Operationalising the 'Green Barometer' for surgical tool use: Moving towards sustainable Operation Rooms by developing an accountability system for sustainability in the field of healthcare

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1. Introduction

The global challenge that will shape our future

Climate change can be considered a multi-layered global problem because of its scale, the shrinking window of opportunity to take action, and the lack of a central authority that holds organisations and businesses accountable for their environmental impact. However, the 'Grand Challenges' these global issues impose, can be addressed through collaborative effort (George, Howard-Grenville, Joshi, & Tihanyi, 2016). Solving 'Grand Challenges' involves changes on individual behaviour level as well as structural changes in society, and changes in implementations on an organisational management level. Initiating and accomplishing change on these multiple levels makes addressing global issues both a scientific and managerial challenge (George et al., 2016). In addition to the 17 Sustainable Development Goals of the UN, as part of the 2030 Agenda for Sustainable development, the European Commission presented 'The European Green Deal' in December 2019 as a collective response to the current climate and environmental challenges (George et al., 2016; European Commission, 2019). So far, it is clear that multiple level change is long due and more importantly; the global transition towards a more sustainable social and economic environment requires the collaborative contribution of organisations that goes beyond organisations, industries and even beyond borders.

Sustainability in healthcare

The European Commission has set the goal of no emissions of greenhouse gasses by 2050 and decoupling economic growth from resource use. One health-related part of the European Green Deal objective is to "…protect the health and well-being of citizens from environment-related risks and impacts". (European Commission, 2019, p. 2). Examples of environmental health risks are air pollution, quality of water and water scarcity, noise and chemicals. The environmental impact of climate change combined with an aging population leads to growing health risks that will increase the pressure on healthcare by the growing healthcare demand (Eurostat, 2020).

Yet, healthcare itself also has a significant impact on our environment. In the US, for example, healthcare is estimated to be responsible for 9.8% of all greenhouse gasses produced and for 7% of the total commercial water usage (Schoen & Chopra, 2018). According to the quartermaster of the 'Green Deal Zorg' in the Netherlands, the Dutch healthcare is responsible

for at least 5% of the total generation of CO2 in the Netherlands (Milieu Platform Zorgsector., n.d.). Given the above, healthcare can be considered both a victim of and contributor to climate change. Over the past years, Dutch initiatives like 'Green Deal Zorg' and 'Green deal 2.0' have been established with the objective to "increase the quality, accessibility and availability of healthcare while at the same time reducing the environmental footprint of health from the long term perspective of impact on people planet and prosperity" (Milieu Platform Zorgsector., n.d.). In the 2.0 edition, they aim towards 49% reduction of CO2 by 2030, circular operating businesses, removing medical residues from waste water and a health-promoting society and environment (Milieu Platform Zorgsector., n.d.). With monitoring programmes like the 'Sustainability monitor' that measures the CO2 footprint, sustainability costs and achievements of a sustainability policy, they seek to integrate sustainability to the core business of healthcare by proving practical tools and insights (Stichting Stimular, n.d.).

The Green Benchmark for Operating Rooms

Operating rooms (ORs) are responsible for three to six time more energy consumption per square foot than any other place in the hospital, produce more than 30% of the total hospital waste and two-thirds of its regulated medicinal waste (biohazard waste) (Practice Greenhealth, n.d.). The US 'Greening the OR' initiative set up by Practice Greenhealth, provides hospitals with implementation modules as tools to start implementing changes to minimise the impact of the operating room (OR) on the environment (Guetter, Williams, Slama, Arrington, Henry, Möller, Tuttle-Newhall, Stein, Crandall, 2018).

In 2018, in the Netherlands, the Radboudumc produced 57,400 tonnes CO2, impacting the environment with the consumption of chemicals, water, paper and other resources, with the ORs using up to 40% of all resources. Because of this, the Dutch academic hospital Radboudumc is working towards becoming "The greenest (most sustainable) OR in Europe by 2022". For this program, four overarching themes and fifteen projects have been formulated. The sixteenth project is to expand this Green OR programme nationally by the Dutch ministry of Public Health (VWS) (Meijerink, 2019). One of the projects within the Green OR programme is sustainable surgical tool use. By identifying and removing items that remain unused during surgical procedures could prevent unnecessary purchase, waste, packaging and energy and maintenance-costs through the sterilisation procedure (Practice Greenhealth, 2011.). However, so far, to the best of my knowledge, comprehensive studies on the effects of rethinking and measuring surgical tool use seem to be close to non-existent.

