FROM VISION TO PRACTICE - MEASURING THE SUSTAINABLE DEVELOPMENT GOALS IN A LOCAL DANISH CONTEXT

A Case Study of Guldborgsund Municipality

MASTER THESIS

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DISCLAIMER

Message from Head of Studies and Head of Study Boards:

'COVID19 and the consequences of the lock-down of society and the university since March 13, 2020 have had influence on which activities that have been possible to stage and carry out as part of the project work. More specifically, this means that activities have been limited to online activities, and that activities such as Lab activities; surveying activities; on-site ethnographic studies and on-site involvement activities have not been possible.

When assessing this project, please bear this in mind.'

The specific influence on our thesis:

The outbreak of COVID-19 and the following consequences of the lock-down had an influence on our Master thesis, as it limited certain activities which otherwise would have been beneficial for the project work. Fortunately, three of the interviews for this thesis were held before March 13. So the main impact of the lock-down is related to the workshop we had planned with Guldborgsund Municipality. The initial idea was to make a workshop with the municipality, where the three participants from the first interview promised to invite other relevant employees from the municipality. Instead the "workshop" was held online on Skype, with the three participants. The meeting only had a few workshop-alike elements, as it was difficult to complete the group tasks online. All things considered the online interview gave good and valid data, but it was of course preferable to hold the interview physically, with more participants, as this is a central aspect from the included theory and methods for this thesis.

PREFACE

This Master thesis was carried out as the 4th and final semester of the M.Sc. program in Sustainable Cities at the Department of Planning, Aalborg University. The thesis was completed over a period of four months by a group of three students.

The theme of this Master thesis takes its point of departure in a semester project from a 3rd semester project, carried out as a part of an internship at COWI. At the time, COWI challenged the student to develop indicators and ultimately the concept of a planning tool for the Sustainable Development Goal (SDG) 11 – Target 11.2, with inspiration from a former planning tool that focuses on walkability. The student was challenged to design a planning tool for the SDG, based on the fact that the government, municipalities, and consultancies have acknowledged the importance of the UN's SDGs and wish to develop means of implementing them in order to achieve the goals in 2030.

The Master thesis is more holistic with regard to developing sustainable cities, where the former research was sector focused and solely concerned with the measurement of a single target, namely SDG 11.2. For this thesis it was decided to conduct research that further developed the planning tool by focusing on SDGs 6, 11, 12, and 17 and their respective targets.

In order to focus on a municipality, we reached out to Guldborgsund Municipality, who proved to be essential to the development of the tool. The municipality has put a lot of resources into the project, which is highly appreciated, especially considering the outbreak of the pandemic COVID-19 during this period. So, we want to especially thank Birgitte Echwald, Lone G. Bak, and Lena D. Berring, who were open to participating in focus group interviews and assessing, discussing and developing findings for this research. It would not have been possible to generate similar findings without their valuable inputs.

Finally, we want to thank Helle Nedergaard Nielsen who has been our supervisor during the Master thesis, especially for her highly appreciated and challenging feedback sessions.

ABSTRACT

In 2015 the United Nation signed the 2030 Agenda for Sustainable Development, a resolution with a number of goals that set the stage for ambitious but necessary development in both developing and developed countries. The Sustainable Development Goals are very broad and cover everything from eliminating hunger to strong partnerships and thus chiefly provide a common direction and frame of reference for global efforts for further sustainable development. Since the adoption of the SDGs, many political bodies and institutions have worked on how to translate the many goals, targets, and indicators into a concrete action-oriented local agenda (SRC, 2016). However, the task has so far been difficult since the SDGs are formulated with a holistic and global perspective.

Based on this challenge, this thesis aims to develop a planning tool for Danish municipalities, which they can use to screen cities in order to be aware of where they are performing well or poorly in relation to the SDGs. This planning tool consists of sustainability indicators (SIs) and a band of equilibrium (BOE), which were developed based on a Systemic Sustainability Analysis (SSA) presented by Bell and Morse (2008) and the SMART concept presented by Gudmundsson (2016). A central feature of the SSA is its acknowledgement of the subjectivity in sustainability, which is why Guldborgsund Municipality was involved in a collaborative process to find relevant SIs, develop the BOE and continually evaluate our planning tool. This resulted in a planning tool consisting of 91 SIs and a BOE constructed based on the SDGs that Guldborgsund Municipality found relevant, namely: SDGs 6, 11, 12, and 17.

The output from the planning tool should be used by local politicians in order to work towards the SDGs. The output of the tool should not be seen as a final answer, but rather as an indication of where a city might have some challenges. The planning tool was designed with a great amount of freedom, so each municipality can adjust the tool to be relevant in their context. This has resulted in a prototype that was well received by the municipality, but a lot of work still needs to be done in order to fully operationalise this planning tool.

DANISH SUMMARY

I 2015 underskrev verdens regeringsledere "The 2030 Agenda for Sustainable Development", en resolution bestående af 17 Verdensmål, med tilhørende delmål og indikatorer. Disse mål sætter dagsordenen for en hidtil uset ambitiøs og nødvendig bæredygtig udvikling frem mod 2030 i alle FN's medlemslande, både i-lande og u-lande. Verdensmålene bygger videre på en lang række initiativer såsom: Brundtlandrapporten fra 1987, Rio-deklarationen fra 1992 og 2015-målene (også kendt som "The Millennium Development Goals"). Verdensmålene er meget brede og dækker alt fra at udrydde sult, til at udvikle bæredygtige byer til at opnå et stærkt samarbejde om implementeringen af disse mål. Siden 2015 hvor Verdensmålene blev offentliggjort, har medlemslandene forsøgt at gøre målene, delmålene og indikatorerne relevante i forskellige lokale kontekster. Det har dog vist sig at være en svær opgave, fordi Verdensmålene netop favner så bredt.

I Danmark er kommunerne helt centrale aktører i at arbejde hen imod Verdensmålene, da de er ansvarlige for meget af den fysiske og lokale planlægning. I 2018 udarbejdede Kommunernes Landsforening en undersøgelse blandt alle landets kommuner, der viser at størstedelen af kommunerne arbejder eller ønsker at arbejde med Verdensmålene, men at de savner værktøjer og metoder for at komme igang. På baggrund af dette, ønsker vi at udvikle et værktøj der kan screene byer eller byområders performance ift. Verdensmålene, i de danske kommuner. Udviklingen af dette værktøj tager udgangspunkt i en teknisk viden om udviklingen af værktøjer fra 3. semester-

et på uddannelsen Sustainable Cities, samt i udviklingen af sustainability indicators (SIs) og et band of equilibrium (BOE) - et reference system. Værktøjet udvikles i et tæt samarbejde med Guldborgsund Kommune, hvor der inddrages teoretisk viden fra Bell & Morse (2008) som resultere i det analytiske rammeværk Systemic Sustainability Analysis (SSA) og fra Gudmundsson (2016) der i sit værk introducere og definere SMART konceptet.

Teorierne bygger på en forståelse af, at bæredygtighed er kontekstafhængigt og bygger på de aktører som arbejder med begrebet. Derfor blev det valgt at involvere Guldborgsund Kommune, for at kunne identificere og definere konteksten i Guldborgsund. Konteksten fungerede som et rammeværk for den videre udvikling af SIs og et BOE, hvilket resulterede i et værktøj som er udviklet til at måle Verdensmål 6 - Rent vand og sanitet, 11 - Bæredygtige byer og lokalsamfund, 12 - Ansvarligt forbrug og produktion og 17 - Partnerskaber for handling. Værktøjet består af et indeks på 91 SIs som er fundet henholdsvis gennem et litteraturstudie af eksisterende værktøjer og metoder, der i dag bruges til at måle forskellige aspekter af bæredygtighed, samt en række øvelser med Guldborgsund Kommune som er inspireret af konceptet fremtidsværksteder. Endeligt blev der givet ideer til videreudviklingen af et BOE.

En prototype af værktøjet blev udviklet i Excel på baggrund af de SIs og BOE der var fundet igennem analyserne. Det blev vurderet til at være vigtigt at udvikle et værktøj med en høj grad af frihed, så det kan bruges af mange forskellige kommuner og tilpasses til deres situation. Dette var vigtigt da bæredygtighed i teorien er kontekstafhængigt, så nogle indikatorer er relevante i en kommune, men ikke i en anden. Den høje grad af frihed åbner også for risikoen for at værktøjet kan misbruges til at 'green washe' et område med. For at imødekomme dette, er indikatorerne bl.a. opdelt i 'state SIs' og 'pressure SIs'. State SIs måler den faktiske status af et specifikt emne, fx cykling - altså hvor mange personer bruger cyklen - mens pressure SIs måler på områder der kan påvirke state SIs fx kilometer cykelsti. I værktøjet er det muligt at prioritere hvor vigtige hver enkelt SI er for kommunen, hvilket har en indflydelse på den endelige score. For pressure SIs er det muligt at vælge "ikke relevant" hvilket vil fjerne indikatoren fra værktøjet, denne mulighed er der dog ikke på state SIs, da det er vigtigt at kende status.

Igennem dette speciale kan det altså konkluderes at der ved hjælp af SSA kan findes og udvikles SIs og et BOE, der kan bruges i et værktøj for at måle hvordan de danske kommuner performer ift. Verdensmålene. Dog skal det også understreges at dette er første udkast til et sådant værktøj og meget arbejde ligger stadig i, at gøre det fuldt operationelt for de danske kommuner.

CONTENT

APPENDIX

1 THE UN'S SUSTAINABLE DEVELOPMENT GOALS

Humanity is currently facing several global and national challenges that can have decisive impacts on and serious consequences for the world we live in. Climate crisis, rapid urbanisation, environmental challenges, hunger, famine, and rising economic inequality are some of the key issues facing the global community. Consequently, at the United Nations Summit 2015, the world's heads of state and government signed the 2030 Agenda for Sustainable Development, a resolution with a number of goals that set the stage for an ambitious but necessary development in both developing and developed countries. The adopted Sustainable Development Goals (SDGs) consist of 17 general goals, 169 targets and 232 approved indicators, which are intended to be achieved by 2030, focusing on sustainable development in all of the UN's 193 member states (United Nations, 2015a). The SDGs have been planned for a long time and did not appear out of thin air but are a continuation of several international initiatives including: The Brundtland Report [1987], The Rio Declaration [1992], and The Millennium Goals [2000]. The SDGs succeed the Millennium Development Goals (MDG), which primarily focused on developing countries (Blanc, 2015).

The 2030 Agenda for Sustainable Development is far from the only resolution concerning sustainability that has been agreed upon: one year later in 2016 world leaders agreed on the Paris Agreement, with the purpose of limiting the global temperature rise to below 2 degrees. This agreement is directly linked to SDG 13 – Climate Action but is also intrinsically linked to the other 16 goals (United Nations, 2015a; United Nations, N/Ac; Kawakubo et al., 2018). In relation to sustainable urban development the United Nations member states agreed to The New Urban Agenda in 2016, which is a shared vision for well-planned and sustainable urbanisation in both developing and developed countries (United Nations, 2016a; United Nations, 2016b). The SDGs have a more holistic approach than other resolutions because they are rooted in the commonly represented three-pillar conception of sustainability, namely, social, economic, and environmental, while supporting the link between human rights, peace and development, where the MDGs have been criticised for excluding both the economic and environmental elements (Blanc, 2015). 16 out of 17 goals can be classified within the three pillars, with the exception of the last goal, which entails the partnership process which supports the achievement of the other goals, as demonstrated in Figure 01.

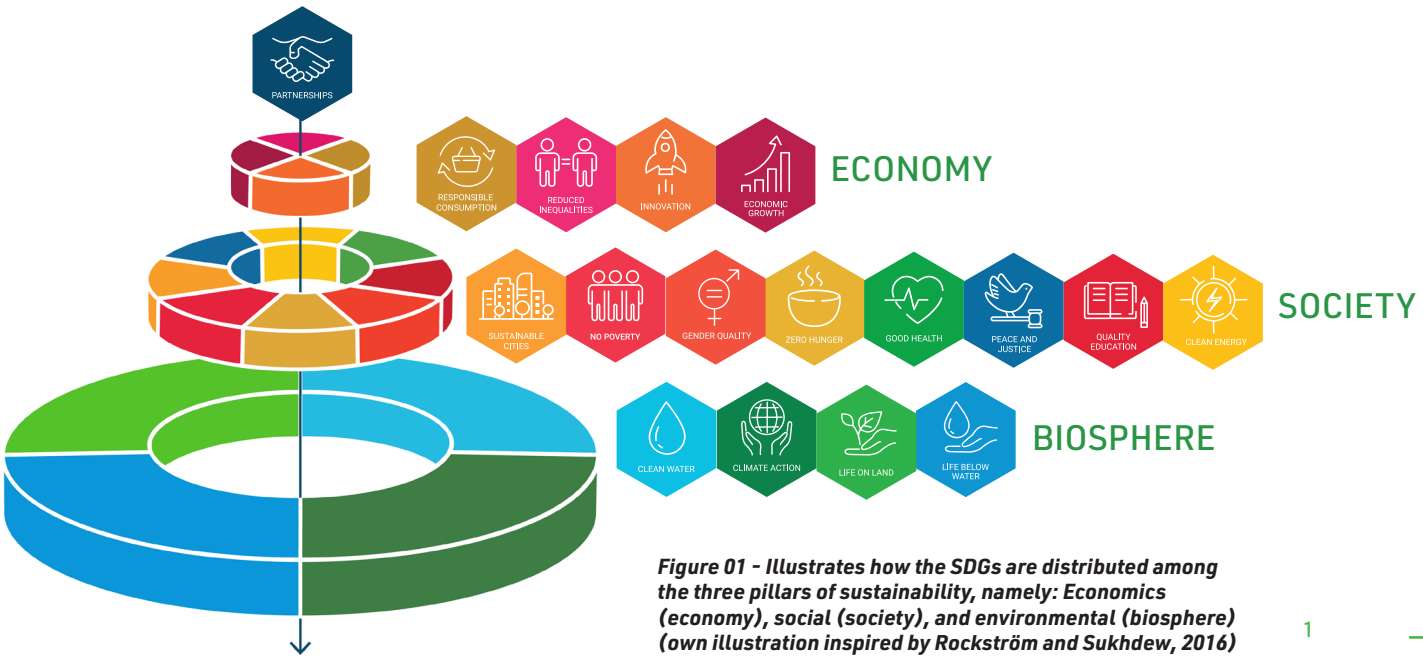


Figure 01 - Illustrates how the SDGs are distributed among the three pillars of sustainability, namely: Economics (economy), social (society), and environmental (biosphere) (own illustration inspired by Rockström and Sukhdew, 2016)

The goal and purpose of the SDGs was presented by Ki-moon (2015), who was the general secretary of the UN when the SDGs were published:

'At its essence, sustainability means ensuring prosperity and environmental protection without compromising the ability of future generations to meet their needs. A sustainable world is one where people can escape poverty and enjoy decent work without harming the earth's essential ecosystems and resources; where people can stay healthy and get the food and water they need; where everyone can access clean energy that doesn't contribute to climate change; where women and girls are afforded equal rights and equal opportunity.' (Ki-moon, 2015)

As highlighted in the quote, the 17 SDGs are very broad and cover everything from eliminating hunger to forging strong partnerships and thus chiefly provide a common direction and frame of reference for global efforts to promote further sustainable development. The SDGs do not provide a toolbox or a recipe for action, and it is up to the governments of all countries to individually handle and explain how they will fulfill them – and report on their progress – both in their own country and through global efforts. Since the adoption of the SDGs, many political bodies and institutions have worked on translating the many goals, targets, and indicators into a concrete action-oriented agenda (SRC, 2016). However, the task has so far been difficult since, among other things, the SDGs are formulated with a holistic and global perspective. Knowledge of how these global goals are to be translated to a local level and thus made tangible in practice is limited.

1.1 THE SDGS IN A DANISH CONTEXT

As part of Denmark's commitment to the 2030 Agenda for Sustainable Development the Danish government developed an action plan in 2017 which sets the framework for the government's approach and prioritisation of how Denmark will achieve the SDGs. The government has created four main priorities, each with a number of goals connected to the SDGs. The priorities are: Prosperity, People, Planet, and Peace. While plans of action at the national level are mandatory, this is not the case for Danish municipalities, and it is up to individual municipalities to decide whether they want to develop plans for the SDGs (Udenrigsministeriet, 2017). According to the agreement for the municipalities' economy for 2019 between Kommunernes Landsforening (KL) and the Danish government, the municipalities do not have any direct commitment to work on the SDGs, but both parties agreed that the municipalities should keep up the good work (Regeringen & KL, 2018). However, there is no guarantee that the municipalities will choose to work towards the SDGs; in fact, PhD student in governance Jannik Egelund (2020) states that: *'I do not have the impression that the municipalities feel obliged to incorporate the SDGs due to the agreement between KL and the government*'. The fact that it is up to each individual municipality to incorporate the SDGs by choice, can be argued to have several consequences.

A report carried out by Deloitte investigating the implementation of the SDGs in Nordic municipalities highlights that the national governments of the Nordic countries, including Denmark, recognise that municipalities play an important role in the implementation of the SDGs (Deloitte, 2018). Kawakubo et al. (2018) support this consideration and argue that the main implementation of solutions and monitoring will occur in cities and local communities and thus the local government has a huge role to play in sustainable development. The

municipalities are well situated between the national government and the local community, which is why they can play a major role in two ways: 1) contributing to national strategies with local knowledge and 2) addressing local problems with knowledge gained through the SDGs. But the report by Deloitte also shows that a common barrier for the implementation of the SDGs is that no clear distinction has yet been made between expectations at national and local levels in relation to the specific role of municipalities. This barrier was identified by the municipalities who have made an attempt to take action with regard to the SDGs (Deloitte, 2018) and Guldborgsund Municipality faces the same barrier, as they state:

'There does not exist a national accepted framework for new projects which guides the practitioner to incorporate the SDGs. [...] So how can we measure the SDGs, and how do we know which baseline we need to use in order to assess our performance? Are we progressing positively – or are we going backwards?' (Focus group interview 1, 2020)

If Denmark wants to move in a more sustainable direction, the municipalities are central players, as many of the crucial and long-term decisions regarding sustainable development take place locally. For example, municipalities decide on levels of social services, integration, urban planning, transport systems, waste disposal, and energy utilisation (KL, 2018). Municipalities can also promote social inclusion and co-creation and ensure productive environments for citizens, businesses, and investments, which in turn can create jobs and open opportunities for innovation. Municipalities thus play a key role in relation to the global agenda. Furthermore, a survey conducted by KL in October 2018 shows that 90 percent of the municipalities are in the process of or are considering starting to work towards the SDGs. At the same time, KL's study highlights that the municipalities need tools and methods to help them start working towards the SDGs (KL, 2019).

Another issue that the municipalities face is that the SDGs were formulated for a global context, which means that they do not consider the contextual characteristics that make each country different in terms of infrastructures, policies, economy, weather conditions, etc. This applies, for example, to Target 11.3, which sets out the goal to: '*Enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries*' (United Nations, 2015b). Here, the official global indicator is the proportion of cities that have democratic involvement of civil society in urban planning. The same can be seen with Target 17.14, which sets out the aim to '*enhance policy coherence for sustainable development*' (United Nations, N/Ab) by measuring the number of countries that have mechanisms in place that can increase policy coherence in relation to sustainable development. These indicators make sense in a global context, but they can be difficult for the municipalities to grasp when they have to "make cities more inclusive and sustainable" or "increase political mechanisms that support sustainable development mechanisms", as it is unclear what should be measured within a Danish context.

1.2 OPERATIONALISING SUSTAINABILITY THROUGH INDICATORS

'The ideas and concepts of sustainability need to be given operational forms if they are to influence and count in the governance [...] Such a prerogative has been acknowledged by many policy bodies and scholars over the last two decades, and the term indicators is often evoked as an important element in this respect' (Gudmundsson et al., 2016: 137)

Due to the broad nature of the SDGs, local authorities struggle to operationalise these goals. Even with 232 official SDG indicators, the Danish municipalities are still failing to incorporate the UN initiative in decision making (KL, 2019). The official indicators were formulated globally, which in most cases makes them nearly impossible for the municipalities to use in local practice. In order to give the SDGs an operational form, new tangible indicators are needed.

Furthermore, by making indicators operational, such as through planning tools, they can provide greater breadth in approaches to discussing sustainable urban development, based on measurable values (Gudmundsson et al., 2016; Bell & Morse, 2008; Rosales, 2011).

'[...] by moving indicators from the ex-post evaluation of cities' problems to an ex-ante stage in which they can be operationalized as planning tools. Indicators then will become auxiliaries in the design of policies, strategies, actions and programs for urban sustainable development.' (Rosales, 2011:2)

Contextual and relevant indicators represented through planning tools are thus essential in order for the SDGs to be fully integrated into urban development processes.

2 RESEARCH QUESTION

By engaging in a collaborative process with Guldborgsund Municipality, how can the UN's Sustainable Development Goals be contextualised and made measurable in a planning tool, as a basis for Danish municipalities' sustainable development of cities?

- How does the literature address the issue of measuring the Sustainable Development Goals?
- How can an index of relevant indicators be developed, through a collaborative process with Guldborgsund Municipality?
- Which opportunities and barriers are present in the planning tool in relation to the Sustainable Development Goals?

3 SCOPE

As Danish municipalities need methods and tools that can measure their progress towards the SDGs, we found it interesting to develop a prototype of such a tool. The scope of this thesis is limited to the planning practices of Guldborgsund Municipality and thematically to the Sustainable Development Goals. Planning practices are in our project defined as the work that is done on the SDGs, and shall not be seen as how the municipality operates in general nor the geographical and physical aspects of planning.

Due to the huge span of the SDGs, our tool will be limited to a smaller sample of goals which in turn should be seen as a representation of how all the goals could be implemented.

The tool is a screening tool for cities, which means that it can contribute with knowledge of which SDGs a municipality is performing well or poorly on. The tool is designed to be used by planners or other practitioners in the municipality, while the output should be used by local politicians to discuss solutions. It was not possible, due to scarcity of data and time restraints, to develop a complete band of equilibrium but instead an example will be designed as a substitute to illustrate the functionality of the tool. The tool was developed in collaboration with three employees at Guldborgsund Municipality, based on our ideas and their needs and preferences. This means that this thesis takes a practical approach.

Sustainability Indicators (SIs) is used as a central concept throughout this thesis. SIs as a concept is constructed to encapsulate subjectivity when measuring sustainability, because sustainability varies from context to context and from person to person (Bell & Morse, 2008). The term 'SIs' differentiate from the traditional term 'indicators' as indicators in theory must be objective in order to be valid. In this thesis, 'SIs' are thus used as a term for: indicators that are assessed to be relevant and context specific by Guldborgsund Municipality.

4 PROJECT STRUCTURE

Figure 02 illustrates the overall structure of this thesis. The middle column shows the different chapters, the right column shows the main theoretical approaches used and the left column presents the methodological approaches used. As a theoretical framework the Systemic Sustainability Analysis (SSA) is used throughout the project. Different methodological choices are made when using the SSA, which is why it is necessary to present the theory before the methodology.

The analytical work began with a literature review of the state-of-the-art knowledge in relation to contextualising and making the SDGs relevant in a local context, together with other frameworks and tools that are designed to measure sustainability. Following this, the SSA was carried out by first understanding the context in Guldborgsund Municipality, and secondly, finding and developing sustainability indicators (SIs) and the band of equilibrium (BOE) in order to develop the tool. Some SIs were found through the literature review and by using the SMART concept, where only the relevant and context-specific indicators were included. Other SIs were developed by the municipality, as they did not find the index of SIs from the literature to be sufficient. Finally, this knowledge was used to develop the planning tool, which included illustrating the output. The tool was then analysed in order to identify its advantages and disadvantages which, together with knowledge from the other analyses, led to a discussion. Based on the discussion a list of recommendations for the user of the tool is presented alongside the conclusion of this thesis. Finally, a recommendation for further research, that describes what work should follow this research in order to make the tool more useful for Danish municipalities.

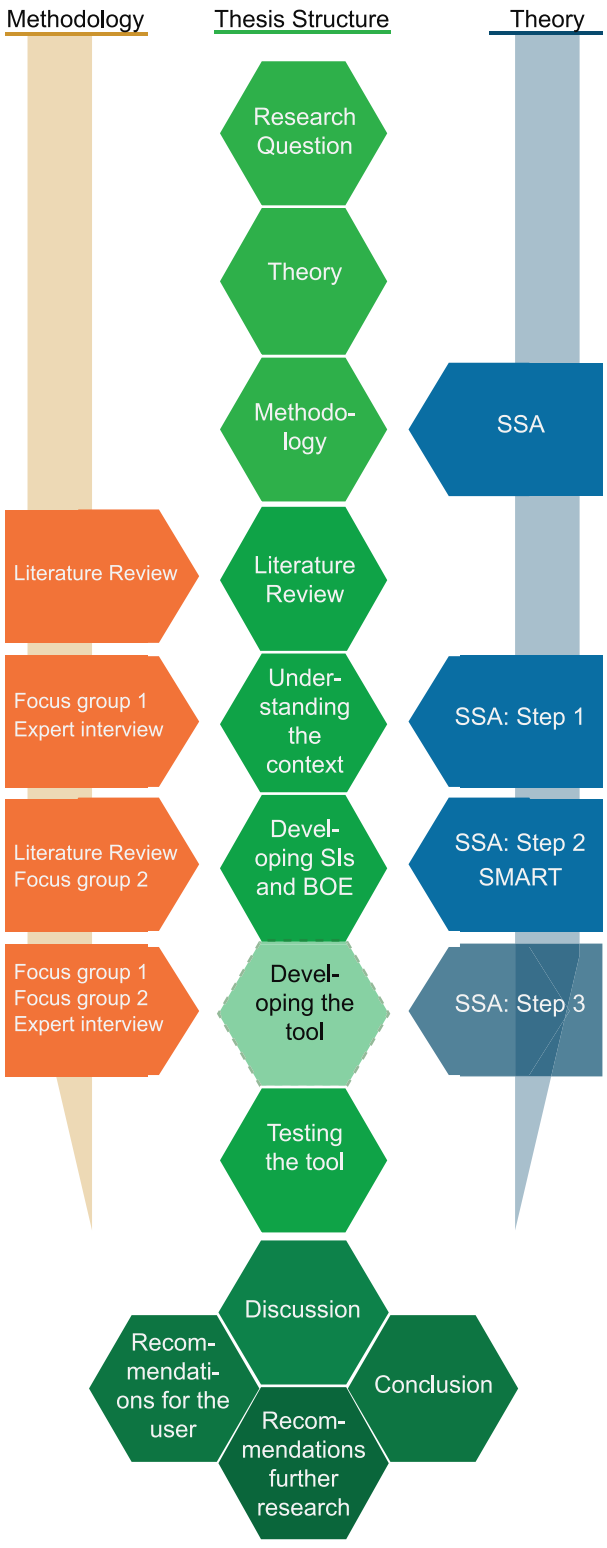


Figure 02 – The project structure

5 THEORY

This chapter aims to describe the thesis' theoretical approach, which is primarily based on how indicators can be used to measure the SDGs and thus be used as a planning tool for sustainable urban development. Questions like: what is an indicator, how are "good" indicators characterised, when is an indicator sustainable, and how should an indicator be presented for maximum effect are all related and will be investigated throughout this chapter.

Indicators have been acknowledged to play an important role in achieving the SDGs, because indicators can contribute towards increasing the understanding of the challenges in cities by monitoring different conditions over time (Valencia et al., 2019; Simon et al., 2016; Klopp & Petretta, 2017).

The theoretical knowledge used in this thesis derives mainly from two books, '*Sustainability Indicators: Measuring the Immeasurable?*' by Simon Bell and Stephan Morse (2008) and '*Sustainable Transportation: Indicators, Frameworks and Performance Management*' by Henrik Gudmundsson et al. (2016).

5.1 CHALLENGES OF USING INDICATORS TO MEASURE SUSTAINABILITY IN CITIES

In order to understand when an indicator is contextual and relevant, it is essential to know what an indicator is. Gudmundsson et al. (2016) define an indicator as '*[...] a variable, or a combination of variables, selected to represent a certain wider issue or characteristic of interest*' (Gudmundsson et al., 2016:139). An indicator is a variable that represents an issue or characteristic of interest, which in this thesis is represented as SDGs. An indicator is used to measure a certain sustainability issue that is known and can be divided into three separate elements: the value, the unit and the variable, as shown in Figure 03.

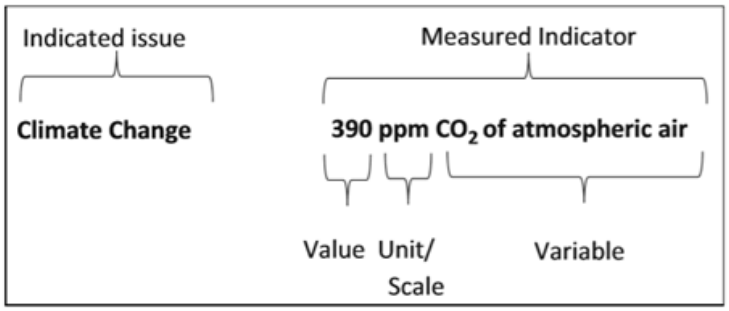


Figure 03 – Explanation of what an indicator consists of (Gudmundsson et al., 2016)

Using indicators to measure sustainability creates some challenges that conflict with the holistic nature of sustainability. Indicators are in their nature specific and have time and spatial boundaries. When measuring a clear spatial unit such as cities, problems arise. Cities are not self-contained entities but have links to other cities and the rural environment (Bell & Morse, 2008). When developing a tool which judges the level of sustainability of a certain area, the time and spatial scale are important to consider due to different reasons:

- Time: Measuring different systems within the city requires different time scales. E.g. upgrading a transport system might be resolved faster compared to the rehabilitation process of cleaning soil from pesticides to ensure clean water, which can take several years. This is a challenge as the improvement of some systems can first be measured by the tool many years later (Bell & Morse, 2008).

