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A Decision Theory Perspective on Wicked Problems, SDGs and Stakeholders: The Case of Deforestation

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Abstract

The Sustainable Development Goals (SDGs) are an opportunity to address major social and environmental challenges. As a widely agreed framework they offer a potential way to mobilise stakeholders on a global scale. The manner in which the goals, with time-based targets and specific metrics, are set out within a voluntary reporting process adopted by both governments and business, provides a fascinating and important case for organisational studies. It is both about advancing performance measurement and evidence-based policy-making for sustainable development, and also participation and consultation at a wider, more global scale, than has ever been possible before. This paper contributes to the notion of SDGs as a wicked problem, answering calls for deeper theorisation, via synthesis with core ideas in the management field of decision theory. A case study on the wicked problem of deforestation and its links to supply chains, multi-stakeholder initiatives and SDG reporting, provides an illustration of the relevance of the application of decision theory to wicked problems, presented using a novel conceptual framework. This helps to illustrate new avenues for research and practical application regarding the balance of technocratic and participative approaches for sustainable development.

Keywords SDGs · Wicked problems · Decision theory · Supply chains · Deforestation

Introduction

The Sustainable Development Goals from a Management Studies Perspective

The UN Sustainable Development Goals (SDGs), or Global Goals for 2030, aim to eliminate poverty and hunger, provide a minimum level of education and healthcare for all, halt deforestation, and a host of other ambitions. The vision is to achieve this for all people within what is now, at the time of writing, less than a decade. The Covid-19 pandemic has also significantly impacted the prior trajectory for global development. The UN (2020) SDG report highlights rising mass unemployment as one of the most significant impacts, and 71 million people expected to be pushed back into extreme poverty—the first rise since 1998 (UN, 2020).

Balancing the economic impact against social and environmental impact has been a constant concern of politicians throughout 2020. Prior to the Covid-19 pandemic, the SDGs have been described as a wicked problem, and that description is amplified further in the context of the pandemic (van Zanten & van Tulder, 2020). The pandemic has also revealed that as a system of reporting, the SDGs have lessons to learn from management studies. The SDGs are somewhat like corporate accounts, looking backwards over past performance. UN (2020) describes global health emergencies, by contrast, as needing rapid communication of information to swiftly mobilise responses to limit negative impacts. The Covid-19 pandemic response required fast, reactive, short-term data for progress. The SDGs are slow and long-term, and their progress is largely considered retrospectively rather than proactively and strategically. To translate long-term strategic goals into operations-level actions to direct resources and engage relevant stakeholders, some additional theorising is beneficial.

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This paper explores the nature of SDGs in relation to wicked problems (Rittel & Webber, 1973) and seeks to provide fresh theoretical depth to recent discussion. Waddock et al. (2015) consider large system change as a wicked problem under conditions of complexity; Dentoni et al. (2018) discuss multi-stakeholder partnerships as a means to address wicked problems; Termeer et al. (2019) consider the effectiveness of wicked problems as a concept in policy studies. Reviewing some 40 years of literature on wicked problems, Peters and Tarpey (2019) state the "popularity of the concept has led to its overuse, and has produced significant conceptual stretching…which…has led to the application of the concept to issues which are not 'wicked' in any meaningful sense." (ibid. page 218).

Some stronger theoretical foundations can help support understanding and bring in potential lessons and insights. The research presented here is primarily conceptual. As described by MacInnis (2011), the conceptual contribution is relating and integrating, with some differentiation. A 'reciprocal synthesis method' (Denyer et al., 2008; Tranfield et al., 2003) is used to show concepts in different fields are essentially different ways of describing the same phenomena, and where and how they differ. A conceptual framework is provided (CF1), synthesising the concepts in wicked problems with parallel ideas in management topics of decision theory, as well as strategic management, the philosophy of science (epistemology) and mathematics. A timeline also shows the parallel development and progression of these ideas.

'Wicked problems' was a term created at a particular moment in history, and this paper reviews that background in order to show assumptions present in its foundations, and subsequent evolution and application. It originated in an interdisciplinary discussion between management science and urban planning policy [described in Skaburskis (2008)], and was taken up especially in policy studies, and also other fields (Head, 2019). The synthesis undertaken here centres on applying parallel and subsequent concepts from decision theory, which is a foundational discipline between management science and behavioural economics, as well as psychology and computer studies.

Participatory vs. Technocratic Approaches to the SDGs

Sustainable development, and the SDGs specifically, can be described as a wicked problem, and to do so suggests something about the underlying complexity and difficulty achieving them. Yet they are also seen as advancing the cause of national statistical analysis to improve the evidence-based policy making needed to deliver progress. The 17 goals of the SDGs intended to be met by 2030 are backed up by 169

specific targets, measured using 232 metric indicators.[1] This suggests that the problems of sustainable development have been formalised in a more comprehensive way than ever before, providing a new *lingua franca* for governments, development agencies, businesses and other stakeholders. With the goals agreed unanimously by all nations at the UN summit in 2015, and with the support of business and NGOs, seen as vital stakeholders, this suggests significant potential for advancing progress. But, as described by Fukuda-Parr and McNeill (2019), two parallel activities in the creation of the SDGs set a dichotomy in place that provides a revealing context to the current status of the SDG programme and their nature as a wicked problem. This distinction is between the 'participatory' and the 'technocratic' approaches to SDGs.

The participatory approach extends from principles of universality on the basis that all people deserve the minimum standards of a decent way of life, as established by the 1948 United Nations' Universal Declaration of Human Rights. This was founded in the aftermath of the Second World War as a new moral framework based on principles of equity and justice to try to prevent repeated waves of intense human suffering. When developing the SDGs from their forerunner, the Millennium Development Goals (MDGs), the Open Working Group of the UN General Assembly sought to overcome the criticism of the MDGs as lacking participation and consultation with developing countries, by creating a substantial stakeholder engagement programme for the SDGs. This was run under the 'Rio+20: The Future We Want' programme and was to broaden the input to include civil society organisations (CSO), academia and businesses as stakeholders needed for successful delivery.

This participatory approach represents an opportunity to overcome inherent complexity in the SDGs, and hence is in-line with the conception of them as a wicked problem. Solving these problems requires the participation of all relevant parties, or stakeholders. This fits with research on multi-stakeholder partnerships as ways to address wicked problems (Dentoni et al, 2018) and on the UN Global Compact as a forum to engage business as a key stakeholder (Rasche & Waddock, 2014) as well as decision theory concepts on the need for multiple perspectives to address complex problems (described below). However, a participatory approach to forming the SDGs is distinct from one required to deliver the SDGs, and progress here deserves greater attention.

In parallel, the 'technocratic approach' to the SDGs was set in motion by the UN's High-Level Panel of Eminent Persons (HLP) to provide a report to inform inter-governmental

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[1] As the SDG indicators and metrics remain in development, the full list is maintained as an online database, where the latest list can be downloaded in various formats: https://unstats.un.org/sdgs/indicators/database/.

negotiations using a 'science-based' strategy that required 'evidence based analysis.' This approach was essentially instrumental, in the spirit of the aphorism that in order to manage something one must first measure it. This approach to the SDGs is epitomised by calls, such as by Lu et al. (2015), for better infrastructure for data collection and monitoring, and the need for standardisation and verification in order to enable scientific methods of management. Better data is seen as needed to provide the ability to better predict-and-provide.

However, technocratic delivery from setting targets to laying out management strategies to meet them is not necessarily straight-forward. To quote Fukuda-Parr and McNeill (2019), "The choice of measurement…brings politics to data…numeric indicators used as policy tools in governance have specific properties that…in fact embed theories, values, and ideologies." (ibid, page 6) In the formulation of the SDGs, the technocratic approach met resistance driven by a sense of injustice about donor-led, North–South power structures manifested in the MDGs. Burke and Rürup (2019) describe the political power struggles taking place around the processes of indicator selection, and the resulting negotiated consensus, describing, "the SDG framework as a 'political thriller' in which the power struggles are hidden behind the veil of technocratic expertise." (ibid, page 137).

We have the notion of the SDGs as a wicked problem, emphasising the critique of the strictly technocratic approach, and a participatory approach seeking to involve multiple perspectives. This illustrates the persistence of political power in such a large multi-stakeholder forum, despite the intention of preventing a single technocratic viewpoint shaping proposed interventions. Doing so risks their not being successful precisely because they fail to take into account the role of complex socially embedded factors.

Yet, despite the contrasts between the participatory and technocratic approaches, we suggest that they are both relevant for the process of developing and implementing the SDGs. The SDGs contain both a need for technocratic reporting of progress against targets and indicators (classical performance measurement, developed by management scholarship and enacted through civil service bureaucracies, agencies and other organisations), and participatory, ethical, undertakings regarding justice and equity, some of which has been formalised through a bureaucratic lens in certain targets.[2]

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[2] For example, SDG 16 targets on equity and justice includes 16.3 'Promote the rule of law at the national and international levels and ensure equal access to justice for all', '16.6 Develop effective, accountable and transparent institutions at all levels', '16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels', '16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance'.

