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"TRUE" COSTS FOR FOOD SYSTEM REFORM:

AN OVERVIEW OF TRUE COST ACCOUNTING LITERATURE AND INITIATIVES

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ABSTRACT

The increasingly industrialized global food system has caused detrimental health, environmental, social, and economic impacts. In response to this, experts in public health, environment, agriculture and life cycle analysis developed True Cost Accounting (TCA) as a comprehensive research mechanism for evaluations and assessments to inform policies and programs aimed at positive change. TCA is a multi-stakeholder, systems approach to measure the costs and benefits of different agricultural production systems. In ideal circumstances, evidence from TCA is put into practice to educate key food systems stakeholders such as policymakers, farmers and consumers to work toward a resilient and regenerative food system that supports public health, communities and ecosystems. This paper provides an overview of the most prominent TCA publications and identifies consensus and differentiation regarding definitions, frameworks and approaches. The report also provides recommendations for future research to address gaps in TCA literature and to strengthen future TCA initiatives and organizing.

INTRODUCTION

Unsustainable agricultural practices deplete soil, pollute waterways, reduce biodiversity and accelerate climate change.[1-4] These environmental and human health costs are not reflected in the price that we pay for artificially inexpensive food that is produced within the industrial food system. True Cost Accounting (TCA) is an emerging strategy to advance a new food system model that has the potential to substantiate and bolster efforts to eliminate these harmful practices. "True Cost Accounting" uses evidence and collective action to generate knowledge and pathways for reform. TCA is defined by the Global Alliance for the Future of Food as:

> "A critical tool to help us, as a global community, better understand the impacts of food systems, address the most harmful practices, and find new, positive pathways forward. By evaluating the impacts—both positive and negative—inherent in different food systems and making these impacts transparent, decision-makers on farms and in governments, institutions and businesses can make better informed decisions that consider the economic, environmental and social impacts of their choices."[5]

This report provides an overview of the existing literature and action around TCA and related theories about how to measure and modify the processes of accounting for the positive and negative effects of diverse forms of food production.

In a capitalist system, transnational corporations have the freedom to produce goods and services with little regulation, or weak regulation, related to production method.[6] Economic externalities are costs that are not reflected in the price of an item.[7] In the food system, externalized costs related to food production help industrial agribusiness maintain their bottom line. One study from KPMG found that the food industry is the most environmentally damaging industry and that if external prices were internalized, they would equal at least 224 percent of the industry's revenue.[8] Often, the food items that are lowest in price come at the highest cost to human health and the environment. As agribusiness profit and

market control continues to grow, companies transfer the economic, health and biological risks associated with agriculture to farmers, farmworkers and consumers. In order to create significant and dramatic food system reform, stakeholders must better understand these externalized costs in order to convince policymakers to disincentivize destructive agricultural practices and create support for more regenerative operations.[9]

This report covers academic literature and white paper publications from a number of institutions, ranging from grassroots to international organizations, with a primary focus on eight publications focused on TCA. However, this is not an exhaustive list and the stock of TCA research is quickly expanding. The literature is assembled and analyzed for consensus and differentiation in regard to definitions, frameworks and approaches. This report also provides a list of recommendations for future research, to address gaps and strengthen TCA initiatives and organizing.

TRUE COST ACCOUNTING: BACKGROUND

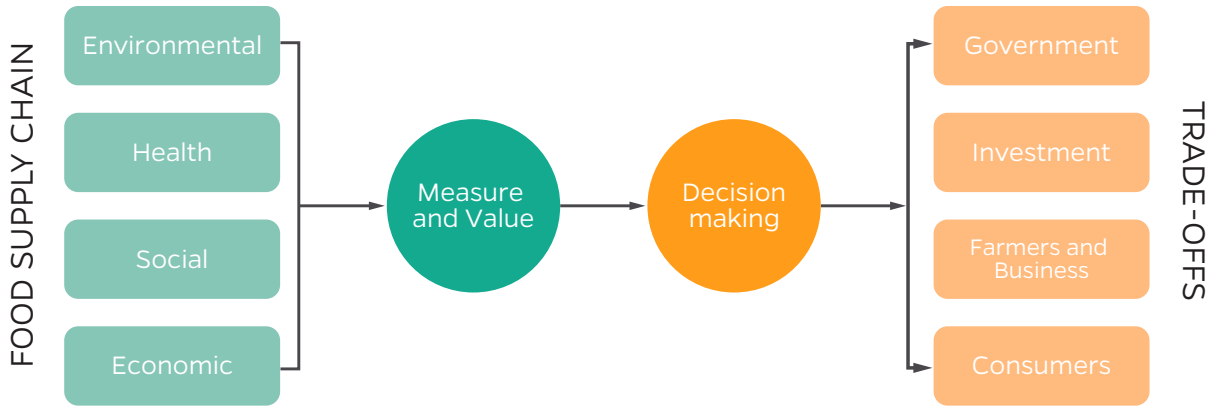
The concept of TCA emerged from the increased awareness of the negative externalities of large-scale, industrial food production and the system that allows for enormous profit for transnational agribusiness, while farmers, communities and ecosystems suffer the negative consequences of this form of production.[10] One of the first mentions of the "true cost" concept for food systems occurred in a 2009 TIME Magazine cover article, "The Real Cost of Cheap Food" by Bryan Walsh. However, some of the first organizing around TCA was due to the leadership of His Royal Highness, Charles, Prince of Wales, who spoke about the concept at the 2013 London conference, "True Cost Accounting in Food and Farming," and subsequently at a meeting at his Gloucestershire Highgrove Estate in 2015.[10] Since then, there have been a number of other convenings, including the "True Cost of American Food" conference in San Francisco in 2016.[10] Some organizations leading the dialogue are Sustainable Food Trust, Global Alliance for the Future of Food (GAFF), The Economics of Ecosystems and Biodiversity for Agriculture and Food (TEEBAgriFood), the Johns Hopkins Center for a Livable Future (CLF), Natural Capital Coalition and Food Tank.

Broadly, TCA is a tool to investigate the negative impacts of industrial and corporate food systems and advocate for sustainable alternatives.[5] The basic theoretical model presented in most publications concerns using TCA to inform decision-makers and transform the food system for the better. The approaches, perspectives and frameworks for using TCA are diverse and will be discussed further in this report. TCA is a response to decades of food and agriculture policy that put the needs of industry and corporations over those of farmers and consumers.