- Spatial scale: As explained, cities or city areas are not self-contained entities and can be heavily influenced by what happens outside these areas (Bell & Morse, 2008). An example is SDG 6 – Clean water and sanitation: if pesticides are discharged in the rural area around the city, it can affect the water in the city.

Furthermore, sustainability is 'wicked', meaning that the improvement of one aspect can negatively impact other aspects (Henry & Vollan, 2014). Gudmundsson (2020) recognises this challenge within the indicator literature

and emphasises: '*You have to be pragmatic and recognize that you cannot include all the aspects of sustainability, meaning that, it is okay for a practitioner to focus on parts of sustainability, as long as it does not mean that you systematically ignore everything else*'. Focusing on parts of the system when measuring sustainability can have several advantages. First of all, the practitioner will ensure that politicians do not encounter an overflow of indicators, which can confuse them instead of assisting (Gudmundsson, 2020). Secondly, the focus can lower the required amount of data and thus the required amount of resources, which can ultimately make the indicators feasible (Gudmundsson, 2020). Thirdly, it might not be all parts of sustainability that are relevant for the politicians; only focusing on parts of sustainability lets the politicians choose which elements are important to them, which makes it possible to include contextual elements in the selection of indicators, which will make the indicators as relevant as possible (Bell & Morse, 2008; Gudmundsson, 2020).

Lastly, it is important to mention the subjectivity involved in creating a tool and indicators for this tool. Bell and Morse (2008) argue that subjectivity occurs in many parts of creating a tool because choices must be made such as: Which indicators are selected for inclusion in or exclusion from the tool? Who decided this? What value do they ascribe the spatial scale and the time dimension? This is furthermore supported by Gudmundsson (2016), who states that '*the word "selected" is included since indicators are never pure, or value-neutral representations; they are selected for various reasons, and therefore inevitably have subjective aspects to them, hidden or not*' (Gudmundsson, 2016:139).

5.2 SYSTEMIC SUSTAINABLE ANALYSIS

One approach, introduced by Bell and Morse (2008), is focusing on creating indicators which are relevant and contextual for those who have to work with them, namely the Systemic Sustainable Analysis (SSA). The SSA is designed to help develop sustainability indicators (SIs) through a holistic and qualitative approach (Bell & Morse, 2008). Put plainly, local stakeholders are, in collaboration with the researchers, asked to select and develop indicators and explore, describe, and assess the level of sustainability of an agreed system the SIs are used in. Consequently, the SSA results in a presentation of the SIs and system's state. Repeating an evaluation of the system's state will thus provide the data to monitor sustainable development. The SSA contains five steps, namely:

1. Understand the context
2. Agreeing on SIs and the band of equilibrium
3. Develop the AMOEBA: scenario making
4. Review and meta-scenario making
5. Publicity, publicising and marketing the message.

Steps 4 and 5 will not be investigated in this thesis as these steps deal more with marketing than the development of a tool. The first three steps in the SSA provide essential guidelines for setting up a system of relevant, context-specific SIs which will be presented in the following sections.

5.2.1 STEP 1: UNDERSTAND THE CONTEXT

The SSA requires close cooperation with the relevant stakeholders. Additionally, it does not attempt to find one single SI which can reflect reality completely (Bell & Morse, 2008) but rather a system defined by multiple SIs. By using the SSA, the practitioner will be able to develop SIs that capture the needs of the chosen context, which in our case means contextualising the SDGs. Bell and Morse (2008) state that it is necessary to understand the complexities

in the system in order to understand the context. It is up to the politicians to define which elements are important in their context, since it is extremely difficult for external stakeholders to define what is important within a local context (Bell & Morse, 2008). As this step is based on participatory methodology and mainly relies on choices made and limitations set by the project group, it will be further elaborated on in Chapter 6.

5.2.2 STEP 2: AGREEING ON SIS AND BAND OF EQUILIBRIUM

An important part of creating the planning tool is creating SIs which can assess the level of sustainability in relation to the local stakeholder's viewpoint. Before addressing the criteria for a good SI, it is important to understand that SIs can be grouped in different ways, but one of the most commonly used and simplest divisions is into:

- State SIs: Indicators that describe the state of a variable. For example, the bike modal share describes the percentage of trips made by bike and is a state SI for modal split (Bell & Morse, 2008).

- Pressure SIs: Indicators that gauge a process which can influence the state SIs. For example, the total distance in kilometres of bike lanes in a city. By improving this indicator, it can have an effect on the bike modal share (the state SI) (Bell & Morse, 2008).

The state and pressure SIs can, as explained in the example above, be related. Often it is preferable to include both types of SIs as *'a state SI may not necessarily provide information on the causes of change'* (Bell & Morse, 2008:29), while pressure SIs fail to assess the level of sustainability. By including both types of SIs in a tool, one ensures that the tool can both assess the level of sustainability and provide information on the causes of change (Bell & Morse, 2008)

5.2.2.1 THE 'SMART' CONCEPT

Step 2 of the SSA deals with creating SIs based on an extensive collaborative process with the stakeholders. Due to both time and practical restraints, this approach was not sufficient. So, to complement the development of SIs, we used the SMART concept, which is not originally a part of the SSA, and applied it to relevant SIs found in the literature; see Chapter 9.1. The SMART concept is an approach used to support the selection of context-appropriate indicators (Gudmundsson, 2016). The SMART concept was introduced for the first time in 1997 by Bernard Broughton and Jonathan Hampshire to aid the process of setting realistic and useful goals for an organisation, where indicators can be thought of as a helpful tool (Broughton & Hampshire, 1997; Gudmundsson, 2016). SMART is an acronym for Specific, Measurable, Attainable, Relevant, and Timely. This concept has a focus on assessing and selecting contextual, practical, and relevant indicators instead of providing scientific support for the indicators (Gudmundsson, 2016:159). An explanation of each criterion is shown in Table 01.

S Specific	M Measurable	A Attainable	R Relevant	T Timely
Key indicators need to be specific and should relate to the conditions the project seeks to change	Each indicator should be measurable and hence requires a precise definition	The indicator must be attainable at reasonable cost using an appropriate collection method	Indicators should be relevant to the management information needs of the people who will use the data	An indicator needs to be collected and reported at the right time to influence many management decisions

Table 01 – shows the SMART concept and each criterion (Broughton & Hampshire, 1997; Gudmundsson et al., 2016:160)

To ensure that the indicators fit the context, which in this case is Guldborgsund Municipality, it is important that each indicator fulfill all five criteria in SMART (Gudmundsson, 2016).

5.2.2.2 THE BAND OF EQUILIBRIUM

The Band of Equilibrium (BOE) refers to the reference conditions. Even though a reference system implies a degree of objectivity the BOE is very subjective since this approach is based on a level of achievement that is agreed on by the target group (Bell & Morse, 2008).

According to Bell and Morse (2008), the BOE should be determined by the local stakeholders based on what is desirable for them and the system they have chosen, which ultimately sets the project's targets or reference position by agreeing upon what is known to be relevant within the context. This also entails defining the outlines of the measured spectrum in terms of the levels of over-achievement and underachievement; hence, what is non-sustainable and what is too sustainable. While the 'below expectation' range for sustainability is reasonably well understood (i.e. baselines, global standards, scientific research), defining what is 'beyond the sustainable' might not be as easy, and it is up to the local stakeholders to make the band realistic and useful (Bell & Morse, 2008).

According to the SSA, it is important that the group of stakeholders can use the SIs in the BOE without prior access to specialised measurement skills: *'In fact, the entire exercise can be undertaken by the stakeholder group, based upon the agreed views and opinions of that group. This is one of the empowering aspects of the approach overall.'* (Bell & Morse, 2008:149).

In order to create a BOE, Bell and Morse (2008) suggest that understanding what each SI measures and what each SI means by sustainability will lead to insights into what is realistically achievable within the project context. Furthermore, Gudmundsson (2020) provides three different methods for building a reference system:

1. Boundaries: The level of achievement is based on scientifically defined standards that control the acceptable range of certain SIs. E.g. for clean water and sanitation, when minimising the release of hazardous chemicals and materials (Target 6.3) the BOE could be based on Danish legislation which states that the limit value for pesticides in drinking water is 1 gram of pesticide per 10,000 cubic metres of drinking water (MST, N/A).

2. Comparative: The level of achievement is based on best practice within a similar context. E.g. for sustainable cities (SDG 11), it will be important that the BOE is based on best practice in cities that are comparable with each other. It does not make sense to compare biking in Copenhagen with biking in Nykøbing Falster.

3. Improvement: The level of achievement is based on the practitioners own progress over time.

Each of the different approaches to the BOE can provide different outputs and it is up to the stakeholders to deem what is most suitable and qualified for their needs (Bell & Morse, 2008). The Boundaries-method is most suited when the stakeholders' aim is to achieve a level of sustainability within a specific range for the context under consideration, whether due to a law requirement or a political desire. The Comparative-method is more suited if the goal is to achieve or exceed the average level of sustainability for similar cases, in an effort to match or rival other groups. For the Improvement-method, there are no external factors that define the BOE, and this method is thus most suited if the stakeholders just want to exceed themselves for each measurement, ideally achieving continuous increase in the level of sustainability (Bell & Morse, 2008).

5.2.3 STEP 3: DEVELOP THE AMOEBA: SCENARIO MAKING

Once the SIs and the BOE are known the next step is to illustrate the output. Bell and Morse (2008) suggest using an AMOEBA diagram, which is very similar to what is known as a radar chart or a spider web chart, see Figure 04. The advantages of this diagram are that it can represent multiple SIs at once while illustrating both the different categories and the levels of sustainability outcomes that are involved in the process. This illustration is a fairly simplistic model, but as Bell and Morse (2008) state, the intention is not to tell the whole story behind the project, but rather use the model as a means of displaying how the SIs are performing in a manner conforming with a common format. Any similar model or device could do this step equal justice.

'The main function of the AMOEBA is to provide a relatively instant presentation of the project's state of health in terms of its sustainability.' (Bell & Morse, 2008:150)

It is important to recognise that the diagram in this approach can be seen as objective, but as mentioned earlier, it is a representation of the stakeholder group and their perception of the system and their definition of the contextual boundaries regarding sustainability (Bell & Morse, 2008).

But the AMOEBA, or a similar illustration, only provides a snapshot, and in order to showcase progress, Bell and Morse (2008) recommend creating multiple illustrations over a period of time. Only by doing this can the illustrations be used effectively as an indicator of movement towards or away from stakeholder desires or understandings of sustainability.

In this project it was not possible to draw a series of AMOEBA, as the focus is on creating the tool and not measuring sustainability performance in Guldborgsund Municipality.

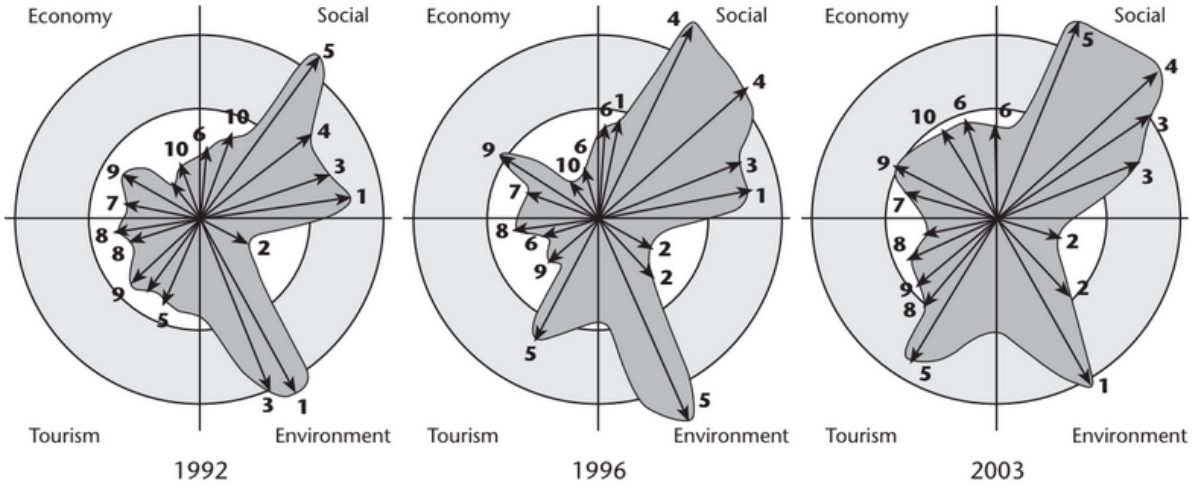


Figure 04 – An exsample of a band of equilibrium over the span of 11 years (Bell and Morse, 2008:184)

6 METHODOLOGY

The following chapter presents the considerations that inform the structure and design of this thesis. The purpose is to describe and justify the methodological basis that has been used throughout the thesis. This thesis seeks to develop an example of a tool which can measure the performance of Danish municipalities with regard to achieving the SDGs and their targets. That is why a part of this thesis relates to the field of measuring sustainability, which covers a broad range of publications and authors. The field of measuring sustainability includes several methods for developing indicators, but these methods have not yet been successfully carried out with regard to the SDGs, which indicates that the field is relatively new and untested. It was therefore necessary to employ a trial-and-error approach by using several methods to develop the tool.

This chapter is twofold as illustrated in Figure 05. The first part highlights the overall methodological choices and introduce the case study as a research design, and justifies the choice of Guldborgsund Municipality as a case for the thesis. The reader is then introduced to the action research approach and given an explanation of its relation to Guldborgsund Municipality, followed by a description of the methods that were used to collect data throughout the study, which includes a description of the interviews and literature review.

The second part of this methodology chapter focus on the tool design. This section begins with a description of all the assumptions and decisions that were made throughout the analyses, in order to use the theoretical knowledge in practice and thereby design a tool for Danish municipalities. This is followed by a technical description of how the tool was designed in Excel and what choices and assumptions we had to make in order to code a functional tool that can carry out the calculations needed to measure the SDGs.

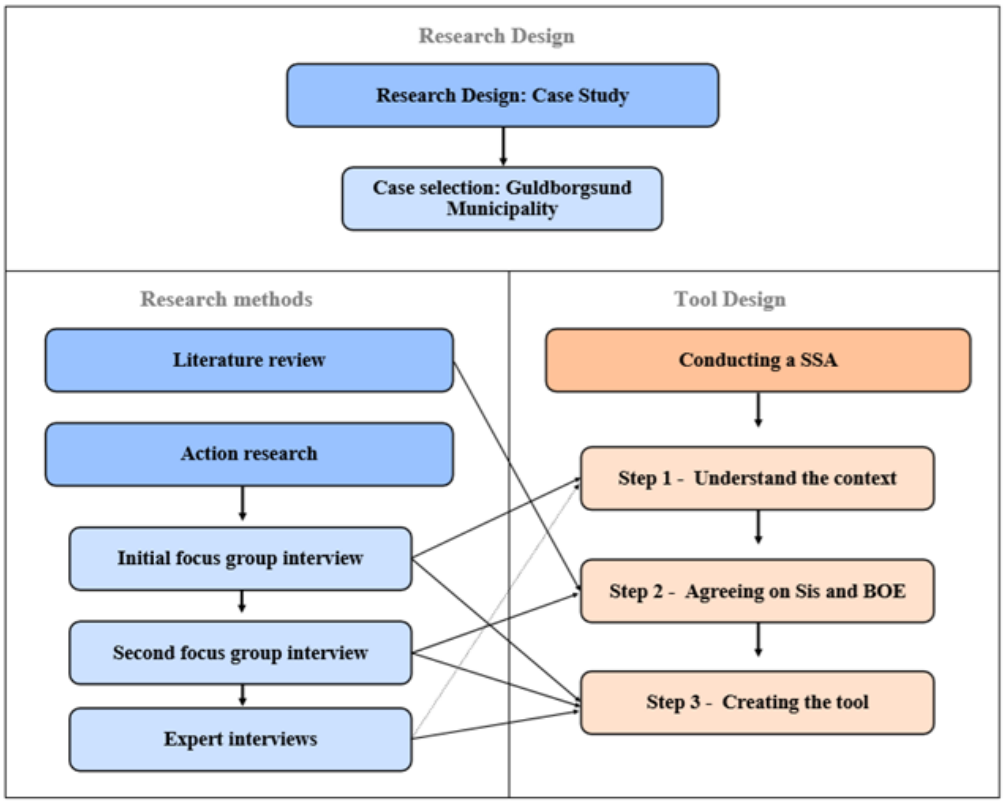


Figure 05 – Illustrates the two parts of this chapter and how the research methods are connected to the tool design.

6.1 RESEARCH DESIGN – A CASE STUDY

The research design can be described as a framework used to answer the research question (Bryman, 2016). Multiple research designs exist as defined by Bryman, but in this study it was decided to carry out a case study of Guldborgsund Municipality. The case study is found to be particularly suitable for studies where the topic is understood or explained in relation to a specific context. Furthermore, it is a common denominator for case studies that they are based on decision making and implementation processes as well as organisational change on several levels within an organisation or community (Andersen, 1990). For these reasons it was considered fitting to conduct a case study, as an aim of this thesis is to investigate how the UN's Sustainable Development Goals can be measured in a local context in order to enhance the planning processes of Danish municipalities. However, the case study as a research design has been criticised in the literature and especially with regard to generalisation. On one hand researchers such as Giddens (1984) and Campbell (1975) have claimed that it is not possible to generalise from a single case study, but that researchers must carry out a number of case studies in order to generalise. This is because multiple case studies produce a broader set of data that can be used to judge the typicality of the findings, thus enabling the generalisation of the findings. On the other hand, Flyvbjerg (2006) identifies and examines five common misunderstandings about the case study. These misunderstandings occur in relation to issues concerning the reliability and validity of the case study as a scientific method. The second misunderstanding Flyvbjerg identifies is that:

'*One cannot generalize on the basis of an individual case; therefore, the case study cannot contribute to scientific development.*' (Flyvbjerg, 2006:221)

This misunderstanding is especially important in this thesis, as it is decided to use Guldborgsund Municipality as a single case study in order to generalise the findings from the case, to develop a tool that can be used by all municipalities in Denmark.

Flyvbjerg (2006) acknowledges that one can generalise by carrying out multiple cases, but he also states that it is incorrect to conclude that it is not possible to generalise from a single case. In his argumentation, Flyvbjerg gives an example of how Galileo managed to reject Aristotle's law based on a single case where the extremes of metal and feather produced the outcome. The case can be categorised as a critical case because the choice of materials was at no point random but was instead made because the materials were so different in terms of their weight. Flyvbjerg corrects the above misunderstanding:

'*One can often generalize on the basis of a single case, and the case study may be central to scientific development via generalization as supplement or alternative to other methods. But formal generalization is overvalued as a source of scientific development, whereas 'the force of example' is underestimated.*' (Flyvbjerg, 2006: 228)

What is key to the correction of the misunderstanding is that Flyvbjerg states that '*the force of example is underestimated*', which emphasises that the findings from an example can be sufficient to generalise, and that the findings of a single example are underestimated. Based on the quote it can be deduced that it is in fact possible to generalise from a single case. But Flyvbjerg also writes that it is only possible to generalise 'often'. This means that it is not possible to generalise from all single case studies, as Flyvbjerg states that '*It depends on the case one is speaking of and how it is chosen*' (Flyvbjerg, 2006:225), meaning that case selection determines the generalisability of a single case study. An interesting aspect in terms of generalising findings, is that Bell & Morse (2008) states the importance of subjectivity when measuring

sustainability through the SSA, which is used to create our tool. This discussion will be elaborated later in this thesis.

6.1.1 CASE SELECTION

Flyvbjerg (2006) begins his discussion of case selection by arguing that the aim of generalising is to generate the greatest possible amount of information on a given issue or phenomenon. Therefore, it is not recommended to conduct a 'representative' or 'random' case study, as it cannot be argued to generate rich information. Instead Flyvbjerg (2006) states that the '*generalizability of case studies can be increased by the strategic selection of cases*' (Flyvbjerg, 2006:229), cases that are either 'extreme/atypical', show 'maximum variation', or are 'critical' or 'paradigmatic'. In relation to its work on the SDGs Guldborgsund Municipality can be argued to be simultaneously an extreme and a critical case, which according to Flyvbjerg (2006) enhances the justification of the case, because the case obtains different perspectives.

The following sections will first describe why Guldborgsund Municipality is an extreme case and then why it is a critical case.

6.1.1.1 GULDBORGSUND MUNICIPALITY AS AN EXTREME CASE

The extreme case is a case that is either especially successful or especially problematic. Flyvbjerg (2006) argues that '*it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur*' (Flyvbjerg, 2006:229). It is thus argued that the investigation of an extreme case is far more valuable than information that is developed from a usual/representative case. This is why generalising from an extreme case is possible.

The work towards the SDGs in Guldborgsund Municipality is a case that includes elements that characterise the extreme case as it is especially problematic to measure the performance towards the SDGs. It is assessed to be especially problematic because the municipality has made attempts to measure the SDGs without further success. The work so far includes:

- The renovation of the residential area called Østerbro. The renovation includes the implementation of initiatives that should improve the municipality's performance with regard to the SDGs. Nevertheless the municiplaity still incounters problems regaridng measuring their performance, as stated in the initial interview: '*How do we know, or how do we measure our baseline with regards to the SDGs and how can we determine if we are improving or worsening our performance*' (Focus group interview 1, 2020).

- The initial planning process of the new harbour. The work has not been started yet, but is in the initial phase where city planners are discussing how to include the SDGs in the planning process. The work faces similar problems to Østerbro as Guldborgsund does not currently know how to prioritise or improve its performance on the SDGs (Focus group interview 1, 2020).

Guldborgsund Municipality has put a lot of resources into the work on the SDGs but still has not managed to measure the performance towards the SDGs, meaning that they are working with an especially problematic issue. Furthermore, there are many different actors involved in implementing the SDGs in a city, which is one of the characteristics that defines the extreme case. The fact that many different actors are actively working on the issue makes this case unique and rich with information, as argued by Flyvbjerg (2006).

6.1.1.2 GULDBORGSUND MUNICIPALITY AS A CRITICAL CASE

Another strategy for selecting a case is to choose a 'critical' case. A critical case is described as a case that is the most likely to give

the researcher the information they need and can thus be argued to be a particularly important case. Several arguments can be used to define a critical case, which differ from profession to profession. Flyvbjerg (2006) gives the example of Galileo who chose to use a piece of metal and a feather in order to test weight as a determinant of free fall acceleration. The case was considered to be critical because the weight of a piece of metal and a feather are so diverse. Flyvbjerg (2006:226) states that '*if Galileo's thesis held for these materials, it could be expected to be valid for all or a large range of materials. Random and large samples were at no time part of the picture*'.

One of the main reasons for choosing Guldborgsund Municipality is the critical nature of the case. First of all, we got in contact with three employees who agreed to allocate resources and participate as a part of the project, which meant that Guldborgsund as a case was more likely to give us the information we needed.

Another argument is that Guldborgsund is the seventh poorest municipality in Denmark (Ullum, 2018), which makes it a critical case, since it can be argued that if Guldborgsund Municipality can manage to allocate the resources and use a tool to measure the municipality's performance on the SDGs, then it can be expected that most other Danish municipalities will also have the resources to carry out an assessment using the tool.

Guldborgsund can thus be argued to include elements of both the 'extreme' and 'critical' case, which means that there is a strong chance of generating generalisable data. The research methods that were used to generate and collect the data are presented in the following sections.

6.2 RESEARCH METHODS

The term 'research methods' covers a wide range of techniques that are used to collect data (Bryman, 2016). For this project we decided to use several research methods: Literature Review, Action Research Processes, and Expert Interviews. In this chapter we will introduce the research methods in the listed order and present how they were used in this project to generate and collect data. Figure 06 illustrates the different research methods in the order in which they were carried out in this thesis.

Figure 06 – Illustrates in which order the different research methods were carried out.

6.2.1 LITERATURE REVIEW

The literature review is a generic term that covers several types of reviews that '*[examine] recent or current literature*' (Grant & Booth, 2009: 94). For this research it was decided to carry out a state-of-the-art (SOTA) review as it is presented by Grant and Booth (2009):

'*State-of-the-art review: Tend to address more current matters in contrast to other combined retrospective and current approaches. May offer new perspectives on issue or point out areas for further research*' (Grant & Booth, 2009: 95)

	Level of sustainability			Geographical Level		Indicators			Concepts					Target group			
Litterature	"New Urban Agenda"	SDG	SDG 11	City / Urban area	Region / Municipality	Developing/ Suggesting indicators	Recommendations for indicator providers	Problems, barriers and suggestions	Trade-offs between goals and sustainability (Holistic)	SMART	Data availability / Reporting	Governance / Policy integration	Conceptual framework / Conseptualising / Translating	Planners	Policy-makers / Public officials	**Author(s)**	**Year**
Adapting the Sustainable Development Goals and the New Urban Agenda to the city level: Initial reflections from a comparative research project	X	X		X	X		X	X	X			X				Valencia, Sandra C. et al.	2019
The urban sustainable development goal: Indicators, complexity and the politics of measuring cities		X	X	X				X		X	X		X			Klopp, Jacqueline M.; Petretta, Danielle L.	2017
Developing and testing the Urban Sustainable Development Goal's targets and indicators – a five-city study		X	X	X		X	X				X				X	Simon, D., Arfvidsson, H., Anand, G., Bazaz, A., Fenna, G., Foster, K., ... Wright, C.	2015
Development and application of a new Resilient, Sustainable, Safe and Inclusive Community Rating System (RESSICOM)	X		X	X		X						X				Diaz-Sarachaga, Jose M.; Jato-Espino, Daniel	2019
Governance for sustainable urban development: the double function of SDG indicators		X	X					X				X	X		X	Hanson, Stina; Arfvidsson, Helen; Simon, David	2019
Initial progress in implementing the Sustainable Development Goals (SDGs): a review of evidence from countries		X				X			X							Allen, Cameron; Metternicht, Graciela; Wiedmann, Thomas	2018
Sustainable Development Goals: A need for relevant indicators		X				X	X			X					X	Hák, Tomás; Janouskova, Svatava; Moldan, Bedrich	2016
Implementing the "Sustainable Development Goals": towards addressing three key governance challenges—collective action, trade-offs, and accountability		X				X		X	X			X				Bowen, Kathryn et al.	2017
A literature-based review on potentials and constraints in the implementation of the sustainable development goals		X						X	X				X			Caiado, Rodrigo G. G. et. al	2018
Towards integration at last? The sustainable development goals as a network of targets		X										X				Blanc, David L.	2015
Sustainability assessment of cities: SDGs and GHG emissions		X		X		X					X					Kawakubo, Shun et al.	2018
Sustainability Indicators Past and Present: What Next?		X				X		X			X	X				Bell & Morse	2018
How to Contextualize SDG 11? Looking at Indicators for Sustainable Urban Development in Germany			X	X		X			X		X	X	X			Koch, Florain; Krellenberg, Kerstein	2018
Local responses to global sustainability agendas: learning from experimenting with the urban sustainable development goal in Cape Town			X	X				X			X	X				Patel, Zarina et al.	2017
Attaining SDG11: can sustainability assessment tools be used for improved transformation of neighbourhoods in historic city centers?			X	X				X								Arslan, Tulin V.; Durak, Selen; Aytac, Deniz O.	2017
Multi actor multi criteria analysis (MAMCA) as a tool to build indicators and localize sustainable development goal 11 in Brazilian municipalities			X	X	X							X	X			Almeida, Ane C. L.	2019

Table 02 - Shows the topics that the different papers found through the literature review cover. This selection of papers by no means represents all the existing literature on measuring the SDGs in a local context, but is a selection covering the most relevant topics.

6.2.1.1 STATE-OF-THE-ART

A rather comprehensive SOTA analysis was carried out in order to acquire knowledge about the current state of knowledge, find inspiration, and make sure this thesis does not overlap with other scientific work (Grant & Booth, 2009). In this analysis, the review is used to gather together international studies related to the SDGs, specifically focusing on researchers who have made an effort to establish a way of measuring the SDGs and to find other more practical methods for measuring the SDGs.

To identify relevant scientific work, we used two databases: Google Scholar and Aub.aau.dk and used chosen keywords such as 'Sustainable Development Goals AND Indicators', 'Sustainable Development Goals AND City Development', 'Sustainable Development Goals AND Tool AND Cities', 'Urban Transformation AND Sustainable Development Goals', 'Sustainable Urban Development AND Sustainable Development Goals' and 'Sustainable Development Goals AND Literature Review'. The keywords were developed and chosen based on a trial-and-error approach, based on which combinations gave the most relevant and manageable references. This search resulted in 36 research articles being chosen based on their title. We read the abstracts of all 36 articles and 18 articles were chosen as the most relevant to continue the literature review. We read each of the 18 articles and categorised the articles based on several topics, as illustrated in Table 02. It is of course relevant to remember that a trial-and-error approach not necessarily finds all the available and relevant scientific work.