Scale and Focus

Part of the issue in differentiating between the two approaches is one of scale and focus. While the goals are a responsibility of governments to report on, the delivery requires many actors across, government, business and civil society. Measuring impacts is something at a macro-scale, and reported retrospectively. However, managing impacts is about stakeholder participation to achieve large-scale change (Dentoni et al., 2018; Reinecke & Ansari, 2015; Waddock et al., 2015). The notion of focus is that looking beneath the top level SDG goals shows a large number of more specific targets. Any one of these could be the focus of extensive data collection, participatory engagement and consideration in alignment with company strategies. Each target can be considered at a national level, or across specific sectors, suggesting vast alternative constellations of participation. The organisation of such participation processes could be potentially vast, and so forms of engagement need focus. More work is needed therefore on the nature of participation and how stakeholders can be considered as part of decision-making processes.

This study makes a novel contribution by introducing decision theory into the organisational studies and business ethics literature on participatory approaches and wicked problems. In the next section, "Conceptual Review: a Decision Theory View of Wicked Problems", we bring both the participatory and technocratic approaches together within one conceptual framework. Following the guidelines of Fawcett et al. (2014) and MacInnis (2011) on conceptual contributions, this shows the parallels between constructs across various disciplines, providing conceptual rigor and clarity to deepen the understanding of wicked problems. This responds to the issues identified by Peters and Tarpey (2019) (quoted above) that overuse of the wicked problem term has diluted its meaning, requiring a strengthening of the theoretical foundations.

The next section provides an account of parallel concepts from decision theory, systems theory, strategic management, and the philosophy of science. This culminates in a comparison matrix (MacInnis, 2011) and a summary conceptual framework (CF1). Section "Case Study on Deforestation in Supply Chains and the SDGs" then describes a case study (Yin, 2009) on stakeholders involved in the wicked problem of deforestation associated with global commodity supply chains. This provides an opportunity to then consider the conceptual framework in light of the sustainable development challenge captured by the SDG targets on cutting tropical deforestation alongside those on raising agricultural commodity production. Engaging in this case study and the related attempt by stakeholders to act on the issue, alongside consideration of the SDGs, allows for theory elaboration according to the case study method of Ketokivi and

Choi (2014). This then leads to a novel extension of the conceptual framework, dubbed CF2, providing insight into the nature of the SDGs and multi-stakeholder partnerships. In the section "Discussion and Conclusions", wider practical and theoretical implications, and a future research agenda, are then proposed.

Conceptual Review: a Decision Theory View of Wicked Problems

The technocratic and participative approaches to the SDGs and the description of them as a wicked problem are not considered via a literature review of decision theory. The list is not exhaustive of everything ever written on this topic, but sufficient in contrasting ideas to enable the formulation of the synthesis model and conceptual framework. A key text is the overview of the historic evolution of decision theory provided by French et al. (2009).

The Rational vs. Behavioural Branches of Management Decision Analysis

The history of decision theory is central to the history of management studies, with its starting point being Taylor (1911) *Principles of Scientific Management*. This presented the—then radical—proposal that management should follow scientific principles of measurement, analysis and prediction, according to the instrumental reasoning of Newtonian physics. This grew with the rise of the accounting profession, concerned with external reporting as a legal requirement and the development of management accounting, which sought rational decision making over the allocation of resources. 'Strategic planning' became a mainstay of corporate life by the mid twentieth century, in particular as a result of advances made during the Second World War and the creation of 'Operational Research' (OR) via the work of Blackett (Kirby & Rosenhead, 2011), Churchman et al. (1957), and Forrester (1948, 1958). OR focused on optimisation and efficiency, and the development of systems theory, extending cybernetic control theory as 'industrial dynamics' (Kast & Rosenzweig, 1972). The OR and Management Science field grow from this point and remain a hugely powerful influence in the world, at the heart of what is now also called 'analytics', 'big data', and 'data science'. The 'technocratic' element in the SDGs, shown by Lu et al. (2015) illustrates the extension of management science ideas into global policy via sustainable development and related fields of economics, ecology, etc. These foundations are important to appreciate the opportunities and problems of such an approach.

The underlying notion of rational decision-making is referred to in decision theory as 'normative' or ideal branch of analysis. This distinguishes it from the empirical, or 'behavioural' branch of decision analysis, which looks at how people actually make decisions in reality. This branch is anchored in psychology, where the human tendency towards certain types of cognitive bias distorts the ability for ideal, 'rational' decision-making in practice (French et al., 2009).

This second branch draws its lineage from Simon (1947), who argued that managers are constrained in their thinking by 'bounded rationality', where a lack of sufficiently accurate or timely data, plus various behavioural biases, made the rational, scientific management proposed by Taylor, difficult or impossible to achieve. This led to the 'behavioural theory of the firm', helping develop the field of organisational studies (Cyert & March, 1963; March & Simon, 1958) as distinct from OR, and seeding the field of behavioural economics (for which Simon won the Nobel prize in 1978). Simon was also active in defining the abilities and limits of decision-making in the computer age, and the role of human creativity in design thinking. In later works, mathematical complexity was also added as a source of bounded rationality (Fernandes & Simon, 1999).

From General Systems Theory to 'Soft Systems Methodology'

Forrester (1958) pioneered cybernetics/control systems theory that saw an organisation as like a mechanical system, where feedback loops sought to optimise performance to a desired equilibrium. Forrester's PhD student, Meadows, later extended this systems model to look at not just organisations as systems, but the whole economy as an economic system, linked to a social system, in turn linked to an ecological system. The 'whole world system model' was used to develop *The Limits to Growth* report (Meadows et al., 1972), a seminal publication in the development of the sustainable development concept. It promoted the concepts of 'systems thinking' and related terms such as 'systemic', or 'holistic', and the notion of a need to be 'in harmony with nature' (Dearing et al., 2014; Nielsen et al., 2019; Steffen et al., 2018).

However, Checkland (1972, 1980, 2000) offered significant criticisms of the fundamentals of systems theory, and its use in both management science and in strategic planning by industry. Through close engagement with industry, Checkland argued that the mainstream approach to rational management decision-making assumed what he called 'hard systems' or 'hard OR', which is an essentially mechanical view. A degree of stability, structure or rigidity was required in the organisational or socio-economic system in order for recorded information to be capable of rendering a predictable outcome. Checkland argued that management science using systems theory was flawed as the related decision models failed to account for the plural perspectives that multiple actors had on the nature of a problem. Furthermore, the

speed with which the system would change could make the analysis out of date before it could be applied.

Checkland's response was to develop 'soft systems methodology' (SSM) (Checkland, 1972, 1980, 2000) to outline processes for engaging all relevant parties ('stakeholders') in a method of deliberative participation to determine their perspectives. This wider 'soft' system included non-metric considerations, and novel methods of using 'rich pictures' to map perceptual issues in social systems and political systems. SSM has been extensively adopted to consider wicked problems, organisational learning, dynamic systems and so forth (Antunes et al., 2016; Augustsson et al., 2019; Tavella & Hjortsø, 2012; Zhou et al., 2007). SSM is notable as a form of participative, group decision making process centred on the idea that no-one has an agreed view of the problem. As an empirical, rather than abstract, method, it pioneered principles of action research and was developed through Checkland's empirical work with industry on how to solve practical problems.

Checkland (1972) on soft systems theory in management paralleled Rittel and Webber (1973) in the fields of planning and policy science. The context and terminology were different but both presented an essentially similar critique of technocratic management science, defined and delivered using general systems theory. This common underlying characterisation of the limits of knowledge regarding 'complex social systems' also echoed Weaver (1948) and Popper (1965) in the field of the philosophy of science, and Simon (1947) in administrative management.

Essentially, all of these scholars show that epistemology—what can be known, and how can one act as a result—has limits, which Simon referred to as 'bounded rationality' (ibid). What differed was the terminology used, and in a very much pre-internet era, it was difficult for interdisciplinary connections to be drawn. The dominance of the systems theory view from the late 1950s to late 1960s is clear from this literature, and its persistence can be seen by its adoption in environmentalism (Meadows et al, 1972).

Structured and Unstructured Decision Contexts

Another parallel is between structured and unstructured types of decision problem. Decision making in organisations often reflects the hierarchical level of the decision maker (Jacques, 1976; French et al., 2009). At the operational level, highly structured decisions are bureaucratic, standard operating procedures where responses are essentially automatic and procedural. At the middle management level, tactical decisions such as in, say, marketing or new product development, may need analysis of quantitative data to direct resources, epitomizing the technocratic tradition. At the top management level, strategic decisions are the responsibility of the board of directors and CEO. These are the most

long-term, uncertain and unstructured types of decision, where experience, judgement and intuition are most valuable as a means to make decisions.

