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Sustainable Development Goals: A need for relevant indicators

Tomáš Hák, Svatava Janoušková *, Bedřich Moldan

Charles University Environment Center, José Martího 2/407, 162 00 Prague, Czech Republic

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ABSTRACT

At the UN in New York the Open Working Group created by the UN General Assembly proposed a set of global Sustainable Development Goals (SDGs) which comprises 17 goals and 169 targets. Further to that, a preliminary set of 330 indicators was introduced in March 2015. Some SDGs build on preceding Millennium Development Goals while others incorporate new ideas. A critical review has revealed that indicators of varied quality (in terms of the fulfilment certain criteria) have been proposed to assess sustainable development. Despite the fact that there is plenty of theoretical work on quality standards for indicators, in practice users cannot often be sure how adequately the indicators measure the monitored phenomena. Therefore we stress the need to operationalise the Sustainable Development Goals' targets and evaluate the indicators' relevance, the characteristic of utmost importance among the indicators' quality traits. The current format of the proposed SDGs and their targets has laid a policy framework; however, without thorough expert and scientific follow up on their operationalisation the indicators may be ambiguous. Therefore we argue for the foundation of a conceptual framework for selecting appropriate indicators for targets from existing sets or formulating new ones. Experts should focus on the "indicator-indicated fact" relation to ensure the indicators' relevance in order for clear, unambiguous messages to be conveyed to users (decision- and policy-makers and also the lay public). Finally we offer some recommendations for indicators providers in order to contribute to the tremendous amount of conceptual work needed to lay a strong foundation for the development of the final indicators framework.

1. Introduction

Historically, the concept of sustainable development (SD) emerged in the context of environmental concerns as witnessed by the first appearance of the term in the World Charter for Nature (UN, 1982) These concerns were addressed in Our Common Future (WCED, 1987) and further elaborated in 40 Chapters of Agenda 21 of the Earth Summit in 1992 (UN, 1992). That may be seen as a successful attempt to reconcile the two seemingly contrasting paradigms: lasting economic growth and an efficient protection of environment and natural resources what was forcefully exposed in The Limits to Growth (Meadows, 1972). Following this, the World Summit on Social Development in Copenhagen in 1995 (UN, 1995) stressed SD's key role in securing global social development and effectively added the "third pillar" to the current definition of SD endorsed by the World Summit on Sustainable Development in Johannesburg in 2002 (UN, 2002) and many subsequent statements and documents. It was recently fully embraced by the Rio + 20 outcome document "The Future We Want" (UN, 2012). In this document the social pillar received prominent attention, as witnessed by the title of the main topic of the Summit: Green economy in the context of sustainable development and eradication of poverty.

From an early stage of the SD concept it has been clear that information and namely quantitative indicators will play an important role. Already Agenda 21 (Chapter 40) called for "indicators that show us if we are creating a more sustainable world"; since then, many indicators, indicator sets and dashboards, compound (composite and aggregated) indicators and indices have been introduced. However, despite all the efforts of many national and international organisations and governments – including long-term programmes such as the European Commission's 'Beyond GDP'[1] and the OECD's 'Measuring the Progress of Societies'[2] – there has not been theoretical consensus on how to measure current well-being nor sustainability (e.g. UNECE, OECD, Eurostat, 2008; Stiglitz et al., 2009). An indicator-based approach underpinned the major global assessment of countriesí progress towards

* Corresponding author. Tel.: +420 220199475; fax: +420 220199462.
E-mail address: svatava.janouskova@czp.cuni.cz (S. Janoušková).

[1] See its webpage at http://ec.europa.eu/environment/beyond_gdp/index_en.html.
[2] See its webpage at http://ww.oecd.org/statistics/measuringwell-beingandprogress.htm.

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Millennium Development Goals and more recently towards Sustainable Development Goals (SDGs) (Sachs, 2012).

The idea of global goals accompanied by concrete indicators was originally proposed by the governments of Colombia and Guatemala and officially introduced at the Rio + 20 Conference. SDGs in their recent form are a universal set of goals, targets and indicators that UN member states will use to frame their agendas and policies over the next 15 years. SDGs follow, and expand on, the Millennium development goals (MDGs), which were agreed by governments in 2000, and will expire at the end of this year (Evans and Steven, 2012). The mandate to develop the proposal on the SDGs was included in Conference Outcome Document, 'The Future We Want' (UN, 2012), which incorporated the request to create an Open Working Group (OWG) with the task of developing the set of SDGs. SDGs were drafted by the OWG established by the UN General Assembly in the "Zero Draft" of July 2014 (UN OWG, 2014), and were endorsed at the 68th session of the UNGA in the autumn of 2014. The ongoing negotiations will finalise the SDGs – i.e. to revise the set of targets and accompany them with related concrete indicators – for adoption in the autumn of 2015. Currently, the background materials comprise 17 goals,[3] 169 targets and 303 indicators. Proposed goals 1–6 build on the core agenda of the MDGs, while goals 7–17 break new ground (UNSD, 2014). The goals are made tangible by targets – there are 169 targets (including 62 targets on the means of implementation) ranging from 5 to 12 targets per goal. The early draft list of indicators built on the proposals of the OWG and the conclusion of the UN Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development, among other inputs. It built on three indicator sets: MDGs indicators (60 indicators), SD indicators of the Conference of European Statisticians (CES SDI, 90 indicators), and indicators by the SD Solutions Network (SDSN, 100 indicators). Their rapid assessment showed that 105 indicators from at least one of the three indicator sets could potentially be used for measurement (UNSD, 2014).