6.2.2 ACTION RESEARCH WITH GULDBORGSUND MUNICIPALITY

The following research methods take inspiration from action research, which is a central methodological part of this thesis. Action research is a research perspective that supports collective action. New knowledge is produced in a social context based on democratic and inclusive values. The main characteristic of the action research method is that the research is carried out without attempting to distance or separate researchers from the area in which the research is being done (Duus et al., 2012). Guldborgsund Municipality was throughout this project involved in the entire research process, starting with an initial focus group interview, which was followed by a secondary focus group interview midway. A presentation of the thesis' final result has also been arranged with Guldborgsund Municipality to take place after we hand in the report. Guldborgsund Municipality was thus a central part of creating the tool, by contextualising the subject and supplying constructive criticism.

The researcher's role in action research differs from other academic directions in that the researcher shares the scientific recognition process as a co-creator of democratic and change-oriented knowledge in the field of practice (Duus et al., 2012). During the focus group interviews, it was for example important to be aware of our role as facilitators but at the same time respect the equal relationship that we wanted to create. The facilitator acts as a coordinator to maintain the interview structure. Nielsen and Lyhne (2015) suggest creating a so-called 'free space' as this will ideally allow the forum to open up for democratic reflection on change without constraints from political or organisational pressure, which can provide greater insight into and understanding of the common work perspective. We tried during our two focus group interviews with Guldborgsund Municipality to create similar conditions of a free space, which implied a presentation round of participants, emphasis on our motivation, a clear structure and time schedule that allowed for free discussions, small assignments that gave rise to small talk, giving each individual the opportunity to elaborate on the subject, etc. The employees at the municipality also had the opportunity to contribute anonymously to the report, which none of them wanted. This is important as the quality of the study depends on whether the interviewees experience they

can participate in the study without having to be uncertain of any subsequent discrepancies with their affiliated organisations.

Methodologically, action research is characterised by great diversity. Both quantitative documentation and qualitative interviews can be part of an action research project. The special feature of action research is that the application of methods that promote and develop change is based on the individual's visions and experiences. The change-oriented focus in our project would be how the municipalities work towards the SDGs, what the current problems are, what would be ideal, and how do we reach this ideal. This is also why we took inspiration from 'future workshops', as will be elaborated on later.

Action research was chosen as it has many similarities with doing a Systemic Sustainability Analysis (SSA). The SSA is based on theories that emphasises the subjectivity in sustainability and acknowledges that the involvement of stakeholders is essential in order to develop contextual solutions (Bell & Morse, 2008). A reason why action research was chosen as a central method is because it offers a set of tools that can be used to involve and co-create solutions with Guldborgsund Municipality.

As a part of the action research with Guldborgsund Municipality two focus group interviews were carried out in order to understand the context. The interviews were carried out with three employees from the municipality who to some extent deal with the SDGs. The employees represented three different administrations in the municipality, as illustrated in Table 03, namely 'Culture and Spare-time", 'Nature and Environment' and 'Occupation & Development'.

Participants	Professions
Birgitte Echwald - Project leader: *"Kultur & Fritid"*	Birgitte's primary tasks includes the urban development and renewal of Guldborgsund
Lone Gjerulff Bak - Chief consultant: *"Erhverv & Udvikling"*	Lone works with occupation and development. Her tasks includes creation of jobs and education
Lena Due Berring - Project coordinator: *"Natur & Miljø"*	Lena takes part in the development of strategies for environmental development in Guldborgsund

Table 03 – Presentation of the employees who were involved throughout research process.

The three employees from Guldborgsund Municipality came from three different administrations in the municipality, which was interesting and useful as their views on sustainability were affected by their individual background.

6.2.2.1 INITIAL FOCUS GROUP INTERVIEW WITH GULDBORGSUND MUNICIPALITY

A focus group interview is characterised by a non-controlling interview style, where the aim first and foremost is to get as many different views on the topic as possible. The facilitator presents the topics to be discussed and facilitates the exchange of views. The task of the facilitator is to create a permissive atmosphere where one can express personal and conflicting views on the topics that are in focus. The goal is not for the focus group to agree or present solutions to the issues that are being discussed, but rather to voice different views on the matter (Kvale & Brinkmann, 2009).

At the beginning of this study we held a focus group interview with the employees from Guldborgsund Municipality who are listed above. The purpose of this interview was to get an understanding of Guldborgsund and which complexities the participants are most concerned about in relation to sustainability and

the SDGs. During the interview, the participants were asked to complete an exercise of prioritising the SDGs, based on what the participants, due to their job position, believed were the most relevant for the municipality to include in a tool.

Creating a tool is a complex way to measure the SDGs, and it can be difficult to discuss and reflect on this unless all the participants have a minimum of knowledge about and experience with the topic. Therefore, a pilot tool for the municipality was presented at the beginning of the interview (the pilot tool can be found in Appendix 2). The idea was to give the participants an idea of our initial thoughts and expand their knowledge on what a tool can measure in relation to the SDGs. This was considered necessary to get their input on the SIs, the band of equilibrium, and the output, all of which are important in relation to the SSA.

The participants developed several ideas on how a tool could be designed and one of the main issues was that the employees thought everything was important to include, both in relation to which SDGs to include and in relation to how the tool should be designed. During the interview the employees were therefore asked to write down the (up to) five most important SDGs for them in their position, without talking to each other. It is important to mention that this exercise was not planned in advance, but turned out to be quite important in our demarcation. This was also an example of action research in practice, as we as researchers developed knowledge together with the participants along the way.

6.2.2.2 THE SECOND FOCUS GROUP INTERVIEW WITH GULDBORGSUND MUNICIPALITY

The second focus group interview took place two months after the first, as a continuation of the co-creation research process. Prior to the interview, an assignment was sent to the three participants. In this assignment they were asked to assess an index of indicators to determine whether each indicator was relevant and attainable for the municipality and the band of equilibrium for each indicator. Besides this, the participants were asked to think about three general criticisms related to the indicators. This was done in order to obtain relevant knowledge for the SMART analysis and to prepare the participants for the focus group interview.

The second focus group interview took inspiration from 'future workshop' as it has been presented by Mette Bladt (Duus et al., 2012). The future workshop is an agenda that consists of three main phases: the criticism phase, the utopia phase, and the realisation phase. It was decided to include elements from this workshop, as Bell and Morse (2008) suggest a workshop to be the optimal method for conducting the SSA. Optimally Bell and Morse (2008) suggest using one to two weeks in collaboration with the stakeholders in order to conduct the SSA. It is of course unrealistic to use this amount of time with the stakeholder in this thesis, why a shorter version of the workshop is used. A future workshop must be inviting for the participants, as the researcher, in collaboration with the participants, creates the knowledge that is produced. The production of knowledge is generated by collective processes, due to the development of a free space among the participants (Nielsen & Lyhne, 2015). In order to develop a tool for measuring the performance of the SDGs it was important that we as researchers and facilitators in cooperation with the participants could come to a consensus regarding SIs and the band of equilibrium (Bell & Morse, 2016). As described in the disclaimer, due to unpredictable circumstances it was only possible to hold the second focus group interview online, which made it challenging to carry out some of the workshop elements.

The workshop was set to last for two hours, which gave us a limited amount of time to carry out the workshop. An invitation to the focus group interview can be found in Appendix 5.

The time schedule was strictly planned and it was necessary to interrupt the participants during transitions from one phase to the next.

Introduction

The introduction phase lasted for 30 minutes and during this phase it was decided to introduce the agenda for the meeting and present the participants to the tool, including SIs, BOE and output, which had been updated since the initial focus group interview. The presentation was essential as this interview was designed to focus on the tool and develop ideas for improvements.

Phase 1: Criticism

The first phase lasted for 40 minutes and according to Duus et al. (2012) this is the phase where the attendees can express their criticism, dissatisfaction, and downsides in relation to the new tool and indicators assessed in the assignment. It is important that the participants do not question or otherwise criticise each other's views. In fact, the group must not apologise their criticisms (Duus et al. 2012). Each participant presented their main points of criticism in a 10-minute presentation. The participants' presentations were prepared from home and were based on an exercise where they assessed the indicators that were found during the literature review; the exercise can be found in Appendix 6. After the participants presented their criticism, they were tasked to develop three to five main points of criticism in consensus. The criticism points were focused on the indicators and the aspects of sustainability that appeared insufficient.

Phase 2: Utopia

The second phase was called 'the utopia phase' and built on the points from the criticism phase and lasted 20 minutes. In this phase, participants had the opportunity to dream without reservation and break habits. Participants had to find solutions to their criticisms without concern about finances or other constraints. The facilitator's role in this phase is important, as the facilitator must ask in-depth questions and help create space for new initiatives (Duus et al., 2012). During this phase the participants were tasked to develop utopian scenarios for Guldborgsund, which focused on the aspects of sustainability that they prioritised during the criticism phase.

Phase 3: Realisation

The third and final phase was called 'Realisation', building on the utopia phase and lasting for 30 minutes. The purpose of the realisation phase is to evaluate the themes of the utopia phase and select the ideas that can be realised (Duus et al., 2012). Each utopia presented was dealt with separately, where the participants developed ideas for measurements and SIs. The participants managed to develop ideas for every scenario, which resulted in a list of 16 new SIs.

Even though this interview was held online, without group tasks as in a physical workshop, it still produced some good and interesting inputs for this thesis' analyses, discussion and tool.

6.2.3 EXPERT INTERVIEWS

Beside the two focus group interviews held with Guldborgsund Municipality, two expert interviews were conducted. The interview is in general a widely used research method, as it allows for intense and deep insight into processes and structural characteristics. By inquiring into the practice, attention is drawn to any problems where the respondents' subjective assessments and experiences form the basis for the further work of the study (Kvale, 1997).

In qualitative research interviews, it can be a challenge to determine how many interviews are required to gather sufficient knowledge of the phenomenon. According to Kvale (1997), it is the purpose of the interview that

determines how many interviews are needed. If the purpose is to investigate *'[...] the relationship between a particular behavior and its context and to find out the logic of the relationship between individual and situation*' (Kvale, 1997:109), a few individual interviews will suffice. Most often, it will be sufficient to conduct interviews until a saturation point is reached when several interviews do not contribute significant new knowledge. The number of interviewees to include in the thesis is thus a compromise between on the one hand, the desire to obtain sufficient empirical data to be able to elucidate the thesis' problem as thoroughly as possible, and on the other hand, the limitations of a realistic timeframe.

Prior to the interviews, an interview guide was prepared (see Appendix 7). We used a semi-structured interview guide, where the questions and structure were open, leaving room to pursue unexpected clues and create an open discussion. As researchers, we used the interviewees' replies actively and asked in-depth questions during the interviews (Kvale and Brinkmann, 2009). The advantage of the semi-structured interview is that it is possible to adapt the interview to the respondent's answers, as the conversation is not limited to a specific series of questions.

Like in the work with Guldborgsund Municipality, in each interview it was made clear that the interview would be taped and transcribed, and it was possible to speak anonymously (Appendix 8-11).

Henrik Gudmundsson

The first expert interview was with senior consultant, Henrik Gudmundsson, from Concito. Gudmundsson has a focus on sustainable mobility and urban development (Gudmundsson, 2020). The purpose of this interview was to get a more theoretical view on our approach to developing context-specific SIs and developing a tool. Henrik Gudmundsson was consulted as an expert on indicators as he is the author of books such as Sustainable Transportation – Indicators, Frameworks, and Performance Management together with several articles about sustainability indicators (Gudmundsson, 2016; Gudmundsson, 2020).

The interview gave us a good understanding of the complexity and challenges involved in developing SIs. Moreover, it was used to acquire knowledge about the dos and don'ts to be aware of when developing indicators.

Jannik Egelund

The second expert interview was conducted with PhD student Jannik Egelund from Roskilde University. Egelund is currently writing a PhD about how Danish municipalities are adapting the SDGs to a local context and how they are using co-creation to translate the goals and find new solutions (RUC, 2018). Jannik Egelund was interviewed for several reasons: 1) he is currently writing a PhD about the Danish municipalities' work towards the SDGs, 2) one of the municipalities he is working with is Guldborgsund Municipality, and 3) his focus is on cooperation in relation to the SDGs within municipalities. The purpose of this interview was to develop an understanding of his approach to and study of the SDGs, his impact on Guldborgsund, and his insights on the development of a tool for measuring the SDGs in a local context.

6.3 TOOL DESIGN

This is the second part of the methodology, which will introduce the methodological approaches taken and choices made to develop the tool, including how and why the tool was designed as it was. It is important to bear in mind that this project was about developing an example of a tool that can measure the performance of the SDGs. The tool is not a final product, but rather a demonstration of one way to operationalise the SDGs for Danish municipalities.

With SSA as a theoretical foundation, this section of the methodology will be divided into three subsections: First, 'Understanding the context', as defined by step one of the SSA. Second, 'Agreeing on SIs and band of equilibrium', based on step two of the SSA and the SMART concept. Last, 'Creating the tool', based on step three of the SSA and empirical data.

6.3.1 CONDUCTING A SYSTEMIC SUSTAINABILITY ANALYSIS

The SSA is an analytical framework based on a set of theoretical concepts developed to help create relevant SIs (Bell & Morse, 2008). The SSA contains five steps which provide a framework for creating SIs, creating the band of equilibrium, and designing the output.

We chose to develop our tool based on SSA for different reasons: 1) It helps understand the context, develop SIs, create the band of equilibrium, and present the output, all of which are important elements in creating a tool, 2) This approach acknowledges that sustainability is subjective, which is essential when one tries to measure it (Gudmundsson, 2020), and 3) It fits well with doing action research in cooperation with the municipality. Figure 07 shows a timeline for how this SSA was conducted and how our tool was designed in cooperation with the municipality.

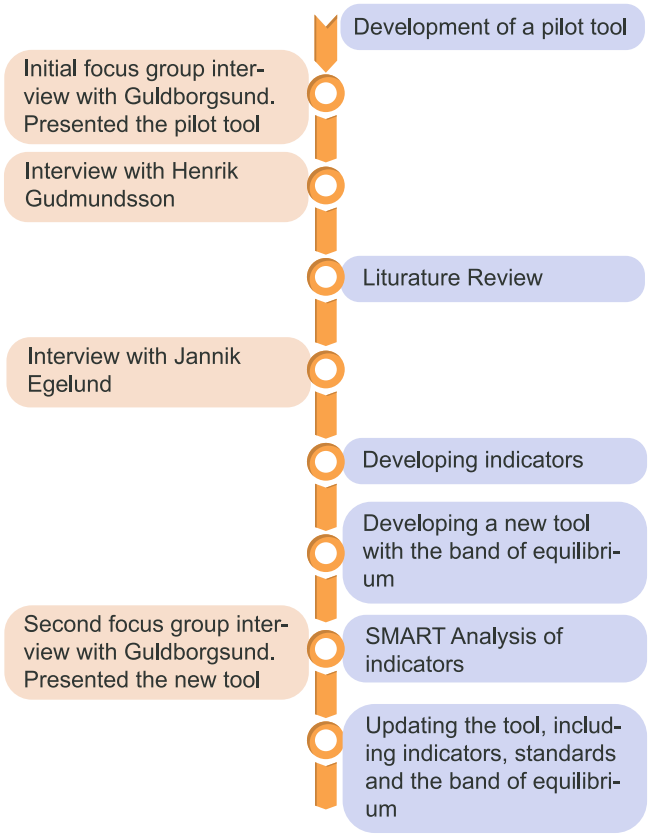


Figure 07 – A timeline of how this Systemic Sustainable Analysis was conducted.

6.3.1.1 STEP 1 – UNDERSTANDING THE CONTEXT

Subjectivity is a core element when measuring sustainability which in this case means that what different municipalities find relevant to include in a tool measuring the SDGs will vary. In theory, it is preferable to involve as many stakeholders as possible in the process of understanding the context (Bell & Morse, 2008). However, due to the limitations of this research, it was decided to focus on the municipality as the only stakeholder for two reasons:

> The municipality is the authority that is responsible for the physical development of the urban environment, meaning that it is the responsibility of the municipality to incorporate and improve the local performance regarding the SDGs.

> The municipality has a set of planners who have already attempted to convert the SDGs from vision into practice (Egelund, 2020).

According to the theory, it is important that the stakeholders are the ones to describe the context. Therefore each of the three participants from Guldborgsund Municipality was in the initial focus group interview asked to point out the (up to) five most important SDGs for them in their position.

6.3.1.2 STEP 2 – AGREEING ON SIS AND BAND OF EQUILIBRIUM

An essential part of a tool is the SIs it uses. Prior to this chapter it was described how we developed indicators with the municipality by holding a 'future workshop'. Supporting this, SIs were also found through a literature review, but in order to ensure the relevance of these indicators, it was found necessary to assess the indicators using the SMART method. The SMART method is an analytical framework that was developed to assess SIs, and was for this reason incorporated into step 2 of the SSA. The SIs that were incorporated into the tool are thus a mix of SIs from the literature and SIs that the participants developed by themselves, as presented in Figure 08. The assessment of the indicators from the literature consisted of several steps, which will be presented in the following chapter.

Each of the four steps was carried out as an iterative process as the arrows in Figure 08 indicate, since we kept returning to the former steps upon the completion of a new step, as new knowledge resulted in corrections. The four steps are presented in the following and are not to be confused with the steps in the SSA.

Step 2.1 – The creation of an indicator index

The creation of an index was carried out based on a literature review. One of the goals of the literature review was to find other frameworks that had developed SIs for measuring sustainability in cities and/or measuring progress towards the SDGs. A total of four different frameworks was chosen. Table 04 shows the four frameworks and their relation to the SDGs and sums up the main reasons for choosing each framework.

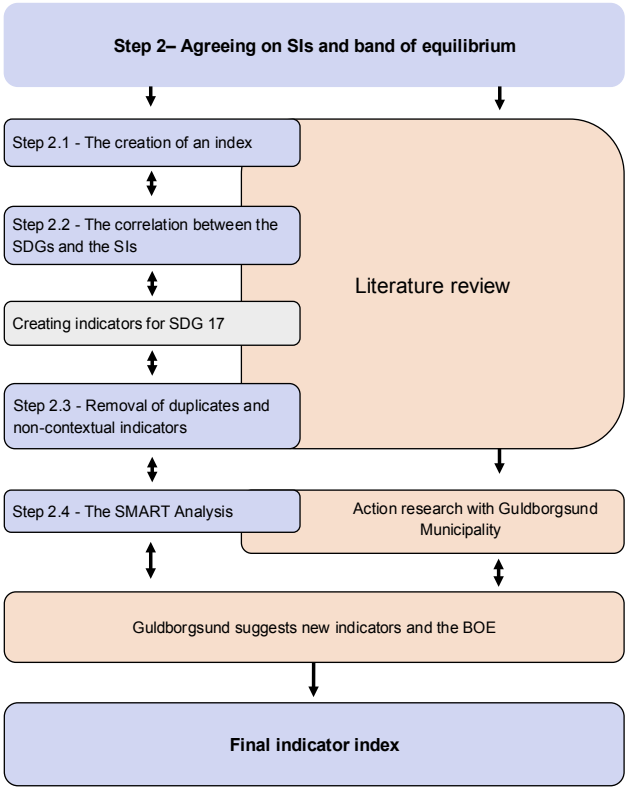


Figure 08 – Illustrates the steps we went through in order to contextualise the indicators to a local context and make sure they were relevant for Guldborgsund Municipality.

Each work has a long set of indicators and all of these indicators were put together to establish the initial index of indicators, which consisted of 235 indicators (see Appendix 3). In order to start working on these indicators, categories of indicators from the frameworks that were not relevant to the four chosen SDGs were deleted (e.g. 'Economy' and 'Education' from the ISO 37120). This resulted in an index of 176 indicators; see Appendix 3.

Not all indicators in this index had a direct relation to the SDGs and targets. It was therefore necessary to divide each indicator into the targets it measures.

Framework	Publisher	Context	Relation to the SDGs	Reasons for including	Source
Baseline for Verdensmålene	Rambøll & DAC	Danish – National	SDG 11	Develops indicators for SDG 11 in a Danish context.	(DAC & RMC, 2019)
DGNB	DGNB	Sustainability in city areas and buildings	Relates existing themes to the SDGs	Is a well-known and broadly accepted certification system for city areas.	(DGNB, 2020)
ISO 37120 – Sustainable Cities and communities	ISO	Sustainability in city areas	The standard contributes to SDGs 6 & 11 (among others)	ISO publish international standards and their work is widely accepted. They have a lot of experience in creating different indicators.	(ISO, 2018)
Collection Methodology for Key Performance Indicators for Smart Sustainable Cities	United 4 Smart Sustainable Cities (a UN initiative)	International – Cities	Creating indicators for cities for relevant SDGs	A UN initiative suggesting a broad range of indicators for the 17 different SDGs relevant for cities.	(U4SSC, 2017)

Table 04 – Shows the four different assessment frameworks, SIs in this thesis are inspired from and why these methods were chosen.

Step 2.2 – The correlation between the SDGs and the SIs

In this step we divided the 176 indicators into the targets of SDGs 6, 11, 12, and 17. 'DGNB', 'Rambøll Baseline' and 'Collection Methodology for Key Performance Indicators for Smart Sustainable Cities' had already directly connected each of their indicators to the SDG targets, which meant that for the ISO standard, it was necessary for us to connect each of the indicators to a target (see Appendix 3).

If an indicator could not be argued to influence any target of the four SDGs, it was not considered necessary for this project and was deleted. It is important that the reader is aware of the possibility of inconsistency in the assessment of which targets each indicator influences. This is due to the fact that the relation between the SDG target and the indicators was assessed by different actors with different perceptions. Connecting the SDGs and the indicators also showed that when working with these four frameworks and this way of assessing which targets the indicators influence, some targets did not have any connecting indicators.

Targets with no connecting indicators
6.5, 6.6
12.1, 12.3, 12.6, 12.7, 12.8
17.1-17.5, 17.7, 17.9-17.19

Table 05 – Shows which targets are not connected to an indicator.

Creating SIs for SDG 17

Step 2.2 revealed that the four frameworks had almost no indicators that related to Goal 17 – *Partnerships for the goals*, and the few that did were related to the internet connection covered by Targets 17.6 and 17.8. But Goal 17 was the only goal that all three participants from Guldborgsund Municipality prioritised, mainly because this goal is defined as essential in order to implement the other SDGs, through partnerships and cooperative processes.

In the interview with Guldborgsund Municipality it became clear that the importance of Goal 17 lies in the cooperation part, primarily explained in Target 17.17[1]. Therefore, it was necessary to develop SIs for cooperation and partnerships to fit Goal 17. To develop SIs for cooperation the project group took inspiration from Helberg's revision of Arnstein's participation ladder, presenting different levels of participation (Agger & Hoffmann, 2008). For every stakeholder group relevant to a project we decided that the practitioner should determine the level of participation:

1. No inclusion: The lowest step is called 'No inclusion', where stakeholders are not included in any of the plans that are carried out in the city area; neither are the stakeholders informed about what is going to happen.

2. Information: The second lowest step is called 'Information'. In this step stakeholders still do not have any influence on the physical development of the city planning, but city planners do inform stakeholders about the coming changes, through the internet, flyers, meetings etc.

3. Dialogue: The middle step is called 'Dialogue'. In this step planners host public meetings where locals can discuss their concerns with the planners, which can influence the planning process and outcome.

4. Participation: The fourth and thus the second highest step is 'Participation', where stakeholders are invited to work groups. The work groups occur in the early planning phases, where the planners have not finalised the plans for the development of the area, meaning that locals actually do have the power to influence the planning process and result, as planners can incorporate ideas from the locals into the plans.

5. Self-determination: Finally, 'Self-determination' is the highest step, where the locals are delegated full control over the planning process. This can as an example occur in communities where the locals have established a local council which is delegated the task of planning processes. This puts the power to influence and control planning processes in the hands of the locals.

(Agger & Hoffmann, 2008)

Based on this knowledge, we created four SIs as an example of these participation indicators. These SIs can be adapted to specific situations if it becomes necessary to include other (more specific) actors:

> Cooperation with citizens

> Cooperation with businesses

> Cooperation with NGOs

> Cooperation with others

Each of the four SIs is given a number from 1 to 5 depending on the level of participation as illustrated in the list above.

Step 2.2 resulted in an index where each chosen indicator from step 2.1 was connected to a relevant SDG and a corresponding underlying target instead of the framework they originated from.

(1) Encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships (SDG, 2015b).

Step 2.3 – Removal of duplicates and non-contextual indicators

Following step 2.2, several actions were carried out in order to remove redundant indicators. The index of indicators contains indicators from several frameworks, which means some indicators are the same while other indicators reach far outside the scope of the tool, either by focusing too much on administrative plans (such as urban planning strategies) or on buildings (primarily indicators from the DGNB). The actions carried out in this step include:

> Removal of duplicates – some indicators were identical or very similar, due to the fact that we used multiple sources.

> Building restricted indicators were removed as this tool is about areas and it would have become too complex if detailed information about buildings (which fall under only one sector) was included.

> Indicators measuring strategies and plans were removed because the tool is limited to only focus on what is in the case area, where strategies and plans often have a broader focus.

> A few indicators were rewritten to give a clear understanding of the indicator or to fit a Danish context.

In conclusion, step 2.3 resulted in a total reduction of indicators from 176 to 97 indicators.

Step 2.4 – The SMART Analysis

The final step was to carry out an analysis using the principles of the SMART concept. This concept is used as it is a well-known and acknowledged approach for assessing indicators, and the rule of thumb being used by the SDG network is that indicators must follow this concept (Klopp & Petretta, 2017). SMART was developed based on theoretical conceptions that good SIs are: Specific, Measurable, Attainable, Relevant, and Timely (Gudmundsson, 2016). These principles are highly context-specific and subjective, as they differ from context to context. In this case the tool was developed based on Guldborgsund Municipality, and for that reason the SMART principles were supposed to be carried out by the municipality. But due to unpredictable circumstances, the workshop was held with fewer people than planned and online, meaning we had to prioritise how the municipality should work with the SMART principles. Therefore, we chose to work with the principles set out in Table 06:

Principle	Meaning	Action
S - Specific	Be specific in relation to the SDG the indicator should measure	Done by the project group
M - Measurable	It is possible to measure in one indicator	Done by the project group
A - Attainable	The indicator should be attainable	Guldborgsund assessed if the indicator was attainable for them
R - Relevant	Relevant for Guldborgsund Municipality	Guldborgsund assessed if it was relevant for them
T - Timely	It is possible to measure the status at a given time	Done by the project group

Table 06 – A presentation of the SMART principles and how they were delegated between the project group and Guldborgsund in order to assess the indicators.

Table 06 shows that three of the five principles were assessed by the project group, while two principles were assessed by the participants from the municipality. It was decided that the municipality should look at the attainable and relevant principles, as they were the best judges of whether an indicator was attainable and relevant for them. It is important to state that the index of indicators was divided into three parts, so each indicator was only assessed by one participant.

Furthermore, the participants were asked to address the band of equilibrium as an additional part of the assessment of indicators. This will be elaborated on in the following section which details the creation of the tool.

6.3.1.3 STEP 3 – CREATING THE TOOL

The tool was created after establishing the theoretical and methodological framework for creating SIs and the band of equilibrium (BOE), all in collaboration with Guldborgsund Municipality. The main idea behind the tool was that the practitioner must, based on the selected SIs, enter data for each of the SIs, which is then evaluated based on a standard (band of equilibrium), so that each SI can be delegated a score. These scores can then determine how well the practitioner is performing for each SDG. Beside the SIs and BOE the tool contains different features, like the dendrogram, weighting- and score system, which is inspired by a 3rd semester project done by one of the group members (Hemmingsen, 2020). The next section presents how the final tool turned out and explain the choices behind the design.

The tool is set up in Excel and can be found in Appendix 1. We recommend that the reader try out the tool while reading this. Upon entry, the practitioner encounters a pre-log sheet which informs the practitioner about the tool and presents the practicalities of the tool. Additionally, the practitioner is able to insert general information here on the case area such as capita and area size. These values have an effect on the BOE of some of the SIs later on. The interface of the tool is divided into four sections, namely: 'Preconditions', 'Presentation of results', 'Band of equilibrium', and 'Backdrop'; see Figure 09. Each section will be presented in the following.

Figure 09 - Illustration of the front page of the tool. The plotted red boxes indicate the division of sheets for the four sections.

Preconditions

The 'Preconditions' section is where the practitioner needs to insert necessary data or make an active choice determining how important an SI or a cluster of SIs is. The determination of an SI will be referred to as an 'importance factor'. After exiting the pre-log sheet, the four selected SDGs, 6 - Clean water and sanitation, 11 - Sustainable cities and communities, 12 - Responsible consumption and production, and 17 - Partnerships for the goals, will be investigated individually, presenting the practitioner with an index of the selected SIs from the SSA. For each SI, the practitioner needs to insert their performance level and choose the importance level of the SI at hand. Each SI has a scrollbar with a function to switch the importance level between 'not important', 'less important', 'important', and 'very important', see Figure 10. If the 'not important' option is selected for an SI, the SI will not be part of any further calculations. Some SIs were estimated by Guldborgsund Municipality, together with the project group, to be too important to neglect; these fall into two categories – relevant or indispensable. For those SIs deemed 'relevant' by the municipality, the 'not important' option was removed in the tool, ensuring that the SI is part of the final score. For the SIs that were deemed 'indispensable', the importance level is set to 'very important' and the user will not have the option to change this. Based on the theory in Chapter 5, it was decided to divide the SIs into state SIs and pressure SIs. It is in the tool not possible to remove state SIs, as the option 'not relevant' is removed. This was done due to the fact that it is essential that a municipality know the status of the different targets, which will be elaborated further on.

