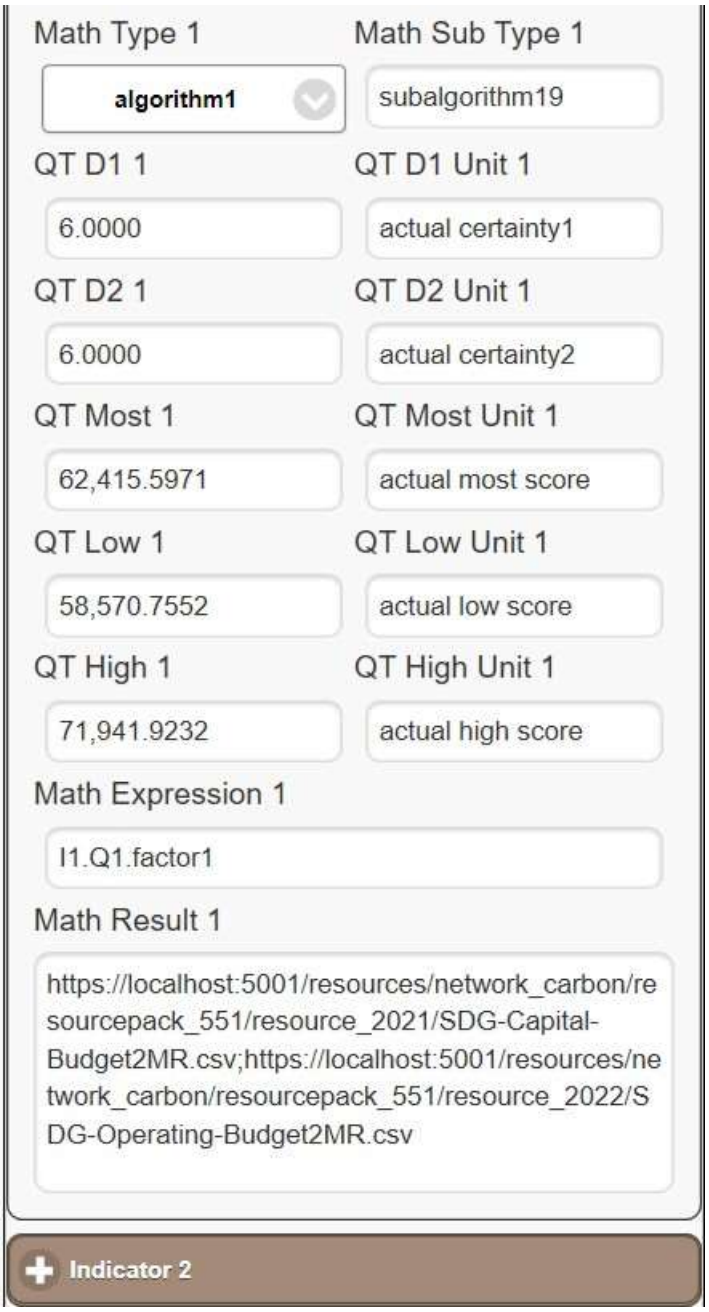
label	locatio	label	name	label	name	allocation	certainty
TAA_I010101__1	1	TAA	M&A Action 1	I010101_1	1.1.1 Population below hh living w	0.5	2
TAA_I010201_1	1	TAA	M&A Action 1	I010201_1	1.2.1 Population below pov line	0.5	2
TAB_I010201_1	1	TAB	M&A Action 2	I010201_1	1.2.1 Population below pov line	1	2
TAC_I010301_1	1	TAC	M&A Action 3	I010301_1	1.3.1 Population covered	1	2
TAD_I010101_1	1	TAD	M&A Action 4	I010101_1	1.1.1 Population below hh living w	1	2
TAE_I050101_1	1	TAE	M&A Action 5	I050101_1	5.1.1 Degree of legal frameworks	1	3
TAH_I050201_1	1	TAH	M&A Action 8	I050201_1	5.2.1 Female violence by partner	0.6	3
TAH_I050202_1	1	TAH	M&A Action 8	I050202_1	5.2.2 Female violence by other	0.25	3
TAH_I050301_1	1	TAH	M&A Action 8	I050301_1	5.3.1 Female youth at marriage	0.15	3
TAG_I050302_1	1	TAG	M&A Action 7	I050302_1	5.3.2 Female genital multilation	0.33	3
TAG_I050601_1	1	TAG	M&A Action 7	I050601_1	5.6.1 Female reproductive decisio	0.33	3
TAG_I050602_1	1	TAG	M&A Action 7	I050602_1	5.6.2 Female reproductive care	0.34	3
TAF_I050102_1	1	TAF	M&A Action 6	I050102_1	5.1.2 Gender wage gap	0.5	3
TAF_I050401_1	1	TAF	M&A Action 6	I050401_1	5.4.1 Unpaid domestic and care w	0.15	3
TAF_I050501_1	1	TAF	M&A Action 6	I050501_1	5.5.1 Female politicians	0.2	3
TAF_I050502_1	1	TAF	M&A Action 6	I050502_1	5.5.2 Female managers	0.15	3
TAI_I130101_1	1	TAI	M&A Action 9	I130101_1	13.1.1 Mortality	0.6	1
TAI_I130101_1	1	TAI	M&A Action 9	I130101_1	13.1.2 SDRR target adoption	0.4	2
TAJ_I130101_1	1	TAJ	M&A Action 10	I130101_1	13.1.1 Mortality	0.5	3
TAJ_I130102_1	1	TAJ	M&A Action 10	I130102_1	13.1.2 SDRR target adoption	0.5	1
TAK_I130103_1	1	TAK	M&A Action 11	I130103_1	13.1.3 Local disaster risk reductio	1	2
TAL_I130201_1	1	TAL	M&A Action 12	I130201_1	13.2.1 Plan adoption	0.33	3
TAL_I130301_1	1	TAL	M&A Action 12	I130301_1	13.3.1 Degree of education	0.33	1
TAL_I130302_1	1	TAL	M&A Action 12	I130302_1	13.3.2 Degree of capacity building	0.33	2
TBA_I010101__1	1	TBA	M&A Action 13	I010101_2	1.1.1 Population below hh living w	0.5	2
TBA_I010201_2	1	TBA	M&A Action 13	I010201_2	1.2.1 Population below pov line	0.5	2
TBB_I010201_2	1	TBB	M&A Action 14	I010201_2	1.2.1 Population below pov line	1	2
TBC_I010301_2	1	TBC	M&A Action 15	I010301_2	1.3.1 Population covered	1	2
TBD_I010101_2	1	TBD	M&A Action 16	I010101_2	1.1.1 Population below hh living w	1	2
TBE_I050101_2	1	TBE	M&A Action 17	I050101_2	5.1.1 Degree of legal frameworks	1	3
TBH_I050201_2	1	TBH	M&A Action 20	I050201_2	5.2.1 Female violence by partner	0.6	3
TBH_I050202_2	1	TBH	M&A Action 20	I050202_2	5.2.2 Female violence by other	0.25	3
TBH_I050301_2	1	TBH	M&A Action 20	I050301_2	5.3.1 Female youth at marriage	0.15	3
TBG_I050302_2	1	TBG	M&A Action 19	I050302_2	5.3.2 Female genital multilation	0.33	3
TBG_I050601_2	1	TBG	M&A Action 19	I050601_2	5.6.1 Female reproductive decisio	0.33	3
TBG_I050602_2	1	TBG	M&A Action 19	I050602_2	5.6.2 Female reproductive care	0.34	3
TBF_I050102_2	1	TBF	M&A Action 18	I050102_2	5.1.2 Gender wage gap	0.5	3
TBF_I050401_2	1	TBF	M&A Action 18	I050401_2	5.4.1 Unpaid domestic and care w	0.15	3
TBF_I050501_2	1	TBF	M&A Action 18	I050501_2	5.5.1 Female politicians	0.2	3
TBF_I050502_2	1	TBF	M&A Action 18	I050502_2	5.5.2 Female managers	0.15	3
TBI_I130101_2	1	TBI	M&A Action 21	I130101_2	13.1.1 Mortality	0.6	1
TBI_I130101_2	1	TBI	M&A Action 21	I130101_2	13.1.2 SDRR target adoption	0.4	2
TBJ_I130101_2	1	TBJ	M&A Action 22	I130101_2	13.1.1 Mortality	0.5	3
TBJ_I130101_2	1	TBJ	M&A Action 22	I130101_2	13.1.2 SDRR target adoption	0.5	1
TBK_I130103_2	1	TBK	M&A Action 23	I130103_2	13.1.3 Local disaster risk reductio	1	2
TBL_I130201_2	1	TBL	M&A Action 24	I130201_2	13.2.1 Plan adoption	0.33	3
TBL_I130301_2	1	TBL	M&A Action 24	I130301_2	13.3.1 Degree of education	0.33	1
TBL_I130302_2	1	TBL	M&A Action 24	I130302_2	13.3.2 Degree of capacity building	0.33	2

Indicator.MathResult: **Reference Case Incremental Cost Effectiveness Analysis (ICERs)**. Example 4 introduced Cost Effectiveness Analysis as a practical decision support tool that recognizes the difficulty of putting a dollar value on social benefits. The 2 datasets are used to generate Example 4A to 4C-style Reference Case Cost Effectiveness Analyses for the generic stakeholder groups.

For example, the full cost of a Nutrient Management crop operation might be allocated to 3 different Indicators representing SDG Targets for climate change, clean water, and improved oceans. The climate change Indicator might also be impacted by several additional M&A Actions, such as tillage and weed control crop operations. The MathResult's ICERs use the allocations to ensure that 100% of the operating budget gets allocated to the capital budget's Indicators.

In practice, the allocations often employ simpler threshold-based ratings (-3 to +3) that experts use to judge the effectiveness of M&A Actions on "resource risks and concerns" (SDG Indicators). This reference believes that automation, even if currently immature, justifies the progression to formal cost effectiveness-based and QASY-based allocations.

Indicator 1 to 15 Transition States. The impact transition states introduced in SPA3 used separate Indicators to measure each state. This algorithm can be run stand-alone by using a separate Indicator. In addition, the following image shows that it can also be run jointly with subalgorithm16. When running joint calculations, the URL to the first dataset must be the capital budget and the URL to the second dataset must be to the operating budget. The image shows that the same relationship holds for the URLs to the 2 MathResults.



When running both budgets jointly, the final Indicator metadata reflects the operating budget's calculations only. The 2 MathResults can then be used to develop multimedia for further decision support. The decision about whether to run the budgets separately or jointly should factor in their subsequent use in the related Resource Stock and M&E Analyzers.

Indicators 1. Transition State 1. 2019 to 2020. All of the following datasets use illustrative data because of the lack of supporting data (i.e. “the empty box syndrome”). The Capital Budget demonstrates that violating Occam’s Rule for limiting TEXT files to 11 columns of explanatory data needs good cause.

Indicator 1. TEXT dataset. **Nexus Capital Budget**. Version 2.1.8 started supporting the minimal Math Expression shown in this image (because the algorithm doesn’t need them, but the code doesn’t accept blank strings).

1.0000	avg actual certainty1
Math Type 1	Math Sub Type 1
algorithm1	subalgorithm19
QT D1 1	QT D1 Unit 1
2.0000	avg actual certainty2
QT D2 1	QT D2 Unit 1
3.0000	avg actual certainty3
QT Most 1	QT Most Unit 1
178.4850	actual most score
QT Low 1	QT Low Unit 1
175.9461	lower 80 % ci
QT High 1	QT High Unit 1
181.0238	upper 80 % ci

Math Expression 1

I1.Q1.factor1

Math Result 1

sdg results
label,location,risks_and_impacts,factor1,factor2,factor3,factor4,factor5,factor6,factor7,factor8,factor9,factor10,factor11,factor12,factor13,factor14,factor15,factor16,factor17,factor18,factor19,factor20,factor21,factor22,factor23,qtmost,qtmostunit,qtlow,qtlowunit,qthigh,qthighunit,certainty1,cer

SDG Indicator properties (18*). To accommodate the SDG, the following dataset employs the UN's labels directly. A new algorithm rule introduced in Version 2.1.8 uses the 1st letter in the label to distinguish the 4 hierarchical elements (i.e. T0101_1 = [T]argets and Categorical Indexes, I010101_1 = [I]ndicator, G01_1 = [G]oals and Locational Indexes, TR1 = [T]otal [R]isk Index. This rule is now being enforced for the 2nd TEXT file's algorithm as well, or subalgorithm16. Example 4's datasets have been upgraded to accommodate this new rule.

label	locati	risks_and_impacts	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9
SDG	**0.00**	**HH Chars Goal 1**	**poverty_ind**	**age_hh**	**age_sp**	**educ_hh**	**educ_sp**	**female_hh**	**indigenous**	**hhsize**	**dirtfloor**
T0101_1	1.00	1.1 Eradicate extreme poverty									
I010101_1	1.00	1.1.1 Population below hh living wage	1/1/2019	1/1/2021	50.00	percent hh	42.00	minus 1 sd	58.00	plus 1 sd	0.00
T0102_1	1.00	1.2 Reduce all poverty									
I010201_1	1.00	1.2.1 Population below pov line	1/1/2019	1/1/2021	2.50	percent hh	-1.30	minus 1 sd	6.30	plus 1 sd	5.10
T0103_1	1.00	1.3 Establish social protection									
I010301_1	1.00	1.3.1 Population covered	1/1/2019	1/1/2021	60.00	percent hh	25.00	minus 1 sd	95.00	plus 1 sd	100.00
G01_1	**1.00**	**1 Poverty Highly Impacted**	**44.30**	**39.74**	**35.03**	**2.68**	**2.52**	**6.47**	**43.32**	**6.20**	**76.93**
T0101_2	1.00	1.1 Eradicate extreme poverty									
I010101_2	1.00	1.1.1 Population below hh living wage	1/1/2019	1/1/2021	25.00	percent hh	17.00	minus 1 sd	33.00	plus 1 sd	0.00
T0102_2	1.00	1.2 Reduce all poverty									
I010201_2	1.00	1.2.1 Population below pov line	1/1/2019	1/1/2021	1.25	percent hh	-2.55	minus 1 sd	5.05	plus 1 sd	2.50
T0103_2	1.00	1.3 Establish social protection									
I010301_2	1.00	1.3.1 Population covered	1/1/2019	1/1/2021	30.00	percent hh	-5.00	minus 1 sd	65.00	plus 1 sd	100.00
G01_2	**1.00**	**1 Poverty Moderately Impacted**	**59.11**	**48.96**	**42.25**	**2.79**	**2.61**	**11.25**	**33.59**	**4.87**	**59.00**
T0501_1	1.00	5.1 End female discrimination									
I050101_1	1.00	5.1.1 Degree of legal frameworks	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
I050102_1	1.00	5.1.2 Gender wage gap	1/1/2019	1/1/2021	75.00	percent	68.30	minus 1 sd	81.70	plus 1 sd	0.00
T0502_1	1.00	5.2 End female violence									
I050201_1	1.00	5.2.1 Female violence by partner	1/1/2019	1/1/2021	15.00	percent	12.90	minus 1 sd	17.10	plus 1 sd	0.00
I050202_1	1.00	5.2.2 Female violence by other	1/1/2019	1/1/2021	25.00	percent	24.30	minus 1 sd	25.70	plus 1 sd	0.00
T0503_1	1.00	5.3 End female harm									
I050301_1	1.00	5.3.1 Female youth at marriage	1/1/2019	1/1/2021	20.00	percent	17.90	minus 1 sd	22.10	plus 1 sd	0.00
I050302_1	1.00	5.3.2 Female genital multilation	1/1/2019	1/1/2021	30.00	percent	29.30	minus 1 sd	30.70	plus 1 sd	0.00
T0504_1	1.00	5.4 Unpaid work									
I050401_1	1.00	5.4.1 Unpaid domestic and care work	1/1/2019	1/1/2021	80.00	percent	17.80	minus 1 sd	142.20	plus 1 sd	0.00
T0505_1	1.00	5.5 Female leadership									
I050501_1	1.00	5.5.1 Female politicians	1/1/2019	1/1/2021	37.00	percent	27.20	minus 1 sd	46.80	plus 1 sd	50.00
I050502_1	1.00	5.5.2 Female managers	1/1/2019	1/1/2021	30.00	percent	19.50	minus 1 sd	40.50	plus 1 sd	50.00
T0506_1	1.00	5.6 Female reproductive rights									
I050601_1	1.00	5.6.1 Female reproductive decisions	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
I050602_1	1.00	5.6.2 Female reproductive care	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
G05_1	**1.00**	**5 Gender Equality Highly Impacted**	**44.30**	**39.74**	**35.03**	**2.68**	**2.52**	**6.47**	**43.32**	**6.20**	**76.93**
T0501_2	1.00	5.1 End female discrimination									
I050101_2	1.00	5.1.1 Degree of legal frameworks	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
I050102_2	1.00	5.1.2 Gender wage gap	1/1/2019	1/1/2021	75.00	percent	68.30	minus 1 sd	81.70	plus 1 sd	0.00
T0502_2	1.00	5.2 End female violence									
I050201_2	1.00	5.2.1 Female violence by partner	1/1/2019	1/1/2021	15.00	percent	12.90	minus 1 sd	17.10	plus 1 sd	0.00
I050202_2	1.00	5.2.2 Female violence by other	1/1/2019	1/1/2021	25.00	percent	24.30	minus 1 sd	25.70	plus 1 sd	0.00
T0503_2	1.00	5.3 End female harm									
I050301_2	1.00	5.3.1 Female youth at marriage	1/1/2019	1/1/2021	20.00	percent	17.90	minus 1 sd	22.10	plus 1 sd	0.00
I050302_2	1.00	5.3.2 Female genital multilation	1/1/2019	1/1/2021	30.00	percent	29.30	minus 1 sd	30.70	plus 1 sd	0.00
T0504_2	1.00	5.4 Unpaid work									
I050401_2	1.00	5.4.1 Unpaid domestic and care work	1/1/2019	1/1/2021	80.00	percent	17.80	minus 1 sd	142.20	plus 1 sd	0.00
T0505_2	1.00	5.5 Female leadership									
I050501_2	1.00	5.5.1 Female politicians	1/1/2019	1/1/2021	37.00	percent	27.20	minus 1 sd	46.80	plus 1 sd	50.00
I050502_2	1.00	5.5.2 Female managers	1/1/2019	1/1/2021	30.00	percent	19.50	minus 1 sd	40.50	plus 1 sd	50.00
T0506_2	1.00	5.6 Female reproductive rights									
I050601_2	1.00	5.6.1 Female reproductive decisions	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
I050602_2	1.00	5.6.2 Female reproductive care	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
G05_2	**1.00**	**5 Gender Equality Moderately Impacted**	**59.11**	**48.96**	**42.25**	**2.79**	**2.61**	**11.25**	**33.59**	**4.87**	**59.00**
T1301_1	1.00	13.1 Disaster risk reduction									
I130101_1	1.00	13.1.1 Mortality	1/1/2019	1/1/2021	10.00	per 100000	8.50	minus 1 sd	11.50	plus 1 sd	5.00
I130102_1	1.00	13.1.2 SDRR target adoption	1/1/2019	1/1/2021	0.50	number un	0.10	minus 1 sd	0.90	plus 1 sd	1.00
I130103_1	1.00	13.1.3 Local disaster risk reduction	1/1/2019	1/1/2021	10.00	per 100000	8.50	minus 1 sd	11.50	plus 1 sd	5.00
T1302_1	1.00	13.2 Climate change policies									
I130201_1	1.00	13.2.1 Plan adoption	1/1/2019	1/1/2021	4.50	gdp per co	2.50	minus 1 sd	6.50	plus 1 sd	7.70
T1303_1	1.00	13.3 Improve local capacity									
I130301_1	1.00	13.3.1 Degree of education	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
I130302_1	1.00	13.3.2 Degree of capacity building	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
G13_1	**1.00**	**1 Climate Change Highly Impacted**	**44.30**	**39.74**	**35.03**	**2.68**	**2.52**	**6.47**	**43.32**	**6.20**	**76.93**
T1301_2	1.00	13.1 Disaster risk reduction									
I130101_2	1.00	13.1.1 Mortality	1/1/2019	1/1/2021	10.00	per 100000	8.50	minus 1 sd	11.50	plus 1 sd	5.00
I130102_2	1.00	13.1.2 SDRR target adoption	1/1/2019	1/1/2021	0.50	number un	0.10	minus 1 sd	0.90	plus 1 sd	1.00
I130103_2	1.00	13.1.3 Local disaster risk reduction	1/1/2019	1/1/2021	10.00	per 100000	8.50	minus 1 sd	11.50	plus 1 sd	5.00
T1302_2	1.00	13.2 Climate change policies									
I130201_2	1.00	13.2.1 Plan adoption	1/1/2019	1/1/2021	4.50	gdp per co	2.50	minus 1 sd	6.50	plus 1 sd	7.70
T1303_2	1.00	13.3 Improve local capacity									
I130301_2	1.00	13.3.1 Degree of education	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
I130302_2	1.00	13.3.2 Degree of capacity building	1/1/2019	1/1/2021	50.00	percent	44.50	minus 1 sd	55.50	plus 1 sd	100.00
G13_2	**1.00**	**13 Climate Change Moderately Impacted**	**59.11**	**48.96**	**42.25**	**2.79**	**2.61**	**11.25**	**33.59**	**4.87**	**59.00**
TR	1.00	SDG Score									

factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18	factor19	factor20	factor21
bathroom	**land**	**hhlabel**	**hhname**	**hhpopcour**	**hhunits**	**lifecyclest**	**allocation**				
10.00	5.00	5.00	mean	1.60	sd	normal	1.00	2.00	3.00	modzscore	8.00
0.50	2.50	2.50	mean	0.70	sd	normal	1.00	2.00	3.00	modzscore	3.80
12.00	4.00	4.00	mean	7.00	sd	normal	1.00	2.00	3.00	modzscore	35.00
52.03	**1.68**	**sdg1high**	**each hh**	**100000.00**	**households**						
5.00	5.00	5.00	mean	0.80	sd	normal	1.00	2.00	3.00	modzscore	8.00
0.25	2.50	2.50	mean	0.35	sd	normal	1.00	2.00	3.00	modzscore	3.80
6.00	2.00	2.00	mean	3.50	sd	normal	1.00	2.00	3.00	modzscore	35.00
62.50	**1.99**	**sdg1mod**	**each hh**	**100000.00**	**households**						
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
15.00	5.00	5.00	mean	1.34	sd	normal	1.00	2.00	3.00	modzscore	6.70
3.00	2.00	2.00	mean	0.42	sd	normal	1.00	2.00	3.00	modzscore	2.10
5.00	4.00	4.00	mean	0.14	sd	normal	1.00	2.00	3.00	modzscore	0.70
4.00	2.00	2.00	mean	0.42	sd	normal	1.00	2.00	3.00	modzscore	2.10
6.00	4.00	4.00	mean	0.14	sd	normal	1.00	2.00	3.00	modzscore	0.70
16.00	16.00	16.00	mean	15.50	sd	normal	1.00	2.00	3.00	modzscore	62.20
7.40	8.00	7.00	mean	2.00	sd	normal	1.00	2.00	3.00	modzscore	9.80
6.00	9.00	6.00	mean	2.10	sd	normal	1.00	2.00	3.00	modzscore	10.50
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
52.03	**1.68**	**sdg5high**	**each hh**	**100000.00**	**households**						
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
15.00	5.00	5.00	mean	1.34	sd	normal	1.00	2.00	3.00	modzscore	6.70
3.00	2.00	2.00	mean	0.42	sd	normal	1.00	2.00	3.00	modzscore	2.10
5.00	4.00	4.00	mean	0.14	sd	normal	1.00	2.00	3.00	modzscore	0.70
4.00	2.00	2.00	mean	0.42	sd	normal	1.00	2.00	3.00	modzscore	2.10
6.00	4.00	4.00	mean	0.14	sd	normal	1.00	2.00	3.00	modzscore	0.70
16.00	16.00	16.00	mean	15.50	sd	normal	1.00	2.00	3.00	modzscore	62.20
7.40	8.00	7.00	mean	2.00	sd	normal	1.00	2.00	3.00	modzscore	9.80
6.00	9.00	6.00	mean	2.10	sd	normal	1.00	2.00	3.00	modzscore	10.50
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
62.50	**1.99**	**sdg5mod**	**each hh**	**100000.00**	**households**						
2.00	1.00	1.00	mean	0.30	sd	normal	1.00	2.00	3.00	modzscore	1.50
0.10	0.10	0.10	mean	0.05	sd	normal	1.00	2.00	3.00	modzscore	0.40
2.00	1.00	1.00	mean	0.30	sd	normal	1.00	2.00	3.00	modzscore	1.50
0.90	1.00	1.00	mean	0.50	sd	normal	1.00	2.00	3.00	modzscore	2.00
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
52.03	**1.68**	**sdg13high**	**each hh**	**100000.00**	**households**						
2.00	1.00	1.00	mean	0.30	sd	normal	1.00	2.00	3.00	modzscore	1.50
0.10	0.10	0.10	mean	0.05	sd	normal	1.00	2.00	3.00	modzscore	0.40
2.00	1.00	1.00	mean	0.30	sd	normal	1.00	2.00	3.00	modzscore	1.50
0.90	1.00	1.00	mean	0.50	sd	normal	1.00	2.00	3.00	modzscore	2.00
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
10.00	5.00	5.00	mean	1.40	sd	normal	1.00	2.00	3.00	modzscore	5.50
62.50	**1.99**	**sdg13mod**	**each hh**	**100000.00**	**households**						

- **factor1:** benchmark date
- **factor2**. actual date
- **factor3**: benchmark stock most likely amount (QASY-like metric preferred but MCDA acceptable)
- **factor4**: hotspots unit of measurement
- **factor5**: benchmark stock low amount
- **factor6**: benchmark stock low unit
- **factor7**: benchmark stock high amount
- **factor8**: benchmark stock high unit
- **factor9**: target stock most likely amount at end of all transition states (i.e. 2030)
- **factor10**: target flow most likely amount for current transition state as of actual date (i.e. 2019 to 2020)
- **factor11**: actual flow at end date for current transition state (although this is a flow measurement, this metric is added to the benchmark stock to calculate an end-of-period actual stock measurement)
- **factor12**: actual low flow at end date
- **factor13**: low unit of measurement
- **factor14**: actual high flow at end date
- **factor15**: high unit of measurement
- **factor16**: distribution type; if actual flows are being measured using multiple observations and PRA techniques (shape parameter = low flow amount; scale = high flow amount; 3 parameter distributions, such as triangular, use the 3 flow amounts in order)
- **factor17**: certainty1; severity, and probable consequence, of this SDG risk on this population/land use as of end date
- **factor18**: certainty2; likelihood of this SDG risk on this population/land use as of end date
- **factor19:** certainty3; degree of sustainability of this stock inventory. The Sustainable Stock Thresholds introduced in Appendix B can be used for this rating.-The Sustainable

Flow Thresholds in that appendix can be used with the accompanying operating budget's certainty property.

- **factor20:** normtype**;** type of normalization to use with the Indicators for each Goal (not each Target because most Targets have 1 Indicator); rules include:
    - if the normtype is a double data type acts as a straight multiplier (i.e. the multiplier is a custom normalization value);
    - if the normtype is text, options include none, zscore, minmax, logistic, logit, tanh, and modz;
    - modzscore is a new option added to this release that carries out the OECD's modified z-score and requires factor21 to be a normalization standard deviation**;**
- **factor21:** weight**;** acts as multiplier for each normalized value; rules include:
    - if the normalized values are not being weighted, set this value to 1
    - if factor20's normtype = modz, must be the normalization standard deviation for the target stock (refer to Appendix B)

SDG Categorical Index properties.

Summations of Indicators with no separate initial properties

SDG Locational Index properties.

- **factor1 to factor 11:** aggregated socioeconomic and landscape properties (see SPA3 for examples)
- **factor12:** generic stakeholder group label (identifies additional background socioeconomic and landscape properties)
- **factor13**: generic stakeholder group name
- **factor14**: stakeholder amount
- **factor15**: stakeholder unit of measurement

Indicator.MathResult. The algorithm adds the following final 11 calculated columns of data. This example used normal distributions for each measured Indicator to generate the initial Most Likely, Low, and High, calculations. These initial calculations, which measure Actual Current

Stocks (i.e. not Flows) are then normalized, in this example, using the OECD's modified z-score, to generate the calculated Indicators shown in the table. The Targets, Goals, and Total Risk Index are summations of their normalized Indicators. The certainty columns reflect averages of Indicators. The final 2 columns measure the percent of the target flow and target stock achieved by each Indicator while the Targets and Goals reflect averages.

label	locatio	risks_and_impacts	qtmost	qtmostunit	qtlow	qtlowunit	qthigh	qthighunit	certainty1	certainty2	certainty3	percentflo	percentsto
SDG	0	HH Chars Goal 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T0101_1	1	1.1 Eradicate extreme pov	6.88	actual mos	5.87	lower 80 %	7.90	upper 80 %	1.00	2.00	3.00	50.63	55.06
I010101_1	1	1.1.1 Population below hh	6.88	actual mos	5.87	lower 80 %	7.90	upper 80 %	1.00	2.00	3.00	50.63	55.06
T0102_1	1	1.2 Reduce all poverty	-0.02	actual mos	0.00	lower 80 %	-0.03	upper 80 %	1.00	2.00	3.00	505.54	98.58
I010201_1	1	1.2.1 Population below pov	-0.02	actual mos	0.00	lower 80 %	-0.03	upper 80 %	1.00	2.00	3.00	505.54	98.58
T0103_1	1	1.3 Establish social protect	-1.02	actual mos	-0.46	lower 80 %	-1.58	upper 80 %	1.00	2.00	3.00	35.64	64.28
I010301_1	1	1.3.1 Population covered	-1.02	actual mos	-0.46	lower 80 %	-1.58	upper 80 %	1.00	2.00	3.00	35.64	64.28
G01_1	1	1 Poverty High	5.84	sdg per po	5.41	lower 80 %	6.28	upper 80 %	1.00	2.00	3.00	197.27	72.64
T0101_2	1	1.1 Eradicate extreme pov	3.75	actual mos	2.75	lower 80 %	4.76	upper 80 %	1.00	2.00	3.00	100.63	30.03
I010101_2	1	1.1.1 Population below hh	3.75	actual mos	2.75	lower 80 %	4.76	upper 80 %	1.00	2.00	3.00	100.63	30.03
T0102_2	1	1.2 Reduce all poverty	0.33	actual mos	0.00	lower 80 %	0.67	upper 80 %	1.00	2.00	3.00	1005.56	150.56
I010201_2	1	1.2.1 Population below pov	0.33	actual mos	0.00	lower 80 %	0.67	upper 80 %	1.00	2.00	3.00	1005.56	150.56
T0103_2	1	1.3 Establish social protect	-1.94	actual mos	0.18	lower 80 %	-4.06	upper 80 %	1.00	2.00	3.00	35.65	32.14
I010301_2	1	1.3.1 Population covered	-1.94	actual mos	0.18	lower 80 %	-4.06	upper 80 %	1.00	2.00	3.00	35.65	32.14
G01_2	1	1 Poverty Moderate	2.15	sdg per po	2.93	lower 80 %	1.37	upper 80 %	1.00	2.00	3.00	380.61	70.91
T0501_1	1	5.1 End female discriminat	3.78	actual mos	3.59	lower 80 %	3.96	upper 80 %	1.00	2.00	3.00	42.12	67.55
I050101_1	1	5.1.1 Degree of legal frame	-8.17	actual mos	-7.34	lower 80 %	-9.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
I050102_1	1	5.1.2 Gender wage gap	11.95	actual mos	10.94	lower 80 %	12.96	upper 80 %	1.00	2.00	3.00	33.69	80.05
T0502_1	1	5.2 End female violence	49.54	actual mos	47.52	lower 80 %	51.56	upper 80 %	1.00	2.00	3.00	73.67	23.01
I050201_1	1	5.2.1 Female violence by p	8.10	actual mos	7.09	lower 80 %	9.12	upper 80 %	1.00	2.00	3.00	67.22	17.02
I050202_1	1	5.2.2 Female violence by o	41.44	actual mos	40.42	lower 80 %	42.45	upper 80 %	1.00	2.00	3.00	80.11	29.01
T0503_1	1	5.3 End female harm	59.06	actual mos	57.04	lower 80 %	61.09	upper 80 %	1.00	2.00	3.00	58.59	28.01
I050301_1	1	5.3.1 Female youth at mar	10.48	actual mos	9.47	lower 80 %	11.50	upper 80 %	1.00	2.00	3.00	50.42	22.02
I050302_1	1	5.3.2 Female genital multil	48.58	actual mos	47.57	lower 80 %	49.59	upper 80 %	1.00	2.00	3.00	66.76	34.01
T0504_1	1	5.4 Unpaid work	1.55	actual mos	0.54	lower 80 %	2.57	upper 80 %	1.00	2.00	3.00	103.84	96.61
I050401_1	1	5.4.1 Unpaid domestic and	1.55	actual mos	0.54	lower 80 %	2.57	upper 80 %	1.00	2.00	3.00	103.84	96.61
T0505_1	1	5.5 Female leadership	-1.93	actual mos	-1.40	lower 80 %	-2.46	upper 80 %	1.00	2.00	3.00	98.53	80.16
I050501_1	1	5.5.1 Female politicians	-0.60	actual mos	-0.47	lower 80 %	-0.74	upper 80 %	1.00	2.00	3.00	95.66	88.16
I050502_1	1	5.5.2 Female managers	-1.33	actual mos	-0.94	lower 80 %	-1.72	upper 80 %	1.00	2.00	3.00	101.39	72.17
T0506_1	1	5.6 Female reproductive ri	-16.34	actual mos	-14.69	lower 80 %	-18.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
I050601_1	1	5.6.1 Female reproductive	-8.17	actual mos	-7.34	lower 80 %	-9.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
I050602_1	1	5.6.2 Female reproductive	-8.17	actual mos	-7.34	lower 80 %	-9.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
G05_1	1	5 Gender Equality Highly In	95.66	sdg per po	92.60	lower 80 %	98.72	upper 80 %	1.00	2.00	3.00	71.22	58.40
T0501_2	1	5.1 End female discriminat	3.78	actual mos	3.59	lower 80 %	3.96	upper 80 %	1.00	2.00	3.00	42.12	67.55

In this example, the final Total Score (TR) signals that SDG Indicators are about 178 standard deviations short of their targets. Given that the Targets, Goals, and Total Scores, aggregate both negative and positive Indicator quantities, some highly performing Indicators can mask their non-performing sibling Indicators. This stylized data is unlikely to correspond with real world data, but it illustrates how non-performing SDG Indicators, or excessive investments in high-performing, or non-equitable, M&A Actions, can be targeted for further investment or disinvestment. These Indicators serve the same purpose as Example 4's Outputs and Outcomes

and are added directly to the 2nd TEXT operating budget, as demonstrated by Examples 4A, 4B, and 4C, to complete Cost Effectiveness Analyses for each impacted stakeholder group.

G13_1	1	1 Climate Change Highly Im	-10.41	sdg per po	-8.79	lower 80 %	-12.03	upper 80 %	1.00	2.00	3.00	77.20	97.88
T1301_2	1	13.1 Disaster risk reductior	7.02	actual mos	6.58	lower 80 %	7.46	upper 80 %	1.00	2.00	3.00	67.73	166.89
I130101_2	1	13.1.1 Mortality	4.01	actual mos	3.46	lower 80 %	4.56	upper 80 %	1.00	2.00	3.00	50.60	220.24
I130102_2	1	13.1.2 SDRR target adoptic	-1.00	actual mos	-0.33	lower 80 %	-1.66	upper 80 %	1.00	2.00	3.00	102.00	60.20
I130103_2	1	13.1.3 Local disaster risk re	4.01	actual mos	3.46	lower 80 %	4.56	upper 80 %	1.00	2.00	3.00	50.60	220.24
T1302_2	1	13.2 Climate change polici	-1.09	actual mos	-0.69	lower 80 %	-1.49	upper 80 %	1.00	2.00	3.00	113.31	71.69
I130201_2	1	13.2.1 Plan adoption	-1.09	actual mos	-0.69	lower 80 %	-1.49	upper 80 %	1.00	2.00	3.00	113.31	71.69
T1303_2	1	13.3 Improve local capacity	-16.34	actual mos	-14.69	lower 80 %	-18.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
I130301_2	1	13.3.1 Degree of educatior	-8.17	actual mos	-7.34	lower 80 %	-9.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
I130302_2	1	13.3.2 Degree of capacity b	-8.17	actual mos	-7.34	lower 80 %	-9.00	upper 80 %	1.00	2.00	3.00	50.56	55.06
G13_2	1	13 Climate Change Modera	-10.41	sdg per po	-8.79	lower 80 %	-12.03	upper 80 %	1.00	2.00	3.00	77.20	97.88
TR	1	SDG Score	178.50	sdg per po	175.90	lower 80 %	181.00	upper 80 %	1.00	2.00	3.00	145.79	76.02

Indicator 2. TEXT dataset. **Nexus Operating Budget**. This Example 4-style budget employs a nexus, or subset, of SDG-related M&A Actions, or best management policies and practices. This reference recommends that, when possible, M&A Actions target the specific stakeholder groups identified in the associated capital budget. M&A Actions must be appropriate for the socioeconomic and landscape characteristics of the stakeholders and geographies. The following table allocates the M&A Actions according to their linkages to separate SDG Indicators. For example, M&A Action 1 causes impacts on 2 SDG Indicators, therefore it's been inserted 2x and allocated (factor6) 50% to each indicator. M&A Action 6 impacts 4 SDG Indicators and has been inserted 4 times with allocations of 50%, 15%, 20%, and 15%, respectively.

Appendix B points out that, even without these explicit allocations, Machine Learning algorithms might be able to deduce the allocations themselves (i.e. by training them with enough high quality datasets). Appendix 12's budgets include optional URL properties where these one-to-many linkages can be stored in TEXT files.

label	locati	risks_and_indicators	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
TAA_I010101__1	**1**	**M&A Action 1**	**6.883**	**5.871**	**7.90**	**4**	**1.1.1 Population be**	**0.5**	**0**	**0**	**0**	**2**	**4**
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAA_I010201_1	**1**	**M&A Action 1**	**-0.01903**	**-0.00449**	**-0.03356**	**4**	**1.2.1 Population be**	**0.5**	**0**	**0**	**0**	**2**	**4**
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAB_I010201_1	1	M&A Action 2	-0.01903	-0.00449	-0.03356	4	1.2.1 Population bel	1	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAC_I010301_1	1	M&A Action 3	3.754	2.748	4.76	4	1.3.1 Population cov	1	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAD_I010101_1	1	M&A Action 4	6.883	5.871	7.9	4	1.1.1 Population bel	1	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
G01	**1**	**Poverty Highly Impacted**	**0**	**0**	**0**	**0**	**total annual cost**	**none**	**0**	**1**	**1**	**0**	**0**
TAE_I050101_1	1	M&A Action 5	-8.172	-7.343	-9	4	5.1.1 Degree of lega	1	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050102_1	1	M&A Action 6	11.95	10.94	12.96	1	5.1.2 Gender wage g	0.5	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050401_1	1	M&A Action 6	1.553	0.5388	2.57	4	5.4.1 Unpaid domes	0.15	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050501_1	1	M&A Action 6	-0.6042	-0.4682	-0.74	4	5.5.1 Female politici	0.2	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050502_1	1	M&A Action 6	-1.325	-0.9352	-1.716	4	5.5.2 Female manag	0.15	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAG_I050302_1	1	M&A Action 7	48.58	47.57	49.59	4	5.3.2 Female genital	0.33	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAG_I050601_1	1	M&A Action 7	-8.172	-7.343	-9	4	5.6.1 Female reprod	0.33	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAG_I050602_1	1	M&A Action 7	-8.172	-7.343	-9	4	5.6.2 Female reprod	0.34	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAH_I050201_1	1	M&A Action 8	8.103	7.092	9.115	4	5.2.1 Female violenc	0.6	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
TAH_I050202_1	1	M&A Action 8	41.44	40.42	42.45	4	5.2.2 Female violenc	0.25	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
TAH_I050301_1	1	M&A Action 8	10.48	9.472	11.5	4	5.3.1 Female youth a	0.15	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
G02	**1**	**Gender Highly Impacted**	**0**	**0**	**0**	**0**	**total annual cost**	**none**	**0**	**1**	**1**	**0**	**0**
TAI_I130101_1	1	M&A Action 9	4.008	3.456	4.56	4	13.1.1 Mortality	0.6	0	0	0	2	4

The Moderately Impacted Stakeholder budget displayed in the bottom section of the table uses the suffix "_2" in the labels to distinguish them from the previous table's Highly Impacted Stakeholders. Although these M&A Actions use arbitrary labels (i.e. TAA combined with the SDG Indicator it effects), national planning must use uniform labeling conventions across all of the communities being rated.

G02	1	Gender Moderately Impacte	0	0	0	0	total annual cost	none	0	1	1	0	0
TAI_I130101_2	1	M&A Action 9	4.008	3.456	4.56	4	13.1.1 Mortality	0.6	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAI_I130102_2	1	M&A Action 9	-0.995	-0.3291	-1.661	4	13.1.2 SDRR target a	0.4	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAJ_I130101_2	1	M&A Action 10	4.008	3.456	4.56	4	13.1.1 Mortality	0.5	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAJ_I130102_2	1	M&A Action 10	-0.995	-0.3291	-1.661	4	13.1.2 SDRR target a	0.5	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAK_I130103_2	1	M&A Action 11	4.008	3.456	4.56	4	13.1.3 Local disaster	1	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAL_I130201_2	1	M&A Action 12	-1.09	-0.6894	-1.491	4	13.2.1 Plan adoptior	0.33	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
TAL_I130301_2	1	M&A Action 12	-8.172	-7.343	-9	4	13.3.1 Degree of edu	0.33	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
TAL_I130302_2	1	M&A Action 12	-8.172	-7.343	-9	4	13.3.2 Degree of cap	0.34	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
G13	1	Climate Moderatel Impacte	0	0	0	0	total annual cost	none	0	1	1	0	0
TR2	1	Moderately Impacted Stake	0	0	0	0	0	none	0	1	1	0	0

Indicator.MathResult. The last 3 columns of the following MathResults divided each Categorical Index's SDG Indicator by the cost of the M&A Action, resulting in a total cost per 1 unit SDG Indicator (i.e. cost per normalized standard deviation distance from SDG targeted Indicator amount). Factor4 records the certainty, or Stock Flow Rating, for each SDG Indicator.

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	QTMost	QTLow	QTUp
TAA_I0101	1.00	M&A Actic	6.88	5.87	7.90	4.00	1.1.1 Populatior	0.50	0.00	0.00	0.00	3.00	3.00	21792.82	22994.38	22784.81
IF1A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
IF1B	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
IF1C	1.00	Input 03	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
TAA_I0102	1.00	M&A Actic	-0.02	0.00	-0.03	4.00	1.2.1 Populatior	0.50	0.00	0.00	0.00	3.00	3.00	-7894736.84	-30000000.00	-5357142.86
IF1A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
IF1B	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
IF1C	1.00	Input 03	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
TAB_I0102	1.00	M&A Actic	-0.02	0.00	-0.03	4.00	1.2.1 Populatior	1.00	0.00	0.00	0.00	3.00	3.00	-10526315.79	-40000000.00	-7142857.14
IF1D	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF1E	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
TAC_I0103	1.00	M&A Actic	3.75	2.75	4.76	4.00	1.3.1 Populatior	1.00	0.00	0.00	0.00	3.00	3.00	133191.26	163755.46	126050.42
IF2A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2B	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2C	1.00	Input 03	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2D	1.00	Input 04	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2E	1.00	Input 05	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
TAD_I0101	1.00	M&A Actic	6.88	5.87	7.90	4.00	1.1.1 Populatior	1.00	0.00	0.00	0.00	3.00	3.00	14528.55	15329.59	15189.87
IF3A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00

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G02	1.00	Gender Moderately	95.66	92.60	98.73	3.73	total annual cos	none	1100000.00	990000.00	1320000.00	3.00	3.00	11498.96	10691.10	13369.93
TAI_I1301	1.00	M&A Action 9	4.01	3.46	4.56	4.00	13.1.1 Mortality	0.60	0.00	0.00	0.00	3.00	3.00	44910.18	46875.00	47368.42
IF1A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	60000.00	54000.00	72000.00
IF1B	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	60000.00	54000.00	72000.00
IF1C	1.00	Input 03	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	60000.00	54000.00	72000.00
TAI_I1301	1.00	M&A Action 9	-1.00	-0.33	-1.66	4.00	13.1.2 SDRR tar	0.40	0.00	0.00	0.00	3.00	3.00	-120603.02	-328167.73	-86694.76
IF1A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	40000.00	36000.00	48000.00
IF1B	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	40000.00	36000.00	48000.00
IF1C	1.00	Input 03	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	40000.00	36000.00	48000.00
TAJ_I1301	1.00	M&A Action 10	4.01	3.46	4.56	4.00	13.1.1 Mortality	0.50	0.00	0.00	0.00	3.00	3.00	24950.10	26041.67	26315.79
IF1D	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
IF1E	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
TAJ_I1301	1.00	M&A Action 10	-1.00	-0.33	-1.66	4.00	13.1.2 SDRR tar	0.50	0.00	0.00	0.00	3.00	3.00	-100502.51	-273473.11	-72245.64
IF1D	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
IF1E	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	50000.00	45000.00	60000.00
TAK_I1301	1.00	M&A Action 11	4.01	3.46	4.56	4.00	13.1.3 Local dis	1.00	0.00	0.00	0.00	3.00	3.00	124750.50	130208.33	131578.95
IF2A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2B	1.00	Input 02	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2C	1.00	Input 03	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2D	1.00	Input 04	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
IF2E	1.00	Input 05	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	100000.00	90000.00	120000.00
TAL_I1302	1.00	M&A Action 12	-1.09	-0.69	-1.49	4.00	13.2.1 Plan adop	0.33	0.00	0.00	0.00	3.00	3.00	-30275.23	-43080.94	-26559.36
IF3A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	33000.00	29700.00	39600.00
TAL_I1303	1.00	M&A Action 12	-8.17	-7.34	-9.00	4.00	13.3.1 Degree o	0.33	0.00	0.00	0.00	3.00	3.00	-4038.18	-4044.67	-4400.00
IF3A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	33000.00	29700.00	39600.00
TAL_I1303	1.00	M&A Action 12	-8.17	-7.34	-9.00	4.00	13.3.2 Degree o	0.34	0.00	0.00	0.00	3.00	3.00	-4160.55	-4167.23	-4533.33
IF3A	1.00	Input 01	1000.00	900.00	1200.00	100.00	units	none	0.00	1.00	1.00	3.00	3.00	34000.00	30600.00	40800.00
G13	1.00	Climate Moderatel	-7.40	-5.67	-9.13	4.00	total annual cos	none	1100000.00	990000.00	1320000.00	3.00	3.00	-148648.65	-174738.77	-144530.82
TR2	1.00	Moderately Impact	105.74	101.42	110.09	3.91	0.00	none	3300000.00	2970000.00	3960000.00	3.00	3.00	31207.80	29285.38	35970.96

A more typical dataset for community policy planning employs the M&A Actions listed in the following types of datasets (FAO, 2018). Although FAO's actions are policies that target countries, a more comprehensive plan adjusts their use to local community policy use. These Actions were not used in this example because of the lack of supporting data.

KEY POLICIES AND PRACTICES FOR ENGAGING AGRICULTURE, FORESTRY AND FISHERIES IN THE 2030 AGENDA

ACTION AREA	Increase productivity, employment and value addition in food systems	Protect and enhance natural resources	Improve livelihoods and foster inclusive economic growth	Enhance the resilience of people, communities and ecosystems	Adapt governance to new challenges
CROPS	1. Genetically diverse portfolio of varieties 2. Conservation agriculture 3. Judicious use of organic and inorganic fertilizers, improved soil moisture management 4. Improved water productivity, precision irrigation 5. Integrated pest management (IPM)	1. Use better practices for biodiversity, such as in situ and ex situ conservation of plant genetic resources, IPM… 2. Use better practices for soil: land rehabilitation, appropriate cropping systems… 3. Use better practices for water management: deficit irrigation, preventing water pollution… 4. Set payments for using and for providing environmental services such as pollinators, carbon sequestration… 5. Set policies, laws, incentives, and enforcement to promote the above	1. Increase/protect farmers' access to resources (e.g. through equitable land and water tenure systems) 2. Increase farmers' access to markets through capacity-building, credit, infrastructure 3. Increase rural job opportunities (e.g. in small and medium enterprises sustainability and related activities) 4. Improve rural nutrition: production of more and affordable nutritious and diverse foods, including fruits & vegetables	1. Increase/protect farmers' access to resources (e.g. through equitable land and water tenure systems) 2. Increase farmers' access to markets through capacity-building, credit, infrastructure 3. Increase rural job opportunities (e.g. in small and medium enterprises sustainability and related activities) 4. Improve rural nutrition: production of more and affordable nutritious and diverse foods, including fruits & vegetables	1. Increase effective participation 2. Encourage formation of associations 3. Increase frequency and content of consultations among stakeholders 4. Develop decentralized capacity
LIVESTOCK	1. Genetically diverse base of breeds 2. Improved resource use efficiency 3. Balanced and precision animal feeding and nutrition 4. Integrated animal health control	1. Conserve animal genetics in situ and ex situ 2. Use grassland for biodiversity, carbon storage and water services 3. Protect water from pollution through waste management 4. Use better practices for reduced emission intensity 5. Set payments for using and for providing environmental services (e.g. grazing fees) 6. Set policies, laws, incentives and enforcement to promote the above	1. Increase/protect farmers' access to resources, such as pasture, water, credit 2. Increase farmers' access to markets through capacity-building, credit, infrastructure 3. Increase rural job opportunities (e.g. in small and medium enterprises sustainability and related activities) 4. Improve rural nutrition: production of more and affordable nutritious and diverse foods, including fruits & vegetables	1. Generalise risk assessment/ management and communication 2. Prepare for/adapt to climate change 3. Respond to market volatility, (e.g. encouraging flexibility in production systems and savings) 4. Contingency planning for droughts, floods, and pest outbreaks; development; social safety nets	1. Increase effective participation 2. Encourage formation of associations 3. Increase frequency and content of consultations among stakeholders 4. Develop decentralized capacity
FORESTRY	1. Sustainable management of natural and planted forests 2. Forest area increase and slowing deforestation 3. Improved efficiency of use of wood-based energy 4. Development of innovative renewable forest products 5. Tree improvement to support productivity and resilience	onserve biodiversity and forest genetic resources 2. Restore and rehabilitate degraded landscapes 3. Enhance the role of forests in soil protection and conservation 4. Enhance the role of forests in the protection and conservation of water resources 5. Use reduced impact harvesting techniques 6. Certification of forest management	1. Improve forest tenure rights and access to forest resources 2. Promote engagement of local stakeholders, including communities and women's groups 3. Promote the development of small and medium-size enterprises 4. Provide forest-based employment including health and safety provisions 5. Establish payment schemes for environmental services (PES) 6. Integrate forestry in poverty reduction strategies	1. Increase resilience of ecosystems to biotic and abiotic hazards including climate change phenomena, pests and diseases, forests 2. Prevent the transmission of pathogens to other countries through international trade 3. Integrate risk prevention and management into sustainable land-use planning	1. Develop personnel and institutional capacity 2. Support good governance of rural areas 3. Decentralise decision-making and empower local communities to promote participatory forestry 4. Develop financial incentive packages to support private investment and enable equitable distribution of benefits 5. Apply mediation and other conflict resolution mechanisms in resource governance 6. Enhance communication to

1st dataset to 2nd dataset Linkages (BMP proxy measurements). The goal of these algorithms is to transparently identify the best management policies and practices that cause the targeted SDG accomplishments documented in the 1st dataset to become actual accomplishments for impacted stakeholder groups. The following image (FAO, 2018) demonstrates typical background, proxy, SDG policy-induced impacts and evidence that planners use to predict final

SDG target achievement. This evidence (i.e. major or contributory) is used by sustainability workers to make the linkages, or allocations, between the 2 datasets. Planners adjust the allocations, and change the M&A Actions, along with their sustainability advice, as better evidence is gathered and reported.

HOW THE FIVE PILLARS CONTRIBUTE TO ACHIEVING THE SDGs

MAJOR: Direct and substantial impact on one or more of the targets of the SDG;
CONTRIBUTE: Indirect or minor impact on one or more of the targets of the SDG.
(x.y): SDG target that is impacted by action area.

PILLAR	Increase productivity, employment and value addition in food systems	Protect and enhance natural resources	Improve livelihoods and foster inclusive economic growth	Enhance the resilience of people, communities and ecosystems	Adapt governance to new challenges
SDG 1: No Poverty	MAJOR: Most poor people live in rural areas and rely on agriculture and food systems for their livelihood. Increasing value addition and productivity translates in higher income and labour opportunities for poor rural populations. (1.4)	CONTRIBUTE: Natural resources degradation affects the poor in a disproportionate way. (1.4, 1.5)	MAJOR: Actions that aim at improving livelihoods and foster inclusive economic growth reduce poverty and inequalities. (1.1, 1.2, 1.3, 1.4, 1.5)	CONTRIBUTE: The poor are also the most vulnerable to shocks. Focusing on the poor in prevention, preparedness and response to shocks, and in strengthening their adaptive capacities can contribute to achieving SDG1 (1.5)	MAJOR: Policy frameworks to address poverty in agriculture sectors and are based on pro-poor and gender sensitive strategies, and support to accelerated investment in poverty reduction areas are central to SDG 1. (1.1, 1.b)
	Focus on: Facilitate access to productive resources, finance and services; Connect smallholders and family farmers to markets; Encourage diversification of production and income; Build producers' knowledge and develop their capacities	Focus on: Enhance soil health and restore land; Protect water and manage scarcity	Focus on: Empower people and fight inequalities; Promote secure tenure rights for men and women; Use social protection tools to enhance productivity and income; Improve nutrition and promote balanced diets	Focus on: Preventing and protecting against shocks: enhancing resilience; Preparing for and responding to shocks; Address and adapt to climate change	Focus on: Enhance policy dialogue and coordination; Strengthen innovation systems; Adapt and improve investment and finance; Strengthen the enabling environment and reform the institutional framework
SDG 2: Zero hunger	MAJOR: SDG 2 is predicated on food security, nutrition and sustainable agriculture. Productive agriculture sectors are a pre-requisite for achieving SDG 2 (2.1, 2.2, 2.3, 2.4)	MAJOR: to achieve the sustainable agriculture target of SDG 2 implies moving towards better use of natural resources and restoration of degraded ecosystems (2.4, 2.5, 2.a)	MAJOR: Actions that aim at improving livelihoods and foster inclusive economic growth in most cases contribute to enhanced food security (2.1, 2.2, 2.3, 2.4)	MAJOR: actions aiming at enhancing the preparedness and response to shocks help reducing the burden and impacts of food crises, thus contributing to food security (2.4)	MAJOR: Cross-sectoral coordination, development of means of implementation and partnerships are central to achieving SDG 2 targets (2.1, 2.3, 2.4, 2.a)
	Focus on: Facilitate access to productive resources, finance and services; Connect smallholders and family farmers to markets; Encourage diversification of production and income; Build producers' knowledge and develop their capacities	Focus on: Enhance soil health and restore land; Protect water and manage scarcity; Mainstream biodiversity conservation and protect ecosystem functions; Reduce losses, encouraging reuse and recycle, and promote sustainable consumption	Focus on: Empower people and fight inequalities; Promote secure tenure rights for men and women; Use social protection tools to enhance productivity and income; Improve nutrition and promote balanced diets	Focus on: Preventing and protecting against shocks: enhancing resilience; Preparing for and responding to shocks; Address and adapt to climate change; Strengthen ecosystem resilience	Focus on: Enhance policy dialogue and coordination; Strengthen innovation systems; Adapt and improve investment and finance; Strengthen the enabling environment and reform the institutional framework
SDG 3: Good health and well being			CONTRIBUTE: Nutrition education and better diets contribute to enhanced health and the reduction of non-communicable diseases (3.4)		
			Focus on: Improve nutrition and promote balanced diets		
SDG 4: Quality education	CONTRIBUTE: Access to extension services and knowledge contribute to skills development and capacity development (4.3, 4.4)		MAJOR: Empowerment of rural people implies enhancing the skills and capacities of youth and adults and contribute to employment, decent jobs and entrepreneurship. (4.3, 4.4)		
	Focus on: Build producers' knowledge and develop their capacities		Focus on: Empower people and fight inequalities		
			MAJOR: Women's economic		

Indicator.MathResult: **ICERs**. The following image (Kim et al, 2016) confirms that the goal of these results is to use Incremental Cost Effectiveness Ratios (ICERs) to support respected health care industry approaches to decision support. Pay particular attention to the QALYs (or DALYs) documented in the 3rd column. This algorithm uses the QASY's (or MCDAs) introduced in

Example 4B for these ICER measurements. Technically, they need additional stakeholder valuation techniques, similar to QALYs and DALYs, but they serve a minimal decision support role until that happens (as explained in Example 12 and Appendix A in Example 4B).

