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Implementation of Sustainable Development Goals in construction industry - a systemic consideration of synergies and trade-offs

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Abstract. According to sustainability research the world has exceeded four out of seven planetary boundaries. The areas of climate change, biodiversity loss, nitrogen cycle and land use have left the so called safe operating space for humanity. The built environment is one of the major contributors to environmental impacts. Especially the embodied energy during the construction phase of the built environment and the energy demands during the use of buildings contribute to a high energy and resource consumption. In the year 2015 the United Nations adopted the Sustainable Development Goals (SDGs), a universal development agenda, which goals need to be fulfilled by the year 2030 and by all UN countries worldwide. Amongst other countries Austria has adopted the 2030 agenda and has committed itself to the SDGs. Research objective was to explore the application of systemic approaches in the field of SDGs. The work presents a systematic literature review (SLR) and discusses an application of a qualitative system analysis (carried out with the tool iMODELER) on the SDGs. Results show how interdependencies among SDGs and among chosen concrete actions, e.g. for the built environment, can be visualized for a better systemic understanding. By visualizing synergies and trade-offs, effects of decisions taken can be estimated from a holistic perspective.

1. Introduction

According to ROCKSTRÖM [1] three load limits of the earth system processes have already been exceeded. Namely the limits in the areas of climate change, the loss of biodiversity and the nitrogen cycle. The fourth area, namely land use, has also already surpassed the worldwide limits of ecological resilience [2]. The economist RAWORTH [3], takes the planetary boundary concept, expands it and introduces also socioeconomic indicators like education, health, gender equality and peace. In this way she defines a necessary bottom line for the social wellbeing of people on earth. The concept is called the "Donut" [3]. There she defines the line which needs to be taken in account if humanity wants to stay within its safe limits, not only in ecological, but also in social terms. The described challenges and limits for our social and earth system wellbeing underlines the importance of the Sustainable Development Goals (SDGs), adopted by the United Nations in September 2015 [4], also called Agenda 2030. These Sustainable Development Goals comprise 17 goals, 169 sub-goals, and 232 indicators [5]. Amongst other countries, also Austria has committed itself to the SDGs [6].

1.1. Implementation of SDGs in Austria

In Austria, the mainstreaming approach is used to implement the SDGs. This means the Agenda 2030 is implemented on a federal level and every federal government department is responsible to implement the Agenda 2030 through relevant strategies and programs. On 12th January 2016, the working group "Implementation Agenda 2030 for Sustainable Development" under the leadership of the Federal Ministry for Europe, Integration and Foreign Affairs (BMEIA), as well as with the participation of other ministries was established. Its task is to coordinate the preparation of the regular progress report complying with



the internationally defined specifications on the basis of the agreed indicators as well as to coordinate the implementation priorities for the respective reporting period [7]. The mainstreaming approach as implementation strategy has been criticized by civil society [8] as well as by a report of the Austrian Court of Audit [9]. The civil society platform SDG Watch is advocating for the implementation of the SDGs and called in an open letter in January 2017 on the Austrian government and ministries to be more active in implementing the SDGs [10]. In the open letter, proposals for a better implementation of the SDGs in Austria, are formulated, for example a comprehensive inventory and gap analysis transparent reporting and the involvement of all stakeholders, is required [8]. From the science perspective, an important project to implement the SDGs in the Austrian higher education landscape is the project UniNetZ, established by the network Alliance for Sustainable Universities. In this project Austrian universities aim towards cooperation for the SDGs on science and research level, furthermore the project tries to establish a better dialog between science-society-policy [11]. One main goal is the creation of an concrete action paper for SDG implementation in Austria, which will be presented to the Austrian government [12-13].