The importance level is necessary as the tool is intended to be used for different case areas, and it is important that the practitioner has some control over which SIs they deem relevant to include and how much influence these SIs have for the case at hand. Guldborgsund Municipality explicitly emphasised that a potential tool for measuring and evaluating sustainability needs to be able to differentiate between contexts (Focus group interview 1, 2020). For example, cycling infrastructure might be more impactful in cities with higher urban density, and it would be unfair for smaller cities' sustainability level to be undermined by logistic and geographical differences. The four different importance levels were thus added to the tool to give the practitioner the power to prioritise SIs. A higher importance level will have more influence on the score output. This will be further elaborated on in the section 'Backdrop'.

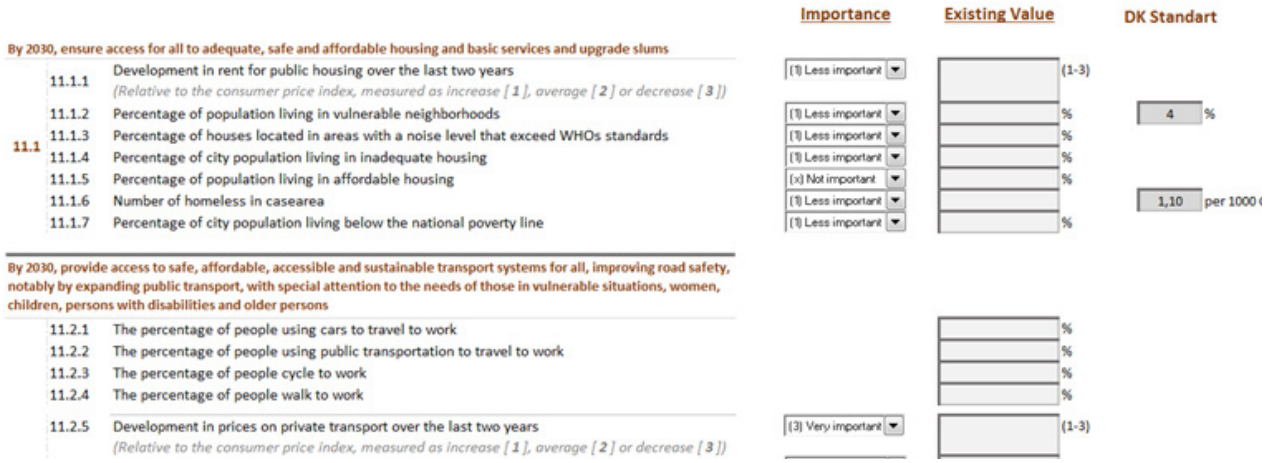


Figure 10 - A segment from the tool (Appendix 1, under the tab 'SDG 11') displaying the setup between the SDG targets 11.1 & 11.2 and their respective indicators.

Figure 10 shows the setup for each SI and target, here with a focus on SDG 11. This setup recurs throughout each individual SDG sheet in the 'Preconditions' section. For some of the SIs, a Danish standard is presented in order to give the practitioner an inkling of the normative assessment. It was the desire of Guldborgsund Municipality that for certain SIs the Danish standard should be the determinant for the scoring of the practitioner's performance level. However, in most cases, a Danish standard required unobtainable data, or assessing it simply did not make sense. Further research could be relevant here. For each Danish standard, the practitioner is able to see how the standard was calculated and the sources used in 'Backdrop'. Figure 11 shows an example of how the Danish standard for SI 11.1.6 'Number of homeless in case-area' was estimated in the tool by dividing the number of homeless people in Denmark by the total population in Denmark, per 1000 inhabitants. Bear in mind that each standard has a different formula, depending on the nature of the SI.

	People living in DK:					5820000	C
Nº	11.1.6*	Data	LINK	Y: 2019			
	Registered homeless living in DK					6400	C
	Formel: Total homeless in DK/ population *1000						
	1,099656357	Registered homeless per 1000 living in DK					

Figure 11 - A segment from the tool (Appendix 1, under the tab 'Data-ark') displaying the calculation of the SI 11.1.6 'Number of homeless in case area'.

The last step of 'Preconditions' contains a sheet where the practitioner can determine the importance level of each SDG; see Figure 12. This is important if every SGD is incorporated in the tool, especially for cases where some SDGs are not relevant, like 'Life Below Water' (SDG 14) for cases on the mainland, or if 'Zero Hunger' (SDG 2) is not an issue for the case area the user can limit the focus on this issue and increase focus on another issue. This function is probably not relevant for Guldborgsund Municipality as the four SDGs were chosen by representatives of the municipality, but they will nevertheless have the option to prioritise different SDGs.

Figure 12 – A segment from the tool (Appendix 1, under the tab 'SDGs') displaying the function for determining the level of importance of each SDG.

Band of equilibrium

Each value inserted in the sheets named 'Preconditions' is evaluated based on the band of equilibrium. The band represents a spectrum with different stages of sustainability. The spectrum ranges from a max score of 5 to a minimum score of 1. In collaboration with Guldborgsund Municipality, it was discussed whether the score system for the SIs should be based on a Danish standard, a standard based on the average for similar municipalities, a utopian perspective (aiming to achieve the best possible outcome), or if the practitioners should determine their own goals. In conclusion, the only sensible outcome was a mixture of the standards, due to the SIs' different natures. Unfortunately, it was not possible for the project group to obtain standards from similar case areas, and as previously mentioned, a Danish standard was also difficult to create. Most SIs' score system was thus based on the project group's own assumptions of what seemed reasonable. As the tool should be seen as an example of how the SDGs can be made measurable, and not as a final product, no further resources were used for this part. It is important to highlight that the band of equilibrium has a huge effect on the outcome of the tool. Depending on the practitioner's intention for the tool, if for instance the practitioner wants to be evaluated based on similar case areas or a Danish average, the band of equilibrium and graduation of score points need to be changed to accommodate these standards. In the tool, the practitioner has the option of changing each individual range in the score system, by inserting a new value in the designated column; see Figure 13. This is also important if the practitioner wants to set their own goals.

Nº	Indicator	Unit	Very Good (5)	Good (4)	Neither or (3)	Not Great (2)	Bad (1)		Score
			Range can be changed after desire						
6.1 6.1.1	Percentage of households wit	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	5
6.2 6.2.1	Percentage of households wit	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	4
6.2.2	Percentage of drainage / stori	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	1
6.3 6.3.1	Percentage of city's wastewat	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	5
6.3.2	Compliance rate of wastewat	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	5
6.3.3	Percentage of households ser	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	2
6.4 6.4.1	Total water consumption per	Liters/day/capita	0 - 35	≤ 55	≤ 75	≤ 95	≤	m³/Y/C	4
6.4.2	Total water consumption per	Liters/day/capita	0 - 130	≤ 150	≤ 170	≤ 190	≤	m³/Y/C	4
6.4.3	Percentage implementation o	Percentage	100 - 95	≥ 90	≥ 80	≥ 70	≥ 0	%	3
6.4.4	Percentage of water loss in th	Percentage	0 - 5	≤ 10	≤ 20	≤ 30	≤ 100	%	5

Figure 13 – A segment of the tool (Appendix 1, under the tab 'standards') displaying the band of equilibrium.

SDG 6																
Step 1						Step 2		Step 3		Step 4		Step 5		Step 6		
Nº		Data input	Score	Imp	Imp	Weight	Contro	Performa	SUB-Sc	Impo	Importa	Weighti	Contro	Perform	SDG-Sc	
6.1	6.1.1*	100	5	1	2	1,00	100%	5,00	5	2	2	0,226		1,13		
6.2	6.2.1*	90	4	1	2	0,40	100%	1,60	2,2	2	2,5	0,283		0,62		
	6.2.2*	0	1	2	3	0,60		0,60		3						
6.3	6.3.1*	99	5	2	3	0,43		2,14		3						
	6.3.2*	97	5	1	2	0,29	100%	1,43	4,143	2	2,333	0,264	100%	1,09	3,75	
	6.3.3*	72	2	1	2	0,29		0,57		2						
6.4	6.4.1*	40,1	4	1	2	0,25		1,00		2						
	6.4.2*	140	4	1	2	0,25	100%	1,00	4	2	2	0,226		0,91		
	6.4.3	80	3	2	2	0,25		0,75		2						
	6.4.4	5	5	2	2	0,25		1,25		2						
SDG 11																
Nº		Data input	Score	Imp	Imp	Weight	Contro	Performa	SUB-Sc	Impo	Importa	Weighti	Contro	Perform	SDG-Sc	

Figure 14 – A segment of the tool (Appendix 1, under the tab 'Data-ark') displaying six steps used to calculate the 'SDG score'.

Backdrop

The backdrop section is not important for the user, but is essential for the tool, as it stores all the Excel formulas and links all the data from each sheet. Each calculation of SDG scores is based on six steps, see Figure 14.

1. The first step represents the practitioner's insertion of values, the chosen importance level, and the practitioner's score output for each SI.

2. A weighting factor is determined for each SI. The weighting factor is the importance level (1-4) of a unit divided by the measured sum of units in the same group. The total weighting factor of the measured sums will then always be 100%. I.e. for a target with two indicators, if indicator x is deemed '(4) very important' and indicator y is deemed '(3) important', indicator x's weighting factor will be 57% and indicator y's weighting factor will be 43%, since weighting factor(x) = (4/7), and weighting factor(y) = (3/7).

3. The practitioner's SI score is multiplied by the corresponding weighting factor to determine the weighted score for each SI, which are then summed up to get the Target-score. Each Target-score represents how well the practitioner is performing regarding the target at hand.

Since the weighting factor is a percentage of a measured sum, it will not matter how many SIs constitute the target when calculating the Target-score. A target with one SI can score just as highly as a target with two or more SIs. Each SI (In) is multiplied with the weighting factor (Wn) and summed up to the Target-score.

$$Target\ score = \sum I_n * W_n$$

The relation between the weighting factor and the number of indicators is exemplified in the following calculations:

Target A, with two indicators, scores 2:

Target-score(A) = (Indicator score(x) * weighting factor(x) + Indicator score(y) * weighting factor(y))

(2 * 57% + 2 * 43%) = (1.14 + 0.86) = 2

Target B, with one indicator, scores 2:

Target-score(B) = (Indicator score(z) * weighting factor(z))

(2 * 100%) = 2

This is important as targets with a lot of SIs will otherwise have a larger effect on the final score than targets with fewer SIs. This will be elaborated in Chapter 10.2.

4. Since the user cannot actively choose how important each target is, a step controlling the importance level needed to be added to ensure compatibility with our score system from 1 to 5. The average importance level for all constituting SIs is calculated for every target, thus obtaining the Importance level of the Target-score.

5. Based on step 4 each target is given an importance level. In this step the weighting factor is calculated similarly to step 2 for each target.

6. The Target-score is multiplied by the corresponding weighting factor to determine the weighted score of each Target, which are then summed up to get the SDG-score, similarly to step 3.

Finally, when all SDG-scores have been determined, the total sustainability score will be calculated in a similar fashion by using the importance level of the SDGs to calculate the weighting factors and then dividing them by the SDG-score (step 7+). Each step is presented in Figure 15. The course of action and design choices throughout the tool represent a dendrogram, where the four levels represent a score; either SI-, Target-, SDG- or Total-score.

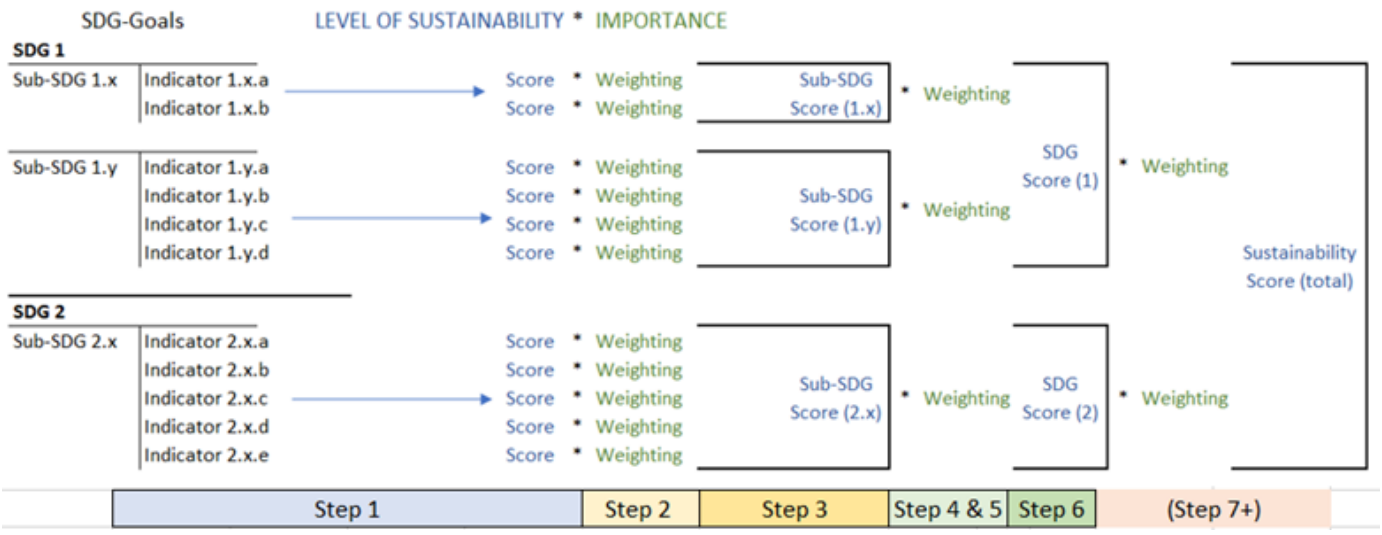


Figure 15 – An illustration of the calculative process that occurs as a result of the practitioner's inputs.

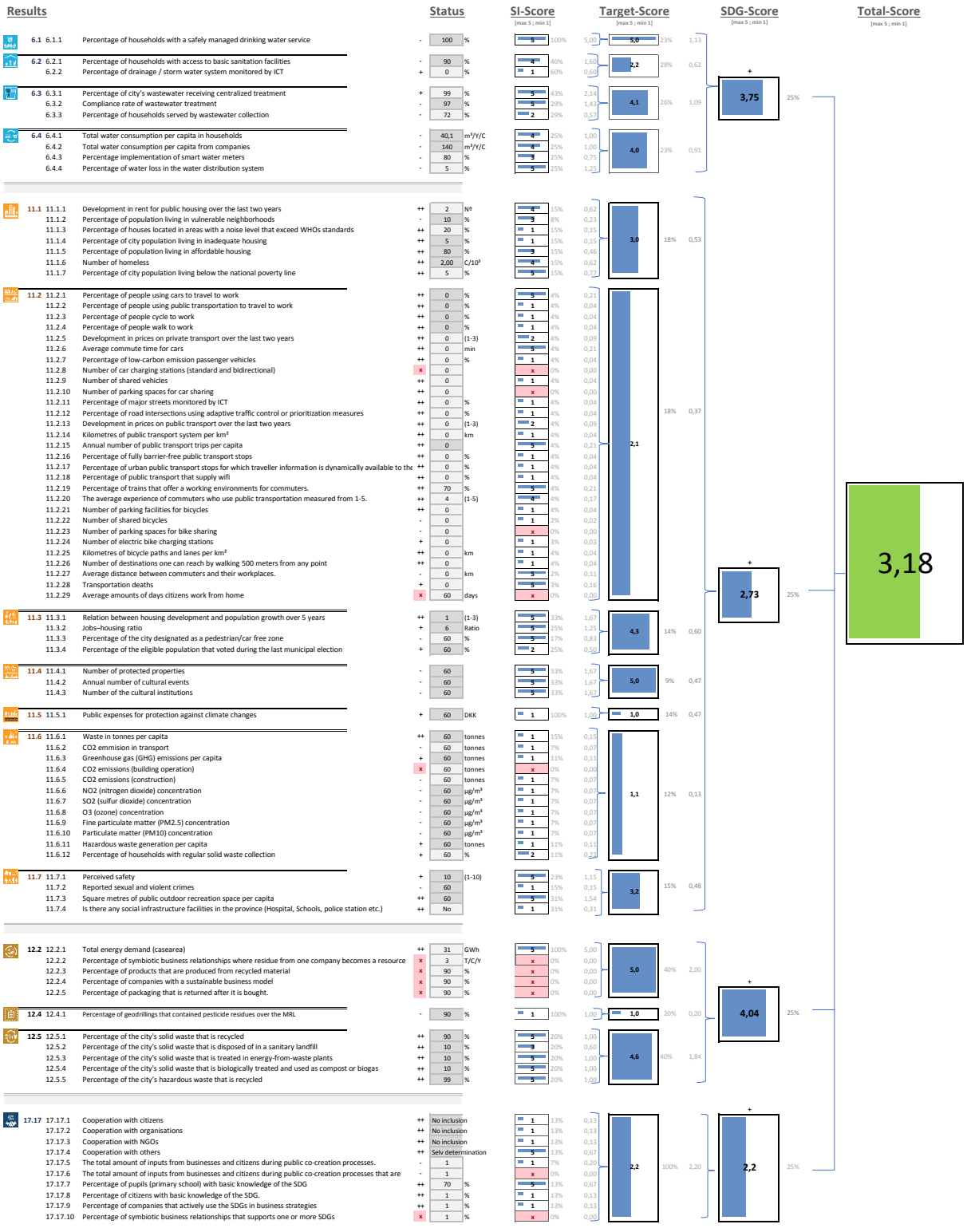


Figure 16 – A segment from the tool (Appendix 1, under the tab 'Results') displaying the results for: SI-Score, Target-Score, SDG-Score and Total-Score.

Presentation of results

This section contains two different visualisations of the final result. Both were highly appreciated by Guldborgsund Municipality. The first visualisation is the above-mentioned dendrogram, giving the user an index of each SI presented in the tool, categorised under the correct SDGs and targets; see Figure 16. The main advantage of this form of presentation is that the user is able to backtrack each step of the chain, and see where it is weakest. The downside is that this form of presentation can be incomprehensible, as it shows too much information at once.

The other form of visualisation is the spiderweb, which provides a quick overview of the scoring for each group, representatively the SDGs, the targets, and each indicator constituting the individual SDGs; see Figure 17.

According to Bell and Morse (2008), this form of visualisation is a useful method that provides relatively instant presentation of the system's state and allows a comparison of the results over time in order to observe progress or deterioration. The better the score, the closer to the edge the blue line will be; the score depends on how much the user's performance level deviates from the band of equilibrium. The visualisation of SDG 11 might be less useful, as the spiderweb has difficulties presenting 57 indicators at once.

How the tool works in practice will be further elaborated on in Chapter 10, where examples are used to assess the tool's capabilities.

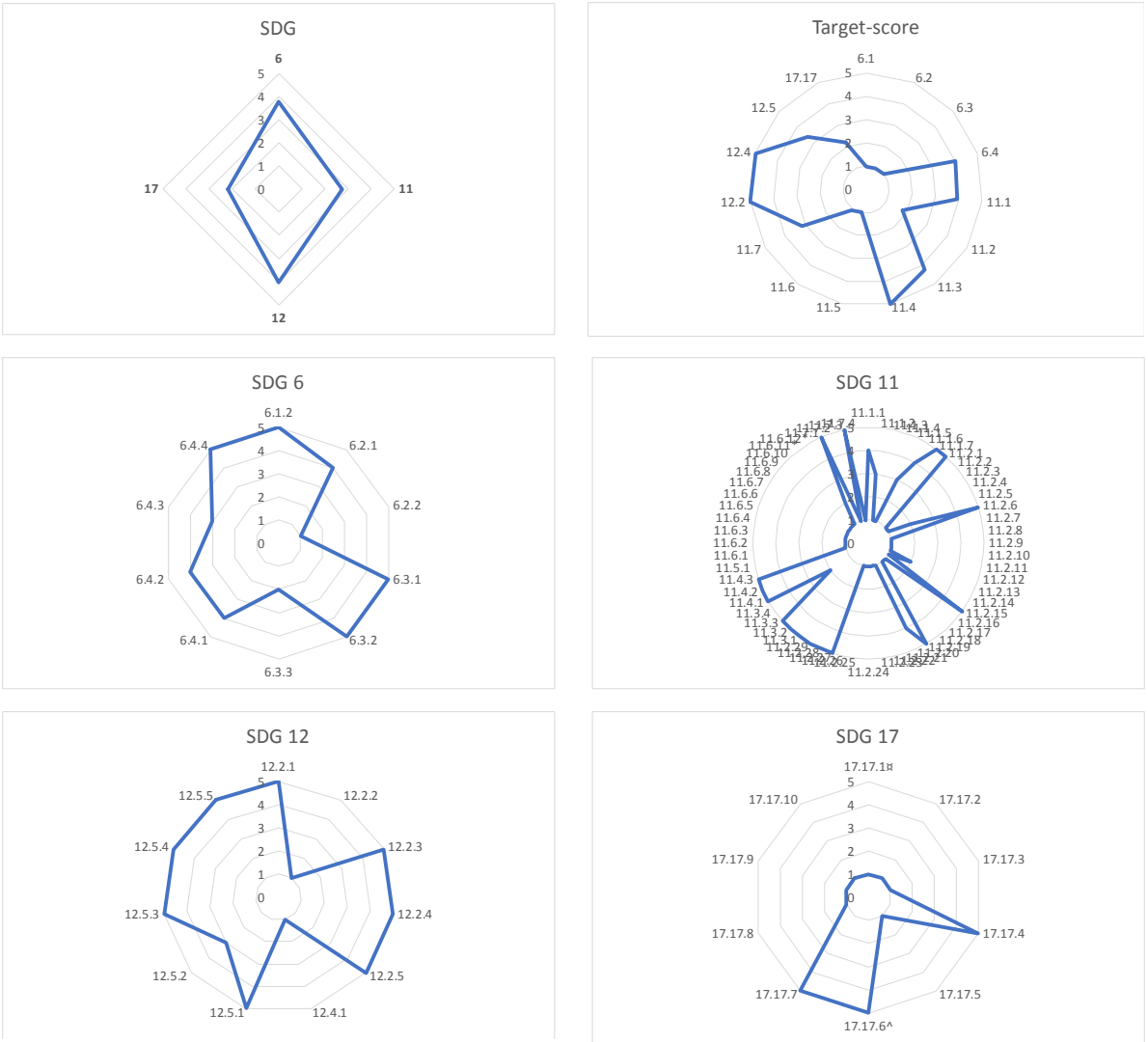


Figure 17 - A segment from the tool (Appendix 1, under the tab 'Visualisations') displaying the results distributed on spiderwebs for the SDG-Score, Target-score and for each of the SDGs and their respective indicators.

7 MEASURING THE SDGS: AN OVERVIEW OF THE EXISTING LITERATURE

This analysis constitutes a review of existing literature. It was considered necessary to carry out a state-of-the-art (SOTA) review, in order to establish an overview of the work that has been carried out in relation to measuring the SDGs and to identify sustainability indicators (SIs) from the literature. This analysis thus aims to answer our first sub-question: '*How does the literature address the issue of measuring the Sustainable Development Goals?*' The existing work can be divided into two types: 1) Scientific work done by researchers in relation to the implementation of the SDGs in local contexts, e.g. SIs for urban areas, and 2) Practical work carried out by international and Danish organisations, both in relation to SDG indicator frameworks and currently used sustainability assessment methods.

7.1 THE SCIENTIFIC WORK ON THE SDGS

The literature on SIs and SDGs is immense, as illustrated in Chapter 6.1. This chapter will briefly describe some of the research done in relation to SIs in cities, assessment tools, and the relation between the SDGs and implementation. All these topics are important to cover in order to establish an overview of what has been done and which topics need more attention.

7.1.1 SUSTAINABILITY INDICATORS IN CITIES

As stated in Chapter 1, the SDGs need to be translated to a local context in order to be relevant for municipalities. A pilot study of five different cities: Bangalore (India), Cape Town (South Africa), Gothenburg (Sweden), Greater Manchester (United Kingdom), and Kisumu (Kenya) carried out by more than 20 researchers from around the world, highlights the importance of translating the SDGs to a local context. The aim of this pilot study is to investigate how the UN's official indicators for SDG 11 work in the five cases. Furthermore, each indicator is assessed by the Sustainable Development Solutions Network's 10 criteria for robust global monitoring indicators (SDSN, 2015; Simon et al., 2016). By testing the indicators on the five cities, the paper concludes that the official indicators are difficult to implement in a local context '*due to a range of definitional issues as well as discrepancies among local realities, varying practices of data collection, and local definitions used*' (Simon et al., 2016:61). It is furthermore noteworthy that none of the indicators tested were assessed to be both important/relevant and easy to measure in terms of data availability by the local authorities. This means that the indicators lack contextual aspects and can be argued to be insignificant for municipalities as they are categorised as 'irrelevant'. It can thus be concluded that contextuality is an important factor for the development of indicators (Simon et al., 2016).

The lack of data availability and/or issues with data collection methodologies is a problem that is well addressed in the literature about SIs for cities. Koch and Krellenberg (2018) state that since the SDGs should be implemented not only on a national level, but also on a local level, with cities playing a huge role, data provision, indicator development, and monitoring become difficult and challenging. Klopp and Petretta (2017) agree with this and conclude in their paper about the challenges of using SDG 11 as a tool for improving cities that '*[...] valuable, open and inclusive data collection in support of improved cities, [...] will have an important, positive, albeit not always perfectly quantifiable, impact on cities, regions and our planetary future*' (Klopp & Petretta, 2017:96-97).

For urban stakeholders, like the municipalities, indicators can play an important role in achieving the SDGs. Indicators can contribute towards increasing the understanding of the challenges in the city by monitoring different conditions over time and more importantly generating political and citizen participation in specific projects or programmes (Valencia et al., 2019; Simon et al., 2016; Klopp & Petretta, 2017). However, what, where, and how to measure are questions which have been the subject of much debate and critique. Indicators need to be seen as supporting tools which can be used and misused as political instruments, rather than as a straightforward way of measuring the complexity of sustainability issues in a city (Valencia et al., 2019; Bell & Morse, 2018).

7.1.2 IMPLEMENTATION OF THE SDGS

Besides the data collection methodologies, data quality, and the issues related to the lack of local (city) indicators in the SDGs, political integration and participation are essential aspects if one is to succeed in implementing an indicator system on a local scale (Koch & Krellenberg, 2018; Bowen et al., 2017; Valencia et at., 2019). Therefore, a lot of research has been done in relation to these topics as well.

The 2030 Agenda marks a shift in global politics. Rather than a more traditional top-down approach, the SDGs build upon non-legally binding goals (Koch & Krellenberg, 2018). Valencia et al. (2019) state that the agenda has an inclusive and participatory aim which calls for an integrated governance approach '*that facilitates the creation of partnerships and dialogues between different levels of government (both horizontally among adjacent local authorities within a single urban agglomeration, and vertically, across sectors and with different societal groups)*' (Valencia et al., 2019:19). Bowen et al. (2017) have identified three key governance challenges that are central in implementing the SDGs.

The first one relates to the issue of ensuring multiple actors work together, which in general is a challenge when working with 'wicked' sustainability issues (Henry & Vollan, 2014). Cooperation between multiple actors is important across scales, contexts, and over time in order to implement the SDGs (Bowen et al., 2017).

The second challenge explained by Bowen et al. (2017) is the trade-off that happens when including the 17 goals. The 17 SDGs present a vision for economic development, environmental sustainability, and social inclusion, all of which are desirable. However, there will surely be many tensions between these and therefore some trade-offs have to be made. Governance agreements must acknowledge these tensions and the negotiations must be transparent and take note of the different potential issues (Bown et al., 2017).

The third and last issue addressed by Bowen et al. (2017) is ensuring accountability. Implementation within the SDG framework needs mechanisms for accountability to make sure the targets and goals are met.

Additionally, a pilot study of Gothenburg, Sweden, investigated how the 17 SDGs and the indicators worked with the double function of being both a report card, measuring progress and performance, and a management tool used to '*help countries develop implementation strategies and allocate resources*' (SDSN, 2015:2). In Gothenburg, the officials were critical of the usefulness of the specific indicators in the report card function, as they considered the indicators to cause a reporting burden, as they lacked clear purpose and were unnecessary to report on an annual basis. The officials were furthermore critical about the indicators as a management tool, as they set the bar too low and did not necessarily constitute sustainable development. Based on this study, it was possible to conclude that the UN's official indicators are not usable or even possible to incorporate in planning practices, as they are too

general and lack the ability to measure performance (Hansson, Arfvidsson & Simon, 2019).

These articles all conclude that the SDGs and their respective indicators are too broad and need to be made relevant to a local context. The scientific work does not seem further concerned about making local and context-specific indicators. It is therefore necessary to look at more practical work in order to measure the SDGs on a local level.

7.2 HOW TO MEASURE THE SDGS AND SUSTAINABILITY

A lot has been done by international organisations, the Danish government, and different private companies in relation to making the SDGs and sustainability measurable. This section aims to find other frameworks which either measure the performance of the SDGs or suggest indicators for measuring sustainability. This section is thus divided into two parts. The first part describes the different assessment tools and frameworks the UN and different consultancies have suggested for measuring the SDGs in a city context. The second part describes assessment tools and frameworks for measuring sustainability in general.

7.2.1 DIFFERENT SDG ASSESSMENT TOOLS

The UN's initiative made for measuring the SDGs in a local (city) context is called Collection Methodology for Key Performance Indicators for Smart Sustainable Cities. This framework divides the indicators, called KPIs (Key Performance Indicators), into three main categories: Economy, Environmental and Society/Culture . The initiative suggests a total of 91 indicators, each of which are categorised as a core or advanced indicator. Core indicators should be able to be reported on by all cities, while advanced indicators provide a more in-depth view of the smartness of sustainability in a city and can measure progress on more advanced initiatives like a shared bicycle initiative. The advanced indicators may be beyond some cities' capability to report and/or implement (U4SSC, 2017). It was considered necessary to include indicators from this initiative in this study, as this is the only initiative made by the UN that suggests indicators on a city level.