The TCA costs discussed in this paper can be broadly divided into health, environmental, social and economic effects, as laid out in the Institute of Medicine and Natural Resource Council 2015 Report, "A Framework for Assessing Effects of the Food System" and the TEEBAgriFood paper, "Measuring What Matters in Agriculture and Food Systems".[11,12] The figure below *(Figure 1)* depicts the TCA decision-making model by combining ideas from TCA publications and concepts from the TEEBAgriFood theory of change. TCA works to measure and value various "negative externalities" within the domains of environmental,

health, social and economic effects.[11,12] Once these negative externalities are identified and measured, decision-makers will have the data necessary to analyze, evaluate and make changes across the food system that reflect the true cost of industrial, corporate agriculture. In an ideal scenario, these beneficial changes would then feed back to the four domains. For example, research could reveal that a particular agricultural policy is not cost effective after TCA. Therefore, government officials change the policy, which then feeds back to the farmers' decision-making, which then affects land use, agricultural practices and the ecosystem (within the environmental domain). Then, as a cyclical and iterative process, the impact can be measured and used for further TCA and policy improvements.

Figure 1: *True Cost Accounting theoretical model*



TCA FRAMEWORKS AND CONCEPTUALIZATION

TCA arose as a response to the faulty valuation dynamics in our food system and overwhelming power consolidation.[10] Yet, the scope and ambition of TCA is large, and this report seeks to synthesize different approaches and conceptualizations. While the term "True Cost Accounting" is most often used in the academia and nongovernmental sectors, there are, however, a number of similar terms, including: Full Cost Accounting (FCA), True Cost Economy (TCE), Natural Capital Accounting (NCA), Impact Valuation, Life Cycle Costing (LCC), Societal Life Cycle Costing (S-LCC)[13] and Triple Bottom Line (TBL).[14] Some of the most prominent reports dedicated to TCA are summarized below *(Figure 2)*. They are from TEEBAgriFood, Sustainable Food Trust, Global Alliance for the Future of Food (GAFF), the Institute of Medicine (IOM), World Business Council for Sustainable Development (WBCSD), Food Tank and Foundation Earth. These publications are centrally focused on TCA as a mechanism for comprehensive food system reform and outline directions for future initiatives. Included below are also two frameworks from IOM and TEEBAgriFood, which were chosen based on the utility and relevance for academic applications of TCA. In addition to those listed below, a number of publications and frameworks, while not centrally focused on TCA, refer to this impact valuation process as a strategy for organizations and industries to adopt. These perspectives are also drawn in for the discussion of consensus and differentiation within the TCA literature.

Figure 2: *Prominent TCA Publications*

INSTITUTE OF MEDICINE (IOM)

A Framework for Assessing Effects of the Food System (2015)

The Institute of Medicine (IOM) and National Research Council (NRC) outline a detailed framework for assessing the health, environmental, social and economic effects of the US food system. The idea came about from the 2012 IOM/NRC workshop, *Exploring the True Costs of Food,* which spurred interdisciplinary discussion about an evidence-based framework to examine complex interactions in the food system. This publication provides an overview of these effects and tools for implementing food system assessments. It describes considerations of boundaries, indicators, data, and budget, as well as examples of the framework in action.

FOUNDATION EARTH

Biosphere Smart Agriculture in a True Cost Economy (2015)

This report frames the argument for climate-conscious agricultural development for the World Bank and other investment institutions. They propose a True Cost Economy with a focus exclusively on green infrastructure. They make an urgent call for multilateral development banks to "1) Set up internal processes to quantify ecological impact of 'externalities' for the agricultural loan applications to show the 'true cost of production'; 2) Compare these externalities to the planet's ecological limits; 3) Reject all damaging agricultural projects and finance the ecologically restorative agricultural projects; and 4) Incentivize the loan officers to follow these True Cost procedures with all development loans". They argue these steps are essential for a new economic model for sustainable agriculture.

GLOBAL ALLIANCE FOR THE FUTURE OF FOOD (GAFF)

On True Cost Accounting & the Future of Food (2018)

In this report, GAFF explains the motivation behind their work with TCA and an overview of their ongoing efforts to apply the TEEBAgriFood conceptual framework for evaluation food systems. TCA is one of GAFF's three priority areas, along with health/wellbeing and agroecology. Their goal is to ally philanthropic foundations to transform global food systems.

TEEBAGRIFOOD

Scientific and Economic Foundations Report (2018) and Measuring What Matters (2018)

Both reports from this UN Environment initiative outline the background and recommendations for a comprehensive measurement framework for the food system. The reports outline strategies to capture the visible and invisible stocks and flows of the "eco-agrifood" system in order to go beyond simplistic and siloed metrics to evaluate system performances to support positive

decision-making. The reports also identify four categories for measurement: health, social, environment and economy. TEEBAgriFood outlines measuring and valuing the stocks and flows of the four "capitals:" natural, human, social and produced, as well as guidelines for prioritizing key actors, policy leverage and calculating the "true cost of food."

FOOD TANK

The Real Cost of Food: Examining the Social, Environmental, and Health Impacts of Producing Food (2015)

Food Tank provides an overview of the justification for TCA by outlining some of the environmental, health, social and economic impacts of the current food system. They also provide some examples of organizations' efforts toward TCA and give a call to action for all the various players in the food system.

SUSTAINABLE FOOD TRUST

The True Cost of American Food: Conference Proceedings (2016)

This document provides an expansive overview of diverse perspectives and ideas surrounding TCA from the True Cost of American Food Conference in San Francisco in April 2016. The conference had over 600 participants, representing farming, business, academia, policy, public health institutions, civil society, investment and philanthropy. The proceedings provide a comprehensive summary of each speakers' main points, as well as overall discussion points for each session.

WORLD BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT (WBCSD)

True Cost of Food: Unpacking the Value of the Food System (2018)

This discussion paper is part of the True Cost of Food Initiative from the WBCSD. The authors provide an overview of the data and methodologies that are currently available to assess the true cost of food. They outline which sectors and indicators have readily available data and which are in need of more methods and tools. In their Valuation Framework, they describe externalities in three main areas: environmental/natural, nutrition/health and socio-economic/human. They describe how some indicators remain qualitative and non-monetized, as "we wait for more mature monetized values to become available." This paper argues that TCA results should be moved from solely sustainability teams to the desks of CEOs and CFOs.