March 11, 2016

Table 15.5. Reference Case Cost-Effectiveness Results (Time Horizon: Lifetime; Costs and Health Effects Discounted at 3%)

Alternative	Total Costs[Ω] Mean (SE)	Total QALYs Mean (SE)	Incremental Cost[†]	Incremental Effectiveness[†] (QALYs)	NMB* Mean (SE)	Incremental NMB[†]	ICER[†] (Incr. Cost / Incr. QALY)
HEALTHCARE SECTOR PERSPECTIVE							
MM + Naltrexone	$250,745 (6,191)	15.01 (0.64)	-	-	$1,250,239 (66,599)	-	-
MM + Acamprosate	$251,817 (6,246)	14.97 (0.65)	$1,072	-0.04	$1,244,704 (65,876)	-$5,535	Dominated[‡]
MM + Naltrexone + Acamprosate	$252,802 (6,335)	14.93 (0.65)	$985	-0.04	$1,240,052 (64,972)	-$4,652	Dominated[‡]
MM Only	$252,938 (6,246)	14.91 (0.66)	$136	-0.02	$1,238,119 (66,963)	-$1,933	Dominated[‡]
CBI Only	$254,085 (6,380)	14.89 (0.67)	$1,147	-0.02	$1,234,822 (68,308)	-$3,297	Dominated[‡]
SOCIETAL PERSPECTIVE							
MM + Naltrexone	-$55,195 (20,181)	15.01 (0.64)	-	-	$1,556,178 (68,324)	-	-
MM + Acamprosate	-$54,213 (20,382)	14.97 (0.65)	$982	-0.04	$1,550,734 (69,208)	-$5,444	Dominated[‡]
MM + Naltrexone + Acamprosate	-$53,379 (20,564)	14.93 (0.65)	$834	-0.04	$1,546,233 (69,984)	-$4,501	Dominated[‡]
MM Only	-$53,373 (20,747)	14.91 (0.66)	$6	-0.02	$1,544,430 (70,410)	-$1,803	Dominated[‡]
CBI Only	-$52,219 (20,956)	14.89 (0.67)	$1,164	-0.02	$1,541,126 (71,617)	-$3,304	Dominated[‡]

The following table summarizes the CEA ratios, total costs, and total SDG Targets and Goals for the Highly Impacted Stakeholders. The last 3 columns measure Cost per Standard Deviation away from SDG Indicator targets. The certainty properties (i.e. factor4, factor10 and factor11) measure the average certainty of the numbers. The denominator in these CEA ratios come from the Capital Budget's Actual Stock metric (i.e. it's not a Flow metric). The Stock metric must correspond to the numerator's Cost metric.

Although this example does not use any discounting, the Cost discounting will also be applied to the Stock metric. This example is technically wrong because the M&A Actions' Costs are being applied to a Stock based on the addition of a single transition state's final Actual Flows to the starting Stock inventory. The Stocks should technically be discounted, or amortized, over the

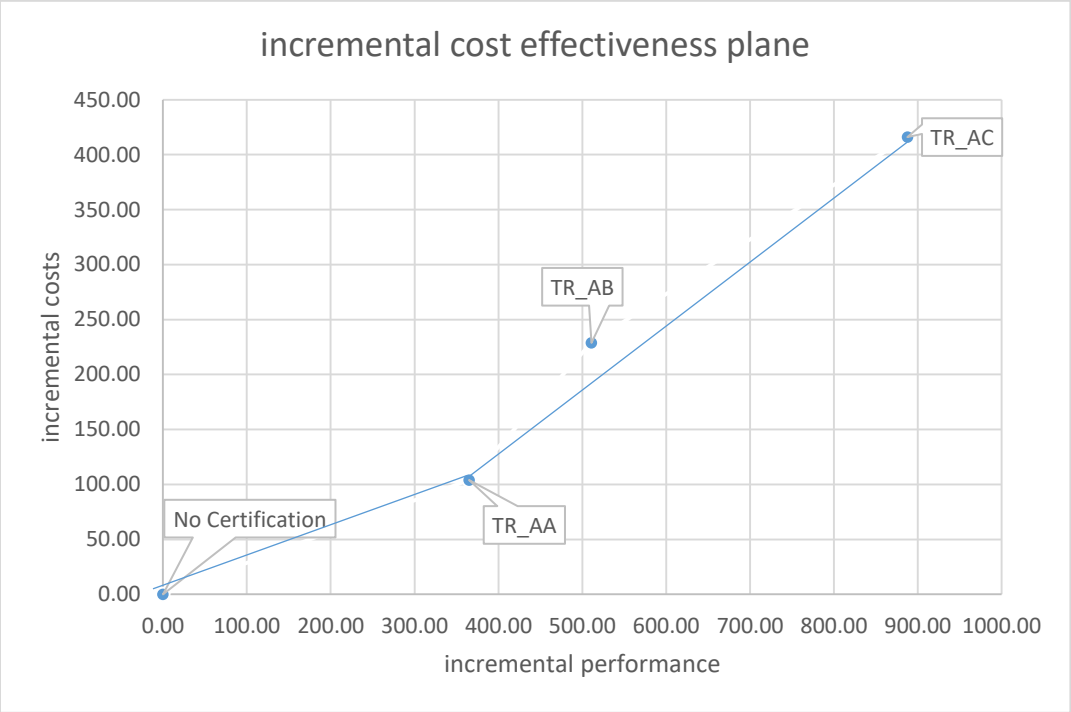
lifespan of the M&A Actions (i.e. the algorithm does so automatically when the properties are set correctly).

Negative normalized standard deviations signal the cost per standard deviation for Indicators that exceed their targets. Some of the high negative amounts in these columns may suggest overinvestment in M&A Actions. Positive normalized standard deviations signal the cost per standard deviation for Indicators that do not meet their targets. In general, these Indicators signal the need for additional investment in M&A Actions.

label	location	risks_and_indicators	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	QTMost	QTLow	QTUp
TAA_I010101__1	1.00	M&A Action 1	6.88	5.87	7.90	4.00	1.1.1 Popu	0.50	-	-	-	3	3	21,793	22,994	22,785
TAA_I010201_1	1.00	M&A Action 1	-0.02	0.00	-0.03	4.00	1.2.1 Popu	0.50	-	-	-	3	3	(7,894,737)	(30,000,000)	(5,357,143)
TAB_I010201_1	1.00	M&A Action 2	-0.02	0.00	-0.03	4.00	1.2.1 Popu	1.00	-	-	-	3	3	(10,526,316)	(40,000,000)	(7,142,857)
TAC_I010301_1	1.00	M&A Action 3	3.75	2.75	4.76	4.00	1.3.1 Popu	1.00	-	-	-	3	3	133,191	163,755	126,050
TAD_I010101_1	1.00	M&A Action 4	6.88	5.87	7.90	4.00	1.1.1 Popu	1.00	-	-	-	3	3	14,529	15,330	15,190
G01	1.00	Poverty Highly Impact	17.48	14.48	20.49	4.00	total annu	none	1,100,000	990,000	1,320,000	3	3	62,922	68,365	64,413
TAE_I050101_1	1.00	M&A Action 5	-8.17	-7.34	-9.00	4.00	5.1.1 Degr	1.00	-	-	-	3	3	(36,711)	(36,770)	(40,000)
TAF_I050102_1	1.00	M&A Action 6	11.95	10.94	12.96	1.00	5.1.2 Gend	0.50	-	-	-	3	3	8,368	8,227	9,259
TAF_I050401_1	1.00	M&A Action 6	1.55	0.54	2.57	4.00	5.4.1 Unpa	0.15	-	-	-	3	3	19,317	50,111	14,008
TAF_I050501_1	1.00	M&A Action 6	-0.60	-0.47	-0.74	4.00	5.5.1 Fema	0.20	-	-	-	3	3	(66,203)	(76,890)	(64,865)
TAF_I050502_1	1.00	M&A Action 6	-1.33	-0.94	-1.72	4.00	5.5.2 Fema	0.15	-	-	-	3	3	(22,642)	(28,871)	(20,979)
TAG_I050302_1	1.00	M&A Action 7	48.58	47.57	49.59	4.00	5.3.2 Fema	0.33	-	-	-	3	3	3,396	3,122	3,993
TAG_I050601_1	1.00	M&A Action 7	-8.17	-7.34	-9.00	4.00	5.6.1 Fema	0.33	-	-	-	3	3	(20,191)	(20,223)	(22,000)
TAG_I050602_1	1.00	M&A Action 7	-8.17	-7.34	-9.00	4.00	5.6.2 Fema	0.34	-	-	-	3	3	(20,803)	(20,836)	(22,667)
TAH_I050201_1	1.00	M&A Action 8	8.10	7.09	9.12	4.00	5.2.1 Fema	0.60	-	-	-	3	3	7,405	7,614	7,899
TAH_I050202_1	1.00	M&A Action 8	41.44	40.42	42.45	4.00	5.2.2 Fema	0.25	-	-	-	3	3	603	557	707
TAH_I050301_1	1.00	M&A Action 8	10.48	9.47	11.50	4.00	5.3.1 Fema	0.15	-	-	-	3	3	1,431	1,425	1,565
G02	1.00	Gender Highly Impact	95.66	92.60	98.73	3.73	total annu	none	1,100,000	990,000	1,320,000	3	3	11,499	10,691	13,370
TAI_I130101_1	1.00	M&A Action 9	4.01	3.46	4.56	4.00	13.1.1 Mo	0.60	-	-	-	3	3	44,910	46,875	47,368
TAI_I130102_1	1.00	M&A Action 9	-1.00	-0.33	-1.66	4.00	13.1.2 SDR	0.40	-	-	-	3	3	(120,603)	(328,168)	(86,695)
TAJ_I130101_1	1.00	M&A Action 10	4.01	3.46	4.56	4.00	13.1.1 Mo	0.50	-	-	-	3	3	24,950	26,042	26,316
TAJ_I130102_1	1.00	M&A Action 10	-1.00	-0.33	-1.66	4.00	13.1.2 SDR	0.50	-	-	-	3	3	(100,503)	(273,473)	(72,246)
TAK_I130103_1	1.00	M&A Action 11	4.01	3.46	4.56	4.00	13.1.3 Loc	1.00	-	-	-	3	3	124,750	130,208	131,579
TAL_I130201_1	1.00	M&A Action 12	-1.09	-0.69	-1.49	4.00	13.2.1 Plar	0.33	-	-	-	3	3	(30,275)	(43,081)	(26,559)
TAL_I130301_1	1.00	M&A Action 12	-8.17	-7.34	-9.00	4.00	13.3.1 Deg	0.33	-	-	-	3	3	(4,038)	(4,045)	(4,400)
TAL_I130302_1	1.00	M&A Action 12	-8.17	-7.34	-9.00	4.00	13.3.2 Deg	0.34	-	-	-	3	3	(4,161)	(4,167)	(4,533)
G13	1.00	Climate Highly Impact	-7.40	-5.67	-9.13	4.00	total annu	none	1,100,000	990,000	1,320,000	3	3	(148,649)	(174,739)	(144,531)
TR1	1.00	Highly Impacted Stake	105.74	101.42	110.09	3.91	0.00	none	3,300,000	2,970,000	3,960,000	3	3	31,208	29,285	35,971
TAA_I010101_2	1.00	M&A Action 1	6.88	5.87	7.90	4.00	1.1.1 Popu	0.50	-	-	-	3	3	21,793	22,994	22,785

Example 4A to 4C demonstrates how to use this raw data to produce the following types of cost effectiveness tables and graphs.

			Most Likely					Low Estimate				
label	location	risks_and_indicators	costs	incremental	performance	incremental	icer	costs	incremental	performance	incremental	icer
PC	1.00	Physical Capita	200.00		75.00			250.00		93.75		
EC	1.00	Economic Cap	70.00		100.00			87.50		125.00		
HC	1.00	Human Capita	250.00		190.00			167.01		237.50		
TR	**1.00**	**Cost per Unit**	**520.02**		**365.00**			**504.52**		**456.25**		
PC_AA	1.00	Physical Capita	240.00	40.00	150.00	75.00	0.53	180.00	-70.00	112.50	18.75	-3.73
EC_AA	1.00	Economic Cap	84.00	14.00	200.00	100.00	0.14	63.00	-24.50	150.00	25.00	-0.98
HC_AA	1.00	Human Capita	300.01	50.01	380.00	190.00	0.26	225.01	58.00	285.00	47.50	1.22
TR_AA	**1.00**	**Cost per Unit**	**624.00**	**103.99**	**730.00**	**365.00**	**0.28**	**468.00**	**-36.52**	**547.50**	**91.25**	**-0.40**
PC_AB	1.00	Physical Capita	288.00	88.00	180.00	105.00	0.84	360.00	110.00	225.00	131.25	0.84
EC_AB	1.00	Economic Cap	100.80	30.80	240.00	140.00	0.22	126.00	38.50	300.00	175.00	0.22
HC_AB	1.00	Human Capita	360.01	110.01	456.00	266.00	0.41	235.75	68.74	403.75	166.25	0.41
TR_AB	**1.00**	**Cost per Unit**	**748.80**	**228.79**	**876.00**	**511.00**	**0.45**	**721.73**	**217.21**	**928.75**	**472.50**	**0.46**
PC_AC	1.00	Physical Capita	360.00	160.00	257.40	182.40	0.88	450.00	200.00	321.75	228.00	0.88
EC_AC	1.00	Economic Cap	125.99	55.99	343.20	243.20	0.23	157.49	69.99	429.00	304.00	0.23
HC_AC	1.00	Human Capita	450.00	200.00	652.08	462.08	0.43	291.99	124.98	526.30	288.80	0.43
TR_AC	**1.00**	**Cost per Unit**	**936.00**	**415.99**	**1252.68**	**887.68**	**0.47**	**899.55**	**395.03**	**1277.05**	**820.80**	**0.48**



The health care industry generates ICERs using data that has been collected with a great deal of rigor. SDG data, especially the environmental indicators, may have much less certainty, requiring particular attention to the 3 certainty factors (factor4 = sustainable flow rating, with factor10 and factor11 defined by the network). Further analysis of the differences between Highly, Moderately, and Minimally, Impacted Stakeholders, supports understanding the tradeoffs and synergies needed to achieve more equitable SDG accomplishment.

Harmonization of Custom Reports to Uniform SDG Reports: In general, Example 10 confirms that custom conversions will be needed to convert custom rating systems to the following SDG system.

Tier Classification Sheet (as of 15 December 2017)

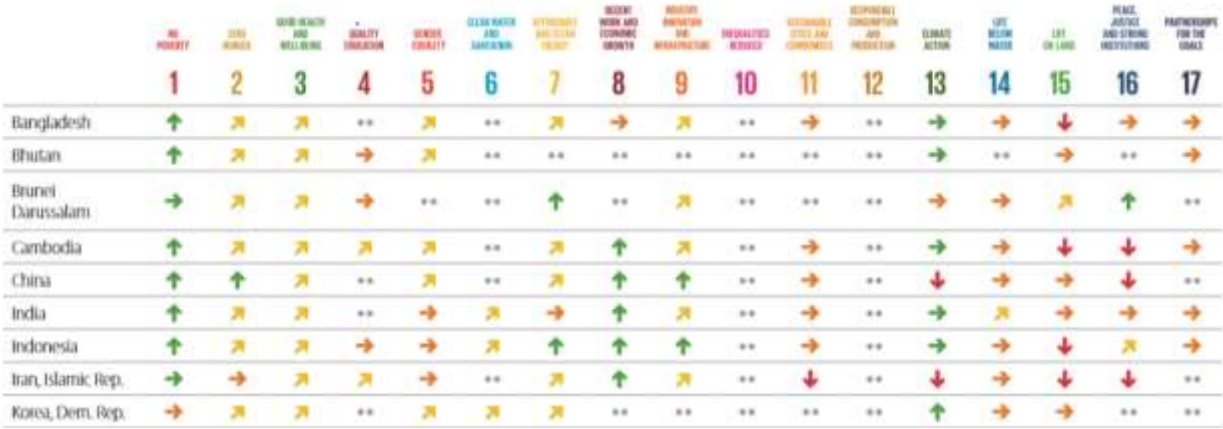
UNSD Indicator Code	Target	Indicator	Initial Proposed Tier (by Secretariat)	Possible Custodian Agency(ies)	Partner Agency(ies)	Updated Tier Classification (by IAEG-SDG Members)
	Goal 1. End poverty in all its forms everywhere					
C010101	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)	**Tier I**	World Bank	ILO	**Tier I**
C010201	1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age	**Tier I**	World Bank	UNICEF	**Tier I**
C010202		1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	**Tier II**	National Gov.	UNICEF, World Bank, UNDP	**Tier II**
C010301	1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable	**Tier I**	ILO	World Bank	**Tier II**
C010401	1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as	1.4.1 Proportion of population living in households with access to basic services	**Tier III**	UN-Habitat	UNICEF, WHO	**Tier III**
		1.4.2 Proportion of total adult				

Machine Learning Aggregate Plans. These individual SDG Plans also serve to train Machine Learning algorithms to figure out causal attribution between SDG scores, M&A Actions, and stakeholder impacts. A future version will include a new reference**,** Machine Learning and Semantic Web Standards for SDG Planning.

Applied SDG Plan Reports Several of the following images demonstrate the Bertelsmann Stiftung SDG Index reports. This example replaces the countries with communities in similar reports. In addition, OECD (2017) recommends basing country, or community, comparisons on SDG Targets rather than this image's Goals because high achieving Targets can hide poorly achieving siblings. For this algorithm, high achieving Indicators can hide poorly achieving siblings. In addition, this example distinguishes the Goals, Targets, and Indicators, by impacted stakeholder groups.

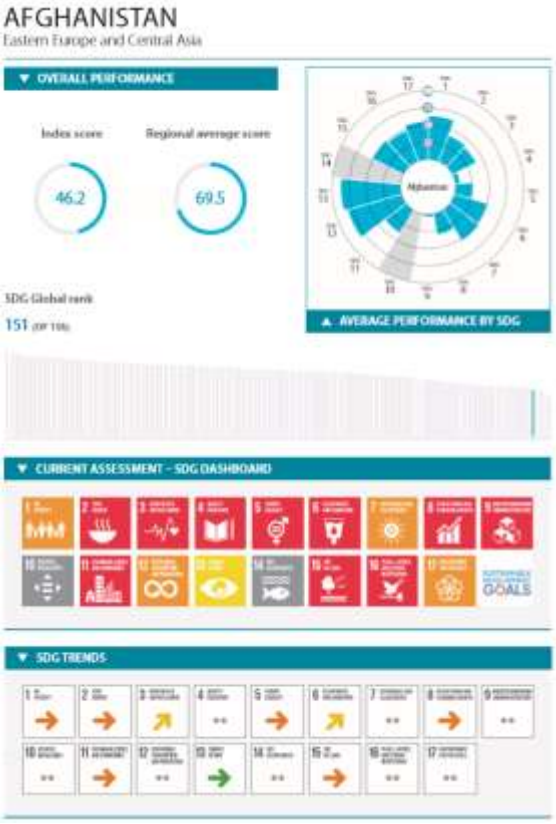
Trends Report

Figure 10 | SDG Trend Dashboard for East and South Asia



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Bangladesh	↑	↗	↗	••	↗	••	↗	→	↗	••	→	••	→	→	↓	→	→
Bhutan	↑	↗	↗	→	↗	••	••	••	••	••	••	••	→	••	→	••	→
Brunei Darussalam	→	↗	↗	→	••	••	↑	••	↗	••	••	••	→	→	↗	↑	••
Cambodia	↑	↗	↗	↗	↗	••	↗	↑	↗	••	→	••	→	→	↓	↓	→
China	↑	↑	↗	••	↗	••	↗	↑	↑	••	→	••	↓	→	→	↓	••
India	↑	↗	↗	••	→	↗	→	↑	↗	••	→	••	→	↗	→	→	→
Indonesia	↑	↗	↗	→	→	↗	↑	↑	↑	••	→	••	→	→	↓	↗	→
Iran, Islamic Rep.	→	→	↗	↗	→	••	↗	↑	↗	••	↓	••	↓	→	↓	↓	••
Korea, Dem. Rep.	→	↗	↗	••	↗	↗	↗	••	••	••	••	••	↑	→	→	••	••

Summary Community Report



M&E Progress Report

SDG-ASB Scorecard								
indicator	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Score**
period	**2017-2018**	**2019-2020**	**2021-2022**	**2023-2024**	**2025-2026**	**2027-2028**	**2029-2030**	**2017-2030**
SDG Target 4. Gender Equality								
sdg target								
most likely sdg actual								
sdg percent								
low sdg actual								
high sdg actual								
certainty 1								
certainty 2								
certainty 3								
totalcost								
Score								xx
SDG Target 13. Climate Change								
sdg target								
most likely sdg actual								
sdg percent								
low sdg actual								
high sdg actual								
certainty 1								
certainty 2								
certainty 3								
totalcost								
Score								xx
SDG Target 6. Clean Water and Sanitation								
sdg target								
..,.								
Total SDG Score								xx

M&E Business Value Report

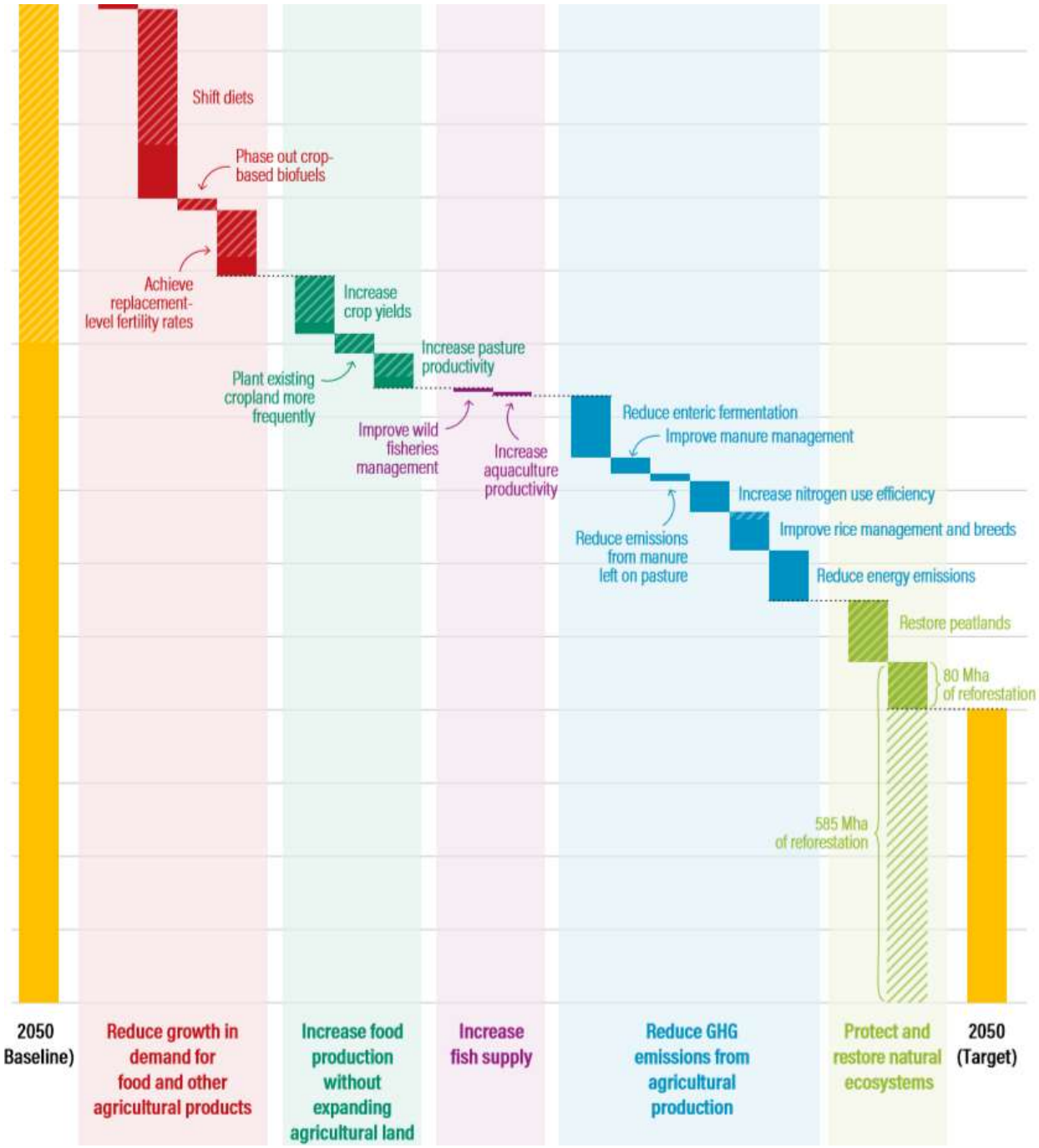
Business Value Report	Inputs	Activities	Outputs	Outcomes	Impacts
Societal Perspective					
Non Harassment and Discrimination Index	x	x	x	x	x
Air Pollution Index	x	x	x	x	x
Water Consumption Index	x	x	x	x	x
Disaster Risk Reduction Index	x	x	x	x	x
Biodiversity Index	x	x	x	x	x
Climate Change, Short Term Index	x	x	x	x	x
Climate Change, Long Term Index	x	x	x	x	x
Stakeholder Group A Perspective					

Industry Perspective					

Applied Community SDG Dashboard and Index Report.

SDG Report - Local Communities in Landscape 1									
SDG Goals	**Overall Score**	**No Poverty**	**Zero Hunger**	**Good Health and Well Being**	**Quality Education**	**Gender Equality**	**...**	**Peace. Justice, and Strong Institutions**	**Partnerships for the Goals**
Goal Number	**10 point Index**	**1**	**2**	**3**	**4**	**5**	**6 to 15**	**16**	**17**
Over 50,000 population									
Community 1	x	x	x	x	x	x		x	x

Supplemental Decision Support Reports. The following image (WRI, 2018) demonstrates the type of additional decision support reports supported by this algorithm. In this instance, to explain the incremental contributions that different policies (i.e. M&A Actions) make, over time, to final SDG target accomplishment.


Shift diets
Phase out crop-based biofuels
Achieve replacement-level fertility rates
Increase crop yields
Plant existing cropland more frequently
Increase pasture productivity
Improve wild fisheries management
Increase aquaculture productivity
Reduce enteric fermentation
Improve manure management
Reduce emissions from manure left on pasture
Increase nitrogen use efficiency
Improve rice management and breeds
Reduce energy emissions
Restore peatlands
80 Mha of reforestation
585 Mha of reforestation
2050 Baseline)
Reduce growth in demand for food and other agricultural products
Increase food production without expanding agricultural land
Increase fish supply
Reduce GHG emissions from agricultural production
Protect and restore natural ecosystems
2050 (Target)

Example 10. Applied Local SDG Plans for Disaster Prevention

Algorithms:

SDG Capital Budget: algorithm1, subalgorithm19 or Example 12's algorithm1, subalgorithm20

SDG Operating Budget: algorithm1, subalgorithm16 or Example 12's algorithm1, subalgorithm21

URLs:

https://www.devtreks.org/greentreks/preview/carbon/resourcepack/SDG Plan Example 10/1565/none

https://localhost:5001/greentreks/preview/carbon/resourcepack/SDG Plan Example 10/552/none

M&E Output Calculator

https://localhost:5001/greentreks/preview/carbon/output/SDG Plan Ex 10/2141223505/none

Stock Input Calculator

https://www.devtreks.org/greentreks/preview/carbon/input/SDG Plan Ex 10/2147397568/none

Example 6 in SPA3 explained how to use SDG approaches with Social Impact Assessment (i.e. or Social Life Cycle Impact Analysis) techniques to improve disaster risk management at watershed scale. This reference confirms that climate change will either force communities to mitigate and adapt to its impacts, or, in some cases, to provide imaginative excuses to local residents, or more accurately, misinformed residents, about why their quality of life continues to deteriorate. Example 6 also documented that serious disaster risk management accounting systems use more comprehensive disaster-related Indicators and Targets than contained in the SDG. The following image (INFORM, 2018) shows the limited number of Indicators found in the SDG.

SELECTED SDG TARGETS AND INDICATORS COVERING DISASTER LOSSES AND RESILIENCE

Target	Indicator
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	**11.5.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
	11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	**13.1.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
	13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030
	13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies

Section D introduced INFORM as a global Indicator and reporting system for managing disaster risks. The following image (INFORM, 2018) shows the relation of INFORM to the SDG. No simple conversion between the 2 Indexes is possible for several reasons:

- each INFORM Indicator can be related to multiple SDG Indicators,
- no stock and flow measurements,
- no certainty estimates,
- no high and low estimates,

- apples to oranges Indicators within different categories (i.e. amount of aid in dollars vs population exposed to flood) make a uniform MCDA approach suspect

CORRESPONDENCE OF INFORM ANALYTICAL FRAMEWORK TO SUSTAINABLE DEVELOPMENT GOALS

HAZARD & EXPOSURE	RELEVANT GOALS	VULNERABILITY	RELEVANT GOALS	LACK OF COPING CAPACITY	RELEVANT GOALS
Natural	**1**	**Socio-Economic**	**1**	**Institutional**	
Earthquake	1, 11	Development & Deprivation	1	Disaster Risk Reduction	1, 9, 11, 13
Tsunami	1, 11	Human Development Index	1	Governance	16
Flood	1, 11, 13	Multidimensional Poverty Index	1	Corruption Perception Index	16
Tropical Cyclone	1, 11, 13	Inequality	1, 4	Government Effectiveness	16
Drought	1, 2, 11, 13, 15	Gender Inequality Index	1, 4, 5	**Infrastructure**	
Human	**16**	Gini Index	1, 4	Communication	9
Current Highly Violent Conflict Intensity Score	16	Aid Dependency Index	1, 10, 17	Adult literacy rate	4, 9
Current National Power Conflict Intensity	16	Net ODA received (percent of GNI)	1, 10, 17	Access to electricity	7, 9
Current Subnational Conflict Intensity	16	Public Aid per capita	1, 10, 17	Internet users	9, 17
Internal Conflict Score	16	**Vulnerable Groups**		Mobile cellular subscriptions	9
GCRI Violent Internal Conflict Probability	16	Uprooted people	11, 16	Physical Infrastructure	9
GCRI Highly Violent Internal Conflict Probability	16	Uprooted population (percentage)	11, 16	Road density	9
		Uprooted population (total)	11, 16	Improved sanitation facilities	6, 9, 11
		Other Vulnerable Groups		Improved water source	6, 9
		Health Conditions	3	Access to Health System	3
		Estimated number of adults living with HIV	3	Physicians density	3
		Tuberculosis prevalence	3	Measles immunization coverage	3
		Malaria Mortality Rate	3	Health care expenditure per capita	3
		Children Under 5	3	Maternal Mortality Ratio	3
		Child mortality	3		
		Malnutrition in children under 5	2, 3		
		Recent Shocks	1, 3, 11, 13		
		Total population affected by natural disasters (3 years)	1, 3, 11, 13		
		Percent of population affected by natural disasters (3 years)	1, 3, 11, 13		
		Food Security	2		
		Food Availability Score	2		
		Food Utilization Score	2		
		Food Access Score	2		

This example suggests that the hundreds of existing certification rating systems introduced in Appendix B will face the same issue –they can't be easily converted to the SDG system. Either custom algorithms, manual conversions and assumptions, or completely separate SDG rating systems, must be used (also refer to Example 12).

Indicators 1. Transition State 1. 2019 to 2020. All of the following datasets use illustrative data because of the lack of supporting data (i.e. "the empty box syndrome").

Indicator 1. TEXT dataset. **Nexus Capital Budget**.

This example substitutes the following list of INFORM Indicators, Targets, and Goals, for the SDG Indicators in Example 9's approach. The Indicator data comes directly from a recent INFORM dataset for the Sahel region of Africa, specifically Burkina Faso.

label	location	risks_and_impacts
SDG	**0**	**HH Chars Goal 1**
T0101	**1**	**INFORM Natural Hazard**
I010101	1	Physical exposure to flood (absolute)
I010102	1	Food Insecurity Probability
I010103	1	Land Degradation (Low Status, Medium to Sto
I010104	1	Land Degradation High Status, Medium to Stor
I010105	1	Land Degradation Score
I010106	1	Land Degradation
I010107	1	People affected by droughts (absolute)
I010108	1	Physical exposure to flood (relative)
I010109	1	People affected by droughts (relative)
I010110	1	Physical exposure to flood (relative)
I010111	1	People affected by droughts (relative)
I010112	1	Frequency of Drought events
I010113	1	People affected by droughts
I010114	1	People affected by droughts and Frequency of
I010115	1	Agriculture Droughts probability
I010116	1	Food Insecurity Probability
I010117	1	Physical exposure to flood
I010118	1	Land Degradation
I010119	1	Droughts probability and historical impact
T0102	**1**	**INFORM Human Hazard**
I010201	1	GCRI Violent Internal Conflict probability
I010202	1	GCRI Highly Violent Internal Conflict probabilit
I010203	1	GCRI Internal Conflict Score
I010204	1	Conflict Intensity
I010205	1	ACLED
I010206	1	Political violence
G01	**1**	**Highly Impacted Hazards and Exposure**
T0201	**1**	**INFORM Socio-Economic Vulnerability**
I020101	1	Human Development Index
I020102	1	Multidimensional Poverty Index
I020103	1	Development & Deprivation Index
I020104	1	Gender Inequality Index
I020105	1	Gini Index
I020106	1	Inequality Index
I020107	1	Total public Aid
I020108	1	Public Aid per capita (USD)
I020109	1	Public Aid per capita
I020110	1	Net ODA received (% of GNI)
I020111	1	Remittances per capita (USD)
I020112	1	Remittances per capita
I020113	1	Economic Dependency Index
T0202	1	INFORM Vulnerable Groups
I020201	1	Total Uprooted people
I020202	1	Uprooted people (total population)
I020203	1	Total/Pop
I020204	1	Total Uprooted people (percentage of the tota
I020205	1	Uprooted people
I020206	1	Estimated number of people living with HIV - A
I020207	1	Tuberculosis prevalence
I020208	1	Malaria mortality rate
I020209	1	Cholera prevalence
I020210	1	Cholera prevalence
I020211	1	Measles prevalence
I020212	1	Measles prevalence
I020213	1	Health Conditions Index
I020214	1	Mortality rate, under-5
I020215	1	Prevalence of Underweight in children 0-59 mo
I020216	1	Children Under 5 Index
I020217	1	Prevalence of GAM (WHZ) in children 6-59 mo
I020218	1	Prevalence of low body mass index (BMI) in W
I020219	1	Malnutrition Index
I020220	1	Total affected by Natural Disasters last 3 years
I020221	1	Natural Disasters % of total pop
I020222	1	Recent Shocks Index
I020223	1	% of population in Food insecurity
I020224	1	Cadre Harmonisé
I020225	1	Food Insecurity Index
I020226	1	Other Vulnerable Groups
G02	1	Vulnerability
T0301	1	INFORM Institutional
I030101	1	HFA Scores
I030102	1	Total Investments in risk reduction per capita (
I030103	1	International Investments in risk reduction
I030104	1	DRR
I030105	1	Corruption Perception Index
I030106	1	Government Effectiveness
I030107	1	Governance
T0302	1	INFORM Infrastructure
I030201	1	Adult literacy rate
I030202	1	Access to electricity
I030203	1	Internet users
I030204	1	Mobile cellular subscriptions
I030205	1	Communication
I030206	1	Improved Sanitation Facilities
I030207	1	Improved Water Source
I030208	1	Physical Connectivity
I030209	1	Phisycians Density
I030210	1	Prevalence of DTP/DTC vaccination
I030211	1	Measles immunization coverage
I030212	1	per capita public and private expenditure on h
I030213	1	Access to health care Index
G03	1	Coping Capacity
T0101	2	INFORM Natural Hazard
I010101	2	Physical exposure to flood (absolute)

The following table employs the dataset format required for this subalgorithm. Only factor3, benchmark stock, came from the INFORM Sahel dataset. All of the remaining columns use fictitious data. Technically, the Indicators have already been normalized and scored by INFORM, but for strictly testing purposes, rather than Example 9's modified z-score, this example normalizes Indicators using the minmax option. In this example, Highly Impacted Stakeholders use location 1, while Moderately Impacted Stakeholders have been added to location 2. In the actual dataset, location 1 holds the first region in the INFORM Sahel dataset, and location 2 holds the 2nd region.

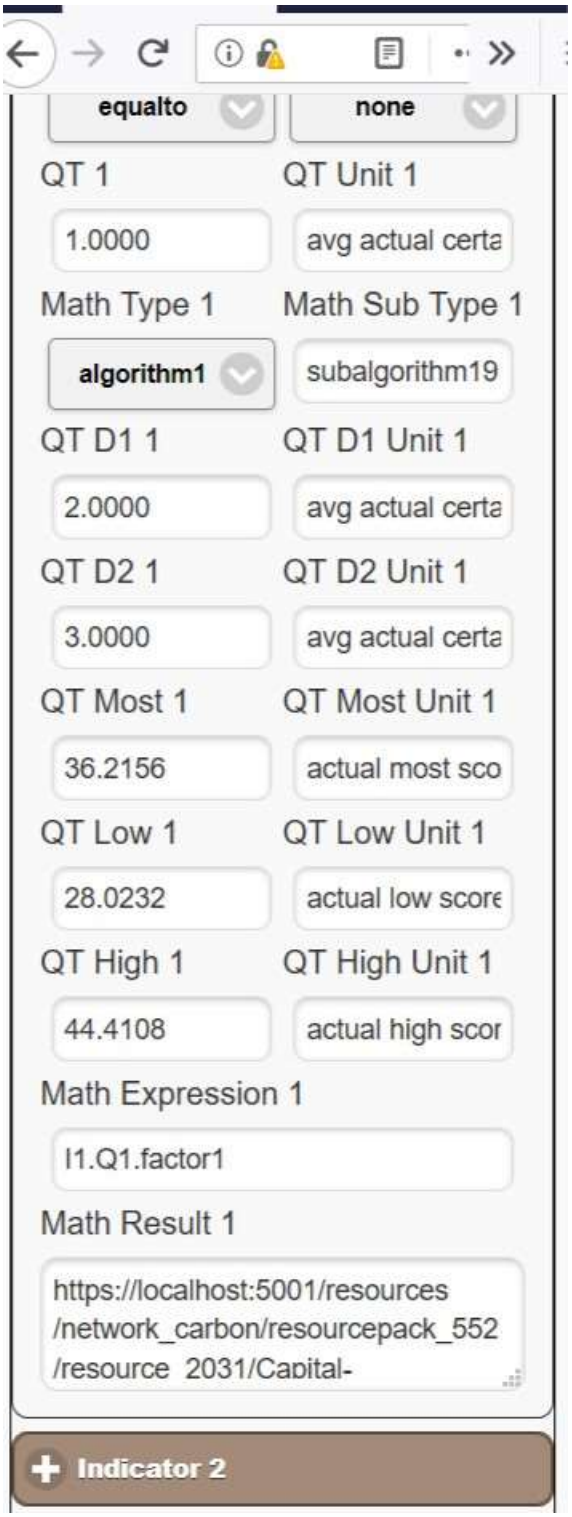
label	locatic	risks_and_impacts	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9
SDG	**0**	**HH Chars Goal 1**	**poverty_i**	**age_hh**	**age_sp**	**educ_hh**	**educ_sp**	**female_hl**	**indigenou**	**hhsize**	**dirtfloor**
T0101	**1**	**INFORM Natural Hazard**									
I010101	1	Physical exposure to flood (absolute)	1/1/2019	1/1/2010	6.1	most likely	4.575	low score	7.625	high score	30.5
I010102	1	Food Insecurity Probability	1/1/2019	1/1/2010	1.1	most likely	0.825	low score	1.375	high score	5.5
I010103	1	Land Degradation (Low Status- Medium to Sto	1/1/2019	1/1/2010	0.4759	most likely	0.356925	low score	0.594875	high score	2.3795
I010104	1	Land Degradation High Status- Medium to Stor	1/1/2019	1/1/2010	0.3674	most likely	0.27555	low score	0.45925	high score	1.837
I010105	1	Land Degradation Score	1/1/2019	1/1/2010	0.3298	most likely	0.24735	low score	0.41225	high score	1.649
I010106	1	Land Degradation	1/1/2019	1/1/2010	8.2	most likely	6.15	low score	10.25	high score	41
I010107	1	People affected by droughts (absolute)	1/1/2019	1/1/2010	10	most likely	7.5	low score	12.5	high score	50
I010108	1	Physical exposure to flood (relative)	1/1/2019	1/1/2010	0.0041	most likely	0.003075	low score	0.005125	high score	0.0205
I010109	1	People affected by droughts (relative)	1/1/2019	1/1/2010	0.0146	most likely	0.01095	low score	0.01825	high score	0.073
I010110	1	Physical exposure to flood (relative)	1/1/2019	1/1/2010	2.7	most likely	2.025	low score	3.375	high score	13.5
I010111	1	People affected by droughts (relative)	1/1/2019	1/1/2010	4.9	most likely	3.675	low score	6.125	high score	24.5
I010112	1	Frequency of Drought events	1/1/2019	1/1/2010	4.9	most likely	3.675	low score	6.125	high score	24.5
I010113	1	People affected by droughts	1/1/2019	1/1/2010	8.5	most likely	6.375	low score	10.625	high score	42.5
I010114	1	People affected by droughts and Frequency of	1/1/2019	1/1/2010	6.7	most likely	5.025	low score	8.375	high score	33.5
I010115	1	Agriculture Droughts probability	1/1/2019	1/1/2010	5	most likely	3.75	low score	6.25	high score	25
I010116	1	Food Insecurity Probability	1/1/2019	1/1/2010	1.1	most likely	0.825	low score	1.375	high score	5.5
I010117	1	Physical exposure to flood	1/1/2019	1/1/2010	4.6	most likely	3.45	low score	5.75	high score	23
I010118	1	Land Degradation	1/1/2019	1/1/2010	8.2	most likely	6.15	low score	10.25	high score	41
I010119	1	Droughts probability and historical impact	1/1/2019	1/1/2010	5.9	most likely	4.425	low score	7.375	high score	29.5
T0102	**1**	**Human Hazard**									
I010201	1	GCRI Violent Internal Conflict probability	1/1/2019	1/1/2010	7.8	most likely	5.85	low score	9.75	high score	39
I010202	1	GCRI Highly Violent Internal Conflict probabilit	1/1/2019	1/1/2010	3.4	most likely	2.55	low score	4.25	high score	17
I010203	1	GCRI Internal Conflict Score	1/1/2019	1/1/2010	6.1	most likely	4.575	low score	7.625	high score	30.5
I010204	1	Conflict Intensity	1/1/2019	1/1/2010	5	most likely	3.75	low score	6.25	high score	25
I010205	1	ACLED	1/1/2019	1/1/2010	4	most likely	3	low score	5	high score	20
I010206	1	Political violence	1/1/2019	1/1/2010	5	most likely	3.75	low score	6.25	high score	25
G01	**1**	**Hazards and Exposure - Highly Impacted SHs**	**44.30**	**39.74**	**35.03**	**2.68**	**2.52**	**6.47**	**43.32**	**6.20**	**0.00**
T0201	**1**	**INFORM Socio-Economic Vulnerability**									**0**
I020101	1	Human Development Index	1/1/2019	1/1/2010	8.4	most likely	6.3	low score	10.5	high score	42

factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18	factor19	factor20	factor21
bathroom	**land**	**hhlabel**	**hhname**	**hhpopcount**	**hhunits**	**lifecyclest**	**allocation**				
1.22	1.098	0.8235	low flow	1.3725	high flow	normal	1	2	3	minmax	1
0.22	0.198	0.1485	low flow	0.2475	high flow	normal	1	2	3	minmax	1
0.09518	0.085662	0.064247	low flow	0.1070775	high flow	normal	1	2	3	minmax	1
0.07348	0.066132	0.049599	low flow	0.082665	high flow	normal	1	2	3	minmax	1
0.06596	0.059364	0.044523	low flow	0.074205	high flow	normal	1	2	3	minmax	1
1.64	1.476	1.107	low flow	1.845	high flow	normal	1	2	3	minmax	1
2	1.8	1.35	low flow	2.25	high flow	normal	1	2	3	minmax	1
0.00082	0.000738	0.000554	low flow	0.0009225	high flow	normal	1	2	3	minmax	1
0.00292	0.002628	0.001971	low flow	0.003285	high flow	normal	1	2	3	minmax	1
0.54	0.486	0.3645	low flow	0.6075	high flow	normal	1	2	3	minmax	1
0.98	0.882	0.6615	low flow	1.1025	high flow	normal	1	2	3	minmax	1
0.98	0.882	0.6615	low flow	1.1025	high flow	normal	1	2	3	minmax	1
1.7	1.53	1.1475	low flow	1.9125	high flow	normal	1	2	3	minmax	1
1.34	1.206	0.9045	low flow	1.5075	high flow	normal	1	2	3	minmax	1
1	0.9	0.675	low flow	1.125	high flow	normal	1	2	3	minmax	1
0.22	0.198	0.1485	low flow	0.2475	high flow	normal	1	2	3	minmax	1
0.92	0.828	0.621	low flow	1.035	high flow	normal	1	2	3	minmax	1
1.64	1.476	1.107	low flow	1.845	high flow	normal	1	2	3	minmax	1
1.18	1.062	0.7965	low flow	1.3275	high flow	normal	1	2	3	minmax	1
1.56	1.404	1.053	low flow	1.755	high flow	normal	1	2	3	minmax	1
0.68	0.612	0.459	low flow	0.765	high flow	normal	1	2	3	minmax	1
1.22	1.098	0.8235	low flow	1.3725	high flow	normal	1	2	3	minmax	1
1	0.9	0.675	low flow	1.125	high flow	normal	1	2	3	minmax	1
0.8	0.72	0.54	low flow	0.9	high flow	normal	1	2	3	minmax	1
1	0.9	0.675	low flow	1.125	high flow	normal	1	2	3	minmax	1
52.03	**1.68**	**sdg1high**	**each hh**	**100000.00**	**household**	normal	**1**	**2**	**3**	minmax	1
1.68	1.512	1.134	low flow	1.89	high flow	normal	1	2	3	minmax	1

The point of this example is not to duplicate INFORM or any of the other international reporting systems. The example illustrates how Appendix A and B's recommendations for SDG reporting can be adapted for more comprehensive climate change-induced disaster risk management reporting at local community and industry scale. Substantial effort is needed to collect data in a manner that can support these types of algorithms (i.e. this data needs further massaging before it can be uniformly normalized; population counts, dollar aid flows, and environmental indicators, have substantially different starting metrics).

Indicator 1. Math Results. The normalization technique used with this example, minmax, doesn't measure Example 9's standard deviation distance between target and actual. Instead, the Indicators, Targets, and Goals, generate uniform scores that can then be interpreted similar to

Sections D's international reports –to assess SDG accomplishment for communities and to make relative or absolute comparisons among communities. The quality of this data means that no weight should be assigned to the absolute values. The results only demonstrate that the algorithm will spit out answers, provided the "data in is not garbage".


equalto
none
QT 1
QT Unit 1
1.0000
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Math Type 1
Math Sub Type 1
algorithm1
subalgorithm19
QT D1 1
QT D1 Unit 1
2.0000
avg actual certa
QT D2 1
QT D2 Unit 1
3.0000
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36.2156
actual most sco
QT Low 1
QT Low Unit 1
28.0232
actual low score
QT High 1
QT High Unit 1
44.4108
actual high scor
Math Expression 1
I1.Q1.factor1
Math Result 1
https://localhost:5001/resources
/network_carbon/resourcepack_552
/resource_2031/Capital-
Indicator 2

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10
SDG	**0.0000**	**HH Chars (**	**poverty_ind**	**age_hh**	**age_sp**	**educ_hh**	**educ_sp**	**female_hh**	**indigenous**	**hhsize**	**dirtfloor**	**bathroom**
T0101	**1.0000**	**INFORM N**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
I010101	1.0000	Physical ex	1/1/2019	1/1/2010	6.1000	most likely	4.5750	low score	7.6250	high score	30.5000	1.2200
I010102	1.0000	Food Insec	1/1/2019	1/1/2010	1.1000	most likely	0.8250	low score	1.3750	high score	5.5000	0.2200
I010103	1.0000	Land Degra	1/1/2019	1/1/2010	0.4759	most likely	0.3569	low score	0.5949	high score	2.3795	0.0952
I010104	1.0000	Land Degra	1/1/2019	1/1/2010	0.3674	most likely	0.2756	low score	0.4593	high score	1.8370	0.0735
I010105	1.0000	Land Degra	1/1/2019	1/1/2010	0.3298	most likely	0.2474	low score	0.4123	high score	1.6490	0.0660
I010106	1.0000	Land Degra	1/1/2019	1/1/2010	8.2000	most likely	6.1500	low score	10.2500	high score	41.0000	1.6400
I010107	1.0000	People aff	1/1/2019	1/1/2010	10.0000	most likely	7.5000	low score	12.5000	high score	50.0000	2.0000
I010108	1.0000	Physical ex	1/1/2019	1/1/2010	0.0041	most likely	0.0031	low score	0.0051	high score	0.0205	0.0008
I010109	1.0000	People aff	1/1/2019	1/1/2010	0.0146	most likely	0.0110	low score	0.0183	high score	0.0730	0.0029
I010110	1.0000	Physical ex	1/1/2019	1/1/2010	2.7000	most likely	2.0250	low score	3.3750	high score	13.5000	0.5400
I010111	1.0000	People aff	1/1/2019	1/1/2010	4.9000	most likely	3.6750	low score	6.1250	high score	24.5000	0.9800
I010112	1.0000	Frequency	1/1/2019	1/1/2010	4.9000	most likely	3.6750	low score	6.1250	high score	24.5000	0.9800
I010113	1.0000	People aff	1/1/2019	1/1/2010	8.5000	most likely	6.3750	low score	10.6250	high score	42.5000	1.7000
I010114	1.0000	People aff	1/1/2019	1/1/2010	6.7000	most likely	5.0250	low score	8.3750	high score	33.5000	1.3400
I010115	1.0000	Agriculture	1/1/2019	1/1/2010	5.0000	most likely	3.7500	low score	6.2500	high score	25.0000	1.0000
I010116	1.0000	Food Insec	1/1/2019	1/1/2010	1.1000	most likely	0.8250	low score	1.3750	high score	5.5000	0.2200
I010117	1.0000	Physical ex	1/1/2019	1/1/2010	4.6000	most likely	3.4500	low score	5.7500	high score	23.0000	0.9200
I010118	1.0000	Land Degra	1/1/2019	1/1/2010	8.2000	most likely	6.1500	low score	10.2500	high score	41.0000	1.6400
I010119	1.0000	Droughts p	1/1/2019	1/1/2010	5.9000	most likely	4.4250	low score	7.3750	high score	29.5000	1.1800
T0102	**1.0000**	**Human Ha**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
I010201	1.0000	GCRI Viole	1/1/2019	1/1/2010	7.8000	most likely	5.8500	low score	9.7500	high score	39.0000	1.5600
I010202	1.0000	GCRI Highl	1/1/2019	1/1/2010	3.4000	most likely	2.5500	low score	4.2500	high score	17.0000	0.6800
I010203	1.0000	GCRI Inter	1/1/2019	1/1/2010	6.1000	most likely	4.5750	low score	7.6250	high score	30.5000	1.2200
I010204	1.0000	Conflict In	1/1/2019	1/1/2010	5.0000	most likely	3.7500	low score	6.2500	high score	25.0000	1.0000
I010205	1.0000	ACLED	1/1/2019	1/1/2010	4.0000	most likely	3.0000	low score	5.0000	high score	20.0000	0.8000
I010206	1.0000	Political vi	1/1/2019	1/1/2010	5.0000	most likely	3.7500	low score	6.2500	high score	25.0000	1.0000
G01	**1.0000**	**Hazards ar**	**2/13/1900**	**2/8/1900**	**35.0300**	**2.6800**	**2.5200**	**6.4700**	**43.3200**	**6.2000**	**0.0000**	**52.0300**
T0201	**1.0000**	**INFORM S**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**0.0000**	**none**
I020101	1.0000	Human De	1/1/2019	1/1/2010	8.4000	most likely	6.3000	low score	10.5000	high score	42.0000	1.6800

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factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18	factor19	factor20	factor21	qtmost	qtmostuni	qtlow	qtlowunit	qthigh	qthighunit	certainty1	certainty2	certainty3	percentflo	percentsto
land	**hhlabel**	**hhname**	**hhpopcount**	**hhunits**	**lifecyclest**	**allocation**	**none**	**none**	**none**	**none**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
none	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**6.4470**	**actual mos**	**4.9880**	**actual low**	**7.9060**	**actual high**	**1.0000**	**2.0000**	**3.0000**	**75.7766**	**23.0256**
1.0980	0.8235	low flow	1.3725	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.4973	actual mos	0.3848	actual low	0.6099	actual high	1.0000	2.0000	3.0000	75.0902	23.0036
0.1980	0.1485	low flow	0.2475	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0895	actual mos	0.0692	actual low	0.1098	actual high	1.0000	2.0000	3.0000	75.0909	23.0036
0.0857	0.0642	low flow	0.1071	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0385	actual mos	0.0298	actual low	0.0473	actual high	1.0000	2.0000	3.0000	75.0000	23.0006
0.0661	0.0496	low flow	0.0827	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0297	actual mos	0.0229	actual low	0.0365	actual high	1.0000	2.0000	3.0000	75.1020	23.0049
0.0594	0.0445	low flow	0.0742	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0266	actual mos	0.0206	actual low	0.0327	actual high	1.0000	2.0000	3.0000	75.0000	23.0018
1.4760	1.1070	low flow	1.8450	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.6686	actual mos	0.5173	actual low	0.8199	actual high	1.0000	2.0000	3.0000	75.0915	23.0037
1.8000	1.3500	low flow	2.2500	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.8155	actual mos	0.6310	actual low	1.0000	actual high	1.0000	2.0000	3.0000	75.0950	23.0038
0.0007	0.0006	low flow	0.0009	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0001	actual mos	0.0000	actual low	0.0001	actual high	1.0000	2.0000	3.0000	87.5000	23.4146
0.0026	0.0020	low flow	0.0033	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0009	actual mos	0.0007	actual low	0.0012	actual high	1.0000	2.0000	3.0000	75.8621	23.0137
0.4860	0.3645	low flow	0.6075	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.2200	actual mos	0.1702	actual low	0.2698	actual high	1.0000	2.0000	3.0000	75.0926	23.0037
0.8820	0.6615	low flow	1.1025	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.3994	actual mos	0.3090	actual low	0.4899	actual high	1.0000	2.0000	3.0000	75.0918	23.0037
0.8820	0.6615	low flow	1.1025	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.3994	actual mos	0.3090	actual low	0.4899	actual high	1.0000	2.0000	3.0000	75.0918	23.0037
1.5300	1.1475	low flow	1.9125	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.6931	actual mos	0.5363	actual low	0.8500	actual high	1.0000	2.0000	3.0000	75.0941	23.0038
1.2060	0.9045	low flow	1.5075	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.5463	actual mos	0.4227	actual low	0.6699	actual high	1.0000	2.0000	3.0000	75.0896	23.0036
0.9000	0.6750	low flow	1.1250	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.4076	actual mos	0.3153	actual low	0.4999	actual high	1.0000	2.0000	3.0000	75.0900	23.0036
0.1980	0.1485	low flow	0.2475	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0895	actual mos	0.0692	actual low	0.1098	actual high	1.0000	2.0000	3.0000	75.0909	23.0036
0.8280	0.6210	low flow	1.0350	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.3750	actual mos	0.2901	actual low	0.4599	actual high	1.0000	2.0000	3.0000	75.0978	23.0039
1.4760	1.1070	low flow	1.8450	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.6686	actual mos	0.5173	actual low	0.8199	actual high	1.0000	2.0000	3.0000	75.0915	23.0037
1.0620	0.7965	low flow	1.3275	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.4810	actual mos	0.3722	actual low	0.5899	actual high	1.0000	2.0000	3.0000	75.0932	23.0037
none	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**2.5520**	**actual mos**	**1.9740**	**actual low**	**3.1290**	**actual high**	**1.0000**	**2.0000**	**3.0000**	**75.0893**	**23.0036**
1.4040	1.0530	low flow	1.7550	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.6360	actual mos	0.4921	actual low	0.7799	actual high	1.0000	2.0000	3.0000	75.0897	23.0036
0.6120	0.4590	low flow	0.7650	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.2771	actual mos	0.2144	actual low	0.3398	actual high	1.0000	2.0000	3.0000	75.0882	23.0035
1.0980	0.8235	low flow	1.3725	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.4973	actual mos	0.3848	actual low	0.6099	actual high	1.0000	2.0000	3.0000	75.0902	23.0036
0.9000	0.6750	low flow	1.1250	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.4076	actual mos	0.3153	actual low	0.4999	actual high	1.0000	2.0000	3.0000	75.0900	23.0036
0.7200	0.5400	low flow	0.9000	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.3260	actual mos	0.2522	actual low	0.3998	actual high	1.0000	2.0000	3.0000	75.0875	23.0035
0.9000	0.6750	low flow	1.1250	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.4076	actual mos	0.3153	actual low	0.4999	actual high	1.0000	2.0000	3.0000	75.0900	23.0036
1.6800	**sdg1high**	**each hh**	**100000.0000**	**household**	**normal**	**1.0000**	**2.0000**	**3.0000**	**minmax**	**1.0000**	**8.9980**	**actual mos**	**6.9620**	**actual low**	**11.0400**	**actual high**	**1.0000**	**2.0000**	**3.0000**	**75.4329**	**23.0146**
none	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**0.1111**	**actual mos**	**0.0861**	**actual low**	**0.1365**	**actual high**	**1.0000**	**2.0000**	**3.0000**	**75.0926**	**23.0037**
1.5120	1.1340	low flow	1.8900	high flow	normal	1.0000	2.0000	3.0000	minmax	1.0000	0.0022	actual mos	0.0017	actual low	0.0027	actual high	1.0000	2.0000	3.0000	75.0952	23.0038

Indicator 2. TEXT dataset. **Nexus Operating Budget**. This Example 4-style budget tests 1 single M&A Action for each separate INFORM Indicator, but allocates 50% of each M&A Action to each of the 2 stakeholders. In this example, Highly Impacted Stakeholders are distinguished from Moderately Impacted Stakeholders by the location proxy.