Different consultancies have also attempted to measure and contextualise the SDGs to different contexts. Three of these attempts were: 1) Orbicon and their Mylius-tool, 2) Suggested Indicators & Toolbox for attractive and sustainable Nordic towns and Regions made by Sweco and 3) Rambøll and DAC[1], who made a Danish Baseline for SDG 11 – Sustainable Cities and Communities. These attempts all try to contextualise the SDGs to a local context but differ greatly from each other in both methodological approach and output.

Orbicon created a dialogue tool called Mylius with the purpose of making it easier for companies to start working with on the SDGs. The tool was developed because the companies described working towards the SDGs as complicated and expensive. Mylius is a simple online tool which gives a visual overview of the SDGs and their targets with the aim of creating dialogue between different stakeholders (Orbicon, 2019). Even though the tool is designed for companies, Guldborgsund Municipality has found it a useful tool for creating dialogue (Focus group interview 1, 2020). This tool is not included further in this thesis, as it was made for creating dialogue and does not have any measurable sustainability indicators.

Sweco was hired[2] to identify indicators for cities and determine how attractive qualities of small and medium Nordic cities affects the environment, public health, and the creation of attractive jobs. The work was done in collaboration with 18 different small and medium cities located in Denmark, Sweden, Norway, Finland, and Iceland. Sweco states that their

(1) Danish Architecture Centre
(2) The project is led by the Norwegian Ministry of Local Government and Modernisation in cooperation with the Ministry of Health and Care Services and the Ministry of Climate and Environment.

purpose is to: '*[develop] a manageable set of indicators which are meaningful, measurable and action-oriented as well as tailored for a Nordic urban context and can easily adapt to the individual needs of towns*' (Sweco, 2018:6). They suggest a total of 30 indicators divided into three main groups: key indicators, supporting indicators, and guiding questions. 17 of these indicators are key indicators, which are described as '*suitable for quantitative assessments and should be manageable to use throughout the networking towns. The use of these indicators can provide decision makers with a status of their current situation*' (Sweco, 2018:17). The 17 indicators have a broad scope and measure everything from waste, to green zones, to gender equality (Sweco, 2018). It was decided not to include these indicators in the current work, due to limitations in time and resources and as the next framework was considered to be more relevant.

Lastly Rambøll and DAC were hired by the 2030-network to create a baseline to show to what extent Denmark is fulfilling the SDGs, used to assess where to act in relation to these goals. The Baseline is translating the goals to a national and municipal level and is calculating how each municipality is performing in relation to SDG 11. Rambøll and DAC have stated that the Baseline is not an assessment of whether certain areas are performing well or poorly, but rather is a basis for decision making (DAC & RMC, 2019; Rambøll, 2019). The indicators from this project were considered highly relevant to include in the following analyses, as it suggests indicators made specific in a Danish context.

7.2.2 OTHER SUSTAINABILITY ASSESSMENT TOOLS AND FRAMEWORKS

Measuring sustainability is not something that was first prompted by the SDGs; many different frameworks, tools, and indexes have been made over the last few decades. This section will briefly describe the frameworks we have sought inspiration from when looking for indicators to measure the SDGs. Furthermore, this section shows other frameworks which were found through the literature review but were for various reasons not included in the current work.

One of the most well-known methods for measuring sustainability in an urban area is the German method DGNB. DGNB is a non-profit and non-governmental organisation. DGNB builds on a holistic understanding of sustainability which includes economic, social, and environmental aspects (DGNB, 2020). One of the purposes is to end 'greenwashing' and the diffuse understanding of sustainability. This is done by using a broad range of different indicators to measure the three aspects of sustainability (DGNB, 2020). It is chosen to include indicators from DGNB in the following analyses, as DGNB is a well-known and tested method for measuring sustainability in urban areas, and as this is the chosen method in Denmark, chosen over LEED and BREEAM (Provenzano, 2013).

Several other methods have been created to measure sustainability in its various forms. The North American LEED (Leadership for Energy and Environmental Design) for cities and communities, which focuses primarily on ecological aspects and the efficient use of natural resources. LEED uses the term 'green' while DGNB focuses more on 'sustainability' (Provenzano, 2013). Furthermore, BREEAM is used in the United Kingdom to assess the three aspects of sustainability in neighbourhoods or on a larger scale, American experts produced STAR to enhance sustainability in US cities, and the Japanese developed CASBEE to fit cities all over the world. The International Organization for Standardization also made an ISO-standard for sustainable communities, namely ISO 37120, which includes 111 indicators divided into 19 different topics like water, urban planning, transportation, housing, and health (Diaz-Sarachaga & Jato-Espino, 2018; ISO, 2018). Indicators from the ISO are also included in the following analyses, as they reflect the three different levels of sustainability and as the ISO is an acknowledged and international non-governmental organisation with

a membership of 164 national bodies (ISO, 2020).

Besides these different frameworks and tools, many different indexes have been made by various publishers. Klopp and Petretta (2017) listed some of the most relevant indexes in relation to cities and the SDGs:

- Global Cities Index
- Green City Index
- Cities of Opportunity
- World's Most Global Cities
- Sustainability Index
- World's Most Liveable Cities
- City Prosperity Index
- Climate Action in MegaCities
- Ecological Footprint
- Sprawl Index
- Canadian Sustainability Index
- Singapore City Biodiversity Index

Based on the time and resources available it was decided not to look further into these indexes, as four frameworks for measuring the SDGs in a Danish context and measuring sustainability in a city context had already been chosen.

7.3 SUB-CONCLUSION

We can conclude that the scientific community agrees that the SDGs need to be translated to a local context in order to use them in projects in Guldborgsund Municipality. This is not an easy task and local participation is essential in order to translate the SDGs and implement the indicator system on a local scale. Furthermore, it became clear that none of the presented works have succeeded in creating a tool which can be used to improve the municipality's performance in relation to the SDGs. From a more practical perspective it became clear that many different tools and frameworks exist for measuring sustainability and a few for measuring the SDGs in a Danish city context. It was chosen to seek inspiration in four different tools and methods when developing indicators for our tool, namely: 1) The UN's initiative Collection Methodology for Key Performance Indicators for Smart Sustainable Cities, 2) Rambøll's baseline for SDG 11 in Denmark, 3) DGNB, and 4) ISO 37120. These four frameworks will be used and unfolded in the subsequent analysis.

8 STARTING THE SSA

The general problems that are associated with the Sustainable Development Goals (SDGs) were presented in Chapter 1. The problems include that the municipalities find it difficult to incorporate the SDGs into planning processes, and thus, Danish municipalities need tools and methods that can be used to measure performance in relation to the SDGs to determine improvements or deteriorations. In this thesis, it was decided to develop SIs with inspiration from the Systemic Sustainability Analysis (SSA). This is done in accordance with the theory proposed by Bell and Morse (2008), as they state that SIs are a reliable approach to use to illustrate performance and incorporate sustainability into the physical planning processes of cities.

The first step in the SSA is to understand the context. As has been stated before, sustainability is a subjective matter which is influenced by the person who uses it and the context they live in (Bell & Morse, 2008). As this study aims to develop a planning tool for Danish municipalities, it is important to create a consensus between the researcher (the project group) and the user (the municipality) on the complexities of the context the tool is dealing with. Guldborgsund Municipality was available to provide useful insights and played a vital role in the development of the planning tool. The following analyses build on the findings from the collaborative processes with the municipality. This was an important step in order to develop SIs and design a planning tool.

This chapter presents data from the two focus group interviews with Guldborgsund Municipality and exercises carried out during these meetings. The chapter presents each of the participants and their understanding of the complexities regarding the SDGs.

8.1 UNDERSTANDING THE CONTEXT

When asked what problems the participants faced in their work towards the SDGs, several issues were highlighted. The participants mentioned that they cannot determine how they should measure their performance or score with regard to the SDGs, i.e. whether it should be based on the amount of money they spend, the number of activities they carry out, or something completely different. This also means that the municipality cannot currently determine whether they are improving or deteriorating (Focus group interview 1, 2020).

According to the SSA it is crucial to understand the context of Guldborgsund and their complexities in order to measure the SDGs. To narrow down the scope of this thesis and determine the context, the participants were asked to prioritise 3-5 SDGs with regard to their importance in Guldborgsund; we present their choices in the following section.

8.1.1 LENA DUE BERRING'S PRIORITISATION OF THE SDGS

Figure 18 - Lena's prioritisation of the SDGs

The participants were asked to complete an exercise where they had to prioritise the SDGs in relation to how important they are for them in their position. As a result of this task Lena chose the following goals:

- SDG 3: Good health and well-being
- SDG 6: Clean water and sanitation
- SDG 7: Affordable and clean energy
- SDG 12: Responsible consumption and production
- SDG 17: Partnerships for the goals

As an argument for choosing SDG 6, Lena stated that: '*Clean water is a top priority [...] we have experienced that several drillings have found a high amount of pesticides from agriculture*' (Focus group interview 1, 2020). The reason for this choice might be Lena's profession, as she works in the Department for Nature and Environment where she develops technical and environmental strategies for Guldborgsund Municipality. The connection became evident when Lena argued for prioritising SDGs 3, 7, and 12, stating that: '*I chose to prioritise these SDGs because I am an environmentalist, and I believe that if you cannot breathe or have access to clean water and food, then it can be argued that the other goals are in fact insignificant – in my opinion at least*' (Focus group interview 1, 2020).

Lena then expanded the arguments for SDG 12, explaining that: '*Reusability and recycling are very important [...] it is possible to reuse and recycle a lot of materials from the building industry and other businesses as long as they are cleaned*' (Focus group interview 1, 2020). The argument is focused on combatting resource depletion and Lena believes that there is a potential in recycling products from local businesses. Another argument for choosing SDG 12 was that she wished that: '*Agriculture that sprays insecticides does not exist in the future*' (Focus group interview 1, 2020). This argument relates to agriculture, which constitutes a big part of Falster's and Lolland's geographical areas.

Finally, Lena chose to prioritise SDG 17, stating: '*and finally I have of course prioritised SDG 17, as it is an important goal in order to implement the other SDGs*' (Focus group interview 1, 2020). Lena argued that SDG 17 is the most important goal, and it is a goal that they are working with, as part of a Ph.D. (Focus group interview 1, 2020; Egelund, 2020).

8.1.2 LONE GJERULFF BAK'S PRIORITISATION OF THE SDGS

Figure 19 - Lone's prioritisation of the SDGs

Lone chose the following goals:

- SDG 4: Quality education
- SDG 8: Decent work and economic growth
- SDG 11: Sustainable cities and communities
- SDG 17: Partnerships for the goals

The goals that Lone chose to prioritise are different to Lena's, where the only goal that both prioritise is SDG 17. When talking about SDG 4 and SDG 8, Lone stated that she picked goal 4 because: '*It is the SDG that I work with the most with regard to my profession. I did not*

pick the SDG based on what I personally think is the most important' (Focus group interview 1, 2020), and for SDG 8 she stated that '*I picked SDG 8 because my occupation is concerned with creating new jobs*' (Focus group interview 1, 2020). Both arguments hint that Lone picked the SDGs based on her profession by representing her department.

But when talking about SDG 11, Lone justified the choice using a different set of arguments: '*I chose SDG 11 because Guldborgsund has a big focus on sustainable cities and local communities, especially with regard to strategies, because we are both developing a town centre and rural areas*' (Focus group interview 1, 2020).

Additionally, Lena, in correspondence to Lone, also agreed that SDG 11 is important, even though she did not prioritise it at first, as she stated: '*CO2 emissions from transport is the biggest problem for the municipality. It would be relevant to focus on this complexity. It is especially commuters that emit a lot of CO2*' (Focus group interview 1, 2020).

Finally, Lone stated that SDG 17 is the most important SDG in her opinion: '*The reason for choosing SDG 17 is that we are a multidisciplinary department that cooperates with a lot of other businesses, and if we do not cooperate with each other, then talking about SDGs does not matter*' (Focus group interview 1, 2020). Thus, according to Lone SDG 17 is an essential goal in order to implement the other SDGs.

8.1.3 BIRGITTE ECHWALD'S PRIORITISATION OF THE SDGS

Figure 20 - Birgitte's prioritisation of SDGs

The first and most obvious observation is that Birgitte chose to prioritise the exact same SDGs as Lone:

- SDG 4: Quality education
- SDG 8: Decent work and economic growth
- SDG 11: Sustainable cities and communities
- SDG 17: Partnerships for the goals

Birgitte argued that these SDGs are important by agreeing with several of Lone's arguments. She furthermore added that: '*SDG 11 is an important goal as it contains multidisciplinary elements, due to the fact that the structures of the city are connected to all the sustainability elements such as clean water, energy, and transport*' (Focus group interview 1, 2020). *This means t*hat the development and design of the infrastructure actually has a huge impact on the other SDGs and is thus important to consider for planning processes.

Finally, Birgitte also argued that goal 17 is the most important SDG and added to the arguments by stating that: '*The goal can be interpreted as co-creation and can include the involvement of citizens and businesses*' (Focus group interview 1, 2020).

8.1.4 CHOOSING 4 SDGS TO REPRESENT GULDBORGSUND MUNICIPALITY

One of the main criticisms of breaking the holistic concept of sustainability down into indicators is that the indicators are unable to reflect the holistic nature of sustainability (Bell & Morse, 2008). In the creation of the tool it was attempted to incorporate the holistic aspect of sustainability by choosing an SDG from each of the levels in Figure 21, developed by the Stockholm Resilience Centre (Rockstrom and Sukhdew, 2016).

The levels are called Biosphere, Society, and Economy and they represent each of the three pillars of sustainability: economic, social, and environmental sustainability. Gudmundsson (2020) acknowledges the importance of setting goals that relate to economic, social, and environmental sustainability, saying: '*It is necessary to include the three aspects of sustainability to create a balance in the tool*' (Gudmundsson, 2020).

- For 'Biosphere' it was decided to pick SDG 6, because it is the only prioritised SDG that reflects the environmental aspects of sustainability and was additionally highly prioritised by Lena, due to concerns about pesticide pollution from nearby agriculture.
- For 'Society' it was decided to pick SDG 11 because Birgitte and Lone argued strongly for how essential this SDG is for the municipality. This SDG is also fundamental for the project group's field of study.
- For 'Economy' it was decided to pick SDG 12, because it includes aspects such as agriculture, reusable products, and circular economy, which the participants argued were important for the municipality.

Finally, SDG 17 was included for two reasons: 1) it was the only SDG all three participants from Guldborgsund Municipality prioritised and 2) according to Figure 21, Goal 17 is central to achieving the other 16 goals.

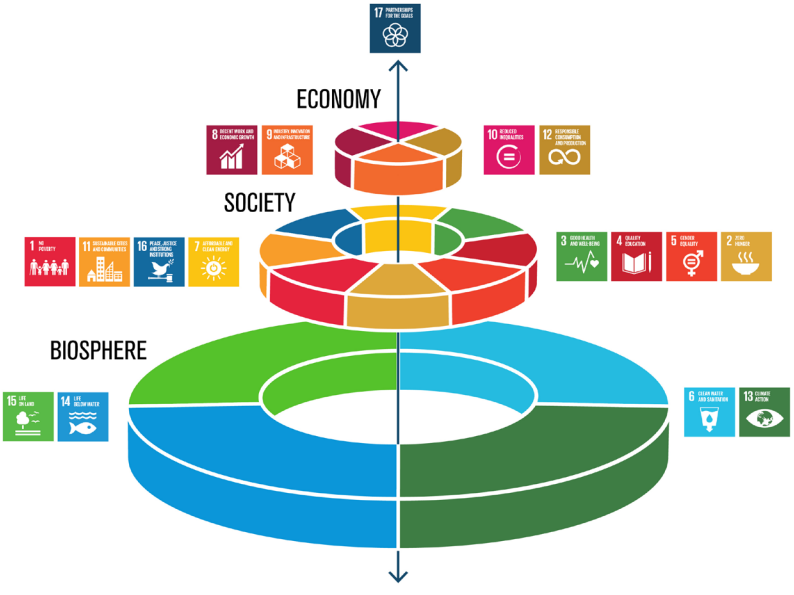


Figure 21 – Illustrates how the SDGs are distributed among the three pillars of sustainability, namely: economics (economy), social (society) and environmental (biosphere) (Rockström and Sukhdew, 2016).

8.2 SUB-CONCLUSION

Each participant chose the SDGs that they believed were the most important for Guldborgsund Municipality. The participants presented eight different goals in total, which we narrowed down to four SDGs, namely: 6 – Clean Water and Sanitation, 11 – Sustainable Cities and Communities, 12 – Responsible Consumption and Production, and 17 – Partnerships for the Goals.

The goals were first and foremost chosen based on the participants' arguments and prioritisation of the SDGs, as the participants managed to put the goals into context by giving examples of which complexities in Guldborgsund the goals concerned. And secondly, because each of the goals together represent the three pillars of sustainability, namely: economic, social, and environmental sustainability.

9 IDENTIFYING THE SIS AND THE BAND OF EQUILIBRIUM

The previous analysis showed the first step in the Systemic Sustainability Analysis – the process of understanding the context in Guldborgsund Municipality. This resulted in a system consisting of four SDGs, namely SDGs 6, 11, 12, and 17. Following the SSA, this analysis aimed to identify relevant and contextual SIs and the band of equilibrium (BOE). It is important to remember that both SIs and the BOE are subjective and depend on the opinions and experiences of the three participants.

The following analysis first briefly describes the SMART analysis as a concept and how it is used to assess indicators, before the SMART analysis is carried out using indicators from the literature. Examples from the analysis are presented in the text. Secondly, new SIs suggested by the municipality during the second focus group interview are introduced and analysed. Finally, this analysis explains and presents the participants' suggestions for the band of equilibrium. This will answer our second sub-question: '*How can an index of relevant indicators be developed, through a collaborative process with Guldborgsund Municipality?*' Analysing the relevant and context-specific SIs and BOE resulted in an index of SIs and a BOE system which can be operationalised as a tool.

The SIs used throughout this chapter are found in four different frameworks, which were chosen based on the literature review. The four frameworks are:

- DGNB
- ISO 37120
- Publication: 'Rambøll Baseline – SDG 11'
- Publication: 'Collection Methodology for Key Performance Indicators for Smart Sustainable Cities.'

It is important to remember that three methodological steps involving the SIs were carried out prior to the SMART analysis. These steps involved (step 1) the development of an index of SIs based on the four frameworks, (step 2) connecting each SI with the relevant SDG and (step 3) removal of duplicates and non-contextual SIs. A more thorough description of these steps can be found in this thesis' methodology chapter. Figure 22 illustrates that these steps are the prerequisites for doing (step 4) the SMART analysis.

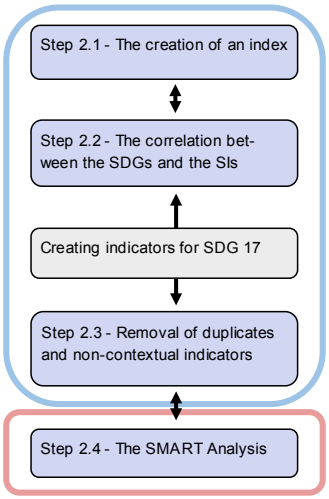


Figure 22 - The steps marked in the blue box are methodological steps necessary to carry out in order to use the SMART concept on the index of indicators.

9.1 THE SMART ANALYSIS

As previously explained, the SMART concept is used to assess indicators in order to ensure they are contextual and relevant, which is why it complements the SSA.

SMART is an acronym for Specific, Measurable, Attainable, Relevant, and Timely. It is important to keep in mind that the Guldborgsund Municipality should ideally assess whether each SI fulfils all of the five criteria in the concept. After completing the three initial steps, we had an index of 97 SIs. It was therefore not realistic, with the time available, to ask the participants to assess all SIs using the five criteria of assessment. It was thus decided that the researchers would assess whether the SIs are specific, measurable, and timely, meaning:

S Specific: whether the SI is specific in relation to the SDG it should measure

M Measurable: whether it is possible to measure the SI with one measurement

T Timely: whether it is possible to measure the SI at a given time.

On the other hand, the participants assessed whether they thought the SIs were attainable and relevant for Guldborgsund Municipality. The participants were asked to consider:

A Attainable: Is the data attainable?

R Relevant: How relevant is the SI?

9.1.1 THE SMART ANALYSIS OF SDG 6 – CLEAN WATER AND SANITATION

It was decided to analyse each of the SDGs separately, and the first SDG is number 6 – Clean Water and Sanitation. In order to carry out the analysis, we applied knowledge from both focus group interviews with Guldborgsund Municipality together with Lena D. Berring's assessment of the SIs and BOE. Table 07 shows how each SI for SDG 6 was given a colour: green, grey, blue, or red to assess how well each SI performed in terms of being specific, measurable, timely, attainable, and relevant. The colours mean:

> Green = No significant challenges

> Yellow = Some challenges

> Red = Significant challenges

> Grey = Not assessed

> Blue = Did not know or did not answer

As explained in the methodology, it is important to keep in mind that these colours are an estimate based on the focus group interviews with the municipality and our own knowledge. The colours should therefore not be seen as a unique or definitive answer. The colours are thought of as indications of which SIs might cause some challenges in relation to the concepts from SMART. Therefore, it is also important to remember that SIs with only green boxes are not necessarily perfect indicators or better than other SIs but are simply indicators

that can be argued to fit under the concepts that are presented in SMART. Table 07 illustrates the results from the SMART analysis for SDG 6, and also, what data Lena D. Berring suggested for the BOE – this will be addressed separately after the SMART analysis of the four SDGs.

SIs in Table 07 marked with red were deleted, while SIs marked with blue were changed in order to make them more relevant and/or fit the local context in Guldborgsund Municipality. The following sections give examples of SIs that were deleted or changed. Each section briefly describes where the SIs derive from, why they were changed or deleted and what they were changed to. The complete SMART analysis can be found in Appendix 4. The chapter concludes with an index of SIs for SDG 6.

9.1.1.1 DELETED INDICATORS

Indicator: 6.4.6 – Freshwater consumption

This indicator is from the UN publication Collection Methodology for Key Performance Indicators for Smart Sustainable Cities. The indicator measures how much of the total water consumption derives from freshwater sources like lakes, rivers, and groundwater (U4SSC, 2017). It was deleted as the water demand is covered in indicators '6.4.1 – Total water consumption in households per capita' and '6.4.2 – Total water consumption of companies per capita'.

Indicator: 6.4.3 – Percentage of water distribution system monitored by ICT

This indicator also derives from the UN publication 'Collection Methodology for Key Performance Indicators for Smart Sustainable Cities'. This indicator describes the total length of the water distribution system monitored by Information and Communication Technology (ICT). It was marked 'not relevant' by Lena. Based on this the indicator was deleted, as it was not possible to change it to a more relevant indicator.

9.1.1.2 INDICATORS CHANGED

Indicator: 6.4.1 – Total domestic water consumption per capita

This indicator derives from ISO 37120 and indicates how much water households use per person living in the area. Lena assessed the indicator to be 'not relevant' with the argument '*we do not have water shortage in Denmark*' (Appendix 6). But as Target 6.4 is about increasing water-use efficiency in all sectors and not only about water shortage, it was considered essential to keep this indicator as it indicates water efficiency (SDG, 2015c). To make it more understandable and prevent misunderstandings it was changed to 'Total water consumption in households per capita'.

Indicator: 6.4.2 – Total water consumption per capita

This indicator also derives from ISO 37120 and at first glance resembles the previous indicator, but this indicator aims to measure the total water consumption in the area including companies' water consumption. Lena assessed this indicator as 'not relevant', using the same argument as with the previous indicator. But as with the previous indicator this indicator was kept as Target 6.4 is about increasing water-use efficiency in all sectors (SDG, 2015c). As the above indicator was about measuring water consumption in households, this indicator was changed to 'Total water consumption of companies per capita'.

Together these two indicators now tell us something about the water-use efficiency of households and companies in the chosen area.

9.1.1.3 FINAL INDEX OF INDICATORS FOR SDG 6

By using the SMART concept on the index of indicators for Goal 6, two indicators were changed in order to make them more relevant and three indicators were deleted for various reasons. As illustrated in Table 08 this resulted in an index of 10 relevant and context-spe-

			Indicators assessed by the project group	Unit	Specific	Measurable	Timely	Indicators assessed by the stakeholders	Unit	Attainable	Relevant	BOE
SDG 6 - Clean water and sanitation	6,1	6.1.1	Compliance rate of drinking water quality	Percentage								
		6.1.2	Percentage of households with a safely managed drinking water service	Percentage				Percentage of households with a safely managed drinking water service	Percentage			Danish Avarage
	6,2	6.2.1	Percentage of households with access to basic sanitation facilities	Percentage				Percentage of households with access to basic sanitation facilities	Percentage			Danish Avarage
		6.2.2	Percentage of drainage / storm water system monitored by ICT	Percentage				Percentage of drainage / storm water system monitored by ICT	Percentage			Danish Avarage
	6,3	6.3.1	Percentage of city's wastewater receiving centralized treatment	Percentage				Percentage of city's wastewater receiving centralized treatment	Percentage			Danish Avarage
		6.3.2	Compliance rate of wastewater treatment	Percentage				Compliance rate of wastewater treatment	Percentage			
		6.3.3	Percentage of households served by wastewater collection	Percentage				Percentage of households served by wastewater collection	Percentage			Danish Avarage
	6,4	6.4.1	Total domestic water consumption per capita	Liters/day per capita				Total domestic water consumption per capita	Liters/day per capita			Danish Avarage
		6.4.2	Total water consumption per capita	Liters/day per capita				Total water consumption per capita	Liters/day per capita			Danish Avarage
		6.4.3	Percentage of the water distribution system monitored by ICT	Percentage				Percentage of the water distribution system monitored by ICT	Percentage			
		6.4.4	Percentage implementation of smart water meters	Percentage				Percentage implementation of smart water meters	Percentage			Danish Avarage
		6.4.5	Percentage of water loss in the water distribution system	Percentage				Percentage of water loss in the water distribution system	Percentage			
		6.4.6	Freshwater consumption	Percentage								

Table 07 – Shows the SMART analysis for SDG 6. Indicators marked with red were deleted while indicators marked with blue were changed in order to make them contextual or relevant. The last column shows Lena's choice and assessment of what each indicator should be compared with, also known as BOE.

cific indicators to include in the tool for Guldborgsund Municipality.

Target		SIs	Unit
6.1	6.1.1	Percentage of households with a safely managed drinking water service	%
6.2	6.2.1	Percentage of households with access to basic sanitation facilities	%
	6.2.2	Percentage of drainage/storm water systems monitored by ICT	%
6.3	6.3.1	Percentage of city's wastewater receiving centralised treatment	%
	6.3.2	Compliance rate of wastewater treatment	%
	6.3.3	Percentage of households served by wastewater collection	%
6.4	6.4.1	Total water consumption in households per capita	Litre/ year/ capita
	6.4.2	Total water consumption of companies per capita	Litre/ year/ capita
	6.4.3	Percentage of implementation of smart water meters	%
	6.4.4	Percentage of water loss in the water distribution system	%

Table 08 – Shows the 10 final indicators for SDG 6

9.1.2 THE SMART ANALYSIS OF SDG 11 – SUSTAINABLE CITIES AND COMMUNITIES

The next SDG to assess using the SMART concept was SDG 11 – Sustainable Cities and Communities. This was done in the same way as SDG 6 and Table 09 illustrates the SMART analysis of Target 11.1. The SMART analysis for the rest of SDG 11 can be found in Appendix 4. This was done as 62 different SIs were analysed in SDG 11, which would take up too much space to illustrate here. Examples of indicators changed and deleted will still be explained in the following sections, but the explanations are condensed to spare the reader. An explanation for each indicator that was changed or deleted can be found in Appendix 4.

There can be multiple reasons for why there are substantially more indicators in this SDG compared to SDGs 6, 12 and 17. Some of the reasons could be that 1) The indicators are found in frameworks which all relate to sustainable cities, 2) The framework 'Baseline – SDG 11' only suggests indicators for SDG 11 and 3) SDG 11 consists of multiple sectors e.g. buildings and transport, which naturally generate a lot of indicators.

The SMART analysis of SDG 11 was carried out in a similar fashion to the analysis of SDG 6. Indicators in Table 09 marked with red were deleted, while indicators marked with blue were changed in order to make them more relevant and/or fit the local context of Guldborgsund Municipality. Some indicators have a yellow box in 'measurable' and were not changed or deleted. This is due to the fact that the indicators contain wordings that require an elaborative definition such as 'affordable housing' (SI 11.1.5) before they can be used in the tool as an SI. It is up to the municipality to make this definition. The following sections briefly describe why the indicators were either deleted or changed. This chapter ends with a final index of SIs for SDG 11.

9.1.2.1 INDICATORS DELETED

Indicator: 11.1.9 – Percentage of city population living below the international poverty line

This indicator derives from ISO 37120 and presents the percentage of the city population living below the international poverty line. This indicator was not seen as relevant in a Danish context and as indicator 11.1.10 describes the population living below the national poverty line, indicator 11.1.9 was deleted.