CONSENSUS

There is widespread consensus regarding the motivation behind TCA and its main goals and vehicles for change. In order to synthesize these ideas, the agreement can be split into two general categories: 1) guiding principles and values; and 2) applying TCA frameworks.

GUIDING PRINCIPLES AND VALUES

Systems Thinking and Multilateral Approach

Systems thinking is "an approach that focuses on the identification of interrelationships between components of a system."[12] A systems approach is critical for TCA to assess the hidden costs of the industrial food system across sectors, regions, and time.[7] The IOM framework works across the entire food supply chain and applies multiple dimensions (health, environment, social and economic) and domains (quantity, quality, distribution and resilience).[11] The authors of the IOM framework state that this systems focus can help identify outcomes and trade-offs that may not be visible with an isolated assessment.[11] Similarly, the TEEBAgriFood report mentions how "Systems-Dynamics" adds deeper analysis of causal feedback loops[i] to the quantitative assessments of food production and food policy.[7] Foundation Earth and GAFF also both cite systems thinking and inter-connectedness as a guiding principle and approach for their work on TCA. GAFF states that it is essential to "avoid siloed approaches, unintended consequences, and limited, narrow, short-term solutions."[5]

There is no singular organization or sector that can account for all the interactions, effects, and feedback loops of the food system. Therefore, a multi-stakeholder, multi-level approach is critical.[7] Various sectors will be better equipped to tackle different accounting systems, and those frameworks and products should be shared and disseminated to inform decision-making worldwide.[7] In order for TCA research to influence decision-making, it must be informed by and applied to other change mechanisms such as market-based tools, public policy, financing, technology, innovation, communications and public advocacy.[15] The TCA publications featured in this report represent many of these approaches; IOM, TEEBAgriFood and GAFF focus on research and knowledge creation, whereas WBCSD and Natural Capital Coalition advocate for sustainable business decisions, and Foundation Earth provides recommendations for international investment. These are great examples of how each organization can use their own expertise to transform various sectors in holistic and wide-reaching ways using TCA.

Transparency and Participation

Through a process of transparency and collaborative action, new knowledge from TCA influences public opinion, leading to widespread "collective deliberation" and new macro-worldviews.[7] As TEEBAgriFood mentions in their report, industrial agribusiness operates in opposition to this system, benefitting from "strategic unknowns," or efforts to generate confusion and defuse knowledge, in order to maintain ignorance, discordance and lack of action.[7] In many cases, corporations actively attempt to stop or bury research that will threaten their bottom line.[7,16] Agribusiness also has great power to influence policy,

i. "Causal feedback loops" are variables or indicators connected in a non-linear fashion.[12]

spending over $137.5 million to fund federal lobbying efforts in 2014.[17] In contrast, most TCA actors agree that sustainability research and information should be readily available and communicated clearly to the general public.[7,10,12,14] Both IOM and TEEBAgriFood argue that promoting transparency and minimizing the likelihood of misinterpretation is important.[7,11] The information should be accessible in content and dissemination, so that it can be translated into holistic action that employs the best solutions in various regions and domains.[7,12,18]

Transformative governance and redirecting structural power

There is widespread agreement that TCA works to transform governance within food system policy and practice in order to combat deeply entrenched power structures.[7] Transformative governance is "an approach to environmental governance that has the capacity to respond to, manage, and trigger regime shifts in social-ecological systems (SES) at multiple scales."[19] It represents a strategy to utilize TCA to change our current corporate food regime to a sustainable model by "altering the structures and processes that define the system".[19] According to TEEBAgriFood, transformational governance is dependent on flexible decision-making and institutional processes that value adapting and learning from trial and error.[7] IOM and Sustainable Food Trust emphasize that adaptive management through combatting prescribed paths or pathway dependencies in the food system "is the only way ahead," as natural and social environments change rapidly.[10,11]

Transformative governance is directly related to other TCA principles for transformational change, such as multi-level participation, strategic political partnerships, democratic control of knowledge, public participation, and engagement with businesses and investors.[7] TEEBAgriFood describes that democracy in the food system and developing governance structures with accessible entry points and platforms for participation "multiplies the centers of power and leads to more diffusion of power overall."[7] A diffusion of power is one of the necessary steps to lend legitimacy to sustainable food systems, which are outlined in the next principles: food sovereignty and agroecology.[7,18]

Food sovereignty: Equity and agency

"Food sovereignty" expands on concepts of food security and the right to food to give light to the contribution of sustainable producers and indigenous growers, with a particular focus on local control of resources and agency over market mechanisms.[7] The food sovereignty movement is embedded in global grassroots peasant movements, led by coalitions such as La Via Campesina, Rural Coalition, and the National Family Farm Coalition.

TCA publications strongly emphasize the importance of food security, equity, agency, localized wealth and power shifts, yet only half mention food sovereignty by name.[7,15,18] The TEEBAgriFood framework mentions the importance of "building a common language" or "universality" for decision-making.[13] It asserts that a shared vocabulary is essential to "achieve the integrated, cross-sectoral decision-making that is required."[7] It is important that organizations utilize shared terms (and cite shared definitions), in order to avoid confusion and establish more explicit agreement.[7]

Agroecology: Resilience and renewal

"Agroecology" is another key term for the shared TCA vocabulary. The majority of publications regarding TCA cite the severe divide between large-scale industrial food production and the small and mid-size "diversified" farms.[5,7,18,20] Now, more so than ever, the urgency of resilient and regenerative farming is critical to withstand intensifying extreme weather and climate change.[9] Agroecology is a "science, practice, and movement rooted in traditional agriculture and ecological practice…and emphasizes small, highly diversified farms and local, farmer-to-farmer knowledge sharing".[21] The authors of the International Agricultural Assessment of Knowledge Science and Technology for Development (IAASTD) Global Report, as well as the UN Special Rapporteur on the Right to Food, have recognized agroecology as one of the best strategies for fighting hunger, while addressing environmental issues and increasing agricultural productivity.[21,22] TCA organizations such as TEEBAgriFood, Foundation Earth, GAFF, and Sustainable Food Trust and countless more are invested in the growth and viability of agroecological practices worldwide.[5,7,10,18] GAFF even lists agroecology as one of their three priority areas.[5] These organizations argue that TCA is a critical tool to help measure benefits and incentivize a transition to agroecological farming practices.[5,7,10,18]