Martin (2014) criticises the persistence of the mid-twentieth century technocratic notion of 'strategic planning' and underlines that strategic decisions are really about taking risks, and hence by definition cannot be known for certain via data. The history of strategic management, evolving from strategic planning, has similarly noted a divide between 'planned strategy' and 'emergent strategy' (Martin, 2014; Mintzberg et al., 1976; Mintzberg & Waters, 1985; Mintzberg & Westley, 2001), where planning entails the notion of predict-and-provide, command-and-control, and emergence entails judement regarding risk, and responsiveness to opportunity or crisis. Each of the above echoes the divide between tame and wicked problems in Rittel and Webber (1973).
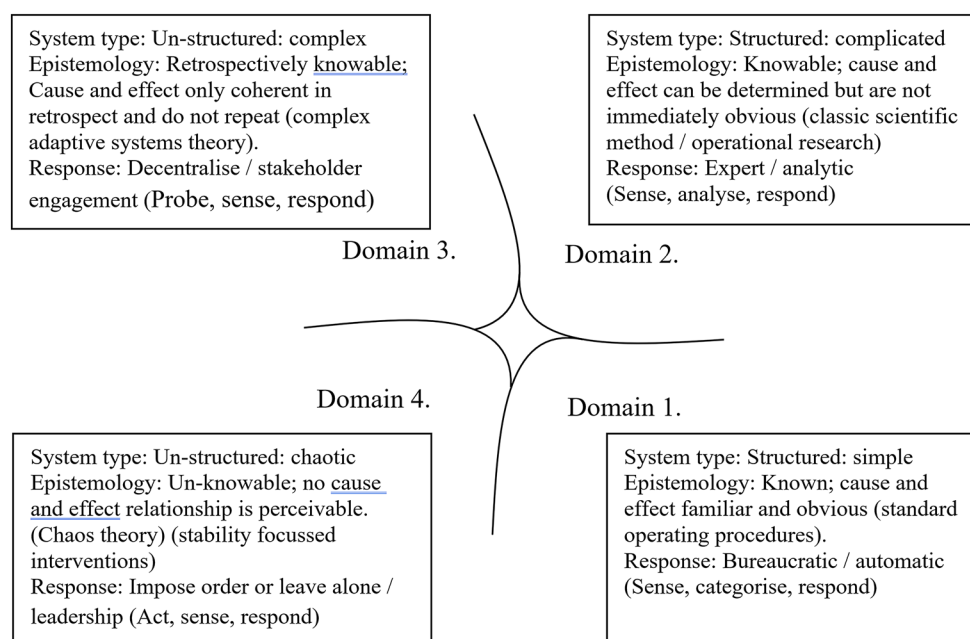
While the description of the phenomena of stable, predictable circumstances and unstable, unpredictable circumstances is common across all of the above, later developments in management scholarship have provided additional depth to the explanation. French et al. (2009) in summarising the history of decision theory, suggest the Cynefin framework (Snowden & Boone, 2007)[3] as encapsulating underlying ideas from chaos theory (Lorenz, 1963) and complexity theory (Nicolis & Prigogine, 1977; Prigogine and Stengers, 1984)[4] in mathematics, and creating a meta-model of approaches to decision making, leading to specific recommended actions by managers. The framework is helpful in illustrating how a system can move from ordered to disordered, and from disordered to ordered, in a dynamic way, and for providing recommendations to managers for each stage. It defines four domains (see Fig. 1) to describe decisions:

(1) Structured: simple.
(2) Structured: complicated.
(3) Unstructured: complex.
(4) Unstructured: chaotic.

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[3] Cynefin, pronounced Kuh-Nevin, is a Welsh word broadly meaning sense-of-place, combining location and heritage, or social-and-physical habitat. Snowden uses it to suggest the broad socio-cultural influences on mind-set that can shape how we try to answer problems.

[4] Chaos theory proves the principle of 'sensitivity to initial conditions' in non-linear relationships, whereby infinite accuracy would be needed for accurate prediction. Hence, bounded rationality exists whenever there is non-linearity. Complexity theory demonstrates the mathematics of autopoiesis, whereby order can emerge from chaos. The interplay of order and chaos at a mathematical level provides a foundation to the structured and unstructured, or tame and wicked contrast. The Cynefin framework builds on this foundation in its recommendations to management (Snowden & Boone, 2007).

Fig. 1 The Cynefin frame-work. The curved arms are to distinguish from a graph with measurable x and y axes. The 'sense/respond' brackets indicate Snowden's sense-making and action model (see Snowden & Boone, 2007)

System type: Un-structured: complex Epistemology: Retrospectively knowable; Cause and effect only coherent in retrospect and do not repeat (complex adaptive systems theory). Response: Decentralise / stakeholder engagement (Probe, sense, respond)	System type: Structured: complicated Epistemology: Knowable; cause and effect can be determined but are not immediately obvious (classic scientific method / operational research) Response: Expert / analytic (Sense, analyse, respond)

Domain 3.　　　　　Domain 2.

Domain 4.　　　　　Domain 1.

System type: Un-structured: chaotic Epistemology: Un-knowable; no cause and effect relationship is perceivable. (Chaos theory) (stability focussed interventions) Response: Impose order or leave alone / leadership (Act, sense, respond)	System type: Structured: simple Epistemology: Known; cause and effect familiar and obvious (standard operating procedures). Response: Bureaucratic / automatic (Sense, categorise, respond)

This forms a bridge between the two camps of 'rational scientific management' and 'bounded rationality' first distinguished by Simon (1947), such that it is about knowing when classical management science is effective and when it is not. A similar distinction can be found in Rittel and Webber (1973) between tame problems and wicked problems—but crucially, rather than taking an exclusionary view, we consider both sides as being well-adapted to given contexts, and hence both elements are worthy of exploration and theorisation.

Decision-making techniques building on the notion that one side enables control (technocratic), while the other must rely on emergence (participation), can be seen in supply chain management. For example, the multiple perspectives of supply chain actors on a problem can be incorporated into complex dynamic systems modelling. The principle of subsidiarity (decentralising responsibility to the lowest level possible) can enable the emergence of a (soft system) logistics network that is superior to the prior (hard systems) approach of centrally attempting to forecast, predict and centrally control the design of a logistics system (Choi et al., 2001; Nair et al., 2009; Pathak et al., 2007).

While this is a strong demonstration of complexity modelling, in a logistics network we can assume that different actors have the broadly similar objectives of minimising the time and cost of deliveries. With wicked problems, participants are often in dispute over the nature of the problem, lack common goals, dispute the views of others, all while the situation may be changing rapidly. This useful conceptual addition is highlighted by SSM as a form of social problem formation (Checkland, 2000). The tension between the potential of good data to get things done, versus issues of who controls data, for what purposes and with what consequences, is a relevant aspect in the delivery of the SDGs.

Alternative-Focused Decision Analysis vs. Value-Focused Decision Analysis

A juxtaposing body of work in decision theory is that of Keeney (1992, 1996), which considers ethical decision-making as demonstrating a different approach to data and metrics. Keeney defines all of the classic OR decision models as seeking to make a rationally optimal choice from available alternatives. Different options are weighed up and assessed according to various rankings of their relative desirability using methods such as multi-criteria decision analysis and a consideration of trade-offs.

However, this approach of 'alternative-focused decision analysis' (AFDA) presupposes that all the obvious options are definitive and well understood. Under bounded rationality, this is not the case. Deciding only from a pre-supposed range of options is a very limited approach. Instead, Keeney suggests 'values-focused decision analysis' (VFDA), whereby all options can be discounted if they do not align with one's values, principles or intended end-goals (Keeney, 1992, 1996). This prompts a more creative approach to problem solving, discards the concept of trade-offs or synergies (as these are about optimising known alternatives), and bypasses the 'analysis paralysis' or 'information bias' that can occur when managers think they need more data before being able to make a decision. Some managers, even CEOs, can feel that they are not empowered to make decisions without a detailed set of calculations as justification. Goebel et al. (2012) explain that this is because managers

in publicly-listed firms are forced to justify their actions to investors, but manager-owned firms are much less susceptible to this and so are able to make decisions on the basis of ethical values. This is an example of VFDA, which can be intuitive, whereas AFDA makes reference to a quantitative, 'computational' argument of costs-and-benefits.

In relation to the Cynefin framework, VFDA can overcome the predominance of a Domain 2 predict-and-provide mindset. It can provide a heuristic shortcut that completely side-steps the need to seek to weigh-up alternatives in a 'trade-off' model, or bring them together in 'synergy'. By contrast, VFDA seeks alignment of options to a set of principles, which can result in all alternatives being discounted. Recent application of this to business sustainability is provided by Benkert (2020). This can further be considered as a contrast between rules-based decision making, which best suits a structured decision problem, and principles-based decision making. French et al. (2009) suggest ways to balance rational, normative decision analysis and empirical, behavioural decision analysis, called prescriptive decision analysis. Here, an understanding of the nature of bias informs the rationalist process. This helps show that all of these techniques are tools to help inform the decision maker as to how to best make a decision.

Summary

Figure 2 (below) shows a timeline locating wicked problems within a broader context of management studies concepts, frameworks and theories concerned with structured or unstructured contexts. Table 1 (below) then provides a more detailed account of the parallels between these. Figure 3 then displays the contrasts in a basic conceptual framework (CF1), derived from the literature review. The next section details a case study to examine the appearance of these themes in relation to multi-stakeholder engagements to advance deforestation-free supply chains and the role that the SDGs might play in this.