1.2. SDGs in construction industry

The SDGs concern many areas of society, including the construction sector. To achieve the goals of global sustainability in the sense of the SDGs, there is a need for redeveloping the construction sector. The construction sector is globally "consuming 40 to 75 percent of the total value of materials extracted" [14]. According to figures mentioned in the International Resource Panel 2017 [15] buildings are also responsible for the use of 25 percent of global water. Furthermore the Global Status Report 2018 of the Global Alliance for Buildings and Construction [16] shows that 36 percent of final energy use in 2017 was caused by buildings and construction sector. This sector is also responsible for around 39 percent of emissions in the year 2017 [16]. Moreover estimated trends of the same report show that energy usage, besides improvements e.g. in building systems or building envelopes, is still growing. The emissions related to the buildings stagnate, due to the achieved energy efficiency in buildings as well as the decarbonisation of the power sector, and balance out development in population growth and the floor area growth. This means further reductions are necessary, if targets of the SDGs want to be achieved [16]. The Annex Report 57 of the International Energy Agency [17] is pointing out the factor that embodied energy and embodied energy emissions from construction industry constitute 20 percent of the global energy consumption and CO₂ emissions. This also implies that a reduction in embodied energy and CO₂ emissions can lead to a significant global decrease in energy consumption and CO₂ emissions. Another field where the built environment could act as driver is biodiversity, addressed in the SDG 15 - Life on Land [18].

The aim of this paper is to apply a systemic approach to identify building relevant actions and interactions between them based on the SDGs. As the SDGs have systemic interdependencies [19] and the Agenda 2030 has a systemic nature [20], the goals relate to each other and can create synergies and trade-offs among each other.

2. Applied methodology

The applied methodology described in this paper illustrates the state-of-the-art of the application of systemic approaches in context with SDGs (section 2.1) and shows how to link concrete actions to the SDG framework aiming to the identification and visualization of synergies and trade-offs (section 2.2) with the tool iMODELER (section 2.3).

2.1. Systematic literature review (SLR)

The literature research on systemic approaches in context of the SDGs was carried out by means of a systematic literature review and the snowball approach [21-22]. First, the following research questions were defined: "Which systemic approaches in context of the SDGs exist?" and "Why is a systemic approach indispensable for illustrating the interdependencies among SDGs?". In order to answer these questions, a systematic literature review was conducted in the literature database ScienceDirect¹. The search for relevant articles was restricted to "Review article", "Research article" and "Book chapters". With the defined keywords in combination with the term Sustainable Development Goals the systematic literature review was carried out. Furthermore, only english-language literature was researched. The following table lists all keywords, which were used in combination with the term Sustainable Development Goals, including the number of articles found.

¹ <https://www.sciencedirect.com>

Table 1: Keywords of the literature research

Key word I	Key word II	Articles found
Sustainable Development Goals	interaction(s)	45
Sustainable Development Goals	trade-off(s)	41
Sustainable Development Goals	synergy / synergies	35
Sustainable Development Goals	links	28
Sustainable Development Goals	linkage	23
Sustainable Development Goals	relation	20
Sustainable Development Goals	correlation	13
Sustainable Development Goals	systemic	13
Sustainable Development Goals	connection	12
Sustainable Development Goals	interdependencies	8
Sustainable Development Goals	interconnection	8
Sustainable Development Goals	interrelationships	5
Sustainable Development Goals	intersections	4
Sustainable Development Goals	interrelations	0

2.2. Systemic approach and systems thinking

The roots of systems science go way back in time. With the statement "The whole is more than the sum of its parts" Aristotle already pointed out that it is not enough to know only the parts of a system, but that the relationship between these parts is crucial. Under the guise of systems science, numerous terms and fields have developed. Often, systems science is divided into systems theory, systems analysis and cybernetics [23]. The insights gained from systems theory and cybernetics led to numerous interdisciplinary approaches. Particularly noteworthy is the approach developed by FORRESTER [24] called System Dynamics to better understand complex systems regarding their nonlinear behaviour. COLLSTE et al. [25] describe system dynamics as "a systems analysis approach that is used to study behavioural patterns of systems". Meanwhile, we look back on more than 50 years of systemic understanding and system dynamics [26]. Systemic thinking, in contrast to analytic thinking, is contextual, which in turn means that systems can only be understood by placing them in an overall context. At the same time, people can not consider the effects of more than four interacting factors at once [27]. This raises the challenge or difficulty of a lack of human understanding for interactions of factors in systemic approaches [28].

Problem-solving methods from the past, due to interconnectedness, complexity, feedback, etc., are no longer adequate for the problems of today's generations. The adaptation of new ways of thinking does not fall victim to the intellectual deficiency of humanity, but rather to the difficulty of storing thought patterns applied over centuries [29]. The first limitations of systemic thinking take place at the latest at the beginning of compulsory education. Through a strict separation of subjects the first interconnections are hidden. Much more seriously, these delimitations of the individual subject areas are then operated in the later school levels and universities. By neglecting the interactions between the subsystems, overarching medium and long term impacts are not visible. Because of the segregation of the individual things according to disciplines and areas of life and the oblivion of the connecting relationships that exist in reality, we lose our cybernetic understanding [30].