APPLYING TCA FRAMEWORKS

True Cost Accounting publications are complementary in their approaches to knowledge generation, dissemination, and collective action across sectors. One common theme is the need for a guiding framework that is adaptable for various contexts and can aid in decision-making and policy.[5,7,10] Using common frameworks facilitates the standardization of methods and analysis, in order to better aggregate and compare data across various sectors and locations. One paper, from Katherine Fiedler, Steven Lord and Jason J. Czarnezki, provides an overview of eight frameworks that use valuation methodology across life cycle stages.[13] They categorize these frameworks into four groups:

> *1) general guidelines for defining the objective, scope, and impacts of the analysis, including broad questions to inform the measurement, valuation, and implementation stages; 2) standardization of the appropriate and necessary externalities and impacts that should be considered; 3) more traditional accounting frameworks that seek to incorporate social and environmental evaluation; and 4) valuation methodologies.*[13]

The IOM and TEEBAgriFood created the two leading frameworks that can be, and have been, used in TCA. These will be covered in greater detail, as they are currently the most applicable to inform academic projects and partnerships. The IOM framework works to recognize complex and interconnected effects across the food system and provides concrete processes and considerations.[11] Similarly, the TEEBAgriFood framework is "an approach for describing and classifying the range of outcomes/impacts for a given scope and value chain boundary, and caused by specified drivers" and meant to be universal, comprehensive, and inclusive.[7,12] The TEEBAgriFood framework uses indicators of capital stocks and value flows across four dimensions: natural, human, social, and produced capital.[7] Following the Fiedler et al. categorization of TCA frameworks, IOM is a framework for "defining objective,

scope, and impacts of the analysis" (1) and TEEBAgriFood is for the "standardization of the appropriate and necessary externalities and impacts that should be considered" (2).[13] Each has distinct characteristics and focus *(See Appendix I)* and can be complementary in their utility to inform future initiatives.

Organizations such as IOM, TEEBAgriFood and GAFF envision applying TCA frameworks as a crucial scientifically validated step that will contribute to the global dialogue and decision-making. Frameworks can be applied to, for example, business analysis, typology and system comparisons, policy evaluation, national accounting, and diet comparisons.[12] TCA applications and case studies will likely utilize an iterative process to compare systems across time and place.

Currently, GAFF is investing in three case studies using the TEEBAgriFood Evaluation Framework.[5]

- Maize in Malawi: This investigation will evaluate the monetized costs and benefits and social, environmental, and health externalities of the system to determine new possibilities for the country.[5]
- Corn in the Mississippi Basin, USA: The project aims to: "1) examine diverse corn systems and value chains; 2) describe and value (where appropriate) the dependencies, impacts, and externalities related to the systems (positive and negative); and 3) reveal opportunities for shifting practices, policies, and subsidies to improve environmental, health, and socio-cultural outcomes across the value chain".[5] Findings will provide recommendations for farmers, industry, and policy makers.[5]
- Sustainability Metrics in the United Kingdom: This study works to: "1) develop an integrated framework for assessing sustainability; 2) use the framework to undertake a series of case studies on a range of farms, including arable, livestock, and mixed systems in the UK; and 3) identify the best features of existing approaches and integrate them."[5]

Similarly, a study from Harpinder Sandhu tested the TEEB AgriFood framework across ten diverse case studies that covered comparisons for agricultural management systems and products, diets, policies, and national accounting. For example, Sandhu et al. studied conventional versus organic production methods in New Zealand, scenarios for plant-based diets in the United States, and an ecosystem assessment in China. They concluded that analysis across the entire value chain poses a number of logistical and methodological challenges, yet nonetheless the findings could be used to inform policy for sustainable agri-food systems.

In addition, the IOM framework outlines ways to begin scoping for TCA, and provides hypothetical examples of its applications, such as:

- Dietary Recommendations for Fish Consumption
- US Biofuels Policy
- Attaining Recommended Amounts of Fruits and Vegetables in the American Diet
- Nitrogen in Agroecosystems

Each of these examples is explained in the context of the IOM framework model: Identify the problem, scope the boundaries and linkages, identify the baseline scenario, conduct analysis, synthesize and interpret results, create a report, and communicate findings. Assessments compare the current system (baseline) to the proposed change (alternative scenario), as well as a comprehensive understanding of the nature and drivers of the problem, the viability and effects of various solutions, and the trade-offs that would arise under various scenarios.

Many experts maintain that TCA frameworks are living documents and should be treated as dynamic and flexible. In addition, the funding for TCA framework applications and case studies, such as those mentioned above, should maintain comprehensive, long-term thinking, in order to sufficiently implement systems-level analysis. [6,18]Many TCA players emphasize that traditional funding structures in the food system have enforced the need for simple, short-term results, which indirectly encourage shortsighted solutions.[6,18] For example, IAASTD mentions how the short-term funding model has hindered the growth of agroecology because it "implies too many parameters and levels of consideration," making it difficult to measure.[22] Therefore, more comprehensive, long-term studies are better equipped to measure and evaluate complicated system-wide issues. Results from these studies should be easily accessible for a range of stakeholders, in order to share knowledge and learning.[6,18]