The continuum of concepts shown in Table 1 is presented in Fig. 3 (below) as a dual track flow chart. First there is a problem requiring a decision. This sits within a decision context, which shapes the way in which the issue is addressed (Snowden & Boone, 2007). The decision maker may be an individual in a position to shape an initiative (including whether or how to adopt a participative, deliberative approach), and a decision is assumed, by definition, to be something that will lead to an action (French et al, 2009). The third step shows the tame problem/wicked problem distinction and parallel concepts from decision theory shown in Table 1 (below). These correlations provide an opportunity for deeper theoretical examination in tandem with practical application, discussed below.

Case Study on Deforestation in Supply Chains and the SDGs

Method

The case considered here takes the wicked problem of deforestation, investigates how it is reflected in the SDGs, and engages in stakeholders involved in this topic. Deep investigation of the setting has been undertaken, with careful reading of professional reports, interviews with experts, and participation in meetings and field trips, totalling some 29 h of audio data collection. Through the empirical data collected, the initial theory is then elaborated in response to the evidence, generating propositions that can be further explored or tested in future research.

Yin's description of the case study method is that it, "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p2). It is well suited to phenomena that are novel or poorly understood, but is distinct from other qualitative methods such as ethnography and grounded theory, in that it includes some theory development prior to data collection.

The case process begins with a research question and propositions, a specific unit of analysis to define the case against its context, a logic linking data to the propositions, and criteria for interpreting the findings (ibid. p29). Data is linked to propositions via pattern matching for explanation building. Hence, the conceptual framework established from literature on decision theory and its reciprocal synthesis with wicked problems, is a correct foundation for a case study. Table 2, below, then shows the validity and reliability criteria.

As Ketokivi and Choi (2014) explain, it is a unique characteristic of case study research to be able to adapt an existing theoretical model on the basis of empirical evidence, in contrast to research methods where theory is either generated from data (grounded theory) or theory is tested (large-n quantitative research).

The initial questions are:

1. How do the SDGs address the wicked problem of tropical deforestation?
2. How do companies address deforestation in their supply chains, and to what extent do they use the SDGs to do so?
3. How is the understanding of deforestation and the SDGs as a wicked problem improved by decision theory (and how might the evidence prompt adaptation to the CF1 model to form CF2)?
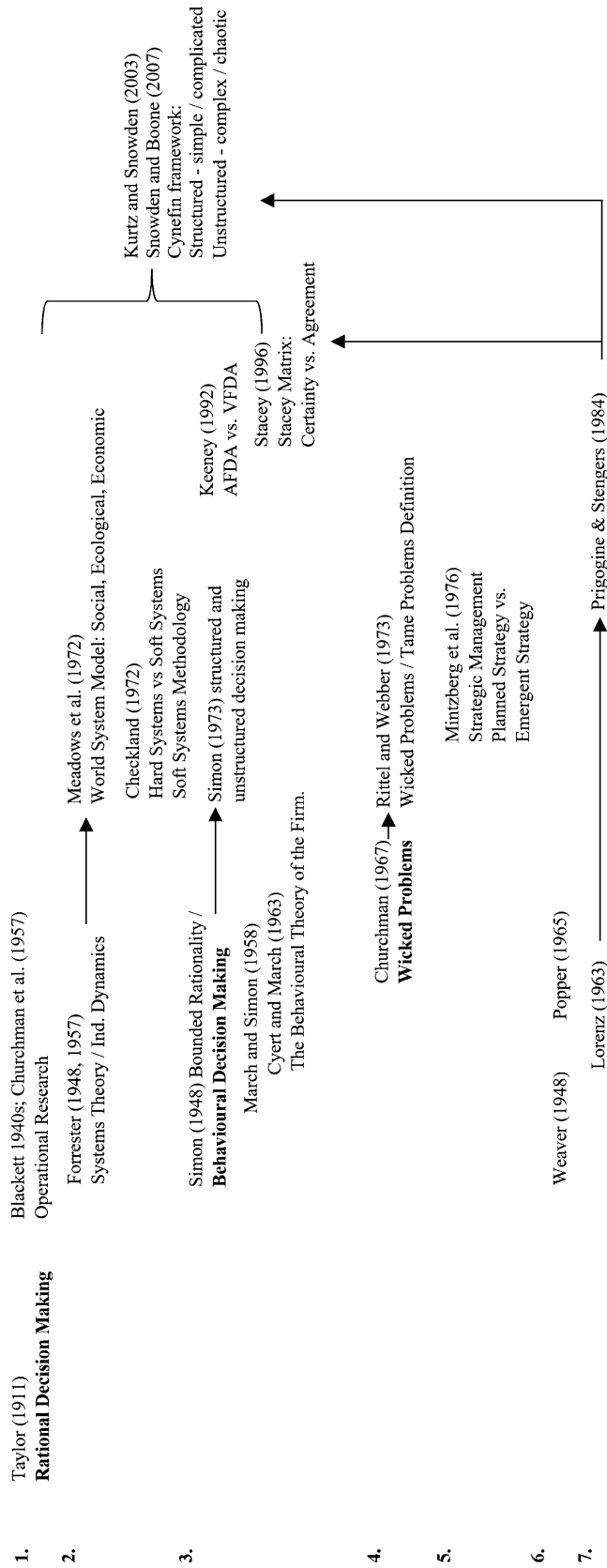
Fig. 2 Timeline of parallel idea concepts across different fields. 1: Operational Research/Management Science. 2: Systems Theory, 3: Behavioural decision theory, 4: Wicked Problems (social policy), 5: Strategic Management, 6: Epistemology/Philosophy of Science. 7: mathematics

Table 1 Comparison matrix of philosophy of science, decision theory, strategic management and wicked problems concepts

Author	Conceptual range across fields: Tame problems ⟷ Wicked problems				
Weaver (1948)	Problems of simplicity	Problems of organised complexity	Problems of disorganised complexity		
Simon (1957)	Optimising (rational decision making)		Satisficing (behavioural decision making)		
Simon (1960)	Structured decisions		Unstructured decisions		
Lorenz (1963)	Linear systems		Non-linear systems		
Popper (1965)	Clock-like problems		Cloud-like problems		
Checkland (1972) 'Soft Systems Methdology'	Hard systems		Soft systems		
Rittel and Webber (1973)	Tame problems		Wicked Problems		Critical problems (Grint, 2005)[a]
Mintzberg (1978)	Planned strategy		Emergent strategy		
Prigogine and Stengers (1984)	Order	The edge of chaos	Chaos		
Stacey (1996) 'Stacey Matrix'	Rational		Political or Judgemental	Edge of Chaos	Chaos
Keeney (1992, 1996)		Alternatives-focused decision analysis	Values-focused decision analysis		
Mintzberg and Westley (2001)	Thinking First	Seeing First			Doing First
Kurtz and Snowden (2003); Snowden and Boone (2007) 'Cynefin framework'	Structured: Simple (known) Bureaucracy (Domain 1)	Structured: Complicated (knowable) Classical Science (Domain 2)	Unstructured: Complex (retrospectively knowable) Stakeholder participation (Domain 3)		Unstructured: Chaotic (unknowable) Leadership/crisis management (Domain 4)
French et al. (2009) Organisational pyramid (after Jaques, 1976)	Automatic decisions Standard operating procedures Short term	Tactical decisions Middle Management Medium term	Strategic decisions Board level Long term		

[a]Grint (2005), on the topic of leadership studies, extends the wicked problems model by adding 'critical problems' to describe rapidly changing and unpredictable emergency conditions, which corresponds with the unstructured: chaotic domain of the Cynefin framework
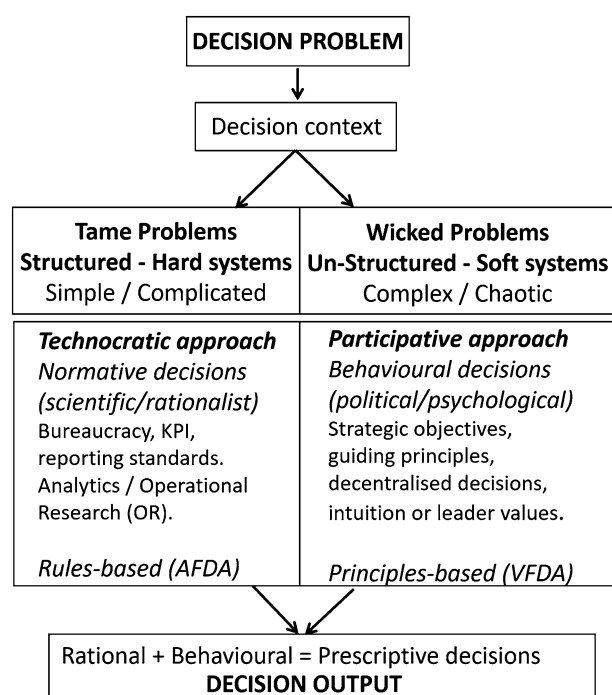
Fig. 3 Synthesised conceptual framework of wicked problems and decision theory (CF1)

Case Description

This case study is part of a multi-project research programme conducted over two years, including interviews across a wide range of stakeholders, including farmers at the forest frontier, local government officials, NGOs concerned with forest conservation, representatives from corporate buyers, plantation owners and investors (See Appendix Table 4). Semi-structured interviews followed the elite interview method, whereby open communication is established on a peer-to-peer basis from the researchers' prior practitioner experience (Vaughan, 2013).