It is generally expected that a summit of heads of state will adopt the SDGs in September 2015. As recommended by the UN Statistical Commission a set of indicative indicators should be developed by September 2015, so that a definitive set can be adopted by the 47th session of the Commission in 2016 (UNSC, 2015). We may thus assume – regardless the exact date – that the SDGs will be approved and will serve as a basis for the global post-2015 development agenda. In order not to waste resources and effort invested so far, the SDGs framework – and the indicators in particular – need to be conceptually and methodologically well-designed and tested prior to adoption.

This article does not seek to redefine the SD concept or consequently propose new SD goals and/or targets. Neither can it explore data availability, financial demands or institutional capacities for successful fulfilment of the whole SDGs commitment. The goal of this article is to contribute to the development of highly relevant SDGs indicators. We briefly examine progress to date in developing SD indicators focusing on efforts to define a concise measurement framework. Based on the experience with SD indicators since UNCED in 1992 we show that indicators of uneven quality have been in use for assessing SD. We take for granted that the current format of SDGs has laid a solid policy framework (despite some countries feeling that 17 goals are too unwieldy to implement or to communicate to a broad public); however, without thorough expert and scientific follow up on their operationalisation the pertinent indicators may be very ambiguous. Therefore we argue that selecting appropriate indicators from existing sets or formulating new ones should be done within a conceptual framework. Experts should primarily focus on the "indicator-indicated fact" relation to ensure the SDGs indicators relevance. This will ensure that right and unambiguous messages are sent to policy makers. Finally we offer some recommendations for indicator providers in order to contribute to the tremendous amount of conceptual work needed to lay a strong foundation for development of the final indicators framework.

[3] Sustainable Development Goals are abbreviated interchangeably further in the text as goals or SDGs.

2. The need for a framework

There are many SD indicators and indices already developed and new metrics will certainly yet appear (e.g. Eurostat, 2007; Bandura, 2008; Tasaki et al., 2010). Some commentators speak about an obsession with numbers and an indicator explosion, others call for new and better indicators (e.g. Riley, 2001; Morse, 2013). Neither the scientific community nor the users know whether this remarkable worldwide effort should be more coordinated and regulated or if the "survival of the fittest (indicator)" strategy is still the most efficient one (Dahl, 2012). In the late 1990s – after the indicator programme was endorsed by the UN Commission on Sustainable Development and subsequently followed by many intergovernmental organisations and governments – the challenge was mainly to define a measurement framework and then select relevant SD indicators (Moldan, 1997). The aim was to structure the indicators into a system (e.g. based on interactions or policy goals) and enhance standardisation. Many such general frameworks have been developed and tested at regional, national and international level. They comprise variously structured human and ecological systems and relationships between them; there are thematic frameworks specifically elaborating some subjects (e.g. health or transport), some frameworks use an accounting approach or economic theory on various types of capital, others base frameworks on causality as Driving force-Pressure-State-Impact-Response (DPSIR), etc. (e.g. Prescott-Allen, 2001; Stanners et al., 2007; Ruta and Hamilton, 2009; OECD, 2010).

UNSD (2015) sees an explicit need to structure the SDGs indicators into a coherent framework. It will secure the completeness of the indicator set and emphasise linkages among the indicators thereby avoiding arbitrariness in the selection process. Griggs et al. (2013) add that a unified environmental and social framework for SDGs manages trade-offs and maximises synergies between targets, The approaches and methods potentially applied to developing indicator frameworks can be classified into two categories: policy-based approaches and conceptual approaches (Eurostat, 2014). While the former use SD strategies and other policy documents as a frame of reference and are typically organised according to strategic issues, the latter include a frame of reference independent from political priorities (based on a model of sustainable development processes and/or their interactions). Since the concept of SD does not lend itself to assessment by measurement, the indicator framework should not only define what to measure but also how to measure it. Several such methods for sustainability assessment have been already developed, tested and used (Singh et al., 2009).