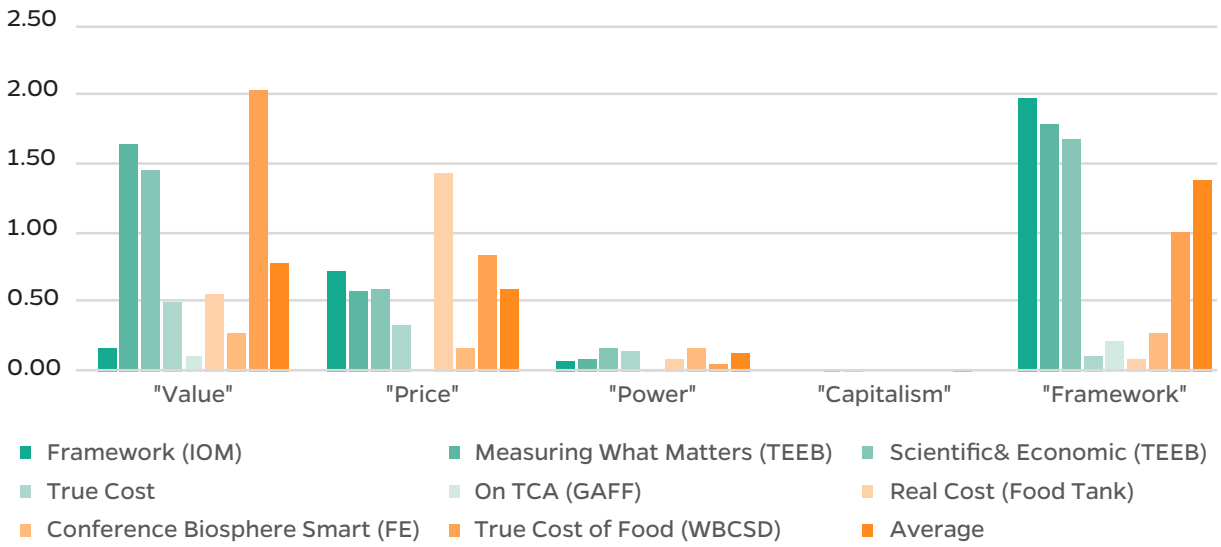
DIFFERENTIATION

DEFINING TCA

Overall, there is extensive overlap within TCA literature regarding values, principles, and data, with very little explicit differentiation across TCA publications and groups. However, the greatest inconsistency or ambiguity for readers lies in the definition and scope of TCA *(for a full list of TCA definitions and conceptualizations see Appendix II)*. The most basic and inclusive definitions describe TCA as a tool to evaluate impacts of different food and production systems, in order to inform decision-makers to make choices that benefit the environment and human health.[5] But TCA has also been categorized as: a critical tool, an emerging discipline and science, a scientifically validated approach, a mechanism for reform and an economic model. This demonstrates some discrepancy of the concept and scope of TCA.

Some organizations describe broader visions of TCA as a mechanism for not only describing the true cost of food but correcting the price of food, or even redefining national accounting systems and making "capitalism work the way it's meant to."[23] The chart below *(Figure 3)* illustrates some of these inconsistencies. For example, although new economic accounting systems are mentioned as future goals, the root driver, capitalism, is not discussed. Similarly, power and power structures as a root cause need more attention. This chart also reflects the discrepancy with value (or cost) and price, which is discussed further in the next section.

Figure 3: *True Cost Accounting average term mention per page*[ii]



DEFINING TCA CONCEPTS OF "VALUE", "COST" AND "PRICE"

Furthermore, TCA publications often describe work regarding "cost", "price", and "valuation" in the food system, yet the interpretation of these terms varies. For example, Foundation Earth describes that "Cost" in their definition of a True Cost Economy[iii] is a value term, not a financial term, stating, "if an economy were to cause a near-dead planet it would hardly be of financial concern to desperate people and the near-extinct or extinct species."[18] However, other definitions use "cost" in the financial sense (e.g. "identifying, categorizing, quantifying, and putting a price on the range of costs and benefits.")[20] There is general agreement that TCA works toward a "polluter pays" scenario, but it's unclear if "pays" implies higher taxes, internalizing externalities, or simply losing out.[9] The linkage between this model and the price, cost, and valuation scenarios that will work to achieve a better food system requires further investigation.

More specifically, using shared meaning of "cost" and "price" will help to rectify whether the goal of TCA is to count the externalities of the industrial food system or to eventually create pathways to internalize externalities and create a new economic order.

Based on the literature, it is not clear whether the goal of TCA is to generate knowledge and recommendations to redistribute public funds or to internalize externalities to eventually make cheap, processed food more expensive to produce and buy, while making healthy foods cheaper to buy and profitable to produce. Currently, TCA can describe a wide range

ii. For each publication, the total mentions were recorded and divided by the number of pages. Inclusion criteria is not case-sensitive and includes: "Value" (value), "Price (price, prices), "Power" (power), "Capitalism" (capitalism, capitalist), "Framework" (framework).

iii. Foundation Earth defines True Cost Economy as, "a holistic economy in that it operates within Earth's carrying capacity, especially by recognizing and avoiding ecological impacts (also known as shifted costs or externalities). It maintains the biosphere's life-support systems. It is one-planet living. The use of 'Cost' in this phrase is not a financial term. If something cost you your life it would not be primarily a financial concern."

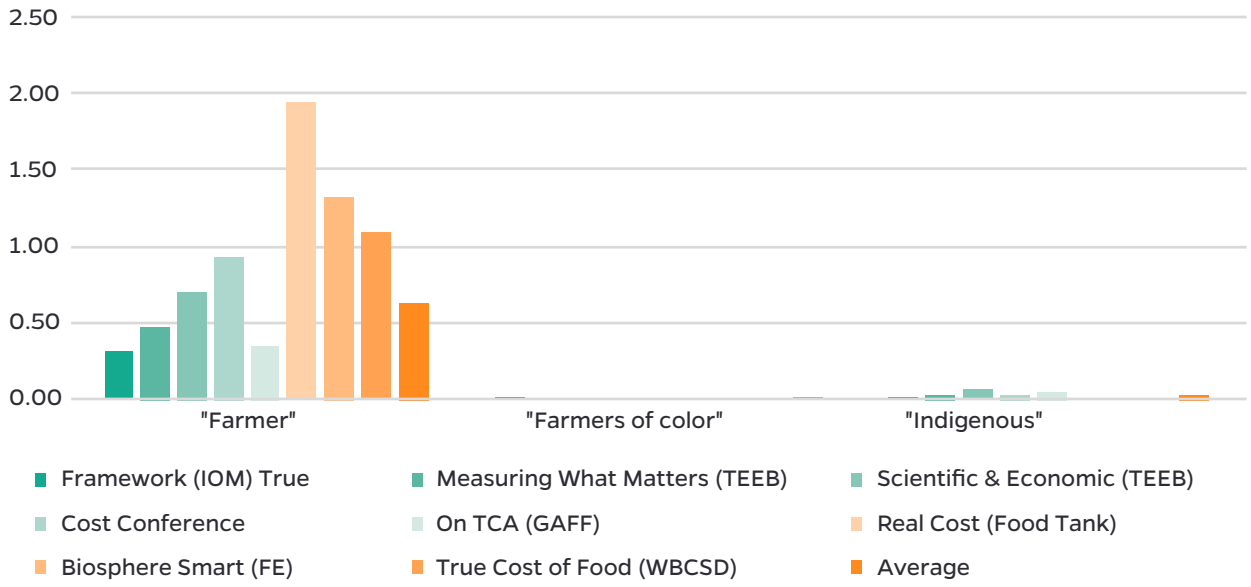
of distinct goals and strategies. TCA encompasses case studies that measure effects of various production practices by quantifying and describing a range of "costs", in order to influence policymaking and redirect public funds. It also encompasses the use of natural capital valuation by putting a price on the externalities in order to influence the price of food (to reflect the "true cost"). For example, Food Tank describes how TCA could influence price. Food Tank asserts that, "ultimately, TCA models can lower the cost of food produced sustainably, while incorporating negative externalities into the retail price of 'cheap' food."[14] Some also describe incorporating these prices from TCA-adjusted prices into economic markets and global economic measurements, such as GDP.[10] However, the link between TCA as a mechanism to reform market forces (incorporating environmental and social value into the economy) and reform public policy and funding (such as the agricultural subsidy system), and the extent to which these two strategies could influence food prices comparatively, remains uncertain.