Sustainable construction - i.e. taking account of environmental, economic, sociocultural, functional and technical aspects in the planning and construction of buildings - not only represents a megatrend in the construction industry, but in recent years, notably through the signing of the Paris Climate Agreement [31] as well as various progress reports [32-34] already anchored in everyday practice.

Especially in the context of sustainable construction, the importance of systemic approaches in an early design stages, is growing [35-36]. The complexity of construction projects is high, so that their underlying dynamics is difficult to understand [28], [37]. Systemic effects can be modeled and effects can be shown that have not been pointed out yet. This can also lead to systemic improvement processes [38]. Another reason for a systemic approach in the construction sector is construction management itself. Generally a lack of methods for the management of necessary lifecycle processes, difficulties arise in the operationalization of integral planning or imprecise stakeholder requirements. These different goals should be optimally considered through systemic approaches, which in turn can lead to increased building quality in terms of sustainability and process optimization and thus to financial and time savings in the planning and the life-cycle of a building [39].

2.3. SDGs and their systemic nature

The systemic approach plays a role as well for the SDGs. They are integrated [4] and have a systemic character and relate to each other [19-20]. The SDGs are a relatively new and an extensive framing concept. This is the reason why there is only little literature specifically on SDG interactions available so far [40-41]. Therefore tools to analyze their complexity, as well as for enhancing their implementation, are important. To understand and unlock their full potential synergies and trade-offs of SDGs need to be analyzed and integrated in policy frameworks out of a holistic perspectives. As there is "a lack of science-informed analysis of interaction across the SDG domains" [20] more systemic science-based analyses can help to develop more coherent and effective decision-making [20]. Furthermore with the application of a systemic approach interactions can be understood and feedback loops between SDGs and their targets and sub-targets can be managed [42].

ALLEN et al. [19] indicate that in the SDG implementation lacks analytical tools and lack instruments to help countries' to assess interactions of SDGs as well as to optimize and understand the systemic impact of the various interventions. Also in the SDG practice of countries gaps are shown, which hinder the transformative potential of the SDGs. Reasons for this is a lack of skills and lack of awareness in system thinking and systems analysis, as well as the lack of SDG tailored systemic tools [19]. Furthermore, also BAI et al. [43] see the opportunity to exploit potential and positive synergies for the SDGs in the use of a system approach. Therefore a systemic view on the SDGs, their synergies and trade-offs connected with the constructed environment is necessary.

2.4. A qualitative systems analysis with the tool iMODELER

The iMODELER is a tool for qualitative explorative cause and effect modeling. With the iMODELER it is possible to visualize complex systems and show interconnections between factors. The connections are shown with arrows between different factors, marked with pluses or minuses, to show a positive or negative correlation. It is a model helping to understand complexity and complex systems with the advantage of relative simplicity compared to quantitative modelling. The applied software can be used for environmental, economic and social problems at regional or national level. It also allows for participatory modelling with different stakeholders with the benefit of not missing potentially important factors. Beside visualization, also analysis of systems is possible with the goal to reach improved planning, communications as well as decision-making and communications. Other use cases of the tool, if data is available, are test scenarios or as a simulation tool [37], [44].

With regard to the SDGs, NEUMANN et al. [44] have already tried to model the SDGs with their systemic interdependencies on a general level. Building on this approach, this article specifically places SDG 11 at the center of the model and visualizes the effects of concrete actions related to the construction industry.

3. Results

This section presents the results of the SLR and the application of the tool iMODELER for the identification and visualization of synergies and trade-offs among SDGs. The developed model represents an exemplary demonstration for the application of a systemic approach for the causal loop investigation of concrete actions based on SDGs. The focus in the illustrated example was directed to the SDG 11.

3.1. Systematic literature review (SLR)

The systematic literature review (SLR) shows that so far some of the authors use systemic approaches to explore the interconnections within the SDGs as well as certain topics.

Figure 1 shows the number of found articles by keywords indicated in table 1 split up by the year of publication. In the years after the adaption of the Sustainable Development Goals in 2015 by the United Nations [4] the numbers of publications levels off.