			Indicators assessed by the project group	Unit	Specific	Measurable	Timely	Indicators assessed by the stakeholders	Unit	Attainable	Relevant	BOE
	11,1	11.1.1	Development in rental in public housing	Index				Development in rental in public housing over 2 years	Number			Similar municipalites
		11.1.2	Number of people in exposed residential areas	Percentage				Number of people in exposed residential areas	Percentage			Utopian goal
		11.1.3	Percentage of houses located in areas with a noise level that exceed WHOs standards	Percentage				Percentage of houses located in areas with a noise level that exceed WHOs standards	Percentage			Danish avarage
		11.1.4	Percentage of city population living in inadequate housing	Percentage				Percentage of city population living in inadequate housing	Percentage			Utopian goal
		11.1.5	Percentage of population living in affordable housing	Percentage				Percentage of population living in affordable housing	Percentage			Utopian goal
		11.1.6	Number of homeless per 1000 population	Number / 1000 inhabitants				Number of homeless per 1000 population	Number / 1000 inhabitants			Danish avarage
		11.1.7	Areal size of informal settlements as a percentage of city area	Percentage								
		11.1.8	Percentage expenditure of income for housing	Percentage								
		11.1.9	Percentage of city population living below the international poverty line	Percentage								
		11.1.10	Percentage of city population living below the national poverty line	Percentage				Percentage of city population living below the national poverty line	Percentage			
		11.2.1	Prices on transport in realtion to consumer price index	Index in relation to CPI				Prices on transport in realtion to consumer price index	Number			
		11.2.2	Availability and distance to public transport for people with reduced mobility	Km								
		11.2.3	Number of high-quality parking facilities for bicycles	Number				Number of parking facilities for bicycles	Number			
		11.2.4	Number of nearby parking spaces for car sharing	Number				Number of parking spaces for car sharing	Number			Similar municipalites

Table 09 – Shows the SMART analysis of SDG 11.1. Indicators marked with red were deleted while indicators marked with blue were changed in order to make them more contextual or relevant. In the last column Birgitte and Lone assessed what they thought each indicator should be compared with. To see the whole SMART analysis for SDG 11, see Appendix 4.

Indicator: 11.2.11 – Percentage of population living within 0.5 km of cycle paths

Indicator 11.2.11 derives from DGNB. Birgitte assessed this indicator to be 'not relevant' as '*it is only relevant if biking is a realistic transport system*' (Focus group interview 2, 2020). By stating this Birgitte implicitly stated that in Guldborgsund Municipality biking is not a realistic transport system. The indicator was therefore deleted.

Indicator: 11.5.2 – Insurance payment regarding cloudburst and storm surge

This indicator originates from Rambøll's 'Baseline for SDG 11' and was developed on a national level to describe the total amount insurance companies paid after a cloudburst or storm surge. This indicator was assessed by the project group as impossible to measure on a local scale, as it would require the amount of insurance paid to each household. It was not possible to change this indicator to something measurable and so the indicator was deleted.

9.1.2.2 INDICATORS CHANGED

Indicator: 11.1.1 – Developments in public housing rent

This indicator comes from Rambøll's Baseline for SDG 11. The indicator measures the changes in public housing rent compared with the Consumer Price Index (CPI). Originally this was illustrated in a graph, but indicators have to be measured in a value in order to fit our tool, which is why this indicator was marked as yellow in 'measurable'. The indicator was furthermore assessed to pose some challenges due to the criterion 'timely', as it originally did not state the time period which these rent developments should be measured over. Based on this, the indicator was changed to 'Developments in rent in public housing over the last 2 years' and is in the tool measured as a number with the following meaning: 1 if public housing rent increased in relation to the CPI, 2 if there was neither an increase nor a decrease between rent and CPI, and 3 if the rent decreased in relation to the CPI. This made the indicator both measurable and timely.

Indicators: 11.2.4, 11.2.5 & 11.2.12

These indicators are described in the same section as they had the same problems in relation to being measurable. Table 10 shows each of the three indicators before and after the assessment done by the project group in the SMART analysis.

As 'nearby' for all three indicators was not defined, it was either deleted (as for indicators 11.2.4 and 11.2.5) or defined (as for indicator 11.2.12). After the changes, Birgitte classified the targets to be measurable, as specified by her assessment.

SIs	Before project group assessment	After project group assessment
11.2.4	Number of nearby parking spaces for car sharing	Number of parking spaces for car sharing
11.2.5	Number of nearby parking spaces for bike sharing	Number of parking spaces for bike sharing
11.2.12	Number of nearby pedestrian path networks that cover all walking possibilities	Number of destinations one can reach by walking 500 metres from any point

Table 10 – Illustrates the four indicators (11.2.4, 11.2.5 and 11.2.12). For all four indicators the word 'nearby' was deleted.

Indicator: 11.2.13 – Fully barrier-free public transport stops

This indicator derives from the DGNB and was originally measured using yes/no. The indicator is used to measure if transport stops are designed for persons with reduced mobility, which is an important part of Target 11.2 (SDG, 2015a). It was assessed by the project group that there were challenges in making it measurable, as it required a yes or no answer. The unit was therefore changed to percentage. The indicator now indicates the percentage of transport stops in an area that are fully barrier free.

Indicators: 11.2.14 – Kilometres of public transport system per 1000 population & 11.2.16 – Kilometres of bicycle paths and lanes per 1000 population

The two indicators are presented in ISO 37120 and the UN publication 'Collection Methodology for Key Performance Indicators for Smart Sustainable Cities'. Both of these indicators were assessed by the project group as being 'not specific' since by measuring the length in relation to the population, sprawling cities have an advantage as these cities require a longer transport network to cover the city. Sprawling cities are normally not preferable in relation to sustainability as they among other things create a great need for transport. Therefore, the unit for both of these indicators was changed to 'km/km^2'.

9.1.2.3 FINAL INDEX OF INDICATORS FOR SDG 11

By using the SMART concept on the initial index of indicators for SDG 11, 18 indicators were changed in order to make them more relevant and 21 indicators were deleted for various reasons. As illustrated in Table 11 this resulted in an index of 55 relevant and context-specific SIs for Guldborgsund Municipality.

Target		Indicators	Unit
11.1	11.1.1	Developments in public housing rent over 2 years	Nº
	11.1.2	Number of people in exposed residential areas	%
	11.1.3	Percentage of houses located in areas with a noise level that exceeds WHO's standards	%
	11.1.4	Percentage of city population living in inadequate housing	%
	11.1.5	Percentage of population living in affordable housing	%
	11.1.6	Number of homeless per 1000 population	Nº
	11.1.7	Percentage of city population living below the national poverty line	%
11.2	11.2.1	Prices of public transport in relation to consumer price index over the last two years	Nº
	11.2.2	Prices of private transport in relation to consumer price index over the last two years	Nº
	11.2.3	Number of parking facilities for bicycles	Nº
	11.2.4	Number of parking spaces for car sharing	Nº
	11.2.5	Number of parking spaces for bike sharing	Nº
	11.2.6	Number of car charging stations (standard and bidirectional)	Nº
	11.2.7	Number of electric bike charging stations	Nº
	11.2.8	Number of destinations one can reach by walking 500 metres from any point	Nº
	11.2.9	Percentage of fully barrier-free public transport stops	%
	11.2.10	Kilometres of public transport system per km^2	Km/km^2
	11.2.11	Annual number of public transport trips per capita	Nº
	11.2.12	Kilometres of bicycle paths and lanes per km^2	Km/km^2
	11.2.13	Transportation deaths per 1000 population	Nº
	11.2.14	Average commute time for cars	Time
	11.2.15	Percentage of urban public transport stops where traveller information is dynamically available to the public in real time	%

11.2	11.2.16	Percentage of major streets monitored by ICT	%
	11.2.17	Percentage of road intersections using adaptive traffic control or prioritisation measures	%
	11.2.18	The percentage of people using cars to travel to work	%
	11.2.19	The percentage of people using public transportation to travel to work	%
	11.2.20	The percentage of people who cycle to work	%
	11.2.21	The percentage of people who walk to work	%
	11.2.22	Number of shared bicycles per 1000 inhabitants	Nº
	11.2.23	Number of shared vehicles per 1000 inhabitants	Nº
	11.2.24	Percentage of low-carbon emission passenger vehicles	%
11.3	11.3.1	Relation between housing development and population growth over 5 years	Nº
	11.3.2	Jobs–housing ratio	Ratio
	11.3.3	Percentage of the city designated as a pedestrian/car-free zone	%
	11.3.4	Percentage of the eligible population that voted during the last municipal election	%
11.4	11.4.1	Number of protected properties	%
	11.4.2	Annual number of cultural events per 1000 population (e.g. exhibitions, festivals, concerts)	Nº
	11.4.3	Number of cultural institutions per 1000 inhabitants	Nº
11.5	11.5.1	Public expenses for protection against climate changes	DKK
11.6	11.6.1	Waste in tonnes per capita	Tonnes
	11.6.2	CO2 emissions in transport	Tonnes
	11.6.3	Greenhouse gas (GHG) emissions per capita	Tonnes
	11.6.4	CO2 emissions (building operation)	Tonnes
	11.6.5	CO2 emissions (construction)	Tonnes
	11.6.6	NO2 (nitrogen dioxide) concentration	µg/m³
	11.6.7	SO2 (sulphur dioxide) concentration	µg/m³
	11.6.8	O3 (ozone) concentration	µg/m³
	11.6.9	Fine particulate matter (PM2.5) concentration	µg/m³
	11.6.10	Particulate matter (PM10) concentration	µg/m³
	11.6.11	Hazardous waste generation per capita	Tonnes
	11.6.12	Percentage of households with regular solid waste collection	%
11.7	11.7.1	Perceived safety	Scala (1-10)
	11.7.2	Reported sexual and violent crimes	Nº/year
	11.7.3	Square metres of public outdoor recreation space per capita	M²/capita
	11.7.4	Social infrastructure facilities in the province (hospital, schools, police station etc.)	%

Table 11 – Shows the 55 final SIs for SDG 11

9.1.3 THE SMART ANALYSIS OF SDG 12 – RESPONSIBLE CONSUMPTION AND PRODUCTION

The next SDG that was assessed using the SMART concept was SDG 12 – Responsible Consumption and Production, illustrated in Table 12. This was done in the exact same way as SDG 6 and 11. Through the literature review 9 indicators for SDG 12 were found; in the following SMART analysis, one of the indicators was changed while three were deleted.

As with the previous SDGs the project group assessed whether the indicators were specific, measurable, and timely, while Lena assessed whether the indicators were attainable and relevant. This chapter ends with a final SI index for SDG 12 which is used in the tool. The following sections briefly describe why some of the indicators were either deleted or changed. This is done in a more compact way than the SMART analysis of SDG 6 and SDG 11, as the reader now hopefully understands the approach. The complete SMART analysis can be found in Appendix 4.

9.1.3.1 INDICATORS DELETED

Indicator: 12.2.3 – CO2 emissions (building operation) & 12.2.4 – CO2 emissions (construction)

Both of these indicators derive from DGNB and measure the emissions in construction and building operation. These indicators are not specific in relation to Target 12.2, which mainly relates to food waste. Both indicators were therefore deleted here and moved to Target 11.6 as this target relates to the environmental impact of cities, including air quality.

9.1.3.2 INDICATORS CHANGED

Indicator: 12.2.1 Final energy demand (building operation), differentiated by heating, cooling, ventilation, hot water, and lighting

This indicator originates from DGNB and is assessed to be impossible to measure in one indicator, as it is differentiated by heating, cooling ventilation, hot water, and lighting. The indicator was therefore changed to 'Final energy demand (building operation)' in order to be able to measure it in one indicator.

9.1.3.3 FINAL INDEX OF SIS FOR SDG 12

By using the SMART concept on the initial index of indicators for SDG 12, one indicator was changed in order to make it more measurable and 3 indicators were either deleted or moved to another SDG for various reasons. This resulted in an index of 6 relevant and context-specific SIs for Guldborgsund Municipality as illustrated in Table 13.

Target		SIs	Unit
12.2	12.2.1	Final energy demand (building operation)	kWh/m2
12.5	12.5.1	Percentage of the city's solid waste that is recycled	%
	12.5.2	Percentage of the city's solid waste that is disposed of in a sanitary landfill	%
	12.5.3	Percentage of the city's solid waste that is treated in energy-from-waste plants	%
	12.5.4	Percentage of the city's solid waste that is biologically treated and used as compost or biogas	%
	12.5.5	Percentage of the city's hazardous waste that is recycled	%

Table 13 – Shows the 6 final indicators for SDG 12

			Indicators assessed by the project group	Unit	Specific	Measurable	Timely	Indicators assessed by the stakeholders	Unit	Attainable	Relevant	BOE
12 - Responsible Consumption and Production	12,2	12.2.1	Final energy demand (building operation), differentiated by heating, cooling, ventilation, hot water and lighting	kWh/m²				Final energy demand (building operation)	kWh/m²			Danish avarage
		12.2.2	Exported energy	kWh/m²								
		12.2.3	CO2 emissions (building operation)	kg eCO2 / person * a								
		12.2.4	CO2 emissions (construction)	kg eCO2/m2								
	12,5	12.5.1	Percentage of the city's solid waste that is recycled	Percentage				Percentage of the city's solid waste that is recycled	Percentage			Danish avarage
		12.5.2	Percentage of the city's solid waste that is disposed of in a sanitary landfill	Percentage				Percentage of the city's solid waste that is disposed of in a sanitary landfill	Percentage			
		12.5.3	Percentage of the city's solid waste that is treated in energy-from-waste plants	Percentage				Percentage of the city's solid waste that is treated in energy-from-waste plants	Percentage			Danish avarage
		12.5.4	Percentage of the city's solid waste that is biologically treated and used as compost or biogas	Percentage				Percentage of the city's solid waste that is biologically treated and used as compost or biogas	Percentage			Danish avarage
		12.5.5	Percentage of the city's hazardous waste that is recycled	Percentage				Percentage of the city's hazardous waste that is recycled	Percentage			Danish avarage

Table 12 – Shows the SMART analysis for SDG 12. Indicators marked with red were deleted while indicators marked with blue were changed in order to make them more contextual or relevant. The last column shows Lena's choice and assessment of what she thought each indicator should be compared with, also known as the BOE.

9.1.4 THE SMART ANALYSIS OF SDG 17 - PARTNERSHIPS FOR THE GOALS

The last of the four chosen SDGs to assess through the SMART concept is SDG 17 - Partnerships for the Goals and is illustrated in Table 14. As explained in the methodology, the four SIs for SDG 17 are developed by the project group, as none of the four chosen frameworks have indicators for measuring cooperation and partnerships. These SIs are developed based on knowledge from the initial focus group interview and a conceptualisation of Arnstein's participation ladder. In this SMART analysis the three participants from Guldborgsund Municipality have assessed the four SIs and the following sections will explain and show the different opinions for measuring cooperation in this way.

As with the previous SDGs the project group has assessed if the SIs are specific, measurable and timely, the participants have assessed if the SIs are attainable and relevant.

Both Lone G. Bak and Lena D. Berring are stating that the four SIs made for measuring cooperation with different actors are relevant. As a comment for these four SIs Lone states: '*How do we measure this? Definitely relevant, but is it the experience of inclusion and influence?*' (Appendix 6). This indicates that the SIs and especially the unit is unclear. Lena is furthermore stating: '*I think attainable data here should be perceived as; is collaboration achievable? However, the goal must include a definition of success.*' (Appendix 6). It can be argued that Lena thinks that the SI is unclear, as the unit of this SI is where the succession is illustrated. The unit is measured as a number from 1 to 5 depending on the level of participation of different actors (1 = no inclusion, 2 = information, 3 = dialog, 4 = participation and 5 = self-determination).

Birgitte Echwald is more sceptical of these four SIs and she could not assess if these SIs are relevant or attainable. In a comment she states '*I think it is too simple. I will think about it for our meeting.*' (Appendix 6). She referred to the second focus group interview where we had a good debate about SIs for measuring cooperation and partnerships, which will be analysed in the next chapter. But in relation to this analysis, the SIs could not be argued to *not* be specific, measurable, attainable, relevant and timely as defined in the SMART approach. Based on this, all four SIs are kept on the note that they need to be explained more thoroughly to make them more clear.

		Indicator	Unit	Specific	Measurable	Timely	Attainable	Relevant	BOE	Comment
17 - Partnerships for the goals Lena	17.17.1	Cooperation with citizens (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number						Danish avarage	I think attainable data here should be perceived as; is collaboration achievable? However, the goal must include a definition of success.
	17.17.2	Cooperation with organisations (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number						Utopian goal	
	17.17.3	Cooperation with NGOs (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number						Utopian goal	
	17.17.4	Cooperation with others (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number						Utopian goal	
17 - Partnerships for the goals Lone	17.17.1	Cooperation with citizens (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							How do we measure this? Definitely relevant, but is it the experience of inclusion and influence?
	17.17.2	Cooperation with organisations (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							
	17.17.3	Cooperation with NGOs (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							
	17.17.4	Cooperation with others (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							
17 - Partnerships for the goals Birgitte	17.17.1	Cooperation with citizens (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							I think it is too simple. I will think about it for our meeting.
	17.17.2	Cooperation with organisations (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							
	17.17.3	Cooperation with NGOs (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							
	17.17.4	Cooperation with others (No inclusion = 0, Information = 1, Dialog = 2, Participation = 3)	Number							

Table 14 – Shows the SMART analysis for SDG 17.

9.2 NEW SIS DEFINED BY THE PARTICIPANTS

The purpose of the second focus group interview was among other things to get the three participants' opinions on the developed set of SIs, and to generate ideas for SIs which they believed that the current index of SIs did not consider. Identifying new SIs in collaboration with the participants was an important aspect of step 2 in the SSA. This interview consisted of three phases: A 'criticism phase' where the participants presented their worries and disagreements from their own assessments of the SIs, as presented in the abovementioned section. A 'utopian phase' where the participants developed utopian scenarios based on the criticism phase. And finally, a 'realisation phase' where the participants were challenged to develop ideas for SIs that could be used to measure the performance of the utopian scenarios.

9.2.1 MAIN TOPICS FROM THE UTOPIAN PHASE

In the 'Utopian phase' the participants presented their ideas of a utopia in 2050 and ideas for SIs that could be used to measure the performance of attempts to create this utopia. It was not possible for the participants to present finalised SIs, due to the limited amount of time, so as a consequence we developed suggestions for SIs based on the participants' stated ideas. These ideas fell under five overall topics:

- Topic 1: Environment
- Topic 2: Co-creation
- Topic 3: Partnerships
- Topic 4: Transport
- Topic 5: Knowledge of the SDGs

For each of the five topics, the participants' ideas for SIs, the final SIs, and the associated SDGs will be presented in the following sections.

9.2.1.1 ENVIRONMENT

The first topic is 'Environment' and was derived from the following utopian scenarios:

1. Statement: *It is not necessary to inspect the environmental legislation of businesses.*
2. Statement: *All reusable products are given the highest priority so that all products are reused.*
3. Statement: *Agriculture that sprays insecticides will not exist.*

In order to reach these goals by 2050, the participants were asked to develop ideas for SIs that could be used to measure the performance of each statement, and the results are presented in Table 15. The participants' ideas are presented in the left-hand column 'Participants Ideas', our suggestions for final SIs are presented in the middle column 'Suggestions for SIs' and the SDG that the SI is associated with is presented in the right-hand column 'Associated SDG'.

Participants Ideas	Suggestions for SIs	Associated SDG
How many businesses cooperate in relation to delegate surplus products?	Percentage of symbiotic business relationships where residue from one company becomes a resource for another	12.2
Products developed based on reuseable materials	Percentage of products that are produced from recycled material	12.2
People who return packaging	Percentage of packaging that is returned after it is bought	12.2
Percent of geodrilling that involve samples of pesticides	Percentage of geodrillings projects that contain pesticide residues above the MRL (maximum residue level)	12.4

Table 15 - The table presents the participants' ideas for environmental SIs and our suggestions for final SIs based on the participants' ideas.

9.2.1.2 CO-CREATION

The second topic is 'Co-creation' and was derived from the following utopian scenario:

1. Statement: *Not everyone should be included in co-creation, only those who have a stake in it.*

Following the same structure as presented above, ideas for SIs regarding co-creation are presented in Table 16. It is interesting to note that the statement does not match the suggested ideas for SIs; this will be further elaborated on in Chapter 11.

Participants Ideas	Suggestions for SIs	Associated SDG
Measure the total amount of suggestions and ideas	The total amount of input from businesses and citizens during public co-creation processes	17.17
How many of these ideas are realised?	The total amount of input from businesses and citizens during public co-creation processes that are realised	17.17

Table 16 - The table presents the participants' ideas for co-creation SIs and our suggestions for final SIs based on the participants' ideas.

9.2.1.3 PARTNERSHIPS

The third topic that the participants chose was 'Partnerships'. The participants picked the topic because they wished that the following utopian scenario would exist in 2050:

1. Statement: *Businesses do not need supervision due to a high degree of responsibility.*

The suggested SIs for partnership are presented in Table 17.

Participants Ideas	Suggestions for SIs	Associated SDG
Sustainable business model	Percentage of companies with a sustainable business model	12.2

Table 17 - The table presents the participants' ideas for partnership SIs and our suggestion for a final SI based on the participants' ideas.

9.2.1.4 TRANSPORT

The fourth topic is 'Transport' and was derived from the following utopian scenario:

1. Statement: *The primary CO2 emissions come from transport, and transport is thus the largest problem for the municipalities; it is especially due to commuters, and we wish to lower the impact.*

Suggested SIs for transport are presented in Table 18.

Participants Ideas	Suggestions for SIs	Associated SDG
Workspaces at home	The average number of days citizens work from home	11.2
The distance between commuters and their workplaces	The average distance between commuters and their workplaces	11.2
WIFI on trains, so you can work while commuting	Percentage of public transport that supplies Wi-Fi	11.2
Workspaces on trains	Percentage of trains that offer a working environment for commuters	11.2
The user experience of public transportation by commuters	The average experience of commuters who use public transportation measured from 1-5	11.2

Table 18 - The table presents the participants' ideas for transport SIs and our suggestions for a final SI based on the participants' ideas.

9.2.1.5 KNOWLEDGE ABOUT THE SDGS

The fifth and final topic is 'knowledge of the SDGs' and was derived from the following utopian scenario:

1. Statement: *To develop increased familiarity with the SDGs.*

Suggested SIs about knowledge of the SDGs are presented in Table 19.

Participants Ideas	Suggestions for SIs	Associated SDG
Measure the reel knowledge of SDGs – test pupils	Percentage of pupils (primary school) with basic knowledge about the SDGs	17.17
Scheme surveys of how familiar the SDGs are for the general public	Percentage of citizens with basic knowledge about the SDGs	17.17
Percentage of companies that actively use the SGDs in business strategies	Percentage of companies that actively use the SDGs in business strategies	17.17
Which other businesses have you cooperated with regarding the SDGs?	Percentage of symbiotic business relationships that supports one or more SDGs	17.17

Table 19 - The table presents the participants' ideas for SIs that relate to 'Knowledge of the SDGs' and our suggestions for a final SI based on the participants' ideas.

9.2.2 FINAL INDEX OF NEW SIS

The exercises that were carried out by the participants during the second focus group interview resulted in a set of SIs. The indicators were developed on the basis of the theory presented by Bell and Morse (2008), who claim that sustainability is subjective, and that SIs should thus be developed with the participants. The analysis resulted in 16 new SIs, which brings the total number of SIs to 91 together with the SIs that were selected based on the literature review. The new SIs can be seen in Table 20.

Target	SIs	Unit
11.2	The average distance between commuters and their workplaces	Km
	The average number of days citizens work from home	Days
	Percentage of public transport that supplies Wi-Fi	%
	Percentage of trains that offer a working environment for commuters	%
	The average experience of commuters who use public transportation measured from 1-5	1-5
12.2	Percentage of symbiotic business relationships where residue from one company becomes a resource for another	%
	Percentage of products that are produced from recycled material	%
	Percentage of packaging that is returned after it is bought	%
	Percentage of companies with a sustainable business model	%
12.5	Percentage of geodrillings projects that contain pesticide residues above the MRL (maximum residue level)	%
17.17	The total amount of input from businesses and citizens during public co-creation processes	Nº
	The total amount of input from businesses and citizens during public co-creation processes that are realised	Nº
	Percentage of pupils (primary school) with basic knowledge about the SDGs	%
	Percentage of citizens with basic knowledge about the SDGs	%
	Percentage of companies that actively use the SDGs in business strategies	%
	Percentage of symbiotic business relationships that supports one or more SDGs	%

Table 20 - The final list of new SIs

9.3 THE BAND OF EQUILIBRIUM

Following the Systemic Sustainability Analysis, an important step is to define the BOE. As explained earlier in this thesis, the BOE is a reference system that describes how well an area is performing on each SI. In this section the BOE is analysed in relation to what it makes sense for Guldborgsund Municipality to compare each SI score with.

There is not one true answer for how to design a BOE as it is up to the participants involved in the process. In the initial focus group interview Lone G. Bak pointed out: '*What should each indicator be put up against, should it be put up against the national average? Should it be put up against similar municipalities, etc.? That is an important point and I think it has crucial importance and will differ depending on the indicator*' (Focus group interview 1, 2020). Lone argued that each SI has to be assessed separately in order to find the best reference point for the municipality. Both Lena D. Berring and Birgitte Echwald agreed with this. In the assessment of indicators each participant was therefore asked to evaluate the BOE for each SI. The participants' choices were not consistent, which concluded in a mix of how the BOE should be measured for each SI. Table 21 shows how many indicators the participants assigned to each of the possible options.

Options	Number of indicators
Utopian goal	7
Danish average	33
Average from similar municipalities	7
Own goal	0

Table 21 - Shows how the participants assessed the SIs in relation to the BOE

As seen, there is a tendency to prioritise the option 'Danish average'. The option was chosen for 33 indicators whereas 'Utopian goal' and 'Average from similar municipalities' were only chosen for 7 indicators. We will elaborate on this in the discussion.

9.4 SUB-CONCLUSION

The band of equilibrium and the participants' final assessment and development of SIs concluded the gathering of data. This meant that we had all the components that were needed to develop the planning tool. The SMART analysis proved to be useful in relation to assessing indicators and by using the concept, it was possible to delete non-contextual SIs. The second step in the SSA proved to be an efficient way of getting Guldborgsund Municipality to identify new SIs. The identification and development of SIs can be argued to supplement each other and give relevant and contextual SIs.

Finally, it was also possible to determine what the band of equilibrium should be, which is needed in order to measure the municipality's performance. It is important to state that the band of equilibrium requires large amounts of data. Future studies are necessary to acquire the needed data.

10 TOOL ASSESSMENT

The following chapter highlights and analyses the functionalities of the final tool. As previously mentioned, the tool was created based on the theoretical foundation of SSA, in a collaborative process with members of Guldborgsund Municipality. Thus, based on the two former analyses the sustainability indicators (SIs) were established and subsequently adopted into the final product. To see how the tool is structured and the underlying mechanics, see Chapter 6.3. Throughout this chapter self-made examples of different scenarios will be presented in order to investigate how each importance level and individual scores will determine the final output. It is important to remember that these are fictitious examples. The intention of the presented examples is not to demonstrate realistic scenarios, but to test how changing different parameters affects the output of the tool. The following sections describe the usage of the tool, including the effect of the score, the effect of the importance level, and finally Guldborgsund Municipality's evaluation of the tool.

10.1 CLARIFICATION OF THE TERMINOLOGY

In order to better understand the following chapter, a recap of the terminology used is presented here:

- ***Practitioner:*** The user of the tool.
- ***Importance level:*** The user's determination of how important an SI is, represented as '(1) not important', '(2) less important', '(3) important' or '(4) very important' in the tool.
- ***SI-score:*** The outcome of how well an area performs for each individual SI, based on a score-system between a minimum of 1 and a maximum of 5.
- ***Target-score:*** The outcome of how well an area performs for each individual Target, based on a score-system between a minimum of 1 and a maximum of 5.
- ***SDG-score:*** The outcome of how well an area performs for each individual SDG, based on a score-system between a minimum of 1 and a maximum of 5.
- ***Total-score:*** The final outcome of the area's performance towards the SDGs.

10.2 USING THE TOOL

The tool design is presented in Figure 23, showing each sheet relevant for the user. Sheets 1-6 comprise operative actions, such as the insertion of data and selection of importance. Sheets 7-8 are presentations of the results, one a dendrogram showing each tier of the calculations and the other a series of spiderwebs showing the SDGs both individually and collectively. Finally, sheet 9 shows the band of equilibrium where the user can manually change the score system for each SI if need be.

