

The Agenda 2030 Compass: development of software tool

Wor Package 3 Report for the Agenda 2030 Compass project

Authors: Jon-Erik Dahlin

Acknowledgements: the author would like to acknowledge the contributions of Henrik Blidh and Karl Hallding.

August 2022

This report presents the findings from the Agenda 2030 Compass project's Work Package 3 focusing on the development of the software tool. The project's overall findings are presented in the Agenda 2030 Compass synthesis report, which can be found along with all available project reports at: www.sei.org/agenda2030compass.

The research and development work has been carried out by a consortium consisting of the Stockholm Environment Institute (SEI), Jernkontoret (the Swedish Iron and Steel Producers' Association), the MIT Center for Collective Intelligence and Swedish software developer Swedwise.

1 Introduction

The Sustainable Development Goals (SDGs) of the Agenda 2030 represent 17 main goals and 169 sub-goals which, if they are addressed in a suitable way, are meant to represent a shortlist of what tasks our society need to embark on in order to develop in a sustainable way. However, those goals are not non-dependent variables but are intrinsically indivisible in nature. This means that any effort being made with intentions to promote progress on any of the goals, will also affect the potential progress on several of the other goals. So-called second-order effects may be either beneficial (synergies) or detrimental (trade-offs).

The objective with the work carried out in work package 3 (WP3) is to develop and deliver a digital platform for delivering workshops around the Agenda 2030 Compass framework. The digital platform supports the testing of an external policy, strategy or project against second-order synergies and/or trade-offs between individual SDGs. In this way, the user organisation can – under the professional guidance of a workshop facilitator – learn how the effect that their supposed intervention will have on a certain number of the SDGs, will also lead to perhaps unforeseen effects. Those might be a mix of such that lead to an enhancement of beneficial societal effects, and such that might lead to adverse effects on some of the SDGs.

Both potential classes of second-order effects can be described as a form of economical externalities, both being of interest for the organisation: the beneficial effects represent additional value being brought by the intended intervention, and mapping such value may increase the willingness of the organisation or other stakeholders to perform said intervention; whereas detrimental effects are extremely important to bring into awareness so that those can be addressed in a suitable manner.

2 Purpose, scope and deliverables

The explicit purpose of WP3 is to develop the infrastructure for the Agenda 2030 Compass tool. The digital platform being developed by Swedwise, SEI and consultants includes a user interface, databases and calculation algorithms, all being interconnected to handle the data stream before and during an Agenda 2030 Compass workshop.

On the input side, the following need to be inserted to the system before a workshop is being administered:

- One or several 'context matrices'
- User data for participants and facilitator(s)

Also, before a workshop, the participants need to have prepared their understanding from a conceptual perspective, of the policy, strategy or project that they will analyse in the workshop. During the execution of the workshop, they will translate this conceptual understanding into a numerical representation in accordance with instructions being given by the facilitator. The numerical representation will then suit as an additional input for the algorithm, calculating second-order effects that the intervention may lead to.

At the end of the workshop, the participants shall have gained:

- A numerical value on the extent to which their intervention may result in a positive or negative net-effect on each of the SDGs, and even to what extent the intervention may enhance or suppress synergies and/or trade-offs already existing between the individual SDGs
- A better understanding on how cross-impact effects progress among and between the SDGs in general, and how their intervention may influence this
- Concrete ideas for how they may improve their intervention in order to enhance existing synergies that may promote an increase positive societal value, and/or depress or counteract against the effect of existing trade-offs between the SDGs

The deliverable of WP3 is the digital platform handling the technological part of the workshop process.

The intended impact is to propose an effective tool for mapping and analysing effects that an external policy, strategy or project or similar intervention that an organisation may want to launch,

in order to learn how this may lead to unforeseen positive or negative effects towards the progress on the SDGs – and for using this knowledge to improve the intervention.

3 Scientific background and state of the art

The interrelationship between individual SDGs is governed by an enormous range of parameters, factors and functions. From a mathematical perspective, each cross-impact interaction between an SDG and another SDG may be described as a non-linear differential function. This means that the cross-impact effects between SDGs in reality may be described by a massive system of differential equations, which in its fullest implementation would approach a complete model of the world.