In the SLR a number of 263 article entries was found. After checking for double entries, 158 papers were identified. In a second step the entries were filtered, first by title, then by abstract and finally by the full article. The SLR showed that interconnections within SDGs were researched with different methods, also systemic approaches. Moreover literature poses that there should be more research to explore the interactions of SDGs and processes behind them, as well as synergies and trade-offs among the SDGs, to progress toward the achievement of the SDGs [45], [46], [47]. Some papers found through the SLR were not addressing the topic of SDG interconnection at all.

In general literature from different disciplines and journals was found, e.g. from the sustainability or environmental sciences, marine research, engineering or agriculture. The SLR results showed that different

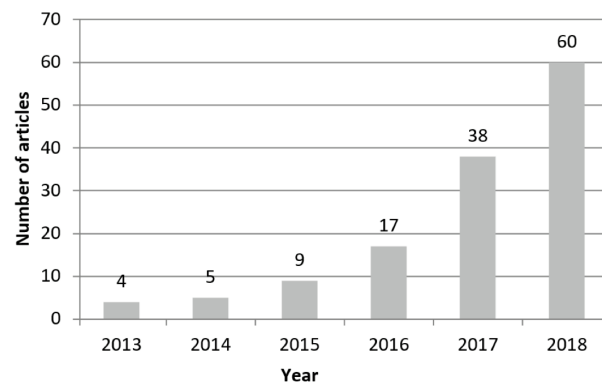


Figure 1: Number of SDG-related articles by the year of publication

authors, depending on their background and discipline, apply different, also non systems-oriented methods and tools to identify SDG interactions and connected synergies and trade-offs.

The thematic topics of the articles addressing SDG interconnections varied as well. Specific topics like salinization or SDG sub-targets like water quality were chosen as a starting point for the exploration of interdependencies among SDGs and the relevant topic. Synergies and trade-offs were not addressed in all papers specifically, sometimes the focus was e.g. just on trade-offs. Furthermore no paper was addressing SDG interdependencies specifically related to the built environment.

The following table 2 lists the titles of the relevant articles as well as their authors and their year of publication. Furthermore, the addressed SDG(s) within the articles are illustrated.

With the SLR only one scientific database has been researched, but for the exploration of the SDGs also grey literature needs to be taken into account. That is why also a snowball sampling was carried out.

One key paper found by snowball sampling, was the article of ALLEN et al. [19]. This paper provides an overview and analysis of expert literature (science-based) and guidelines (evidence-based) for SDG implementation worldwide. In an analytical framework 17 relevant papers as well as eight relevant guidelines and toolkits were identified and analyzed. One criterion was systems thinking and system analysis: in all eight guidelines or toolkits systems thinking and system analysis were applied. Moreover, 12 out of 17 papers used systems thinking. Further applied approaches identified in the expert literature were "nexus approaches, quantitative modeling, indicator-based-assessments and benchmarking, scenario analysis and MCA² decision-frameworks" [19].