A pilot study, conducted as a one-day stakeholder engagement workshop, with responsible sourcing managers from multi-national food manufactures and international commodity traders, plus campaign managers from international NGOs, and experts in supply chain management and environmental science from academia, provided insights into how the SDGs are regarded by business in relation to deforestation and sustainability in general. Follow-up interviews with stakeholders across food commodity supply chains, including producers, their investors, commodity buyers, retailers and consultants, plus NGO campaigners, provided further insights into deforestation, SDGs and the role of multi-stakeholder initiatives. The boundaries of the full case are then set as the supply chains of companies based in Europe, sourcing palm oil from South-East Asia.

Table 2 Criteria for high quality case study research design (Yin, 2009)

Case study criteria	Description
Construct validity	Data inventory records multiple sources of evidence
Internal validity	Pattern matching conducted to see causal relationships
Reliability	Case protocol and data logged in detail
External validity	Findings generalizable to other cases

Question 1 How do the SDGs address the wicked problem of tropical deforestation?

The issue of corporate responsibility for tropical deforestation linked to supply chains became particularly acute after an effective NGO campaign in 2010, which linked palm oil to habitat destruction and the threat of primate extinction, produced a significant response from consumers and other stakeholders. Alongside existing concerns for tropical forest conservation, in 2015, a public declaration was made by governments and major businesses as part of the UN's New York Declaration on Forests—to achieve zero-deforestation supply chains within 5 years. The SDGs, launching that same year, incorporated similar targets to halt deforestation globally by 2030.

For the SDGs, global supply chains link to international development issues, with forest-frontier production touching on multiple challenges of rural development and forest conservation. Figure 4 shows a number of SDGs relevant to the deforestation case study (the specific targets are listed in full in Appendix Table 5). Starting with Goal 2: End Hunger, the specific targets seek an increase in agricultural production. Yet given the rate of increase in yield per hectare has plateaued since the 1990s (Cassman & Grassini, 2020), a major route for increasing agricultural output is by land-conversion, which in tropical countries typically means clearing forests. Figure 4 shows Goal 2: End Hunger alongside Goal 17: International Partnerships, since multi-stakeholder partnerships can include multi-national corporations supporting rural livelihoods via supplier development initiatives. This then helps meet Goal 8: Decent Work and Economic Growth with its target to increase levels of exports from developing countries.

However, Fig. 4 shows that alongside Goal 8 must sit the targets in Goal 15: Life on Land which require halting deforestation and achieving sustainable agriculture. Part of the wicked problem seen in how deforestation is addressed in the SDGs is that forest conservation appears in contradiction to increasing agricultural production and exports, with all hope lying in the concept of 'sustainable intensification' (Cassman & Grassini, 2020). Additional targets such as 1.4.2 on secure tenure rights to land can also be controversial at
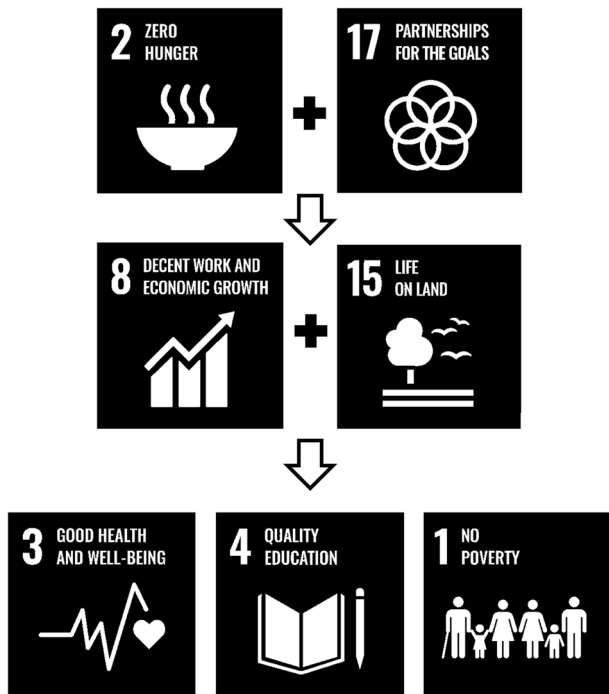
Fig. 4 A cascade of SDGs to show link between agricultural productivity, global supply chains, and social outcomes whilst maintaining forest preservation

the local scale, especially in forest-frontier areas with governance voids and illicit land trafficking. Other SDG targets also have influence, such as target 9.1.1 that seeks to increase the proportion of population living within 2 km of an all-season road. This is seen as an important way to reduce rural poverty, but roadbuilding in forest-frontier areas is a significant driver of deforestation. Such sensitivities to local context provide challenges to the SDGs. The inherent contradiction that the SDGs can simultaneously increase agricultural output whilst halting deforestation is unresolved within the framework of the goals.

Figure 4 then shows that the end result of improved rural economic activity is to help deliver Goals 1, 3 and 4, to cut poverty, improve healthcare and ensure universal education. The specific detail of the targets behind these goals is provided in Appendix Table 5 to illustrate deforestation as a wicked problem and help support future research on this topic.

The extent to which these seven SDGs are highlighted by relevant stakeholder businesses and tropical country governments is important to advancing future success on addressing deforestation. Prioritization of these SDGs and their interconnection by relevant companies in 'forest-risk

commodity' supply chains[5] aligned with the goals prioritised by governments in countries exporting such commodities, could help focus both the participative exercises and the provision of data to assist in an evidence-base for policy actions.

Question 2 How do companies address deforestation in their supply chains, and to what extent do they use the SDGs to do so?

Participative Approach

This section first addresses how the case study data relates to this question in terms of the participative, wicked problem side of CF1. First, the unstructured nature of the problem is explicit:

> Issues around deforestation are not simple and are highly complex. It's highly interconnected, because what we're talking about here, often is about livelihoods, and education, and farming practices. It's about incentives, and even local government and to what extent they're actually supporting, or are a positive or a detrimental role, in bringing about change.

The complexity prompts participation of multiple stakeholders, and numerous forums and partnership initiatives exist to provide a platform for dialogue and, in principle, advance sustainable development. Buying companies, downstream in the supply chain, are recognised as key stakeholders, and have driven recent changes as a result of the targets set in the SDGs and UN New York Declaration on Forests in 2015. To quote a sustainable sourcing manager,

> The deforestation agenda in the last few years has really picked up. 2018 was the year when companies that had set zero deforestation commitments for 2020 said, 'Okay, we need to really raise our game now… who do we need to be working with in order to get there?'

There is, therefore, a sense that to achieve results there is a need for some form of analytical insights into how to make an effective intervention, but basic data is lacking. The number of potential stakeholders is vast, and the relative situation of specific governments, businesses their numerous competitors, and numerous relevant civil society organisations, shows how broad and complex the issue is.

Companies recognise the need for participative processes to engage stakeholders. This quote from a sustainable commodities consultant captures the challenges of the

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5 The forest-risk commodities are various described but typically include soy, palm, beef and leather, pulp and paper, and sometimes cocoa, coffee and other crops.

participative approaches to 'forest risk commodities', and the complexity of the issues:

> I think people tend to think that we can just sort of convene a roundtable, you know, email everybody and they will [attend]…When we're putting together work plans and budgets to people to actually explain… setting up something like this, cannot be underestimated…you want to get the voice of producers of seven commodities…rubber, soya, timber, palm, cocoa etc. Who do you mean by producers? Do you want me to have European producers, American, or just tropical countries? Do you want concessions? Do you want smallholders? Do you want individual farmers? Do you want an indigenous rights representative? … and if I get them on a call and I suddenly end up [with] globally seven commodities, every size of industry producer on the call, what am I asking them? …And how do I not confuse them or build up expectations or create some kind of political fallout, having a call with a group of who could be an incredibly disparate group of people?…Is this the right mechanism to do that dialogue process or that outreach?

Processes of participation are complex and challenging. To lead to solutions that are effective in enabling lasting change to deliver the SDGs, a considerable investment in effective political engagement of relevant stakeholders is needed. However, although company sustainability reports frequently use the SDGs as a format, there is a need for better alignment and focus between the SDGs and how businesses operate. Existing corporate systems of performance measurement and reporting may include social or environmental outcomes, and these may be well-aligned with commercial priorities. Yet, as one FMCG sustainable sourcing manager described,

> The SDGs are the outcome but they're not the driver… SDGs are long term, but businesses are very short term… Firms long-standing commitments to improving social well-being and environmental impact now need to be retrofitted to the SDGs.

Companies have long engaged in sustainable development projects, especially in relation to agriculture or extractive industry activities in developing countries. The suitability of company engagement and the need for both appropriate stakeholder engagement and types of organisation skilled in this, is illustrated in this quote from a commodity producer,

> [Our] stakeholder engagement involves two community development projects where they undertake farming…We have built seven schools in community villages and now have three or four health centres. We would like to start a foundation to manage all of

these development issues and find other funders. It is difficult for private companies to be responsible for development. We have to deal with Local Authorities and Chiefs, and deal with political territory and administration for all of these…We also work with local NGOs to make these interactions more independent because the communities want more and more so the NGO acts as a facilitator…We are funded by different public banks and we have lots of requirements, so we have to undertake an environmental, social action plan with timetable and progress, and this needs money but…as we are not profitable it is difficult to prioritize environmental and social issues. The labour issues are difficult, and it is difficult to increase wages. We need to prioritize but there is a lack of agreement.