AREAS FOR FUTURE TCA RESEARCH

INCLUSIVE, DEMOCRATIC PROCESS WITHIN TCA ORGANIZING

While most TCA publications deeply value systems thinking and equity frameworks, few bring in substantial inclusion of smallholder farmers, communities of color, and indigenous peoples. Considering the philosophical questions of valuation, multi-level governance and transparency, understanding how communities affected by climate change and oppressive food and farm policy conceptualize these movements is essential. TCA incorporates strong values for food sovereignty and agroecology, but the frameworks have not utilized leadership from the kinds of groups that developed these concepts. The word chart below *(Figure 4)* illustrates the distribution of attention given to various groups and perspectives. Few publications reviewed in this report included terms related to indigenous peoples. This indicates a gap in the TCA perspective, especially considering the intellectual and historical roots of agroecology in traditional and place-based farming. Furthermore, farmers were mentioned often in most publications, yet the type of farmer was often not specified, and farmers of color or other socially disadvantaged farmers were only mentioned once across all publications. This demonstrates a significant gap in the representation and inclusion of these populations in TCA organizing and research.

Figure 4: True Cost Accounting average term mention per page[iv]



TCA data systems must be developed with leadership and direct partnership with indigenous groups, communities of color, rural peasants, and smallholder farmers in order to practice democratic reform and incorporate diverse value systems. The food system is rooted in an extractive economy that has historically exploited, enslaved, and robbed Black, Brown, and Indigenous communities. To develop a true cost valuation system without the leadership from communities that have experienced and resisted these injustices will only develop false solutions. TCA assessments should address white supremacy as a root cause of the current food system by incorporating racial equity and the "environmental debt" that powerful nations, stakeholders, and companies have to these communities.[23] Diversity in TCA leadership will ensure that any value assigned to ecosystem services and externalities will work to benefit communities and land-defenders and will not disregard or de-politicize their struggle, history, resistance and resilience. A global accounting system based on the needs of farmers and historically marginalized communities is vital to the re-imagining of an equitable, resilient and renewable food system for all.

NATURAL CAPITAL AND MONETIZING NATURE

More research is needed to investigate the best practices of economic valuation within the food system. One criticism of some TCA approaches is that the valuation of ecosystem services and harms can become a "monetization of nature"[10] or even a mechanism of "enlisting environmentalism in the service of the worldwide expansion of capitalism".[23] While many TCA publications acknowledge these concerns and issues around defining valuation and "pricing the priceless" without actually "putting nature on the balance sheet per se"[10], few

iv. Inclusion criteria for each term includes, "Farmer" (farmer, farmers, producers, growers), "Farmers of color" (farmers/producers/growers of color, black farmers/producers/growers, Latino/Latina/Latinx farmers/producers/growers, socially disadvantaged farmers/producers/growers, historically disadvantaged farmers/producers/growers, non-white farmers/producers, growers), and "Indigenous" (indigenous, American Indian(s), Alaska Native, tribal, tribe, tribes).

explore the tension between the two. It would strengthen the TCA literature and movement to address conflicts between TCA and monetizing nature.

For example, a few stakeholders have commented that the monetization of ecosystem services introduces methodological and philosophical challenges. For example, Nadia El–Hage Scialabba of the FAO at the 2016 TCA Conference in San Francisco said, "Even when market data is used, monetization remains an inaccurate proxy for societal values… [For example,] when the Social Cost of Carbon is chosen, costs vary between $85 to $112 per ton of CO2e, depending on coverage and the choice of key parameters such as discount rate and time-horizon."[10] Furthermore, a visionary for ecological economics, Herman Daly also stated that internalizing all externalities into the economic system is logistically implausible; he states, "Long before such a total takeover of the ecosystem, the human economy and the civilization it supports would have collapsed under the weight of God-like information requirements and managerial complexity."[24] Future research should explore the economic mechanisms that would use the true cost accounting of externalities.

The philosophical conflict around TCA, measuring natural capital, and monetizing nature can be illustrated by controversy around a similar financial mechanism, the Green Development Mechanism (GDM).[23] The GDM established a market-based institutional framework, which would enable payments for companies, consumers, and stakeholders for ecosystem services and biodiversity protection.[23] At a global conference, delegates from Bolivia spoke out against this strategy and claimed that financial resources should come from public funds, not market mechanisms.[23] Their delegate, Carla Ledezma, criticized market mechanisms to achieve positive change, stating:

> *The North has environmental debt because for many years they used our natural resources without paying anything in exchange. Biodiversity cannot be assessed in economic terms. For centuries it has been represented in social and cultural terms… Some would like it to be put on sale saying that we can only save what has value. Now, that is a wrong vision of things. I don't want to expand on capitalism and its nature, we don't want to repeat the same errors.*[23]

This demonstrates the apprehension some groups have with pricing natural capital. Some state that by placing monetary values on ecosystem services, it can simplify and de-politicize the historical and geographical realities that lead to environmental degradation and displacement.[23] Some TCA organizations (specifically those focused on the business perspective), such as Natural Capital Protocol, are criticized for wanting to maintain industries' access to "cheap natures".[23] Raj Patel, author of *Stuffed and Starved*, also sums up the concern of valuing externalities as "who gets to decide?".[25] In other words, environmental valuations may appear to use scientific and "impartial" data tools but the equations include deeply political assumptions.[25] The idea of placing monetary value on the environment is even a profoundly insulting concept according to many indigenous cosmologies.[25] Patel says, "Once you're pricing the materials of nature…the most harm often comes to some of the most politically marginalized people and priorities."[25] Considering the violent history of colonialism, inequitable market systems, neoliberalism, and environmental destruction,

the valuation of ecosystem services has been a cause for concern among various groups. Therefore, future research should critically analyze TCA methodology and its relationship to these issues, while making necessary changes to methodologies that could create additional harm or continue to commit the same mistakes of an extractive economy.