² multi-criteria analysis

Table 2: List of relevant articles of the SLR and snowball approach

Article title	Author	Year	Adressed SDGs
Water quality and its interlinkages with the Sustainable Development Goals	Joseph Alcamo	2019	SDG 6, and SDGs 2, 3, 7, 14, 15
Analysing trade-offs between SDGs related to water quality using salinity as a marker	Flörke et al.	2018	SDG 2, 6, 7, 12, 15,
Defining and advancing a systems approach for sustainable cities	Bai et al.	2016	SDG 11, but more cities in general
More than Target 6.3: A Systems Approach to Rethinking Sustainable Development Goals in a Resource-Scarce World	Zhang et al.	2016	SDG 6 and other SDG
A rapid assessment of co-benefits and trade-offs among Sustainable Development Goals	Singh et al.	2018	SDG 14 and other SDGs
Trade-offs between social and environmental Sustainable Development Goals	Scherer et al.	2018	SDG 1 and SDG 6, 10, 13, 15
From goals to joules: A quantitative approach of interlinkages between energy and the Sustainable Development Goals	Santika et al.	2019	SDG 7 and other SDGs
Connecting SDG 14 with the other Sustainable Development Goals through marine spatial planning	Ntona Mara and Morgera Elisa	2018	SDG 14
Articulating natural resources and sustainable development goals through green economy indicators: A systematic analysis	Merino-Saum et al.	2018	SDGs and topic natural resources
Dynamic modeling approaches to characterize the functioning of Health Systems: A systematic review of the literature	Chang et al.	2017	No specific SDGs
Distilling the role of ecosystem services in the Sustainable Development Goals	Wood et al.	2017	SDG 1, 2, 3, 6, 7, 8, 9, 11, 12, 13, 14, 15
Building Urban Resilience for Disaster Risk Management and Disaster Risk Reduction	Etinaya et al.	2017	SDG 11
Towards a governance heuristic for sustainable development	Müller et al.	2015	No specific SDGs
SDG synergy between agriculture and forestry in the food, energy, water and income nexus: reinventing agroforestry?	van Noordwijk et al.	2018	No specific SDGs
The nexus across water, energy, land and food (WELF): potential for improved resource use efficiency?	Ringler et al.	2013	No specific SDGs
National pathways to the Sustainable Development Goals (SDGs): A comparative review of scenario modelling tools	Allen et al.	2016	No specific SDGs
Toward a systemic monitoring of the European bioeconomy: Gaps, needs and the integration of sustainability indicators and targets for global land use	O'Brien et al.	2017	No specific SDGs
Towards integration at last? The sustainable development goals as a network of targets.	Le Blanc David	2015	SDG 12, 10 other SDGs
Modeling and measuring sustainable wellbeing in connection with the UN Sustainable Development Goals	Costanza Robert	2016	SDGs and topic of wellbeing
Evaluating agricultural trade-offs in the age of sustainable development	Kanter et al.	2018	SDG 2
Initial progress in implementing the Sustainable Development Goals	Allen et al.	2018	No specific SDGs (Review)
Map the interactions between Sustainable Development Goals	Nilsson et al.	2016	All SDGs
Policy coherence to achieve the SDGs: using integrated simulation models to assess effective policies	Collste et al.	2017	SDG 3,4,7
Connecting the sustainable development goals by their energy inter-linkages	McCollum et al.	2018	SDG 7 and other SDGs

3.2. Application of the systemic approach

As part of the UniNEtZ project, several expert workshops in the area of SDG 11 were held. The aim of these workshops was to develop concrete actions for the Austrian Federal Government in order to contribute to the achievement of the Agenda 2030. In these workshops, first subject areas by experts were defined to holistically cover the targets of SDG 11. In the expert workshops it turned out that there are numerous interdependencies among these subject areas and subsequently between SDG sub-targets and SDGs. In figure 2 the process model is illustrated. In the center of the model is the factor SDG 11. For an initial modeling, the following assumptions were made, which also stem from the framework of the SDGs:

- all SDGs have an equivalent meaning and thus a same weighting³
- the targets and indicators were taken as defined by the United Nations
- all targets have an equivalent meaning and thus a same weighting
- interdependencies among the targets were not considered
- interdependencies among the indicators were not considered
- defined subject areas were linked to the indicators only