Both approaches apparently function differently having their own processes and objectives. However, they both have their place in supporting the different stages of a policy cycle: Policy formulation (identifying issues, setting goals and objectives reflecting ideas and visions and formulating issues in such a way as to facilitate succeeding operationalisation), policy legitimisation, policy implementation, policy evaluation, and policy change. Purely from the perspective of indicators, crucial are the fourth and – to a lesser extent – second stage, i.e. policy evaluation and policy legitimisation with an instrumental role for experts (Fig. 1). They contribute

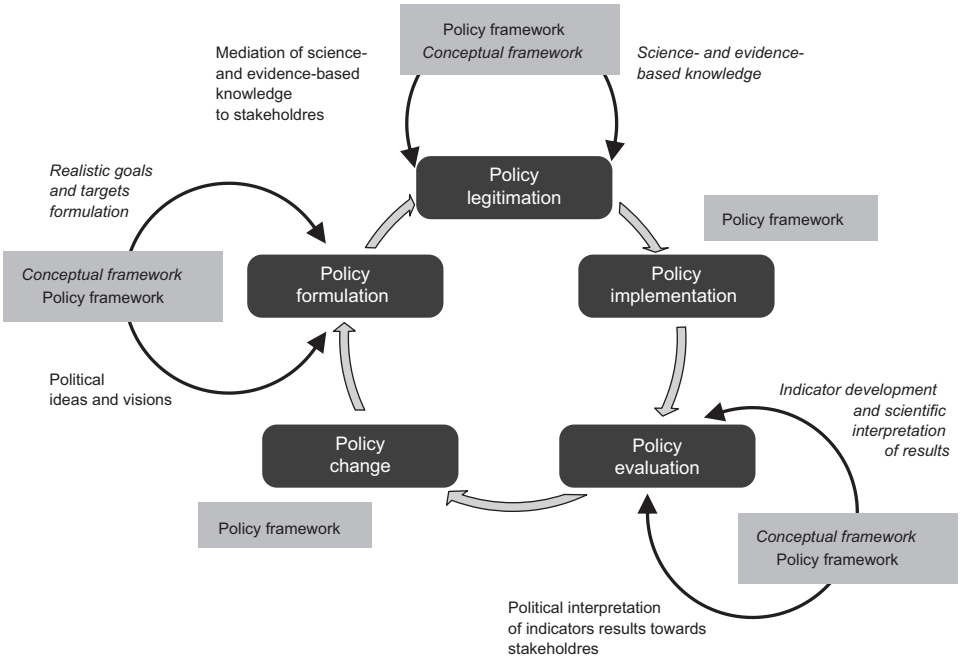

Fig. 1. A policy cycle linked to policy and conceptual frameworks.

substantially to assessing the extent to which the policy was successful or the policy decision was correct; and if implementation had the desired effect. During the legitimisation stage the chosen policy instruments must attract support; it can involve legislative or executive approval, science-based evidence supporting the policy or decision, consultation with interest groups and the public, etc.). The early input of science into the policy cycle increases policy space and potential for effective policy making (Barkenbus, 1998). To apply this to our policy cycle and SDGs development: experts – academia, indicators providers, statisticians etc. should be fully engaged already in the policy formulation phase, i.e. in the targets formulations and contribute thus to their capacity to be operationalised (Glaser, 2012). This approach complies with current trends in sustainability indicator construction, i.e. the combination of top-down and bottom-up approaches, in which indicators are formalised (defined, constructed, and assessed) by measurement experts, but their choice depends on political and social preferences (Pissourios, 2013).

Despite diverse concepts of policy cycles – and diverse processes in the development of indicators frameworks – it seems sufficiently clear that a rigorous indicator framework can be neither a purely conceptual framework, nor only a policy-oriented frame of reference defined basically by the SDGs themselves. To evaluate the quality of SDIs it is necessary to identify the key determinants and appropriate criteria for evaluating it. Credibility, relevance and legitimacy (so-called CRELE) have often been proposed as such determinants and criteria (Heink et al., 2015). Despite complementarities and trade-offs between these criteria, the indicator framework should secure their appropriate level. The goals and targets may be legitimised and see political uptake only within policy work. The policy framework usually seeks meeting the criteria of salience (referring to the relevance of the assessed theme or phenomenon to decision makers) and legitimacy (referring to the perception that the overall assessment is respectful of stakeholders' divergent values and beliefs, unbiased, and fair in its treatment of opposing views and interests). The conceptual framework can then deliver well-structured methodologies for SD assessment and thus secure the credibility criterion (Cash et al., 2003; Parris and Kates, 2003). It may ensure the application of scientific methods which would rarely be applied by decision makers working with the criteria of salience and legitimacy as they are always, or often, driven by particular or short-term objectives.