INCORPORATE BEST PRACTICES FOR ACCOUNTABILITY THROUGH TRANSFORMATIVE GOVERNANCE

While research is essential to highlight the hidden costs of cheap food and industrial agriculture, further attention is needed to understand best practices for transformative governance to create structural and institutionalized change. Food Tank's "Real Cost of Cheap Food" report states, "Once the true cost of food is determined, the next major challenge is determining who will bear the cost of the externalities."[14] Yet, a 2013 study from TruCost totaled the globe's "unpriced natural capital"—or the ecological materials and services that businesses do not pay for, such as land use and water consumption—found that none of the world's largest businesses would be profitable if they had to pay for those services.[23,26] The global political economy requires that these costs be externalized in order to make a profit. As Jessica Dempsey states in *Enterprising Nature*, "Convincing decision-makers to internalize the full cost of goods and services produced and provided by nature is like trying to get a Goldman Sachs executive to give up his obscenely high bonus."[23] Many food system publications emphasize the potential for TCA studies to influence decision-making and policy.[5,7,18,20] However, the tension between market-based tools, profit-seeking industry, and the larger equity and sustainability goals of TCA is an ongoing challenge that must be addressed head-on, in order to create fundamental change.[13] TCA work can bolster these efforts by creating greater political clout for concrete action by investigating transformative governance strategies. This will work to establish institutional structures and deep-rooted policies that promote human and environmental health over market gains.

CONCLUSION

TCA research represents a widespread commitment to transforming food systems through the lens of food sovereignty, agroecology and transformative governance. TCA has the potential to generate new knowledge and pathways for structural food system reform by identifying leverage points and trade-offs across diverse sectors and regions. Moving forward, TCA stakeholders must work to incorporate leadership from rural peasants, farmworkers, indigenous groups, and historically marginalized communities in order to create inclusive valuation frameworks. Similarly, organizations working with TCA must aim to set shared goals and define common terms. Stakeholders must work to resolve whether TCA intends to account for food system externalities in order to redistribute public funds or create mechanisms for market forces to internalize externalities. It is crucial to account for the urgent and growing non-monetized costs of the current system, such as malnutrition and the displacement of land-based peoples, in order to find new pathways forward. Connected by shared TCA frameworks, all sectors can work against the foundation of extractive and oppressive systems. Now is the time for radical establishment of a food system that boasts regenerative farms, dignified farm work, vibrant ecosystems and healthy communities.

APPENDIX I: TCA FRAMEWORK COMPARISON

FRAMEWORK	OVERVIEW	STRENGTHS
Institute of Medicine (IOM) "A Framework for Assessing Effects of the Food System" 2015	**Aim:** Recognize effects across the full system and food supply chain. **Framework type:** "Define objective, scope, and impacts of the analysis."[13] ▸ **Food supply chain:** inputs and production, processing and distribution, consumption and waste. ▸ There are four domains of food system effects. Within each domain, there are four dimensions, which measure "how much of what the food system provides, where and to whom it goes, and how sustainably it can do so". **Domains:** ▸ Health, environmental, social and economic **Dimensions to measure:** ▸ Quantity (e.g. consumption, pollutants) ▸ Quality (e.g. nutrition, safety, cultural relevance) ▸ Distribution (where an outcome goes, for example:food access, spatial dispersion of biodiversity, exports) ▸ Resilience (ability to bounce back from sudden shocks and long-term pressures) **Steps:** ▸ Problem, Scope, Scenario, Analysis, Synthesis, Report **Guiding Principles:** ▸ Consider effects across the full food system. ▸ Address all domains and dimensions of effects. ▸ Account for system dynamics and complexities. ▸ Choose appropriate methods for analysis and synthesis.	▸ The framework is simple and easy-to-use. ▸ Could be applicable for various types of institutions, especially research and NGOs. ▸ Uses an indicator approach, which is generally more cost-effective and less time intensive than direct measurement. ▸ Studies using this framework could most likely be completed in 2-3 years. ▸ Mentions budget, time constraints, defining boundaries, as well as baselines, alternatives, statistical analysis, and systematic error. ▸ Describes engaging stakeholders. **AREAS FOR FURTHER TCA DEVELOPMENT** ▸ Could be more comprehensive in their description of how to measure the dimensions and provide examples of case studies, rather than just hypothetical ideas. ▸ Framework could incorporate more concepts from TCA literature, such as food sovereignty and agroecology. ▸ Future developments could utilize more shared lexicon for measurement terms, such as outcome and impact. ▸ Future developments should incorporate leadership and partnership with farmers and POC-led organizations.

FRAMEWORK	OVERVIEW	STRENGTHS
TEEBAgriFood Evaluation Framework "Measuring What Matters in Agriculture and Food Systems" 2018	**Aim:** To make all 'economically invisible' costs and benefits visible, primarily by utilizing a universal and comprehensive Evaluation Framework. **Framework type:** "Standardization of the appropriate and necessary externalities that should be considered."[13] **Capital:** ▸ Natural, human, social, and produced capital **Measure and Value:** ▸ **Value flows:** Act as drivers, some are not economically visible and it is the goal of the TEEBAgriFood framework to utilize valuation techniques to estimate invisible prices. There are four types of flows: ▸ Agricultural and food production and consumption ▸ Purchased inputs to production ▸ Ecosystem services ▸ Residual flows **Capital stocks:** Changes to stocks are outcomes **Impacts:** Positive or negative contribution to the dimensions (health, environment, social, and economic). **Steps:** ▸ Measure and value stocks and flows, outcomes and impacts. ▸ Assess across agriculture and food value chain. **Guiding principles:** ▸ Universality, comprehensiveness and inclusion.	▸ Framework uses economic assessment that may work well for national government and global decision-making. ▸ Very comprehensive, especially in their description of food system challenges and principles for a shared framework. ▸ Published from the UN, demonstrating a global reach. ▸ Mentions how to define boundaries. ▸ Could provide research for improving national accounting systems. **AREAS FOR FURTHER TCA DEVELOPMENT** ▸ Could include clear steps for measuring the economic dimensions, in order to make these assessment tools more accessible for food system stakeholders. ▸ Timeline for study applications may be longer, develop strategies to work within a shorter timeline. ▸ Future developments could use more shared lexicon for measurement terms, such as domain and dimension. ▸ Future developments should incorporate leadership and partnership with farmers and organizations led by people of color.