³ although is not necessarily the case in reality

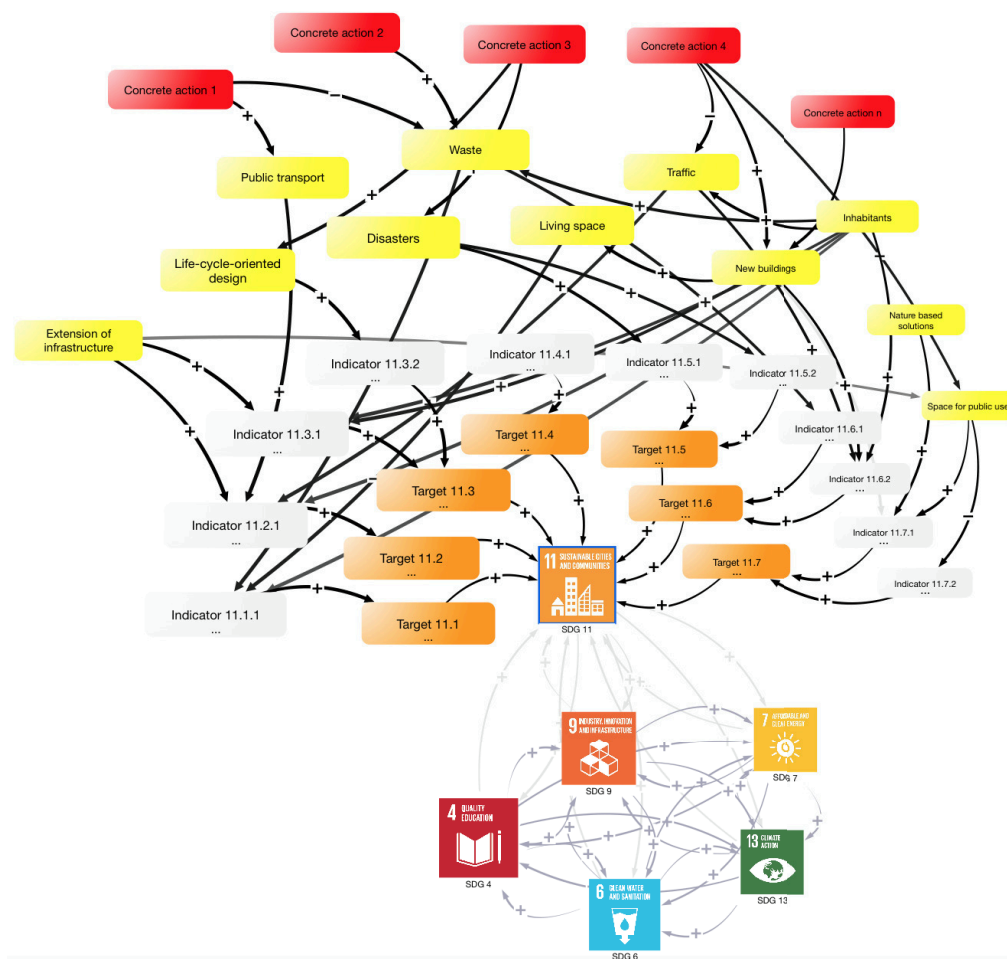


Figure 2: Interdependencies among defined subject areas within SDG 11

In iMODELER direct relations between factors have to be considered. This method is called know-why method [48] and concludes four know-why questions:

- What leads directly to more of a factor?
- What leads directly to less of a factor?
- What might lead directly to more in the future?
- What might lead directly to less in the future?

In the illustrated example (figure 3) an increased fulfillment of target 11.1⁴ and target 11.6⁵ directly causes to SDG 11. By analogy, the increased fulfillment of the Indicator 11.1.1⁶ leads directly to an increased fulfillment of target 11.1.

Further examples for the interpretation of the model:

- more inhabitants lead to more traffic
- more inhabitants lead to more waste

⁴ By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

⁵ By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

⁶ Proportion of urban population living in slums, informal settlements or inadequate housing

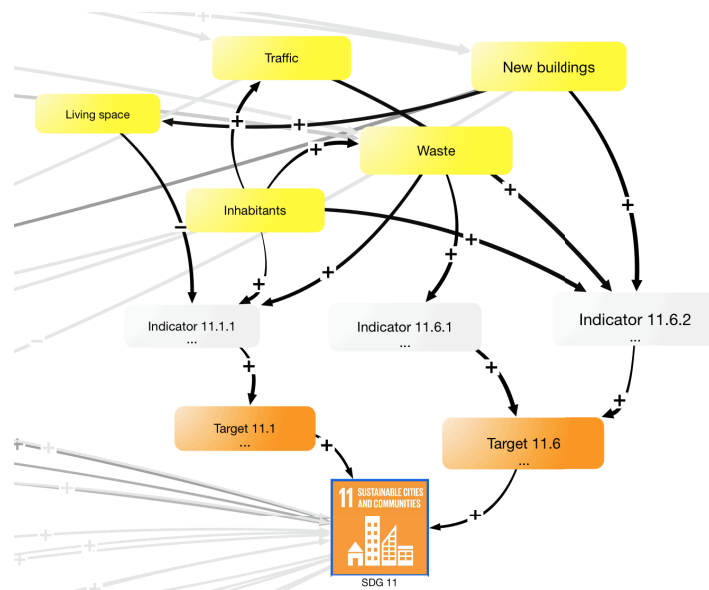


Figure 3: Exemplary illustration of synergies and trade-offs - an excerpt of the model

- more waste leads to more urban solid waste (indicator 11.6.1⁷)
- more inhabitants lead to more fine particulate matter (indicator 11.6.2⁸)
- more traffic leads to more fine particulate matter (indicator 11.6.2)
- more new buildings lead to more fine particulate matter (indicator 11.6.2)
- more new buildings lead to more living space

As shown in figure 3 concrete actions were linked to the defined subject areas. These concrete actions may influence the subject areas in positive or negative ways. To visualize the interdependencies of single actions or to identify the most useful action for SDG 11 or for one of the targets or indicators, the iMODELER is a helpful tool.