This quotation (provided in full to give the rich context of a number of different issues) shows that companies are not necessarily well-skilled in the complex, political aspects of meeting community sustainable development needs. The cost-sensitive, profit-driven perspective of the company is not well-equipped to deal with a range of development priorities of communities, and so they seek the involvement of wider stakeholders, such as NGOs, better able to represent communities and attract development funding. The processes of negotiation with stakeholders including government and local community leaders (chiefs) show how the participatory approach is inherently political, and thus deserves greater understanding as to how these processes can best meet agreed goals around SDGs, which are themselves complex.

Even basic structuring of the issue is seen as a barrier, with a lack of a shared definition of deforestation. According to one producer company, "[producer country] government has a different definition of deforestation than the RSPO [a multi-stakeholder initiative]." Who is best placed to negotiate the creation of a shared agreement? For governments to adopt a definition it may be inter-governmental organisations such as the UN FAO who can start to build consensus. In other relationships, other actors who have roles of influence are relevant.

A counter example to NGOs as mediators is seen with businesses trying to influence the supply chain, where buyers are best placed to overcome lack of agreement. "We're talking to suppliers who have no inkling about sustainability… but with trade they actually sit up and listen to you…We are having conversations with suppliers that we would never be able to get as government agencies or as NGOs."

This form of business-to-business stakeholder participation thus appears more effective than the previous example of a business dealing with development issues, precisely because of the nature of the relationship. Participatory processes may then be seen to be valid for the wicked part,

but the processes are eclectic and under-developed. New approaches are being developed all the time but, in terms of theory and practice, these are less advanced for deforestation and agricultural commodities than in older sustainable supply chain concerns such as conflict minerals or anti-corruption measures.

Technocratic Approach

The next section now addresses the case study data in relation to the technocratic approach. Table 3 below gives examples of data indicating the challenges companies face in using the SDGs. The source of the data are discussions specifically on deforestation in supply chains, and while various initiatives exist to address this, the theme of technocratic approaches to data, and the problems that managers report in trying to achieve this, highlights two key points. Firstly, that there is an expectation that more data can enable better management. This is not surprising given the strength of a technocratic point of view in many organisations. Secondly, that there is an opportunity that the challenges could be overcome with an alternative perspective, including new approaches to participation, currently under-theorised or under-developed in practice. Table 3 considers the underlying concepts at play and a set of propositions in relation to this.

Insights on stakeholder participation processes, due to their less advanced status, are outweighed by technocratic processes. Interviews with some 20 stakeholder organisations, including producers, retailers, investors, and NGOs, explored participatory approaches, finding low engagement with the SDGs as a system. Table 3 specifically covers SDG engagement and finds that the issues are primarily those of trying to accommodate the SDGs within a technocratic approach. With a participatory approach, there was (in practice) low understanding of the SDGs. One manager described the SDGs as language of policymakers and that within their organisation staff had very low understanding of the detail and how to implement it into their working practices. The first challenge for achieving the SDGs was simply one of communication and presenting the underlying indicators in terms that were accessible and understandable.

Yet this communication contained its own risks. An investor regarded the SDGs as an easy example of virtue signalling that might not go beyond the icon of the SDG logo,

> Company CEOs and top management very proudly wear those colorful SDG badges...but some are using this as marketing...It looks fashionable today, 'Let's talk about it'. Overall, it has helped companies to think about [environmental and social] issues.

Given the cost of such new reporting processes, beyond prompting a discussion, the extent to which the SDGs have been successful in establishing detail into what actions are needed to help meet the goals, is more mixed. As another investor describes,

> We all have to be aware of the risk of SDG-washing... Some companies are genuine, and some others are just tacking what they have been doing already to the SDGs, which is not difficult because [there are] a lot of sub-SDGs...When we engage with companies, we would try to understand...whether they're really genuine or whether it's just a PR marketing thing.

Genuine responses here benefit from a level of technocratic analysis, where companies can operationalise progress towards SDGs because they have the data and objectives clearly understood. The following table summarises some of the underlying codes from the data that suggest the ways in which the companies included in the case study on deforestation in supply chains actually find this difficult.

New technocratic tools, such as for supply chain visibility and environmental impact reporting, provide new opportunities and could be integrated into metrics established by the SDGs, but there must be a cost-effective way of doing so. Higher costs from increased monitoring and data transparency in the supply chain are a challenge, and intermediaries are reluctant to pass it on. The end-consumer, as one of the most important stakeholders, is seen as unwilling to pay a premium in the short term for more sustainable and legally sourced commodities (outside of niche markets for ethical or environmentally certified products). The food sector has become defined by high levels of competition, leading to low prices and low margins. This then provides a problem for introducing active monitoring of SDG impacts related to agricultural production and subsequent environmental or social outcomes. While it seems possible to create a new data architecture for performance measurement around sustainable development in the supply chains, incumbent companies are constrained from significant investment that shakes up the status quo.

So far, while business has been supportive of the SDGs, just as they are often supportive of multi-stakeholder initiatives (MSIs), work is needed to establish how these can be effective drivers for actual change. Each of the informants in this study was supportive of the SDGs but struggled with how to operationalise them within their firms. The overall awareness of the SDGs within their organisation, and across their networks of suppliers was also seen as a major barrier, suggesting significant communication of the SDGs are still needed to develop traction.

Value-Focussed Decision Analysis (VFDA)

Some changes in the attitude of business may be underway via the 'corporate purpose agenda' where a more long-term

Table 3 Example quotes and related generalised concepts

Example quotes	Underlying Concept	Proposition
EQ1: "There are huge databases on what companies measure as part of their performance management, including analysis used by investors. But these are not aligned with SDGs."	Bounded rationality due to *lack of data* prevents analytics for improved SDG performance. Company *metrics not aligned* with SDG metrics	Data relevant to SDGs is not collected, and so does not inform management decision-making
EQ2: "Firms have had long-standing commitments to improving social wellbeing and environmental impact. These now need to be retrofitted to the SDGs."	Data architecture needed for reporting and for internal performance management. Existing data needs *translation* to SDGs	Data structure of the SDG metrics is not necessarily compatible with existing reporting structures
EQ3: "Companies are also in competition with each other, so need to be very careful about their spending. They are under intense pressure not to waste money."	Company objectives are profit maximisation. Sustainability outcomes must align with profitability, hence, *cost sensitivity*	Company cost pressure drives a view that SDG outputs must align with competitive advantage
EQ4: "Important questions become how to manage complexity in this, who to work with, how to work with them, how fast, how efficient can this undertaking be?"	Effective *stakeholder engagement*, doing so in a rapid and efficient way	It is important to determine the best stakeholders to work with and how best to engage them
EQ5: "Managers will need to frame this problem in a way that is pragmatic and efficient. If you say, 'here are 17 priorities', they will go crazy."	Need greater *simplicity* in objectives	Priority, by definition, should mean single most important, so the 17 SDGs are too many for companies to understand
EQ6: "Regulation is a highly significant source of influence, in particular regarding competition law. Too much coordination in commodity chains can be seen as forming cartel-like 'anti-trust' activity."	*Market-rules* (anti-trust) can prevent orchestration for social or environmental outcomes.	Some stakeholder relationships are discouraged, such as between competitors, so the rules over pre-competitive 'collective action' are important
EQ7: "Corruption is a huge barrier"	Addressing *corruption* may be an effective enabler of other SDG outcomes	Governance voids in developing countries are challenges. Prioritizing anti-corruption (SDG 17) could better enable other SDGs
EQ8: "How much do we understand about the fuzziness in the supply chain?...Achieving 2/3rds transparency is achievable, but what about the last 3rd, or the last 10th? Does this get ever more difficult?"	Bounded rationality in data collection	Transparency comes with a cost, and in a price-sensitive sector such as food, consumers are unwilling to pay premiums. Lower cost of transparency is thus important
EQ9: "Quality of data is an issue too. In the horsegate scandal, buyers thought they had good transparency of their meat supply chains. But actually they didn't. Chains were long and there was major fraud. Now, they do more testing (which makes it more expensive)."	Bounded rationality in *data quality*/data collection	It is necessary to have independent checks for data quality. SDG 17 targets on methods of data analysis are important
EQ10: "Knowing where something comes from is one thing—doing something about it is another. Data without decision is not very useful or interesting. [It] has to result in an action."	A decision must by definition lead to *action*	Data collection on SDG impacts must link with corporate decision making processes
EQ11: "SDGs are long term, but businesses are very short term…"	Misalignment in *stakeholder* interest	Companies do not tend to operate over the multi-year timescales of the SDGs and instead are focused on the immediate market context. Greater long-term strategic thinking aligned with the SDG agenda is therefore to be encouraged
EQ12: "The SDGs are the outcome but they're not the driver"	SDGs seen as valid but not 'valuable' (*cost sensitivity*) SDGs are a measure of an outcome, but not the means of delivering it	There is a lack of clarity on what is needed to deliver the SDGs. They tell us what (outcome) but not how (who needs to do what, when)

view is encouraged and short-term profit maximisation is contained. Initiating this requires strong leadership from the top of an organisation and its senior management team. Notably, one leading business service provider in the field of deforestation and supply chains seeks to engage in incumbent food sector multi-nationals by appealing first to ethical values, rather than to technocratic justifications of business case. To quote,

> Our values are our greatest asset. They guide us forward and serve as the cultural cornerstone, as we interact with businesses, stakeholders and our peers. It is no coincidence that our first step to engage people in our work always puts values at the center of the conversation...All our interactions with peers, stakeholders and ourselves are grounded in respect—Respect of perspectives, dignity and boundaries...Our work is, above all, with people. And to connect with people, it is crucial that we be able to see their perspectives and understand their feelings towards an issue. The chaotic nature of our work also requires us to be compassionate towards ourselves and our peers so that we may not compromise our own values (Poynton, 2015).