1.1 Research objective and questions

It is necessary to adequately measure the implementation of organisational regulation, policies, or goals regarding the impact of the hospital's sustainability strategy. The hospital, as well as management and employees, are then able to account for the implementation and reflect on the change process of the sustainability strategy. For this purpose, a sustainability benchmark tool can serve as an issue-selling device in and between hospitals. Therefore, the 'Green Barometer' is the overarching research project of this thesis, and two other theses, as part of the aforementioned Green OR programme. As of today, there is no sustainability benchmark for ORs in Dutch healthcare, and there is little available academic literature on sustainability initiatives in healthcare (Guetter et al., 2018). Therefore, this study aims to identify *implications* for the Green Barometer as an accountability system for sustainably operating ORs in the field of healthcare that should be considered when developing the Green Barometer. Studying the implications of introducing the Green Barometer as an accountability system, may provide relevant insights for both the development of the Green Barometer, and in the theoretical discourse on accountability of sustainability in the field of healthcare. Hence, the corresponding research question to this research objective reads as follows:

> „Which implications of introducing an accountability system for sustainability in the field of healthcare should be considered when developing the Green Barometer?"

The research project builds upon previous research of Eijsackers (2018) on the development of a benchmark tool for sustainability in healthcare. The research project also aims to narrow down the scope further by focussing on how to operationalise the three sub-themes of *waste*, *energy* and *surgical tool use* in the Green Barometer. So, the secondary aim of this study is to identify critical aspects that need to be taken into account when operationalising the Green Barometer for the sub-theme of *surgical tool use*. Therefore, the second research question reads as follows:

> „How can sustainable surgical tool use in ORs be measured by the Green Barometer?"

The research data required to answer this set of research questions will be based on existing research (Eijsackers, 2018), academic literature, and several in depth interviews with a variety of stakeholders of a large Dutch academic hospital to gain insights from a multiple stakeholder's perspective.

1.2 Outline thesis report

The remainder of this thesis report will continue with an overview of the theoretical framework in the second chapter, regarding the theoretical fields of accountability and sustainability assessment. Chapter three provides an outline of the methods used in collecting data from (online) interviews and how they were analysed using the technique of template analysis. Within this chapter, the final template, the quality criteria, and integration of research ethics will be elaborated on. Chapter four presents the results of the analysis of the collected data from the interviews, which are structured according to identified main themes and sub-themes in the final template. Chapter five provides an overview of the key findings through a conceptual framework that visualises the roadmap of the legitimisation process for sustainability in the field of healthcare, and the developed prototype of the Green Barometer. Hereafter, a discussion of the theoretical contribution is included, which links the key findings of this study to the existing theories on accountability and sustainability. This is followed by addressing the limitations of this study and consequently, elaborating on directions for further research. Based on the identified implications for introducing an accountability system in the field of healthcare, managerial recommendations are provided. This fifth and final chapter closes off with a general reflection on the research project. The Appendices provide an overview of the interview guide, the codebook, and the Green Barometer prototype for sustainable surgical tool use.

2. Theoretical framework

The following paragraphs of this chapter present a framework of relevant theories and perspectives, regarding the implications of introducing an accountability system for sustainability. The research questions are studied through the theoretical fields of *accountability* (§2.1) and *sustainability assessment* (§2.2). An overview of relevant theories, perspectives, models, critical assumptions, interpretations and relations used in this study regarding the two research questions are made clear throughout this chapter.

2.1 Accountability

2.1.1 Accounting for sustainability

The aim of developing an assessment tool for sustainability, is to properly account for the progress of an organisation's sustainability strategy. 'Accounts', as defined by Morgan (1988) are "always engaged in interpreting a complex reality, partially, and in a way that is heavily weighted in favour of what the accountant is able to measure and chooses to measure, through the particular scheme of accounting to be adopted" (p. 480, as cited in Gray, 2010). This results in the issue of differing narratives on various levels of the account for 'sustainability' (Gray, 2010). Differing narratives may prove to be troublesome, as an assessment tool needs to be widely adopted by incumbents in the organisational field as the new standard, in order to leverage the impact (Wijen, 2014).