3. Progress to date

SDGs are already firmly embedded in a policy frame: during the course of their development they went through a political process and the Zero Draft evolved from broad political negotiations. Definition of both the targets and namely the indicators have, however raised a lot of questions and much debate (Ritschelova, 2015). Therefore, the targets were assessed – collectively and individually – as to whether they are backed up by scientific evidence (ICSU ISSU, 2015), Results showed that out of 169 targets, 49 (29%) were considered well developed, 91 targets (54%) could be strengthened by being more specific, and 29 (17%) required significant work. The major identified weaknesses were the poor alignment of targets and goals with existing international agreements and political processes; lack of effective implementation; conflicts between Goals and targets, and non-quantified targets. A similar rigorous assessment was applied to the indicators (SDNS, 2015). It was based on a public consultation process during which hundreds of organisations and experts (national statistical offices, international statistical agencies, and experts from academia, civil society, and business) submitted detailed comments on the proposed list of indicators. Besides conceptual and methodological aspects also data availability and overall feasibility was assessed. Currently (March 2015), SDNS proposes 100 Global Monitoring Indicators, accompanied by suggestions for Complementary National Indicators, which are together to track the full range of SDGs and targets in an integrated manner. Despite Global Monitoring Indicators being designed to be truly universal indicators it is envisaged that some may not apply to every country (tropical diseases, oceans, etc.). Complementary National Indicators are suggested only for inspiration – it is expected that due to national adaptations of the goals, targets, and supporting indicators quite a large number of other complementary indicators may emerge over time.

Generally, the conceptualisation of sustainability assessment and operationalisation of goals and targets should follow certain agreed principles. However, they are often either too theoretical (e.g. the so-called Bellagio principles; Pintér et al., 2012) or mostly of a strict methodological nature (e.g. UNDESA, 2007). The former do not reach the operationalisation level, the latter concentrate on the process of data processing. Thus indicators' other qualities beyond methodological aspects, in particular relevance, tend to be underdeveloped. The Zero Draft requires the targets to be accompanied by relevant indicators and UNSD (2015) sets several selection criteria for the indicators: They should be relevant, methodologically sound, measurable, easy to communicate and access, limited in number and outcome focused. The first criterion – relevance – comprises three different aspects:

- *Link to the target*: The indicator should be clearly linked to one or more targets and provide robust measures of progress towards the target(s).
- *Policy relevance*: The indicator should be relevant to policy formulation and provide enough information for policy making.
- *Applicability at the appropriate level*: For global monitoring, the indicator should be relevant to all countries; for national monitoring, the indicator should be relevant to national priorities.

These relevance criteria are of different nature: Policy relevance and applicability at the appropriate level fall into the policy framework while the link to the target is to be secured within the conceptual framework. We argue that the latter can only be done by conceptualisation and operationalisation of targets. The conceptualisation phase occurred at the level of the goals definition. After political endorsement of the overall idea of SDGs, the scope of the activity was designed to encompass 17 goals which were then formulated, their desired features created (targets) and requirements formulated (indicators). The next step is the operationalisation of the targets: first, it will be necessary to specify the extent of the concept behind each target, i.e. describe what is and what is not part of that concept. This step will be important particularly for the targets which have a broad, multi-theme definition (e.g. target 15.1: By 2020 ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements). This will be followed by the elaboration of clear-cut and detailed formulations of working hypotheses on the measurement of particular facts (phenomena, objects, processes). Only proper conceptualisation and operationalisation of the targets will transform them from vague and mostly theoretical concepts to tools, which are clearly understandable in terms of empirical observations measurable or describable by appropriate indicators. No matter how relevant, measurable or applicable, the development or selection of indicators does not necessarily contribute to designing the right concepts beyond the targets. Operationalisation of the targets through indicators would be methodologically incorrect and might lead to distortions in the development of the policy agenda (such an approach might cause the false interpretation that only what can be measured is important to our lives). In other words, the concept of the target cannot be simply defined by a pack of statistics and indicators, regardless how relevant they are. The concept, based on best scientific knowledge, must precede and then be operationalised as far as possible by the available data. It may be that some components of the concept thus remain without currently available indicators yet they remain integral elements of the concept and thus inspire further research and define future data requirements.

4. Appropriate indicators to assess sustainability

As stated above, the Zero Draft called for further elaboration of targets through indicators focused on measurable outcomes. Agreement has not yet been reached on that requirement – we may just assume that development of SDGs indicators will build on the experience with MDGs and their indicators (Loewe, 2012; Brito, 2012; SDNS, 2015).

Fortunately, a range of indicators suitable for various aspects of the development agenda including sustainability assessment are already in place. At present, hundreds of different indicators have been suggested and are used in many differing contexts, by different users and for diverse purposes. To our knowledge no exhaustive account exists but we can assume the existence of hundreds of various indices and sets of indicators or even several thousands of such metrics if individual indicators are included (OECD, 2002a; Tanzil and Beloff, 2006; Hass et al., 2002). However, despite all the efforts of many national and international organisations and governments, from the key findings on the use of indicators it is obvious that the whole process faces weaknesses, many of which stem from an insufficiently developed conceptual (theoretical) framework. Many experts, even 40 years ago (Bunge, 1975) called for more theoretical and methodological work rather than an increase in the amount of developmental statistics and indicators (Hak et al., 2007). Also Niemeijer and De Groot (2008) require a transparent selection of the best available indicators based on a conceptual framework. The SDGs is an example of a policy indicator-based initiative with somewhat underdeveloped relevance issues. As a starting point, we take the commonly agreed assumptions:

- There is already over 20 years of experience and sufficient knowledge in the development of SD indicators to ensure the development of reliable indicators. The role of science will be instrumental in this process.
- There is still little agreement or consensus on a common set of scientific and management criteria for evaluating indicators from several points of view (e.g. data quality, scientific rigour of definitions of indicators, correctness of underlying assumptions and concepts, relevance of various phenomena for sustainable development).
- In order for sustainability indicators to evaluate or measure sustainability in a realistic, reliable way and convey true information they must meet certain criteria. (Eurostat, 2012). Despite generous resources allocated to the development and establishment of SD indicators over the past 20 years, they still face many conceptual and methodological weaknesses. The concept of relevance is one the most underdeveloped and neglected issue (Parris and Kates, 2003; Rickard et al., 2007).
- Unless the above quality features are operationalised they are of little gain in practical use (Bunge, 1975, 2009; Hartmuth et al., 2008; Hak et al., 2012). At the same time it is well-known that most indicator providers do not have any procedures for getting a comprehensive picture of the indicatorsí quality (usually only data collection follows certain, often internationally agreed, quality assurance/control procedures).

Reporting requirements agreed between countries and international bodies to provide data and information have increased to such an extent that they generate significant demands in terms of quality. We reviewed approaches used in more than twenty major organisations (e.g. European Environmental Agency, Organisation for Economic Cooperation and Development, United Nations Environment Programme, US National Research Council, Eurostat, US Environmental Protection Agency, World Bank, etc.) and examined approximately 260 criteria used for the quality evaluation of indicators (Hak, 2007). We found that the organisations formulated

similar requirements for the indicators they use. In line with Parris and Kates (2003), they can be characterised by three overarching attributes: salience, credibility and legitimacy. In practice, it is hard to meet all these criteria concurrently. However, although all the criteria are mostly well-defined in terms of theory, the rules for application of these criteria (i.e. for their operationalisation) in practical use are far from being ready to use. In other words we know that the indicator should be e.g. easy-to-understand but we do not know how to recognise that it really is.

The criterion included in all quality standard sets is relevance. It has an exclusive position – it is mentioned the most often and it is usually listed among the first/most important criteria. The reasoning for this may be that it is known that for some purposes, users may be willing to accept conceptual or methodological weaknesses in an indicator if it provides really important information (Kurtz et al., 2001). Despite its prominence, it is, however, a criterion associated with many ambiguities – both terminological and conceptual. When SD indicators developers and users speak about relevance it is often unclear what they mean (Relevance of what? For who?). Relevance is a concept that is intuitively understood, but very difficult to define. It has already become a major area of study of information science (Cosijn and Ingwersen, 2000). Moreover, this criterion falls into both the above frameworks: the policy framework should ensure that the given sustainability theme (e.g., climate change, education or sustainable economic growth) is useful for policy making and meaningful to a broad audience while the conceptual framework should warrant that the selected indicators are highly representative for the given sustainability theme and it means that there is a clear "indicator-indicated fact" relation. We further elaborate on the latter type of relevance (close to validity concept applied in social science) of the SDGs indicators in the hope of thus avoiding the often experienced situation when organisations measure what is measurable rather than what is important concerning the given subject or phenomenon (Rickard et al., 2007).

Relevance is obviously an important but elusive concept; therefore we have defined it and distinguished between the policy relevance (i.e. relevance of the theme assessed by an indicator, often called salience) and the relevance of the indicator for the theme (i.e. indicator relevance) (Hak et al., 2012). In terms of SDGs, the policy relevance has been provided by the policy framework: the themes of SDGs represent the agreed key global challenges as e.g., biodiversity, inequality, climate change, health. The weak spot of the current SDGs is the unknown indicator relevance for the theme, i.e. representativeness of proposed indicators for the SDGs (goals and targets). Ideally, we should test whether the indicators selected and used for a certain theme (e.g. safe cities) really provide relevant information on this phenomenon. Our understanding of indicator relevance corresponds with Eurostat's quality profiles, where relevance comprises the content and suitability of the indicator to measure appropriately the phenomenon considered (Eurostat, 2012). This concept of indicator relevance is also elaborated by Rametsteiner et al. (2011). He emphasises the need to find the right approach to representing a given issue through an indicator. Despite its critical importance, this phase in indicator development is somewhat inchoate and thus difficult to accomplish. However, the theoretical concept of indicator relevance is not a new topic at all – it was developed by Bunge (1975) for quality of life indicators. He sees an indicator as a symptom of a given condition: For example, paleness may indicate bad health and high unemployment a sick economy. More precisely, an indicator is an observable variable assumed to point to, or estimate, some other (usually unobservable) variable. Some indicators are fairly reliable (they show high indicator relevance) because they can be checked through further indicators or, in some cases, because there are well-confirmed theories containing formulas relating indicators to what they indicate (a theme). In most cases, however, it is a hypothesis that is beyond our selection of an indicator. Because this "indicator-indicated fact" relation is a hypothesis, it must pass certain empirical tests to become valid.