Example 9 points out that Version 2.2.0 supports running the operating budget jointly with the capital budget in 1 Indicator, by putting the operating budget's dataset URL and MathResult URL in the second position (after a semi-colon delimiter).

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
TA1_I010101	1	M&A Actic	0.4973	0.3848	0.6099	4	Physical ex	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA2_I010102	1	M&A Actic	0.0895	0.0692	0.1098	4	Food Insec	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA3_I010103	1	M&A Actic	0.0385	0.0298	0.0473	4	Land Degra	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA4_I010104	1	M&A Actic	0.0297	0.0229	0.0365	4	Land Degra	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA5_I010105	1	M&A Actic	0.0266	0.0206	0.0327	4	Land Degra	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA6_I010106	1	M&A Actic	0.6686	0.5173	0.8199	4	Land Degra	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA7_I010107	1	M&A Actic	0.8155	0.631	1	4	People aff	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA8_I010108	1	M&A Actic	0.0001	0	0.0001	4	Physical ex	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA9_I010109	1	M&A Actic	0.0009	0.0007	0.0012	4	People aff	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA10_I010110	1	M&A Actic	0.22	0.1702	0.2698	4	Physical ex	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA11_I010111	1	M&A Actic	0.3994	0.309	0.4899	4	People aff	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA12_I010112	1	M&A Actic	0.3994	0.309	0.4899	4	Frequency	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA15_I010115	1	M&A Actic	0.1873	-0.1752	0.5497	4	Agriculture	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA16_I010116	1	M&A Actic	-1.063	-1.142	-0.9829	4	Food Insec	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA17_I010117	1	M&A Actic	0.6931	0.5363	0.85	4	Physical ex	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA18_I010118	1	M&A Actic	0.6686	0.5173	0.8199	4	Land Degra	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA19_I010119	1	M&A Actic	0.481	0.3722	0.5899	4	Droughts p	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA20_I010201	1	M&A Actic	0.636	0.4921	0.7799	4	GCRI Viole	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA21_I010202	1	M&A Actic	0.2771	0.2144	0.3398	4	GCRI Highl	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA22_I010203	1	M&A Actic	0.4973	0.3848	0.6099	4	GCRI Inter	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA25_I010206	1	M&A Actic	0.4076	0.3153	0.4999	4	Political vi	0.5	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
G01	**1**	**Hazards and Exposure - Highly Impacted SHs**											
TA28_I020103	1	M&A Actic	0.0025	0.0019	0.0031	4	Developm	0.5	0	0	0	2	4

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TA82_I030211	2	M&A Actic	0	0	0	4	Measles in	0.5	0	0	0	2	4
IF1A	2	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	2	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TA83_I030212	2	M&A Actic	0.8073	0.6247	0.9899	4	per capita	0.5	0	0	0	2	4
IF1A	2	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	2	Input 02	1000	900	1200	100	units	none	0	1	1	3	3

Several SDG Indicators were mistakenly overwritten when preparing this budget. **Appendix D** points out that sustainability accounting teams must be staffed properly –all of this work can be and should be automated.

Indicator 2. Math Results. Given the caveats for Indicator 1's data, these results only demonstrate that subalgorithm 16 and subalgorithm21 will generate correct cost and effect results, provided the initial data follows Example 4's or 12's directions.

Math Type 2	Math Sub Type 2
algorithm1	subalgorithm16
QT D1 2	QT D1 Unit 2
2.5275	actual certainty
QT D2 2	QT D2 Unit 2
2.5275	actual certainty
QT Most 2	QT Most Unit 2
399,390.3705	actual most sco
QT Low 2	QT Low Unit 2
477,129.5884	actual low score
QT High 2	QT High Unit 2
384,414.3064	actual high scor

Math Expression 2

I2.Q1.factor1

Math Result 2

https://localhost:5001/resources/network_carbon/resourcepack_552/resource_2032/Operating-Budget1MR.csv

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	QTMost	QTLow	QTUp
TA1_I0101	1.000	M&A Actic	0.497	0.385	0.610	4.000	Physical ex	0.500	0.000	0.000	0.000	3.000	3.000	201085.864	233887.734	196753.566
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA2_I0101	1.000	M&A Actic	0.090	0.069	0.110	4.000	Food Insec	0.500	0.000	0.000	0.000	3.000	3.000	1117318.436	1300578.035	1092896.175
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA3_I0101	1.000	M&A Actic	0.039	0.030	0.047	4.000	Land Degra	0.500	0.000	0.000	0.000	3.000	3.000	2597402.597	3020134.228	2536997.886
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA4_I0101	1.000	M&A Actic	0.030	0.023	0.037	4.000	Land Degra	0.500	0.000	0.000	0.000	3.000	3.000	3367003.367	3930131.004	3287671.233
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA5_I0101	1.000	M&A Actic	0.027	0.021	0.033	4.000	Land Degra	0.500	0.000	0.000	0.000	3.000	3.000	3759398.496	4368932.039	3669724.771
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA6_I0101	1.000	M&A Actic	0.669	0.517	0.820	4.000	Land Degra	0.500	0.000	0.000	0.000	3.000	3.000	149566.258	173980.282	146359.312
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA7_I0101	1.000	M&A Actic	0.816	0.631	1.000	4.000	People aff	0.500	0.000	0.000	0.000	3.000	3.000	122624.157	142630.745	120000.000
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA8_I0101	1.000	M&A Actic	0.000	0.000	0.000	4.000	Physical ex	0.500	0.000	0.000	0.000	3.000	3.000	1000000000.000	Infinity	1200000000.000
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA9_I0101	1.000	M&A Actic	0.001	0.001	0.001	4.000	People aff	0.500	0.000	0.000	0.000	3.000	3.000	111111111.111	128571428.571	100000000.000
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA10_I010	1.000	M&A Actic	0.220	0.170	0.270	4.000	Physical ex	0.500	0.000	0.000	0.000	3.000	3.000	454545.455	528789.659	444773.907
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA11_I010	1.000	M&A Actic	0.399	0.309	0.490	4.000	People aff	0.500	0.000	0.000	0.000	3.000	3.000	250375.563	291262.136	244947.949
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA12_I010	1.000	M&A Actic	0.399	0.309	0.490	4.000	Frequency	0.500	0.000	0.000	0.000	3.000	3.000	250375.563	291262.136	244947.949
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA15_I010	1.000	M&A Actic	0.187	-0.175	0.550	4.000	Agriculture	0.500	0.000	0.000	0.000	3.000	3.000	533902.830	-513698.630	218300.891
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA16_I010	1.000	M&A Actic	-1.063	-1.142	-0.983	4.000	Food Insec	0.500	0.000	0.000	0.000	3.000	3.000	-94073.377	-78809.107	-122087.700
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA17_I010	1.000	M&A Actic	0.693	0.536	0.850	4.000	Physical ex	0.500	0.000	0.000	0.000	3.000	3.000	144279.325	167816.521	141176.471
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA18_I010	1.000	M&A Actic	0.669	0.517	0.820	4.000	Land Degra	0.500	0.000	0.000	0.000	3.000	3.000	149566.258	173980.282	146359.312
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA19_I010	1.000	M&A Actic	0.481	0.372	0.590	4.000	Droughts p	0.500	0.000	0.000	0.000	3.000	3.000	207900.208	241805.481	203424.309
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA20_I010	1.000	M&A Actic	0.636	0.492	0.780	4.000	GCRI Viole	0.500	0.000	0.000	0.000	3.000	3.000	157232.704	182889.657	153865.880
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA21_I010	1.000	M&A Actic	0.277	0.214	0.340	4.000	GCRI Highl	0.500	0.000	0.000	0.000	3.000	3.000	360880.549	419776.119	353148.911
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA22_I010	1.000	M&A Actic	0.497	0.385	0.610	4.000	GCRI Inter	0.500	0.000	0.000	0.000	3.000	3.000	201085.864	233887.734	196753.566
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
TA25_I010	1.000	M&A Actic	0.408	0.315	0.500	4.000	Political vi	0.500	0.000	0.000	0.000	3.000	3.000	245338.567	285442.436	240048.010
IF1A	1.000	Input 01	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
IF1B	1.000	Input 02	1000.000	900.000	1200.000	100.000	units	none	0.000	1.000	1.000	3.000	3.000	50000.000	45000.000	60000.000
G01	1.000	Hazards ar	5.971	3.980	7.963	4.000	none	none	2100000.000	1890000.000	2520000.000	3.000	3.000	351729.336	474910.169	316459.670
TA28_I020	1.000	M&A Actic	0.003	0.002	0.003	4.000	Developm	0.500	0.000	0.000	0.000	3.000	3.000	40000000.000	47368421.053	38709677.419

Multi Criteria Decision Analysis (MCDA) and ICERs. Although the quality of the initial data used in this example does not support "real" disaster risk management, the CTAP tutorial explains that the underlying MCDA approach employed by this algorithm has been, and will continue to be used, for that purpose. The Incremental Cost Effectiveness Ratios generated in the 2nd dataset supports a basic understanding of which investments make sense and which are too costly. As usual, sustainability accounting teams are encouraged to develop better algorithms for these purposes.

Example 11. Applied Local SDG Plans for Organizations and Products

Algorithms:

SDG Operating Budget: algorithm1, subalgorithm16 or Example 12's algorithms

URLs:

https://www.devtreks.org/greentreks/preview/carbon/resourcepack/SDG Plan Example 11/1566/none

https://localhost:5001/greentreks/preview/carbon/resourcepack/SDG Plan Example 11/553/none

Output Stock Calculator

https://localhost:5001/greentreks/preview/carbon/output/SDG Plan 11B/2141223506/none

Output M&E Calculator

https://www.devtreks.org/greentreks/preview/carbon/output/SDG Plan 11B/2141223491/none

This example introduces SDG Plans completed by sustainability workers for organizations and products. Examples 9 and 10 introduce the more comprehensive SDG Planning that first takes place at community and landscape scale. Example 12 advocates the use of new social sustainability media platforms to support these scoring systems. The Community SDG Plans establish many of the proxy SDG impacts associated with industry best management practices, or M&A Actions. Companies and products that honestly employ the best practices receive higher sustainability scores in the SDG Plans.

Organization Sustainability Scores. The following URL and image demonstrate how sustainability workers currently score food vendors for food safety. This example demonstrates supplementing the food safety scores with organization sustainability scores. Note the consistency between the recommendations raised in Section E for communicating SDG content

to consumers and these food safety threshold ratings and their conversion to a simpler A to C rating system for consumer use.

Last accessed March 13, 2019:

https://www1.nyc.gov/assets/doh/downloads/pdf/rii/how-we-score-grade.pdf

How We Score and Grade

The Health Department inspects about 24,000 restaurants a year to monitor compliance with City and State food safety regulations. Since July 2010, the Health Department has required restaurants to post letter grades showing sanitary inspection results. Restaurants with a score between 0 and 13 points earn an A, those with 14 to 27 points receive a B and those with 28 or more a C. Inspection results are posted on the Health Department's website.

Food Safety Inspections: What's Behind the Score?

A restaurant's score depends on how well it follows City and State food safety requirements. Inspectors check for food handling, food temperature, personal hygiene, facility and equipment maintenance and vermin control. Each violation earns a certain number of points. At the end of the inspection, the inspector totals the points and this number is the restaurant's inspection score; the lower the score, the better.

The points for a particular violation depend on the health risk it poses to the public. Violations fall into three categories:

- A **public health hazard**, such as failing to keep food at the right temperature, triggers a minimum of 7 points. If the violation can't be corrected before the inspection ends, the Health Department may close the restaurant until it's fixed.
- A **critical violation**, for example, serving raw food such as a salad without properly washing it first, carries a minimum of 5 points.
- A **general violation**, such as not properly sanitizing cooking utensils, receives at least 2 points.

Inspectors assign additional points to reflect the extent of the violation. A violation's condition level can range from 1 (least extensive) to 5 (most extensive). For example, the presence of one contaminated food item is a condition level 1 violation, generating 7 points. Four or more contaminated food items is a condition level 4 violation, resulting in 10 points.

When Is a Score Converted to a Grade?

Two types of inspections result in a letter grade: initial inspections for which the restaurant earns an A and re-inspections that result in an A, B or C.

A restaurant has two chances to earn an A in every inspection cycle. If it doesn't earn an A on the first inspection, it's scored but ungraded. An inspector goes back to the restaurant unannounced, typically within a month, to inspect it again and the re-inspection is graded. If the grade is a B or C, the restaurant will receive a grade card and a grade pending card. It can post either card until it has an opportunity to be heard at the Office of Administrative Trials and Hearings Health Tribunal.

Until a restaurant has a graded inspection, it is listed as Not Yet Graded on the Health Department website.

Which Inspections Are Not Graded?

The following are scored but not graded:

- Initial inspections that result in a score of 14 points or higher
- Monitoring inspections at a restaurant that has performed very poorly on its re-inspection. The Health Department may continue to inspect the restaurant roughly once a month until it scores below 28 or the Department closes it for serious and persistent violations.
- Inspections at new restaurants not yet open to the public
- An inspection at a restaurant seeking to reopen after the Department closed it
- Some inspections in response to complaints
- Inspections before July 27, 2010

More Information

- What to Expect When You're Inspected: A Guide for Food Service Establishments
- Self-Inspection Worksheet, a list of every violation an inspector may cite and the points for each scored violation.
- Guide to Condition Levels, a description of violation severity levels, along with examples.

For these documents, go to nyc.gov and search for Food Service Operator.

NYC Health

Michael R. Bloomberg
Mayor

Thomas Farley, M.D., M.P.H.
Commissioner

March 2012

Product Sustainability Scores. The following URL and image demonstrate how food vendors currently score their products using food calories as a proxy Indicator for consumer health. This example demonstrates supplementing this "food healthiness score" with product sustainability

scores. Note the consistency between these ratings and Section E's environmental product ratings.

Last accessed March 13, 2019:

https://www.fda.gov/downloads/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/UCM583492.pdf

Figure 20: Example of a menu or menu board that describes an opportunity for the consumer to combine standard menu items for a special price (and the calories for each standard menu item that may be combined are declared elsewhere on the menu or menu board).

SANDWICH		Whole Serving	Pick 2
Turkey Breast	$5.89	560 Cal.	280 Cal.
Tuna Salad	$5.89	660 Cal.	330 Cal.
Ham and Swiss	$5.89	730 Cal.	370 Cal.
Chicken Salad	$6.89	700 Cal.	350 Cal.
SOUP	Bread Bowl	Bowl	Cup
	$5.39	$4.39	$3.69
Broccoli Cheddar	900 Cal.	360 Cal.	230 Cal.
Chicken Noodle	780 Cal.	160 Cal.	110 Cal.
New England Clam Chowder	1040 Cal.	570 Cal.	370 Cal.
Chicken and Rice	840 Cal.	260 Cal.	180 Cal.
SALAD			
Caesar	$5.49	320 Cal.	160 Cal.
Greek	$5.89	400 Cal.	200 Cal.
Apple and Chicken	$7.29	570 Cal.	280 Cal.
Southwest with Chicken	$7.49	650 Cal.	320 Cal.
Pick 2	½ Sandwich • ½ Salad • Cup of Soup		$6.79

2,000 calories a day is used for general nutrition advice, but calorie needs vary.
Additional nutrition information available upon request.

5.4. I am a covered pizza parlor that uses both online menus and menu boards in our establishment. Do I have to provide calorie declarations on our menu boards within the establishment if we declare calories on our online menu?

Product and Organization Sustainability Guidance Documents. The following image, from the same URL, demonstrates the guidance, or regulations, that food vendors must follow before posting their "food healthiness scores". The evidence gathered using Example 9, 10, and 12's approaches is similarly codified so that organizations can post "product sustainability scores" for all of the goods and services they sell. Besides the community-level guidance and this image's national guidance, the European Commission's PEF and OEF approaches demonstrate providing this guidance at international scale.

Contains Nonbinding Recommendations

Menu Labeling: Supplemental Guidance for Industry

Additional copies are available from:
Office of Nutrition and Food Labeling, HFS-800
Center for Food Safety and Applied Nutrition
Food and Drug Administration
5001 Campus Drive
College Park, MD 20740
(Tel) 240-402-2373

http://www.fda.gov/FoodGuidances

You may submit written comments regarding this guidance at any time. Submit electronic comments to http://www.regulations.gov. Submit written comments to the Dockets Management Staff (HFA-305), Food and Drug Administration, 5630 Fishers Lane, rm. 1061, Rockville, MD 20852. All comments should be identified with the docket number [FDA–2011–F–0172] listed in the notice of availability that publishes in the *Federal Register*.

U.S. Department of Health and Human Services
Food and Drug Administration
Center for Food Safety and Applied Nutrition

May 2018

This reference suggests that, for many communities, food safety won't matter if unsustainable organizations and production practices contribute to decreases in the overall quality of life due to worsening community capital stock conditions (i.e. their portion of the planet becomes uninhabitable). Castellani et al (2017) use the following statement to explain this further for the production and consumption of food stocks, alone.

“Current patterns of food production and consumption are increasingly considered unsustainable. On the one hand, there is the need to fulfil a fundamental human need for nutrition, and on the other hand, this poses critical threats to the environment. According to EEA (2012) food and drink consumption is found to be responsible for around 20–30 % of environmental impacts caused by consumption in the EU in most impact categories.”

This example’s images suggest that many communities already have the infrastructure in place to supplement existing community safety ratings with increasingly vital sustainability scores for products and organizations. Almost all of the tutorials in DevTreks demonstrate alternative ways to document the costs, benefits, and performance of organizations and/or their products. The key requirement for this example’s sustainability scores is to assign the scores to specific best management practices, or M&A Actions, for specific impacted stakeholders. The associated SDG impacts are documented in the “guidance documents” shown in the previous image. Antonopoulos et al (2016) use the following image to demonstrate typical content in these guidance documents for specific industries.

Based on environmental hotspots Table 13.2 maps across the most relevant BEMPs contained in this SRD to 12 major farm types. Simplification is inevitably involved, and farms may include features typical of multiple farm types (mix of intensive and extensive areas, mixed animal and crop production, etc).

Table 13.2: Priority best practices (BEMPs) described in this report for 12 major farm types (dark shading=high priority; medium shading=medium priority; white=not applicable or low priority) [59]

BEMP	Intensive dairy*	Extensive dairy	Intensive eef*	Extensive beef	Sheep	Intensive pigs*	Intensive poultry*	Extensive pig & poultry	Cereals and oils	Root crops	Field fruit & vegetables	Covered fruit & vegetables
3.1												
3.2												
3.3												
3.4												
3.5												
3.6												
3.7												
4.1												
4.2												
4.3												
4.4												
5.1												
5.2												
5.3												
5.4												
6.1												
6.2												
6.3												
6.4												
6.5												
7.1												
7.2												
7.3												
7.4												

Example 11C will demonstrate that more sophisticated sustainability scoring systems may prefer assigning scores to the Hotspots results that can be produced from these scoring systems rather than only to the initial M&A Actions. Example 12 further demonstrates how fuller scoring systems support more comprehensive sustainability efforts.

Stakeholder Participation in SDG Planning. This tutorial confirms that many industries are already taking independent action to fully address sustainability, including the SDG. The tutorial verifies that investors, supply chain participants, and consumers, will continue applying pressure on recalcitrant industries to comply with these types of sustainability requirements. This

reference strongly advocates lessening potential conflicts among these stakeholders by forcefully engaging all stakeholders in these scoring systems (i.e. including kicking some in the butts to get them to go to the meetings). Experts in community planning, conflict resolution, and Section B's Stakeholder Identification and Engagement processes, may be the most important initial hires for SDG Planning.

Examples. The following examples demonstrate using the existing tools in DevTreks to develop sustainability scores for organizations and products. Additional algorithms may also be developed for this purpose.

Example 11A. Organization Sustainability Score. This example demonstrates adding sustainability scores directly to the M&A Actions documented in Example 4-style operating or capital budgets to generate organization sustainability scores.

Guidance Document SDG Proxy Impacts for M&A Actions. Example 9 introduced the following example of an M&A Feasibility Assessment. For this example, the certainty factor can be used as a sustainability score that sustainability workers use to make their organization and product scores.

> **M&A Feasibility Assessments**. The following table illustrates the use of a worksheet to make Example 4's allocations and certainty ratings. This worksheet is a simplified version of Appendix A's M&A Feasibility Assessments, with the SDG Indicators replacing the Assessment's Indicators. In effect, SDG Goals and Targets are proxies for the 7 community capital dimensions explained in the Appendix.

label	locatio	label	name	label	name	allocation	certainty
TAA_I010101__1	1	TAA	M&A Action 1	I010101_1	1.1.1 Population below hh living w	0.5	2
TAA_I010201_1	1	TAA	M&A Action 1	I010201_1	1.2.1 Population below pov line	0.5	2
TAB_I010201_1	1	TAB	M&A Action 2	I010201_1	1.2.1 Population below pov line	1	2
TAC_I010301_1	1	TAC	M&A Action 3	I010301_1	1.3.1 Population covered	1	2
TAD_I010101_1	1	TAD	M&A Action 4	I010101_1	1.1.1 Population below hh living w	1	2
TAE_I050101_1	1	TAE	M&A Action 5	I050101_1	5.1.1 Degree of legal frameworks	1	3
TAH_I050201_1	1	TAH	M&A Action 8	I050201_1	5.2.1 Female violence by partner	0.6	3
TAH_I050202_1	1	TAH	M&A Action 8	I050202_1	5.2.2 Female violence by other	0.25	3
TAH_I050301_1	1	TAH	M&A Action 8	I050301_1	5.3.1 Female youth at marriage	0.15	3
TAG_I050302_1	1	TAG	M&A Action 7	I050302_1	5.3.2 Female genital multilation	0.33	3
TAG_I050601_1	1	TAG	M&A Action 7	I050601_1	5.6.1 Female reproductive decisio	0.33	3
TAG_I050602_1	1	TAG	M&A Action 7	I050602_1	5.6.2 Female reproductive care	0.34	3
TAF_I050102_1	1	TAF	M&A Action 6	I050102_1	5.1.2 Gender wage gap	0.5	3
TAF_I050401_1	1	TAF	M&A Action 6	I050401_1	5.4.1 Unpaid domestic and care w	0.15	3
TAF_I050501_1	1	TAF	M&A Action 6	I050501_1	5.5.1 Female politicians	0.2	3
TAF_I050502_1	1	TAF	M&A Action 6	I050502_1	5.5.2 Female managers	0.15	3
TAI_I130101_1	1	TAI	M&A Action 9	I130101_1	13.1.1 Mortality	0.6	1
TAI_I130101_1	1	TAI	M&A Action 9	I130101_1	13.1.2 SDRR target adoption	0.4	2
TAJ_I130101_1	1	TAJ	M&A Action 10	I130101_1	13.1.1 Mortality	0.5	3
TAJ_I130102_1	1	TAJ	M&A Action 10	I130102_1	13.1.2 SDRR target adoption	0.5	1
TAK_I130103_1	1	TAK	M&A Action 11	I130103_1	13.1.3 Local disaster risk reductio	1	2
TAL_I130201_1	1	TAL	M&A Action 12	I130201_1	13.2.1 Plan adoption	0.33	3
TAL_I130301_1	1	TAL	M&A Action 12	I130301_1	13.3.1 Degree of education	0.33	1
TAL_I130302_1	1	TAL	M&A Action 12	I130302_1	13.3.2 Degree of capacity building	0.33	2
TBA_I010101__1	1	TBA	M&A Action 13	I010101_2	1.1.1 Population below hh living w	0.5	2
TBA_I010201_2	1	TBA	M&A Action 13	I010201_2	1.2.1 Population below pov line	0.5	2
TBB_I010201_2	1	TBB	M&A Action 14	I010201_2	1.2.1 Population below pov line	1	2
TBC_I010301_2	1	TBC	M&A Action 15	I010301_2	1.3.1 Population covered	1	2
TBD_I010101_2	1	TBD	M&A Action 16	I010101_2	1.1.1 Population below hh living w	1	2
TBE_I050101_2	1	TBE	M&A Action 17	I050101_2	5.1.1 Degree of legal frameworks	1	3
TBH_I050201_2	1	TBH	M&A Action 20	I050201_2	5.2.1 Female violence by partner	0.6	3
TBH_I050202_2	1	TBH	M&A Action 20	I050202_2	5.2.2 Female violence by other	0.25	3
TBH_I050301_2	1	TBH	M&A Action 20	I050301_2	5.3.1 Female youth at marriage	0.15	3
TBG_I050302_2	1	TBG	M&A Action 19	I050302_2	5.3.2 Female genital multilation	0.33	3
TBG_I050601_2	1	TBG	M&A Action 19	I050601_2	5.6.1 Female reproductive decisio	0.33	3
TBG_I050602_2	1	TBG	M&A Action 19	I050602_2	5.6.2 Female reproductive care	0.34	3
TBF_I050102_2	1	TBF	M&A Action 18	I050102_2	5.1.2 Gender wage gap	0.5	3
TBF_I050401_2	1	TBF	M&A Action 18	I050401_2	5.4.1 Unpaid domestic and care w	0.15	3
TBF_I050501_2	1	TBF	M&A Action 18	I050501_2	5.5.1 Female politicians	0.2	3
TBF_I050502_2	1	TBF	M&A Action 18	I050502_2	5.5.2 Female managers	0.15	3
TBI_I130101_2	1	TBI	M&A Action 21	I130101_2	13.1.1 Mortality	0.6	1
TBI_I130101_2	1	TBI	M&A Action 21	I130101_2	13.1.2 SDRR target adoption	0.4	2
TBJ_I130101_2	1	TBJ	M&A Action 22	I130101_2	13.1.1 Mortality	0.5	3
TBJ_I130101_2	1	TBJ	M&A Action 22	I130101_2	13.1.2 SDRR target adoption	0.5	1
TBK_I130103_2	1	TBK	M&A Action 23	I130103_2	13.1.3 Local disaster risk reductio	1	2
TBL_I130201_2	1	TBL	M&A Action 24	I130201_2	13.2.1 Plan adoption	0.33	3
TBL_I130301_2	1	TBL	M&A Action 24	I130301_2	13.3.1 Degree of education	0.33	1
TBL_I130302_2	1	TBL	M&A Action 24	I130302_2	13.3.2 Degree of capacity building	0.33	2

Organization Sustainability Inspections. What's Behind the Scores? An organization's score depends on how well it follows community sustainability requirements. Sustainability workers check for how well organizations apply best practice M&A Actions. Each violation earns a certain number of points. At the end of the inspection, the workers total the points and that becomes the sustainability score; the lower the score, the better. This example recommends starting with the NYC food vendor scoring system as a basis for their local organization sustainability scoring system.

Nexus Operating Budget for Organization Sustainability Scores. Example 9 used the following table to illustrate adding SDG Impact scores to Operating Budgets for the purpose of fully documenting M&A Actions and using Cost Effectiveness Analysis for decision support. In this example, organizations supply similar, but field-oriented, Operating Budgets to sustainability workers. The Budgets document the best management practices employed by companies to produce their products. Sustainability workers inspect each M&A Action and use the previous image's guidance documents to add sustainability scores, and the LCC/LCB properties, for each M&A Action.

label	locati	risks_and_indicators	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
TAA_I010101__1	**1**	**M&A Action 1**	**6.883**	**5.871**	**7.90**	**4**	**1.1.1 Population be**	**0.5**	**0**	**0**	**0**	**2**	**4**
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAA_I010201_1	**1**	**M&A Action 1**	**-0.01903**	**-0.00449**	**-0.03356**	**4**	**1.2.1 Population be**	**0.5**	**0**	**0**	**0**	**2**	**4**
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAB_I010201_1	1	M&A Action 2	-0.01903	-0.00449	-0.03356	4	1.2.1 Population bel	1	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAC_I010301_1	1	M&A Action 3	3.754	2.748	4.76	4	1.3.1 Population cov	1	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAD_I010101_1	1	M&A Action 4	6.883	5.871	7.9	4	1.1.1 Population bel	1	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
G01	**1**	**Poverty Highly Impacted**	**0**	**0**	**0**	**0**	**total annual cost**	**none**	**0**	**1**	**1**	**0**	**0**
TAE_I050101_1	1	M&A Action 5	-8.172	-7.343	-9	4	5.1.1 Degree of lega	1	0	0	0	2	4
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050102_1	1	M&A Action 6	11.95	10.94	12.96	1	5.1.2 Gender wage g	0.5	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050401_1	1	M&A Action 6	1.553	0.5388	2.57	4	5.4.1 Unpaid domes	0.15	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050501_1	1	M&A Action 6	-0.6042	-0.4682	-0.74	4	5.5.1 Female politici	0.2	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAF_I050502_1	1	M&A Action 6	-1.325	-0.9352	-1.716	4	5.5.2 Female manag	0.15	0	0	0	2	4
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
TAG_I050302_1	1	M&A Action 7	48.58	47.57	49.59	4	5.3.2 Female genital	0.33	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAG_I050601_1	1	M&A Action 7	-8.172	-7.343	-9	4	5.6.1 Female reprod	0.33	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAG_I050602_1	1	M&A Action 7	-8.172	-7.343	-9	4	5.6.2 Female reprod	0.34	0	0	0	2	4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3
TAH_I050201_1	1	M&A Action 8	8.103	7.092	9.115	4	5.2.1 Female violenc	0.6	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
TAH_I050202_1	1	M&A Action 8	41.44	40.42	42.45	4	5.2.2 Female violenc	0.25	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
TAH_I050301_1	1	M&A Action 8	10.48	9.472	11.5	4	5.3.1 Female youth a	0.15	0	0	0	2	4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3
G02	**1**	**Gender Highly Impacted**	**0**	**0**	**0**	**0**	**total annual cost**	**none**	**0**	**1**	**1**	**0**	**0**
TAI_I130101_1	1	M&A Action 9	4.008	3.456	4.56	4	13.1.1 Mortality	0.6	0	0	0	2	4

When is a Score Converted to a Grade? Two types of inspections result in a letter grade: initial inspections for which the organization earns as A and re-inspections that result in an A, B, or C. Refer to the NYC scoring system for additional criteria.

The following MathResults, from Example 9, demonstrate that the algorithm used in this example, algorithm1 with subalgorithm16 or subalgorithm21, generates several overall types of scores. The background guidance documents used with these scoring systems must thoroughly explain how these types of scores directly translate into more sustainable organizations.

1. **Indicator Revenues and Costs.** The final 3 columns record the life cycle costs (negative numbers) and revenues (positive numbers) for each Indicator. Factor10 and factor11 are certainty scores for the Indicator revenues and costs.
2. **Target Sustainability Score**. The columns named factor1, factor2, and factor3, record the sustainability score range for each M&A Action. Factor4 records the certainty score for the sustainability score. Factor10 and factor11 are average certainty scores for the Target's children Indicators.
3. **Goal Revenues and Costs**. The columns named factor7, factor8, and factor9, record the sum of the Revenues or Costs for all of the Goal's children Indicators (i.e. not Targets).
4. **Goal Sustainability Score**. The columns named factor1, factor2, and factor3, record the sum of the sustainability scores for each of the Goal's children M&A Actions, or Targets. Factor4, factor10 and factor11 record the average certainty scores for the Goal's children Targets.
5. **Goal Revenues and Costs per Unit Sustainability Score**. The final 3 columns record the life cycle costs (negative numbers) or revenues (positive numbers) per unit sustainability score for the sum of the Goal's children Targets.
6. **Total Scores**. The final line, or TR2, has the same scores as the Goals, except they use summations and averages of all of the TR's children Indicators.

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	QTMost	QTLow	QTUp
TAA_I0101	1	M&A Actic	6.883	5.871	7.9	4	1.1.1 Popu	0.5	0	0	0	3	3	21792.82	22994.38	22784.81
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	50000	45000	60000
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3	50000	45000	60000
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3	50000	45000	60000
TAA_I0102	1	M&A Actic	-0.01903	-0.00449	-0.03356	4	1.2.1 Popu	0.5	0	0	0	3	3	-7894737	-3E+07	-5357143
IF1A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	50000	45000	60000
IF1B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3	50000	45000	60000
IF1C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3	50000	45000	60000
TAB_I0102	1	M&A Actic	-0.01903	-0.00449	-0.03356	4	1.2.1 Popu	1	0	0	0	3	3	-1.1E+07	-4E+07	-7142857
IF1D	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
IF1E	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
TAC_I0103	1	M&A Actic	3.754	2.748	4.76	4	1.3.1 Popu	1	0	0	0	3	3	133191.3	163755.5	126050.4
IF2A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
IF2B	1	Input 02	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
IF2C	1	Input 03	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
IF2D	1	Input 04	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
IF2E	1	Input 05	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
TAD_I0101	1	M&A Actic	6.883	5.871	7.9	4	1.1.1 Popu	1	0	0	0	3	3	14528.55	15329.59	15189.87
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	100000	90000	120000
G01	**1**	**Poverty Hi**	**17.482**	**14.481**	**20.4928**	**4**	**total annu**	**none**	**1100000**	**990000**	**1320000**	**3**	**3**	**62921.86**	**68365.44**	**64412.87**
...																
...																
TAL_I1302	1	M&A Actic	-1.09	-0.6894	-1.491	4	13.2.1 Plar	0.33	0	0	0	3	3	-30275.2	-43080.9	-26559.4
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	33000	29700	39600
TAL_I1303	1	M&A Actic	-8.172	-7.343	-9	4	13.3.1 Deg	0.33	0	0	0	3	3	-4038.18	-4044.67	-4400
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	33000	29700	39600
TAL_I1303	1	M&A Actic	-8.172	-7.343	-9	4	13.3.2 Deg	0.34	0	0	0	3	3	-4160.55	-4167.23	-4533.33
IF3A	1	Input 01	1000	900	1200	100	units	none	0	1	1	3	3	34000	30600	40800
G13	**1**	**Climate M**	**-7.4**	**-5.6656**	**-9.133**	**4**	**total annu**	**none**	**1100000**	**990000**	**1320000**	**3**	**3**	**-148649**	**-174739**	**-144531**
TR2	**1**	**Moderate**	**105.7428**	**101.4158**	**110.0888**	**3.9091**	**0**	**none**	**3300000**	**2970000**	**3960000**	**3**	**3**	**31207.8**	**29285.38**	**35970.96**

Example 11B. Product Sustainability Score. This example demonstrates adding sustainability scores directly to the M&A Actions documented in Resource Stock and M&E-based supply chains to generate product sustainability scores.

Product Sustainability Scores. What's Behind the Scores? A product's score depends on how well it follows community sustainability requirements throughout its supply chain. Sustainability workers check for how well products are made using best practice M&A Actions. Each violation earns a certain number of points. At the end of the inspection, the workers total the points and that becomes the sustainability score; the lower the score, the better.

In order to realistically test product supply chains, the URL to following image shows that 15 TEXT datasets holding Example 9's Operating Budget were added to 15 Indicators to simulate 15 life cycle stages and/or supply chain parts. A final Operating Budget was added to the Score to simulate an overall Impact Evaluation that could serve as an overall product sustainability score. Simpler products can probably be rated directly by company workers. But these types of more complicated sustainability efforts may need professional sustainability workers who specialize in these types of field inspections and rating systems.

Math Operator

equalto

Most Likely: 399,390.3705
Most Unit: actual most score
Low Estimate: 477,129.5884
Low Unit: actual low score
High Estimate: 384,414.3064
High Unit: actual high score
Math Type: algorithm1
Math Sub Type: subalgorithm16

Math Result

https://localhost:5001/resources/network_carbon/resourcepack_553/resource_2055/Operating-

Score URL

https://localhost:5001/resources/network_carbon/resourcepack_553/resource_2048/Operating-

Calculations Description

Example 11B in SDG Plan reference. v218e

Media URL

https://localhost:5001/resources/network_carbon/resourcepack_553/resource_2049/NYC-

Data URL

[redacted]

Indic 14 Description: Example 11B in SDG Plan reference.
Indic 15 Name: Life Stage 15 | Label: SDG15
Date: 03/20/2019 | Rel Label:
Math Type: algorithm1 | Dist Type: none
Math Sub Type: subalgorithm16 | Base IO: none
Q1 Amount: 0.0000 | Q1 Unit:
Q2 Amount: 0.0000 | Q2 Unit:
Q3 Amount: 0.0000 | Q3 Unit:
Q4 Amount: 399,390.3705 | Q4 Unit: benchmark most score
Q5 Amount: 477,129.5884 | Q5 Unit: benchmark low score
Math Express: I15.Q1.factor1 | Math Operator: equalto
QT Amount: 384,414.3064 | QT Unit: benchmark high score
QT D1 Amount: 2.5275 | QT D1 Unit: actual certainty1
QT D2 Amount: 2.5275 | QT D2 Unit: actual certainty2
QT Most Amount: 399,390.3705 | QT Most Unit: actual most score
QT Low Amount: 477,129.5884 | QT Low Unit: actual low score
QT High Amount: 384,414.3064 | QT High Unit: actual high score
Indic 15 Description: Example 11B in SDG Plan reference.

Output Series : Product 01

Indicators Details

Indic 0 Name: Score | Label: SCORE1
Date: 03/20/2019 | Rel Label:
Math Type: algorithm1 | Dist Type: none
Math Sub Type: subalgorithm16 | Base IO: none
Math Express: I1.Q1.factor1 | Math Operator: equalto
QT Amount: 384,414.3064 | QT Unit: benchmark high score
QT D1 Amount: 2.5275 | QT D1 Unit: actual certainty1
QT D2 Amount: 2.5275 | QT D2 Unit: actual certainty2
QT Most Amount: 399,390.3705 | QT Most Unit: actual most score
QT Low Amount: 477,129.5884 | QT Low Unit: actual low score
QT High Amount: 384,414.3064 | QT High Unit: actual high score
Score Math Result:
https://localhost:5001/resources/network_carbon/resourcepack_553/resc
Budget16MR.csv
Indic 1 Name: Life Cycle Stage | Label: SDG01

Guidance Document SDG Proxy Impacts for M&A Actions. This example confirms that complicated supply chains require considerable knowledge and skills on the part of sustainability workers. In this fictitious example, each Indicator's budget holds 150+- M&A Actions, each of which gets rated for sustainability. Although the previous image's absolute numbers are

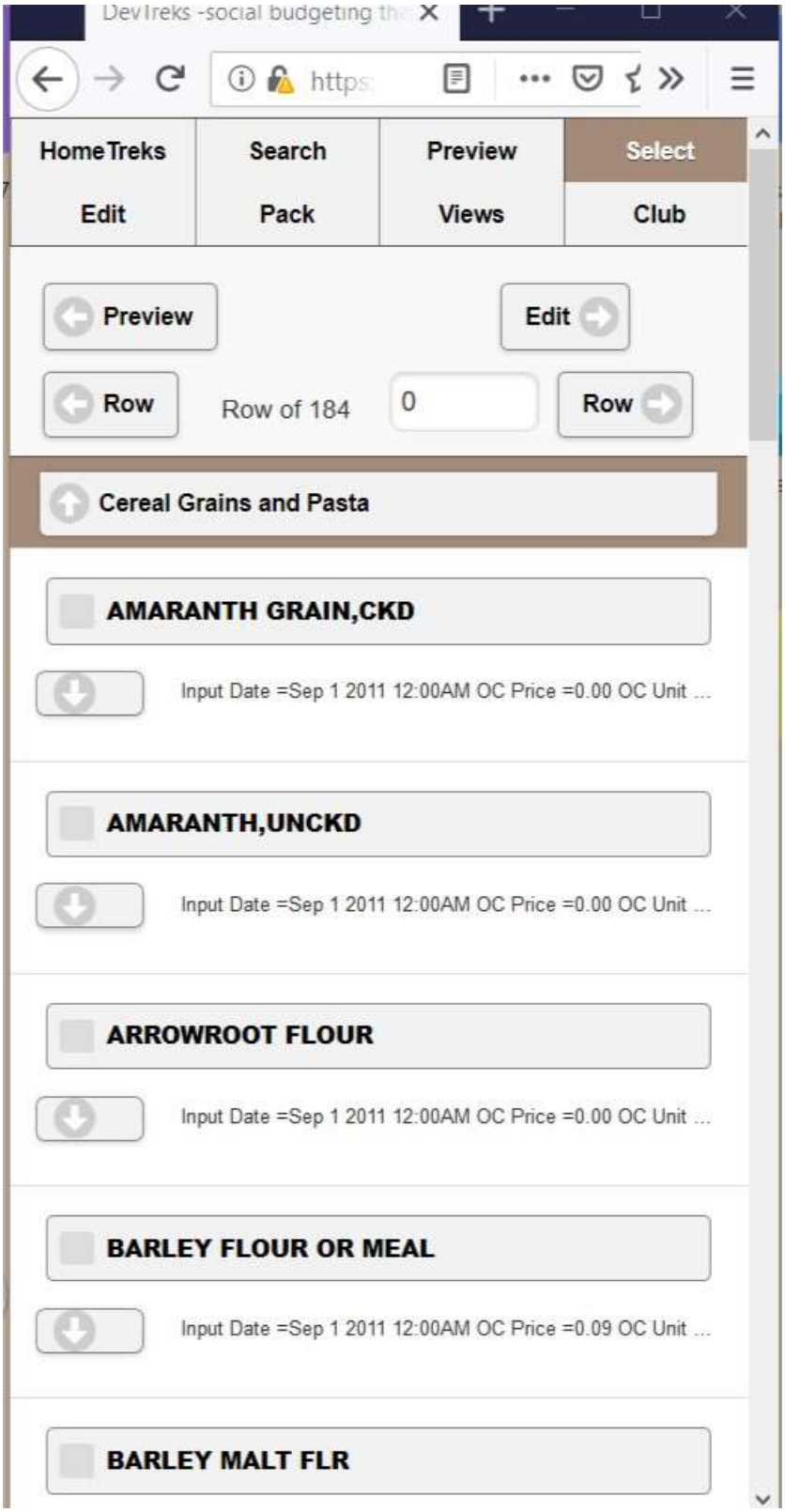
meaningless, guidance documents must thoroughly explain how these sustainability scores get set for each life cycle stage and supply chain part. Professional sustainability workers who specialize in guidance document development may lead to the start of a completely separate professional industry (**9***).

When is a Score Converted to a Grade? Two types of inspections result in a letter grade: initial inspections for which the product earns as A and re-inspections that result in an A, B, or C. [Refer to the NYC scoring system for additional criteria.]

Example 11C. Product Category Rules, Organization Sector Rules, and Baskets of Products. Appendix B confirms that Product Environmental Footprint Category Rules (PEFCRs) are used to establish LCA rules for whole groups, or categories, of consumed products. These rules help to identify common attributes of products used to complete PEFs for each product. The European Commission (2017) uses the following statement to describe these rules:

"PEFCRs help to shift the focus of the PEF study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency of the results by reducing costs versus a study based on the comprehensive requirements of the PEF guide."

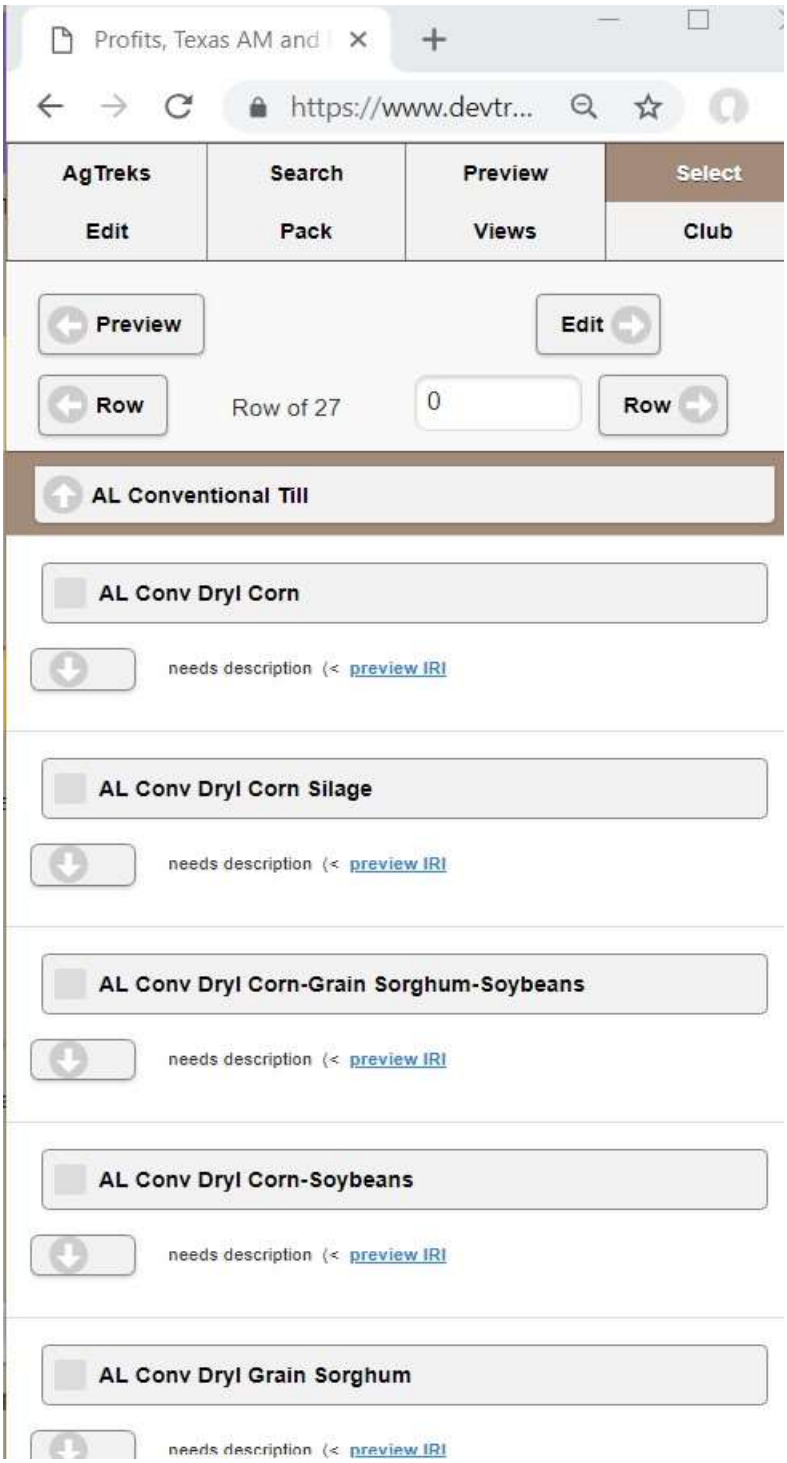
In DevTreks, categories of products are referred to as Input and Output Groups. The Malnutrition Analysis tutorial introduces the following image's group of food Inputs. This USDA, ARS reference dataset includes 7200+ food items plus their ARS food nutrient composition. The tutorial also confirms that series of products are referred as Input and Output Series.


DevTreks -social budgeting th
https
HomeTreks
Search
Preview
Select
Edit
Pack
Views
Club
Preview
Edit
Row
Row of 184
0
Row
Cereal Grains and Pasta
AMARANTH GRAIN,CKD
Input Date =Sep 1 2011 12:00AM OC Price =0.00 OC Unit ...
AMARANTH,UNCKD
Input Date =Sep 1 2011 12:00AM OC Price =0.00 OC Unit ...
ARROWROOT FLOUR
Input Date =Sep 1 2011 12:00AM OC Price =0.00 OC Unit ...
BARLEY FLOUR OR MEAL
Input Date =Sep 1 2011 12:00AM OC Price =0.09 OC Unit ...
BARLEY MALT FLR

Similarly, Organization Environmental Footprint Sector Rules (OEFSRs) establish LCA rules for whole groups, or sectors, of companies. These rules help to identify common attributes of organizations used to complete OEFs for each company. The European Commission (2018) uses the following statement to describe these rules:

"OEFSRs help to shift the focus of the OEF study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency of the results whilst reducing costs in comparison to a study based on the comprehensive requirements of the OEF Guide. OEFSRs are defined primarily with reference to the activities characteristic of the sector, as represented in a typical Product Portfolio."

The following image, from the Ag Production tutorial, demonstrates that DevTreks refers to whole groups of organizations, or in this image, an industry's enterprises, as Budget Groups and Budgets. Each Budget uses Time Periods, or enterprises, to hold Operation/Component and Input base elements. These elements document the company's production practices, or M&A Actions. Outcome and Output base elements document the goods and services produced by each company.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AL Conv Dryl Corn-Soybeans
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needs description (< preview IRI

The following image (Castellani et al, 2017) demonstrates conducting sustainability assessments for representative baskets of products (BoPs) purchased by consumers throughout nations and regions.

Table 1. Composition of the BoP food in terms of product groups, representative products and related quantities (referred to the reference flow, i.e. food consumption of an average EU-27 citizen in the reference year 2010)

Product Group	Representative product	Per-capita consumption (kg/pers.*yr^{-1})	% of total per-capita apparent basket consumption
MEAT	Pig meat	41.0	*7.1%*
	Beef meat	13.7	*2.4%*
	Poultry meat	22.9	*4.0%*
DAIRY	Milk & Cream	80.1	*14.0%*
	Cheese	15.0	*2.6%*
	Butter	3.6	*0.6%*
CEREAL-BASED PRODUCTS	Bread	39.3	*6.9%*
	Pasta	8.2	*1.4%*
SUGAR	Sugar	29.8	*5.2%*
OILS	Sunflower oil	5.4	*0.9%*
	Olive oil	5.3	*0.9%*
VEGETBLES	Potatoes	69.1	*12.2%*
FRUIT	Oranges	17.4	*3.0%*
	Apples	16.1	*2.8%*
COFFEE	Coffee	3.5	*0.6%*
BEVERAGES	Beer	69.8 L	*12.2%*
	Wine	24 L	*4.2%*
	Mineral water	105 L	*18.3%*
PRE-PREPARED MEALS	Meat based dishes	2.9	*0.5%*

Source: Eurostat (2014a)

The annual consumption of the BoP amounts to 572 kg per inhabitant per year. The BoP consumption is thus representative of 61% of the total apparent yearly consumption per inhabitant (933.2 kg/inhabitant) of all food and beverage products reported in the Eurostat-Prodcom database. As for the economic value, the BoP food covers 45.6% of the apparent consumption of food by European citizens (568 € per inhabitant per year, out of 1,246 € per inhabitant per year, calculated as apparent consumption from Prodcom data). The choice of Prodcom database as a basis to calculate the apparent consumption of food is due to the

Castellani et al (2017) use the following statement to explain how these BoPs support a fuller understanding of which products, production practices, and life cycle stages, have the most significant impacts on the environment. For example, Crenna et al (2019) extended Castellani's

study with additional food inputs and more recent data to identify the main drivers of biodiversity loss in both Europe and developing countries.