Gray (2010) roughly categorized sustainability accounts into four levels, knowing; general discourse in and around business, corporate reporting itself, initiatives designed to advance the corporate sustainability agenda, and the range of (academic) experiments designed to provide an articulation at the organisation level (p. 49). Seen from a more critical perspective, the first three categories may be interpreted as 'subjective' accounts of sustainability. This may illustrate how businesses are constructing the dominant discourse on sustainability, while ignoring the growing body of scientific literature in pursuit of their own strategy agenda's (Gray, 2010). Likewise, Achterbergh and Vriens (2019) view organisations as 'social systems' that continuously interact, both internally and externally, and deliver a societal contribution. This reciprocal relation mirrors the effect organisations have on society and the other way around. Given this perspective, it could be argued that there is this taken for granted assumption within the current business discourse, that an organisation cannot succeed without the approval their stakeholders as social and environmentally responsible functioning organisations,

consequently leading to the unchallenged presupposition that the organisation is indeed that responsible (Gray, 2010, p. 49).

So, narratives on sustainability in organisations need to be critically reviewed, challenged even, to come to some agreement for any specific organisational field. As Gray (2010) indicated, this could be one way in which accountability might be able to contribute to sustainably functioning organisations, considering one cannot establish clear objectives without having any form of agreement on what these objective apply to. Alternatively, Wijen (2014) proposes to create so called 'niche-institutions' that can close the bridge between universal institutions and context-specific institutions, as the understanding on sustainability is socially constructed and therefore context-driven in specific organisational fields.

2.1.2 Legitimizing sustainability in practice

The strategic change process organisations experience calls for the creation of a sustainability strategy, preferably one that is aligned with the overall strategy of an organisation. Yet, implementing a sustainability strategy alongside the overall strategy of the organisation can present several issues. One of the much researched issues identified by scholars is 'decoupling' (Bromley & Powell, 2012; Hengst, Jarzabkowski, Hoegl & Meuthel, 2020; Heese, Krishnan & Moers, 2016; Wijen, 2014). 'Decoupling' is defined and referred to when "organizations adopt a policy symbolically without implementing it substantively" (Haack and Schoeneborn, p. 307, 2015). For example, the symbolic adoption of a sustainability policy may be the result of establishing external legitimacy, which amplifies the decoupling of the sustainability policy from the overall strategy of an organisation. 'Tight integration', on the contrary, involves the extent to which the sustainability strategy is integrated with the overall competitive strategy can be manifested in organisational products services and processes (Yuan, Bao & Verbeke, 2011, as cited in Hengst et al., 2020). Based on findings of their longitudinal qualitative research, Hengst et al. (2020) developed a dynamic procedure model on the integration of dual strategies at the action and organisation levels, viewed as a process of legitimacy making. 'Legitimacy' can be defined as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, p. 574, 1995). By reviewing the integration of dual strategies from a legitimacy perspective, Hengst et al. (2020) acknowledge the social construction of a normative system that facilitates this integration, and whether this is perceived as a legitimate one or not.

However, Hengst et al. (2020) found that the integration of the sustainability strategy into the overall (competitive) strategy of an organisation led to tensions experienced by managers. The three identified types of tension each triggered 'action cycles' that formed the implementation process of the sustainability strategy as an integrative part of the overall strategy. Firstly, the tension between products and features triggered *compromising and reinterpreting or splitting action cycles*. So, the product and feature limitations led to a compromise or a reinterpretation of the sustainability strategy, and 'splitting' the sustainability strategy, in the sense of considering a more or less sustainable strategy per product or feature. Secondly, the tension between organisational values triggered *sacrificing and valorising action cycles*. This involved that the sustainability strategy was (partly) sacrificed as a result of the trade-off between the sustainability and overall strategy of the organisation. Additionally, this resulted in the valorisation process of the priorities that were decided upon. Third, the tension between strategic goals triggered procedural *embracing and synergising action cycles*. This involved the managers' use of existing procedures to incorporate the sustainability strategy in daily practices, which in time resulted in process efficiencies within the overall strategy. For example, it was found that the more managers reported on the sustainability KPIs, the more they benefitted from them, also for their overall strategy activities (Hengst et al., 2020).

Based on these insights, it can be argued that "working through" the aforementioned tensions in their action cycles, may help to legitimise the sustainability strategy by incorporating sustainability strategy tasks alongside the overall strategy tasks. Moreover, the effect of multiple tasks was significant in strengthening organisational commitment to integrate the sustainability strategy alongside the overall strategy of the organisation (Hengst et al., p. 263, 2020).