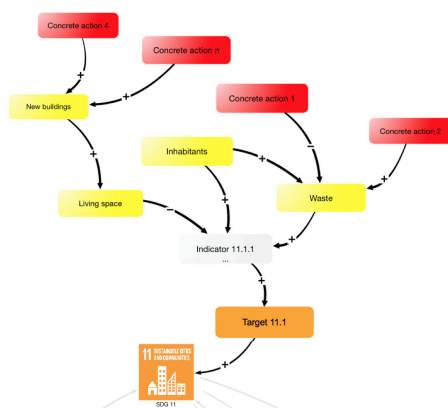


Figure 4: Target 11.1 in the center of the model

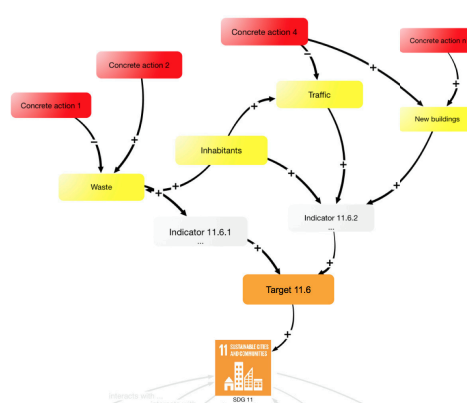


Figure 5: Target 11.6 in the center of the model

⁷ Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities

⁸ Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)

In figure 4 and figure 5 the comparison of influences on exemplary factors is shown. To visualize the systemic effects of concrete actions the tornado chart was used. In order to analyze the influencing factors for a selected target factor, the target factor must be placed at the center of the process model. The tornado chart shows positive and negative influences between the respective actions as well as synergies and trade-offs resulting from this consideration.

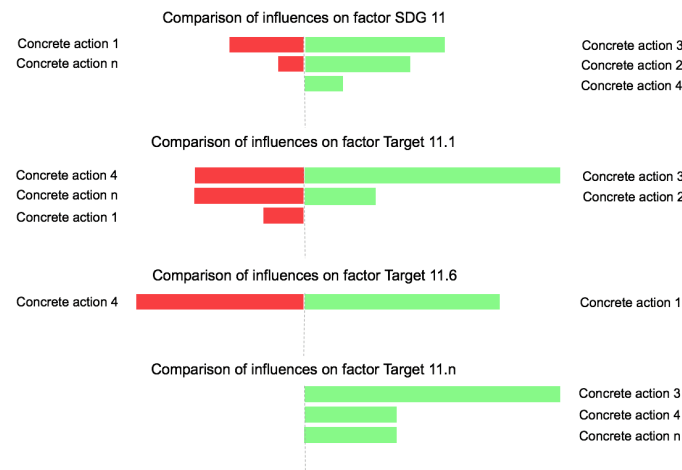


Figure 6: Concrete actions and their synergies and trade-offs shown as tornado chart

Behind the calculation of the effects is an extensive algorithm. The calculation of the tornado chart is done by multiplying the weights of influences between two factors. Starting points of the calculations are loops of inventory factors, which allow an exponential increase of influences in self-reinforcing loops. In order for the potential effect of loops to become clear, they run through the time steps (short-term, medium-term and long-term) twice.

For decision makers, this implies that action 2 and action 3 should be executed first. These actions have no negative effects on any of the centered target factors. Action 4 has a positive impact on the entire SDG 11 but has a negative impact on sub-target 11.1 and on sub-target 11.6. That implies that action 4 must have positive impacts on other sub-targets (not illustrated in figure 6). If action 4 will be taken decision makers have to estimate how strong the negative effects on sub-targets 11.1 and 11.6 are and whether these have negative effects in the medium or long term. If decision makers only consider sub-target 11.6 and therefore executes action 1, this would lead to a negative impact on the entire SDG 11. With the systemic consideration within the tool iMODELER, these occurring synergies and trade-offs can be quickly identified and visualized.