The BoP food is built to assess the impact associated to food consumption in Europe from raw material extraction to end of life. The reference flow is the amount of food consumed by an average citizen in a reference year. It consists of a process-based life cycle inventory model for a basket of products that represent the most relevant food product groups, selected by importance in mass and economic value. The 19 products in the basket are: pork, beef and poultry meat, milk, cheese, butter, bread, sugar, sunflower oil, olive oil, potatoes, oranges, apples, mineral water, roasted coffee, beer, pre-prepared meals, wine, and pasta.

The consumer footprint for the BoP food is assessed using 15 environmental impact categories as for the ILCD LCIA method and running a sensitivity for a number of impact categories with updated models. Results show that agriculture is the life cycle stage of the food system with the larger contribution to most of the impact categories. The product groups that emerge as hotspots in most of the impact categories are meat products, dairy products, and beverages. The main impact for the life cycle of meat products comes from the emissions due to agricultural activities for the production of feed. Direct emissions from animal husbandry (methane, dinitrogen oxide, ammonia, etc.) contribute as well. Normalized results show that the BoP food contributes significantly to several impact categories, with a different ranking depending upon the adopted normalisation reference (European or global). Ecotoxicity, human toxicity, eutrophication, acidification, water depletion and climate change are among the leading impacts. Since many LCA study on food are limited to the assessment of climate change related emissions, the BoP food baseline aims at helping to understand the wider array of impacts associated to the food system of production and consumption.

Moreover, the Consumer Footprint BoP food baseline has been assessed against 5 scenarios, referring to improvement options related to the main drivers of impact. In fact, the scenarios act on the hotspots identified within the baseline and refer to the most relevant eco-innovations and behavioural changes identified through a review of the scientific literature. Scenario 1 and Scenario 4 act on the nutrients cycle, with the aim of recovering nutrients either at the production stage or the end of life stage. Scenario 2 acts at the end of life stage as well, by assuming an improvement of the efficiency of the waste water treatment in Europe. Scenario 3 is a first attempt to address the benefits of behavioural changes, with an example of reduced amount of meat consumed. Scenario 5 regards the topic of food waste prevention, and entails a number of prevention measures, acting at different stages of the food supply chain, including the use phase. The scenarios tested on the baseline of the BoP food provided insights on the potential for reducing environmental impacts of food consumption in Europe. Each scenario acts on a different component of the BoP (in term of either products, life cycle stages or composition of the basket). As the scenarios are different in type it was found out that the was a large difference on the different scores and savings among the investigated impact categories. In general, among the scenarios assessed, the options that allow for a higher reduction of impacts are the ones acting on the drivers of freshwater eutrophication, such as recovery of nutrients from urine or improvement of the wastewater treatment. It is important to highlight that results of scenarios shall be analysed considering a certain "uptake

The Malnutrition Analysis tutorial uses the following dataset to confirm that Inputs can also be grouped into Operations/Components (i.e. meals, crop operations) and Outputs into Outcomes (i.e. crops physical attributes; stakeholder quality of life measurements).

Operation : 2011 Subsistence Meal BM SR01(Amount: 1.000; Date: 12/31/2011

Nutrition Details

Input : 2011 BARLEY,PEARLED,RAW

Nutrition Details

Input : 2011 POTATO,FLESH and SKN,RAW

Nutrition Details

Container Size : 25.000	Serving Cost : 0.140
USDA Servings Per Cont : 25.000	Servings Per Cont : 25.000
Serving Size Unit : potato, large (3in to 4-1-4in dia)	Serving Size : 1.000
Water g : 219.573	Energy Kcal : 213.098
Protein g : 5.590	
Lipid g : 0.249	Ash g : 2.989
Carbohydrate g : 48.348	Fiber (TD) : 6.089
Sugar (Tot) g : 2.159	Calcium mg : 33.210
Iron mg : 2.159	Magnesium mg : 63.653
Phosphorus mg : 157.748	Potassium mg : 1,165.118
Sodium mg : 16.605	Zinc mg : 0.803
Copper mg : 0.299	Manganese mg : 0.423
Selenium pg : 0.830	Vitamin C mg : 54.520
Thiamin mg : 0.221	Riboflavin mg : 0.089
Niacin mg : 2.917	Panto mg : 0.819
Vitamin B6 mg : 0.816	Folate (Tot) pg : 44.280
Folic Acid pg : 0.000	Food Folate pg : 44.280
Folate (DFE) pg : 44.280	Choline (Tot) mg : 33.487
Vitamin B12 pg : 0.000	
Vitamin A (IU) : 5.535	Vitamin A (RAE) : 0.000
Retinol pg : 0.000	Alpha Carotene pg : 0.000
Beta Carotene pg : 2.768	Beta Crypt pg : 0.000

Example 4 used the following image of an Operating Budget for Household Living Wages to confirm that this reference's budgeting techniques also supports the analysis of BoPs. Example 9

demonstrates that M&A Feasibility Assessments and SDG Capital Budgets support adding sustainability ratings to the products being consumed by this type of typical household.

label	locati	risks_and_indicators	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
SCA	**1**	**Food**	0.00	0.00	0.00	0.00	montly cost	120.00	0.00	0.00	0.00	2.00	4.00
IF1A	1	Plain Rice	415.00	311.25	518.75	10.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1B	1	Sticky Rice	35.00	26.25	43.75	13.50	grams	none	0.00	1.00	1.00	3.00	3.00
IF1C	1	Noodles	9.00	6.75	11.25	50.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1D	1	Bread	6.00	4.50	7.50	20.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1E	1	Potato	20.00	15.00	25.00	10.60	grams	none	0.00	1.00	1.00	3.00	3.00
IF1F	1	Tofu	17.00	12.75	21.25	19.70	grams	none	0.00	1.00	1.00	3.00	3.00
IF1G	1	Peanuts	14.00	10.50	17.50	55.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1H	1	UHT milk	90.00	67.50	112.50	36.70	ml	none	0.00	1.00	1.00	3.00	3.00
IF1J	1	Eggs (duck)	58.00	43.50	72.50	32.30	grams	none	0.00	1.00	1.00	3.00	3.00
IF1K	1	Pork	21.00	15.75	26.25	65.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1L	1	Fish	88.00	66.00	110.00	25.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1M	1	Morning glory	140.00	105.00	175.00	12.90	grams	none	0.00	1.00	1.00	3.00	3.00
IF1N	1	Tomato	77.00	57.75	96.25	8.70	grams	none	0.00	1.00	1.00	3.00	3.00
IF1O	1	Mustard green	88.00	66.00	110.00	6.90	grams	none	0.00	1.00	1.00	3.00	3.00
IF1P	1	Banana	78.00	58.50	97.50	5.90	grams	none	0.00	1.00	1.00	3.00	3.00
IF1Q	1	Watermelon	96.00	72.00	120.00	7.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1R	1	Oil	20.00	15.00	25.00	22.50	grams	none	0.00	1.00	1.00	3.00	3.00
IF1S	1	Sugar	16.00	12.00	20.00	16.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1T	1	Tea	50.00	37.50	62.50	13.80	grams	none	0.00	1.00	1.00	3.00	3.00
IF1X	1	Fish sauce	16.00	12.00	20.00	20.00	grams	none	0.00	1.00	1.00	3.00	3.00
IF1Y	1	Additional Staple	0.14	0.12	0.20	21100.00	total cost	none	0.00	1.00	1.00	3.00	3.00
SCB	**1**	**Housing**	0.00	0.00	0.00	0.00	montly cost	1.00	0.00	0.00	0.00	2.00	4.00
IF2A	1	Electricity	122000.00	91500.00	152500.00	0.10	kwh/month	none	0.00	1.00	1.00	3.00	3.00
IF2B	1	Piped Water	70000.00	52500.00	87500.00	1.00	m3/month	none	0.00	1.00	1.00	3.00	3.00
IF2C	1	Garbage collection	1.00	0.75	1.25	10000.00	monthly cost	none	0.00	1.00	1.00	3.00	3.00
IF2D	1	Gas for cooking	80000.00	60000.00	100000.00	1.00	l/month	none	0.00	1.00	1.00	3.00	3.00
IF2E	1	Public lighting	1.00	0.75	1.25	5000.00	total cost	none	0.00	1.00	1.00	3.00	3.00
IF2F	1	Rent	1.00	0.75	1.25	800000.00	total cost	none	0.00	1.00	1.00	3.00	3.00
SCC	**1**	**NFNH**	0.00	0.00	0.00	0.00	montly cost	1.00	0.00	0.00	0.00	2.00	4.00
IF3A	1	Food Cost Ratio	0.794	0.596	0.993	2896332.000	nual food ra	none	0.000	1.000	1.000	3.000	3.000
SCD	**1**	**Miscellaneous**	0.00	0.00	0.00	0.00	montly cost	1.00	0.00	0.00	0.00	2.00	4.00
IF4A	1	Unexpected events	0.050	0.038	0.063	6173219.608	nual food ra	none	0.000	1.000	1.000	3.000	3.000
SC	**1**	**Household Expendables**	0.00	0.00	0.00	0.00	total cost	none	0.00	1.00	1.00	0.00	0.00
ECA	**1**	**Gross Monthly Wage Adjustments**	0.00	0.00	0.00	0.00	ntly living wa	1.00	0.00	0.00	0.00	2.00	4.00
IF1A	1	Net takehome pay	0.470	0.353	0.588	-6481880.588	1/fte/mont	none	0.000	1.000	1.000	3.000	3.000
IF1B	1	Mandatory deductions	0.105	0.079	0.131	3046483.877	nual food ra	none	0.000	1.000	1.000	3.000	3.000
ECB	**1**	**Benefits**	0.00	0.00	0.00	0.00	montly cost	1.00	0.00	0.00	0.00	2.00	4.00
IF2A	1	In kind benefits (lunch)	1.000	0.750	1.250	-358800.000	onthly bene	none	0.000	1.000	1.000	3.000	3.000
IF2B	1	Cash allowances and bonus	1.000	0.750	1.250	-448333.000	onthly bene	none	0.000	1.000	1.000	3.000	3.000
EC	**1**	**Wage Adjustments**	0.00	0.00	0.00	0.00	total cost	none	0.00	1.00	1.00	0.00	0.00
TR	**1**	**Adjusted Gross Living Wage**	0.000	0.000	0.000	0.000	0.000	none	0.000	1.000	1.000	0.000	0.000

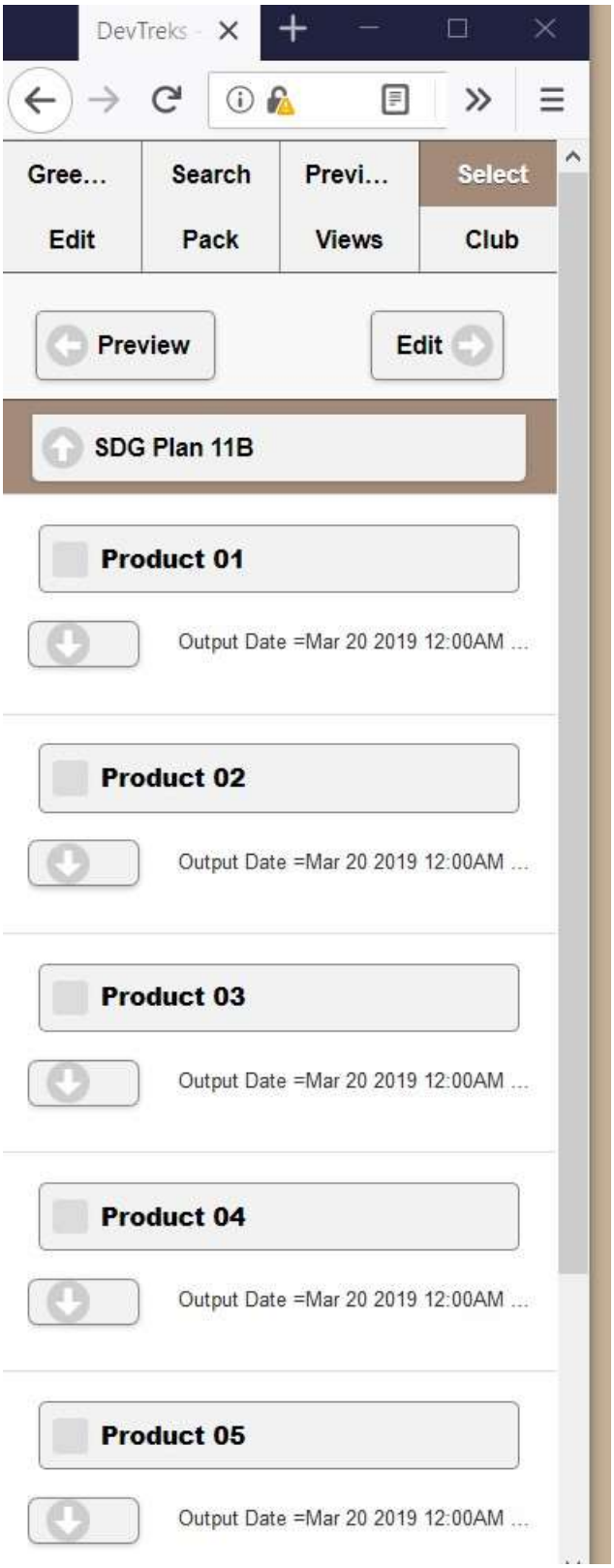
This example demonstrates adding sustainability scores to these base elements for purposes similar to OEFSRs, PEFCRs, and Baskets of Products. Sustainability workers develop representative M&A Actions for categories of products, sectors of industries, and baskets of products, that can be used to set priorities on the major environmental, social, and economic, factors influencing sustainability. Example 3 demonstrated how these types of techniques support Hotspots Analysis, explained in the following statement by that example's UN-SETACe reference.

"When applied to Life Cycle Assessment, the benefits of Hotspots Analysis include ensuring:

- Focus on priority issues (e.g., waste, water, materials of concern)
- Focus on the right life cycle stage (e.g., material acquisition, manufacturing, use, end of life)
- Focus on the right actors (e.g., producers, manufacturers, suppliers, retailers, customers, government officials) to evaluate, influence and implement solutions
- Implications of trade-offs are understood
- Resources (e.g., time, money) can be effectively allocated to actions."

Rather than repeat examples of similar techniques that have already been explained throughout DevTreks' tutorials, this example added five children Output Series to Example 11B's M&E and Stock Output calculations. The 16 TEXT datasets were then automatically inserted into the 5 Output Series and the following Output Analyses were conducted. This metadata analysis is comparing the Incremental Statistics and Changes taking place over time to the 5 Output Series.

Output with Output Series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SDG Plan 11B
Product 01
Output Date =Mar 20 2019 12:00AM ...
Product 02
Output Date =Mar 20 2019 12:00AM ...
Product 03
Output Date =Mar 20 2019 12:00AM ...
Product 04
Output Date =Mar 20 2019 12:00AM ...
Product 05
Output Date =Mar 20 2019 12:00AM ...

Stock Statistics Analysis (the same dataset is used with all Indicators and Output Series)

https://localhost:44304/greentreks

Observations					
Name	Life Cycle Stage 01	Life Cycle Stage 01	Life Cycle Stage 01	Life Cycle Stage 01	Life Cycle Stage 01
Label	SDG01	SDG01	SDG01	SDG01	SDG01
Total	399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Unit	actual most score	actual most score	actual most score	actual most score	actual most score
Mean	399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Median	399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Variance	0.0000	0.0000	0.0000	0.0000	0.0000
Std Dev	0.0000	0.0000	0.0000	0.0000	0.0000
Indicator Observations	1.0	1.0	1.0	1.0	1.0
Name	Life Cycle Stage 02	Life Cycle Stage 02	Life Cycle Stage 02	Life Cycle Stage 02	Life Cycle Stage 02
Label	SDG02	SDG02	SDG02	SDG02	SDG02
Total	399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Unit	actual most score	actual most score	actual most score	actual most score	actual most score
Mean	399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Median	399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Variance	0.0000	0.0000	0.0000	0.0000	0.0000
Std Dev	0.0000	0.0000	0.0000	0.0000	0.0000
Indicator Observations	1.0	1.0	1.0	1.0	1.0

M&E Change by Id Analysis (the same dataset is used with all Indicators and Output Series). This analysis will also be used with **Appendix D. Institutional Support for Digital SDG Planning**.

Media | Mobile | Desktop

Intro | 1 | 2 | 3 | Help

Your analysis has been saved. The analysis can be viewed whenever this analyzer addin is opened.

Output Group : RCA Output Examples ; none						
Output	All	Alt. 0				
Name		SDG Plan 11B				
Label		SDG11B				
Output Series	All	Alt. 0	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Name		Product 01	Product 02	Product 03	Product 04	Product 05
Label		SDG01	SDG02	SDG03	SDG04	SDG05
Alternative						
Indicator 0		Score	Score	Score	Score	Score
Observations		1.0	1.0	1.0	1.0	1.0
Date		03/20/2019	03/20/2019	03/20/2019	03/20/2019	03/20/2019
Label		SCORE1	SCORE1	SCORE1	SCORE1	SCORE1
Most Unit		actual most score	actual most score	actual most score	actual most score	actual most score
Most		399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Most Amount Change		0.00	0.00	0.00	0.00	0.00

In practice, the European Commission's PEF for Beer (2018) highlights the typical datasets that can be employed by these representative products (i.e. lagers, ales, stouts, sours, fruits).

Representative organizations can be treated in a similar fashion for OEFCRs (i.e. breweries, microbreweries, brew pubs, tap rooms, bars). Similar analyses can be conducted for all base elements (i.e. all products, organizations, categories of products, industrial sectors, and baskets of products).

In terms of Hotspots Analysis, each Indicator measures a life cycle stage and/or supply chain phase, each M&A Action measures a production practice, and each dataset's Categorical Index added an SDG Impact as a proxy for SDG-related elementary flows. The raw MathResult TEXT files can be added to spreadsheets, or automated in other manners, for more comprehensive Hotspots purposes.

More sophisticated sustainability scoring systems may prefer assigning scores to the Hotspots results rather than only to the initial M&A Actions. For example, the following images demonstrate how Castellani et al (2017) use this type of Hotspots-related data in support of more comprehensive sustainability efforts.

Table 21. Overview of ecoinnovation options relevant for the area of consumption of the BoP food and the link with possible scenarios

Hotspots	Areas of eco-innovation	Proposed solutions and eco-innovation	References
Animal-based products	Feed	Reducing the feed intake per animal to reduce the overall feed need	Sonesson et al., 2016
		Using food waste as feed for animals	Chen et al., 2015 Röös et al., 2016 Girotto et al., 2015 San Martin et al., 2016 De Meester et al., 2012
	Manure management	Less nitrogen and phosphorous are present in manure due to higher feed efficiency with the use of synthetic amino acids and phytase for increased phosphorous uptake	Sonesson et al., 2016
		Anaerobic digestion of the manure to produce biogas	Sonesson et al., 2016 Weidema et al, 2008;
		Manure storage with floor coverage	EC-JRC, 2015
	Animal breeding	Energy and water saving measures for pigs and poultry housings	EC-JRC, 2015
		To avoid oversupply of Cu and Zn in animal diets	Dourmad and Jondreville, 2007 Weidema et al., 2008
		Improved nutritional strategies to reduce ammonia emissions	EC-JRC, 2015

Table 22. Overview of principles of organic agriculture and applicability to the BoP food

Organic agriculture principle	Feasibility of implementation in the BoP
Crops are rotated so that on-site resources are used efficiently	Documentation of current assumptions in the background databases used to model the agricultural activities is not fully clear on this topic. In order to model properly the implementation of this principle, further analysis on the datasets is needed.
Chemical pesticides, synthetic fertilisers, antibiotics and other substances are severely restricted	Applicable. According to the results of the hotspot analysis, the largest effect is expected from the reduction of fertilizers and pesticides used to produce animal feed. Antibiotics, even if used in the average practice of animal breeding, are currently not accounted for in the datasets used to model the BoP food.
Genetically modified organisms (GMOs) are banned	GMOs are not modelled in LCA at the moment. A

The Green Public Procurement (GPP) criteria for Food and Catering Services are currently under revision. The criteria under discussion cover the following areas[5]:

— Purchase of organic food products

— Promotion of vegetarian food and meals in canteens (e.g. by proposing a fully vegetarian menu once or twice per week, to encourage people to not have meat all days)

— Purchase of marine and aquaculture fish products that are sustainably cached and grown

— Protection of animal welfare

— Reduction of food waste throughout the whole chain (for production of food products to the provision of the services), by optimizing the catering services (e.g. better planning of purchases) and by raising awareness among people attending the canteens (students and adults).

The implementation of the discussed criteria as possible scenarios of eco-innovation and

8.1 List of the scenarios tested in the BoP Food

The illustrative scenarios pre-selected to be built and implemented in the model of the BoP food, and finally evaluated against the baseline, are the following:

1) Nutrients cycle: recovery of nutrients by recycling food waste as animal feed:
    a. recycling of food waste at processing plant
    b. recycling of food waste at retailing
    c. recycling of food waste at processing and at retailing.
2) Improvement of wastewater treatment: 100% of wastewater treated with tertiary treatment for the removal of nutrients in EU-27.
3) Diet changes: diets with reduced quantity of meat and dairy products, substituted by a higher consumption of cereal-based products. Two options have been tested: 25% reduction and 50% reduction.
4) Nutrients cycle - recovery of nutrients from urine: separate collection of urine through eco-innovative toilets and recovery of nutrients (as urea) by fertilizing agricultural soil with urine:
    a. long-term storage of urine without any treatment before reuse;
    b. ozonation of urine before reuse, to inactivate pharmaceuticals and hormones.
5) Food waste prevention: prevention of food waste at household and consequent reduction of the quantity of food bought (i.e. reduction of amount of food in the BoP). Several measures for food waste prevention are tested (in brackets, the life cycle stage to which they refer):
    a. Produce Specifications (Agricultural stage)
    b. Manufacturing Line Optimization (Manufacturing stage)
    c. Improved Inventory Management (Retail)
    d. Cold chain management (Retail)
    e. Consumer Education Campaigns (Food consumption at households)
    f. Standardized Date Labelling (Food consumption at households)
    g. Packaging Adjustments (Food consumption at households).

Reports.

Applied Product SDG Dashboard and Index Report (see Example 1)

SDG Report - Food Industry in Landscape 1									
SDG Goals	**Overall Score**	**No Poverty**	**Zero Hunger**	**Good Health and Well Being**	**Quality Education**	**Gender Equality**	**…**	**Peace. Justice, and Strong Institutions**	**Partnerships for the Goals**
Goal Number	**10 point Index**	**1**	**2**	**3**	**4**	**5**	**6 to 15**	**16**	**17**
Food Products									
Product 1	x	x	x	x	x	x		x	x

Example 12. Applied Sustainability Accounting Platforms –Household Networks, Clubs, and Members

Algorithms:

Household LCI Budget: algorithm1, subalgorithm21 (new for 2.2.0)

Household LCIA Budget: algorithm1, subalgorithm20 (new for 2.2.0)

URLs:

https://www.devtreks.org/greentreks/preview/carbon/resourcepack/SDG Plan Example 12/1567/none

https://localhost:5001/greentreks/preview/carbon/resourcepack/SDG Plan Example 12/555/none

M&E Input Calculator

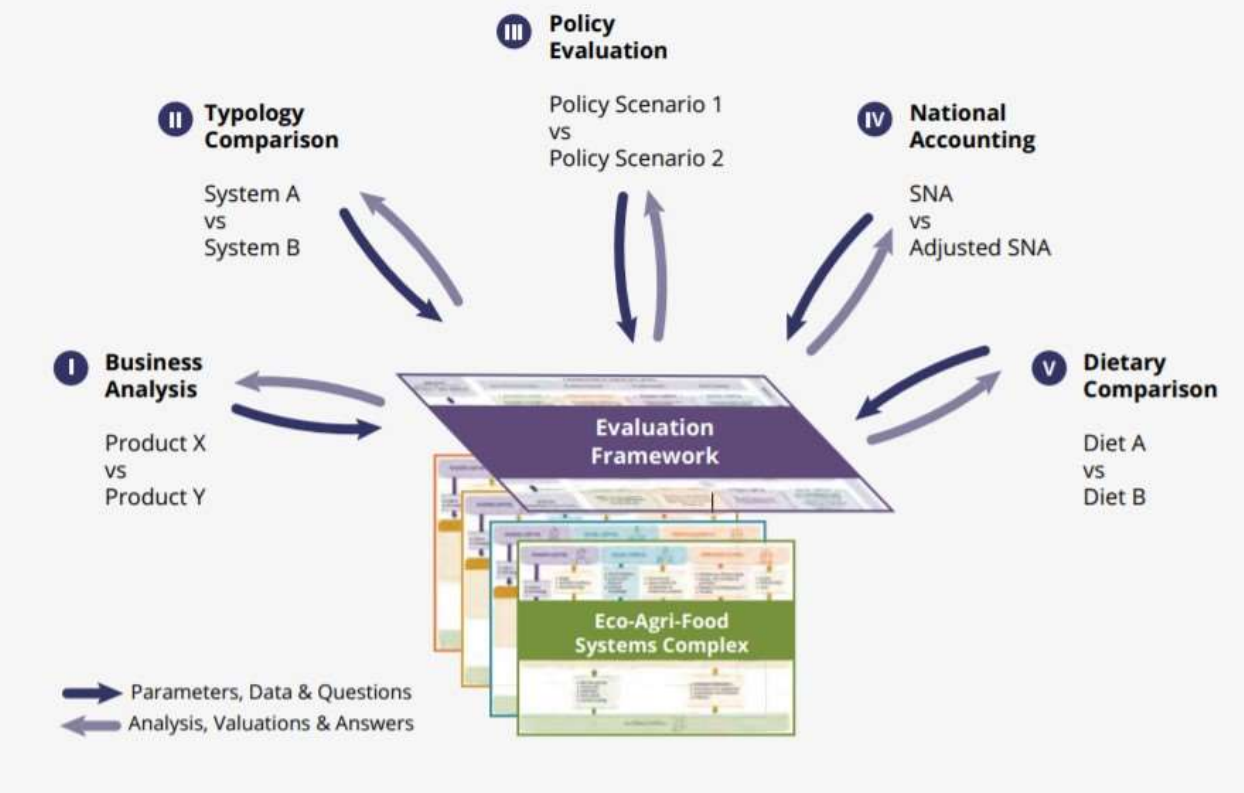
https://localhost:5001/greentreks/preview/carbon/input/SDG Plan Ex 12/2147409853/none

Stock Output Calculator

https://www.devtreks.org/greentreks/preview/carbon/output/SDG Plan Ex 12/2141223492/none

TEEB (2018) use the following image to explain how their Agri-Eco-System Framework, which closely resembles this tutorial's RCA Framework, can be used for general sustainability assessment purposes.

Figure 4.4 Applications of a universal Evaluation Framework (Source: Sandhu *et al*. 2018)



This example demonstrates the integration of community sustainability offices, sustainability accounting networks and clubs, social sustainability media platforms, and local sustainability workers, to assess community capital improvements for similar sustainability purposes. Although this example focuses on households, the general approach supports the more general framework introduced in the previous image, but with a greater emphasis on local scale. **Appendix C**, Social Sustainability Accounting for General Sustainability Assessments, explains the relation of this Agri-Eco-System Framework to the RCA Framework.

Household Sustainability Accounting Context

This section explains how Appendix C's general approach can been adapted for household sustainability accounting purposes. This section warns that sustainability accounting assessments that fail to fully address their community capital context are more useful for public relations than actual household, business, and community decision support.

Impact Pathway Stocks, Flows, and Outcomes –Community Sustainability Accounting Systems. TEEB (2018) uses the following image as a checklist that sustainability workers can use to account for the stocks, flows, and expected outcomes, for their assessments. The main reference explains that the SDGs are based on these community capitals and can be considered proxy measurements for the capitals themselves.

Stocks / Outcomes (change in capital stock)			
	Natural capital	Water (incl.quality, quantity)	
		Soil (incl. quality, quantity)	
		Air	
		Vegetation cover and habitat quality	
		Biodiversity	
		Other	
	Produced capital	Buildings	
		Machinery	
		Infrastructure	
		Research and development	
		Finance	
		Other	
	Human capital	Education/skills	
		Health	
		Working conditions (decent work)	
		Other	
	Social capital	Land access/tenure (private, public and communal)	
		Food security (access, distribution)	
		Opportunities for empowerment (gender and minority)	
		Social cooperation (incl. networks/unions)	
		Institutions	
		Laws and regulation (e.g. child labor)	
		Other	

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Flows			
	Agricultural and food outputs	Agricultural and food products	
		Income: value added, operating surplus	
		Subsidies, taxes and interest	
	Purchased inputs	Labour inputs (incl. skills)	
		Intermidiate consumption (produced inputs such as water, energy, fertilizers, pesticides, animal health and veterinary inputs)	
	Ecosystem services	Provisioning (e.g. biomass growth, freshwater)	
		Regulating (e.g. pollination, pest control, nutrient cycling)	
		Cultural (e.g. landscape amenity)	
	Residuals	Agricultural and food waste	

The main reference and Example 9 explain that the SDGs have been designed primarily for policy planning purposes, not actual sustainability accounting. Example 9's approach primarily supports uniform SDG policy planning, monitoring, evaluating, and reporting. Sustainability

workers use existing business and community social sustainability accounting systems to actually measure the SDGs and the community capitals. These existing systems are modified, similar to Example 9's capital stock inventories, to more fully document their underlying impact pathways (i.e. Stock-Flow-Outcome-Impacts) to ensure a full community capital context. The following image (GRI, 2015) shows the part of the specific sustainability accounting system used in this example.

Environment

Performance Indicators

Aspect: Materials

CORE **EN1** Materials used by weight or volume.

CORE **EN2** Percentage of materials used that are recycled input materials.

Aspect: Energy

CORE **EN3** Direct energy consumption by primary energy source.

CORE **EN4** Indirect energy consumption by primary source.

ADD **EN5** Energy saved due to conservation and efficiency improvements.

ADD **EN6** Initiatives to provide energy-efficient or renewable energy-based products and services, and reductions in energy requirements as a result of these initiatives.

ADD **EN7** Initiatives to reduce indirect energy consumption and reductions achieved.

Aspect: Water

CORE **EN8** Total water withdrawal by source.

ADD **EN9** Water sources significantly affected by withdrawal of water.

ADD **EN10** Percentage and total volume of water recycled and reused.

Aspect: Biodiversity

CORE **EN11** Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas.

CORE **EN12** Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.

ADD **EN13** Habitats protected or restored.

ADD **EN14** Strategies, current actions, and future plans for managing impacts on biodiversity.

ADD **EN15** Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk.

Aspect: Emissions, Effluents, and Waste

CORE **EN16** Total direct and indirect greenhouse gas emissions by weight.

CORE **EN17** Other relevant indirect greenhouse gas emissions by weight.

ADD **EN18** Initiatives to reduce greenhouse gas emissions and reductions achieved.

CORE **EN19** Emissions of ozone-depleting substances by weight.

The following URL and image show the reporting requirements followed by the GRI system. Note the inclusion of stakeholder perspectives in the reporting requirements.

https://www.process.st/checklist/gri-standards-101-foundation-2016-checklist-template/

8	**Report content:**	
9	Follow requirements and guidance for stakeholder inclu…	>
10	Balance conflicting stakeholder views	>
11	Test you stakeholder inclusiveness	>
12	Follow requirements and guidance for sustainability cont…	>
13	Frame overall performance in the broader context of sus…	>
14	Test your sustainability context	>
15	Follow requirements and guidance for materiality	>
16	Test your materiality	>
17	Follow requirements and guidance for completeness	>
18	Test your completeness	>
19	**Report quality:**	
20	Follow requirements and guidance for accuracy	>
21	Test for accuracy	>

Community Capital (i.e. Sustainability) Context. Wikipedia's entry for GRI (as of January, 2020) includes the following criticism of these types of reporting systems.

"As GRI has been pointing out for over a decade now, corporate sustainability reports must be inclusive of sustainability context to be meaningful. Environmental impacts should be reported relative to ecological thresholds, and social impacts relative to human needs [and stakeholder perspectives]. At the same time, significant human rights issues such as freedom of expression

and privacy are undermined. There simply cannot be any true, authentic, or empirical disclosure of sustainability performance unless such context is included; any more than there can be financial reporting without expenses being included."

In other words, reporting that doesn't fully account for sustainability contexts ends up being more concerned with public relations, and potentially, misinformation, rather than sustainability decision support. This example extends Example 9 and Appendix C's techniques with sample GRI Indicators to establish the community capital contexts needed for better sustainability decision support. These techniques address accounting system flaws by including:

- more comprehensive community capital stock flows, specifically ecosystem services and emissions,
- more comprehensive community capital stocks; specifically human, social, cultural, and institutional stocks [Note: Example 9-style stock measurements were tested with this algorithm for this purpose, but required too many assumptions and guesses, so DevTreks fell back on the "Linkage Documents" section, explained below, to relate the algorithm's flow measurements with stocks],
- high and low ranges for stock and flow measurements,
- certainty scores for stocks and flows,
- location and stakeholder-specific target threshold scores and percent target achievement for stocks and flows,
- stakeholder identification and outreach techniques for understanding stakeholder perspectives, including Social Impact Assessments [Note, the final algorithm produces Example 3's Hotspots Analysis but requires manual completion of the associated SIA (i.e. the numerator comes from the Hotspots data while the denominator comes from socioeconomic data),
- integrated valuation techniques for assessing the impacts of M&A Actions; specifically social media analysis approaches,

- more transparent, uniform, and "internationally-recognized", accounting showing how household input measurements translate into social impact categories; specifically by incorporating Example 3's LCIA approaches,
- compliance with certification requirements, specifically by requiring objective, 3rd party, sustainability clubs and networks to employ Internal Management Systems to codify certification compliance.

Even these improvements in sustainability accounting can't fully address the pronounced aversion to scientific evidence, and facts, held by many business managers, households, and community leaders, or more accurately, misleaders. Recent history confirms that several countries are experiencing a remarkable surge of support for sophistry and misinformation –as long as the fiction benefits particular special interest groups. Similarly, they can't fully deal with the institutional failure that explains why these flaws still persist. The main body of this reference recommends addressing these severe accounting threats through institutional changes that lead to consumer demand for "strong, objective, 3rd party, "verifiers" who are backed with strong certification requirements that follow transparent, internationally recognized, standards." [and relegating the transgressors to platforms where they can only amuse one another]

Impact Pathway M&A Actions and Impacts: Community Guidance Documents and M&E Worksheets. Appendix B introduced the following M&A Action worksheet used as a simple M&E system for community sustainability planning. This example uses these types of worksheets, as part of the Community Sustainability Accounting system, for the source of the M&A Actions that impact individual households. Appendix C explains that, unlike Example 9, where these M&A Actions are allocated to specific SDG targets, their specific impacts and scoring systems are documented in background guidance documents.

Sustainability Planning Guide

Sustainability Goal #1:	[e.g. service sustained; income diversification; amount to be raised; in-kind support; organizational infrastructure strengthened; partnership established; training delivered; etc.]
Sustainability Method(s):	[Method(s) used to achieve sustainability goal]

Primary Activity	Secondary Activities / Deliverables	Alignment with OAH Factors for Program Sustainability	Person/Group Responsible	Timeline	Resources and/or individual T/A Needed	Progress Update
1.	a.					
	b.					
	c.					
2.	a.					
	b.					
	c.					

4

This Sustainability Planning Guide was adapted by the Office of Adolescent Health from the TPP LEAD Collaborative and the University of Massachusetts Donahue Institute.

Impact Pathway M&A Actions: Community SDG Policy Plans. The main reference introduced the following tables to convert local proxy Indicators to SDG Indicators. This example requires that sustainability workers document these relations in background guidance documents.

ALIGNMENT						MEA
SDGs	SDG Target	Indicators	Target(s) from City Strategy (quantified, if possible)	Target source document	Institution responsible for target	Mea Indic
Goal 1. End poverty in all its forms everywhere	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)				
	1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age				
		1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions				
	1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable				

The following URLs and image how to use this example's GRI reporting system and the SDGs. They use Example 9-style techniques to develop the actual SDG Plans from these relations.

https://www.globalreporting.org/standards/resource-download-center/

GRI Standards Linkage Documents

Documents that highlight connections between the GRI Standards and other frameworks and initiatives - enabling organizations to fulfill multiple reporting requirements using the Standards.

Linking the GRI Standards and CASS CSR 4.0 (English)

Effective From: 05 Aug 2019

Linking the GRI Standards and CASS CSR 4.0 (Chinese)

Effective From: 05 Aug 2019

Linking GRI Standards and EU NFR Directive disclosure

Effective From: 14 Feb 2017

Linking the GRI Standards and the SEBI BRR Framework

Effective From: 14 Feb 2017

SDG Compass Annex: Linking the SDGs and GRI Standards

Effective From: 06 Feb 2017

Linking GRI and CDP: How are Standards and CDP climate change questions aligned?

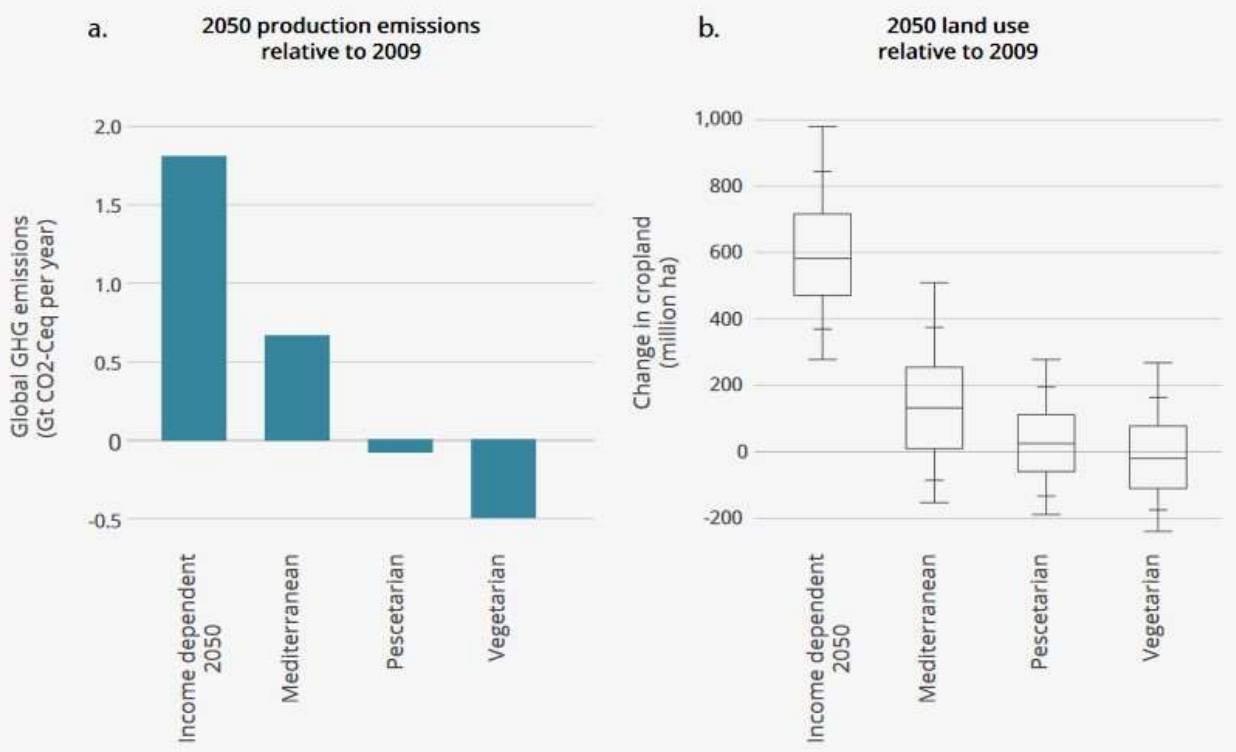
SDG Compass

Developed by: GRI, United Nations Global Compact, wbcsd

SDG	Business Theme	Relevant GRI Standard or Sector Disclosure	Disclosure/ Indicator Nr.	Disclosure/Indicator Title
1. End poverty in all its forms everywhere	Access to financial services	G4 Sector Disclosures: Financial Services	FS6	Percentage of the portfolio for business lines by specific region, size (e.g. micro/sme/large) and by sector
			FS7	Monetary value of products and services designed to deliver a specific social benefit for each business line broken down by purpose
			FS13	Access points in low-populated or economically disadvantaged areas by type
			FS14	Initiatives to improve access to financial services for disadvantaged people
			former FS16	Initiatives to enhance financial literacy by type of beneficiary
	Access to land	GRI 413: Local Communities	413-2	Operations with significant actual and potential negative impacts on local communities
		G4 Sector Disclosures: Mining and Metals, Oil and Gas	MM1	Total number of operations taking place in or adjacent to indigenous peoples' territories, and number and percentage of operations or sites where there are formal agreements with indigenous peoples' communities
			MM6	Number and description of significant disputes relating to land use, customary rights of local communities and indigenous peoples
			MM7	The extent to which grievance mechanisms were used to resolve disputes relating to land use, customary rights of local communities and indigenous peoples, and the outcomes
			MM8	Number (and percentage) of company operating sites where artisanal and small-scale mining (asm) takes place on, or adjacent to, the site; the associated risks and the actions taken to manage and mitigate these risks
			OG9	Operations where indigenous communities are present or affected by activities and where specific engagement strategies are in place

Impact Pathway Impact Valuation: Household Impacts. Appendix C points out that the Inputs (i.e. food) and Outputs (i.e. wages) documented in Example 4 and 11's household budget can't be fully used for social budgeting because of missing, important, Stock Flows. The household budget fails to account for the social costs associated with Residuals (i.e. food waste, food packaging) and the social benefits associated with Public Goods, particularly Ecosystem, Services. For example, TEEB (2018) uses the following image to document the GHG emission reductions associated with improved diets.

Figure 3.1 Effects of diets on GHG emissions (Source: Adapted from Tilman and Clark 2014)



Impact Pathway Integrated Valuation: Household Sustainability Accounting. Household sustainability accounting systems modify the community-level sustainability accounting systems for household record keeping. The following table illustrates tying household proxy indicators to the community sustainability accounting systems. Community sustainability workers use local, household, guidance documents to adjust the GRI guidance documents, or similar sustainability accounting system instructions, to educate networks and clubs about the use of these household accounting systems. For example, community stock and flow thresholds and targets are modified for household accounting. Although this type of household accounting may not be common practice today, better IT will make them feasible soon (i.e. household energy audits, the US EPA's household carbon footprint calculators)

GRI Label	**GRI – Community and Business**	**GRI - Household**
ENM	**Materials**	**Consumer Purchases**

EN1	Materials used by weight	Products consumed by weight
EN2	Percentage of materials that are recycled input materials	Percentage of household products that use recycled ingredients
new		Household product use score
ENE	**Energy**	**Energy**
EN3	Direct energy use by primary source	Electricity use by household
new		Household energy audit score
ENW	**Water**	**Water**
EN8	Total water withdrawal by source	Total water consumed by household
new		Household water use score
ENB	**Biodiversity**	**Natural Areas**
EN13	Habitats protected or restored	Time spent enjoying and caring for parks, hiking trails, and natural areas
new		Household natural area support score
ENW	**Emissions, Effluents, and Waste**	**Emissions and Waste**
EN16	Total direct and indirect GHG emissions by weight	Total household GHG emissions by weight
new		Household carbon footprint score

Common Sustainability Accounting Records. The following URLs and images highlight the challenges of developing uniform household sustainability accounting records. Although DevTreks' networks work on domain specific areas such as health care or climate change, which technically can develop these types of custom records (i.e. custom algorithms), the IT goal for collecting and using the records is always simplicity (i.e. fewer algorithms is better). That means developing common accounting records that can be used by any network.

https://www.healthit.gov/faq/what-information-does-electronic-health-record-ehr-contain

HealthIT.gov

Data Briefs

What information does an electronic health record (EHR) contain?

Electronic Health Records: The Basics

An electronic health record (EHR) contains patient health information, such as:

- Administrative and billing data
- Patient demographics
- Progress notes
- Vital signs
- Medical histories
- Diagnoses
- Medications
- Immunization dates
- Allergies
- Radiology images
- Lab and test results

An EHR is more than just a computerized version of a paper chart in a provider's office. It's a digital record that can provide comprehensive health information

https://www.ahrq.gov/ncepcr/tools/pf-handbook/mod8-app-b-john-donut.html

Sample Medical Record: John Donut

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Use for January 2011 abstraction

WeServeEveryone Clinic	
1111 First Street California 111-111-11111 Fax: 111-111-1111	Chart Summary

John Donut

Home: 000-000-0000 Male DOB: 01/01/1935	0000-11111	Ins: Commercial xxxxx

Patient Information

Name: John Donut	**Home Phone:** 000- 000-0000
Address: 1111 Donut Road Fast Food. California	**Office Phone:**

For example, the following table illustrates common sustainability records that correspond to these types of domain-specific records. Unlike the health care record, or any domain-specific record, these records are used for any community capital accounting. As a simple example, the household's uniform digital accounting system can include a tab that connects to their common medical record data, a tab that connects to their common financial records, a tab that connects to their common household sustainability records, ….

Medical Record	Common Community Capital Record
Administrative and billing record	Household checking and mobile payment account records
Patient demographics	Household profile
Progress notes	Household monitoring and evaluation progress
Vital signs	Household sustainability scores, such as health eating indexes, energy audits, club scores assigned to member households
Medical histories	Sustainability time series and transition state stock scores
Diagnoses	Club sustainability advisor recommendations and automated background guidance documents
Medications	Household M&A Actions and stock flows
Immunization dates	Sustainability accounting dates: recycled waste pickup dates, sustainability club meeting dates, transition state dates
Allergies	Household sustainability risk drivers
Radiology images	Household sustainability club media management: maps, site sketches, housing drawings, waste management pictures, best management videos
Lab and test results	Integrated valuation using household club sustainability monitoring, evaluating, and reporting (i.e. audits)

Club and Network Sustainability Management and Certification. The following image (Meinshausen et al, 2019) summarize EU requirements that groups of organic farmers must

follow to receive producer group certification. For this example, groups of households, or clubs, receive household club certification after meeting community sustainability requirements.

7.3 Annex III: Summary of group certification requirements within the main organic regulations

Group Certification Requirements EU
European Commission Guidelines for the evaluation of the equivalence of organic producer group certification schemes applied in developing countries (2008)

- Scope of Group certification (pre-requirements)
- Only small farms (some guidance on bigger members, processing units etc.). Note: the new Organic Regulation 2018/848 defines additional restrictions for who can be member of a group (less than 5 hectares / 15 hectares grassland; or maximum turnover/output from organic farming)
- Similar production systems & in geographic proximity
- Group must be formally established
- Collective marketing
- An Internal control system(ICS)
- Document the internal quality system and a contract with each group member
- The role of internal inspectors
- One annual internal inspection of each group operator (incl. visit to fields & facilities)
- Appropriate documentation of the ICS
- Sanctions to individual members who do not comply with production standards.
  Need to inform certification body of irregularities, non-compliances and corrective actions
- External control of group operations
- One annual inspection of the group per year, evaluating the effectiveness of the ICS to assess compliance with the production standard by all producers in the group
- Each year at least the square root of the number of farms needs to be externally inspected, choosing predominantly different farms from year to year. For medium and high risk situations.

Sustainability workers help the clubs to attain certification by supervising their record keeping and providing professional sustainability advice. Appendix C explains that the workers employ sustainability management systems (i.e. Meinshausen et al's Internal Management Systems) for their background business management system. For example, the following table (adapted from

Meinshausen et al, 2019) illustrates the relation between household sustainability management systems and the Internal Control Systems used by some organic producer groups.

Internal Control Systems (ICS) and Organic Farm Group Certifications	**Sustainability Accounting Club Management Systems and Certifications**
Written contracts with each producer	Online Service Agreements with each member
Internal organic standard /understandable summary of relevant production rules	Automated household club guidance documents
Farm details for each producer	Household details for each club member
Updated production records	Updated household purchase and consumption records
Effective technical field extension	Effective sustainability worker outreach
Field advisors experienced in organic production	Sustainability workers experienced in household sustainability management and accounting
Producer list / register: complete & up to date	Club list for each network; Member list for each club; Product and Organization sustainability lists; complete and up to date
Overview maps & plots	Overview maps and plots
Internal inspection includes field visit and farmer interview	Club and household inspection includes household visit and interview
Sufficient number of internal inspectors / internal inspections are thorough	Sufficient number of sustainability workers / household inspections are thorough
Internal inspectors have knowledge of organic farming, standard requirements and inspection techniques	Sustainability workers have knowledge of community and household sustainability management, accounting, monitoring, and evaluating
Effective follow up of material non-conformities and sanctions by the ICS	Effective follow up of material non-conformities and sanctions by the ICS

ICS informs CB about material NCs and sanction	ICS informs Certification Body about material non-compliance and sanction by clubs
ICS Buying procedures: only products from certified farms is bought as organic	ICS consumer purchase recommendations: only products from certified sustainable organizations are bought as sustainable. Consumers use sustainable, and unsustainable, organization and product recommendation lists when making, and refraining from making, purchases.
Effective System to manage conflicts of interest of ICS staff	Effective system to manage conflicts of interest by ICS staff
	Example 5 in SPA3 identifies additional ICS requirements such as grievance mechanisms, household club audits, capacity building, and rewards systems.

Appendix C recommends that new sustainability service industries get built to support the sustainability workers. Appendix C also reiterates the importance of unbiased certifications. Some existing certification schemes may be biased towards producer, special interest, and authoritarian government, stakeholder perspectives, and neglect other stakeholder perspectives (i.e. no backing down from this point –recent speeches and protest marches by the younger generation confirms that they recognize the failures of existing, conventional, institutions, including producers and their production systems, consumers with their consumption preferences, and governments with their political partisanships). This reference recommends that households address institutional failure by demanding that these service industries "use strong, objective, 3rd party, "verifiers" who are backed with strong certification requirements that follow transparent, internationally recognized, standards."

Impact Pathway Household Monitoring and Evaluating: Machine Learning and Semantic Web Technologies. Appendix C explains that the RCA Framework places greater emphasis on Integrated Valuation techniques than Impact Valuation approaches. Integrated Valuation focuses more directly on supporting household decisions that can increase their quality of life. Rather than attempting to derive a quantitative estimation of impact value, Sustainability Accounting Networks and Clubs aggregate individual household preference data inferred from their use of social sustainability media platforms. The accounting networks and clubs still use household records, such as the previous table's human capital records, but also use other social media, including purchasing decisions, social media habits, expense records, sustainability audits, narrative blogs, stories, and social media preferences, to value impacts.

Datasets for Applied SDG Household Club Plans

These algorithms use the following 3 datasets to apply this planning approach. Although this example focuses on LCIA techniques, Appendix C endorses additional internationally-supported techniques that can be automated in guidance documents and that can help consumers and producers to make better choices.

Operating Budgets for Household Club Resource Stock and Flow Inventories. Example 3 confirms that most sustainability accounting requires a complete inventory (i.e. Life Cycle Inventory, or LCI) of the inputs (i.e. household purchases) being expended in the production of output (household well-being, household waste production, and wealth accumulation). Households use operating budgets for these inventories. This example employs a new algorithm for these budgets.

Besides production and consumption inputs and outputs, the TEEB framework identifies emissions and ecosystem services as additional, key "flows" needed in these inventories. Although this example focuses on household LCIs, Appendix C confirms that additional types of LCIs support additional types of accounting, including landscape and ecosystem planning.

In the long run, these LCIs should be the only data submitted by communities, businesses, or households, to the accounting platform. Their corresponding Capital Stock relations are

maintained, digitally, in the background guidance documents, and will automatically generate the final LCIAs, SLCIAs, and sustainability reports (i.e. by using institutional change to start Appendix C's new service industries and Appendix D's digital support teams).

Capital Budgets for Household Club Sustainability Accounting. The TEEB Community Stock Inventory image shown above gets applied using actual community sustainability accounting systems. Although Example 9 demonstrates how to use the SDGs directly for sustainability accounting, this reference confirms that, in practice, communities and businesses employ formal sustainability accounting systems. These systems have been developed specifically for formal accounting purposes and their Indicators reflect practical, concrete, measurements. Although this example modifies the GRI system for this purpose, any equivalently modified community sustainability accounting system can be used. A new algorithm extends Example 9's SDG Planning Targets and Goals (i.e. MCDA scores) with Appendix C's impact pathways (i.e. LCIA cause and effect pathways). Appendix C points out that, depending on data availability and accounting system, simpler algorithms and additional assessment techniques can also be used for the accounting.

Common Community Club Records plus Hotspots Results for Household Performance Measurements and Stakeholder Impacts. Appendix C explained the importance of linking sustainability scores with community, business, and household, management metrics (i.e. elementary flow per employee, % consumers satisfied with natural capital management work processes, life cycle stage impact on stakeholder group). A new algorithm generates Example 3's Hotspots Score results for the sustainability metrics (i.e. the numerator). This example's "common community capital records" are recommended for the management metrics (i.e. by manually setting appropriate divisors). The performance measurements support better consumer and production choices. In this example, they also support simplified Stakeholder Impact Assessments.

DevTreks requires that households, businesses, and communities use common sustainability accounting records and reports. While some stakeholders are capable of using these full accounting systems, with their full sustainability contexts, others will rely on guidance document

scoring systems devised by sustainability workers who use this type of more comprehensive approach (i.e. cause and effect pathways, target accomplishments, common scores). More advanced algorithms integrate the initial LCI, the LCIA, and "fixed" data such as conversion and characterization factors datasets (i.e. the Capital Input calculators use this automated guidance document approach).