In a previous work by Weitz *et al* (2018), indirect effects between SDGs were analysed in relation to how they may unfold in a particular context. The authors realised that each one of the 169 targets defined in the Agenda 2030, in light of all of them being indivisible in regards to each other, would potentially affect the progression on each of the remaining 168 targets. Thus, the authors were able to construct a matrix for which each element would represent an interaction between one target and another target. Furthermore, in their work, they defined a scale on which they would define how the interaction between the level of progress on one SDG or target may affect each of the other SDGs/targets. In turn, they drew on a seven-point interaction typology that had previously been introduced by Nilsson *et al.* (2016) and ICSU (2016), ranging from cancelling -3 ('cancelling') through -2 ('counteracting'), -1 ('constraining'), 0 ('consistent' when there is no significant interaction), +1 ('enabling'), +2 ('reinforcing'), and to +3 ('indivisible'). In the work performed on the *Agenda 2030 Compass*, we used a similar seven-point scale to quantify the interaction between SDGs, and developed similar cross-impact matrices – one for each particular context that were analysed.

The cross-impact effect by one SDG on all the other SDGs is modelled by a 'context matrix', being a 17 X 17 elements matrix representing the interrelationship between the individual SDGs in a certain context. A 'context matrix' is tied to a geographically, temporally and conceptually limited context, in which it is defined for each interaction by one SDG on another SDG, to what extent such interaction would lead to a synergy (i.e. progress on SDG #i enhances the potential for progress on SDG #j) or trade-offs (i.e. progress on SDG #i causes a potential for halted or reversed progress on SDG #j).

In order to analyse the second-order effects that the intervention may have on the SDGs, the 'direct effect vector' is multiplied by the 'context matrix' using a non-ordinary linear multiplication of the two entities. This results in another vector that represents the net effect that the intervention would lead to, after taking second-order effects of the given context into account.

4 Methods and implementation

For each stakeholder analysis, a particular strategic intervention was defined, called 'the strategy'. The strategy was thus a set of actions that the stakeholder perceived as something they would benefit from and which would also bring benefit to society in form of a positive effect on one or several of the SDGs. For each stakeholder analysis, a particular context was also defined in relation

to geography, time and other parameters that would provide delimitation to the scope of the analysis.

As a preparatory work before a workshop or series of workshops would begin, the strategy and the context would be defined in terms of qualitative descriptions of each. Also, the context would be quantified in the form of a 'context matrix', similar to those described by Weitz *et al* (2018) but for SDGs only and not specified on target level. This initial work thus provided some input material for each workshop in terms of a qualitative description of a strategic intervention that would be analysed at the workshop with representatives of the stakeholder organisation and potentially together with external experts; and a context matrix which would be a 17×17 matrix **A** for which each element α_{ij} would represent an interaction between one SDG i and another SDG j where $i, j \in \mathbb{N} [1:17]$.

During the workshop process, being described elsewhere in this report, there are three distinct sections where the qualitative input material is being used in the analysis, in one of which the workshop participants are also collectively creating additional qualitative material:

4.1 Strategy assessment and direct effects

In a collective process, workshop participants were asked to quantify the direct effect they would anticipate the strategy to have on each of the 17 SDGs. Direct effects could be either net positive or net negative. Each participant was asked to evaluate those effects using a seven-point scale ranging from -3 (severely negative effect) through +3 (strongly positive effect). In a discussion, the evaluation was normalised in regards to differences between participants' perception in regards to the respective steps in the scale. Also, if there were any disparities between whether effects were net positive or net negative those were also discussed and in the end all participants had the chance to re-evaluate their judgements.

The end-result of this process-step was a quantification on an averaged seven-point scale of the direct effect that workshop participants expected the strategy to have on the 17 SDGs. This result was mathematically defined as a vector **S** (called the 'strategy vector') with 17 elements S_k where $k \in \mathbb{N} [1:17]$.

4.2 Assessment and discussion of indirect effects

The direct effects of the strategy on each SDG would create indirect effects on all the other SDGs, in accordance with the conclusions by Weitz *et al* (2018). This means that for each element S_k in the strategy vector **S**, which represents a direct effect on one of the SDG caused by the strategy, the remaining SDGs will also be affected indirectly. Each element α_{jk} in the context matrix **A** indicate the cross-impact interaction between SDG # i and SDG # j . The indirect effect that the strategy would have, in a particular context, could be describe as a vector **E** (called the 'effects vector') with 17 elements e_l where $l \in \mathbb{N} [1:17]$. The *indirect effects* vector **E** is calculated by matrix multiplication:

$$\mathbf{E} = \mathbf{A} \otimes \mathbf{S} \quad (1)$$

where the '⊗ -sign' denotes a matrix multiplication.