Data input

Visualisations

BOE

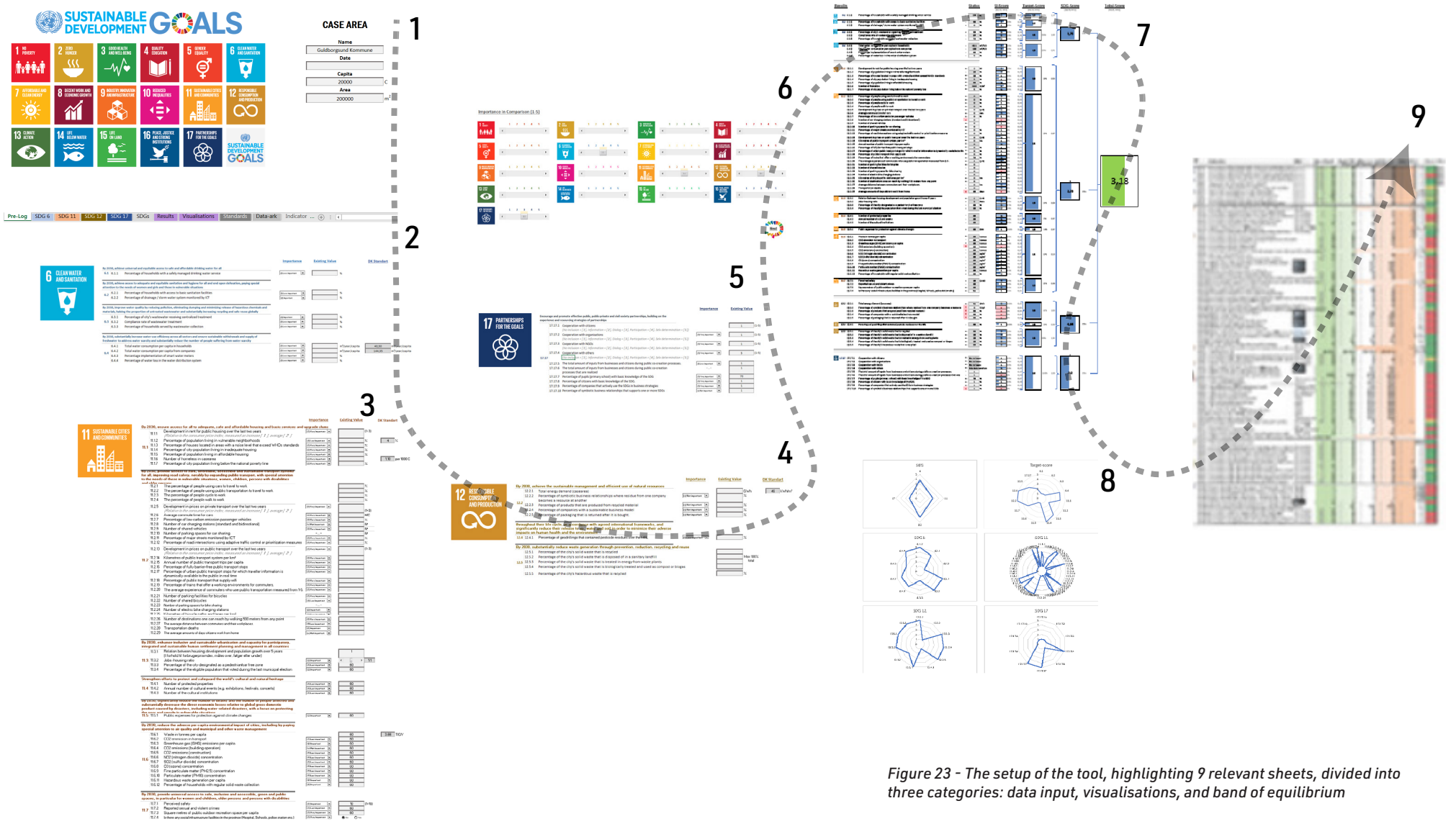


Figure 23 - The setup of the tool, highlighting 9 relevant sheets, divided into three categories: data input, visualisations, and band of equilibrium

Before using the tool, an urban area needs to be defined; this area can be a whole city or an area inside the city. When a practitioner uses the tool, the practitioner needs to insert data for each SI and actively determine the importance level for each SI and each SDG. Subsequently, the tool will present the user with a visualisation of the outcome, which is in other words a representation of the area's performance level towards the SDGs. Both the SI scores and the importance level have a significant influence on the outcome and will be tested in the following. The dendrogram (sheet 7 in Figure 23) will be used as a visual baseline for each example presented throughout this chapter, as it shows the whole system, making it easier to show the effect that changing the parameters has on the outcome.

10.2.1 THE EFFECT OF THE SCORE

The impact of each SI-score is quite straightforward. Without the influence of the importance level, each score is the average of the constituting scores. If each SI-score is a high score, the Target-score will also score well, and vice versa if each SI has a low score. This is best illustrated in Figure 24, for SDG 6 - Clean water and Sanitation, where each SI under Targets 6.1 and 6.2 scores the highest possible score (5), which is thus represented in a high Target-score, and vice versa for Target 6.3, with just low SI-scores. A mix of high and low scores, as seen for Target 6.4, will result in a Target-score of (3), the average.

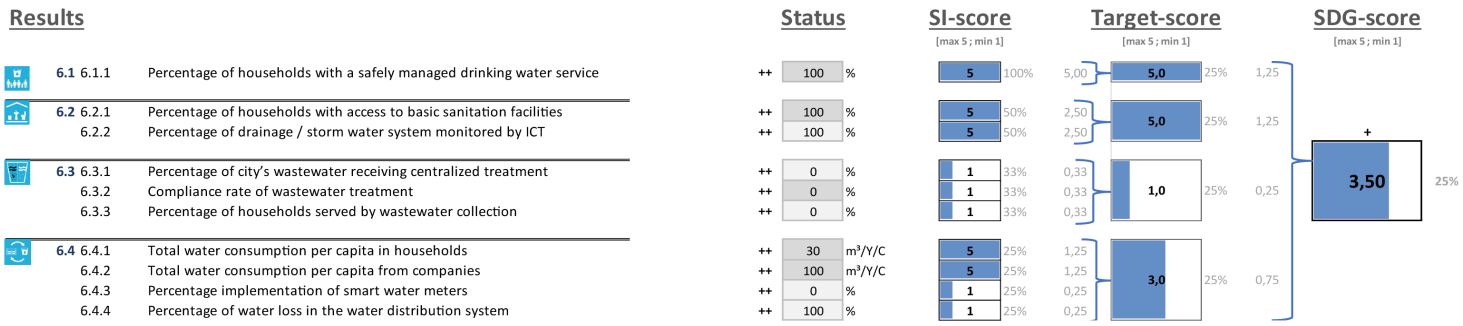


Figure 24 - A segment of how the scores for SDG 6 are presented in the tool. At the far left the list of indicators is divided into the four targets. The column 'Status' represents the user's data input, followed by a dendrogram of the different scores, namely the SI-score, the Target-score, and the SDG-score.

As shown in the example, ten different SIs are presented for SDG 6, whereas five SIs score the highest possible outcome (5) and five SIs score the lowest possible outcome (1). This results in a SDG-score of 3.5 and not 3 which would be the total average of the SI-scores. This is due to a distortion in terms of the number of SIs for each target. The SDG-score will therefore not be influenced by the amount of SIs, but only the average from the Target-score. A target with 29 constituting SIs can give the same outcome as a target based on only one SI. This is a deliberate design choice to ensure consistent and comparable outcomes. A drawback of this method is that it is more difficult for the user to obtain a high or a low score for targets with a higher number of constituting SIs than targets with few SIs. Based on probability calculations, the 'law of large numbers' states that the

average of many outcomes of a variable will approach the mean, in contrast with the average of a variable with few outcomes, which is more likely to be spread out equally (Svan & Lyndrup., 2019). As illustrated in Figure 25, a target with a large number of constituting SIs, such as Target 11.2 with 29 SIs, will statistically have a higher chance of resulting in an average score of 3. Consequently, this leads to a discussion of how fair it is to compare the score of a target with multiple constituting SIs against a target with only one SI, as seen in Figure 26.

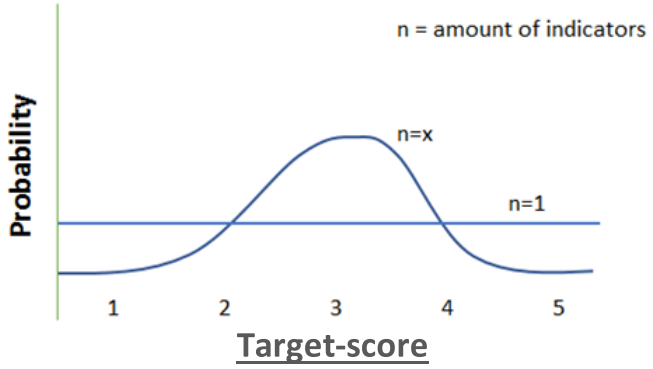


Figure 25 - Two variables different outcomes depending on the amount of indicators

Results				Status		SI-score		Target-score
11.2	11.2.1	Percentage of people using cars to travel to work	↔	74	%	2	4%	0,07
	11.2.2	Percentage of people using public transportation to travel to work	↔	20	%	5	4%	0,19
	11.2.3	Percentage of people cycle to work	↔	5	%	2	4%	0,07
	11.2.4	Percentage of people walk to work	↔	1	%	1	4%	0,04
	11.2.5	Development in prices on private transport over the last two years	↔	2	(1-3)	4	4%	0,15
	11.2.6	Average commute time for cars	↔	35	min	3	4%	0,11
	11.2.7	Percentage of low-carbon emission passenger vehicles	↔	40	%	5	4%	0,19
	11.2.8	Number of car charging stations (standard and bidirectional)	↔	90		5	4%	0,19
	11.2.9	Number of shared vehicles	↔	90		5	4%	0,19
	11.2.10	Number of parking spaces for car sharing	↔	90				
	11.2.11	Percentage of major streets monitored by ICT	↔	100	%	5	4%	0,19
	11.2.12	Percentage of road intersections using adaptive traffic control or prioritization measures	↔	100	%	5	4%	0,19
	11.2.13	Development in prices on public transport over the last two years	↔	2	(1-3)	4	4%	0,15
	11.2.14	Kilometres of public transport system per km²	↔	40	km	5	4%	0,19
	11.2.15	Annual number of public transport trips per capita	↔	240		4	4%	0,15
	11.2.16	Percentage of fully barrier-free public transport stops	↔	100	%	5	4%	0,19
	11.2.17	Percentage of urban public transport stops for which traveller information is dynamically available t	↔	100	%	5	4%	0,19
	11.2.18	Percentage of public transport that supply wifi	↔	100	%	5	4%	0,19
	11.2.19	Percentage of trains that offer a working environments for commuters.	↔	80	%	5	4%	0,19
	11.2.20	The average experience of commuters who use public transportation measured from 1-5.	↔	4	(1-5)	4	4%	0,15
	11.2.21	Number of parking facilities for bicycles	↔	2000000		5	4%	0,19
	11.2.22	Number of shared bicycles	↔	90		5	4%	0,19
	11.2.23	Number of parking spaces for bike sharing	↔	90				
	11.2.24	Number of electric bike charging stations	↔	90		5	4%	0,19
	11.2.25	Kilometres of bicycle paths and lanes per km²	↔	90	km	5	4%	0,19
	11.2.26	Number of destinations one can reach by walking 500 meters from any point	↔	800		5	4%	0,19
	11.2.27	Average distance between commuters and their workplaces.	↔	60	km	1	4%	0,04
	11.2.28	Transportation deaths	↔	1		1	4%	0,04
	11.2.29	Average amounts of days citizens work from home	↔	140	days	5	4%	0,19
11.5	11.5.1	Public expenses for protection against climate changes	↔	7E+08	DKK	5	100%	5,00

4,1

5,0

Figure 26 - A segment of the outcome of Targets 11.2 and 11.5, highlighting how the difference in SIs can affect the Target-score.

10.2.2 THE EFFECT OF IMPORTANCE LEVEL

The other factor influencing the outcome of each tier is the importance level. Depending on the practitioners priority of each SI, either 'very important', 'important' or 'less important', the corresponding SI-score will be impacted accordingly. If the user chooses a high importance level for an SI, the SI-score will have a bigger impact on the Target-score compared to other SIs with a lower importance level. To highlight the influence of the importance level, Target 17.17 is presented in Figure 27, where, in this example, three SIs scored 5 and six SIs scored 1. The average, and thus the Target-score, would be 2.3 but due to the higher importance level of the three SIs with the high scores, the Target-score is 3.

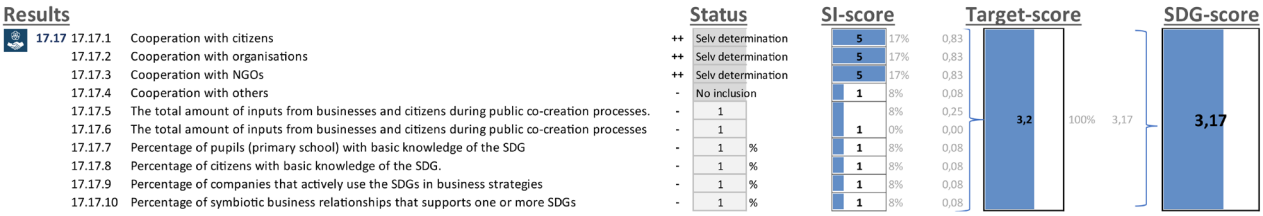


Figure 27 - A segment of the outcome of Target 17.17, highlighting the effect of a high importance level on SIs with high scores.

A similar tendency occurs if the scores are switched and the importance level remains the same, as shown in Figure 28. The average would be 3.7 but due to the higher importance level of the three SIs with a low score, the Target-score is 3.

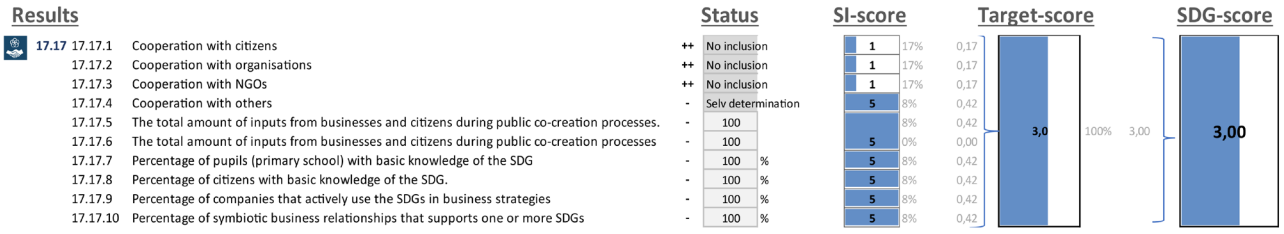


Figure 28 - A segment of the outcome of Target 17.17, highlighting the effect of a high importance level on SIs with a low score.

Which SIs the user deems important can have a huge effect on how the SI-score is represented in the Target-score. The effect of the importance level is also illustrated in the dendrogram as the grey percentage to the right of each score. This percentage determines the impact of the SI-Score in the cumulated calculation of the Target-score. In Figure 28, this is 17% for each SI with a high importance level; thus 17% of the score of 1, which equals 0.17, is transferred to the Target-score. Figures 29 and Figure 30 show two examples of the effect alternating importance levels can have on multiple Target-scores. In example 1 each SI with a high score is delegated a high importance level and in example 2 each SI with a high score is delegated a low importance level. Both examples are based on SDG 6, where each target has a different number of constituting SIs. The SI-score remains the same for both examples.

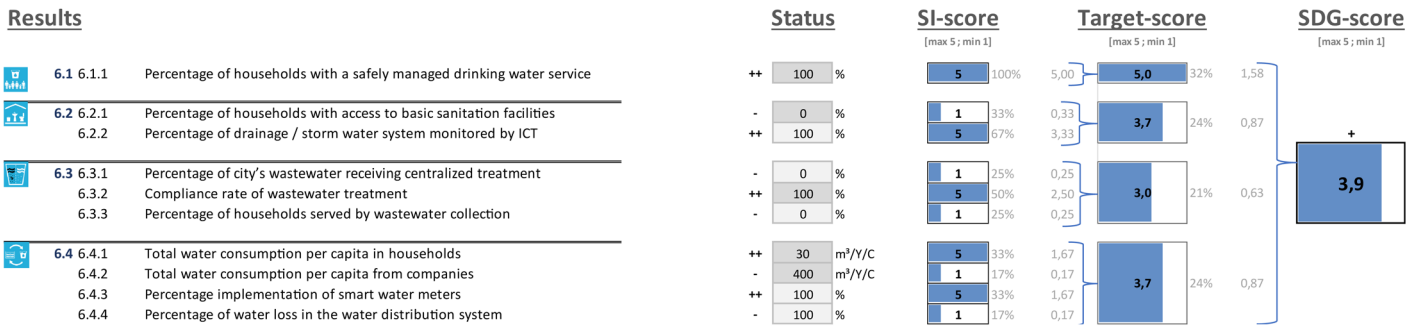


Figure 29 - Example 1: A segment of the outcome of SDG 6, where each SI with a high score is delegated a high importance level.

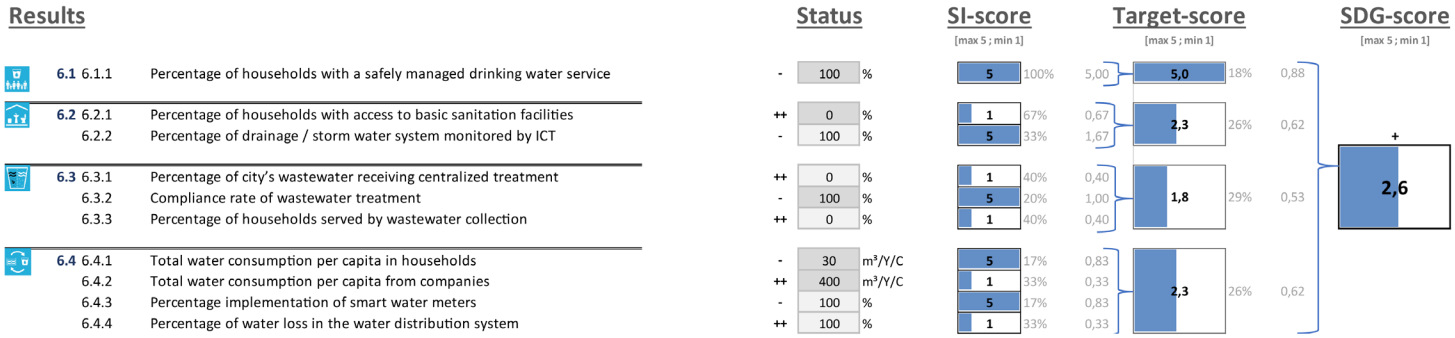


Figure 30 - Example 2: A segment of the outcome of SDG 6, where each SI with a high score is delegated a low importance level.

Comparing examples 1 and 2 shows that the chosen importance level has a huge effect on each tier of the dendrogram, and thus affects the final outcome. In these examples the SDG-score changed from 3.9 to 2.6. This is for two reasons. First, for example 1, each SI with a high score was also delegated a high importance level, which means that these SI-scores represent a bigger fraction of the Target-score, as also illustrated in the grey percentage and value between the scores. Second, the average importance level of each group of SIs constituting a target is used for the importance level of the individual Target-score. This is best highlighted in the two examples for Target 6.1, where, in example 1, a high importance level means that the Target-score represents 32% of the SDG-score, rather than 18% as in example 2 with a low importance level.

10.3 TOOL EVALUATION BY GULDBORGSUND MUNICIPALITY

The first two analyses resulted in a planning tool consisting of multiple components. The tool has been assessed in this analysis and is now ready for a review in order to determine its significance. The review is based on the part of the second focus group interview where the tool was presented and evaluated by the three participants from Guldborgsund Municipality. In general, the response was positive all around. It was even commented that the tool was '*[...] exactly what we need*' (Focus group interview 2, 2020). Especially the option to choose the importance level and design the BOE was highly appreciated: '*I think it is very positive that you [the user] have the power to decide which factors are important, and also, to determine the range [score system]*' (Focus

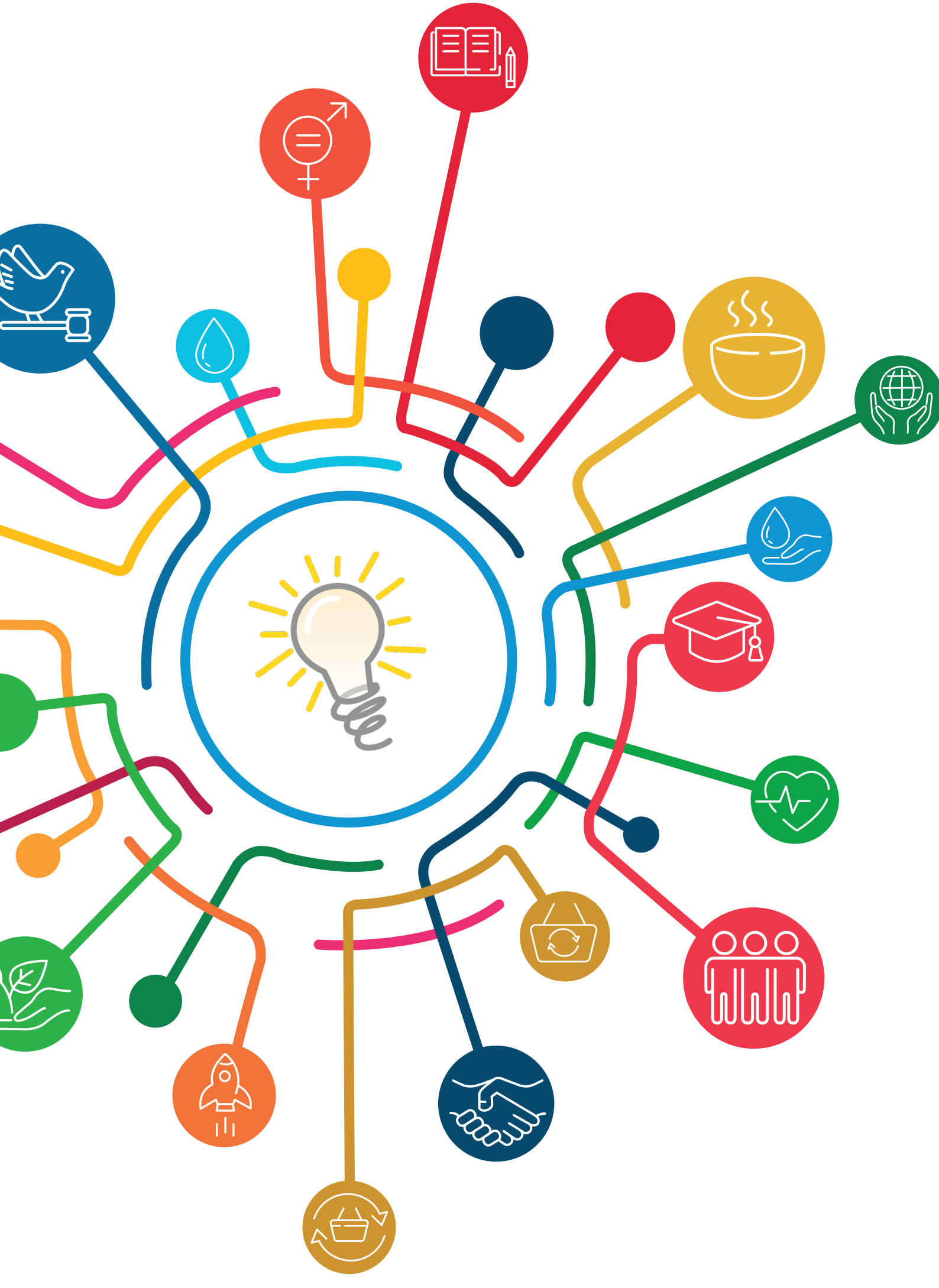
group interview 2, 2020). However, it should be borne in mind that this high praise was based on a presentation of the tool and not on the participants' own experiences of using the tool. Their critique dealt more with the SIs than the functions and manoeuvring of the tool itself, as shown in Chapter 9.

Nevertheless, the participants were asked if a score from 1 to 5 was sufficient for evaluating the aspects of sustainability, to which was replied, '*Well, you have to make decisions based on something*' (Focus group interviw 2, 2020). This was furthermore supplemented with '*For a tool that is designed to give a general overview of where we are in an SDG-context, 1-5 from my point of view is ideal because otherwise it can become too differentiated and complex, so that the overview is lost*' (Focus group interview 2, 2020).

Likewise, the participants were also asked if the presentation of the results, both as the dendrogram and the spiderwebs, was sufficient and if both visualisations were necessary. It was highly emphasised that each visualisation brought something different to the table and it was clear that each participant had her own preference. For the spiderwebs, it was for example stated by Lone that '*You [the user] get a fast overview of the system, and where you perform well. Also, I think that [this format] is recognisable, because you know it from other contexts where you use this form of visualisation, and many can thus relate to it*' (Focus group interview 2, 2020), while for the dendrogram, Lena stated that '*I usually do not use spiderwebs, and I doubt I will use it here. But this [the dendrogram], with the values, is something I can relate to much better, so it's good that both visualisations are implemented*' (Focus group interview 2, 2020). It is essential that both visualisations are part of the tool, as each participant – each with a different professional background – will have unique preferences with regard to the outcome and thus the use of the tool. '*There is a great strength in these ways of presenting, both for the total score and the individual SDGs. It is very impressive*' (Focus group interview 2, 2020).

10.4 SUB-CONCLUSION

Despite the fact that the three participants from Guldborgsund Municipality were highly appreciative of the tool it is not without its flaws. As demonstrated, the number of SIs of the targets is not equally distributed, which can result in an unjustified spending of resources if the municipality decides to prioritise targets with multiple SIs based on the tool's results. Furthermore, giving leeway to the practitioners to optimise the tool according to their own wishes, both in the form of choosing the importance level of each SI and the option of adjusting the BOE, has advantages as well as disadvantages. A big concern of the participants was that a tool would not be able to differentiate between contexts; that a rural area would not be judged on the same basis as a metropolitan area. The freedom of the tool tried to accede to this demand, but in doing so, it is also much easier to misuse or misinterpret the outcome of the tool. The importance level as shown affects the score immensely, and if the practitioner selects a high importance level for SIs where the area is already performing well, the final result will show that the area progress towards the SDG is good. The dendrogram provides some transparency in the tool, as also noted by Lena D. Berring, since each value and score is presented. If the practitioner uses the tool multiple times over time, in order to provide data for monitoring sustainable development, it is necessary that the chosen importance levels and BOE remain the same, as both affect the total score.



11 DISCUSSION

In collaboration with Guldborgsund Municipality an index of Sustainability Indicators (SIs) was created and subsequently implemented in a planning tool. The results of this process will be interpreted in this discussion in order to answer the sub-question: 'Which opportunities and barriers are present in the tool in relation to the Sustainable Development Goals?'

This chapter is divided into four sections. The first addresses some of the challenges that occur when measuring sustainability through SIs. The second section will discuss SDG 17, which was assessed to be the most important for Guldborgsund Municipality. The third section addresses the advantages and disadvantages of the tool, including how it can be misused. Finally, the chapter ends with a discussion of the possibilities for generalising this tool to other Danish Municipalities.

11.1 MEASURING SUSTAINABILITY: CHALLENGES OF USING SIS

Measuring sustainability through SIs is well addressed in the literature. Two of the main challenges presented in the literature relate firstly to the fact that sustainability is holistic, in opposition to indicators, which have spatial and time-related boundaries, and secondly, the 'wicked-problems' that occur when measuring sustainability.

When using a planning tool consisting of 91 SIs it can be argued that practitioners attempt to capture the complex and diverse processes of sustainability in a few simple measures. Such an approach is easily criticised because the world is a complex place and in theory it can never be argued that a set of SIs can encapsulate all aspects of sustainability. Therefore, it could be discussed whether or not it is possible to measure sustainability?

Measuring sustainability has divided authors: on one hand authors criticise SIs by stating that '*some systems are so complex, with millions of interactions, that we are unable to look at every one.*' (Bell & Morse, 2008:41) but on the other hand (as a response to the critique) Bell & Morse responds '*Biologists have been dealing with complex ecosystems for many years, and they have long used indicators as a tool for gauging ecosystem health.*' (Bell & Morse, 2008:41). This argument is especially relevant in combination with the statement from biologist Lawrence B. Slobodkin, who have worked with complex ecosystems for many years:

'*The number of possible interactions among species is astronomical. If ecosystems science is strictly a study of species interactions, it is hopelessly complex. But just as we need not consider all cell-to-cell interactions whenever we discuss a single organism, so we need not consider all possible species-to-species interactions whenever we discuss ecosystems.*'(Bell & Morse, 2008:41)

Bell & Morse recognise that sustainability is complex and consists of a close-to endless possible interactions, but also argue that scientists must deal with sustainability in manageable bits in order to make sense of it. That is why our index of SIs was never argued to be absolute, because the selection of SIs that constitute the planning tool is subject to biases, as one may construe from the preceding chapters. A selection of SIs were found in existing sustainability frameworks and evaluated by Guldborgsund Municipality's subjective assessment while another fraction of the SIs were developed by Guldborgsund Municipality themselves. It is thus possible to criticise Bell & Morse's (2008) analytical framework SSA, because an index of SIs can never encapsulate all the interactions that are connected to sustainability. But the findings from this study also shows that a tool which can measure bits of sustainability, i.e. the SDGs, is requested by Danish Municipalities in order to determine performance. It can thus be argued that to measure sustainability is in fact needed in order to make sense of sus-

tainability, as argued by Bell & Morse (2008), but one should be critical to the SIs and continuously seek to develop and optimise these.

11.1.1 THE HOLISTIC NATURE OF SUSTAINABILITY

Sustainability has a holistic nature and does not feature any spatial or time-related boundaries, which contradicts with indicators, because indicators cannot exist without boundaries (Bell & Morse, 2008). When measuring sustainability in relation to the performance of the SDGs in a defined urban area, the results will be affected by external circumstances, which means that the solution cannot always be found within the chosen urban area. An example of such a 'spatial boundaries issue' is the quality of drinking water. A part of SDG 6 is to ensure the provision of drinking water that does not contain pesticides. In the initial focus group interview with Guldborgsund Municipality, Lena D. Berring argued that pesticides originate from outside the city, but leach into the groundwater and affect the water quality in the city (Focus group interview 1, 2020). A problem arises because the purpose of the tool is to support sustainability planning practices in the municipality's cities and the pesticides that affect the cities' drinking water are deduced by the agriculture, which is located outside the city. Another example could be SI 11.6.2 'CO^2 emission in transport': how should this be measured in a defined urban area? Does one only include emissions from transport that has its start and stop points within the chosen area? Does one include all transport passing through the area? Or does one only include trips which either start or stop in the area? Based on both of these considerations it could be relevant for the municipality to not only focus on solutions which can be implemented inside the chosen urban area. Instead, a specific urban area can be screened with the tool and based on these results broader initiatives can be initiated. A concrete example could in this case be to look at the local agriculture and ensure they meet pesticide restrictions. The spatial boundaries of the chosen urban areas should therefore to some extent be ignored when finding solutions.