Dataset 1. Life Cycle Inventories (LCI)

Employs a new algorithm, subalgorithm21, based on Example 4's household budget, to serve as a life cycle cost/benefit-based LCI. The following table shows that Example 4's household budget has been stylistically changed to account for lifestyle choices, health care expenses, natural areas improvement (i.e. ecosystem improvement), garbage and waste (i.e. emissions), and household wealth (i.e. assets and debts). Appendix C points out that, although existing LCI datasets may have considerably different purposes, automated guidance documents make appropriate connections to Dataset 2-like Capital Stock inventories and generate final LCIA calculations.

subalgo16

locati	risks_and_indicators	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
1	**Diet**	**0**	**0**	**0**	**0**	**montly cost**	**120**	**0**	**0**	**0**	**3**	**3**
1	Plain Rice	415	415	518.75	10	grams	none	0	1	1	3	3
1	Sticky Rice	35	26.25	43.75	13.5	grams	none	0	1	1	3	3
1	Noodles	9	6.75	11.25	50	grams	none	0	1	1	3	3
1	Bread	6	4.5	7.5	20	grams	none	0	1	1	3	3
1	Potato	20	15	25	10.6	grams	none	0	1	1	3	3
1	Tofu	17	12.75	21.25	19.7	grams	none	0	1	1	3	3
1	Peanuts	14	10.5	17.5	55	grams	none	0	1	1	3	3
1	UHT milk	90	67.5	112.5	36.7	ml	none	0	1	1	3	3
1	Eggs (duck)	58	43.5	72.5	32.3	grams	none	0	1	1	3	3
1	Pork	21	15.75	26.25	65	grams	none	0	1	1	3	3
1	Fish	88	66	110	25	grams	none	0	1	1	3	3
1	Morning glory	140	105	175	12.9	grams	none	0	1	1	3	3
1	Tomato	77	57.75	96.25	8.7	grams	none	0	1	1	3	3
1	Mustard green	88	66	110	6.9	grams	none	0	1	1	3	3
1	Banana	78	58.5	97.5	5.9	grams	none	0	1	1	3	3
1	Watermelon	96	72	120	7	grams	none	0	1	1	3	3
1	Oil	20	15	25	22.5	grams	none	0	1	1	3	3
1	Sugar	16	12	20	16	grams	none	0	1	1	3	3
1	Tea	50	37.5	62.5	13.8	grams	none	0	1	1	3	3
1	Fish sauce	16	12	20	20	grams	none	0	1	1	3	3
1	Additional Staple	0.14	0.12	0.2	21100	total cost	none	0	1	1	3	3
1	**Housing**	**0**	**0**	**0**	**0**	**montly cost**	**1**	**0**	**0**	**0**	**3**	**3**
1	Electricity	122000	91500	152500	0.1	kwh/month	triangul	0	1	1	3	3
1	Piped Water	70000	52500	87500	1	m3/month	triangul	0	1	1	3	3
1	Garbage collection	1	0.75	1.25	10000	monthly cost	triangul	0	1	1	3	3
1	Gas for cooking	80000	60000	100000	1	l/month	triangul	0	1	1	3	3
1	Public lighting	1	0.75	1.25	5000	total cost	triangul	0	1	1	3	3
1	Rent	1	0.75	1.25	800000	total cost	triangul	0	1	1	3	3
1	**NFNH**	**0**	**0**	**0**	**0**	**montly cost**	**1**	**0**	**0**	**0**	**3**	**3**
1	Food Cost Ratio	0.794	0.596	0.993	2896332	annual food ra	none	0	1	1	3	3
1	**Miscellaneous**	**0**	**0**	**0**	**0**	**montly cost**	**1**	**0**	**0**	**0**	**3**	**3**
1	Unexpected events	0.05	0.038	0.063	6173220	annual food ra	none	0	1	1	3	3
1	**Health Care**	**0**	**0**	**0**	**0**	**monthly score**	**1**	**0**	**0**	**0**	**3**	**3**
1	Premiums	100	50	200	1	premium cost	none	0	1	1	3	3
1	Copays	30	20	40	1	copay cost	none	0	1	1	3	3
1	**Household Expendabl**	**0**	**1**	**1**	**0**	**total cost**	**none**	**0**	**0**	**0**	**3**	**3**
1	**Gross Monthly Wage**	**0**	**0**	**0**	**0**	**montly living**	**1**	**0**	**0**	**0**	**3**	**3**
1	Net takehome pay	0.47	0.353	0.588	-6481881	1/fte/mont	none	0	1	1	3	3
1	Mandatory deductions	0.105	0.079	0.131	3046484	annual food ra	none	0	1	1	3	3
1	**Benefits**	**0**	**0**	**0**	**0**	**montly cost**	**1**	**0**	**0**	**0**	**3**	**3**
1	In kind benefits (lunch)	1	0.75	1.25	-358800	monthly benef	none	0	1	1	3	3
1	Cash allowances and b	1	0.75	1.25	-448333	monthly benef	none	0	1	1	3	3
1	**Wage Adjustments**	**0**	**1**	**1**	**0**	**total cost**	**none**	**0**	**0**	**0**	**3**	**3**
1	**Adjusted Gross Living**	**0**	**2**	**2**	**0**	**0**	**none**	**0**	**0**	**0**	**3**	**3**
1	**Lifestyle**	**0**	**0**	**0**	**0**	**monthly score**	**1**	**0**	**0**	**0**	**3**	**3**
1	Exercise	14	9	20	14	hours per mon	mcda	minmax	1	1	3	3
1	Mindfulness	1	0.5	2	25	hours per mon	mcda	minmax	1	1	3	3
1	Natural Areas	1	0.5	2	14	hours per mon	mcda	minmax	1	1	3	3
1	**Waste**	**0**	**0**	**0**	**0**	**monthly score**	**1**	**0**	**0**	**0**	**3**	**3**
1	Recycled products	50	25	75	1	percent of purchases		minmax	1	1	3	3
1	Carbon footprint	50	25	75	1	GWP100	mcda	minmax	1	1	3	3
1	**Sustainability Score**	**0**	**1**	**1**	**0**	**score**	**mcda**	**0**	**0**	**0**	**3**	**3**
1	**Adjusted Sustainabilit**	**0**	**2**	**2**	**0**	**score**	**mcda**	**0**	**0**	**0**	**3**	**3**
1	**Household Credit**	**0**	**0**	**0**	**0**	**annual debt**	**1**	**0**	**0**	**0**	**3**	**3**
1	Credit cards	1	0	10	3500	debt balance	none	0	1	1	3	3
1	Car loan	1	0	3	5500	debt balance	none	0	1	1	3	3
1	**Household Debt**	**0**	**1**	**1**	**0**	**total debt**	**none**	**0**	**0**	**0**	**3**	**3**
1	**Gross Monthly Wealth**	**0**	**0**	**0**	**0**	**annual wealth**	**1**	**0**	**0**	**0**	**3**	**3**
1	Retirement Savings	1	0.75	1.25	25000	savings balanc	none	0	1	1	3	3
1	Mandatory 401K contr	1	0.75	1.25	1500	annual contrib	none	0	1	1	3	3
1	**Household Wealth**	**0**	**0**	**0**	**0**	**annual contrib**	**1**	**0**	**0**	**0**	**3**	**3**
1	In kind benefits (401K)	1	0.75	1.25	-1000	annual benefit	none	0	1	1	3	3
1	IRS earned income cre	1	0.75	1.25	-5000	annual benefit	none	0	1	1	3	3
1	**Wealth Adjustments**	**0**	**1**	**1**	**0**	**total debt**	**none**	**0**	**0**	**0**	**3**	**3**
1	**Adjusted Gross Living**	**0**	**2**	**2**	**0**	**net wealth**	**none**	**0**	**0**	**0**	**3**	**3**

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label	locat	risks_and_indic	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18	factor19	factor20	factor21	factor22	factor23	factor24	factor25
T01	**1**	**Diet**																									
IF1A	1	Plain Rice	1/1/2020	415	grams	415	mean	103.75	sd	normal	10	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1B	1	Sticky Rice	1/1/2020	35	grams	35	mean	8.75	sd	normal	13.5	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1C	1	Noodles	1/1/2020	9	grams	9	mean	2.25	sd	normal	50	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1D	1	Bread	1/1/2020	6	grams	6	mean	1.5	sd	normal	20	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1E	1	Potato	1/1/2020	20	grams	20	mean	5	sd	normal	10.6	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1F	1	Tofu	1/1/2020	17	grams	17	mean	4.25	sd	normal	19.7	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1G	1	Peanuts	1/1/2020	14	grams	14	mean	3.5	sd	normal	55	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1H	1	UHT milk	1/1/2020	90	grams	90	mean	22.5	sd	normal	36.7	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1J	1	Eggs (duck)	1/1/2020	58	grams	58	mean	14.5	sd	normal	32.3	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1K	1	Pork	1/1/2020	21	grams	21	mean	5.25	sd	normal	65	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1L	1	Fish	1/1/2020	88	grams	88	mean	22	sd	normal	25	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1M	1	Morning glory	1/1/2020	140	grams	140	mean	35	sd	normal	12.9	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1N	1	Tomato	1/1/2020	77	grams	77	mean	19.25	sd	normal	8.7	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1O	1	Mustard green	1/1/2020	88	grams	88	mean	22	sd	normal	6.9	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1P	1	Banana	1/1/2020	78	grams	78	mean	19.5	sd	normal	5.9	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1Q	1	Watermelon	1/1/2020	96	grams	96	mean	24	sd	normal	7	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1R	1	Oil	1/1/2020	20	grams	20	mean	5	sd	normal	22.5	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1S	1	Sugar	1/1/2020	16	grams	16	mean	4	sd	normal	16	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1T	1	Tea	1/1/2020	50	grams	50	mean	12.5	sd	normal	13.8	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1U	1	Fish sauce	1/1/2020	16	grams	16	mean	4	sd	normal	20	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF1V	1	Additional Stapl	1/1/2020	0.14	grams	0.14	mean	0.035	sd	normal	21100	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
T02	**1**	**Housing**	**0**	**0**	**montly cost**																						
IF2A	1	Electricity	1/1/2020	122000	kwh/month	91500	low q	152500	high q	triangular	0.1	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF2B	1	Piped Water	1/1/2020	70000	m3/month	52500	low q	87500	high q	triangular	1	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF2C	1	Garbage collect	1/1/2020	1	monthly cost	0.75	low q	1.25	high q	triangular	10000	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF2D	1	Gas for cooking	1/1/2020	80000	l/month	60000	low q	100000	high q	triangular	1	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1
IF2E	1	Public lighting	1/1/2020	1	total cost	0.75	low q	1.25	high q	triangular	5000	monthly do	none	0	1	1	1	0	0	0	0	2	3	1	2	none	1

New types of indicators, such as the Lifestyle category's Mindfulness Indicator, have been added to reinforce the need for institutional changes that support next generation social norms and habits [i.e. to combat blue screen disease; because plenty of last generation social norms are doing more harm than good; because it works for this Oregon-based author].

Some of the more comprehensive accounting contained in the guidance documents, such as for human and legal rights, must be addressed by community level plans and additional algorithms.

Dataset 2. LCIA Assessment

Employs a new algorithm, subalgorithm20, based on Appendix C's LCIA impact pathway approaches, to measure sample GRI Indicators and Appendix C's SLCA-related Indicators. The final results from these assessments include summary LCIA and SLCA measurements, percent target accomplishments, and several sustainability scores. This example's Guidance Document section demonstrates how to use these common sustainability scores. The scores also support the consistent comparisons and tradeoffs needed to support producer and consumer choices.

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
T301-01	**1**	**Materials**	**cfname**	**1**	**cf1**	**1**	**mean**	**0.5**	**sd**	**normal**	**lifec01**	**prodp01**	**2**
I301-01a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I301-01b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T301-02	**1**	**Recycled i**	**cfname**	**1**	**cf1**	**1**	**mean**	**0.5**	**sd**	**normal**	**lifec01**	**prodp01**	**2**
I301-02a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I301-02b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
I301-02c	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I301-02d	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T301-03	**1**	**Reclaimed**	**cfname**	**1**	**cf1**	**1**	**mean**	**0.5**	**sd**	**normal**	**lifec01**	**prodp01**	**2**
I301-03a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I301-03b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
G301	**1**	**Materials**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
T302-01	1	Energy cor	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I302-01a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I302-01b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T302-02	1	Energy cor	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I302-02a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I302-02b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T302-03	1	Energy inte	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I302-03a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I302-03b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T302-04	1	Reduction	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I302-04a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I302-04b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T302-05	1	Reductions	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I302-05a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I302-05b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
G302	**1**	**Energy Sc**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
T303-01	1	Interactior	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I303-01a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I303-01b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T303-02	1	Managem	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I303-02a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I303-02b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T303-03	1	Water wit	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I303-03a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I303-03b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T303-04	1	Water disc	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I303-04a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I303-04b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T303-05	1	Water con	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I303-05a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I303-05b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
G303	**1**	**Water and**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
T304-01	1	Operation	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I304-01a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I304-01b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T304-02	1	Significant	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I304-02a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I304-02b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T304-03	1	Habitats p	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I304-03a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I304-03b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
T304-04	1	IUCN Red	cfname	1	cf1	1	mean	0.5	sd	normal	lifec01	prodp01	2
I304-04a	1	Indicator (	43831	5	most likely	1	low units	10	high units	none	multiplier	1	multiplier
I304-04b	1	Indicator (	43831	10	most likely	5	low units	20	high units	none	multiplier	1	multiplier
G304	**1**	**Biodiversi**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**

factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18	factor19	factor20
2	**3**	**30**	**7.5**	**2**	**minmax**	**1**	**Q1*Q2**	**www.devtreks.org/c**	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	**3**	**60**	**15**	**2**	**minmax**	**1**	**mcda:Q1***	**www.devtreks.org/c**	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	**3**	**30**	**7.5**	**2**	**minmax**	**1**	**Q1*Q2**	**www.devtreks.org/c**	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
none	**none**	**10**	**2**	**none**	**minmax**	**1**			
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
none	**none**	**10**	**2**	**none**	**minmax**	**1**			
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
2	3	30	7.5	2	minmax	1	Q1*Q2	www.devtreks.org/ca	
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	10	2.5	Q1*Q2*Q
multiplier	emission n	0.5	emission u	midpoint	2	midpoint	20	5	Q1*Q2*Q
none	**none**	**10**	**2**	**none**	**minmax**	**1**			

Dataset 3. Score Hotspots Analysis with Common Community Capital Records (CCCR) for Stakeholder Impacts (under development)

The Score.MathResults hold the same Hotspots data as documented in Example 3. Example 9's algorithm directly produces Stakeholder Impact Assessments. Dataset 2 confirms that this algorithm does not –it produces the sustainability scores illustrated in the Guidance Document section below. Appendix C explains that these Performance Measurements (i.e. stakeholder characteristic / sustainability score) support simplified Stakeholder Impact Assessments (but are not automated yet).

LCI Operating Budget Indicator Properties. The following properties show that subalgorithm21 modifies Example 4's subalgorithm16 to support LCIs better.

- **factor1**: date input expended or output received
- **factor2:** most likely quantity of Indicator. This will be used to calculate Indicator.QTM. If using this to conduct PRA, this factor is equivalent to QT.
- **factor3:** unit of measurement for factor2
- **factor4**: low quantity of Indicator. This will be used to calculate Indicator.QTL. If using this to conduct PRA, this factor is equivalent to QTD1 (i.e. shape).
- **factor5**: unit of measurement for factor4
- **factor6**: high quantity of Indicator. This will be used to calculate Indicator.QTU. If using this to conduct PRA, this factor is equivalent to QTD2 (i.e. scale).
- **factor7**: unit of measurement for factor6
- **factor8:** probability distribution type (see Example 2: none, normal, lognormal, triangle …) when factor1, factor2, and factor3 are used to conduct PRA.
- **factor9**: price of Q, or general multiplication factor
- **factor10**. Unit of measurement for final LCC cost or LCB benefit (P * Q).
- **factor11**: type of escalation or discounting as defined in Example 4
- **factor12**: either an escalation rate used with the escalation type, or a multiplication factor representing a pre-discounted value

- **factor13**: number of years to use in discounting formulas
- **factor14**: recurrent times
- **factor15**: allocation factor (general multiplier for allocating this input or ouput to parent CI)
- **factor16**: salvage value
- **factor17:** planning construction years: Number of years in the planning and construction period. Also known as the preproduction period.
- **factor18**: service life: The life span of the Input or Output.
- **factor19**: years from base date: The base date is the factor1 date. The specific year within the Planning Construction Years when the Input is installed or Output's revenue received.
- **factor20**: real discount rate (in digital format: 2.125)
- **factor21**: nominal discount rate
- **factor22**: certainty1 of Indicator (similar to Example 9's certainty1 column)
- **factor23**: certainty2 of Indicator (similar to Example 9's certainty2 column)
- **factor24**: normalization (see Example 9)
- **factor25**: weight (see Example 9)
- **factor26**: URL to linkages (i.e. LCIAs)

LCI Operating Budget Categorical Index Properties. The following properties show that subalgorithm21 modifies Example 4's subalgorithm16 to support LCI Cost Effectiveness Analyses (CEA) better.

- **factor1**: none
- **factor2:** most likely quantity of CEA divisor. This will be used to calculate the cost effectiveness of Indicator.QTM.
- **factor3:** unit of measurement for factor2
- **factor4**: low quantity of CEA divisor. This will be used to calculate the cost effectiveness of Indicator.QTL.
- **factor5**: unit of measurement for factor4
- **factor6**: high quantity of CEA divisor. This will be used to calculate the cost effectiveness of Indicator.QTU.

- **factor7**: unit of measurement for factor6
- **factor8**: certainty of factors 2, 4, and 6

LCIA Capital Budget Indicator (Flow Properties). The following properties show that subalgorithm21 modifies Example 3's subalgorithm15 to support LCIAs better.

- **factor1**: date of flow measurement
- **factor2:** Most likely quantity of Indicator (i.e. Appendix C identifies this as the 1st LCIA measurement, such as quantity of input used). This will be used to calculate Indicator.QTM. If using this to conduct PRA, this factor is equivalent to QT.
- **factor3:** unit of measurement for factor2
- **factor4**: Low quantity of Indicator. This will be used to calculate Indicator.QTL. If using this to conduct PRA, this factor is equivalent to QTD1 (i.e. shape).
- **factor5**: unit of measurement for factor4
- **factor6**. High quantity of Indicator. This will be used to calculate Indicator.QTU. If using this to conduct PRA, this factor is equivalent to QTD2 (i.e. scale).
- **factor7**. Unit of measurement for factor6
- **factor8:** probability distribution type (see Example 2: none, normal, lognormal, triangle …) when factor2, factor4, and factor6 are used to conduct PRA.
- **factor9**: Name for Appendix C's 2nd LCIA measurement.
- **factor10**: Quantity, or conversion factor, for factor10
- **factor11**: Unit of measurement for factor 10
- **factor12**: Name for Appendix C's 3rd LCIA measurement.
- **factor13**: Quantity, or conversion factor, for factor12
- **factor14**: Unit of measurement for factor 12
- **factor15**: Name for Appendix C's 4th LCIA measurement.
- **factor16**: Quantity, or conversion factor, for factor15
- **factor17**: Unit of measurement for factor 15
- **factor18**: benchmark amount for calculation results from factor20
- **factor19**: target amount for calculation results from factor20

- **factor20:** math expression used to calculate the 4 LCIA midpoint measurements; the expression takes the form of Q1*Q2*Q3*Q4 or Q1*(Q2/3.0)*Q3*Q4+2; the term "none" signifies that no calculations should be run

LCIA Capital Budget Categorical Indexes

- **factor1.** Name for Appendix C's 5th LCIA measurement, such as a damage characterization factor.
- **factor2:** Most likely quantity of 5th LCIA measurementIf using this to conduct PRA, this factor is equivalent to QT. The results of this calculation will be multiplied by the result from the sum of the Indicator's measurement's most likely Impact Category quantity.
- **factor3**: Unit of measurement for factor2. Also used to aggregate multiple CIs into Elementary Flows for the Score's Hotspots Analysis (i.e. DALY per kgPM25)
- **factor4**: Low quantity of 5th LCIA measurement. If using this to conduct PRA, this factor is equivalent to QTD1 (i.e. shape). The results of this calculation will be multiplied by the result from the sum of the Indicator's measurement's low Impact Category quantity.
- **factor5**: Unit of measurement for factor4
- **factor6**. High quantity of 5th LCIA measurement. If using this to conduct PRA, this factor is equivalent to QTD2 (i.e. scale). The results of this calculation will be multiplied by the result from the sum of the Indicator's measurement's high Impact Category quantity.
- **factor7**. Unit of measurement of factor 6.
- **factor8:** probability distribution type (see Example 2: none, normal, lognormal, triangle …) when the sibling factors are used to conduct PRA.
- **factor9**: Label used to aggregate multiple CIs into Life Cycle Stages for the Score's Hotspots Analysis (i.e. when each Indicator has multiple life cycle stages).
- **factor10:** Label used to aggregate multiple CIs into the Production Processes for the Score's Hotspots Analysis. When possible, use the Labels from Example 21's budgets.
- **factor11**: certainty1; severity, and probable consequence, of this sustainability flow calculation

- **factor12**: certainty2; likelihood of this sustainability flow calculation
- **factor13**: benchmark amount for result of factor18's most likely calculation
- **factor14**: target amount for result of factor18's most likely calculation
- **factor15**: certainty3; degree of sustainability of this flow calculation. The Sustainable Flow Thresholds introduced in Appendix B can be used for this rating.
- **factor16**: normalization (use "none" if the calculated Categorical Indexes, such as Human Health and Ecosystem Quality, are not being normalized);
- **factor17**: weight (use 1 if the calculated Categorical Indexes are not being weighted)
- **factor18**: math expression used to calculate the final 2 LCIA measurements; the expression takes the form of Q1*Q2 or (Q1/3)*Q2+5, with Q1 derived from the math expression for Indicator.factor20 and Q2 derived from these Categorical Index calculations; the term "none" signifies that no calculations should be run; using a prefix of "mcda:" in the expression (i.e. mcda:Q1*Q2) signifies that the Indicators should be normalized after running the math expression (i.e. Example 4B's MCDA calculations)
- **factor19**: URL to background calculations

LCIA Capital Budget Locational Indexes. Supports the sustainability scores illustrated in the Guidance Document section of this example. Similar to subalgorithm15's properties, but, for convenience, uses the same properties, or factors, and the Categorical Index. [This algorithm started by adding the normalized CI flow properties to normalized LI stock measurements, similar to Example 9's benchmark-target-actual properties, but decided that too many assumptions, or guesses, are needed for the stock properties. In the long run, the stock measurements are maintained digitally in automated guidance documents**.**]

- **factor13**: benchmark normalized amount (Benchmark Percent = (benchmark amount / average of sum of children CIs) *100)
- **factor14**: target normalized amount (Target Percent = (target amount / average of sum of children CIs) *100)
- **factor16**: normalization (use "none" if the calculated Locational Indexes are not being normalized). This factor normalizes the Locational Indexes, which start with normalized

Categorical Indexes. Some of the references use the term "Area of Protection" in a similar way to the Locational Indexes.

- **factor17**: weight (use 1 if the calculated Locational Indexes are not being weighted)

Total Risk Index properties

Final sustainability scores for each community capital.

Scores and Common Community Capital Records (Performance Measurement Properties)

Uses Example 3's Hotspots Analysis and manual use of Appendix C's Sustainability Management Performance Measurement techniques. Similar to the "medical record to common record conversion" shown above, which contains records like the following EMAS (2017).

Annual reference data	
Year	2019
Number of employees (FTE) by 31.12. of actual year	1
Work hours / actual year	1
Turnover [MEuro]	1
Gross value added [MEuro]	1
Size of property [m²]	1
Building footage [m^2]	1
Heated area [m²]	1
Air conditioned area [m²]	1
Production volume [Pieces/a]	1
Production volume [t/a]	1
number of overnights (hotels)	1
number of inhabitants (public admin.)	1
Quantity of waste processed (waste sector)	1
total energy produced (utilities)	1
Reference value [unit]	1
Reference value [unit]	1

In terms of control variables, Fujiwara and Campbell (2011)[64] provide a list of the main determinants of life satisfaction found in the literature to date:

- Income
- Age
- Gender
- Marital status
- Educational status
- Employment status
- Health status
- Social relations
- Religious affiliation
- Housing and environmental conditions and crime levels in the vicinity
- Number of children and other dependents (including caring duties)
- Geographic region
- Non-market good being valued
- Personality traits (such as extroversion)

Controlling for these potential confounders allows us to get closer towards a causal estimate. The issue of reverse causality is particularly important to consider in the estimation of the effect of income on life satisfaction. The causal estimate of income on life satisfaction is thus estimated

[64] Fujiwara, D. & Campbell, R. (2011). Valuation Techniques for Social Cost-Benefit Analysis: Stated Preference, Revealed Preference and Subjective Well-Being Approaches. HM Treasury and Department for Work and Pensions.

through an instrumental variable approach. The details of this technique are discussed in more depth in section 4, when conducting the case study for the UK.

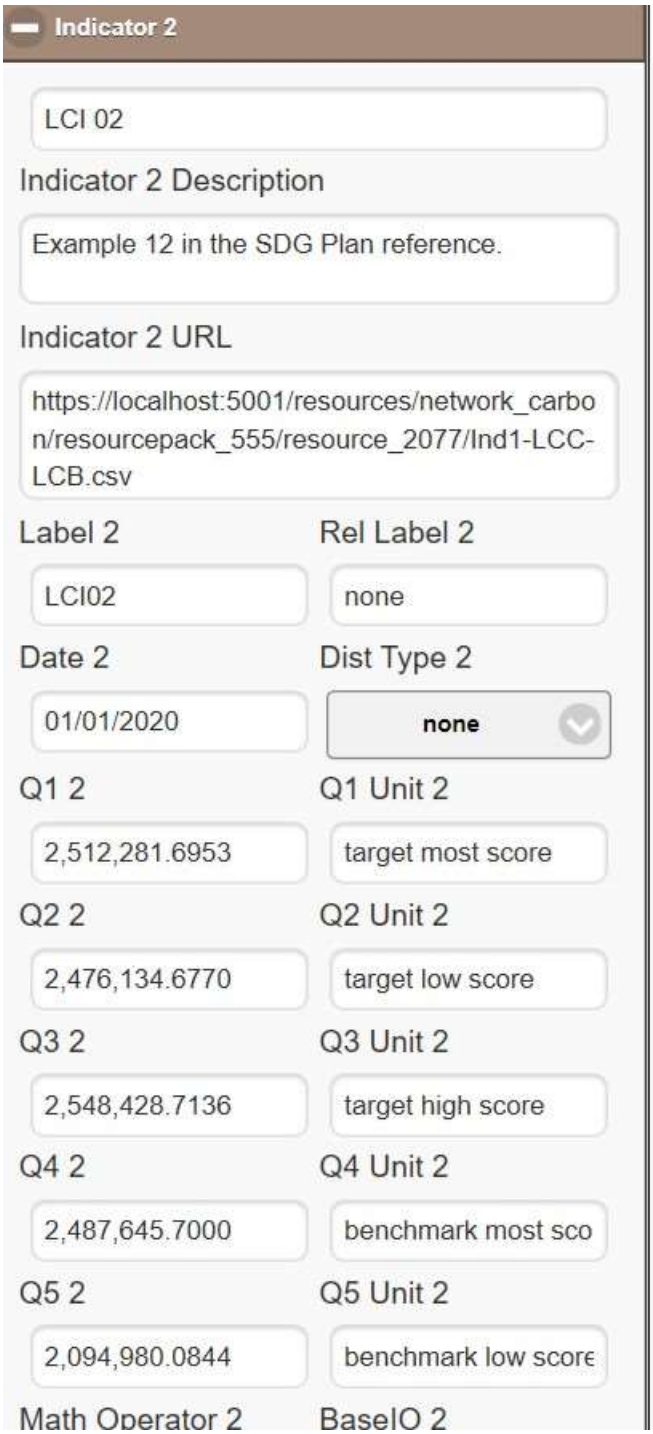
Stakeholder categories	Subcategories
Stakeholder "worker"	Freedom of Association and Collective Bargaining Child Labour Fair Salary Working Hours Forced Labour Equal opportunities/Discrimination Health and Safety Social Benefits/Social Security
Stakeholder "consumer"	Health & Safety Feedback Mechanism Consumer Privacy Transparency End of life responsibility
Stakeholder "local community"	Access to material resources Access to immaterial resources Delocalization and Migration Cultural Heritage Safe & healthy living conditions Respect of indigenous rights Community engagement Local employment Secure living conditions
Stakeholder "society"	Public commitments to sustainability issues Contribution to economic development Prevention & mitigation of armed conflicts Technology development Corruption
Value chain actors* not including consumers	Fair competition Promoting social responsibility Supplier relationships

Additional LCIA Capital Budget Properties

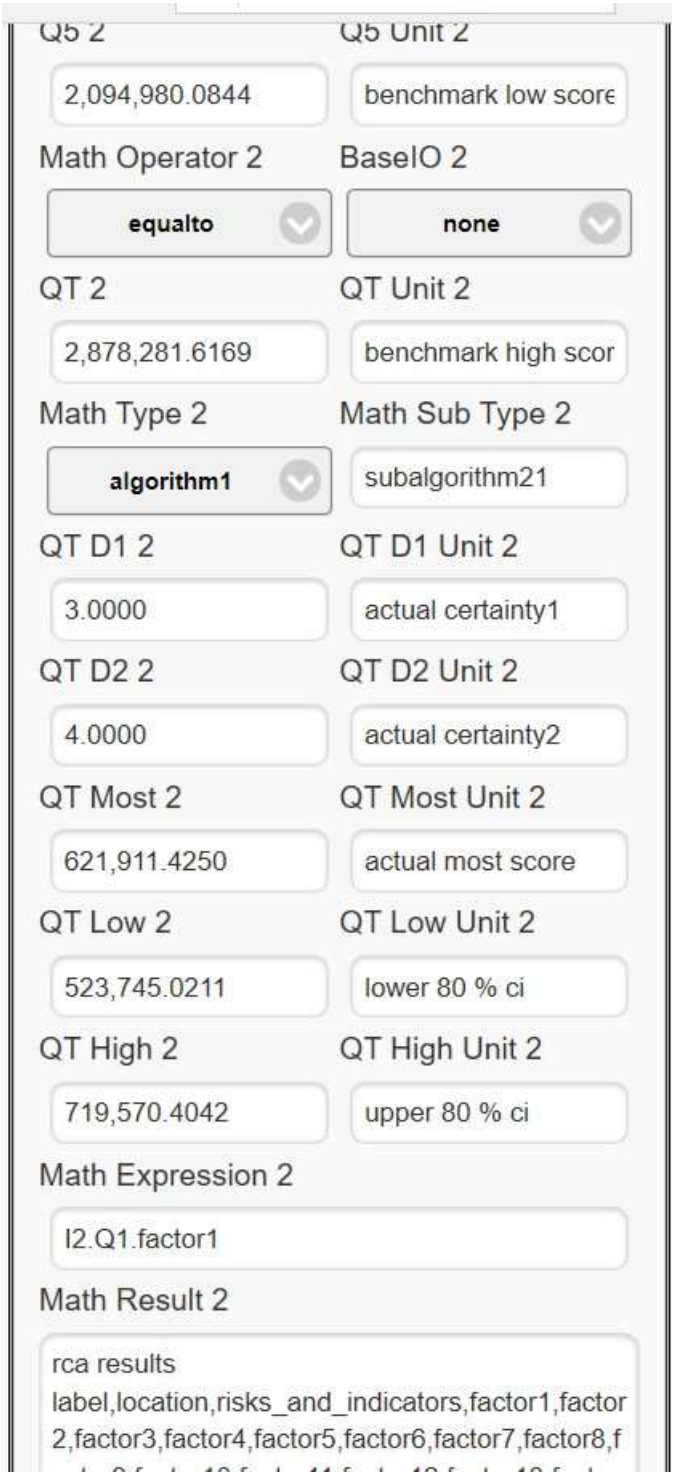
Additional candidate properties for LCIA Capital Budgeting include Example 4's approaches for escalation, discounting, and pricing, as well as additional properties for trend and scenario analysis. Full ecosystem and landscape reporting requires new algorithms with new properties. DevTreks decided that adding additional properties to these algorithms promotes the mistaken impression that these algorithms have progressed to the point of applied work. First comes the institutional change required to get Appendix C and D's service industries up and running.

Scenario Planning. The following images show that these algorithms use SPA2 techniques (i.e. no suffix = target scenario, _A suffix = benchmark scenario, _AA suffix = actual scenario) for scenario planning. TEEB's more comprehensive process models require Appendix C's service industries and Appendix D's digital support teams.

subalgo 21: no suffix = target scenario with straight Example 4 LCC/LCB calculations, _A suffix = benchmark scenario with Example 12 PRA (normal distributions) techniques



subalgo 21: _AA suffix = actual scenario with Example 4B CEA techniques



Math Results

In the long run, the linkages between the LCI, LCIA, and Stakeholder CCCRs, takes place using automated guidance documents developed by new service industries. In this example, the LCI and LCIA budgets are submitted using 1 Indicator, but calculated separately.

LCI Math Results. Example 4 to 4C introduce these calculations. Example 4's subalgorithm16 has been upgraded to be compatible with subalgorithm21.

subalgo 21: no suffix = target scenario with straight Example 4 LCC/LCB calculations

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	QTMost	QTMostUr	QTLow	QTLowUni	QTHigh	QTHighUni	certainty1
TCA	1	NIST Table	none	none	none	none	none	none	none	none	516391	none	449959.2	none	597461.5	none	3
IF1A	1	Electricity	43831	250000	mostunit	225000	lowunit	300000	highunit	none	302600	highunit	272340	lowunit	363120	none	0
IF1B	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	104142.3	highunit	78106.74	lowunit	114556.6	none	0
IF1C	1	CO2 Equiv	43831	8500	mostunit	7000	lowunit	10000	highunit	none	170	highunit	140	lowunit	200	none	0
IF1D	1	Plant Repl	43831	1	mostunit	1	lowunit	1	highunit	none	8416.559	highunit	8416.559	lowunit	8416.559	none	0
IF1E	1	Initial Inve	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	103000	highunit	92700	lowunit	113300	none	0
IF1F	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-1937.87	highunit	-1744.08	lowunit	-2131.65	none	0
TCB	1	NIST Table	none	none	none	none	none	none	none	none	544983.8	none	450441.8	none	626097.3	none	3
IF2A	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	7933.414	highunit	7933.414	lowunit	7933.414	none	0
IF2B	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	142800	highunit	125664	lowunit	171360	none	0
IF2C	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	171679.4	highunit	151481.9	lowunit	201975.8	none	0
IF2D	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	98164.13	highunit	73623.1	lowunit	107980.5	none	0
IF2E	1	Second Inv	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	48543.69	highunit	36407.77	lowunit	53398.06	none	0
IF2F	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	36300.99	highunit	27225.74	lowunit	39931.09	none	0
IF2G	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	50000	highunit	37500	lowunit	55000	none	0
IF2H	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-10437.9	highunit	-9394.07	lowunit	-11481.6	none	0
TCC	1	LCC Examp	none	none	none	none	none	none	none	none	520718.7	none	429037.4	none	597489.7	none	3
IF3A	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	7933.414	highunit	7933.414	lowunit	7933.414	none	0
IF3B	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	140234.5	highunit	123406.3	lowunit	168281.4	none	0
IF3C	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	149979.8	highunit	132335.1	lowunit	176446.9	none	0
IF3D	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	98164.13	highunit	73623.1	lowunit	107980.5	none	0
IF3E	1	Second Inv	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	48543.69	highunit	36407.77	lowunit	53398.06	none	0
IF3F	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	36300.99	highunit	27225.74	lowunit	39931.09	none	0
IF3G	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	50000	highunit	37500	lowunit	55000	none	0
IF3H	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-10437.9	highunit	-9394.07	lowunit	-11481.6	none	0
GNC	1	Natural Ca	0	0	0	none	none	none	none	none	1582093	none	1329438	none	1821048	none	3
TCD	1	LCC Examp	none	none	none	none	none	none	none	none	868853.9	none	735396.5	none	1015252	none	3
IF4A	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	7933.414	highunit	7933.414	lowunit	7933.414	none	0
IF4B	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	488369.7	highunit	429765.4	lowunit	586043.7	none	0
IF4C	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	149979.8	highunit	132335.1	lowunit	176446.9	none	0
IF4D	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	98164.13	highunit	73623.1	lowunit	107980.5	none	0
IF4E	1	Second Inv	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	48543.69	highunit	36407.77	lowunit	53398.06	none	0
IF4F	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	36300.99	highunit	27225.74	lowunit	39931.09	none	0
IF4G	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	50000	highunit	37500	lowunit	55000	none	0
IF4H	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-10437.9	highunit	-9394.07	lowunit	-11481.6	none	0
GPC	1	Physical Ca	0	0	0	none	none	none	none	none	868853.9	none	735396.5	none	1015252	none	3
TCA	1	LCC Examp	none	none	none	none	none	none	none	none	36698.3	none	30145.18	none	41981.21	none	3
IF5A	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	1062.316	highunit	1062.316	lowunit	1062.316	none	0
IF5B	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	9708.738	highunit	8543.689	lowunit	11650.49	none	0
IF5C	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	9787.379	highunit	8635.922	lowunit	11514.56	none	0
IF5D	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	6796.117	highunit	5097.087	lowunit	7475.728	none	0
IF5E	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	6923.218	highunit	5192.413	lowunit	7615.54	none	0
IF5G	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	3764.844	highunit	2823.633	lowunit	4141.328	none	0
IF5H	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-1344.31	highunit	-1209.88	lowunit	-1478.75	none	0
GEC	1	Economic	0	0	0	none	none	none	none	none	36698.3	none	30145.18	none	41981.21	none	3
TR	1	Total Cost	0	0	0	none	none	none	none	none	2487646	none	2094980	none	2878282	none	3

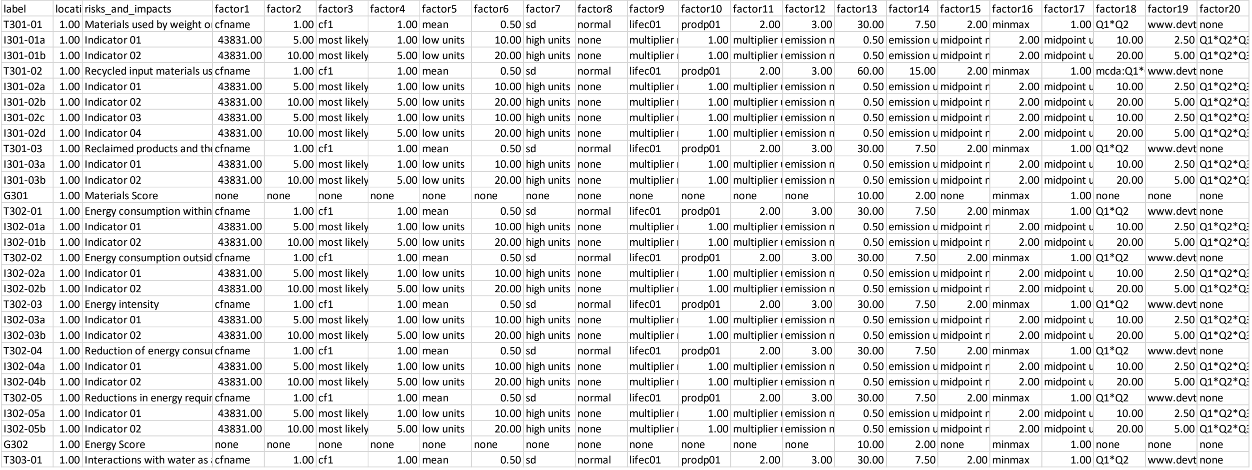
subalgo 21: _A suffix = benchmark scenario with Example 12 PRA (normal distributions) techniques

TCA_A	1	NIST Table	none	none	none	none	none	none	none	none	521504.9	none	514002.5	none	529007.3	none	3	4	0	0	0	0
IF1A_A	1	Electricity	43831	250000	mostunit	250000	lowunit	62500	highunit	normal	305597.3	highunit	301194.9	lowunit	309999.8	upper 80 %	0	0	0	0	0	0
IF1B_A	1	OMR	43831	1	mostunit	1	lowunit	0.25	highunit	normal	105173.3	highunit	103663.3	lowunit	106683.4	upper 80 %	0	0	0	0	0	0
IF1C_A	1	CO2 Equiv	43831	8500	mostunit	8500	lowunit	2125	highunit	normal	171.6839	highunit	169.2106	lowunit	174.1572	upper 80 %	0	0	0	0	0	0
IF1D_A	1	Plant Repl	43831	1	mostunit	1	lowunit	0.25	highunit	normal	8499.883	highunit	8377.842	lowunit	8621.923	upper 80 %	0	0	0	0	0	0
IF1E_A	1	Initial Inve	43831	1	mostunit	1	lowunit	0.25	highunit	normal	104019.7	highunit	102526.2	lowunit	105513.2	upper 80 %	0	0	0	0	0	0
IF1F_A	1	Residual V	43831	1	mostunit	1	lowunit	0.25	highunit	normal	-1957.05	highunit	-1928.95	lowunit	-1985.15	upper 80 %	0	0	0	0	0	0
TCB_A	1	NIST Table	none	none	none	none	none	none	none	none	550380.8	none	542463.2	none	558298.4	none	3	4	0	0	0	0
IF2A_A	1	Replaceme	43831	1	mostunit	1	lowunit	0.25	highunit	normal	8011.955	highunit	7896.92	lowunit	8126.989	upper 80 %	0	0	0	0	0	0
IF2B_A	1	Electricity	43831	125000	mostunit	125000	lowunit	31250	highunit	normal	144214.5	highunit	142136.9	lowunit	146292	upper 80 %	0	0	0	0	0	0
IF2C_A	1	Natural Ga	43831	1700	mostunit	1700	lowunit	425	highunit	normal	173380	highunit	170882.3	lowunit	175877.7	upper 80 %	0	0	0	0	0	0
IF2D_A	1	OMR	43831	1	mostunit	1	lowunit	0.25	highunit	normal	99135.95	highunit	97712.57	lowunit	100559.3	upper 80 %	0	0	0	0	0	0
IF2E_A	1	Second Inv	43831	1	mostunit	1	lowunit	0.25	highunit	normal	49024.27	highunit	48320.39	lowunit	49728.16	upper 80 %	0	0	0	0	0	0
IF2F_A	1	Plant Repl	43831	1	mostunit	1	lowunit	0.25	highunit	normal	36660.37	highunit	36134	lowunit	37186.73	upper 80 %	0	0	0	0	0	0
IF2G_A	1	Initial Inve	43831	1	mostunit	1	lowunit	0.25	highunit	normal	50495	highunit	49770	lowunit	51220	upper 80 %	0	0	0	0	0	0
IF2H_A	1	Residual V	43831	1	mostunit	1	lowunit	0.25	highunit	normal	-10541.2	highunit	-10389.8	lowunit	-10692.5	upper 80 %	0	0	0	0	0	0
TCC_A	1	LCC Examp	none	none	none	none	none	none	none	none	525875.3	none	518310.8	none	533439.9	none	3	4	0	0	0	0
IF3A_A	1	Replaceme	43831	1	mostunit	1	lowunit	0.25	highunit	normal	8011.955	highunit	7896.92	lowunit	8126.989	upper 80 %	0	0	0	0	0	0
IF3B_A	1	Electricity	43831	125000	mostunit	125000	lowunit	31250	highunit	normal	141623.5	highunit	139583.3	lowunit	143663.8	upper 80 %	0	0	0	0	0	0
IF3C_A	1	Natural Ga	43831	1700	mostunit	1700	lowunit	425	highunit	normal	151465.4	highunit	149283.4	lowunit	153647.4	upper 80 %	0	0	0	0	0	0
IF3D_A	1	OMR	43831	1	mostunit	1	lowunit	0.25	highunit	normal	99135.95	highunit	97712.57	lowunit	100559.3	upper 80 %	0	0	0	0	0	0
IF3E_A	1	Second Inv	43831	1	mostunit	1	lowunit	0.25	highunit	normal	49024.27	highunit	48320.39	lowunit	49728.16	upper 80 %	0	0	0	0	0	0
IF3F_A	1	Plant Repl	43831	1	mostunit	1	lowunit	0.25	highunit	normal	36660.37	highunit	36134	lowunit	37186.73	upper 80 %	0	0	0	0	0	0
IF3G_A	1	Initial Inve	43831	1	mostunit	1	lowunit	0.25	highunit	normal	50495	highunit	49770	lowunit	51220	upper 80 %	0	0	0	0	0	0
IF3H_A	1	Residual V	43831	1	mostunit	1	lowunit	0.25	highunit	normal	-10541.2	highunit	-10389.8	lowunit	-10692.5	upper 80 %	0	0	0	0	0	0
GNC_A	1	Natural Ca	0	0	0	none	none	none	none	none	1597761	none	1574777	none	1620746	none	3	4	0	0	0	0
TCD_A	1	LCC Examp	none	none	none	none	none	none	none	none	877459	none	864829.5	none	890088.4	none	3	4	0	0	0	0
IF4A_A	1	Replaceme	43831	1	mostunit	1	lowunit	0.25	highunit	normal	8011.955	highunit	7896.92	lowunit	8126.989	upper 80 %	0	0	0	0	0	0
IF4B_A	1	Electricity	43831	125000	mostunit	125000	lowunit	31250	highunit	normal	493207.2	highunit	486102.1	lowunit	500312.3	upper 80 %	0	0	0	0	0	0
IF4C_A	1	Natural Ga	43831	1700	mostunit	1700	lowunit	425	highunit	normal	151465.4	highunit	149283.4	lowunit	153647.4	upper 80 %	0	0	0	0	0	0
IF4D_A	1	OMR	43831	1	mostunit	1	lowunit	0.25	highunit	normal	99135.95	highunit	97712.57	lowunit	100559.3	upper 80 %	0	0	0	0	0	0
IF4E_A	1	Second Inv	43831	1	mostunit	1	lowunit	0.25	highunit	normal	49024.27	highunit	48320.39	lowunit	49728.16	upper 80 %	0	0	0	0	0	0
IF4F_A	1	Plant Repl	43831	1	mostunit	1	lowunit	0.25	highunit	normal	36660.37	highunit	36134	lowunit	37186.73	upper 80 %	0	0	0	0	0	0
IF4G_A	1	Initial Inve	43831	1	mostunit	1	lowunit	0.25	highunit	normal	50495	highunit	49770	lowunit	51220	upper 80 %	0	0	0	0	0	0
IF4H_A	1	Residual V	43831	1	mostunit	1	lowunit	0.25	highunit	normal	-10541.2	highunit	-10389.8	lowunit	-10692.5	upper 80 %	0	0	0	0	0	0
GPC_A	1	Physical Ca	0	0	0	none	none	none	none	none	877459	none	864829.5	none	890088.4	none	3	4	0	0	0	0
TCA_A	1	LCC Examp	none	none	none	none	none	none	none	none	37061.71	none	36528.64	none	37594.79	none	3	4	0	0	0	0
IF5A_A	1	Replaceme	43831	1	mostunit	1	lowunit	0.25	highunit	normal	1072.833	highunit	1057.429	lowunit	1088.237	upper 80 %	0	0	0	0	0	0
IF5B_A	1	Electricity	43831	125000	mostunit	125000	lowunit	31250	highunit	normal	9804.906	highunit	9663.657	lowunit	9946.155	upper 80 %	0	0	0	0	0	0
IF5C_A	1	Natural Ga	43831	1700	mostunit	1700	lowunit	425	highunit	normal	9884.326	highunit	9741.932	lowunit	10026.72	upper 80 %	0	0	0	0	0	0
IF5D_A	1	OMR	43831	1	mostunit	1	lowunit	0.25	highunit	normal	6863.398	highunit	6764.854	lowunit	6961.942	upper 80 %	0	0	0	0	0	0
IF5E_A	1	Initial Inve	43831	1	mostunit	1	lowunit	0.25	highunit	normal	6991.758	highunit	6891.371	lowunit	7092.144	upper 80 %	0	0	0	0	0	0
IF5G_A	1	Plant Repl	43831	1	mostunit	1	lowunit	0.25	highunit	normal	3802.116	highunit	3747.525	lowunit	3856.706	upper 80 %	0	0	0	0	0	0
IF5H_A	1	Residual V	43831	1	mostunit	1	lowunit	0.25	highunit	normal	-1357.62	highunit	-1338.13	lowunit	-1377.12	upper 80 %	0	0	0	0	0	0
GEC_A	1	Economic	0	0	0	none	none	none	none	none	37061.71	none	36528.64	none	37594.79	none	3	4	0	0	0	0
TR_A	1	Total Cost	0	0	0	none	none	none	none	none	2512282	none	2476135	none	2548429	none	3	4	0	0	0	0

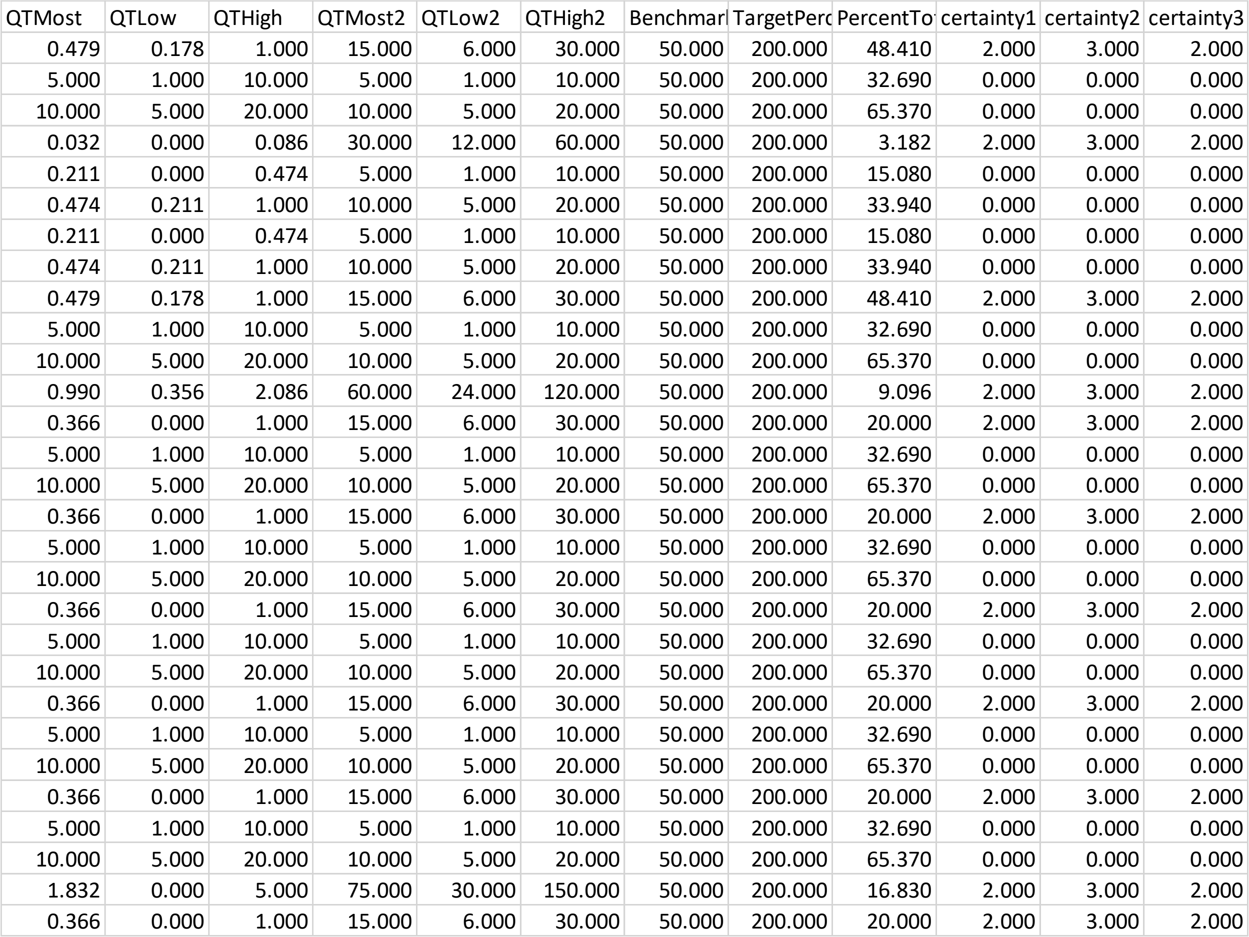
subalgo 21: _AA suffix = actual scenario with Example 4B CEA techniques

TCA_AA	1	NIST Table	none	2	mostceaur	2	lowceauni	2	highceauni	3	129097.8	none	112489.8	none	149365.4	none	3	4	258195.5	224979.6	298730.7	3
IF1A_AA	1	Electricity	43831	250000	mostunit	225000	lowunit	300000	highunit	none	151300	highunit	136170	lowunit	181560	none	0	0	0	0	0	0
IF1B_AA	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	52071.16	highunit	39053.37	lowunit	57278.28	none	0	0	0	0	0	0
IF1C_AA	1	CO2 Equiv	43831	8500	mostunit	7000	lowunit	10000	highunit	none	85	highunit	70	lowunit	100	none	0	0	0	0	0	0
IF1D_AA	1	Plant Repl	43831	1	mostunit	1	lowunit	1	highunit	none	4208.279	highunit	4208.279	lowunit	4208.279	none	0	0	0	0	0	0
IF1E_AA	1	Initial Inve	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	51500	highunit	46350	lowunit	56650	none	0	0	0	0	0	0
IF1F_AA	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-968.933	highunit	-872.039	lowunit	-1065.83	none	0	0	0	0	0	0
TCB_AA	1	NIST Table	none	2	mostceaur	2	lowceauni	2	highceauni	3	136245.9	none	112610.5	none	156524.3	none	3	4	272491.9	225220.9	313048.6	3
IF2A_AA	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	3966.707	highunit	3966.707	lowunit	3966.707	none	0	0	0	0	0	0
IF2B_AA	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	71400	highunit	62832	lowunit	85680	none	0	0	0	0	0	0
IF2C_AA	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	85839.72	highunit	75740.93	lowunit	100987.9	none	0	0	0	0	0	0
IF2D_AA	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	49082.06	highunit	36811.55	lowunit	53990.27	none	0	0	0	0	0	0
IF2E_AA	1	Second Inv	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	24271.84	highunit	18203.88	lowunit	26699.03	none	0	0	0	0	0	0
IF2F_AA	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	18150.49	highunit	13612.87	lowunit	19965.54	none	0	0	0	0	0	0
IF2G_AA	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	25000	highunit	18750	lowunit	27500	none	0	0	0	0	0	0
IF2H_AA	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-5218.93	highunit	-4697.03	lowunit	-5740.82	none	0	0	0	0	0	0
TCC_AA	1	LCC Examp	none	2	mostceaur	2	lowceauni	2	highceauni	3	130179.7	none	107259.4	none	149372.4	none	3	4	260359.3	214518.7	298744.8	3
IF3A_AA	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	3966.707	highunit	3966.707	lowunit	3966.707	none	0	0	0	0	0	0
IF3B_AA	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	70117.23	highunit	61703.17	lowunit	84140.68	none	0	0	0	0	0	0
IF3C_AA	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	74989.91	highunit	66167.57	lowunit	88223.43	none	0	0	0	0	0	0
IF3D_AA	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	49082.06	highunit	36811.55	lowunit	53990.27	none	0	0	0	0	0	0
IF3E_AA	1	Second Inv	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	24271.84	highunit	18203.88	lowunit	26699.03	none	0	0	0	0	0	0
IF3F_AA	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	18150.49	highunit	13612.87	lowunit	19965.54	none	0	0	0	0	0	0
IF3G_AA	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	25000	highunit	18750	lowunit	27500	none	0	0	0	0	0	0
IF3H_AA	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-5218.93	highunit	-4697.03	lowunit	-5740.82	none	0	0	0	0	0	0
GNC_AA	1	Natural Ca	6	6	6	none	none	none	none	none	395523.4	none	332359.6	none	455262.1	none	3	4	791046.7	664719.2	910524.2	3
TCD_AA	1	LCC Examp	none	2	mostceaur	2	lowceauni	2	highceauni	3	217213.5	none	183849.1	none	253813	none	3	4	434427	367698.2	507626	3
IF4A_AA	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	3966.707	highunit	3966.707	lowunit	3966.707	none	0	0	0	0	0	0
IF4B_AA	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	244184.9	highunit	214882.7	lowunit	293021.8	none	0	0	0	0	0	0
IF4C_AA	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	74989.91	highunit	66167.57	lowunit	88223.43	none	0	0	0	0	0	0
IF4D_AA	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	49082.06	highunit	36811.55	lowunit	53990.27	none	0	0	0	0	0	0
IF4E_AA	1	Second Inv	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	24271.84	highunit	18203.88	lowunit	26699.03	none	0	0	0	0	0	0
IF4F_AA	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	18150.49	highunit	13612.87	lowunit	19965.54	none	0	0	0	0	0	0
IF4G_AA	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	25000	highunit	18750	lowunit	27500	none	0	0	0	0	0	0
IF4H_AA	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-5218.93	highunit	-4697.03	lowunit	-5740.82	none	0	0	0	0	0	0
GPC_AA	1	Physical Ca	2	2	2	none	none	none	none	none	217213.5	none	183849.1	none	253813	none	3	4	434427	367698.2	507626	3
TCA_AA	1	LCC Examp	none	2	mostceaur	2	lowceauni	2	highceauni	3	9174.574	none	7536.295	none	10495.3	none	3	4	18349.15	15072.59	20990.61	3
IF5A_AA	1	Replaceme	43831	1	mostunit	1	lowunit	1	highunit	none	531.158	highunit	531.158	lowunit	531.158	none	0	0	0	0	0	0
IF5B_AA	1	Electricity	43831	125000	mostunit	110000	lowunit	150000	highunit	none	4854.369	highunit	4271.845	lowunit	5825.243	none	0	0	0	0	0	0
IF5C_AA	1	Natural Ga	43831	1700	mostunit	1500	lowunit	2000	highunit	none	4893.689	highunit	4317.961	lowunit	5757.282	none	0	0	0	0	0	0
IF5D_AA	1	OMR	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	3398.058	highunit	2548.544	lowunit	3737.864	none	0	0	0	0	0	0
IF5E_AA	1	Initial Inve	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	3461.609	highunit	2596.207	lowunit	3807.77	none	0	0	0	0	0	0
IF5G_AA	1	Plant Repl	43831	1	mostunit	0.75	lowunit	1.1	highunit	none	1882.422	highunit	1411.816	lowunit	2070.664	none	0	0	0	0	0	0
IF5H_AA	1	Residual V	43831	1	mostunit	0.9	lowunit	1.1	highunit	none	-672.157	highunit	-604.941	lowunit	-739.373	none	0	0	0	0	0	0
GEC_AA	1	Economic	2	2	2	none	none	none	none	none	9174.574	none	7536.295	none	10495.3	none	3	4	18349.15	15072.59	20990.61	3
TR_AA	1	Total Cost	10	10	10	none	none	none	none	none	621911.4	none	523745	none	719570.4	none	3	4	621911.4	523745	719570.4	3

LCIA Math Results. Example 3 to 3B introduce these calculations. Example 3's subalgorithm15 has been upgraded to be compatible with subalgorithm20.



label	locati	risks_and_impacts	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18	factor19	factor20
T301-01	1.00	Materials used by weight o	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I301-01a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I301-01b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
T301-02	1.00	Recycled input materials us	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	60.00	15.00	2.00	minmax	1.00	mcda:Q1*	www.devt	none
I301-02a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I301-02b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
I301-02c	1.00	Indicator 03	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I301-02d	1.00	Indicator 04	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
T301-03	1.00	Reclaimed products and the	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I301-03a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I301-03b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
G301	1.00	Materials Score	none	none	none	none	none	none	none	none	none	none	none	none	10.00	2.00	none	minmax	1.00	none	none	none
T302-01	1.00	Energy consumption within	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I302-01a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I302-01b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
T302-02	1.00	Energy consumption outsid	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I302-02a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I302-02b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
T302-03	1.00	Energy intensity	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I302-03a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I302-03b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
T302-04	1.00	Reduction of energy consu	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I302-04a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I302-04b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
T302-05	1.00	Reductions in energy requir	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none
I302-05a	1.00	Indicator 01	43831.00	5.00	most likely	1.00	low units	10.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	10.00	2.50	Q1*Q2*Q3
I302-05b	1.00	Indicator 02	43831.00	10.00	most likely	5.00	low units	20.00	high units	none	multiplier	1.00	multiplier	emission n	0.50	emission u	midpoint n	2.00	midpoint u	20.00	5.00	Q1*Q2*Q3
G302	1.00	Energy Score	none	none	none	none	none	none	none	none	none	none	none	none	10.00	2.00	none	minmax	1.00	none	none	none
T303-01	1.00	Interactions with water as	cfname	1.00	cf1	1.00	mean	0.50	sd	normal	lifec01	prodp01	2.00	3.00	30.00	7.50	2.00	minmax	1.00	Q1*Q2	www.devt	none



QTMost	QTLow	QTHigh	QTMost2	QTLow2	QTHigh2	Benchmar	TargetPerc	PercentTo	certainty1	certainty2	certainty3
0.479	0.178	1.000	15.000	6.000	30.000	50.000	200.000	48.410	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
0.032	0.000	0.086	30.000	12.000	60.000	50.000	200.000	3.182	2.000	3.000	2.000
0.211	0.000	0.474	5.000	1.000	10.000	50.000	200.000	15.080	0.000	0.000	0.000
0.474	0.211	1.000	10.000	5.000	20.000	50.000	200.000	33.940	0.000	0.000	0.000
0.211	0.000	0.474	5.000	1.000	10.000	50.000	200.000	15.080	0.000	0.000	0.000
0.474	0.211	1.000	10.000	5.000	20.000	50.000	200.000	33.940	0.000	0.000	0.000
0.479	0.178	1.000	15.000	6.000	30.000	50.000	200.000	48.410	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
0.990	0.356	2.086	60.000	24.000	120.000	50.000	200.000	9.096	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.000	200.000	20.000	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
0.366	0.000	1.000	15.000	6.000	30.000	50.000	200.000	20.000	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
0.366	0.000	1.000	15.000	6.000	30.000	50.000	200.000	20.000	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
0.366	0.000	1.000	15.000	6.000	30.000	50.000	200.000	20.000	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
0.366	0.000	1.000	15.000	6.000	30.000	50.000	200.000	20.000	2.000	3.000	2.000
5.000	1.000	10.000	5.000	1.000	10.000	50.000	200.000	32.690	0.000	0.000	0.000
10.000	5.000	20.000	10.000	5.000	20.000	50.000	200.000	65.370	0.000	0.000	0.000
1.832	0.000	5.000	75.000	30.000	150.000	50.000	200.000	16.830	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.000	200.000	20.000	2.000	3.000	2.000

For Indicators, the columns, QTMost and QTMost2, are derived by:

1) Running the PRA (i.e. normal distribution) on the first LCIA measurement (i.e. Q1 in the Indicator.MathExpression).
2) Running the Indicator.MathExpression for the 4 LCIA measurements and adding the result to Indicator.QTM.
3) If the parent CategoricalIndex.MathExpression uses a "mcda:" prefix, the calculated children Indicators will be normalized and the column, QTMost will hold the normalized results (i.e. Example 4B's MCDA technique). If the Indicators have not been normalized, the same column holds the nonnormalized calculated results.
4) Adding the nonnormalized calculated results to the QTMost2 column.