This clearly represents an example of the VFDA process described above, and the way that this method is well-suited to the unstructured, wicked problem context. The conceptual framework (CF1) provided in Fig. 3 thus gives a deeper theoretical explanation for this approach.

Notably, many of the problems encountered by the case study informants in Table 3 concern the failure of a technocratic approach to function well within the complex, wicked problem context. The VFDA approach, by contrast, sidesteps this, by operating a heuristic founded in moral and ethical principles as being the basis for decision-making, not the optimisation of quantifiable relationships intended to maximise corporate profit. There is at least one example of an organisation adopting this approach, and doing so for reasons that suggest an appreciation for the plural and contested perspectives that underlie the issue of tropical deforestation linked to supply chains.

VFDA may therefore be a better approach to wicked problems than overcoming bounded rationality with additional data and mathematical structuring. Such an approach may be useful alongside the current wave of technocratic management being applied to the sector via the practices of 'natural capital accounting' and related activities. These seek to assign numerical quantities to natural systems in order to incorporate them into the incumbent technocratic systems of accountancy and finance.

Question 3 How is the understanding of deforestation and the SDGs as wicked problems improved by decision theory (and how might CF1 be elaborated as CF2)?

The high level of complexity corresponds with the criteria of wicked problems, but also provides insights in relation to decision theory and related concepts. The comparison matrix in Table 1, shows that wicked problems correlate with soft systems and other complex contexts, and numerous of these parallel accounts recommend the role of stakeholder engagement and participation in decision making processes. CF1, as a synthesised conceptual framework, provides the headings for a review of the case study data detailed above. The key concepts of the technocratic approach are using data to enable scientific analysis based on rational rules. For the participative approach they are using psychological or political, 'behavioural' factors, intuition and values, that are principles-based.

Theory elaboration of CF1 to CF2 should follow from the themes emerging from the data that are not included in the original CF1. Table 3 (above) provides a summary of these, leading to propositions. These are primarily around the priorities of business to include a cost consideration into the need for decision-making, seen as a barrier. Essentially, within a technocratic frame, changes to the status quo are not seen as viable because the cost model adopted sees the level of data infrastructure needed to establish transparency as being high cost. Interestingly, for those companies that have put in systems of traceability to claim deforestation-free supply chains, these serve as alerts to convince buyers that their supplies are clean. A key problem is that the 'unclean' product that is associated with deforestation still enters the supply chain. Firstly, corruption and the reliability of data remain acute problems. Secondly, while the SDGs are about reducing issues such as rural poverty, if a multinational buyer cut purchases from a supplier because those commodities have come from areas of recent deforestation that risks forcing the supplier (farmer) into greater poverty by excluding them from a market. Such 'supplier deselection' results in their simply selling to an 'unregulated market' to maintain income. Hence, the desired end result of halting deforestation (as stipulated in SDG 15.2) is not met. The process for excluding supplies associated with deforestation is not also considering the link to rural poverty. Such issues are of course complex and so illustrate the wicked nature of the problem.

The elaborated CF2, shown in Fig. 5 below, adds these barriers and opportunities to the twin columns of the tame and wicked dichotomy. It then also alters the attempt to balance the two approaches via 'prescriptive' decision analysis, with the notion that the participation of stakeholders can be enabled by the greater availability of data technologies. A further proposition here is that the potential for digital communications (stipulated in SDGs such as 4.4.1 'proportion of youth and adults with information and communication technology (ICT) skills') can contribute to a democratisation of data, bringing the technocratic and the participative
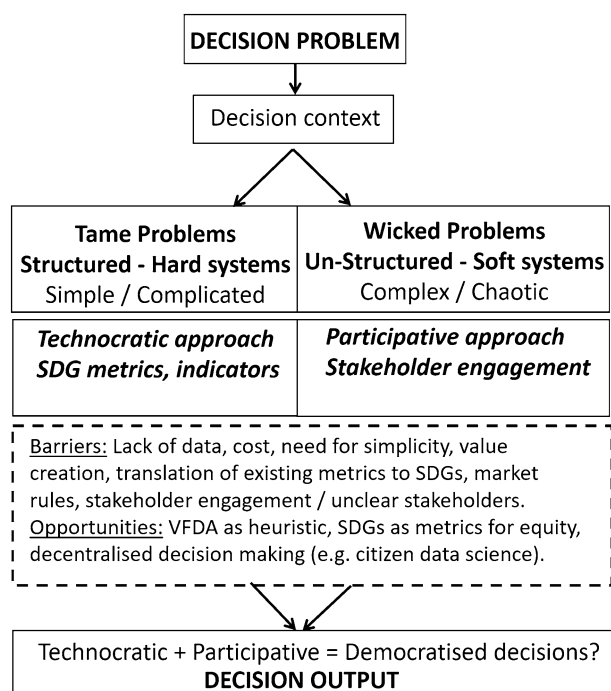
DECISION PROBLEM

Decision context

Tame Problems Structured - Hard systems Simple / Complicated	Wicked Problems Un-Structured - Soft systems Complex / Chaotic
Technocratic approach *SDG metrics, indicators*	*Participative approach* *Stakeholder engagement*

Barriers: Lack of data, cost, need for simplicity, value creation, translation of existing metrics to SDGs, market rules, stakeholder engagement / unclear stakeholders.
Opportunities: VFDA as heuristic, SDGs as metrics for equity, decentralised decision making (e.g. citizen data science).

Technocratic + Participative = Democratised decisions?
DECISION OUTPUT

Fig. 5 Elaborated conceptual framework on the basis of novel case data (CF2)

Discussion and Conclusions

In this study, we have drawn on insights from management studies on the role of data and of stakeholder participation in decision making, and how both inform the practice of meeting certain SDGs. Much of the wicked problems literature does not fully acknowledge these two 'sides of the coin'. The dichotomy highlighted by Fukuda-Parr and McNeill (2019) between the technocratic and participatory approaches in creating the SDGs has been elaborated in the combined decision model proposed in Fig. 5. Both remain active, and both can be brought into balance, rather than assume it is all one, or all another.

The consideration of the deforestation case study, and reflecting on related literature, shows the presence of the elements shown in the conceptual framework. These include that bounded rationality (Simon, 1947) in the context of SDGs could be due to a lack of good quality data or the potential impacts of underlying complexity. In an early state, where there is essentially insufficient data, any additional data collection may well produce benefits. If the context is complex and unstructured (Fig. 1, domain 3 or 4), then any

such data will not enable a predictive model of cause and effect, and a more responsive and engaged approach must be taken. We can see examples in the SDG programme where good quality data is sought, potentially contributing to technocratic analysis.[6]

As shown in Table 1, the distinction between the structured and un-structured problem, or between the tame and the wicked, has been considered in epistemology, in policy studies, and in management studies (in both decision analysis and in strategy). Many thinkers have come to the same explanations using different terminology. As noted by Head (2019) in a 40 year retrospective, "The literature on 'wicked problems' since 1973 has grown exponentially, but often in ways that disconnect discussion from the insights available in…the broader social sciences." (ibid page 183).

Considerable potential exists for more interdisciplinary synthesis across these fields of study (Denyer et al., 2008; Tranfield et al., 2003). The balance between the two traditions of positivist and constructivist approaches to wicked problems is discussed by Head (2019) as needing to be on a continuum (just as suggested by Popper (1965)), but he also notes that, "critical perspectives have challenged the salience of positivist certainties in social policy and questioned the alluring vision of 'evidence-based' policymaking" (Head, 2019, page 181), and that, "The wicked problems framework resonates more positively with constructivist approaches to policy studies because of the emphasis given to the diversity and primacy of stakeholder values and practitioner perspectives….[and] the role of dialogue and conflict resolution as methods." (ibid page 192).

There is a need for some appreciation of the benefits and limitations of both approaches. If constructivist organisation scholars only focus on issues they think are wicked, and ignore where increasing structure and data can be usefully applied, and if technocratic policy scholars ignore the benefits of stakeholder engagement, then this combined approach will be missed.