According to Bell and Morse (2008), time scale is a further dimension in relation to the holistic nature of sustainability. When measuring the performance of the SDGs this relates to two challenges: 1) The improvement of the SDGs occurs over different time scales and 2) Different elements in the same SDG may be affected differently over time. The first challenge relates to the fact that the improvement of progress towards some SDGs can first be measured by our tool many years after the investment is made. SDG 6 and 'drinking water quality' can be used as examples of this challenge. Reducing pesticides from agriculture can positively affect the quality of drinking water in the city, but several years elapse between implementing a change and seeing the result in practice. (Bell & Morse, 2008). Investments will therefore not always have an immediate impact on the tool's results. The second challenge reflects the problems that occur when SIs for the same target are measured using different time scales. If a municipality wants to increase the number of commuters who use their bikes, they might decide to improve SI 11.2.13 'Kilometres of bicycle paths and lanes per km^2'. The construction of new bicycle lanes will be reflected in the score of the tool as soon as they are built, while it can take longer to affect SI 11.2.22 'The percentage of people who cycle to work'. This is a natural condition when measuring initiatives for sustainable development (Bell & Morse, 2008). The effect of different time scales is not highlighted in our tool, because 1) it was difficult to determine the time frame of each SI, and 2) the effect will, at some point when it is visible, become a part of the data input for a new screening. Therefore, it is important that politicians not only focus on areas with a short time scale in order to immediately get a better score in the tool.

So far, this thesis has equated sustainability and the SDGs. But one can argue that the SDGs themselves are a way of breaking down and translating sustainability into more manageable targets and SIs. Perhaps the danger of

losing the holistic perspective of sustainability does not lie in the creation of indicators for the SDGs, as the SDG framework has already done this, but in the physical demarcation of a city area, as sustainability does not have spatial or time-related boundaries. With this in mind it can be argued that developing relevant and context-specific SIs for the SDGs does not remove the holistic perspective of sustainability. It is thus important for politicians to look for solutions outside a defined city area, or otherwise the spatial boundaries will set limitations on the holistic perspective of sustainability. Furthermore, it is important that politicians are aware of the differences in time scale, and do not only prioritise indicators which will affect the outcome of the tool immediately, as this will set further limitations for the holism of sustainability.

11.1.2 SUSTAINABILITY AS A WICKED PROBLEM

When investigating the SDGs, it became clear that the nature of the goals varies quite significantly when it comes to measurability in a local context. Some SDGs, like 6, 11 and 12, have a more structural nature, meaning that they largely represent physical structures in the city, such as different transport systems, water systems, waste collection etc., while SDG 17 represents systemic issues such as partnerships and cooperation. Indicators for measuring SDG 17 are more often a matter of judgement for the practitioner as with our suggested SIs for SDG 17. But as this study shows, it is possible to use the SSA to find or develop SIs for both types of SDGs. The problem lies therefore not in creating indicators for the 17 goals, but rather as described by Bowen et al. (2017) that trade-offs will happen when including 17 goals, due to the fact that sustainability is a 'wicked problem', as described in the theory chapter.

In this context, the 'wicked problem' issue means that the improvement of some SDGs will adversely affect other SDGs, meaning that a natural trade-off will occur. An imagined and simplified example could be that as part of ensuring economic growth (which is a part of SDG 8), transport demand will increase (Andersen, 2002), which will in turn lead to increased pollution. So, by improving the performance of SDG 8, the performance of other goals like 11 and 13 – Climate Action will decrease. This will make it impossible to get a maximum final score in our tool, since the improvement of some indicators will lead to the degradation of other indicators. The 'wicked problem' issue is not something our tool can overcome, because it is impossible to determine to what extent the improvement of one indicator degrades another. But the advantage of creating specific SIs, such as the ones in our tool, is that this trade-off becomes more visible. When using the tool over time it is possible to see which SIs have improved and which SIs have deteriorated. One way to address and minimise this 'wicked problem' issue is to not include all aspects of the 17 SDGs because as explained by Gudmundsson (2020), '*You have to be pragmatic and recognize that you cannot include all the aspects of sustainability, meaning that, it is okay for a practitioner to focus on parts of sustainability, as long as it does not mean that you systematically ignore everything else*'. A tool that can measure the performance of the SDGs does not according to Gudmundsson have to focus on all aspects of sustainability. In this thesis this was done by including Guldborgsund Municipality in the usage of the SSA and SMART concepts, which both focus on developing context-specific and relevant SIs rather than developing SIs for all the parts of the chosen SDGs. SI 11.2.11 'Percentage of population living within 0.5 km of cycle paths' was deleted in the previous analysis due to not being relevant for Guldborgsund Municipality as Birgitte argued '*it is only relevant if biking is a realistic transport option*' (Focus group interview 2, 2020). This was an interesting decision, as on the one hand Gudmundsson argues in the previous quote that the purpose of using SIs is to capture the diversity of sustainability to an acceptable extent, so improvements can be made without systematically ignoring certain areas. While on the other hand Guldborgsund Municipality, based on the SSA approach, sug-

gested deleting indicators related to bikes as a transport mode, as it was not a realistic transport mode for them. This forms the basis for some interesting and central choices regarding the tool: Which indicators should be included in the tool and which should not? To answer this, it is relevant to remember the purpose of this tool, which is to measure the performance of the SDGs on a local scale. Therefore, the tool cannot ignore whole areas (like bikes) as argued by Gudmundsson, but on the other hand the SIs have to be relevant to Guldborgsund Municipality in order to create a relevant tool for the municipality. If the SIs are not relevant the problems are the same as with the original UN indicators – they are not relevant in a local context. To solve this dilemma, the tool was designed with State SIs and Pressure SIs (Bell & Morse, 2008). State SIs describe the status of a specific system, e.g. SI 11.2.22 'Percentage of people who cycle to work'. As explained earlier, the tool is designed so the municipality can select how important each indicator is for them and here it is possible to choose 'not relevant', which removes the indicator from the results. However, it is not possible to remove the state SIs from the tool, as it is arguably important to know a municipality's status in terms of how well it is performing in relation to the SDGs, even in areas the municipality does not find relevant today. Pressure SIs are indicators that can affect the state SIs e.g. SI 11.2.13 'Kilometres of bicycle paths and lanes per km^2', which can affect how many citizens use their bike to commute to work – which is the state indicator. It is important to state that improving pressure SIs does not necessarily mean that the performance of the state SIs will increase and especially not within the same time scale, as described earlier. Furthermore, the performance of state SIs can also be improved without improving the performance of pressure SIs.

11.1.3 CONTEXT-SPECIFIC AND RELEVANT INDICATORS VS. SUSTAINABILITY

The focus in this thesis so far has been on creating relevant and context-specific SIs for Guldborgsund Municipality, where it was briefly described how some SIs were removed from the tool because they were not relevant for the municipality; see Chapter 9. This raises the following question: Do we lose some aspects of sustainability when using SSA and SMART to develop relevant and context-specific SIs? It can be argued that if one addresses sustainability as an objective term, some aspects will be lost when using the SSA and SMART approach. It is here important to remember the subjectivity involved in creating SIs: '*indicators are never pure, or value-neutral representations; they are selected for various reasons, and therefore inevitably have subjective aspects to them, hidden or not*' (Gudmundsson, 2016:139). Furthermore, Bell and Morse (2008) argue that subjectivity occurs in many aspects of creating SIs. It is also important to remember that the SMART concept is used on indicators from four different frameworks, made in different contexts. So, using the concept ensures that the indicators are relevant for Guldborgsund Municipality, and minimises the chances of systematically ignoring aspects of sustainability that are relevant for Guldborgsund Municipality. A danger when working with 'relevant SIs' can be that non-relevant SIs are removed. But who are these indicators not relevant for? Only Guldborgsund Municipality or Danish municipalities in general? This discussion will be elaborated later on.

The SSA passes the decision of which indicators to include over to the municipality. Looking at the empirical data in this thesis, an interesting finding emerges. In order to accommodate the municipality's high prioritisation of SDG 17, the project group developed four SIs with inspiration from Arnstein's theory on citizen participation, focusing on citizens, businesses, NGOs, and others (the practitioner can insert a relevant stakeholder here). In the sec-

ond focus group interview it was stated that: '*Some versions of collaboration are about citizens needing to feel heard, and that is the goal. That version of collaboration is going to lose value in making something concrete happen, because sometimes, if everyone needs to be heard, it can be the lowest common denominator that will set the bar*' (focus group interview 2, 2020). This indicates that there was a desire not always to include all citizens, but only the ones who have a stake in the given project. To represent this viewpoint, it was decided to measure the number of inputs during public co-creation processes. This indicator might be farfetched from the original idea about not including everyone. One reason could be that the idea is unorthodox and might be misinterpreted and the suggested indicator is an attempt to give it a more positive spin. Nevertheless, this indicates that in some situations the municipality is not always the best actor to identify SIs. But it is important to remember that according to the SSA it is beneficial to include multiple stakeholders, who could perhaps offer other suggestions for indicators.

11.2 COLLABORATION AND PARTNERSHIPS FOR THE GOALS

Another notion regarding the complexities of working with sustainability was presented during our empirical data collection. There was an interesting gap between Guldborgsund Municipality's main priority and the data extracted from the literature review. Whereas the municipality stated that SDG 17 was the most important goal, in order to ensure external collaboration to reach the other goals, no relevant indicator was presented in the four chosen frameworks. One framework had indicators for Wi-Fi availability, which technically would classify under Target 17.8 – 'enhancing the use of enabling technology, in particular information and communications technology' (United Nations, N/Ab), but this was determined by the project group to be irrelevant.

During the focus group interviews, it was easy to see that the municipality's understanding of, and thus prioritisation of SDG 17 was heavily influenced by their close collaboration with Jannik Egelund. When asked what is the most important SDG, Lone stated that '*I have written Partnership for the goals because we are an interdisciplinary organisation with a lot of external cooperation. And as Lena says, this [SDG 17] is most important, because if we do not cooperate with each other, then nothing matters*', while Egelund highlighted the importance of the goal by using Gladsaxe Municipality as an example '*They emit less than 10% of the CO2 emitted in the whole municipality. That means, if you want to do anything for the CO2 reduction, you have to have the other stakeholders on board. So how do you do that? This is based on a partnership-mindset, to try and see how to include the others with collaborative theoretical glasses on*'. It was evident that the municipality sees the goal more as the importance of communication and collaboration between stakeholders, which is only an interpretation of Target 17.17 – Encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships – rather than all of the 19 targets.

In its description of SDG 17, the UN states that the purpose of the goal is to ensure that countries have sufficient means of implementation to achieve the SDGs, but as seen from the literature review, several indicator frameworks had little to no relevance in relation to SDG 17, which could explain why the SDGs have been difficult for the municipalities to incorporate in a local planning context. As previously stated, nearly all of the targets constituting SDG 17 focus on national as well as international matters e.g. financial support to developing countries, so only focusing on collaboration and partnerships is a way for Guldborgsund Municipality to overcome the ambiguity of the targets. Limiting SDG 17 to Target 17.17 does not mean that the goal becomes less important; in fact the findings from the analyses indicate the opposite. Making decisions without other stake-

holders can be argued to be rational and expert focused (Agger & Hoffmann, 2008). To combat this critique of indicator frameworks, it can be argued to be especially important to develop indicators for SDG 17, as it can ensure that the municipality does not make decisions based solely on indicators, but actually manages to get inputs from other stakeholders who have different priorities and might be able to point out important areas that the municipality cannot identify by themselves. Including others in decisions can thus expand the groundwork for decisions and give politicians and planners additional knowledge when coming to decisions. This means that it can be argued that SDG 17 is especially important with regard to the SDGs and that an indicator tool should not only measure structural and physical indicators, but also include process-oriented indicators, such as citizen participation and partnerships.

11.3 THE TOOL – PROS AND CONS

This thesis is centred on creating a new planning tool which Danish municipalities can use to measure the performance of the SDGs in a specific urban area. As shown in the literature review, this topic has been rather problematic for municipalities, researchers, and consultants ever since the publication of the SDGs. Attempts to measure the SDGs using frameworks of indicators have been made by consultancies; however, none of these frameworks have been successfully implemented in Danish municipalities.

We do not claim that our planning tool is without flaws but it offers a different approach to measuring the performance of the SDGs in the Danish municipalities. It was emphasised by Guldborgsund Municipality that the lack of relevant and context-specific SIs was one of the main problems when evaluating the performance of the SDGs, which we tried to incorporate in the tool. Nevertheless, there are pros and cons regarding this tool and the following chapter will address some of these.

11.3.1 SUSTAINABILITY INDICATORS

When creating the tool, one of the main concerns that arose was the number of SIs needed to measure the performance of the 17 SDGs, as Gudmundsson (2020) emphasises the importance of ensuring that users do not encounter an overflow of indicators. In order to measure the four chosen SDGs a total of 91 SIs were identified or created, which means that a tool including all 17 SDGs will in theory have a total of more than 380 SIs. One way to avoid an overflow is to exclude some aspects of sustainability (Gudmundsson, 2020). There are three primary advantages of doing so: 1) The practitioner will ensure that the decision makers do not encounter an overflow of indicators, which can confuse more than it assists, 2) The exclusion can lower the required amount of data, which will reduce the resources needed, and 3) It might not be all aspects of sustainability that are relevant for the decision makers. By only focusing on relevant aspects of sustainability the decision makers can choose which elements are important to the specific case, which will make the indicators as relevant as possible (Bell & Morse, 2008; Gudmundsson, 2020). In one way it can be argued that the SIs in this thesis do not reflect all aspects of the four chosen SDGs, as there are targets with no connecting SIs, e.g. Target 12.3, 12.4 and 6.5. Still, no areas are systematically ignored, as these SIs were found through the existing literature and developed in collaboration with Guldborgsund Municipality. Before the second focus group interview the participants were asked to assess the 79 SIs and when discussing their main criticisms of the tool in the 'criticism phase', none of the participants pointed out the number of indicators as a problem. This is interesting as a study from Gothenburg in Sweden concludes that the indicators can cause a reporting burden, lack clear purpose, and are unnecessary to report on an annual basis (Hansson, Arfvidsson & Simon, 2019). An explanation for why this was not pointed out as a problem by the participants in Guldborgsund Municipality could be that the tool was only presented to them and

they did not work with it themselves. Another reason could be that the assessment of the indicators was divided into three parts, so each participant only assessed ⅓ of the total indicators. Furthermore, it can be argued that it is not possible to design a tool which has to measure multiple aspects of sustainability without creating numerous indicators in order to reflect its holistic nature. It thus becomes a matter of balancing a vast number of indicators and the risk of losing transparency and intuition of the tool versus fewer indicators, with the risk of losing the holistic nature of the SDGs.

Another relevant discussion is the effect the number of SIs has on the final score. Some targets, like 6.1, are based on only one SI, while other targets consist of multiple SIs (the largest target is 11.2, which contains 29 SIs). This becomes problematic, since the more indicators a target has, the higher the chance that the outcome will become a medium score of around 3 due to the 'law of large numbers', as explained in Chapter 10.2 (Svan & Lyndrup, 2019). In practice this means that more resources have to be used in order to make a significant impact on the targets with many SIs. Based on Target 11.2 with 29 SIs, an imagined and simplified example could be that 14 of these SIs have the minimum score of 1, while 15 SIs have the maximum score of 5. If a municipality wants to improve the Target-score for 11.2, they need to focus on the 14 indicators with the lowest score, but improving these indicators, such as 'Kilometres of bicycle paths and lanes per km^2' and similar SIs of the same magnitude, will require a lot of resources. On the other hand, it will require relatively fewer resources to improve the Target-score on targets with one or very few indicators like Target 6.1.

There is a risk that because of the 'law of large numbers' the final score will often be around 3, as it is unlikely that an urban area will perform 'really well' compared to a Danish average or the average of similar municipalities in all targets. It is thus important for the politicians and practitioners to not only look at the final score but also backtrack the results, to identify which SIs an urban area performs well on and which SIs the area performs poorly on.

11.3.2 BAND OF EQUILIBRIUM AND OUTPUT

Another important part of the tool is the band of equilibrium (BOE). Based on Guldborgsund Municipality's assessment of indicators, it was clear that there is no uniform structure when setting up the BOE, since it varied from SI to SI, as seen in Table 22.

Options	Number of indicators
Utopian goal	7
Danish average	33
Average from similar unicipalities	7
Own goal	0

Table 22 - Shows how the participants assessed the SIs in relation to the BOE

The choice of BOE, whether it is a Danish average, an average from similar municipalities, an own goal, or a utopian goal, will have a relatively large impact on the tool. An example here is SI 11.2.22 'the percentage of people who cycle to work'. If this indicator is compared to similar municipalities it will be easier to obtain a higher score compared to a Danish average where large cities like Copenhagen and Aarhus are included, because a larger percentage of the population uses bicycles as a means of transportation due to higher urban density. Again, if one compares the indicator to a utopian goal, it can be even more difficult to get a high score. The point is that depending on the BOE an urban area will get a different score even though the situation in the area is the same. Therefore, it is important to remember and acknowledge the subjectivity in this tool and it is important not to view the final score in our tool as a complete and objective picture of the sustainability level.

This project has not focused on developing and finding the right values for the BOE. We acknowledge that obtaining the right BOE will be a strenuous and difficult task, and will require a lot of resources. Many researchers in

the literature also highlight the problems and challenges of monitoring and data provision (Koch & Krellenberg, 2018; Klopp & Petretta 2017). If one succeeds in finding the right data to create the BOE, another problem arises. The BOE differs from a normal reference system by acknowledging the subjectivity in sustainability as described above, but another important feature of the BOE is that it is a band. This means that it is both possible to score too low (meaning being 'not sustainable') and to score too high (meaning being 'too sustainable'). An example here could be SI 11.2.3 'Number of parking facilities for bicycles'. It is basically good to have many parking facilities for bikes in order to increase the possibility for people using bikes. But theoretically there can be too many parking facilities for bikes. In a BOE this will be shown by being too sustainable, as the result achieved exceeds the band. In our tool the BOE cannot take this into account and will always state that more is better (to a certain extent, where one gets the score 5). A problem when creating a BOE which actually has a band, is that sustainability becomes a 'yes or no answer' (Bell & Morse, 2008). Either an indicator falls inside the band, and will be described as 'sustainable' or the indicator will fall outside the band (both over and under) and will be described as 'not sustainable'. This is a problem as it removes the nuances of sustainability. The advantage of having a BOE system with a score of 1-5 is that it reflects the nuances of sustainability to a greater extent.

When the practitioner has the opportunity to design the BOE, then it becomes relevant to consider the possibilities of 'greenwashing' the output of the tool. The participants showed that they were aware of the fact that the output can have a big influence on the usage of the tool: '*Is it because we want to boast in front of neighbouring municipalities, or is it because we want to use the output to make a sincere difference? I don't want to use the tool just to show that we are performing better than the other municipalities*' (Focus group interview 1, 2020). Nevertheless, the findings from the construction of the BOE show that they are not consistent in their choice.

One can question whether or not the municipality chose to deviate from the Danish average on 14 of the indicators, because they knew they would score beneath the Danish average. When given the power to determine the BOE the municipality has the power to ensure that they will in general acquire a high score. It can then be discussed whether or not such a choice is an act of greenwashing or if it is a choice that is made to make the tool more relevant from their subjective perspective. Let us first look at the option of deviating from the Danish average in order to score better. In this scenario the municipality will often acquire a great score – but is this desirable? The danger here is that the tool can become a way to greenwash the results in order to show off a great score, which Guldborgsund Municipality was critical of. The tool is then adjusted by the municipality with the purpose of making it easier to score better, but this is not the purpose of the tool. The purpose of the tool is to screen a city in order to allocate resources for sustainable improvements. It can then be stated that the practitioner should not use the tool with the mindset that they need to acquire a 'perfect-score'. In fact the opposite is the case. The tool is designed to give the municipality an overview of the sustainability elements that relate to the SDGs and for them to identify areas that need special attention in order to become more sustainable. It should also be stated that a municipality can never achieve a perfect score in our tool, because of the complexities in relation to wicked problems and the holistic nature of sustainability, that were previously mentioned. Practitioners should thus use the tool with a sincere intention of achieving improvements rather than showing off a perfect score.

11.3.2.1 USING AND MISUSING THE TOOL

In the literature review it is stated that a tool needs to be seen as a supporting tool, which can be used and misused as a political instrument, rather than as a straightforward measurement of the complexities of sustainability (Valencia et al., 2019; Bell & Morse, 2018). Birgitte Echwald also addressed this issue by stating that the tool can be misused: '*[...] if you actually see it as a tool for starting an "agenda of change" which lies implicitly in the SDGs or if you just want to greenwash yourself*' (Focus group interview 1, 2020). Birgitte followed this statement by saying: *'It is just investing in 3 bus stops. Period. That was it*' (Focus group interview 1, 2020). Birgitte has a good point. By breaking each sustainability goal into highly specific SIs, like the number of bus stops, it is possible for a municipality to improve the score just by building more bus stops. In itself this does not improve sustainability, as sustainability requires that people shift from using cars to public transport. It is therefore important that the tool is used to support decisions and that decisions are not made based only on the results of the tool.

11.4 GENERALISATION

According to Flyvbjerg (2006), conducting a case study makes it possible to generalise the findings to similar cases. To end this discussion, we will try to determine to what extent it is possible to justify that other municipalities can benefit from this planning tool.

In Denmark it can be argued that there exist large variations with regard to infrastructure, businesses, and politics from municipality to municipality. This became especially apparent throughout this thesis. During the second focus group interview the participants stated that several indicators would not be relevant in Guldborgsund Municipality, but might be relevant in major cities (Focus group interview 2, 2020). As stated above, the participants determined that SI 11.2.11 – Percentage of population living within 0.5 km of cycle paths was not relevant in Guldborgsund Municipality because cycle paths do not exist in the municipality in the same way they do in a major city such as Copenhagen.

This is another reason why we developed a function in the tool that permits the practitioner to decide which SIs should count in the total score and which should not. The SIs are divided into state SIs and pressure SIs, as described earlier in this discussion. The state SIs ensure that the performance of every area is measured, while pressure SIs can be turned off in order to make the tool as relevant as possible for all Danish municipalities. With the implementation of this function, it can be argued that the planning tool can be used by multiple Danish municipalities under the assumption that the municipalities do not misuse the function by getting rid of indicators that will score poorly.

12 RECOMMENDATIONS FOR THE USER

Before presenting the conclusion of this thesis it is relevant and necessary to provide some recommendations for the users of this tool. These recommendations derive from the previous discussion and are important to bear in mind in order to avoid misunderstandings and misuse of the tool when working towards the SDGs:

1. It is important that the tool is used as a supporting tool, which can be used in the political debate about solutions.

2. It is not sufficient for politicians to only look at the final score. They need to backtrack the results, gaining knowledge about which SIs an urban area is performing well on and which SIs the area is performing poorly on.

3. When looking at solutions for SIs which the urban area is performing poorly on, it is important to be aware that the solution may lie outside the chosen area.

4. Furthermore, it is important that solutions with a longer time scale do not get ignored, even if they will first have an influence on the score far ahead in the future.

5. Finally, it is important to remember to include different stakeholders in the process of finding solutions. No solution should be based solely on the result of the tool.

13 CONCLUSION

Through this thesis' analytical work, it has been highlighted how Danish municipalities are struggling to incorporate the UN's Sustainable Development Goals in their everyday urban planning processes. To tackle this issue, we have used the theoretical approaches of SSA and SMART in order to create a set of contextualised and measurable sustainability indicators, which were operationalised as a planning tool that can measure the municipality's progress towards the SDGs. The results of our analyses led to several major key points which ultimately answer the research question:

'By engaging in a collaborative process with Guldborgsund Municipality, how can the UN's Sustainable Development Goals be contextualised and made measurable in a planning tool, as a basis for Danish municipalities' sustainable development of cities?'

First and foremost, as the SSA emphasises, it is important to acknowledge the many subjective choices that have to be made when measuring sustainability. We found that Guldborgsund Municipality had difficulties working on the SDGs due to the broad nature of the goals, and as a result saw the goals more as labels of sustainability rather than the individual constituting targets. This makes sense as many of the targets deal with national and international matters and thus lack the ability to be usable or useful on a local scale, essentially lacking the subjectivity of sustainability. In our attempt to make the targets relevant, and thus the SDGs, we configured a prototype of a planning tool based on a set of SIs developed by studying and analysing a comprehensive literature review in collaboration with the municipality. After limiting the scope of this thesis to SDGs 6, 11, 12, and 17, chosen based on the municipality's own preferences, we executed the SMART concept on indicators found in the literature. Together with the municipality's own assessment, a final index of 91 relevant SIs was established. Although the number of indicators never seemed to be a problem for the municipality, creating an index of relevant SIs for all 17 SDGs could result in an overburden of information, and it could become strenuous and time consuming for the practitioner to fill in the required data.

In order for these indicators to be useful, a band of equilibrium has to be created. We found that there was no standard method for setting up a BOE, as the municipality alternated between referencing SIs with regard to similar municipalities, the Danish average, or a utopian scenario. Obtaining the required data for the BOE is a comprehensive and highly subjective task. It was stated by Guldborgsund Municipality that an objective reference system would be inappropriate, as the context of different cities, in terms of geographical and demographic differences, could not be compared fairly.

The final step of creating the tool was to set up a visual presentation of the practitioner's performance. This was done in the form of a dendrogram and spiderwebs, which was well received by the municipality. Since the SDGs can be seen as a complex and incomprehensible term, it was important that the tool is user-friendly and supports sustainable planning processes, which our tool seemed to achieve. Guldborgsund Municipality displayed their general satisfaction with the tool, and emphasised that this method of contextualising the SDGs was particularly successful. This means that in this study, it was possible to conclude that establishing relevant SIs was an efficient way to measure and contextualise the SDGs.

Furthermore, it is important to state that the understanding and prioritisation of sustainability is highly subjective, which is why the tool has been designed so that it is possible to determine the significance of each SI and SDG by weighting their importance. The tool is thus designed to be flexible with regard to the understanding and prioritisation of sustainable aspects, but also if practitioners wish to develop new SIs or to remove existing SIs. It should therefore be noted that the practitioners must be aware that using the tool will only illustrate

one reflection of reality and can never be argued to reflect the whole truth, due to the fact that the tool is designed based on a subjective evaluation of sustainability – this evaluation might differ under dissimilar circumstances. Additionally, giving the user freedom to optimise the BOE and the importance of SIs can change the scores radically, and it is easy to misuse or misinterpret the output. This is why politicians must be critical of the results and carefully assess the results before they develop recommendations for future actions. The tool should only be used as a screening tool to see which aspects of the SDGs are lacking in a chosen city area.

Developing a planning tool through the SSA can be argued to be an optimal method in order to work towards the SDGs as it gives municipalities a tool to assess their performance with and reform how they allocate resources. It can thus be concluded that municipalities who wish to implement the SDGs can benefit from either this tool or a similar one.

14 RECOMMENDATION FOR FURTHER RESEARCH

This Master thesis was concerned with the development of a prototype for a planning tool, but future studies need to be carried out in order to further increase the measurability of the SDGs.

For example, in this thesis it became evident that the BOE requires a study of its own. In order to establish an adequate BOE, it is necessary to carry out studies that calculate either the Danish average, utopian goals, or the average results of similar municipalities. The data does not yet exist for every single SI, which is why it is necessary to develop these in order to make the tool operational. Bell and Morse (2008) recognise that it is a complex task to construct a BOE, mainly because the research would require the generation of large amounts of quantitative data in order to justify the valuation of the BOE. The data must lead to an agreement on what sustainability is for each SI, so that it is possible to determine whether or not the performance of an SI is sustainable, too sustainable, or not sustainable. This in itself is a challenge, as Bell and Morse (2008: 181) state that *'the authors have been struck by the difficulty that various academic and practitioner communities have had in coming to any agreement about what constitutes sustainability [...] it is because sustainability is a difficult term to tie down*'. Such a study would be a required step in order to finalise the tool for assessments in practice.

Whereas we only dealt with the first three steps of the SSA, it could be interesting to delve into the succeeding step: Review and meta-scenario-making. The assessments could for example be carried out for Guldborgsund Municipality where the data is collected and inserted in the tool to measure the municipality's performance in relation to the SDGs. In the theory, it is recommended to run real-life scenarios, in order to assess the functionality of the tool and develop improvements based on the findings. Carrying out assessments in practice can develop valuable knowledge that cannot be achieved from theories alone. These scenarios can be used to identify strengths and weaknesses which can be used to improve the planning tool (Bell & Morse, 2008).

Finally, it could be interesting to include a more political aspect, as it is assumed that politicians will use the output of the tool to discuss decisions in relation to city planning. It could be interesting to look at the trade-off that will happen when including the 17 SDGs in the planning tool, as no municipalities have the resources to focus on all goals. It is most likely that the tool will show a long list of SIs where the municipality can make improvements, and it is then up to the politicians to prioritise them. This negotiation could be interesting to follow, to see how it will affect the output and the final sustainable development of cities.

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