In this phase of the workshop process, it was also discussed what the summarised effect on each of the SDGs would be when taking all indirect effects into account.

5 Results and outcomes

5.1 Characterising different types of indirect effects

In this subsequent phase of the workshop process, it was discussed which individual interactions between the strategy and the context matrix that would be the driving ones for the result seen in the previous phase. In particular, it was noted out for the participants that there may be four distinctly different types of interactions each of which would lead to an indirect effect (see Figure 1):

- A. When the strategy leads to progress (through direct effect) on a particular SDG which in turn leads to a positive (indirect) effect on another SDG, this would represent a **synergy**. This outcome thus represents an effect where something that the stakeholder does to create a positive outcome is also creating another positive outcome – and this effect is something that could be emphasised or at the very least acknowledged.
- B. When the strategy leads to a negative effect (direct effect) on a particular SDG, which in turn results in a reinforcing (indirect) effect on another SDG, this would represent a scenario where a potential indirect positive effect would **diminish**. Obviously, this is not good but indeed the negative direct effect is probably even more problematic and this scenario represents something that the stakeholder would probably want to avoid or at least mitigate.
- C. When the strategy leads to progress (through direct effect) on a particular SDG which in turn leads to a negative (indirect) effect on another SDG, this would represent an important **trade-off** that must be identified. The Agenda 2030 Compass has the ability to identify strong such effects, which is important for the stakeholder to become aware of in order to mitigate any potential negative outcome, or to seek help from other stakeholders to potentially discuss how these goal-conflicts could be decreased or even avoided.
- D. When the strategy leads to a negative effect (direct effect) on a particular SDG, which in turn results in a negative (indirect) effect on another SDG, this would represent the perhaps somewhat strange circumstance when those negatives might **cancel** each other out. It is important to become aware of such cases since those might represent future problem areas when the direct (negative) effect is eventually taken care of.

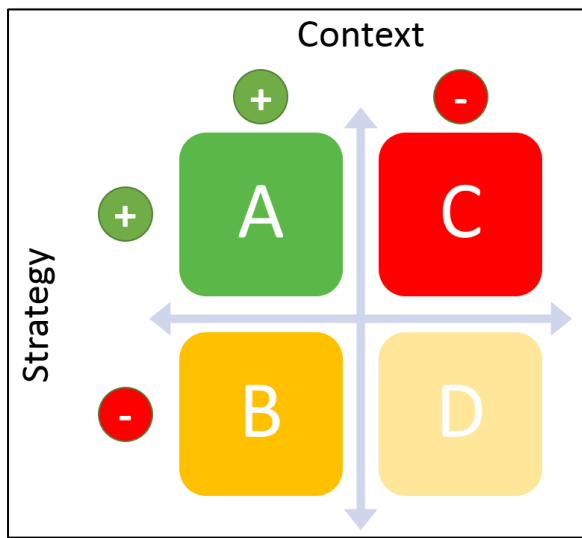


Figure 1. A visualisation of all four potential types of interaction between strategy and context, which might lead to indirect effect.

The Agenda 2030 Compass tool has a feature in which it provides a map of all potential interactions between the strategy vector and the context matrix, and then allows the user to filter out only those interactions that would be stronger than a certain level. By adjusting the filtering limit eventually, a manageable number of cross impact interactions can be singled out and even ranked if preferred. This provides the input material for the participants in this particular phase of the workshop process.

6 Conclusions

The method developed in this work package has been used in the Agenda 2030 Compass project's Strategy Analyser, which is a workshop-based process and toolbox to analyse the sustainability implications of a planned intervention within that context. The analysis of indirect effects is part of the toolbox to evaluate SDG interactions as part of workshop case study discussions.

7 References

ICSU (2016) A Draft framework for understanding SDG interactions. International Council for Science (ICSU), Paris

Nilsson, M., Griggs, D. & Visbeck, M. Policy: Map the interactions between Sustainable Development Goals. *Nature* **534**, 320–322 (2016). <https://doi.org/10.1038/534320a>

Weitz, N., Carlsen, H., Nilsson, M. *et al.* Towards systemic and contextual priority setting for implementing the 2030 Agenda. *Sustain Sci* **13**, 531–548 (2018). <https://doi.org/10.1007/s11625-017-0470-0>