For assessing SDGs (quality of life, SD, wellbeing, etc.) there are many more or less suitable indicators already at our disposal. In terms of their relevance this means that there will be indicators backed by hypotheses verified to a different extent: from not verified at all (and then our assumption that an indicator measures the given fact equals mere speculation) to "indicator-indicated fact" relation verified by reasonably true theory or by an empirical test. Since there are typically many, sometimes mutually contradicting, underlying theories, hypotheses, assumptions, relevance cannot always be unambiguously defined. Therefore measurement of most of the facts – regardless of the theme but especially in the social domain – will require the employment of a battery of indicators where an indicator is just one component of a vector pointing to a condition of a fact (Bunge, 1975).

5. Indicators specifically related to SDGs and their targets

For selecting and/or developing indicators relevant to SDGs we may make these assumptions:

- SDGs and their targets are to be assessable by means of indicators (both quantitative and qualitative). A special attention must be paid to neglected or insufficiently explored SD aspects: immeasurables (e.g. Bell and Morse, 1999; Attaran, 2006,) and intangibles (e.g. Burford et al., 2013).
- The indicators should be relevant, i.e. closely linked to indicated facts.
- The indicators should also comprise other qualities (sound methodology, legitimacy, etc.).
- The indicator set should be of a "manageable size".

The SDGs agenda does not specify the scope of indicators but due to a high number of targets we may expect a high number of indicators (the proposed number of indicators ranges from 100 to 303 at the time of this manuscript, i.e. April 2015). Therefore, we see an inherent contradiction. A standard solution suggests itself – a larger set of indicators and a small set of headline indicators. A decision on this should be made in cooperation between decision makers and experts (see Fig. 1). Besides the key requirement of relevance, some other criteria will have to be applied: understandability, timeliness, scope, etc. The development of headline indicators is one of the challenges to the SDGs agenda.

All of the above assumptions are either policy- or science-driven; i.e. based on policy or conceptual frameworks. However, none of the assumptions can be met automatically. Development of SDGs is a process of both scientific knowledge production and of political norm-creation and both components need to be mutually acknowledged. If the whole process of indicators development is well designed and performed, both perspectives are bridged in a final indicator framework (Rametsteiner et al., 2011). Although we do not question norm-creation and knowledge-production perspectives (see Fig. 1). We consider the indicator relevance to be the crucial one. Since the indicators should serve several objectives including raising public awareness and drawing attention to SD themes, the framework should comprise both indicators easily understandable for the non-expert audience (headline or key indicators) and indicators of a more "technical" nature. All of them should be highly relevant for SDGs, i.e. directly (closely) related to the goals and targets.

The selection and/or development of SDGs indicators has just started; however, the indicator framework seems to be based rather