For Indicators, the columns, Benchmark and Target Percents, are derived by:

1) For subalgorithm20, dividing the benchmark and target amounts by their respective Indicator.benchmark and target amounts (prior to normalizing and weighting the CIs). Subalgorithm15 doesn't have benchmark or target amounts and doesn't have these columns.

For Indicators, the column, Total Percent, is derived by:

1) Dividing column Indicator.QTMost by the parent CI.QTMost prior to normalization of the CIs.

For Categorical Indexes, or CIs, the columns, QTMost and QTMost2 are derived by:

1) Running the PRA (i.e. normal distribution) on the fifth LCIA measurement (i.e. Q1).
2) Summing the children Indicator.QTMs (i.e. Q2), running the CI.MathExpression (i.e. Q1 * Q2), storing the calculated results for display in QTMost2, and adding the calculated results to a vector of CI.QTMs.
3) Normalizing and weighting the vector of CI.QTMs and adding each normalized value to CI.QTM for display in the QTMost column.

For CIs, the columns, Benchmark and Target Percents, are derived by:

1) For subalgorithm20, dividing the benchmark and target amounts by their respective CI.benchmark and target amounts (prior to normalizing and weighting the CIs).. Subalgorithm15 doesn't have benchmark or target amounts (i.e. although DevTreks

convention of conducting scenario analysis using "_A" and "_AA" suffixes can be used for that purpose).

For CIs, the column, Total Percent, is derived by:

1) Dividing each separate normalized CI by the sum of the normalized CIs.

For Locational Indexes, the columns, QTMost and QTMost2 are derived by:

1) Summing the children normalized and weighted Categorical Index.QTMs.
2) Normalizing and weighting a vector of LocationalIndex.QTMs, from step 1's results, and adding each normalized member to the LocationalIndex.QTMost property.
3) Summing the children Categorical Index QTMost2 calculations (nonnormalized amounts) and adding the result to QTMost2.

The column, Percents, are derived by:

1) For subalgorithm20, summing the children benchmark and target percents and adding the average of the sum to the percent columns.
2) For TotalPercent, Dividing each separate normalized LI by the sum of the normalized LIs.

For Total Risk Indexes (TR), the calculated results derive from simple summations or averages of their children Locational Indexes.

Stakeholder Impact Math Results. Example 3 introduce these Hotspots calculations that get automatically added to the Score.MathResult. Each row derives from the Categorical Indexes for any Indicator calculated using subalgorithm15 or subalgorithm20. Example 3's subalgorithm15 has been upgraded to be compatible with subalgorithm20. The Hotspots properties include:

factor2, factor4, and QTMost: elementary flows

factor10 and factor11: life cycle stage and production process

label	location	risks_and_	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	
LCIA01	na	Indicator 1	LCIA01	na	Indicator 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T301-01	1.000	Materials	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T301-02	1.000	Recycled i	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T301-03	1.000	Reclaimed	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T302-01	1.000	Energy cor	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T302-02	1.000	Energy cor	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T302-03	1.000	Energy inte	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T302-04	1.000	Reduction	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T302-05	1.000	Reductions	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T303-01	1.000	Interactior	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T303-02	1.000	Manageme	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T303-03	1.000	Water witl	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T303-04	1.000	Water disc	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T303-05	1.000	Water con	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T304-01	1.000	Operation	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T304-02	1.000	Significant	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T304-03	1.000	Habitats p	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T304-04	1.000	IUCN Red	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-01	1.000	Direct (Sco	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-02	1.000	Energy ind	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-03	1.000	Other indir	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-04	1.000	GHG emiss	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-05	1.000	Reduction	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-06	1.000	Emissions	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T305-07	1.000	Nitrogen o	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T306-02	1.000	Waste by t	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T306-03	1.000	Significant	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T306-04	1.000	Transport	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T307-01	1.000	Non-comp	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T308-01	1.000	New suppl	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
T308-02	1.000	Negative e	0.000	cfname	1.000	cf1	1.000	mean	0.500	sd	normal	lifec01	prodp01	2.000	3.000
LCIA04	na	Indicator 2	LCIA04	na	Indicator 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T301-01	1.000	Materials	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T301-02	1.000	Recycled i	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	mcda:Q1*
T301-03	1.000	Reclaimed	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T302-01	1.000	Energy cor	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T302-02	1.000	Energy cor	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T302-03	1.000	Energy inte	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T302-04	1.000	Reduction	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T302-05	1.000	Reductions	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T303-01	1.000	Interactior	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T303-02	1.000	Manageme	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T303-03	1.000	Water witl	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T303-04	1.000	Water disc	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T303-05	1.000	Water con	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T304-01	1.000	Operation	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T304-02	1.000	Significant	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T304-03	1.000	Habitats p	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T304-04	1.000	IUCN Red	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-01	1.000	Direct (Sco	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-02	1.000	Energy ind	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-03	1.000	Other indir	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-04	1.000	GHG emiss	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-05	1.000	Reduction	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-06	1.000	Emissions	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T305-07	1.000	Nitrogen o	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T306-02	1.000	Waste by t	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T306-03	1.000	Significant	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T306-04	1.000	Transport	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T307-01	1.000	Non-comp	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T308-01	1.000	New suppl	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2
T308-02	1.000	Negative e	0.000	cf04	1.000	cf1	cf1	low units	lifec01	high units	normal	lifec01	prodp01	1.000	Q1*Q2

QTMost	QTLow	QTHigh	QTMost2	QTLow2	QTHigh2	Benchmar	TargetPer	PercentTo	certainty1	certainty2	certainty3
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.479	0.178	1.000	15.000	6.000	30.000	50.990	204.000	25.000	2.000	3.000	2.000
0.032	0.000	0.086	30.000	12.000	60.000	2.326	9.303	50.000	2.000	3.000	2.000
0.479	0.178	1.000	15.000	6.000	30.000	50.990	204.000	25.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	20.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	25.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	25.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	25.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	25.000	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	14.290	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	14.290	2.000	3.000	2.000
0.366	0.000	1.000	15.000	6.000	30.000	50.990	204.000	14.290	2.000	3.000	2.000

Automated Community Capital Guidance Document Content and Scoring

This section illustrates the typical content found in Community Capital Guidance Documents. The goal of these guidance documents is uniform community capital improvement through uniform sustainability scoring. In practice, that means demonstrating how the thousands of existing sustainability reports, audits, and tools, can be applied using common community capital records, audits, reports, and tools. A health care, or human capital, household record, employs the same record format as a business accounting, or produced capital, record.

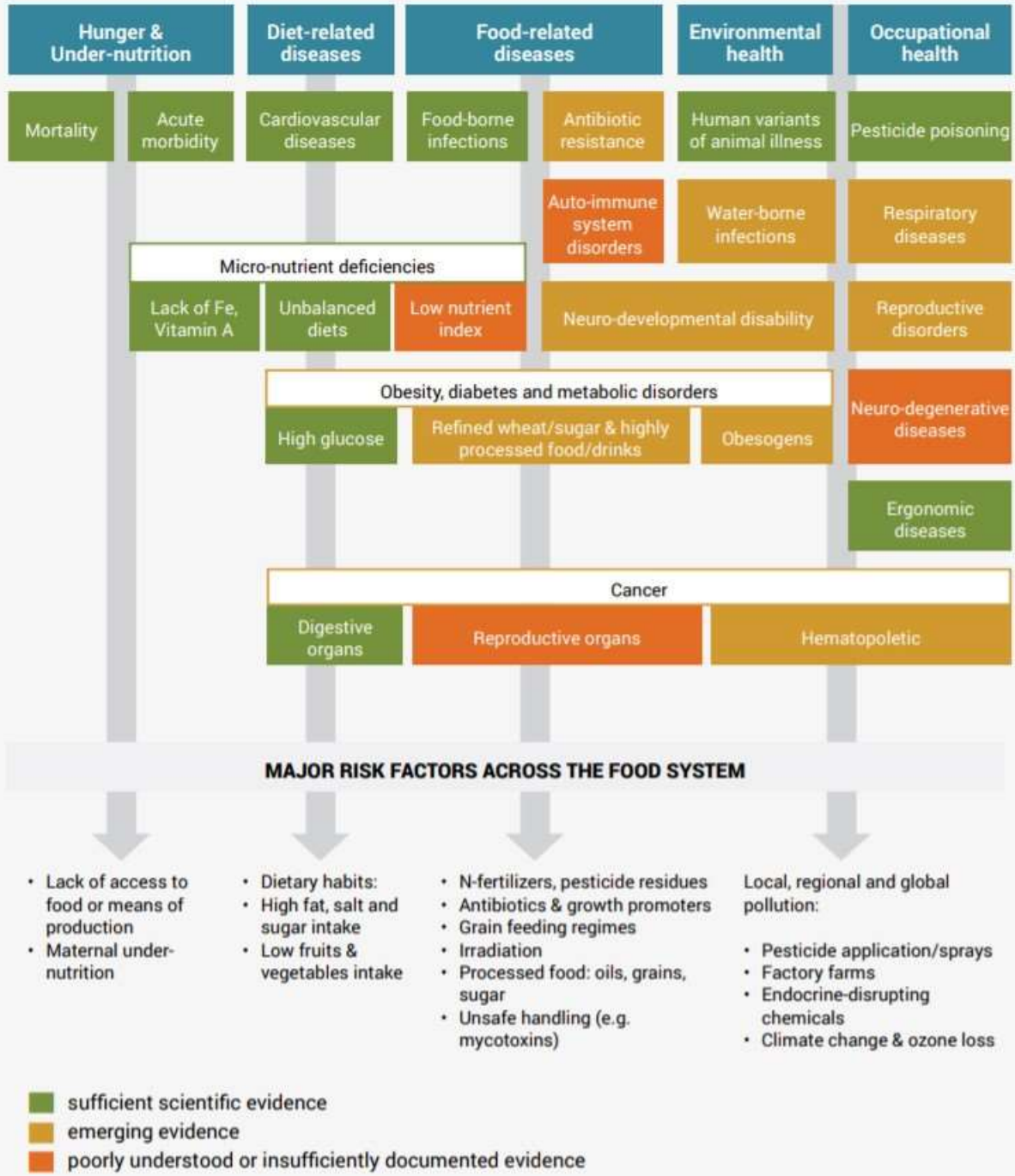
The guidance documents always explain how to use a uniform sustainability scoring system to measure each community capital better. Ideally, careful use of this example's Capital Budget Categorical and Locational Indexes, and their Hotspots properties, can be used to generate these disparate scores. Although this example focuses on household accounting, the opening TEEB image verifies that Appendix C's approach supports a wide assortment of scoring systems. In the long run, these uniform scores are generated automatically when a household club, business, or community, submits an LCI to the accounting platform (i.e. via Appendix C's new service industries).

Appendix C confirms that global heating requires that the Natural Capital stock act as an encompassing community capital for the remaining stocks. Most community capital stock measurements must explain their impacts on their encompassing natural capital stocks. Many of this example's references specifically recommend using ecosystem service metrics, as explained in Appendix C, for this purpose (i.e. see Castellani et al, 2017 and Crenna et al, 2019, for examples).

Guidance documents are prepared that target the cultural and social communication requirements of highly impacted stakeholders (i.e. via Appendix C's new service industries).

Natural and Human Capital Scores. The following image (TEEB, 2018) documents the state of current scientific evidence linking food systems and health. Guidance documents use this type of background scientific evidence to develop M&A Actions to address these risks for impacted stakeholders.

Figure 3.2 Food ecology and health (Source: adapted from Scialabba forthcoming)



The USDA (2015) use the following Healthy Eating Index (HEI-2015) to assess how well household diets contribute to healthy lives. In the context of this tutorial, this Index measures how the Food Stock Flows documented using operating budgets change Human Capital Stocks in a capital budget (i.e. measured using HEI-2015 as a proxy for the impact pathway's Outcome measurement).

HEI-2015[1] Components and Scoring Standards

Component	Maximum points	Standard for maximum score	Standard for minimum score of zero
Adequacy:			
Total Fruits[2]	5	≥0.8 cup equivalent per 1,000 kcal	No Fruit
Whole Fruits[3]	5	≥0.4 cup equivalent per 1,000 kcal	No Whole Fruit
Total Vegetables[4]	5	≥1.1 cup equivalent per 1,000 kcal	No Vegetables
Greens and Beans[4]	5	≥0.2 cup equivalent per 1,000 kcal	No Dark-Green Vegetables or Legumes
Whole Grains	10	≥1.5 cup equivalent per 1,000 kcal	No Whole Grains
Dairy[5]	10	≥1.3 cup equivalent per 1,000 kcal	No Dairy
Total Protein Foods[4]	5	≥2.5 cup equivalent per 1,000 kcal	No Protein Foods
Seafood and Plant Proteins[4,6]	5	≥0.8 cup equivalent per 1,000 kcal	No Seafood or Plant Proteins
Fatty Acids[7]	10	(PUFAs + MUFAs)/SFAs ≥2.5	(PUFAs + MUFAs)/SFAs ≤1.2
Moderation:			
Refined Grains	10	≤1.8 ounce equivalent per 1,000 kcal	≥4.3 ounce equivalent per 1,000 kcal
Sodium	10	≤1.1 grams per 1,000 kcal	≥2.0 grams per 1,000 kcal
Added Sugars	10	≤6.5% of energy	≥26% of energy
Saturated Fats	10	≤8% of energy	≥16% of energy

[1] Intakes between the minimum and maximum standards are scored proportionately.
[2] Includes 100% fruit juice.
[3] Includes all forms except juice.
[4] Includes legumes (beans and peas).
[5] Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.
[6] Includes seafood, nuts, seeds, soy products (other than beverages), and legumes (beans and peas).
[7] Ratio of poly- and mono-unsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

FAO (2017d) use the following statement to explain the importance of linking diet with lifestyle improvements.

"What is certain is that diets and lifestyle substantially contribute to health outcomes. Adhering to healthy dietary principles, along with physical activity (3.5 hours a week), non-smoking and a body mass index lower than 30 (calculated as weight in kilograms divided by height in meters

squared), has been found to lower the risk of diabetes by 93%, heart attack by 81%, stroke by 50% and cancer by 36%."

Diets and Lifestyle Scores. Example 11 used the following image to demonstrate how consumers can use sustainability scores derived from diet and lifestyle measurements to make better decisions about purchases (i.e. calories are replaced with social sustainability scores which include a healthy eating index, such as HE-2015, and carbon footprint scores) Sustainability workers help clubs use similar scoring systems, including physical activity and lifestyle indexes, that can be communicated to household members in similar ways. Besides the direct benefits to consumers (i.e. fewer healthcare expenses), the community health impacts documented in the last paragraph (i.e. 93% reduction in risk of diabetes with related reductions in health care costs) can protect national health care budgets from absorbing most public spending (i.e. the U.S.'s 17+%).

Appendix B recommended that similar product sustainability scoring systems be used for all industries and that they include natural capital scoring as well (i.e. to also protect consumers from suffering unaffordable losses and national disaster loss budgets from absorbing most public spending).

Figure 20: Example of a menu or menu board that describes an opportunity for the consumer to combine standard menu items for a special price (and the calories for each standard menu item that may be combined are declared elsewhere on the menu or menu board).

SANDWICH		Whole Serving	Pick 2
Turkey Breast	$5.89	560 Cal.	280 Cal.
Tuna Salad	$5.89	660 Cal.	330 Cal.
Ham and Swiss	$5.89	730 Cal.	370 Cal.
Chicken Salad	$6.89	700 Cal.	350 Cal.
SOUP	Bread Bowl	Bowl	Cup
	$5.39	$4.39	$3.69
Broccoli Cheddar	900 Cal.	360 Cal.	230 Cal.
Chicken Noodle	780 Cal.	160 Cal.	110 Cal.
New England Clam Chowder	1040 Cal.	570 Cal.	370 Cal.
Chicken and Rice	840 Cal.	260 Cal.	180 Cal.
SALAD			
Caesar	$5.49	320 Cal.	160 Cal.
Greek	$5.89	400 Cal.	200 Cal.
Apple and Chicken	$7.29	570 Cal.	280 Cal.
Southwest with Chicken	$7.49	650 Cal.	320 Cal.
Pick 2	½ Sandwich • ½ Salad • Cup of Soup		$6.79

2,000 calories a day is used for general nutrition advice, but calorie needs vary.
Additional nutrition information available upon request.

5.4. I am a covered pizza parlor that uses both online menus and menu boards in our establishment. Do I have to provide calorie declarations on our menu boards within the establishment if we declare calories on our online menu?

Natural and Produced/Consumed Capital Scores. OECD (2018) cites statistics showing that 29% of the mortality in any given year, throughout the world, relates to environmental risks, such as air pollution and contaminated water. Besides any "intrinsic or cultural" values that stakeholders may associate with nature, their own "instrumental" health directly depends on the condition of their natural environment (SPA2 introduced these 3 terms for valuing ecosystem services). The Health Care Analysis tutorial confirms that the health care industry in many countries already understands the impacts that climate change is having on their customers, and points to the partnerships they are forming and the M&A Actions they are taking.

Household Sustainability Records, Audits, and Scores. The following URL and image confirm that practical household record keeping and sustainability audits are currently available in some countries. Club guidance documents contain instructions for completing these types of audits, including social sustainability, or community capital, audits.

https://www.energy.gov/articles/askenergysaver-home-energy-audits

Home » #AskEnergySaver: Home Energy Audits

A home energy audit is the first step to improving your home's energy efficiency. Making energy efficiency upgrades identified in a home energy audit can save 5-30 percent on your monthly energy bill while also ensuring the health and safety of your house. | Infographic by Sarah Gerrity, Energy Department.

To help you save money by saving energy, we launched #AskEnergySaver -- a new series that gives you access to some of the Energy Department's home energy efficiency experts. Over the

LICA Indicators and Characterization Factors (CFs) Examples and Recommendations. The following table (FAO, 2019) shows how UNEP LICA Indicators and CFs are calculated and used for sustainability accounting. In this case,

using the UNEP AWARE LCIA Indicator and CFs to assess the impact of livestock production on water scarcity. For households, these calculations are based on the household and household club contribution to water scarcity. As FAO notes "the calculation method used with the AWARE method (water characterization factor multiplied by a water use inventory quantity) applies to most water impact assessment [reporting]".

Table 7: AWARE and Blue Water Scarcity Index (BWSI) for a hypothetical livestock product system (e.g. dairy product)

	Inventory results	Scarcity factor		Impact assessment		
	Water consumption (m^3/product)	AWARE model ($m^3_{world\ eq.}/m^3$) (Boulay *et al.*, 2018)	BWSI (Hoekstra *et al.*, 2012)	Water scarcity footprint (using AWARE) ($m^3_{world\ eq.}$)	Does the overall water consumption in the area exceed the available water for humans?	Fraction of product's water consumption located in regions with BWSI > 1
Feed production	45	10	2.10	450	Yes	45%
	35	0.5	0.15	17.5	No	–
Cow growth	7	0.5	0.15	3.5	No	–
Milking	4	0.5	0.15	2	No	–
Package production	8	1.5	0.80	12	No	–
Processing and shipment	1	3	1.50	3	Yes	1%
Total	100	–	–	481	–	46%

Table 7 summarizes the water inventory results and scarcity indexes, with resulting values for the water scarcity impact assessment of the hypothetical system. Impact assessment of water consumption for each process and each area can be calculated by multiplying the water consumption inventory results and characterization factors (here water scarcity indexes) for the area concerned. The result of the impact assessment with the AWARE model quantifies, for water consumption in a specific location (i.e. the water inventory), the corresponding volume of water equivalent to that consumption in an average world location, considering the po-

44

Assessment: Water scarcity impact

tential to deprive other users. For instance, the potential impact of consuming 45 m^3 in watershed A is equivalent to a consumption of 450 m^3 in a world average area, based on watershed A having 10 times less remaining water then the world average ($CF = 10\ m^3_{world\ eq}/m^3$).

Sustainable Business Investment and Sustainable Business Development Training and Scoring. Traditional capital budgets identify household assets and debts. In addition, much of the development literature (i.e. Sustainable Livelihoods Framework, Heifer International, Hernando de Soto's publications) identifies business ownership backed with clear property rights as being a key precursor to wealth accumulation. Household living wages allows families to scrape by, but the wages don't lead to wealth accumulation.

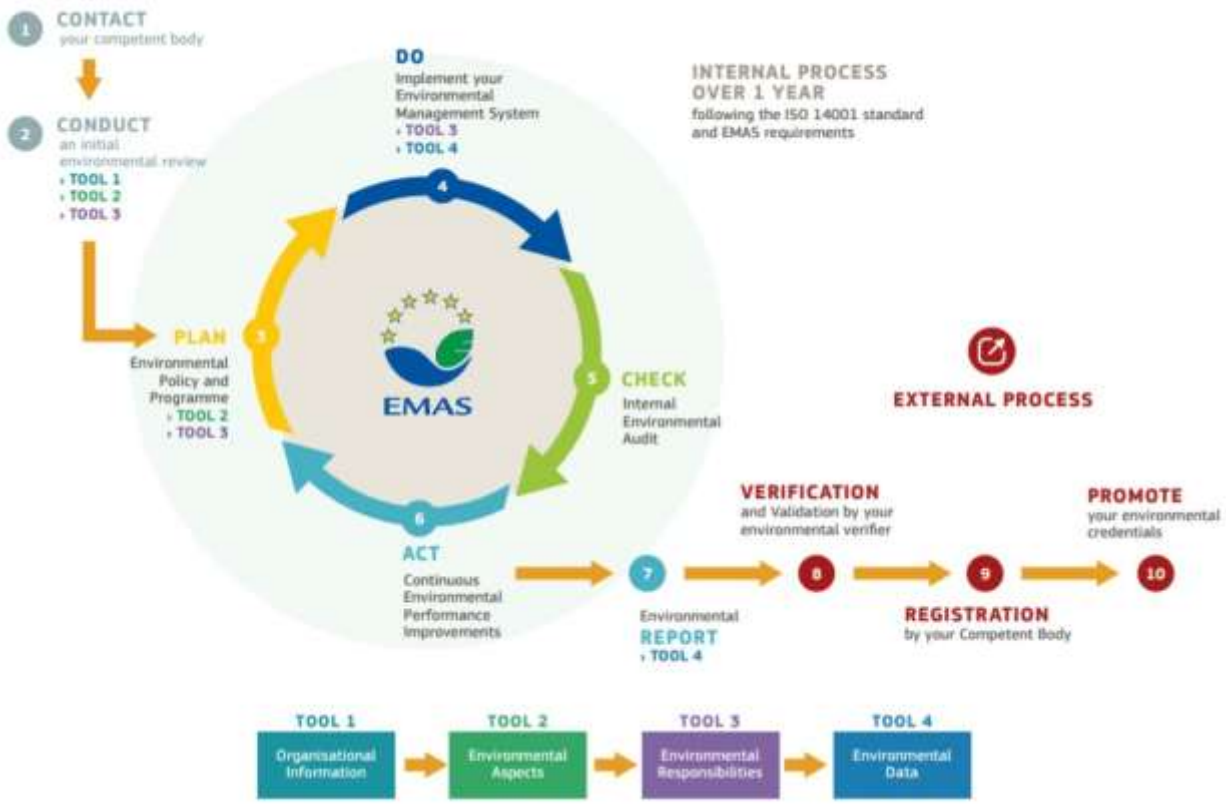
Communities (i.e. Portland, Oregon, USA) have passed referendums for collecting climate justice taxes that will be used to fund sustainable business development. The

following URLs and images introduce the type of sustainable business accounting toolkits (i.e. EU Eco-Management and Audit Scheme or EMAS; Example 12's system) available to assist these new businesses to document the Natural and Produced Capital dimensions of their accounting system, or their clients' accounting systems.

https://ec.europa.eu/environment/emas/pdf/other/Emas%20toolkit_instruction%20manual.pdf

This is what EMAS easy is about
It lowers the bureaucracy, the barriers of knowledge and consulting & certificati

Introduction	What is EMAS ? What is ecomapping, what is ISO/EMASeasy?
Informal	Ecomapping – getting started Step 1 : Urban situation map Step 2 : Material flow Step 3 : Workers opinion poll - the Weather map Step 4 : Eco-map water Step 5 : Eco-map soil and storage Step 6 : Eco-map air, odours, noise and dust Step 7 : Eco-map energy Step 8 : Eco-map waste Step 9 : Eco-map risk Step 10 : Your environmental information system
Formal	Moving from ecomapping to EMAS Step 11 : Upgrade your ecomaps for EMAS **Steps 12 to 16 : Planning your environmental management system** Step 12 : Your environmental policy Step 13 : Environmental aspects identification Step 13 and 14 : FLIPO Step 15 and 16 : Objectives and targets **Step 17 to 23 : Implementation and day to day management** Step 17 : Assign jobs and tasks to your EMAS Step 18 : Train your staff Step 19 : Your environmental manual **Step 24 to 28 : Controlling your environmental management system** Step 24 and 25: Internal controlling -your quick check Step 26 : Recording of events and documents - your ecologbook Step 27 : Step 28 : Management review - your control panel Step 29 : Environmental statement Step 30 : Verification of your EMAS and use of the EMAS logo The online EMAS toolkit for SMEs



Occupational Risk Scores. Recent news reports have covered local occupational and safety and health, or sustainability, workers, holding meetings with Spanish speaking farmworkers to inform them of their rights. Specifically, the farmworkers were informed of their employers' requirement to train them in safety requirements in their own language. Guidance documents must be prepared that target the communication needs of specific, highly impacted, stakeholders.

Climate Change (i.e. human-induced) Business and Household Damage Scores. Example 6a in SPA3 demonstrates using business continuity plans and emergency preparedness plans to reduce the risk of damages from natural resource disasters. Guidance documents modify the business plans for household emergency preparedness scoring.

Household Living Wage Scores. Example 4 used a Household Living Wage Budget to demonstrate how to complete household operating budgets for sustainability purposes. In

this case, to ensure that needy, rural, stakeholders had sufficient resources to live "a basic but decent life". This example demonstrates using similar budgets to assess the sustainability of households. The households used in these budgets reflect representative subpopulations of impacted stakeholders. The budgets can be collected through conventional record keeping, or sustainability, networks and clubs. The budgets can also be put together using the sustainability preferences expressed by members of new Sustainability Accounting Platforms (i.e. replacements for current social media platforms).

Household Living Wealth Scores. The previous budget does not show how household wealth and well-being change over time. Example 4 explained that these budgets can be used for either operating or capital budgeting. Guidance documents explain how to use capital budgets to track household wealth. Besides documenting personal monetary assets and debts, most household wealth (i.e. good health, secure housing, robust family relations, interesting hobbies, rewarding faith-based and civic organization engagement) derives from their local community capitals. Guidance documents focus on understanding and improving the community capitals so that sustainability workers can take outreach efforts to increase the participation of households in the types of community capital formation that will increase their household wealth.

Natural and Social Capital Scores. Much of the social discord taking place throughout the world relates to stakeholder dissatisfaction with formal institutions, including political and business systems. Much of the social partisanship taking place in many countries relates to disparate stakeholder perspectives grounded in different social norms (i.e. gun rights, voting rights, gender rights). Social capital measures these formal and informal institutions so that reasonable tradeoffs can be made to accommodate disparate stakeholder perspectives.

Property and Human Rights and Access to Legal System Scores. Household wealth, broadly defined, can only accumulate when vulnerable stakeholders have full access to legal systems that protect their property and human rights. Sustainability workers include legal workers that assist highly impacted stakeholders to use local legal systems to

improve their household wealth. In relation to Natural Capital, Costanza (2017) explains that the public goods nature of ecosystem services requires clear property rights over ecosystem systems, "without privatizing them". Sustainability workers include legal workers that assist highly impacted ecosystems to use local legal systems to improve their community's wealth.

Adverse Social and Cultural Norms and Gender Role Scores. Sustainability workers focus on improving local laws and regulations that protect females and lgbtq genders against violence and discrimination. Sustainability workers undertake outreach efforts to change adverse social and cultural norms held by dominant stakeholder groups that lead to this type of violence and discrimination.

Community Sustainability Accounting Networks and Clubs Support and Equity Scores. Guidance documents provide sustainability workers with the instructions needed to build and support accounting networks and clubs. The workers act as sustainability advisors who focus on understanding their stakeholders' needs and communicating sensible advice about fair tradeoffs among stakeholders needed to accomplish sustainability goals.

Transition States 2 to 15 and Score.

The previous transition state's capital budget becomes the starting capital budget for the subsequent state. The previous state's operating budget will be changed to reflect the actual flows measured in the subsequent state.

Properties may be added that allow initial forecasts, such as linear trends, to be used as initial transition state budgets. Separately forecasted budgets may be useful for scenario planning.

M&E Reporting and Communicating

The following image (EMAS, 2017) is an example of the uniform community capital reports supported by these household accounting systems. This example's focus on full sustainability

contexts requires that these reports include target accomplishments based on impact thresholds, more comprehensive coverage of all of the community capitals, and final scores that support comparisons and tradeoffs. DevTreks assumes that the S and G in ESG reporting is missing from these reports because international standards for socioeconomic measurements haven't been fully codified yet (i.e. meaning that special interest group and authoritarian government biases can slip through). This example believes that careful use of Appendix C's techniques, particularly institutional change that leads to new sustainability management service industries, can mitigate the biases.

Your material flows and resource use

Step 2

Your company is a black box. Raw material, energy, auxiliary products and packaging are entering the company. New products, services and also different types of waste (solid, liquid, airborne) are leaving the company.

A material process flow will allow you in terms of kilograms (Kgs), tonnes (T), cubic metres (M3) to get a clear picture of resource use, non productive output and a better understanding of the very nature of the products you use or dispose of. Please use generally accepted international metrics (m3, kWh, Tons, Kg, etc.)

Decide which flows deserve the most attention

IN (per year)

	Consumption	Nature of product
Energy		
Heating Fuel	..... litres	....
Gaz	..... m^3	....
Electricity	..... kWh	....
Diesel & fuel for vehicles	..... litres	....
Renewable energy	..... kWh	....
Water consumption		
Distribution water	..... m^3	....
Groundwater	..... m^3	....
Packaging		
Films	..... kg	....
Cans	..... kg	....
Cardboard	..... kg	....
Auxiliary products used		
Lubrification	..... litres	....
Detergeants	..... litres	....
Cleaners, salt	..... litres	....
Office supplies	..... kg	....
Computers and electronics	..... Units	....
Raw material		
Paints	..... kg	....
Solvents	..... kg	....

OUT (per year)

	Production	Nature of product
Emissions to Air		
CO_2	..... kg	....
SO_x	..... kg	....
NO_x	..... gr	....
concentration of solvents	..... ppm	....
Waste Water		
Recycling of water in process	..... m^3	....
DBO	..... mgr/lit	....
CDO	..... mgr/lit	....
Waste		
Packaging waste	..... kg	....
Hazardous waste	..... kg	....
Non toxic waste	..... kg	....
Paper and card board	..... kg	....
Liquid waste	..... litres	....
Products and services		
Finished products	..... Units	....
Semi-finished products	..... Units	....
Service unit	..... Units	....

Please identify if possible the nature of the products :

1 2 3 4 5 6 7

FAO (March, 2017) use the following survey to assess household satisfaction with current quality of life (i.e. QASYs or Subject Well Being Valuations). Household survey data is kept by the networks administering the household clubs. When member privacy is a major concern (i.e.

as it is with most farm record keeping associations), the surveys are completed for the network's clubs, or anonymous reference clubs, rather than individual club members.

Annex 3 – MARCH Survey Instrument

Q1. Are you male or female?
1 = Male
2 = Female

Q2. What is your date of birth?
____/____/_____ *(day/month/year)*

Q3. Life satisfaction
We would like to ask you a question about your feelings about your life overall. There are no right or wrong answers. For this question, we'd like you to circle your answer on a scale of 0 to 10, where 0 is 'not at all' and 10 is 'completely'.
Overall, how satisfied are you with your life nowadays?
0 = Not at all satisfied
1
2
3
4
5
6
7
8
9
10 = Completely satisfied

Personal Information

Q4. Marital status
(a) What is your legal marital status?
1 = Married / in civil partnership
2 = Separated
3 = Divorced
4 = Widowed
5 = Single (never married or in civil partnership)

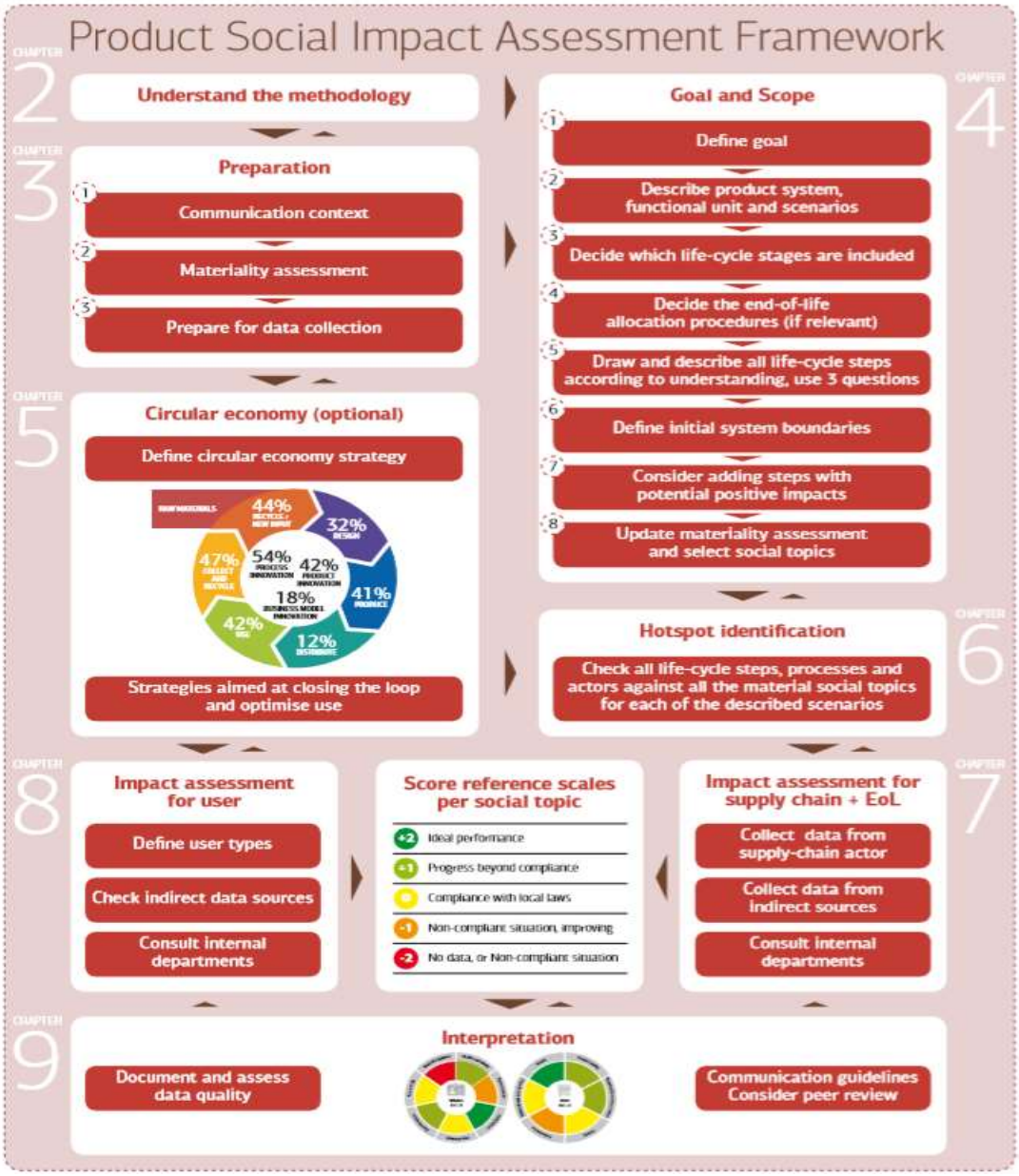
If your answer above is not Married / in civil partnership, please also answer part (b).
(b) Are you living as a couple with another person?
1 = Yes
2 = No

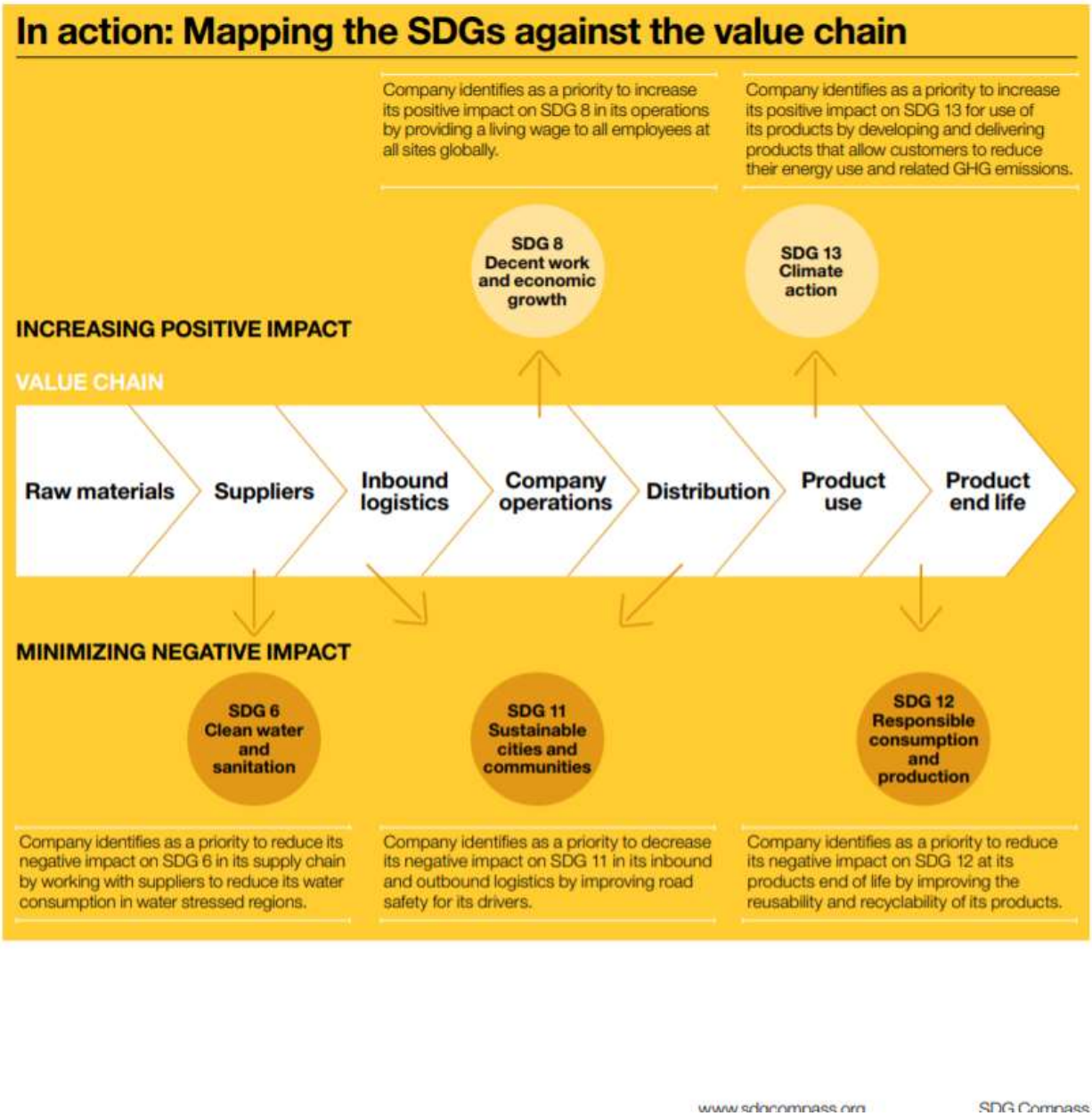
Q5. Dependents
(a) How many dependent children are there in your household?
____ *(please enter number)*
(b) How many dependents other than children are there in your household?

Example 12a. Applied Sustainability Accounting Platforms –Supply Chains (under planning for Version 2.2.4)

Household Sustainability Accounting Media Management: under consideration (2.4.0? – although Resource, or multimedia, base elements can be linked to linked views, or digits, Appendix C & D's sustainability worker teams need to get their hands dirty (i.e. Instagram for science))

Switch to machine learning examples and explain how the following types of sustainability frameworks are supported.


Product Social Impact Assessment Framework
2
Understand the methodology
3
Preparation
1
Communication context
2
Materiality assessment
3
Prepare for data collection
5
Circular economy (optional)
Define circular economy strategy
44%
32%
47%
54%
42%
18%
41%
42%
12%
Strategies aimed at closing the loop and optimise use
4
Goal and Scope
1
Define goal
2
Describe product system, functional unit and scenarios
3
Decide which life-cycle stages are included
4
Decide the end-of-life allocation procedures (if relevant)
5
Draw and describe all life-cycle steps according to understanding, use 3 questions
6
Define initial system boundaries
7
Consider adding steps with potential positive impacts
8
Update materiality assessment and select social topics
6
Hotspot identification
Check all life-cycle steps, processes and actors against all the material social topics for each of the described scenarios
8
Impact assessment for user
Define user types
Check indirect data sources
Consult internal departments
Score reference scales per social topic
+2 Ideal performance
+1 Progress beyond compliance
0 Compliance with local laws
-1 Non-compliant situation, improving
-2 No data, or Non-compliant situation
7
Impact assessment for supply chain + EoL
Collect data from supply-chain actor
Collect data from indirect sources
Consult internal departments
9
Interpretation
Document and assess data quality
Communication guidelines
Consider peer review



Appendix D may discuss technical aspects of machine learning and semantic web development. In summary, from a technologist perspective, Berners-Lee semantic web approach is correct, but from a public goods perspective, that type of business model may be completely wrong.

DevTreks will consider upgrading DevTreksStatsAPI for these advancements (but it's still not clear that a small ngo should be doing all of the work).

Appendix A. Introduction to SDG Mitigation and Adaptation (M&A) Feasibility Assessments

IPCC (2018) uses formal assessments to determine the feasibility of M&A Actions to reduce the impacts of global heating. Given that the existing SPA references didn't directly address Feasibility Assessments or actual M&A Action Portfolio development and selection, this section introduces the IPCC Feasibility Assessment procedure which is needed for SDG Plan development.

Feasibility Dimensions. The following image (IPCC, 2018) lists 6 dimensions and 51 indicators that can be used to assess the feasibility of M&A Actions designed to address global heating.

Table 4.10: Sets of indicators against which the feasibility of adaptation and mitigation are assessed, for each feasibility dimension (in Sections 4.3.1-4.3.4, 4.3.5 and 4.3.7)

	Characteristics	Adaptation indicators	Mitigation indicators
	Economic	Micro-economic viability Macro-economic viability Socio-economic vulnerability reduction potential Employment & productivity enhancement potential	Cost-effectiveness Absence of distributional effects Employment & productivity enhancement potential
	Technological	Technical resource availability Risks mitigation potential	Technical scalability Maturity Simplicity Absence of risk
	Institutional	Political acceptability Legal & regulatory feasibility Institutional capacity & administrative feasibility Transparency & accountability potential	Political acceptability Legal & administrative feasibility Institutional capacity Transparency & accountability potential
	Socio-cultural	Social co-benefits (health, education) Socio-cultural acceptability Social & regional inclusiveness Intergenerational equity	Social co-benefits (health, education) Public acceptance Social & regional inclusiveness Intergenerational equity Human capabilities

	Environmental/ecological	Ecological capacity Adaptive capacity/ resilience building potential	Reduction of air pollution Reduction of toxic waste Reduction of water use Improved biodiversity
	Geophysical	Physical feasibility Land use change enhancement potential Hazard risk reduction potential	Physical feasibility (physical potentials) Limited use of land Limited use of scarce (geo)physical resources Global spread

The following list relates these dimensions to the 7 community capitals used in the RCA Framework that underlies this reference, and, as documented in SPA3, the SDG. This relationship helps to explain why these dimensions can also be used to assess the feasibility of M&A Actions for all SDG targets, rather than just climate change targets. The 6 dimensions also help the planning teams avoid skipping dimensions, especially Institutional and Socio-cultural, which are commonly neglected in conservation planning (i.e. see Goedkoop et al, 2018, for an example from the private sector).

Economic Capital: Economic Dimension and most of the Technological Dimension

Institutional Capital: Institutional Dimension

Social Capital, Cultural Capital, and Human Capital: Socio-Cultural Dimension

Natural Capital: Environmental and Ecological Dimension

Physical Capital: Geophysical Dimension and part of the Technological Dimension

The Assessments use the following 3 thresholds, documenting degree of barriers to adoption.

Threshold A. Insignificant barrier to feasibility

Threshold B. Moderate barrier

Threshold C. Significant barrier

The rating system employs the following scoring criteria. Although this system works at global scale because scientific citations can be found to score the thresholds, this section will illustrate adapting the system for local scales where scientific publications will not be available.

Supplementary Material 4.D.1, Table 2: Parameters used for the calculation of the overall feasibility of the dimension-option combinations

$\#indicators$	Number of indicators used to assess the overall feasibility of a dimension, typically two to five.
$\#NA$	Number of indicators that are not applicable (NA) to the option
$\#NE\&LE$	Total number of indicators for which there is no evidence (NE) or limited evidence (LE)
$\#A$	Number of indicators assessed as A
$\#B$	Number of indicators assessed as B
$\#C$	Number of indicators assessed as C
$\#effective\ indicators$	$\#effective\ indicators = \#indicators - \#NA$

AVG	$AVG = (1 * \#A + 2 * \#B + 3 * \#C)/\#effective\ indicators$

Supplementary Material 4.D.1, Table 3: Legend criteria for the overall feasibility of the dimension-option combinations as shown in Table 4.1 or adaptation options.

Legend of Table 4.11 and Table 4.12	**Legend criteria for the overall feasibility of each of the dimension-option combinations**
	$\#indicators = \#NA$
	$\#NE\&LE > 0.5 * \#effective\ indicators$
	$AVG \leq 1.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$
	$1.5 < AVG \leq 2.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$
	$AVG > 2.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$

Mitigation. The following images (IPCC, 2018) demonstrate how to use feasibility assessments to identify mitigation options for tackling climate change. IPCC (2018) defines mitigation options as (also see their Glossary):

"Mitigation refers to efforts to reduce or prevent the emission of greenhouse gases, or to enhance the absorption of gases already emitted, thus limiting the magnitude of future warming (IPCC,

2014c). Mitigation requires the use of new technologies, clean energy sources, reduced deforestation, improved sustainable agricultural methods, and changes in individual and collective behavior."

They score 24 Indicators to generate the 6 feasibility dimensions (i.e. CIs) used in these assessments.

Table 4.11: Feasibility assessment of examples of 1.5°C-relevant mitigation options with dark shading signifying the absence of barriers in the feasibility dimension, moderate shading that on average, the dimension does not have a positive, nor a negative effect on the feasibility of the option, and faint shading the presence of potentially blocking barriers. No shading means that not sufficient literature could be found to make the assessment. Evidence and agreement assessment is undertaken at the option level. The context column on the far right indicates how the assessment might change if contextual factors are different. For the methodology and literature basis, see supplementary material D.1 and D.2.

System	Mitigation option	Evidence	Agreement	Ec	Tec	Inst	Soc	Env	Geo	Context
Energy system transitions	Wind energy (on-shore & off-shore)	Robust	Medium							Wind regime, economic status, space for windfarms and enhanced by legal framework for independent power producers affect uptake; cost-effectiveness affected by incentive regime.
	Solar PV	Robust	High							Cost-effectiveness affected by solar irradiation and incentive regime. Also enhanced by legal framework for independent power producers affect uptake.
	Bioenergy	Robust	Medium							Depends on availability of biomass and land and capability to manage sustainable land use. Distributional effects depend on the agrarian (or other) system used to produce feedstock.
	Electricity storage	Robust	High							Batteries universal but grid flexible resources vary with area's level of development
	Power sector CCS	Robust	High							Varies with local CO2 storage capacity, presence of legal framework, level of development and quality of public engagement
	Nuclear energy	Robust	High							Electricity market organisation, legal framework, standardisation & know-how, country's 'democratic fabric', institutional and technical capacity, and safety culture of public and private institutions
Land & ecosystem transitions	Reduced food wastage & efficient food production	Robust	High							Will depend on the combination of individual and institutional behaviour
	Dietary shifts	Medium	High							Depends on individual behaviour, education, cultural factors and institutional support
	Sustainable intensification of agriculture	Medium	High							Depends on development and deployment of new technologies
	Ecosystems restoration	Medium	High							Depends on location and institutional factors
	Land-use & urban	Robust	Medium							Varies with urban fabric, not geography or economy; requires capacitated local

Adaptation. The following image (IPCC, 2018) demonstrates how to use feasibility assessments to identify adaptation options for tackling climate change. IPCC (2018) defines adaptation (also see their Glossary):

"Adaptation refers to the actions taken to manage the impacts of climate change (IPCC, 2014e). The aim is to reduce vulnerability and exposure to the harmful effects of climate change (e.g. sea–level rise, more intense extreme weather events or food insecurity). It also includes exploring the potential beneficial opportunities associated with climate change (for example, longer growing seasons or increased yields in some regions)."