4. Discussion

This article shows no analyses of concrete actions nor a recommendation for necessary actions to fulfill SDG 11. Rather it recommends a systemic approach supported by the iMODELER to handle the complexity of SDGs and their numerous subtargets. The detailed analyses of actions and their effects is currently under development in the UniNEtZ project. In Austria the implementation of SDGs shall be implemented on federal level. To coordinate the preparation and implementation the Federal Chancellery and other Austrian ministries established an Implementation Agenda 2030 for Sustainable Development. Civil society criticizes the way and intensity of this implementation process executed by the Austrian government and ministries. It is an important topic in regard to SDG implementation and policy. The development of the SDG indicators is already given, nevertheless the completeness and meaningfulness of many indicators can still be improved. The special focus in this work on SDGs in construction industry reveals that there is a need for a complete redevelopment of the construction sector because of its high energy and material use. The systematic literature review shows that literature on the topic of SDGs and interactions has increased in recent years from 4 articles in the year 2013 to 60 in the year 2018. Literature on the systemic nature of the Agenda 2030, and especially on synergies and trade-offs, is still in its infancy. In this relation insights gained from systems theory and cybernetics concepts play an important role in thinking and understanding of interconnections between different aspects and factors.

For the definitions of the SDGs and targets the linking between subtargets is a difficult step because targets are formulated very generally. Even when the SDGs are considered equivalent, the most important SDGs and targets for Austria, e.g. in regard to the building sector, should be identified. The definition and introduction of subject areas is a first attempt to make the model more comprehensible and tangible. In this manner new topics can be added and the extensibility of the model is possible. In any case before implementation the identified measures should be analyzed in regard to their impact. Based on several expert workshops in the area of SDG 11 the qualitative exploration of the interdependencies among SDG targets and related sub-targets and indicators as well as the levels of influence between immediate actions was exemplarily performed with the tool iMODELER.

5. Conclusion

We as a global society face great challenges which can only be solved together. With the SDGs we now have an agenda that addresses them in a comprehensive framework. That is why the Agenda 2030 can be chosen as a starting point to transform society in a sustainable way and it should also be used in science as well as in practice. High energy consumption, CO₂ emissions and material consumption are a problem in the Austrian building sector and must also face its responsibilities. Although it seems difficult, as there are multiple reinforcing and nested interactions among the SDGs, it is important that the Austrian building sector and its actors take into account systemic thinking and systemic approaches to contribute to the SDGs. Moreover approaches like the UniNetZ project which aims for better science-society-policy dialogues should be implemented and used more often to bring different stakeholders together to identify common solutions supported a comprehensive and integrated know-how, towards the implementation of SDGs. Research recommendations are that the interdependencies within the Agenda 2030 should be explored in a systemic way for the Austrian implementation of the SDGs especially regarding the construction sector and the built environment. The tool iMODELER can help to pave the way for decision makers and assist them with decision-making as well as an argumentation and visualization tool e.g. for presentations. This must happen soon because as the Agenda 2030 should be implemented and reached by the year 2030, it must be clear that this is a very short timespan from this moment on. The research also shows that the iMODELER tool is a reasonable tool to model interdependencies among SDGs, their targets and indicators and helps to visualize synergies and trade-off between different actions connected to them. This tool can support decision makers to opt for the action with the least trade-offs and the most synergies with other SDGs. With regard to the pressing challenges the world and humanity is faced at the moment, such as the huge environmental impact of the buildings and construction sector, there is a need to rethink and redesign the sector to contribute to the SDGs, also in Austria. The Agenda 2030 is an opportunity to lead and initiate a change in this sector. Moreover this work shows that it is essential to work with systemic thinking and systemic approaches towards the implementation of the SDGs, demonstrating a complex and integrated framework, to address challenges of our time until the year 2030 in the optimum way. The tool iMODELER offers decision makers in Austria an option to visualize actions, which will e.g. developed by the UniNetZ project, and their synergies and trade-offs. In a second step in this way immediate actions can be better prioritized and the actions with the highest synergies and least trade-offs can be chosen.

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