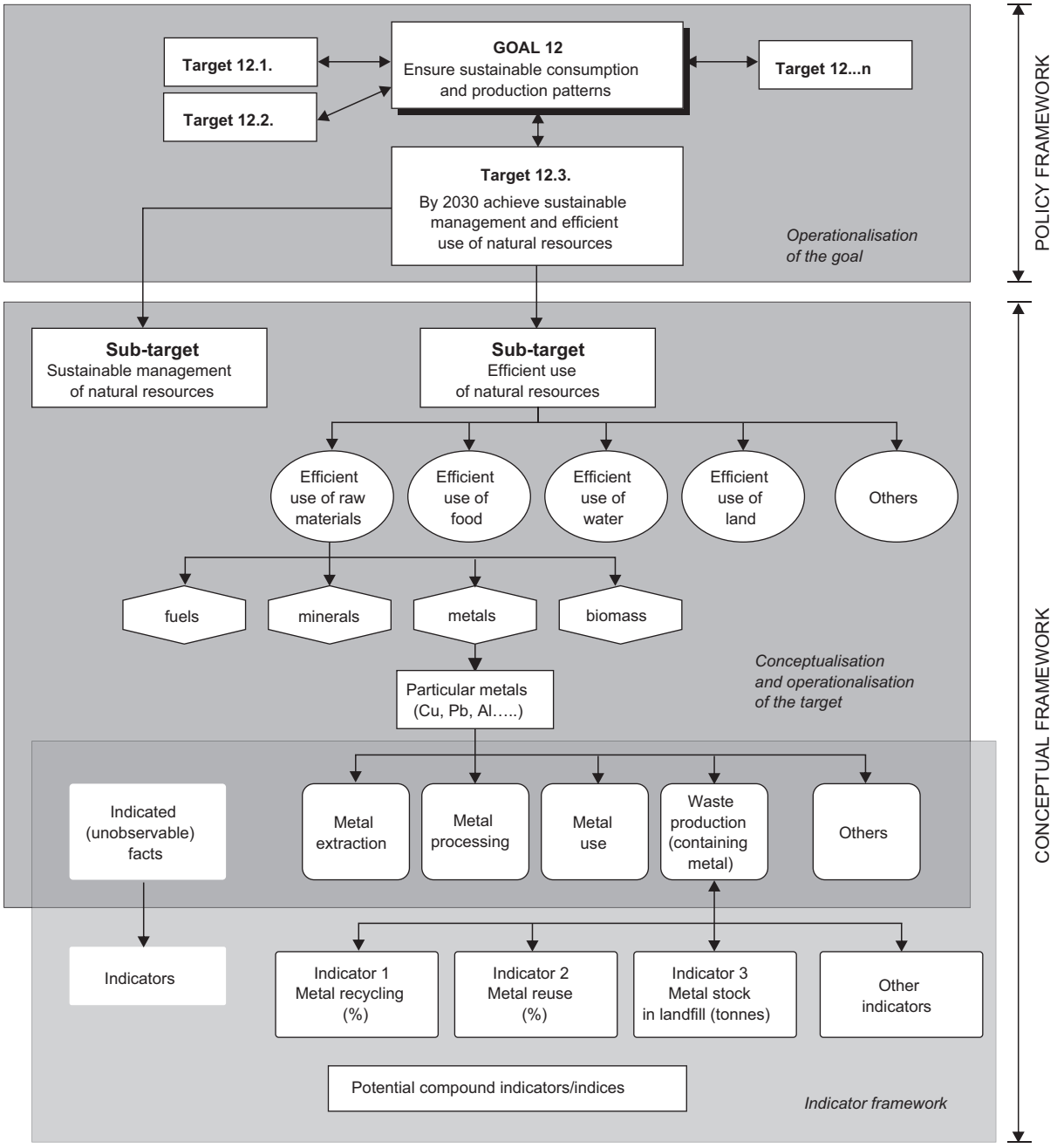

Fig. 2. Setting and operationalisation of the goals and targets.

on data availability (thus often based on a conventional approach to indicators) than on necessary conceptual considerations. Therefore there is a risk of matching various ready-to-use indicators/sets of indicators to individual targets on the basis of terminological or content affinity without verifying, or even considering, the "indicator-indicated fact" relation. Naturally, the vague definition of the targets will allow – and will tempt – such a solution. That is why we do not criticise various existing indicators and indices, in fact exactly the opposite. A huge amount of work in the field of indicators has been done in many domains (examples from the environmental field include ecosystem and biodiversity indicators, climate change indicators, resource use and efficiency indicators) and this work must be fully utilised. We merely argue for the rigorous application of conceptual and methodological approaches for the targets conceptualisation and operationalisation, which we argue will contribute to the selection and development of highly relevant indicators.

Fig. 2 schematically shows the overall process from setting goals and targets to developing an indicator framework. We argue that the process must include conceptualisation and operationalisation to warrant the relevant indicator framework (i.e. a framework with indicators relevant to measured facts). An example of goal 12 (Ensure sustainable consumption and production patterns) elucidates the key conceptual interventions necessary for full operationalisation of related targets. We assume that the goal has been endorsed and thus provides a legitimate basis for targets operationalisation. Our example "SDGs target 12.3." (By 2030 achieve sustainable management and efficient use of natural resources) combines two linked, but conceptually and methodologically distinct sub-targets: By 2030 achieving (1) sustainable

management of natural resources and (2) efficient use of natural resources.

- Sub-target "By 2030 achieving sustainable management of natural resources" must be conceptualised including challenging thoughts of strong/very strong vs. weak/very weak sustainability concepts since they have direct implications for measurements. Then it may be defined and further operationalised by applying e.g. fundamental principles of environmental sustainability such as: (i) rates of use of renewable resources do not exceed regeneration rate; (ii) rates of use of non-renewable resources do not exceed rates of development of renewable substitutes; (iii) rates of pollution emissions do not exceed assimilative capacities of the environment, and (iv) stock of critical capital is stable or increasing (e.g. Goodland, 1995; Daily and Ehrlich, 1996).
- Sub-target "By 2030 achieving efficient use of natural resources" is elaborated in Fig. 2 to give an idea of a multi-step operationalisation process. Similar to the previous sub-targets also here various approaches may be applied; however, we always have to keep in mind what are the indicated facts (i.e. what we want to report on) for which we construct the relevant indicators. Operationalisation of the sub-target will include the following steps:

  - Natural resources can be broken down into raw materials, food, water, etc. Raw materials are defined further as fuels, minerals, metals and biomass and finally, the metals may be broken down into particular metal elements such as cadmium, lead, nickel, etc.
  - For example, for each particular metal we will need data related to its "use": extraction, production, processing, use, and waste (collecting, recycling, etc.).
  - Each phase of the life cycle of a particular metal must be checked for relevance to the sub-target: Does the "recycling rate of Cu from waste" have a sufficient tie to the sub-target "achieving efficient use of natural resources"?
  - For relevant indicated facts, appropriate indicators will be selected (from existing sets) or developed.
  - The relationships between these indicators and indicated facts must be tested by appropriate methods – by a theory, empirically (e.g. by applying a set of indicators) or by an expert educated judgement.
  - The indicators that pass will be ready for reporting on the particular sub-target. They may be also employed in a decoupling analysis that is often used for the efficiency assessment (OECD, 2002b; UNEP, 2011). An indicator can be expressed as e.g. consumption of the resource per unit of economic output.
  - The indicators may be also combined into compound indicators (aggregated or composite indicators, and indices) if there is a demand. The well-established Material Flow Analysis (or Substance Flow Analysis) methodology might be applied here (BIO Intelligence Service, IFF, SERI, 2012) and e.g. Domestic Material Consumption indicator per unit of Gross Domestic Product (DMC/GDP) can be reported.

The above example shows a possible method of the target operationalization. It may not be applicable across the board, in the numerous areas of SD indicators. Therefore, involvement of the experts on particular issue is needed. The number of indicators may differ depending on the theme or issue (social and economic themes may require a larger number of indicators for testing the hypotheses establishing the "indicator-indicated fact" relation). It will further depend on explored correlations between potential indicators (indicators with a strong degree of correlation with other indicators may be taken out since they do not bring new information) and also on practical considerations such as data availability or on policy considerations, such as an agreed maximum number of indicators per theme.

Some trade-offs and synergies between the elements constituting a target, as well as causal relationships between the indicated facts may be disclosed during operationalisation process. It may subsequently result in redefinition of the particular target. Ideally, this whole process will lead to an indicator framework based on highly relevant indicators.

6. Conclusions

It is envisaged that the process of further formulation of SDGs will take place during 2015 when a final decision on an indicator set is expected. We recommend devoting proper time to the crucial task of target operationalisation (even if the final acceptance of the indicators is delayed/postponed). The selection and construction of SDGs may build upon the recent experience with MDGs – in particular with the process of establishing the policy framework. One must keep in mind that the overall experience with MDGs is a positive one and the SDGs could be seen as continuation in a similar direction (e.g. Sachs, 2012; Griggs et al., 2013; UN, 2014). However, in terms of the conceptual framework, extensive assistance from experts and scientists is needed to develop and/or apply adequate approaches for strengthening the largely neglected indicators characteristic – relevance.

According to the Zero Draft, the "The Future We Want" document provided a basis for formulation and operationalisation of SDGs. That 49-page document is certainly important for setting a policy framework for SDGs – it, inter alia, explicitly recognises the importance of SDGs – however, in terms of their operationalisation, the document is not very helpful. It states that there is a need for global, integrated and scientifically based information on SD, and that the achievement of the SDGs needs to be assessed and accompanied by targets and indicators. Further, it underscores that SDGs should be action-oriented, concise and easy to communicate, limited in number, aspirational, global in nature and universally applicable (Para 247, 250, 251).

All the targets and particularly indicators should be thoroughly analysed by experts. It may lead to streamlining and/or reduction in their number. After scrutinising the existing indicator framework for SDGs, we put forward the following messages:

- The properly operationalised targets will meet the criteria for SMART targets (specific, measurable, ambitious, realistic, time-bound) (Maxwell et al., 2015). They will reveal overlaps among potential variables, their causal, quasi-causal and falsely causal (only statistical) relations, data gaps and other difficulties.
- There will necessary be a large number – several hundred – of quite specific and technically/methodologically advanced indicators to cover relevant aspects of all the goals and targets. The importance of headline indicators should not be forgotten in terms of informing and alerting the general public without which the whole issue of SDGs remains only a bureaucratic exercise.
- The respective indicators must then certainly follow all the rules of sound science (robustly supported science, confirmed by multiple peer-reviewed studies) and respect data constraints but at the same time they must be strongly relevant for the given target.

The above leads us to the most important aspect of all. Let us recall the first stage of a policy cycle – policy formulation. The final format of the goals and targets is, of course, a matter of political process. However, for the sake of an efficient operationalisation process – and success of the whole SDGs agenda – the political process should consider scientific knowledge and evidence already in early stages of the policy cycle.

Underdevelopment or underestimation of a key indicators feature – relevance – could lead to false assessments of the degree of target-achievement, and thereby erode the credibility of SDGs. Hence, we reiterate our main message: the indicator framework for SDGs needs more intense conceptual and methodological work rather than merely the production of new social, economic and environmental statistics.

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