They score 27 Indicators to generate the 6 feasibility dimensions (i.e. CIs) used in these assessments.

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Table 4.12: Feasibility assessment of examples of 1.5°C-relevant adaptation options with dark shading signifying the absence of barriers in the feasibility dimension, moderate shading that on average, the dimension does not have a positive, nor a negative effect on the feasibility of the option, and light shading the presence of potentially blocking barriers. No shading means that not sufficient literature could be found to make the assessment. NA signifies that the dimension is not applicable to that adaptation option. For methodology and literature basis, see supplementary material D.

System	Adaptation option	Evidence	Agreement	Ec	Tec	Inst	Soc	Env	Geo	Context
Energy system transitions	Power infrastructure, including water	Medium	High							Depends on existing power infrastructure, all generation sources and with intensive water requirements
Land & ecosystem transitions	Conservation agriculture	Medium	Medium							Depends on irrigated/rainfed system, ecosystem characteristics, crop type, other farming practices
	Efficient irrigation	Medium	Medium							Depends on agricultural system, technology used, regional institutional and biophysical context
	Efficient livestock	Limited	High							Dependent on livestock breeds, feed practices,and biophysical context (e.g. carrying capacity)
	Agroforestry	Medium	High							Depends on knowledge, financial support, and market conditions
	Community-based adaptation	Medium	High							Focus on rural areas and combined with ecosystems-based adaptation, does not include urban settings
	Ecosystem restoration & avoided deforestation	Robust	Medium							Mostly focused on existing and evaluated REDD+ projects
	Biodiversity management	Medium	Medium							Focus on hotspots of biodiversity vulnerability and high connectivity
	Coastal defense & hardening	Robust	Medium							Depends on locations that require it as a first adaptation option
	Sustainable aquaculture	Limited	Medium							Depends on locations at risk and socio-cultural context
Urban & infrastructure system transitions	Sustainable land-use & urban planning	Medium	Medium							Depends on nature of planning systems and enforcement mechanisms
	Sustainable water management	Robust	Medium							Balancing sustainable water supply and rising demand especially in low-income countries
	Green infrastructure & ecosystem services	Medium	High							Depends on reconciliation of urban development with green infrastructure

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Local SDG Feasibility Assessments. Even if local sustainability workers decided that climate change poses a sufficient existential threat to justify full, 51 Indicator, Feasibility Assessments, the "drivers" of climate change, that is, the SDG Indicators, and their ameliorating "SDG best practices", are likely to be just as important. Although IPCC (2018) mentions that the Integrated Assessment Models (IAMs) used for climate change forecasting are getting better at factoring in SDG targets, those models are usually useful at gross, global scales that rely on internationally available data. Unless the billion dollar investments needed for full SDG global data collection provides the necessary local data (see Espey, 2017), local planning efforts will be needed for local SDG decision support (**5***).

The M&A Actions displayed in these feasibility assessments are too gross for local SDG Planning. For example, the M&A Action, Conservation agriculture, listed in the previous table could involve hundreds of actual conservation practices used by national and local planning groups. In addition, most local sustainability workers won't have the evidence, time, or experience, needed to complete 51 Feasibility Indicators to rate each conservation practice (or M&A Action) for each SDG Indicator (or Target). Local sustainability workers are more likely to use MCDA-related scoring systems, similar to SPA2's Examples 1 and 2, to determine how SDG best practices (or systems) lead to the desired SDG impacts (**1***).

The SPA3 documented that many natural resource planning groups, many of whom may be responsible for local, SDG-related, Feasibility Assessments, are bad at addressing socioeconomic and insitutional risks in their work. Requiring these groups to use, at minimum, the 6 dimensions themselves in the assessments may be the most practical approach for local planning purposes. Local sustainability workers rely on their experience to rate the Best Practice – SDG Impact, but develop that experience by using the "impact pathways" algorithmic approaches demonstrated in Examples 1 to 8 to gather the background evidence that leads to their experience.

The following example of part of an SDG Plan illustrates how this type of SDG Feasibility Assessment might work in practice. Example 9 introduces the underlying planning process for completing the full SDG Plan.

Planning Part 4. Feasibility of Mitigation and Adaptation Actions: The following Stakeholder Feasibility Assessments are completed for the best practices that mitigate and adapt to the prioritized SDG Risks and Impacts identified for impacted stakeholder groups.

SDG. 13. Climate Change. Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in this local community (i.e. Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population)
SDG Best Practice 1. Wind energy. • Install 4,500 wind turbines that will meet 25% of local energy demand

- Provide sufficient consumer incentives to result in 20% switch over.
- Provide sufficient company incentives to result in 30% switch over.

Stakeholders Feasibility Assessment (1 = insignicant barrier to feasibility; 2 = moderate barrier 3 = significant barrier)

Stakeholder	**Econ**	**Tech**	**Instit**	**Socio**	**Env**	**Geo**	**Score**
Highly Impacted	1	2	3	1	2	3	2
Indicator 1	x	x	x	x	x	x	x
Indicator 2	x	x	x	x	x	x	x
Moderately Impacted	x	x	x	x	x	x	x
Indicator 1	x	x	x	x	x	x	x
Indicator 2	x	x	x	x	x	x	x
Minimally Impacted	x	x	x	x	x	x	x
Indicator 1	x	x	x	x	x	x	x
Indicator 2	x	x	x	x	x	x	x

Stakeholder Participatory Practices: The following practices have proven to help to overcome the barriers to SDG Practice adoption, and gain the acceptance, of the targeted stakeholder groups

Table 6.1: Behavioural and political success factors.

Success factor	Example(s)
Directly addressing distributional impacts	• LPG price increases in **Brazil** and **Mexico** were combined with existing social welfare mechanisms to mitigate the effects of higher prices (Adeoti *et al.*, 2016; Toft *et al.*, 2016). • Kerosene subsidy reforms in **Indonesia** and **Yemen** were accompanied by measures promoting the use of liquefied petroleum gas (LPG) as a household cooking fuel (Clements *et al.*, 2013). • In **Indonesia**, social assistance programmes enabled the government to reform fossil fuel subsidies in the mid-2000s (Chelminski, 2018), while India and Iran provided some form of cash transfer to compensate households (Rentschler and Bazilian, 2017a; Jain *et al.*, 2018). • **Switzerland**, **Alberta** and **British Columbia** (see table 6.2) have used revenues from carbon pricing to compensate households and, to a degree, firms.
Establishing trust in governments	• Countries with relatively high levels of trust and low levels of perceived corruption, such as **Finland**, **Norway**, **Sweden** and **Switzerland**, tend to have higher carbon prices (Rafaty, 2018). • Subsidy reform in **Indonesia** had previously been difficult due to public distrust in the

Figure ES.6: Key issues for making fiscal reforms politically viable (upper part) and solutions and measures to address them (lower part).

The following table (World Resource Institute, 2018) provides comprehensive M&A Actions that may be needed in the agricultural sector as a result of imminent population increases. Each M&A Action will require similar Feasibility Assessments when used for SDG Planning.

Table 1 | **The menu for a sustainable food future: five courses**

MENU ITEM	DESCRIPTION
DEMAND-SIDE SOLUTIONS	
Course 1: Reduce growth in demand for food and other agricultural products	
Reduce food loss and waste	Reduce the loss and waste of food intended for human consumption between the farm and the fork.
Shift to healthier and more sustainable diets	Change diets particularly by reducing ruminant meat consumption to reduce the three gaps in ways that contribute to better nutrition.
Avoid competition from bioenergy for food crops and land	Avoid the diversion of both edible crops and land into bioenergy production.
Achieve replacement-level fertility rates	Encourage voluntary reductions in fertility levels by educating girls, reducing child mortality, and providing access to reproductive health services.

Section B, Mitigation and Adaptation Targets and M&A Action Impacts, used the following image (Antonopoulos et al, 2016) to illustrate how to communicate these results for simpler, field-oriented, planning purposes.

Based on environmental hotspots Table 13.2 maps across the most relevant BEMPs contained in this SRD to 12 major farm types. Simplification is inevitably involved, and farms may include features typical of multiple farm types (mix of intensive and extensive areas, mixed animal and crop production, etc).

Table 13.2: Priority best practices (BEMPs) described in this report for 12 major farm types (dark shading=high priority; medium shading=medium priority; white=not applicable or low priority) [59]

BEMP	Intensive dairy*	Extensive dairy	Intensive eef*	Extensive beef	Sheep	Intensive pigs*	Intensive poultry*	Extensive pig & poultry	Cereals and oils	Root crops	Field fruit & vegetables	Covered fruit & vegetables
3.1												
3.2												
3.3												
3.4												
3.5												
3.6												
3.7												
4.1												
4.2												
4.3												
4.4												
5.1												
5.2												
5.3												
5.4												
6.1												
6.2												
6.3												
6.4												
6.5												
7.1												
7.2												
7.3												
7.4												

Appendix B. Introduction to SDG Plan Prerequisites

This Appendix introduces the prerequisite planning that must first be carried out before sustainability workers can generate uniform sustainability scores for communities, organizations, and products.

Environmental Footprints for the Natural and Physical Capital Dimensions of SDG Planning. The EC's Product Environmental Footprint (PEF) and Organization Environmental Footprint (OEF) pilot projects (EC, 2017 and 2018) explain the objective behind this reference – harmonization of the hundreds of disparate sustainability reporting and certification systems that make uniform sustainable production and consumption choices, "scientifically challenging". ECb (2017) use the following statement to describe the mandate driving the pilot phase.

"establish a common methodological approach to enable Member States and the private sector to assess, display and benchmark the environmental performance of products, services and companies based on a comprehensive assessment of environmental impacts over the life-cycle ('environmental footprint')"

The pilot projects are currently moving into a transition phase, prior to decisions being made about adoption throughout the EU. ECb (2017) uses the following statement to summarize the conflicting perspectives raised by independent reviewers of the pilot projects.

"Indeed, there is a strongly polarized view on Environmental Footprint (EF): broadly speaking, such view is more positive from the industrial perspective that see the opportunity to use LCA in the promotion of a green market in EU, and more negative from some consumer and environmental NGOs, who have cast serious doubts on the use of PEF/OEF for its perceived purpose around communication to consumers. At the same time there is a substantial interest from international actors on what the EC is doing on PEF and OEF."

SPA2's Example 3, Product Life Cycle Impact Assessment, used the following statement from prominent LCA practitioners to highlight some of the reasons behind this polarization.

"Notarnicola et al (2017) review the state of LCA art in food system analysis and highlight the numerous challenges remaining to be tackled in this industry. These challenges include

- the need for dietary shifts to sustainable food systems
- field level LCAs that don't adequately address landscape level sustainability impacts on soil quality and fertility, land erosion, reduced ecosystem services, and biodiversity loss
- integration of social, economic, and cultural factors into LCA studies
- the reliance on average LCAs for predominant food production systems rather than the reality of extreme production variability
- technical deficiencies dealing with product quality, geographical contexts, temporal variability, machinery, functional units, ecosystem services and biodiversity
- consumer education that results in behavioral change
- missing supply chain phases such as food waste
- integration with "mixed methods explanatory approaches" used in food production studies
- accounting for accidents and disasters"

The same example included a Brazilian LCA conducted for coffee production to raise many of these same points. That coffee LCA is the same one employed by the EU to study a basket of commodities consumed by an EU resident in 1 year (Castellani et al, 2017). Anyone who drinks good coffee (i.e. arabica versus robusta), tries different varieties and brewing methods (i.e. Ethiopian drip, Guatemalan espresso), knows agriculture well (i.e. Brazil, itself, has several distinct coffee growing ecosystems), or worked in the field on conservation planning (i.e. where LCA is rarely used because of lack of local, reliable data and because it's been narrow-minded), realizes the extent of the potential problems around relying solely on LCA for SDG planning (at least at this stage of maturity).

Although the EU's development of Product Category Rules (PEFCR) and Organization Sector Rules (OEFSR) address many of the criticisms leveled at conventional LCA (i.e. predefined functional units, uniform category and sector level definitions for products and organizations), the pilots had to drop a coffee PEFCR because of lack of agreement on defining an end product

for coffee consumption (i.e. although different varieties and brewing techniques make end coffee product definition difficult, a pilot PEFCR for beer demonstrates how to deal with different types of end products –such as lagers, ales, and stouts).

Social Life Cycle Assessment (SLCA) for the Social, Human, Institutional, Cultural, and Economic, Capital Dimensions of SDG Planning. Nevertheless, the underlying mandate for PEF and OEF is sound, LCA has international scientific credibility, and the EU jumped in full-heartedly to tackle a fundamental conservation problem vexing every country. In relation to the SDG, FAO SAFA (2014) use the following statement to address the most glaring shortfall[s] of LCA, including OEF –the missing socioeconomic dimensions.

"SAFA is focused on supply chains and the evaluation of enterprise(s) in those supply chains. Other sustainability assessment programmes have a product focus and often use a life Cycle Analysis (LCA) approach which has an emphasis on the evaluation of the environmental impacts of a product through its lifecycle. SAFA covers many of the same elements of a product based LCA, such as an analysis of the inputs, outputs and environmental impacts; however the focus on an enterprise rather than a product enables a more comprehensive consideration of good governance and social well-being components of sustainability."

Hundreds of existing sustainability reporting, certification reporting, conservation planning, and adaptation planning, systems currently exist (Annex 2 in ECc, 2018) and most won't rely exclusively on the PEF or OEF approaches for planning or harmonized sustainability reporting. SAFA's identification of their missing socioeconomic, and SDG, dimensions, may explain a large part of their reasoning. Current examples include:

- The Business Roundtable (2019) changed the primary purpose of corporations from "exist[ing] primarily to serve shareholders" to "benefit[ting] all stakeholders -customers, employees, suppliers, communities, shareholders".
- Shinwell et al (2018) verify the increasing importance of Environmental, Social, and Good Governance (i.e. SDG) factors in investment and purchasing decisions (i.e. citing a 25% increase in responsible investments made between 2014 and 2016).

- OECD (2018) recently updated their Responsible Business Conduct and Due Diligence recommendations for enterprises so that companies "avoid and address adverse impacts related to workers, human rights, the environment, bribery, consumers and corporate governance that may be associated with their operations, supply chains and other business relationships.".

Given that OEF and PEF's purpose is to directly address the shortfalls of these exact hundreds of reporting systems, this reference identifies Social Life Cycle Assessment (SLCA) as the missing, and most practical, sibling LCA approach that has the potential to satisfy the sustainability reporting requirements of the "existing hundreds", the "international standards community", and the international SDG reality (**12***).

SPA2's Example 3B illustrates applying the UN's SLCA approach, Goedkoop et al (2018) demonstrate a private sector approach for Product Social Impact Assessments, and FAO's SAFA demonstrate a representative approach for Organization Social Impact Assessments. Di Noi et al. (2017) demonstrate how to include SLCA with environmental LCA software (i.e. openLCA). Examples 5 and 6 extend the SLCA approach with Stakeholder, or Social, Impact Assessments (SIAs). The 5 approaches complement one another and demonstrate that SLCA and SIA are technically feasible and practical for the purpose of developing international product and organization standards while being acceptable to a wide number of reporting systems. The following statement, cited in Example 3B, confirms that the European Commission recognized this several years ago, but did not yet have this type of evidence showing how to integrate SLCA with Environmental LCAs, such as PEFs and OEFs.

Environmental LCA does not address **social and economic elements** of the product life cycle. For an integrated sustainability assessment, the ILCD Handbook needs to be complemented by other instruments that capture social and economic aspects of the analysed systems. **Social LCA** (that includes Life Cycle Working Environment and some elements of Life Cycle Accident Assessment) and LCC are instruments that are closely related conceptually and can be fully coherent with the (environmental) LCA provisions of the ILCD Handbook. They can be integrated with the ILCD guidance on environmental LCA to develop guidance on complete life cycle-based sustainability assessment.

The coherent integration of complementary information and methods, combining the ILCD Handbook with authoritative guides from other domains, could lead to a comprehensive, systematic approach for performing efficient and fully **integrated environmental, economic and social life cycle-based sustainability assessments**.

Environmental LCA is structurally open to a stepwise **extension to a full sustainability assessment** that includes Life Cycle Costing (LCC) and social LCA. Social LCA covers aspects such as job creation, equal pay for women, etc. This integration is possible because the basis of any environmental LCA is the technical life cycle model of the analysed product, i.e. its complete supply chain, use and end-of-life treatment. In environmental LCA, the environmental information on resource use and emissions is related to each of the process steps of this technical life cycle model. In the same way, cost and social information can be related to these very same process steps. A limited number of such integrated studies have been carried out in research and industry since about 2000. An integrated, authoritative approach for such an integrated life cycle sustainability assessment still needs to be developed.

This reference strongly supports the EC's transition phase, but adds SLCA as a practical way to incorporate the SDG into the OEF and PEF uniform sustainability reporting goal. In technology terms, SLCA must be compatible with the UN's LCIA and SLCA advancements and EU's OEF and PEF standards (**12***), while being flexible enough to satisfy the SAFA and "existing hundreds" reporting systems. From a typically technologist viewpoint, that means the EU's formal LCA "algorithms", along with their storage databases, are supplemented with complementary algorithms (i.e. Examples 9 to 11; openLCA's SLCA components). Section D points out that final report harmonization will remain just as important as algorithm development.

Generic Socioeconomic Stakeholder Groups and Landscape Areas for SDG Planning. Example 5 in SPA3 used the following MathResults to illustrate conducting Stakeholder, or Social, Impact Assessment (SIA). The table verifies that Example 5 and 6's stakeholder groups were based upon demographic characteristics that included income, gender, and livelihood.

Landscape areas were based upon geographical characteristics that included elevation, cropping pattern, tenure, and land productivity.

label	ocatio	risks_and_impacts	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11
A	0	Farmer Characteristics	hhincome	gender	age	ethnicity	disability	education	experience	hhsize	hhwealth	hhfood index	poverty index
B	0	Farm Characteristics	tenure	management	size	sublocation	total gross revenue	coffee gross revenue	access to services	trading relationship	farm productivity	visual soil assessment	standard precipitation
A1A	**1**	**Small scale coffee farmers male low income**	5500	male	45	hispanic	none	4	10	5	3500	3.5	5
IF1A	1	Non Harassment and Discrimination Index	75	Percent Workers at	37.5	135	lower and upper 80% CI	2	3.00	normal	HCA	production	1/1/2018
IF1B	1	Air Pollution Index	80	daly / kg PM25	60	150.00	Lower and upper	2	3.00	normal	EDE	production	1/1/2018
IF1C	1	Water Consumption Index	60	daly / m3	40	75.00	lower and upper 80% CI	2	3.00	normal	EDF	production	1/1/2018
IF1D	1	Damage Risk Reduction Index	60	daly / extreme	40	75.00	lower and upper 80% CI	2	3.00	normal	PCB	production	1/1/2018
B1A	**1**	**Small scale farms 1000-3000 m slopes <20% 60 SQI**	owned	moderate	2.5	25	5000.00	3000	3.5	5	4	3.5	5
IF2A	1	Biodiversity Index	45	amd	25	65.00	lower and upper 80% CI	2	3.00	normal	EDG	production	1/1/2018
IF2B	1	Climate Change Short Term Index	45	gwp 100	25	65.00	lower and upper 80% CI	2	3.00	normal	ECB	production	1/1/2018
IF2C	1	Climate Change Long Term Index	45	gtp 100	25	65.00	lower and upper 80% CI	2	3.00	normal	ECC	production	1/1/2018
A2A	**1**	**Small scale coffee farmers female low income**	4500	female	45	hispanic	none	4	10	5	3500	3.5	5
IF1A	1	Non Harassment and Discrimination Index	75	Percent Workers at	37.5	135	lower and upper 80% CI	2	3.00	normal	HCA	production	1/1/2018
IF1B	1	Air Pollution Index	80	daly / kg PM25	60	150.00	Lower and upper	2	3.00	normal	EDE	production	1/1/2018
IF1C	1	Water Consumption Index	60	daly / m3	40	75.00	lower and upper 80% CI	2	3.00	normal	EDF	production	1/1/2018
IF1D	1	Damage Risk Reduction Index	60	daly / extreme	40	75.00	lower and upper 80% CI	2	3.00	normal	PCB	production	1/1/2018
B2A	**1**	**Small scale farms high elevation moderate slopes**	owned	moderate	2.5	25	5000.00	3000	3.5	5	4	3.5	5

The stakeholder groups displayed in the full table serve the same purpose as the stakeholder categories used to conduct SLCAs –they document SDG impacts on specific socioeconomic groups, preferably based on households. The question arises whether uniform socioeconomic groups and landscape areas can be identified that can support the uniform SDG reporting required by SDG Plans. For example, Goedkoop et al (2018) identify relevant stakeholders as workers, local communities, small-scale entrepreneurs and users. Example 3B confirms that the UN identifies stakeholders as workers, consumers, local communities, society, and value chain actors. The Business Roundtable (2019) identifies stakeholders as customers, employees, suppliers, communities, and shareholders. Example 4B confirmed that the health care sector bases CEA on a Health Care Perspective, a Societal Perspective, and a Payer Perspective (i.e. industry, community, and consumer groups).

This reference suggests that local SDG planning must have a great deal of flexibility in identifying targeted stakeholders –the stakeholders targeted in watershed A may be completely

different than the stakeholders needing to be targeted in watershed B. The stakeholders most affected by SDG Target 1 may be completely different than the stakeholders most impacted by SDG Target 6. For example, the rural stakeholders identified by the following statement from Example 5 in SPA3, may have a completely different set of concerns and constraints from the urban residents in a neighboring watershed.

"IITA and COSA (2016) provide an example for coffee production that show how the poorest stakeholders have significantly lower adoption rates for sustainable practices, with related causal factors, than the richest."

The generic nature of the goals introduced in this reference for SDG planning, such as increasing the quality of life for households, suggest the need for generic socioeconomic groups. Uniform sustainability reporting dictates that the groups can't be tied to a specific stakeholder characteristic –such as age, employee status, income, or gender. This reference replaces the income-based and land use groups shown in the previous table with the following generic socioeconomic groups and landscape areas.

Socioeconomic Stakeholder Groups	**Landscape Groups**
Highly Impacted Stakeholders	Highly Impacted Areas
Moderately Impacted Stakeholders	Moderately Impacted Areas
Minimally, or Not, Impacted Stakeholders	Minimally, or Not, Impacted Areas

These impact categories derive from the final SDG scores generated by SDG Plans. Three thresholds must be identified to distinguish high, medium, and low, scores (i.e. similar to the thresholds introduced in Appendix A and Example 1 and those used by the international reports introduced in Section D). In effect, the stakeholders and areas are tied directly to the SDG targets

–highly impoverished or badly malnourished stakeholders, as identified by scoring thresholds, become “highly impacted stakeholders”.

The underlying demographics (i.e. age, race, gender, income, education, stakeholder classification, and disability) and landscape characteristics (i.e. refer to FAO, 2017a, 2017b, and 2017c for examples) are collected through either National Statistical Office, or SDG-related, household surveys and social media platform techniques. The latter data supports SDG planning interventions, or M&A Actions, that can address the specific socioeconomic and landscape characteristics associated with the most impacted stakeholders (i.e. as demonstrated in SPA3). In practice, many SDG Goals, such as No Poverty or Gender Equality, will, in fact, be based on single, or a minimal number of, characteristics, such as a Poverty Index or a Gender Type.

The SPA3 reference verifies that numerous population and LCA-like algorithms can be used to generate this type of SLCA/SIA data, so this reference makes no assumptions about how the latter data is derived (i.e. such as being collected by National Statistical Offices, custom surveys, expert consensus, or teams of sustainability workers).

Stakeholder BMP-based Operating and Capital Budgets (Social Budgeting) for SDG Planning. Section B explained that SDG achievements must be based on short and long term quality of life measurements for impacted stakeholders and landscapes. In the context of social budgeting, appropriate instruments for measuring these changes include short term operating budgets that measure stock flows (2019 stock additions such as increases in GHG, or depletions such as soil erosion), and long term capital budgets that measure changes to the stock inventories (2019 to 2030 total GHG in atmosphere, overall soil quality). Unlike formal financial accounting, where short term changes in income can be translated directly into long term changes in wealth, the actual M&A Actions documented in operating and capital budgets serve as proxy “stock flow” and “stock inventory” measurements for the 2 budgets.

Antonopoulos et al (2016) demonstrate how best management practices (BEMPs) can be developed based on LCA approaches (i.e. by using the PEF or OEF data as background evidence for the environmental dimension). SAFA (2014) further demonstrates how BMPs are often used

as proxy outcome measurements for documenting fuller SDG effects and interactions (i.e. by using SLCA data as background evidence for the social and economic dimensions). The 2 authors verify that these types of operating flow and capital stock relationships often rely upon expert judgement derived from BMP-like proxy measurements summarized in the following statement.

"What is the amount of a sustainable stock inventory for a specific community, organization, or product? What is the corresponding sustainable stock flow measurement that changes the inventories, or that adds value to the quality of life of targeted stakeholders, as new or improved M&A Actions are taken?"

The examples in this reference further employ this BMP-based approach for SDG planning by including an Example 4 Life Cycle Budget to document the BMPs (i.e. M&A Actions) and an Example 5-style capital stock budget to document the SDG impacts. These budgets rely on expert knowledge to define the level of sustainable stock, as illustrated in the Indicator thresholds systems introduced in Example 1, and in the following threshold table.

Stock Inventory Thresholds (2019 to 2030)	**Stock Flow Thresholds (2019)**
Highly Sustainable Stocks	Highly Sustainable Flows
Moderately Sustainable Stocks	Moderately Sustainable Flows
Minimally, or Not, Sustainable Stocks	Minimally, or Not, Sustainable Flows

Scientists and RCA Technologists collect the background BMP evidence by using algorithms that link the 2 budgets, similar to the linkages in the following BMP-based Proxy Evidence table, to document the interactions between M&A Action, SDG target accomplishment, and stakeholder quality of life.

Planning Part 7. SDG Plan BMP-based Background Proxy Evidence

SDG. 13. Climate Change. Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in this local community (i.e. Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population) **SDG Target 13.1** Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries						
SDG Indicator. Id: 1**; Name:** Climate Change 1**. Units** GWP 100						
Stock Inventory. Climate Change **(**Total GHG in Atmosphere)			**Stock Flow.** Climate Change **(**Contribution to GHG in Atmosphere)			
SDG Best Practice 1. Wind energy**.** • Install 4,500 wind turbines that will meet 25% of local energy demand (changes SDG inventory ratings) • Provide sufficient consumer incentives to result in 20% switch over (changes SDG flow ratings) • Provide sufficient company incentives to result in 30% switch over (changes SDG flow ratings)						
Stakeholder Participatory Practices 1: Participatory SDG Budgeting (i.e. social budgeting)						
M&A Action Id	Indicator (Inventory and Flow) Id	Stock Inventory Rating	Stock Flow Rating	Certainty 1 (Feasibility Rating)	Certainty 2 (Quality Rating)	Score
Highly Impact Stakeholders						
x	x	x	x	x	x	x

Sustainability workers and RCA Assessors then use this background evidence in simpler operating and capital budget-like rating systems as an SDG accounting system that be used to understand the approximate linkages between M&A Actions, SDG impacts, and stakeholder/landscape groups, to serve as an M&E system that verifies progress in achieving SDG targets, and to support uniform scoring, reporting, and decision support.

Institutional Failure. OECD (2018) warns that many existing conservation programs, especially those targeting the agriculture sector, fail to even consider these basic thresholds when compensating growers for BEMPs. Instead, all growers, including those in minimally impacted areas, or where stocks and flows are already highly sustainable, or who can easily afford to pay for the BEMPs themselves, receive the same incentive as everyone else. Appendix C and Example 12 further confirm that many existing sustainability accounting systems fail to fully account for their actual ecosystem and community capital "context". The accounting systems end up being more useful for public relations rather than actual ecosystem and stakeholder improvement. Additional institutional failures arise when countries roll back environmental, community safety, and human rights, requirements so that special interests and authoritarian governments can profit at the expense of the community. Recent tutorials in DevTreks refer to this as "institutional failure" on the part of governments, and recommend consequential digital activism to overcome the failures (i.e. figure out what the transgressors peddle and get them out of the shopping basket).

Standardized Sustainability Scores for SDG Plan Capital Budgeting and Reporting. Section B and D introduced 3 international sustainability scoring systems (SDG Index, Inform, EU QOL) that use proxy Indicators to make uniform sustainability scores for individual countries. These scoring systems greatly abstract the SDG Planning elements and fundamental stock and flow measurements introduced in this reference. In large part, they assume that planning and implementation happened behind the scenes and resulted in the observed proxy indicator measurements. Section A warned that when the proxy measurements are abstracted too greatly from concrete households, the households are less likely to understand and support SDG Planning. Although this section introduces the EU QOL scoring system for uniform scoring

purposes, the more comprehensive SDG Planning context introduced throughout this reference must first be carried out before those proxy scores can be used.

The OECD (2017) uses a "standardized difference" approach, or modified z-score, to measure the "distance" between SDG targets and SDG actuals. The algorithms used in this reference introduce a new normalization option, "modz", that employs the same approach to normalize and aggregate the Indicators used in the capital budget, or stock inventories. This approach requires standard deviation statistics derived from all of the SDG Plans included in the landscape reports (i.e. this references uses communities within landscapes and products and organizations within industries, rather than the OECD countries). The authors provide the following example of the scoring.

"[SDG Target 5.5], women's full and effective participation in leadership, is measured through the share of seats in national parliaments held by women. The level to be achieved by 2030 is 50%, as the target is full gender equality. The standard deviation of the shares currently observed among OECD country scores is ~10 percentage points. Denmark's share of seats held by women is 37%. So its standardised score on this indicator is the difference between its current share (37%) and the target (50%), divided by the standard deviation (10%) = 13/10 = 1.3 units"

The units of measurement for the final score in this example, 1.3, is the number of standard deviations by which a country (or community, or product, or organization) needs to improve in order to reach the target. Scores of zero or below mean that countries have met the target, while scores greater than zero mean that countries have not met the target. Those scores can then be converted to a scale more appropriate for final reporting to stakeholders (i.e. A to E where A is best).

Example 9 illustrates using this normalization pattern for each SDG Indicator, rather than OECD's normalization of SDG Targets. Indicators are further aggregated into SDG targets, goals, and the total score. The aggregated scores are interpreted as the number of standard deviations across all indicators that either need further M&A Actions (i.e. positive amounts) or whose M&A Actions are succeeding (i.e. negative numbers). Although Indicators with large

negative quantities will distort their non-performing siblings in their aggregated Targets, the raw data readily identifies which Indicators have M&A Actions that have too little, or too much, investment. Analysts must critically assess whether such scoring will support their investment decisions (i.e. the high and low ranges don't factor into the aggregation decision; Example 10 illustrates using regular normalization options, such as minmax and z-score).

Standardized QALYs, DALYs, QASYs (or MCDAs) for SDG Impact Valuations and ICERs. OECD (2017) use the following statement to introduce the relationship between their Quality of Life (QOL) Rating System and the SDG.

"The OECD well-being framework focuses on people rather than the economic system; it includes both objective aspects observable by third parties and subjective states known only to individuals, and it concentrates on outcomes (e.g. health status) rather than inputs (e.g. health-care spending) or outputs (e.g. the quality and quantity of surgery). The framework also takes account of inequalities within each dimension, reflecting the idea that community and societal welfare reflects both average outcomes and how they are distributed across people with different characteristics. Finally, the framework recognizes the importance for well-being outcomes to be sustainable over time. This requires preserving different types of capital whose benefits will accrue over time but that are affected by decisions taken today. The focus on these resources is in line with the recommendations of Stiglitz et al. (2009) and other measurement initiatives that distinguish between well-being "here and now" and the stocks of resources that affect the well-being of generations coming "later" (UN, 2014)."

Most tutorials in DevTreks emphasize the importance of fully documenting these types of Outcomes and Outputs in all social budgeting approaches. Example 4B documented the importance of basing Outcome valuations on standardized quality of life scoring systems, such as Quality Adjusted Life Years (QALYs) and Disability Adjusted Life Years (DALYs). Example 4A and 4B used the following image (Kim et al, 2016) to verify that the health care sector in many countries is using that approach for uniform decision making based upon this table's Cost Effectiveness Analysis (CEA) and Incremental Cost Effectiveness Analysis Ratios (ICERs).

Table 15.5. Reference Case Cost-Effectiveness Results (Time Horizon: Lifetime; Costs and Health Effects Discounted at 3%)

Alternative	Total Costs[Ω] Mean (SE)	Total QALYs Mean (SE)	Incremental Cost[†]	Incremental Effectiveness[†] (QALYs)	NMB* Mean (SE)	Incremental NMB[†]	ICER[†] (Incr. Cost / Incr. QALY)
HEALTHCARE SECTOR PERSPECTIVE							
MM + Naltrexone	$250,745 (6,191)	15.01 (0.64)	-	-	$1,250,239 (66,599)	-	-
MM + Acamprosate	$251,817 (6,246)	14.97 (0.65)	$1,072	-0.04	$1,244,704 (65,876)	-$5,535	Dominated[‡]
MM + Naltrexone + Acamprosate	$252,802 (6,335)	14.93 (0.65)	$985	-0.04	$1,240,052 (64,972)	-$4,652	Dominated[‡]
MM Only	$252,938 (6,246)	14.91 (0.66)	$136	-0.02	$1,238,119 (66,963)	-$1,933	Dominated[‡]
CBI Only	$254,085 (6,380)	14.89 (0.67)	$1,147	-0.02	$1,234,822 (68,308)	-$3,297	Dominated[‡]
SOCIETAL PERSPECTIVE							
MM + Naltrexone	-$55,195 (20,181)	15.01 (0.64)	-	-	$1,556,178 (68,324)	-	-
MM + Acamprosate	-$54,213 (20,382)	14.97 (0.65)	$982	-0.04	$1,550,734 (69,208)	-$5,444	Dominated[‡]
MM + Naltrexone + Acamprosate	-$53,379 (20,564)	14.93 (0.65)	$834	-0.04	$1,546,233 (69,984)	-$4,501	Dominated[‡]
MM Only	-$53,373 (20,747)	14.91 (0.66)	$6	-0.02	$1,544,430 (70,410)	-$1,803	Dominated[‡]
CBI Only	-$52,219 (20,956)	14.89 (0.67)	$1,164	-0.02	$1,541,126 (71,617)	-$3,304	Dominated[‡]

Example 4B introduced Quality Adjusted Stock Years (QASYs) as a more comprehensive, multi-sector, multi-capital, quality of life, metric. The example also explained the relationship between Multi-criteria Decision Assessment (MCDA) and QASYs. One of the example's footnotes explained that the health care sector appeared to be "leaning towards" accepting MCDA approaches as an alternative, or at least supplement, to QALYs or DALYs. Given the importance that DevTreks places on better Outcome measurement as a basis for making better decisions, this algorithm uses the capital budget's MCDA system as a QASY-like Outcome measurement that can then be used to produce ICERs.

Version 2.2.0 added Example 12 to demonstrate the importance of using "integrated valuation" approaches, including new sustainability accounting platforms, mixed method assessments, QASY-like measurements such as Subjective Well Being scores, "true prices" or social costs, and participatory stakeholder approaches, to value the impacts associated with changes to the community capital stocks.

Monitoring and Evaluation of SDG Plans. The 3 examples use the following basic approaches for the purpose of monitoring and evaluating SDG Plans. Their most practical, applied, use may be to support Section F's average product and organization scores (Lupiáñez-Villanueva et al, 2018) and Footnote 13's uniform, objective, internationally standardized, sustainability scores.

Indicators 1 to 15. Transition States. Benchmarks, Targets, and Actuals for Performance Monitoring. 2019 to 2030.

Capital Budget SDG Ratings. Each transition state indicator employs a partial, or nexus, capital budget that includes a starting benchmark score that establishes the beginning state of nexus SDG priorities, 2 target scores that document current period and full period goal aspirations, and an actual score that verifies ending SDG achievement.

Operating Budget M&A Actions. Each transition state indicator employs a partial, or nexus, operating budget to document the specific M&A Actions that generate changes, or BMP-based proxy flows, to the capital budget's stock inventories.

Community Capital to Operating Budget SDG Plan Linkages. Community SDG Plan algorithms support linkages that are similar to the Proxy Evidence table introduced in the previous section.

Product and Organization SDG Plans. Product and Organization SDG Plans use simpler rating systems based upon background evidence (i.e. the Proxy Evidence table, PEFs, OEFs, SLCAs, and SIAs). For example, most cities hire workers to complete food safety ratings for local restaurants. The workers base their safety ratings on best practices derived from scientific background evidence, but don't directly collect the evidence themselves. Sustainability workers use similar rating systems to complete environmental, social, and good governance, or SDG ratings, for products and organizations within industries and communities.

The following image (USHHS, 2018) confirms that food sustainability workers rely on secondary sources of information when complying with food safety requirements (i.e. the

Malnutrition tutorial demonstrates how food nutritionists develop this type of background evidence).

7.2. Am I required to conduct laboratory analysis to determine the nutritional content of my standard menu items? If not, what are examples of a "reasonable basis" to determine the nutritional content of my standard menu items?

Answer: No. You are not required to conduct laboratory analysis to determine the nutritional content of your standard menu items. While laboratory analysis of standard menu items would be considered a reasonable basis for determining calorie and other nutrient information for your standard menu items, this is not the only reasonable basis permitted. You may use any one of a number of means to arrive at these values, including:

- Calculations based on nutrient databases such as the USDA National Nutrient Database for Standard Reference (http://ndb.nal.usda.gov/ndb/foods), or valid and appropriate trade association or industry databases (with or without computer software programs);
- Calculations based on the Alcohol and Tobacco Tax and Trade Bureau's (TTB's) methods for determining values for the voluntary Statements of Average Analysis and voluntary Serving Facts statements;
- Values listed in a cookbook;
- Laboratory analysis of your menu items; or
- Other reasonable means such as:
    - Use of Nutrition Facts on the labels of packaged foods that comply with the nutrition labeling requirements of section 403(q)(1) of the FD&C Act and 21 CFR 101.9;
    - FDA's nutrient values for raw fruits and vegetables (Appendix C of 21 CFR part 101; or
    - FDA's nutrient values for cooked fish (Appendix D of 21 CFR part 101).

For this reference, sustainability questions and answers are modified as follows:

"Am I required to conduct Life Cycle Analysis (LCA) to determine the sustainability of the products and services I sell? If not, what are examples of a "reasonable basis" to determine the sustainability of my products and services?

"No. You are not required to conduct LCA-based analysis to determine the sustainability of your standard products and services. […] You may use the following types of background sustainability evidence completed in your community, similar communities, in your industry or country, or by international organizations, for that purpose:

a) Community M&A Action Feasibility Assessments,

b) Community SDG Plans,

c) Certified Product Category, Product, Organization Sector, Organization, and Basket of Products, SDG Plans

d) Certified PEFs and OEFs,

e) Industrial Sectors

Agriculture

European Commission. Best environmental management practices for the agriculture sector - crop and animal production.

…

Food

USHHS Guidance for Labeling.

f) Certified SDG Standard Setters

ISEAL certified; M&E of the certifications conducted by international organizations; uniform sustainability scoring across certification systems

g) Certified Social Sustainability Scores

Certified scoring systems developed by sustainability networks and clubs using social sustainability media platforms

Score. Full Impact Evaluation. 2019 to 2030. The final Score evaluates the degree to which the final SDG impacts achieved their targeted scores. A combination of Indicator 1's benchmarks, along with some plausible assumptions about technological changes in the 2019 to 2030 period,

can supply an imperfect proxy measurement for the counterfactual identified in Example 8 as necessary for carrying out a full Impact Evaluation. Example 8 explained that a complete counterfactual has to be based on stakeholders who did not participate in SDG Planning but who are equivalent to the participant stakeholders (i.e. if they survive). Example 7 begins to demonstrate how Machine Learning algorithms can be used to conduct the full Impact Evaluations.

The operating budgets help sustainability workers to understand technological changes and improvements that will be needed for many M&A Actions. For example, IPCC (2018) document how the unit costs for climate change practices, such as solar panels, have dropped in recent years, leading to more widespread adoption. IPCC (2018) also documents how many climate change mitigation and adaptation technologies remain immature or have not yet been invented.

SPA3 demonstrates how the capital budget's related socioeconomic data can be used to more fully document the actual impact pathways and impact transition states that lead to final SDG accomplishment for impacted stakeholders.

This reference dodges some of the serious issues associated with ICERs, such as the identification of the dollar thresholds, as possibly being beyond the scope for a small NGO to fully address. This reference recommends using the health care industry's thresholds (i.e. WHO) as reasonable approximations for quality of life measurements. This algorithm's use of QASYs in the ICERs is also a prerogative of a small NGO (i.e. although the author believes a similar metric should be a requirement for any SDG Plan –refer to Appendix C's Subjective Well Being Assessments).

Harmonization of Custom Reports to Uniform SDG Reports: Example 10 confirms that existing certification standard setters who continue using their own standards must develop custom algorithms, or manual means, to convert their standards to the SDG standards used in uniform landscape and industry reports.

Stories and Stakeholder Engagement. Mixed methods qualitative techniques, such as case studies, multimedia story-telling (i.e. podcasts), informant interviews, and community outreach,

help targeted stakeholder and local household groups take ownership of the SDG Plans. Appendix A and B demonstrates supplementing direct M&A Actions with complementary Stakeholder Participatory Actions, such as Participatory, or Social, Budgeting. Stakeholder participation is the single greatest need identified in this reference for SDG planning.

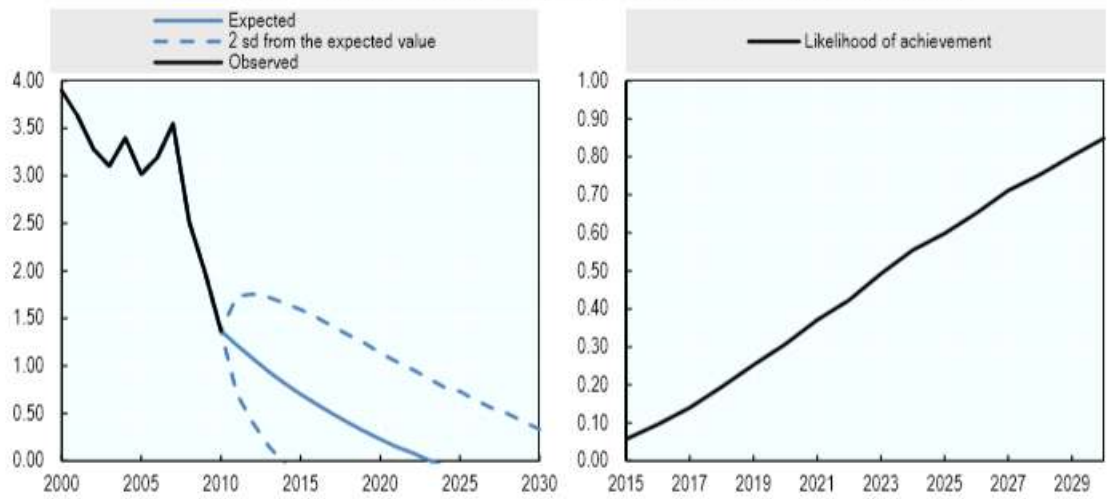
Aggregate datasets for Machine Learning: The single sustainability scores generated from an SDG Plan can be improved over time by using the SDG datasets to train Machine Learning algorithms. Planners judge the strength of the BMP in effecting, or causing, the SDGs by allocating the SDG measurement to a corresponding M&A Action in the budget. The basic idea is to train Machine Learning algorithms with the actual and allocated, SDG impacts that get added to the capital budget's initial, targeted and allocated, SDG impacts and the actual costs documented in the operating budget (i.e. the operating budget is finalized at the time of the Actual SDG measurements).

Oftentimes, the initial socioeconomic and landscape properties, and full impact pathways, used to generate the SLCA/SIA will be added to the data for this purpose. This helps to address the "complexity problem" explained in Section B. A subset of the scoring results, or "actual" SDG impacts, which get recorded over the multi-year planning horizon, will be used to predict scoring trends and ratings associated with new scenarios and socioeconomic pathways.

For initial planning purposes, OECD (2017) use the following graph to illustrate using more advanced algorithms to make future predictions for future transition states, such as 2030. A future version will include a new reference**,** Machine Learning for SDG Planning.

45. The Study so far has been 'static', focusing on distances to travel rather than on rates of improvement. However, using past trends to project possible future performance could provide a key complement to assessing the starting positions, and also inform priority setting. For instance, if a country is very close to reaching a given target today, but has been slowing down or even reversing earlier progress, then in a few years it may lose its relative strength in that target and need to take action to achieve it. Dynamic assessments can also suggest the degree of effort required to meet a target, and how this varies across targets: where there is a long distance to travel, but recent progress has been rapid, it may be easier to close the gap than where the initial distance is short but recent progress has been slow or negative. The Study has therefore also been exploring Monte Carlo simulations for a selection of indicators where sufficient data on past performance is available. By way of example, Figure 10 shows observed and predicted fatal traffic accidents in Slovenia. The target is to reduce such deaths by half by 2020. The Monte Carlo simulations indicate that, based on past trends, there is only about a 30% chance of this being achieved by the deadline, though it is much more likely to be achieved by 2030 (right panel).

Figure 10. Observed and predicted fatal traffic accidents - Slovenia



Note: Left panel: Slovenian traffic accidents in standard deviation units, with zero representing the 2030 target level. Black line shows actual data to 2010. Blue lines show projected values to 2030, the solid line representing the most likely path based on past performance, and the dotted lines the 95% confidence interval, based on Monte-Carlo simulations. Right panel: The probability of achieving the 2030 targeted reduction of Slovenian traffic accidents in each year from 2015 to 2030, based on the Monte Carlo simulations, from zero (impossibility) to 1 (certainty).

Full SDG Plans (i.e. SDG Policy Plans). The following images (CDC, 2012) demonstrate the ingredients of full SDG Plans that serve as the metadata plan, and policy context, for collection of the raw data. These full plans make it clear that the technical skills needed to complete the raw datasets are within the existing skills sets of many professional sustainability workers –many of whom have worked on various social planning teams throughout their careers. The underlying references also include templates for developing training programs that can increase the SDG planning skills of sustainability workers. The OECD's (2017) Better Life Initiative demonstrate

how to use a subset of SDG Plan indicators to allow stakeholders to assess their own well-being (i.e. the sustainability of their lifestyle) and begin to participate in SDG planning.

Example of a Community Action Plan with SMART Objectives

Project Period Objective	**Description of the Objective**	**Priority Area**
By Year 3, increase the percent of total miles of physical infrastructure for walking by 30%.	Very few neighborhoods and community common areas have sidewalks, trails, or walking paths that can support residents' need for active transportation to school and work and the ability to be physically active within the majority of the community.	Obesity and Physical Inactivity
Annual Objective	**Description of the Objective**	**Sector**
At the end of 12 months, increase percent of developments (e.g., housing, schools and commercial) with paved sidewalks to 100%.	Current sidewalk ordinance does not require sidewalks to be paved for new housing developments with less than 120 homes; schools and commercial developments can receive a waiver if building in rural areas (designated by certain zip codes). Ordinance must be evaluated, revised, and approved to exclude such exceptions and begin developing stronger sidewalk networks.	Community-At-Large
		Number of People Reached
		167,000
Activities	**Activity Title**	**Description**
	Gap analysis on existing ordinance	Review sidewalk ordinance for policy language and language gaps
	Meeting with county architecture board	Meet with county architecture board about sidewalk development and share draft of revised ordinance language for new developments
	City council meeting	Attend city council meeting to inquire about stance on sidewalks for future developments and current budget for developing sidewalk network
	Town hall meetings	Hold town hall meetings with neighborhood home owners associations to build local support for revised ordinance

Centers for Disease Control and Prevention. Community Health Assessment and Group Evaluation (CHANGE) Action Guide: Build-

Sustainability Planning Guide

Sustainability Goal #1:	[e.g. service sustained; income diversification; amount to be raised; in-kind support; organizational infrastructure strengthened; partnership established; training delivered; etc.]
Sustainability Method(s):	[Method(s) used to achieve sustainability goal]

Primary Activity	Secondary Activities / Deliverables	Alignment with OAH Factors for Program Sustainability	Person/Group Responsible	Timeline	Resources and/or individual T/A Needed	Progress Update
1.	a.					
	b.					
	c.					
2.	a.					
	b.					
	c.					

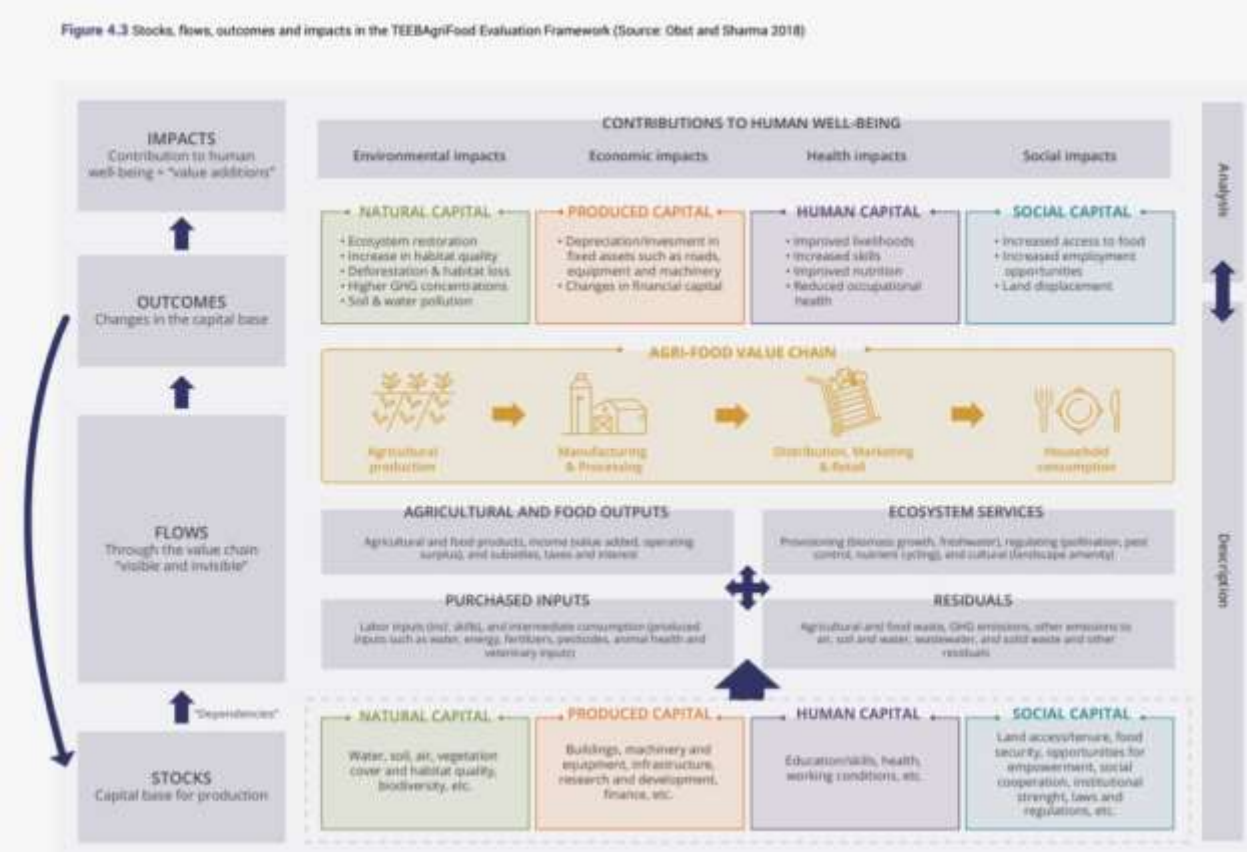
4

This Sustainability Planning Guide was adapted by the Office of Adolescent Health from the TPP LEAD Collaborative and the University of Massachusetts Donahue Institute.

Additional Algorithms. As with the PEF and OEF background evidence, sustainability accounting teams can still develop additional algorithms that focus on understanding more comprehensive SDG linkages. Specifically, to understand the effects of the operating budget's M&A Actions on all of the capital budget's SDG ratings. Although the author has worked on interdisciplinary planning teams that used the latter approach extensively for conservation planning, evidence for these more comprehensive interactions, or "conservation effects", is scarce at local scale (and hard for field sustainability workers to employ). In fact, the author unsuccessfully tried simpler alternatives to the linkages employed in Example 9 because past experience has found this approach subjective and overly dependent on the experts in the planning room. The most commonly applied alternative, or "winging it", also proved unsatisfactory (hence these Examples). A future version will explore the emerging digital alternative, Machine Learning, as a potential solution.

Appendix C. Social Sustainability Accounting for General Sustainability Assessments

TEEB (2018) use the following image to explain their framework for improving household quality of life through the balanced management of community capital stocks. This Appendix explains similarities and differences between this framework (TEEB) and the RCA Framework.



SPA1 introduced the following conceptual framework (IPBES, 2019) to explain why the Natural Capital stock acts as an encompassing community capital stock for the Produced Capital, Human Capital, and Social Capital, stocks (i.e. anthropocentric assets). IPCC (2018) and UNEP (2018, 2019) confirm that the global heating crisis requires the Natural Capital stock to encompass the full community capital stocks. The majority of the references used in this tutorial warn that "as the planet goes, so goes everything else".

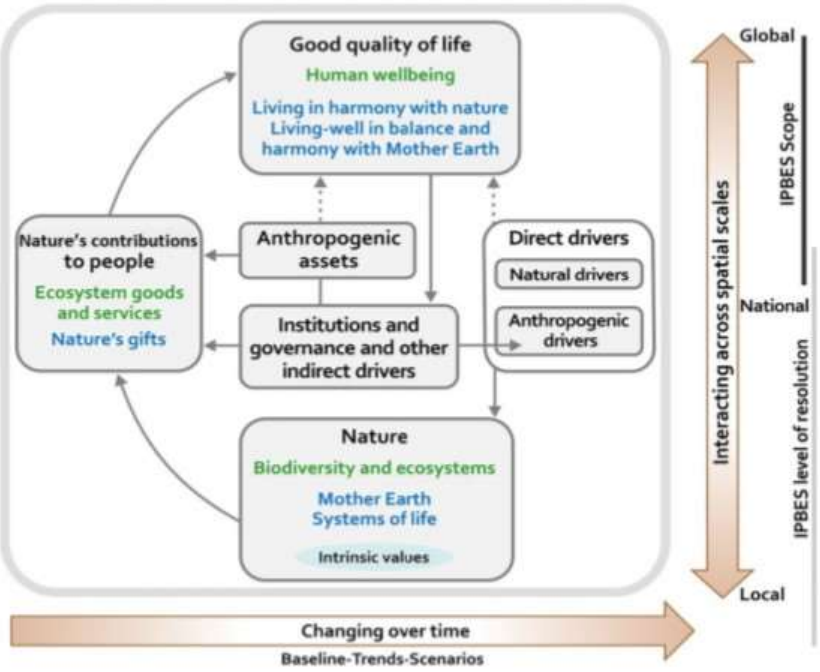


Figure X. **The IPBES Conceptual Framework is a highly simplified model of the complex interactions between the natural world and human societies.** The model identifies the main elements (boxes within the main panel delimited in grey), together with their interactions (arrows within the main panel), that are most relevant to the Platform's goal. "Nature", "nature's contributions to people" and "good quality of life" (indicated as black headlines and defined in the box) are inclusive categories that were identified as meaningful and relevant to all stakeholders involved in IPBES during a participatory process, including various disciplines of the natural and social sciences and the humanities, as well of other knowledge systems, such as those of indigenous peoples and local communities. Text in green denotes the concepts of science; and text in blue denotes those of other knowledge systems. . Solid arrows in the main panel denote influence between elements; dotted arrows denote links that are acknowledged as important, but are not the main focus of the Platform. The thick coloured arrows below and to the right of the central panel indicate different scales of time and space, respectively. This conceptual framework was accepted by the Plenary in decision IPBES/2/4 and the Plenary took note of an update presented in IPBES/INF/24 in decision IPBES/5/1. Further details and examples of the concepts defined in the box can be found in the Glossary and in Chapter 1

Decision Support Planning Context

This reference introduces an overall planning process used with these accounting frameworks to help decision makers make better sustainability choices. Several ingredients in the planning process help to further clarify differences between the 2 frameworks. Example 12 explains that sustainability assessments that fail to fully address their full decision support and community

capital contexts end up being more useful for public relations rather than actual production and consumption choices (i.e. fossil fuel companies use Example 12's GRI system).