APPENDIX II: TCA DEFINITONS

ORGANIZATION	TCA DEFINITION AND CONCEPTUALIZATION
Food Tank	"True Cost Accounting (TCA) is an economic model that allows all of us, as eaters, to understand the full cost of everything that goes into producing food. From fertilizer production and fossil fuel use, to algae blooms and antibiotic resistance."[14]
	"TCA in agriculture principally helps us to understand the impacts, both positive and negative, that agricultural practices and food systems have on three areas: environment, society, and the economy. In addition to measuring the negative costs associated with food production, TCA can help account for positive impacts of the food system on communities, society, and environment. Ultimately, TCA models can lower the cost of food produced sustainably, while incorporating negative externalities into the retail price of 'cheap' food."[14]
Global Alliance for the Future of Food	"TCA is a mechanism for reform within research and knowledge exchange—research advances methods of TCA so that policy makers can make informed decisions."[15]
	"A critical tool to help us, as a global community, better understand the impacts of food systems, address the most harmful practices, and find new, positive pathways forward. By evaluating the impacts—both positive and negative—inherent in different food systems, and making these impacts transparent, decision-makers on farms and in governments, institutions, and businesses can make better informed decisions that take into account the economic, environmental, and social impacts of their choices."[5]
	"[TCA] aims to make the full costs and impacts of food visible by investing in efforts to identify, measure and value the positive and negative environmental, social and health externalities of food systems, and to deploy innovative strategies to effect associated policy and market changes."[20] *Lauren Baker, Director of Programs*
	"We aim to make visible the full costs and impacts of food by investing in efforts to identify, measure, and value the positive and negative environmental, social, and health externalities of food systems, and to deploy innovative strategies to effect associated policy and market change."[5] "Through our work on TCA, we aim to see: TCA established as a scientifically validated approach that informs policy and practice toward healthy and sustainable food systems amongst governments, agriculture stakeholders, corporations, the finance and investment community, and other relevant stakeholders. A robust global dialogue on the importance and potential of TCA for food systems that strengthens TCA's systemic approach (including climate, health, and agroecology), and the utilization of shared frameworks and tools to inform decision-making. TCA actively applied to business analysis, dietary comparisons, farm typologies, policy analyses, and national or corporate accounting, informing and informed by the broader TCA work of Global Alliance member foundations."[5]
Lexicon of Food	"A practice that accounts for all external costs—including environmental, social and economic—generated by the creation of a product."[27]

ORGANIZATION	TCA DEFINITION AND CONCEPTUALIZATION
Sustainable Food Trust	"Identifying, categorizing, quantifying, and putting a price on the range of costs and benefits arising from different production systems and developing various mechanisms through which we can ensure that in the future, polluters will pay and those that are producing healthy and sustainable food will be better rewarded financially than those whose food production systems are damaging the planet and undermining public health."[14]
	"The objective of the emerging discipline and science of TCA is to overcome these key barriers to change by identifying, categorizing, quantifying and monetizing the range of impacts, both positive and negative, of different farming and food production systems on environmental, natural, social and human capital."[20] Patrick Holden, Founding Director
TEEBAgriFood	"The hidden costs of the global food trade are largely not known or recognized by policy makers. It is such externalities and invisibles that are a focus of true cost accounting in agriculture and food, and thus this report."[7]
Unraveling the Food Health Nexus	"Full Cost Accounting or True Cost Accounting approaches can help to bring to light the true cost of cheap food, and to consider where these costs fall and the extent to which they offset any pro-poor impacts of the current model."[28]

Agroecology: A science, practice, and movement rooted in traditional agriculture and ecological practice; it is knowledge intensive (rather than capital intensive) and emphasizes small, highly diversified farms and local, farmer-to-farmer knowledge sharing.[21]

Capital: The economic framing of the various stocks in which each type of capital embodies future streams of benefits that contribute to human well-being.[12]

Dimension: Categories in the IOM framework to measure—quantity, quality, distribution, and resilience—within each domain (health, environmental, social, and economic).[11]

Domain: Four subsets of food system effects: health, environmental, social, and economic.[11]

Driver: "A flow which arises from the activities of agents (i.e. governments, corporations, individuals) in eco-agri-food value chains, resulting in significant outcomes and leading to material impacts."[12]

Externality: "A positive or negative consequence of an economic activity or transaction that affects other parties without this being reflected in the price of the goods or services transacted."[12]

Flow: "A cost or benefit derived from the use of various capital stocks (categorized into agricultural and food outputs, purchased inputs, ecosystem services and residuals)."[12]

Food Sovereignty: A state in which empowered communities everywhere work together democratically, so that: farmers, ranchers, and fishers have control over their lands, water, seeds and livelihoods; all people have access to healthy, local, delicious food; the food system ensures health, justice and dignity for all.[29]

Framework: "An approach for describing and classifying the range of outcomes/impacts for a given scope and value chain boundary, and caused by specified drivers, that answers the question 'what should be evaluated?'"[12]

Human Capital: "The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being."[12]

Natural Capital: "The limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services."[12]

Produced Capital: "all manufactured capital, such as buildings, factories, machinery, physical infrastructure (roads, water systems), as well as all financial capital and intellectual capital (technology, software, patents, brands, etc.)".[12]

Social Capital: "Encompasses networks, including institutions, together with shared norms, values and understandings that facilitate cooperation within or among groups."[12]

Systems thinking: "An approach that focuses on the identification of interrelationships between components of a system."[12]

Transformative Governance: "An approach to environmental governance that has the capacity to respond to, manage, and trigger regime shifts in social-ecological systems (SES) at multiple scales".[19]

True Cost Accounting: "A critical tool to help us, as a global community, better understand the impacts of food systems, address the most harmful practices, and find new, positive pathways forward. By evaluating the impacts—both positive and negative—inherent in different food systems and making these impacts transparent, [so that] decision-makers on farms and in governments, institutions and businesses can make better informed decisions that consider the economic, environmental and social impacts of their choices."[5]

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