A combined approach is implicit in the work of several authors. In Simon's (1947) decision theory, the recognition of bias is accommodated alongside rationalist methods. French et al. (2009) describe a 'prescriptive' decision model that combines rationalist and behavioural elements. Baba and HakemZadeh (2012) take a similar approach, whereby the behavioural forces make managers (or politicians) seek to disempower evidence-based policy, as it constrains their decisions from including things that are politically expedient

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[6] These include, specifically, SDG 17.18 'By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts'.

or serve their own hidden agendas. Hence, the use of evidence is a political and legal force against such bias. Data therefore has a political angle, and data is also a means by which participation can achieve improvement. The question is how practical such efforts are, which can mean simply how expensive they are. Gathering and analysing data can be costly, as can prosecuting unfairness through the courts, and business is often driven by what is cost-effective and expedient.

Wicked problems, due to their complex scope and nature, present challenges for business leaders, and Keeney's (1992, 1996) values-focused approach to decision-making suggests that moral principles may form an effective heuristic. According to Snowden and Boone's (2007) Cynefin framework, chaotic or complex contexts demand leadership that imposes order, or permits order to emerge by listening to multiple stakeholder views.

Thompson (2010) provides an additional insight into this approach by proposing that while values can be all-important, the complexity of modern business can overwhelm the ability of a personal moral compass. In an, "amplified universe of global stakeholders with competing value claims and value systems whose interests must be considered and often included in the decision-making process" (ibid. p15) some form of universal consensus, here dubbed a 'global moral compass', is sought.

Some authors promote the technocratic approach. Examples such as Lu et al. (2015), Persson et al. (2016), Biermann et al. (2017) all emphasize the importance of restructuring data-gathering and evaluation networks in order to address SDG challenges. However, these normative calls appear disconnected from the business reality of how to deal with the SDGs as a data structure aimed at delivering important changes in society. Seen as a form of performance measurement and management for sustainability, the SDGs do not currently interact well with the needs and perceptions of businesses. More attention is needed on how the SDGs interface with strategic thinking in business, and how orchestration between wide constellations of stakeholders across public, private and civil society sectors may be better achieved (Abbott & Bernstein, 2015; van Tulder & Keen, 2018).

The fundamental misalignment between SDGs and the motivations of individual firms presents some cause for alarm. Firstly, there is an issue of scale, whereby firms acting in isolation are insufficient in scale to make an impact. If firms coordinate with other firms engaged in a similar area (such as, say, other international buyers of cocoa concerned with deforestation and child labour associated with cocoa growing in West Africa), then they risk being guilty of collusion under anti-trust legislation (Scott, 2016). This point is under-represented in work on inter-organisational collaborative decision making in multi-stakeholder partnerships such as MacDonald et al. (2019). Notably, a substantial fine of

more than 400 million Euro had been charged to two major FMCG firms for co-ordinating their efforts over new products that they promoted on the basis of huge benefits to their product's environmental footprint (Scott, 2016). Such partnering therefore needs careful governance to avoid potential legal crises.

Second, there is an issue of motivation and timescale. Firms are faced with a constant battle for survival where disruptions to supply chains or changes in consumer preferences can upend their plans. The question of how and who conducts the orchestration of the multiple stakeholders needed to deliver the SDGs is crucial. Hence, when viewing the SDGs as a wicked problem, that is expressed as something that urgently needs more data, better data analysis, and enforcement of standards, this seems like a classic instrumental rationalist, technocratic command-and-control approach. Yet the SDGs were also deliberately formulated as non-coercive and voluntary in order to enable a catalytic, emergent response, rather than a coercive one that would meet resistance (and is anyway beyond the remit of the United Nations as a non-sovereign entity) (Abbott & Bernstein, 2015).

Instead, the need for alternative forms of decision making for different types of problems, and the realities of bounded rationality, may hold a basis for future theorising and alternative paths for action. These forms include the use of heuristics and the role of ethical values, not just more data to enable command-and-control performance management. The 17 goals, made up of 169 targets, applied to 184 countries, with highly varied circumstances, requested to report on a regular basis, represents a vast undertaking in data management which is still in the process of getting under way (Merry, 2019).

However, for businesses who are time-conscious and cost sensitive, rather than focus on a conventional data-driven metric performance approach, might decision theory instead suggest a values-focused heuristic approach, and leave the retrospective reporting on progress to government statisticians. If we combine an orchestration view (Abbott & Bernstein, 2015), with the normative values of Keeney (1992, 1996), we can consider the orchestration of organisations contributing to targets and goals on the basis of pragmatism and ethical norms, not rational optimisation. The end result is also not to seek profit maximisation (aligning a sustainability outcome with an economic benefit), but for the end goal of achieving the SDGs as a normative goal in its own right.

A 'fast and frugal' heuristic for SDG decision-making at a corporate level might ask 'does this investment align with the firm's expertise and interest, and does it maximise an SDG outcome or enable improvement across a range of SDGs?'. Priorities could include, say, landlocked developing nations (where poverty is highest), or those particularly

vulnerable to disease, or hunger, or climate impacts. A firm could make a quick judgement about assisting a country on a particular issue, which might be better than being unable to determine a rational calculation to justify a decision.

The broad pattern of a decision theory approach to wicked problems around multi-stakeholder initiatives (MSI), is that one cannot exclusively focus on determining the optimal solution. Having data in order to conduct modelling, draw forecasts, predict and provide, is limited in effectiveness to stable, predictable, and hence tame decision contexts. It is not suited for wicked problems defined by, "knowledge uncertainty, value conflict and dynamic complexity" (Dentoni et al., 2018). Instead, a behavioural decision theory approach, accepting that bounded rationality moves one more towards values-focused decision analysis and ethical decision-making, aligns with the principles and defence of the human rights of equity, fairness and justice underpinning the SDGs.

There is a need to incorporate concepts of complexity into our understanding of the SDGs, both the complex societal issues the SDGs seek to address, and the dynamics of multi-stakeholder relationships (Bryson, 2004; Van Tulder & Keen, 2018). Therefore, drawing on the range of approaches established to address complexity in decision theory via heuristics (Gigerenzer & Gaissmaier, 2011; Keeney, 1992, 1996; Snowden & Boone, 2007) may provide fertile ground for new theory and practice.

This paper sought to address the question of how the study of decision theory can inform the multi-stakeholder challenge of meeting the SDGs. Hopefully, the attempt to introduce some themes from decision theory into a conceptual framework, seasoned with some direct empirical insight from a deforestation case study, has suggested some areas for further research.

Whilst the world economy reels from the catastrophic change of novel Covid-19 coronavirus, equivalent in its social and technological transition as a world war, the social fabric of the 'developing world' seems imperilled as never before. We might anticipate that, as with the Second World War, this may prompt a transition to a new world and so attention must focus on what sort of world must be rebuilt. Here, the SDGs offer something of a foundation, leading to the question of not 'what should be done' (that is outlined in the 17 goals, 169 targets, and 232 measurable indicators), but the more pragmatic question of 'how should it be done'. With the pandemic epitomising unpredictability, and directly demonstrating the difference between what is known, knowable and unknowable, the insights of decision theory into complex decision contexts is highly relevant. Furthermore, given that the notion that data and analysis is only one side of the coin, and that the other is the ethical and moral foundation for decision making, the basis of the SDGs in equity, justice and the right to life, are highly significant.

Appendix

See Tables 4, 5.

Table 4 Case study data

Research activity	Description	Interviewees
Fieldtrip to tropical forest frontier region (January 2019) and analysis of secondary data from livelihood surveys in the region (January 2019 to December 2020)	Visited farms to discuss livelihoods, problems, opportunities, and relate these to SDG indicators	Small-holder farmers (×8) Community park rangers (×4) Local government officers (×1) NGO fieldworkers (×8) Mill operations manager (×1)
Workshop with MNE buyers, NGOs and academics. (March 2019)	One day workshop on barriers and opportunities for zero deforestation policies in supply chains and link with SDGs	Sustainable sourcing manager, MNE trader (×1) Sustainable sourcing manager, FMCG manufacturer (×1) Campaign manager, International environmental NGO (×1) Forest product certification policy expert, International environmental NGO (×1) Professor in supply chain (×1) Professor in environmental science (×1)
Interviews with NGOs, Investors, traders, manufacturers, consultants (April to July 2020)	Interviews with forest-risk commodity stakeholders to assess nature of stakeholder engagement around deforestation commitments	NGO policy experts (×5) Consultants (×4) Investors (×4) FMCG manufacturers and Retailers (×4) Palm oil plantation companies (×4)
Interviews with sector consultants and policy advisors, and participant observation in group workshops (October to December 2020)	Interviews with forest commodity experts to assess nature of data capture and decision making around deforestation commitments and supply chain sustainability	NGO policy expert (×1) Sustainable commodities consultant (×1) Policy consultant (×1) Agricultural data consultant (×1)

Table 5 Specific targets within goals relevant to tropical country, forest -frontier communities

SDG: Goal	Specific target
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture + SDG 17: partnerships (with global buyers of commodities)	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality 17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020 17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts 17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries
Leads to	
SDG 8: sustainable economic growth (increase revenue) + SDG 15: protect eco-systems (e.g. through community conservation)	8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries 8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms (n.b. use of child labour in some forest frontier commodity production areas remains high, for example in cacao production in Ivory Coast. See Fountain (2018)) 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
Leads to	
SDG 3: ensure health and well-being + SDG 4: ensure education + SDG 1: eliminate poverty	3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births 4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes 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

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