Researchers vs. Applied Practitioners. The TEEB framework targets researchers, economists, and national policy makers who have the time and resources to carefully carry out their studies. They often employ the framework to study, at depth, single purpose policies, such as national requirements for conducting Cost Benefit Analysis to study environmental issues. Their time-intensive, expertise laden, custom work, often targets academic publications and single purpose national policies. They may employ national data, including population surveys and formal LCI databases, to monitor and evaluate the effectiveness of their recommended policies.

The RCA Framework targets applied practitioners charged with community and industry planning. They often apply the framework to develop sustainability plans that local communities, consumers, and producers can use for local decision making. Their studies are used as SDG Plans and Guidance Documents that applied sustainability workers can use to carry out best practice M&A Actions. They employ local community and company data, including accounting records, budgets, and local surveys, to monitor and evaluate the effectiveness of their recommended practices.

Systems Assessment Research versus Sustainability Management Systems. TEEB focuses on the unique characteristics of the agricultural and food sector and requires "eco-agri-food systems complex" management. The RCA Framework accommodates any industrial, community, or household, context, and uses background scientific evidence, including systems assessment research, for the following types of applied sustainability management purposes.

> **Sustainability Management**. Sustainability workers employ SPA3's Social Impact Assessments and Environmental and Social Management Systems, or Meinshausen et al's (2019) Internal Control Systems and Internal Management Systems, for running their sustainability organization. For example, Loew et al (2019) use the following table to list 20 core ingredients that they've identified for managing social sustainability business departments. Although their studies focused on actual business management practices

(i.e. the majority of companies participating in their study had more than 5000 employees), similar sustainability management gets applied by sustainability workers in support of all businesses, communities, and households.

Table 2: The 20 most relevant elements for a sustainability management system

Area	The 20 most relevant elements for a sustainability management system
Policies and rules	Policy (f,e) Code of conduct (e)
Organisational structure	Responsibilities within executive board (f,e) Responsibilities within senior management (f,e) Sustainability officer (f,e) Sustainability department (e)
Processes	Integration in business processes (f,e) Systems to ensure compliance (f,e)
Continuous improvement	Goals and measures (progress tracking) (f,e) Monitoring / performance evaluation with sustainability indicators (f,e) Management of ESG risks (f,e) Grievance mechanisms (f) Training (f)
Communication	Sustainability reporting (f,e) Leadership and commitment (e) Internal communication (f) Stakeholder dialogue (e) Stakeholder engagement (f)
Preparatory tasks	Determining the relevant aspects (f,e) Determining the scope of the management system (e)
(f) top 15 in frameworks (e) top 15 according to experts	

For experts, the management elements identified might not be particularly surprising as they know that management systems consist of an interaction between policies, responsibilities, processes and

Similarly, the USCDC (2012) used the following Table of Contents to explain how sustainability management systems can be built to support “Healthy [or Sustainable] Communities Initiatives”.

Sustainability Management Performance Measures. The RCA Framework introduced in SPA1 recommended presenting sustainability accounting measurements in terms of performance measurements that help consumers to make better consumption choices and producers make better production choices. The following image (EMAS, 2017) show some of the types of performance metrics associated with sustainable business accounting systems. These measurements help managers adjust their management activities based on

the links between the Indicators' environmental and social metrics and actual household, company, or community, business management metrics.

EMISSIONS

Emission Indicators			unit	2016	2017	2018	2019
total amount of greenhouse gases	/	Number of employees	[kg CO_{2eq}/FTE year]				
total amount of greenhouse gases	/	Work hours (1.1. to 31.12.)	[kg CO_{2eq}/h]				
total amount of greenhouse gases	/	heated surface	[t/m^2]				
total amount of greenhouse gases	/	Production volume (quantity)	[kg CO_{2eq}/piece]				
total amount of greenhouse gases	/	Production volume (weight)	[kg CO_{2eq}/t]				
total amount of greenhouse gases	/	Turnover	[kg CO_{2eq}/MEUR]				
total amount of greenhouse gases	/	number of overnights (hotels)	[kg CO_{2eq}/h]				
total amount of greenhouse gases	/	number of inhabitants (public admin.)	[kg CO_{2eq}/person]				
total amount of greenhouse gases	/	Quantity of waste processed (waste sector)	[kg CO_{2eq}/t]				
total amount of greenhouse gases	/	total energy produced (utilities)	[kg CO_{2eq}/kWh]				
total amount of greenhouse gases	/	other reference	[kg CO_{2eq}/tbd]				

Emission Indicators			unit	2016	2017	2018	2019
total amount of NO_x emissions	/	Number of employees	[g/FTE year]				

Goedkoop et al (2018) use the following image to explain the general linkages between business management activities and stakeholder group objectives. In terms of performance measures, these impacts can be translated using metrics such as % workers with high job satisfaction, % consumers satisfied with company natural capital management activities, increase in worker productivity and salaries arising from skills development training, % increase in per capita household wealth arising from community natural capital investments. Example 12 uses these linkages as simplified Stakeholder Impact Assessments.

When selecting social topics, we considered that companies interact with society in two ways:
1. They are dependent on the way society functions (social dependencies)
2. They affect the way society functions (social impacts)

The impacts and dependencies that companies have on stakeholders influences various capitals of human well-being. Companies can build or maintain positive influence on capitals through its daily operations, or the products or services it provides various users.

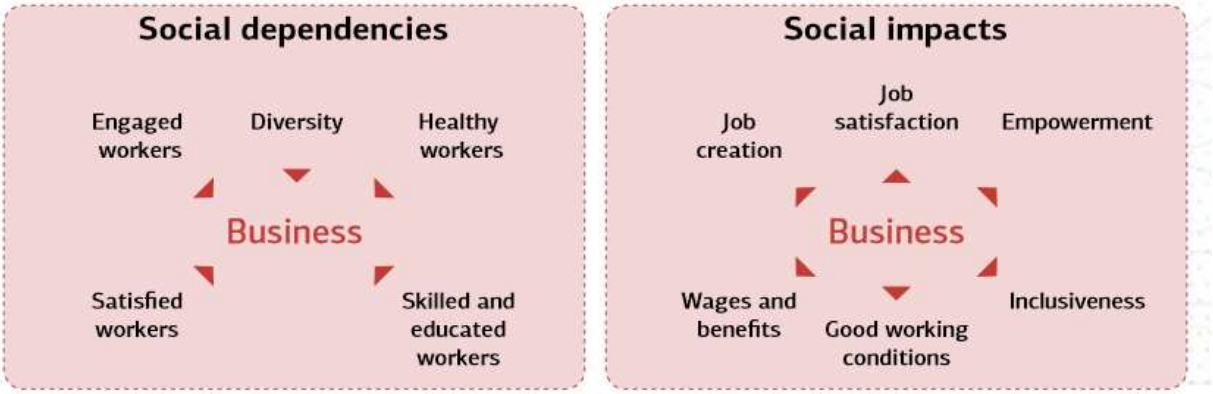


Figure 2.3: Business dependencies and social impacts for workers

Unbiased Sustainability Management Service Industries. Sustainability management and accounting systems, and their sustainability workers, require complete, professional, service industries (i.e. the job creation endorsed by advocates of better climate change policies). These service industries strive to accommodate multiple stakeholder perspectives (i.e. so that their applied accounting systems don't end up primarily supporting public relations or authoritarian governments), Meinshausen et al (2019) use the following example to exemplify the increasing need for these comprehensive service industries:

"Consistent group certifications are particularly relevant now as the new EU regulation for organic farming (published in 2018 and coming into force in 2021) will allow group certification of small farms anywhere in the world, including the EU."

Without naming names, the author's review of some international group certification schemes concluded that some are biased towards producer perspectives. In the same vein, the author's review of several LCI databases used for sustainability accounting concluded

that most are biased toward researcher and specialty consultant use. This reference recommends that consumers demand that these service industries "use strong, objective, 3rd party, "verifiers" who are backed with strong certification requirements that follow transparent, internationally recognized, standards."

National Policies vs. Local Plans. TEEB uses their approach for national policy planning purposes. The RCA Framework uses SDG-related planning for local stakeholder quality of life improvements. For example, Example 1 in SPA1 used the following statement to introduce the Sustainable Livelihoods Framework's (SLF) impact pathway of Vulnerability Factors (i.e. Flows including drivers) -> Livelihood Assets (i.e. Stocks) ->Livelihood Strategies (i.e. M&A Actions) -> Livelihood Outcomes (i.e. Outcomes and Impacts).

"Mbowa et al (2014) present an example for coffee production that uses the Sustainable Livelihoods Framework (SLF), which "emphasizes access to or ownership of livelihood assets – (i.e. human capital; social capital; [natural capital]; and physical capital) that are key in influencing livelihood strategies."

RCA planning addresses the need for improved livelihood assets by using a variety of planning approaches, including Example 9's Community SDG Plans and Appendix B's SDG Policy Context Plans **(19*)**.

TEEB Impact Pathway versus LCIA-related Impact Pathways. Example 3 used the following LCIA pathway (i.e. Emission -> Fate -> Exposure -> Effect –> Damage) to explain a basic approach for converting field measurements to social impacts, or human damage categories. In effect, TEEB's simple Flow-Stock-Outcome-Impact pathway has more subtlety, and is more similar to, Example 6's disaster risk management impact pathway: Risk Drivers -> Hazards -> Exposure -> Vulnerability -> Capacity -> Impacts. These pathways are not absolute – they serve as abstractions that allow codification of cause and effect relations between input and output measurements and final human and ecosystem impact.

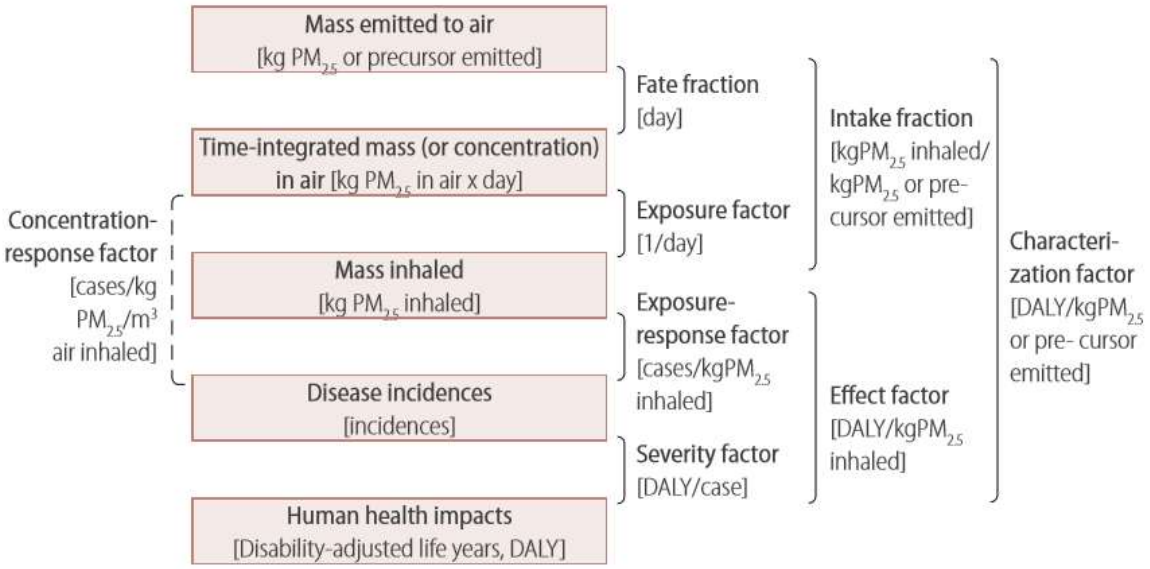


Figure 4.1: Impact pathway followed and framework for assessing human health effects from fine particulate matter ($PM_{2.5}$) exposure in life cycle impact assessment
Adapted from (Fantke et al. 2015).

Example 3 also explained that international scientific organizations, (i.e. the USETAC references) are attempting to codify these measurements because:

"With the globalization of economies there has also been a steadily growing need to create a worldwide consensus set of environmental impact category indicators embedded in a consistent, methodological framework. Such a set of indicators is expected to be used in environmental product information schemes, benchmarking in industry sectors, corporate reporting by companies, intergovernmental and national environmental policies, and common LCA work commissioned by governments and companies."

This tutorial adds community and household sustainability accounting to that statement. The following image (EMAS, 2017) shows that, in practice, the accounting systems that are currently used to document these measurements often use condensed versions of LCIA pathways to measure sustainability accounting Indicators. This image shows that input measurements, such as the quantity of automobile gas consumed, gets converted to an Energy Consumption amount (kWh), which then gets converted to a CO2 equivalent emissions amount (gkWh).

Emissions resulting from energy consumption

GHG

Conversion factors in orange are not yet available . You can complete these fields or wait for the next revision of

Energy-Input		Consumption (kWh)					CO2 equivalent emissions (g)				
Energy source	Unit	Conversation factor to kWh	2016	2017	2018	2019	Conversation factor to CO_2 equiv. [g/kWh]	2016	2017	2018	2019
Scope 1 related energy consumption											
Heating energy from fossil fuels											
Hard coal	kg	8.33	0	0	0	0	337.0	0	0	0	0
Lignite (brown coal)	kg	2.56	0	0	0	0	404.0	0	0	0	0
Heating oil	l	9.95	0	0	0	0	268.5	0	0	0	0
Natural gas	kWh	1	0	0	0	0	201.6	0	0	0	0
Wood chips	kg	3.71	0	0	0	0	4.1	0	0	0	0
Wood pellets	kg	4.5	0	0	0	0	1.5	0	0	0	0
LPG/propane	kg	12.9	0	0	0	0	229.9	0	0	0	0
Climate relevant gases consumed in production processes											
Acetylene	m^3	14.7	0	0	0	0	223.9	0	0	0	0
other gas	m^3		0	0	0	0		0	0	0	0
Fuels used in company vehicles											
CNG (vehicle use)	l		0	0	0	0	201.6	0	0	0	0
LPG/Propane gas (vehicle use)	kg	12.9	0	0	0	0	229.9	0	0	0	0
Diesel (< Euro 6 vehicle use)	l	9.9	0	0	0	0	247.7	0	0	0	0
Diesel (Euro 6 vehicle use)	l	9.9	0	0	0	0	247.7	0	0	0	0
Petrol (vehicle use)	l	8.94	0	0	0	0	244.0	0	0	0	0
Scope 2 related energy consumption											
Electrical energy	kWh	1	0	0	0	0	617.0	0	0	0	0

The following tables illustrate how to modify the previous table to include the UNEP LCIA recommendations. In this example, additional Climate Change Impact characterization factors (CFs), such as Example 3's Global Warming Potential CFs and Global Temperature Change Potential CFs, are added to generate final uniform measurements (i.e. GWP 100 and GTP 100). These measurements support uniform comparisons and tradeoffs among products, production and consumption systems, organizations, organization management systems, communities, and community management systems. UNEP identifies the need for continued development of more comprehensive regional and local CFs that can support these comparisons and tradeoffs (i.e. via new service industries).

Global Warming Potential (GWP 100)						
Energy source	Unit	Characterization Factor to GWP 100	2016	2017	2018	2019
Fuels used in company vehicles						

Gas	l	x	x	x	x	x

Global Temperature Potential (GTP 100)						
Energy source	Unit	Characterization Factor to GTP 100	2016	2017	2018	2019
Fuels used in company vehicles						
Gas	l	x	x	x	x	x

Stakeholder, Ecosystem, and Human/Social, Impact Pathways. In order to stay consistent with the UNEP LCIA approaches, this algorithm adopts Example 3's LCIA approach to measure the natural capital stock flows. That approach is extended to also measure produced/human/capital and ecosystem impact pathways.

Example 3b confirms that Social Life Cycle Assessments (SLCAs) haven't progressed yet to the same level of advancement as environmental LCIA. Uniform characterization factors aren't available yet for quantifying impacts for socioeconomic indicators. Footnote 10 verifies that international efforts are underway to improve SLCA, but require more time. This reference assumes that these efforts will have similar goals as the UNEP LCIA goals -development of socioeconomic indicators and characterization factors that can be used for uniform, global, comparison and tradeoff analysis. The likelihood that these measurements will be manipulated by special interest groups, such as to justify biased certification requirements, makes these international efforts particularly vital.

Although the UNEP environmental LICA pathways (i.e. Emission -> Fate -> Exposure -> Effect –> Damage), may not work for SLCA, this reference will assume a similar "5 conversion factor" social impact pathway can work, in a "to be determined but still simplistic" manner, for SLCA.

For example, the CTAP reference's disaster risk reduction pathway algorithms (i.e. Hazard -> Exposure -> Vulnerability -> Capacities -> Impact) employed socioeconomic indicators and categories. TEEB (2018) employs their pathway, Flow – Stock – Outcome – Impact, for assessing all community capitals, including socioeconomic indicators.

This algorithm uses the environmental LICA Indicator system, with a "to be verified" social impact pathway, for SLCA flow measurements. Real conversion factors that can be used with this system do not fully exist yet and may not be needed as long as the pathway's relations are documented properly. This example uses a combination of Example 6's impact pathway (i.e. Risk Drivers and Hazards -> Exposure -> Vulnerability -> Capacities -> Impact), and, when cause and effect pathways can't be used or are not essential, a variant of Example 3b and Example 9's target-goal classifications and multi-criteria decision assessment techniques (MCDA).

This following section employs the UNEP LCIA human damage impact approach for carrying out Stakeholder Impact measurements. The same approach is then modified to cover Social Life Cycle Impact Assessments. Finally, UNEP's (2019) ecosystem quality AOP recommendations can employ a similar approach to carry out simplified Ecosystem Impact measurements.

Community Capital Impact Pathways. This algorithm modifies Example 3's LCIA stock and flow accounting as follows:

Produced/Natural Capital Indicator Stock Flows:

1. starting input or output quantity,
2. allocating a portion of the 1st field measurement based on parent co-input and co-output contributions, regional characterization factors, or indirect upstream and downstream activities, or a driver of risk or hazard (i.e. pollution, climate change)
3. conversion of the 2nd field measurement (kg N / ha; kg coal) to an emission unit (kWh; kg NO2 / ha),
4. conversion of the 3rd measurement to a "midpoint" environmental impact unit (CO2 equivs),

5. conversion of the 4th measurement to an "endpoint" LCIA damage category (CF: GTP 100; DALY/kgPM25).

Human/Social/Natural Indicator Stock Flows:

1. starting input or output quantity related to stakeholder social risk drivers and hazards (i.e. adequacy of sexual harassment legal frameworks, degree of flood hazard risk, current diet or lifestyle measurement),
2. allocation, or conversion, of the 1st field measurement to an exposure unit ((i.e. sexual harassment complaints, location in flood plain, gender role in diet or lifestyle needs)
3. conversion of the 2nd field measurement to a vulnerability unit (percent workers satisfied with sexual harassment enforcement; number of exposed assets; stakeholder exposure to starting risks and hazards, neighborhoods may not offer exercise facilities),
4. conversion of the 3rd measurement to a capacity and resiliency unit (percent workers at 100% capacity due to sexual harassment enforcement, damages to physical assets, mortality, reduction in ecosystem services, neighborhood has high incidence of diabetes),
5. conversion of the 4th measurement to an SLCA impact category (sexual harassment policy contribution to SDG goals such as gender equality, DALY, QASY, diet, or lifestyle, score).

Categorical Index Stock Inventories:

Supports Example 9's target stock measurements (i.e. benchmarks, targets, actuals, certainties) in support of the various "scores" illustrated in the Guidance Documents.

Location Index Stakeholder Impacts:

Supports Example 12's Guidance Document scores.

Scores:

Employs Example 3's automatic Hotspots results plus a community, business, or household, TEXT profile to generate additional performance metrics (gender equality scores for each stakeholder group, total elementary flow per employee, life cycle stages causing most stakeholder impact, consumer satisfaction with specific production processes). Supports simplified Stakeholder Impact Assessments.

Ecosystem, or Ecosystem Quality Area of Protection (AOP), Impact Pathways. UNEP (2019) advises sustainability accounting systems to account for "new developments" in environmental measurement, with emphasis on ecosystem services. Although the authors acknowledge that ecosystem services measurements haven't been codified to the same degree as their environmental Indicators and CFs, they still provide recommendations that sustainability modelers and accounting systems can follow. The authors, and Example 12's GRI system, verify that the previous section's LCIA approach can include indicators that account for ecosystem services.

In addition, the authors recommend more comprehensive ecosystem modeling that focuses on understanding the relation between ecosystem structures, functions, and services. Example 5 introduced a basic approach for conducting Landscape Impact Assessments. This algorithm adapts that simplistic approach to Example 3's LCIA impact accounting for ecosystem, or area of protection, based planning. The authors note that impact pathways that can consistently measure ecosystem services needs more work. In the interim, this example uses a combination of Example 6's impact pathway (i.e. Risk Drivers and Hazards -> Exposure -> Vulnerability -> Capacities -> Impact), and, when cause and effect pathways can't be used or are not essential, a variant of Example 3b and Example 9's target-goal classifications and multi-criteria decision assessment techniques (MCDA).

UNEP (2019) implies that these accounting measurements rely on more advanced ecosystem modeling, or algorithms. The following applied sustainability accounting uses these advanced models.

Ecosystem Quality Indicator Stock Flows: [this is not the author's area of expertise, so the pathway and units of measurement need work]

1. starting input or output quantity related to ecosystem risk drivers and hazards,
2. allocation, or conversion, of the 1st field measurement to an exposure unit
3. conversion of the 2nd field measurement [ecosystem unit] to ecological vulnerability unit (ecosystem service risk)
4. conversion of the 3rd measurement to a "midpoint" to a capacity and resilience unit (reduction in ecosystem services, reduction in ecosystem adaptive capacity),
5. conversion of the 4th measurement to an "endpoint" ecosystem service impact or recovery potential category (CF: Example 3's UNEP, Biodiversity Damage Potential; Crenna et al, 2019, Potentially Disappeared Fraction (PDF) *years).

Categorical Index Stock Inventories:
Supports Example 9's target ecosystem service measurements (i.e. benchmarks, targets, actuals, certainties) in support of the various "scores" illustrated in the Guidance Documents.

Location Index Ecosystem, or Area of Protection, Impacts:
Supports Example 12's Guidance Document scores.

Scores:
Example 3's automatic Hotspots results plus a community, business, or household, TEXT profile to generate additional performance metrics (ecosystem services per employee, ecosystem transition stages causing most ecosystem quality impact, consumer satisfaction with specific ecosystem M&A Actions). Supports simplified Ecosystem Impact Assessments.

The critical long term requirement for these easily-biased measurements remains "the use of strong, objective, 3rd party, "verifiers" who are backed with strong certification requirements that follow transparent, internationally recognized, standards."

Automated Guidance Documents (i.e. automated LCI to LCIA). UNEP (2019) published recent recommendations for extending Example 3's LCIA to assess additional environmental risks. Using their rice crop LCIA, the additional recommendations include:

- **"Human Toxicity and Eco Toxicity**. Traditional rice cultivation requires pesticides, hence provided an excellent basis for testing candidate and recommended indicators proposed by the human toxicity and eco toxicity Task Forces.
- **Acidification and Eutrophication**. Rice cultivation requires fertilisation and causes nitrogen and phosphorous emissions, therefore helped the acidification and eutrophication Task Force to test their candidate and recommended indicators.
- **Soil Quality and Ecosystem Services**. Rice cultivation may affect the soil quality and thus provided a good basis to test approaches quantifying impacts on ecosystem services.
- **Regionalized Characterization Factors**. The supply chain is sufficiently complex to urge the experts to provide regionalised factors as well as default factors, applicable to situations with limited or no geographic or temporal information.
- **Mineral Resources**. The rice supply chain does not require a large range of mineral resources. Therefore, the Task Force on mineral resources relied on a different case study – driving an electric car"

The Guidance Document section of Example 12 shows how to document these types of uniform LCIA Indicators, conversion factors, characterization factors, and target scores, for uniform sustainability goal setting, scoring, and reporting. The example measures the GRI EN8 Water Aspect Indicator by multiplying a water use inventory quantity (i.e. the starting input quantity, or amount of household water consumed), by the UNEP's AWARE CF documented in the guidance documents (i.e. the final damage characterization factor; EU's ILCIA reference calculations). Uniform comparisons can then be made among members, club, and networks at both local and national scales.

The following advice (UNEP, 2019, UNEP's GLAD initiative), which corresponds to the recommendations in the Work Breakdown Structure tutorial and Example 4, explains the importance of new service industries that address the institutional flaws explaining why these

systems aren't up and running for applied work (i.e. the International Consensus LCI and LCIA Database section, below, explains this further).

"For harmonisation, it is strongly recommended to develop a common reference nomenclature and classification system for life cycle inventory analysis (LCI) and LCIA."

These harmonized systems, or DevTreks preferred phrase, "high quality data standards", are needed before automated guidance documents can be developed. Example 12 explains that these automated guidance documents allow households, businesses, and communities, to submit LCI inventories to the accounting platforms. The following images (UNEP, 2019) illustrate how the platforms, or automated guidance documents, use the LCIs to automatically generate the LCIAs, SLCIAs, and sustainability reports. The 2nd image implies the need for both stakeholder, or population-based, LCIs, and landscape, or ecosystem-based, LCIs. This automation reinforces the need for new sustainability service industries that address the institutional changes needed to get these systems up and running.

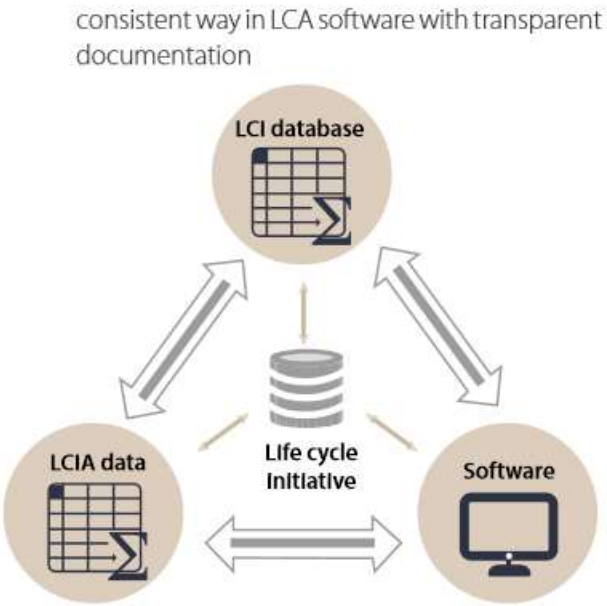


Figure 2.3. Proposed international, multi-stakeholder collaborative structure for facilitating harmonisation in LCI and LCIA connection and data exchange

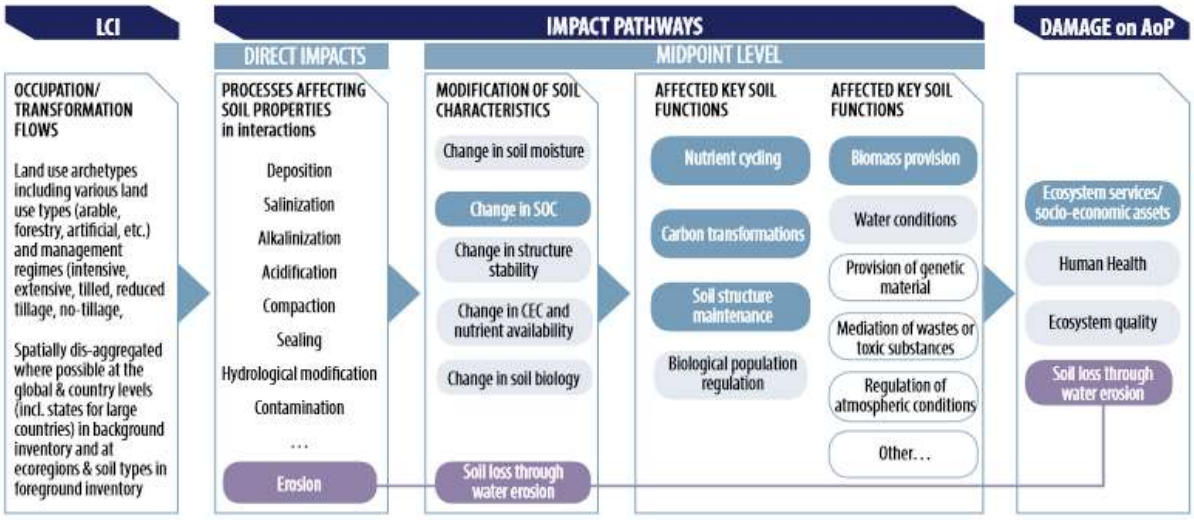


Figure 6.1. Impact pathway of land use impact on soil quality and soil loss through water erosion

13 http://www.fao.org/soils-portal/soil-degradation-restoration/global-soil-health-indicators-and-assessment/en/

Global Guidance on Environmental Life Cycle Impact Assessment Indicators – Volume 2

SPA2 used the following image (UNSETAC, 2017) to confirm that firms and communities also use formal LCIA-related tools to automatically calculate LCIAs. This Appendix explains that more advanced algorithms use lookup tables (i.e. to the LCI, conversion, and CF tables), and additional calculations (i.e. DALYs from air contaminant exposure response curves), for this type of accounting (i.e. like the Capital Input calculators). In effect, these types of tools, spreadsheets, and algorithms, carry out the actual sustainability accounting supported by automated guidance documents. The final, uniform, sustainability reports can then be generated that support sustainability reporting systems, such as Example 12's GRI.

ENVIRONMENTAL IMPACT CATEGORIES - CML-IA baseline (v4.2) method within SimaPro					
PARAMETER	UNIT	Indirect Upstream Activities	Direct Activities	Indirect Downstream Activities	Total
Global Warming Potential	tonnes CO_2 eq.	266,000	22,800	59,100	348,000
Ozone Depletion Potential	kg CFC11 eq.	17	1	11	30
Formation Potential of Tropospheric Ozone Photochemical Oxidants	kg C_2H_4 eq.	36,534	829	10,506	47,869
Acidification Potential	kg SO_2 eq.	674,969	177,790	247,258	940,017
Eutrophication Potential	kg PO43- eq.	178,307	4,753	58,301	241,361
Abiotic Depletion Potential for Non-Fossil Resources	kg Sb eq.	655	0	149	805
RESOURCE USE - Cumulative Energy Demand (ver. 1.09) methodology within SimaPro					
Total use of renewable primary energy resources	GJ	110,000	4,880	13,400	128,000
Total use of non-renewable primary energy resources	GJ	1,919,000	3,810	948,000	2,870,000
INVENTORY LEVEL INDICATORS - Primary data provided by AKG Gazbeton					
Hazardous waste disposed	ton	92			
Non-hazardous waste disposed	ton	310			
Use of net fresh water (well)	m³	542,000			

Table 3. AKG Gazbeton – Impact assessment results for 2015

The O-LCA study shows that upstream supply chain activities are the dominant life cycle stage (Table 3). Regarding energy, upstream activities have higher energy requirements (embodied) compared to direct and downstream activities. Within

LCIA and Common Evaluation Frameworks. When cause and effect is not needed or is too difficult to measure, Appendix B illustrates the use of simpler stock and flow scoring systems (i.e. the CTAP MCDA algorithms, Example 2's PRA algorithm). The key point is not whether or not LCIA techniques are the "best techniques" for sustainability accounting –it's whether the accounting techniques can be backed with "international consensus" that supports automated guidance document development. Example 12's image of a universal, or common, evaluation framework implies that the resultant automation allows consistent comparisons and tradeoffs for a variety of sustainability purposes, including products, organizations, projects and communities. Some of TEEB's alternative valuation techniques (i.e. systems analysis) may be evolving to the LCIA level of international codification and automation maturity.

LCI and LCIA Databases (Caveats about International Consensus). As with most of the algorithms introduced in this tutorial, no actual, full, datasets could be found that support the measurements explained in this Appendix. Plenty of companies use Example 12-style sustainability accounting system reports, academic references continue to use LCIA, and companies still submit domain-specific LCI inventories to LCI "databases", but not a single useful dataset, or example of a useful dataset, could be found for Example 12. Raising questions about that last paragraph's assertion of LCIA "automation maturity".

For example, try downloading and using, a dataset from the following LCI database: https://www.nrel.gov/lci/about.html . The USEPA (2017) LCI reference represents a typical scientific consensus attitude towards these approaches to data collection, storage and dissemination. These 2 references also confirm that most current databases of LCIs and LCIAs target researchers, industrial engineers, and specialty consultants and rely, to a great extent, on proprietary data. This consensus makes a deep case that these approaches must first be used prior to the TEXT-based algorithm approach recommended in Footnote 14.

Given DevTreks continual criticism of conventional approaches to most budget-related data management and use, it's not surprising that this Appendix finds Footnote 14's criticism to be plausible, if not completely correct. That is, special interest groups may have a vested interest in a single consensus approach, when multiple alternative approaches may be better. That's worrisome because it implies that "international consensus" data management approaches may still be flawed. This Appendix recommends allowing new service industries and Appendix D's digital support teams to discover alternative approaches for applied sustainability accounting, while respecting international consensus approaches that deal squarely with George Orwell's concerns about authoritarians screwing things up for everybody.

Impact Valuation vs. Integrated Valuation (**20***). OECD (2018) summarizes recent advances in formal, cost-benefit, impact valuation techniques which are consistent with many of the approaches recommended in the TEEB references (i.e. hedonic pricing, contingent valuation, general equilibrium modeling). The authors verify the policy and project oriented purposes

behind these Cost-Benefit techniques. OECD (2018) use the following statement to summarize one of the primary differences between TEEB's focus on Impact Valuation and the RCA Framework's focus on Integrated Valuation.

"In terms of the practical implications for project appraisal, [the wide assortment of stakeholder value systems and preferences] entails a strong degree of participative and deliberative approaches alongside "traditional valuation techniques"."

The RCA Framework believes that the "complexity problem" explained in this reference makes traditional valuation estimations, including CBA and Systems Analysis, at best, challenging, and more likely, unsatisfactory, for applied planning (i.e. until data management, Machine Learning, and Semantic Web, approaches mature). Instead, RCA places greater emphasis on identifying likely quality of life improvements, or M&A Actions, that have a high probability of benefitting households. Integrated Valuation (see Constanza et al 2017) might be distinguished from TEEB's "integrated approaches" as follows (i.e. "might be" because the TEEB approach appears flexible enough to accommodate these differences):

- **M&E Accounting Systems**. Concrete accounting systems, grounded in M&E and Adaptive Management techniques (i.e. participative and deliberative approaches), keep track of what's needed, what works, and what doesn't work (i.e. via sustainability networks and clubs on social sustainability accounting and media platforms).
- **Conservation Technology Assessment (CTA) for Decision Support Context (Community Capital Stocks, Flows, and Impacts).** The Resource Stock tutorials used the following definition to introduce a primary sustainability assessment technique employed in DevTreks for assessing how well M&A Actions work. This definition implies that the automated guidance documents documented in the Impact Pathway section of this Appendix, actually contain numerous tools for supporting better production and consumption sustainability choices. The RCA Framework supplies the overall community capital context for supporting the choices.

"Conservation Technology Assessment (CTA) is the analysis of resource stock flows and balances, and conservation technologies that are designed to prevent or correct imbalances in the stocks."

- **Mixed Methods Assessments**. The RCA Framework uses "mixed methods" techniques to quickly identify nonperforming M&A Actions and replacing them with better ones. These techniques include outreach efforts, informant interviews, multimedia storytelling, and social sustainability media techniques. Reference Impact Evaluations (see SPA3), conducted using household surveys, record keeping data, and social sustainability media, codify the proven actions for more widespread, population-wide use. The M&A Actions become the basis for the Best Management Practices and Guidance Documents introduced in Appendix B.
- **Narrative Intrinsic and Cultural Valuations**. Impact Valuation techniques, such as CBA, emphasizes the quantification of instrumental values (i.e. refer to SPA1). Integrated Valuation adds the narrative explanation of intrinsic and cultural values. That makes the actual benefit estimative technique (i.e. QALY, CBA) used for the impact valuation less important than the overall accounting and participatory platform context that communicates effective M&A Actions to the stakeholders and verifies improvements in their wellbeing.
- **CEAs, QASYs (or Subjective Well Being Valuation), and Social Costs**. When formal benefit estimation techniques must be used in the Integrated Valuation approach, Example 4's CEA's, QASYs and "True Prices" or social costs, probably come closest to the formal Impact Valuation techniques. QASYs are similar to the OECD (2018) and FAO (2017d) Subjective Wellbeing Valuation (WV) techniques. The QASY and WV approaches focus on understanding the values that stakeholders themselves experience from improvements in their quality of life (i.e. stakeholder perspectives). Stakeholders themselves focus on outcomes. Do the stakeholders perceive improvements in their short term and long term wellbeing? Although FAO (2017d) explains the use of household surveys for WV scoring, this reference believes that the scores can be derived

automatically from the stakeholders' habits using new social sustainability accounting and media platforms.

Model Platforms vs. Social Sustainability Media Platforms. The TEEB framework's focus on national policies that can be evaluated by economists and scientists accommodates traditional desktop and web-based IT platforms (i.e. InVEST, Aries, UNEP's LCIA modeling). The RCA Framework's focus on local community, industry, and household, sustainability accounting accommodates IT platforms with the following characteristics:

- **Social Sustainability Media Platforms**. Just as current social media platforms automatically record consumer preferences for targeted advertisements, new social sustainability media platforms automatically record stakeholder preferences for targeted sustainability purposes. The new platforms are similar to new types of social media platforms (i.e. Berners-Lee, 2019), but focus more directly on science, algorithms, sustainability accounting systems, and public goods software.
- **Sustainability Accounting Networks and Clubs**. Conventional record keeping associations help their members make better investments and produce higher profits (i.e. social budgeting). Sustainability Accounting Networks and Clubs supplement these conventional purposes with sustainability purposes (i.e. social sustainability accounting).
- **Social Sustainability Clubs, Networks, and Member Stakeholder Privacy**. Clubs own their members data. Networks administer the clubs. The clubs and networks decide on the degree of privacy protection needed by their members.
- **Social Networks and Clubs promote Social Norms for Member Stakeholders**. Much of the value perceived by stakeholders derives from their personal social norms as reinforced by the social networks and clubs they choose to work with. Social sustainability media platforms focus on supporting and understanding these value systems, or stakeholder perspectives. Outreach efforts take place to educate stakeholders whose norms clash with sustainability goals. Sustainability workers try to communicate sensible tradeoffs that can keep disparate stakeholders reasonably appeased. Stakeholders moderate their "my way or the highway" attitudes [i.e. including Lawrence, and possibly Gene, Tierney's accents] in favor of improving "our community capitals". The platforms

require strong policies for booting out networks, clubs, and members who refuse to compromise and grow up (i.e. prominent examples aren't hard to find).

Population Surveys vs. Sustainability Accounting for Monitoring, Evaluation, and Reporting. Most of the Social Performance Analysis examples use Stakeholder Accounting, or Budgeting, to conduct business or product sustainability assessments. In contrast, most SDG-related assessments, such as TEEB, focus more on using population or household survey data to make these assessments. The following sections illustrate the main difference between the 2 approaches –population survey data is best for broad policy purposes and stakeholder accounting is best for discerning the actual sustainability of individual, or "reference", businesses, products, communities, projects, households, and limited policies. The 2 approaches complement one another –this reference advocates using the population survey data to identify reference impacted stakeholders and to conduct population Monitoring and Evaluation of community led M&A Actions.

- **Population Monitoring and Reporting**. The following image (US CDC, 2019) demonstrates how National Statistical Offices use formal Monitoring and Evaluation population surveys, measured using health-related Indicators and Indexes, to report how national household populations are progressing in the achievement of SDG-related targets. Note the sparseness of the Environmental Quality ratings. Many (most?) existing national population surveys focus on similar, narrow, sets of household quality of life factors. For example, oftentimes the only household budget variable used with these surveys is household income –the real life intricacies associated with that income, such as job insecurity, high housing costs, or externalities caused by waste, are difficult to understand from this data (i.e. even though other population surveys may be collecting that information). The data supports limited national policies but M&A Actions can't be fine-tuned to address the household intricacies.

Table IV–2. Midcourse Progress for Leading Health Indicators

LEGEND

✓ Target met or exceeded[1,2] | + Improving[3,4] | ○ Little or no detectable change[5–9] | − Getting worse[10,11] | Baseline only[12] | Informational[13]

Objective Description	Baseline Value (Year)	Midcourse Value (Year)	Target	Movement Toward Target[14]	Movement Away From Baseline[15]	Movement Statistically Significant[16]
Access to Health Services						
+ [3] **AHS-1.1** Persons with medical insurance (percent, <65 years)	83.2% (2008)	86.7% (2014)	100%	20.8%		Yes
○ [5] **AHS-3** Persons with a usual primary care provider (percent)	76.3% (2007)	76.5% (2012)	83.9%	2.6%		No
Clinical Preventive Services						
+ [3] **C-16** Adults receiving colorectal cancer screening based on most recent guidelines (age-adjusted, percent, 50–75 years)	52.1% (2008)	58.2% (2013)	70.5%	33.2%		Yes
+ [3] **HDS-12** Adults with hypertension whose blood pressure is under control (age-adjusted, percent, 18+ years)	43.7% (2005–2008)	48.9% (2009–2012)	61.2%	29.7%		Yes
○ [7] **D-5.1** Adults with diagnosed diabetes whose A1c value is greater than 9% (age-adjusted, percent, 18+ years)	18.0% (2005–2008)	21.0% (2009–2012)	16.2%		16.7%	No
+ [3] **IID-8** Children receiving the recommended doses of DTaP, polio, MMR, Hib, HepB, varicella, and PCV vaccines by age 19–35 months (percent)	68.4% (2012)	71.6% (2014)	80.0%	27.6%		Yes
Environmental Quality						
✓ [1] **EH-1** Air Quality Index greater than 100 (number of days, weighted by population and Air Quality Index value)	2,200,000,000 (2006–2008)	982,186,972 (2012–2014)	1,980,000,000	553.6%		
✓ [1] **TU-11.1** Children exposed to secondhand smoke (percent, nonsmokers, 3–11 years)	52.2% (2005–2008)	41.3% (2009–2012)	47.0%	209.6%		Yes
Injury and Violence						

- **Population Social Impact Assessments**. The following image (US CDC, 2019) demonstrates how National Statistical Offices use the same disaggregated population surveys to support the Social Impact Assessments, and equitable tradeoff analysis, introduced in SPA3 and further developed in this reference. Note the wide disparity between the Highly Impacted and Minimally Impacted Stakeholders. The techniques used in this reference use this data to identify impacted stakeholders. For example, in the 1st objective, Highly Impacted Stakeholders include indigenous, poor, and

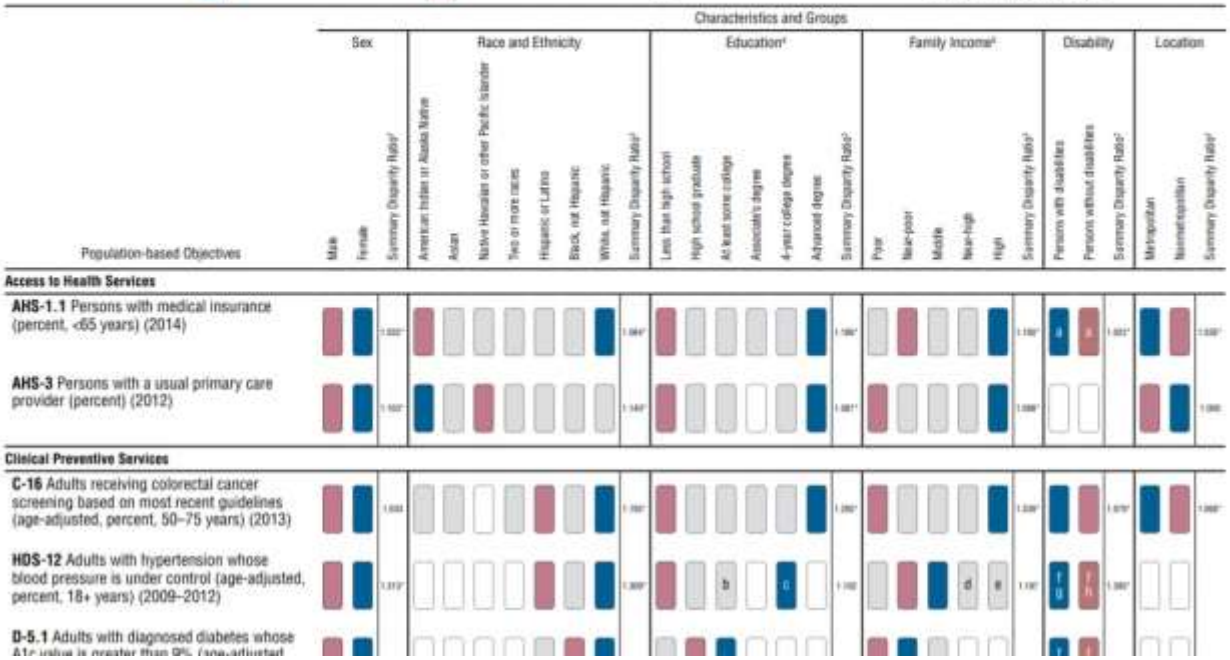
nonmetropolitan stakeholders. Once identified, M&A Actions can be designed that target those stakeholders.

Table IV–3. Midcourse Health Disparities[1] for Population-based Leading Health Indicators

Most favorable (least adverse) and least favorable (most adverse) group rates and summary disparity ratios[2,3] for selected characteristics at the midcourse data point

LEGEND

At the midcourse data point: Group with the most favorable (least adverse) rate; Group with the least favorable (most adverse) rate; Data are available, but this group did not have the highest or lowest rate; Data are not available for this group because the data were statistically unreliable, not collected, or not analyzed.



- **Population Impact Evaluation using Traditional Approaches.** The following images (FAO, 2017d) explain how to use one of the most common assessment technique employed with population survey data, statistical regression analysis, to conduct impact evaluations. The data explained in the images point to the problem with that approach when applied in these frameworks. The dependent variable being evaluated in this approach if often narrowly focused on 1 aspect of household quality of life –in this example, colorectal cancer. Example 7 and 8 use regression analysis to demonstrate this further – total household expenditures, not household budgets, are used to evaluate the impact of a new health care program. The intricacies behind household health, such as diet, exercise, leisure, and work, patterns, can't be fully understand just using the population data. Example 7 explains that these impact valuations still serve valuable

purposes. TEEB (2018) further explains how these single quality of life explanations can also be used in Appendix B's guidance documents for "benefit transfer" purposes, and with care, household budgeting.

A. Model and data preparation

A.1. Identify the health conditions that are to some extent affected by the food system. A preliminary framework must be set, as explained in Chapter 2. For example, colorectal cancer has been found to be linked to a deficit of fibre in the diet and excess meat intake.

A.2. Establish the quantitative link between the food system and resulting health conditions. This results in a probability that the health condition (or risk factor) is caused by the food system. Some examples are mentioned in Chapter 2. In the example, the probability of colorectal cancer being caused by the food system could be roughly estimated to be 50-75%.

A.3. Find or collect the data required for wellbeing valuation of the health condition. This requires data on SWB (e.g. life satisfaction), the health conditions, income and control variables and this step is explained in more detail in Section 4.2.1. For instance, the Health Survey Northern Ireland gives data on colorectal cancer and the control variables.

B. Model derivation and value estimation

B.1. Estimate the impact of the health conditions identified in Step A.1 on life satisfaction, using data from Step A.3, using for example regression analysis. In the example, the impact of having colorectal cancer is associated with a 1.054 lower life satisfaction on a scale of 1 to 7 with 1 being "completely dissatisfied" and 7 being "completely satisfied"[65].

B.2. Estimate the impact of income on life satisfaction, using data from Step A.3, using for example regression analysis. For example, this study uses an instrumental variable approach on

In terms of control variables, Fujiwara and Campbell (2011)[64] provide a list of the main determinants of life satisfaction found in the literature to date:

- Income
- Age
- Gender
- Marital status
- Educational status
- Employment status
- Health status
- Social relations
- Religious affiliation
- Housing and environmental conditions and crime levels in the vicinity
- Number of children and other dependents (including caring duties)
- Geographic region
- Non-market good being valued
- Personality traits (such as extroversion)

Controlling for these potential confounders allows us to get closer towards a causal estimate. The issue of reverse causality is particularly important to consider in the estimation of the effect of income on life satisfaction. The causal estimate of income on life satisfaction is thus estimated

[64] Fujiwara, D. & Campbell, R. (2011). Valuation Techniques for Social Cost-Benefit Analysis: Stated Preference, Revealed Preference and Subjective Well-Being Approaches. HM Treasury and Department for Work and Pensions.

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through an instrumental variable approach. The details of this technique are discussed in more depth in section 4, when conducting the case study for the UK.

- **Impacted Stakeholder Performance Monitoring and Impact Evaluation using Sustainability Network Records and Sustainability Accounting Platforms.** Example 1 explained that farm record keeping associations commonly aggregate their members' budget accounting data to help their members make better production choices. Current social media platforms automatically classify the preferences held by users of their platforms (i.e. for targeted advertising and to supply misinformation). New types of record keeping networks and clubs replace these advertisement-centric platforms with sustainability accounting platforms. The primary purpose of the new platforms is to

automatically discern their members' quality of life preferences for sustainability outreach purposes (i.e. as contrasted to advertisements, misinformation, and citizen control). Members gladly share their private data in support of public goods improvements that also directly improves the quality of their life and their neighbors' lives.

- **Machine Learning and Semantic Web Technologies applied with Community SDG Plans, SDG Policy Context Plans, and Stakeholder Records (i.e. M&E Reports, Budgets)**. Communities use Example 9-style inventories to account for SDG progress. Local sustainability workers use Appendix B's Policy Context Plans to document the concrete M&A Actions being taken to increase local household quality of life. Record keeping networks and clubs track their members household budgets, monitoring and evaluation records, or social media habits, using Example 12-style approaches (i.e. best practices, automated guidance documents, club certifications, sustainability accounting platforms), to verify whether or not the community M&A Actions are actually reaching down to the households.

  Household records, such as meta-data budgets, feedback from the record keeping networks and clubs to the community sustainability workers to assist them eliminate ineffective M&A Actions and adopt better ones at community scale. Although this approach doesn't require any direct linkages between the accounting systems, machine learning and semantic web approaches, such as algorithms that aggregate the sustainability records, support understanding causal attribution among risk drivers, stakeholders, M&A Actions, and SDG impacts.

Appendix D. Institutional Support for Digital SDG Planning.

Example 11 used the following image of an M&E Comparative Output Analysis. This analysis is conducting a metadata analysis of 16 Indicators, calculated using 16 TEXT datasets, for 5 Output Series. A Total of 96 datasets, or operating budgets, are being calculated and analyzed (1 Output with 5 Output Series * 16 TEXT files).

Media | Mobile | Desktop

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Your analysis has been saved. The analysis can be viewed whenever this analyzer addin is opened.

Output Group : RCA Output Examples ; none						
Output	All	Alt. 0				
Name		SDG Plan 11B				
Label		SDG11B				
Output Series	All	Alt. 0	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Name		Product 01	Product 02	Product 03	Product 04	Product 05
Label		SDG01	SDG02	SDG03	SDG04	SDG05
Alternative						
Indicator 0		Score	Score	Score	Score	Score
Observations		1.0	1.0	1.0	1.0	1.0
Date		03/20/2019	03/20/2019	03/20/2019	03/20/2019	03/20/2019
Label		SCORE1	SCORE1	SCORE1	SCORE1	SCORE1
Most Unit		actual most score	actual most score	actual most score	actual most score	actual most score
Most		399,390.3705	399,390.3705	399,390.3705	399,390.3705	399,390.3705
Most Amount Change		0.00	0.00	0.00	0.00	0.00

The following 3 bugs were discovered when this analysis was run.

Bug 1. Indicator 15 couldn't be saved because this integer had been set to 15 (even when documentation clearly indicated it should be 16).

```
//218: changed from 15 to 16 for ind15
private int MaximumNumberOfME2Indicators = 16;
```

Bug 2. The 16 datasets couldn't be inserted into the final 4 Output Series because this string array had mistakenly reused its parent Output string array name, which caused the parent loop count to change from 5 to 1. Although, in practice, sibling Output Series usually require their own datasets, a lot of time is saved by automatically filling in all of their calculator and Indicator properties.

```
//218 bug fix: that's why it takes software testers

string[] arrLinkedView2 = sLinkedView.Split(Helpers.GeneralHelpers.STRING_DELIMITERS);
```

Bug 3. This line of stylesheet code prevented Indicators 5 to 15 from being displayed in the Comparative Analysis view. A simple string concatenation could have fixed this bug. The Full Analysis view prints fine because the underlying data is correct.

```
<xsl:if test="(@TME2Name5_5 != '' and @TME2Name5_5 != 'none')">
```

Bug 4. Version 2.2.0 hunted down the following intermittent bug documented in the Malnutrition tutorial. This boolean flag had been set to the wrong value, causing the calculated results not to be saved properly.

```
else if (docToCalcURI.URIDataManager.AppType
    == DataHelpers.GeneralHelpers.APPLICATION_TYPES.prices)
{
    bool bNeedsSummaryPriceDocs
        = DataAppHelpers.Prices.NeedsSummaryPriceDocs(docToCalcURI);
    if (bNeedsSummaryPriceDocs)
    {
        //220 bug fix (that's why it takes software testers)
        bStillNeedsSave = true;
    }
}
```

Tutorial Bug. The Social Budgeting tutorial was only partially updated with the results of Version 2.1.6 and 2.1.8.

All of these are relatively minor bugs that should have been caught with better software testing protocols. Raising the point that, although cloud computing software applications can be run at international scale and technically support most local community SDG Planning, they require institutional coordination and support. Several footnotes (5, 6, 8, 13, and 14) reflect skepticism on the part of this author that this type of institutional support exists for public goods-related digits (i.e. especially in conventional institutions).

Although Footnote 12 states that it's not necessary for DevTreks itself to be right with these approaches, it is critical that both the local sustainability workers and their digital support teams are right. Communities must establish policies, with funding, that help the teams to discover the right approaches for SDG Planning. New institutions that can provide national and international coordination of the teams, especially the digital support teams, can help ensure that data can be aggregated for uniform global decision support to aid our planet's global heating and biodiversity loss crises (**17***).