2.1.3 Sustainability standards as institutions for accountability

As elaborated on in the previous section, it is important for sustainability strategies to be legitimised on multiple levels within the organisation. This legitimisation perception is the result of a "socially constructed system of norms, values, beliefs and definitions" (Suchman, p. 574, 1995). Therefore, the social construction of a normative system could facilitate the integration process of a sustainability strategy within an organisation, rather than symbolically adopting a sustainability policy without properly implementing it. Sustainability standards can be seen as *institutions*, as they consist of rules that define social practices, assign roles and guide interactions (Young, 1994, as cited in Wijen, 2014). Therefore, a benchmark for sustainability

can be viewed as an institution, as it (ideally) functions as a normative system, that is socially constructed by multiple actors from within the field, and simultaneously serves as an accountability system.

Recently, the discussion among scholars regarding 'decoupling' has expanded from the symbolical adoption of sustainability policies, by researching the inability of 'compliant adopters' to achieve the intended objective of sustainability policies (Bromley & Powell, 2012; Wijen, 2014). The trade-off regarding this 'means-ends decoupling' involves the balancing of means in order to achieve the intended goal in 'opaque fields' (Wijen, 2014, p. 302). Sustainability can be considered as one of these opaque fields, as sustainability is regarded by scholars as a socially constructed, continuously evolving concept inhibiting causal complexity (Gray, 2010; Wijen, 2014). Wijen (2014) provides the three 'compliance barriers' identified within opaque fields with possibilities to deal with these barriers. Firstly, the *lack of attention* for sustainability standards could be dealt with through the standards being widely carried by incumbents to leverage its impact. Secondly, the *lack of motivation* could be resolved by either creating moral motivation or the internalisation of goals. Third, the *lack of knowledge* could be countered by sharing knowledge and practices that consider contextual contingencies.

Nonetheless, Haack & Schoeneborg (2015) critically point out that the 'means-end' type of decoupling as defined by Wijen (2014) is grounded in the functionalist paradigm, which is linked to a *positivist* epistemology, while on the contrary, the policy-practice type of decoupling originates from the interpretive paradigm, linked to the *social-constructionist* epistemology. Secondly, the 'means-end' type of decoupling neglects the dynamic constructive part, as goals, the so called 'ends' need to be continuously (re-)negotiated by various actors in the field, resulting in a non-linear process (Haack & Schoeneborn, 2015). However, the aforementioned conditions and opportunities could enable the design of flexible, context oriented sustainability institutions, which are prone to develop parallel to the evolving nature of sustainability (Wijen, 2014). Ultimately, this would encompass using the appropriate means to achieve the intended goals in the opaque field of sustainability. What do or should these goals then entail precisely, however, can be disputed (see Gray, 2010).

2.1.4 Accountability systems and the role of professional bodies

By acknowledging the aforementioned 'compliance barriers' and specifically the opportunities to deal with them, we have to consider the role of professional bodies in introducing an accountability system for sustainability the organisational field through an institutional lens.

'Organisational fields' can be defined as "organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products." (DiMaggio & Powell, p. 148, 1983). Within the institutional theory literature, research has mostly focussed on *the effects* of field dynamics, i.e. by illustrating how communities of organisations respond to institutional norms in a collective fashion. In contrast, there has been much less research done on field dynamics, i.e. understanding what drives the effects of isomorphism, leading to a limited understanding of *why* and *how* institutional practices change within an organisational field (Greenwood, Suddaby, & Hinings, 2002).

'Isomorphism' is described by Hawley (1968) as "a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions" (as cited in DiMaggio & Powell, p. 149, 1983). This process leads to organisations in a field to become more and more homogenous by normative sanctions regarding their environmental context. Apart from 'competitive isomorphism', which focusses on market competition for resources and customers, there is 'institutional isomorphism', which recognizes that organisations also compete for political power and institutional legitimacy (DiMaggio & Powell, 1983).

DiMaggio and Powell (1983) have identified three institutional *isomorphic change mechanisms*; 'coercive isomorphism', 'mimetic processes' and 'normative pressures'. *Coercive isomorphism* results from formal and informal pressures organisations of a certain field exert on one another. *Mimetic pressures* result from uncertainty that encourages imitation or 'organisational modelling', when organisations poorly deal with (new)technologies, environmental uncertainty or ambiguous goals. *Normative pressures* emerge from 'professionalisation', in which two aspects are deemed important sources for isomorphism; formal education and legitimization from university specialists, and growing professional networks spanning organisations that stimulate the spreading of new models. (DiMaggio & Powell, p. 152, 1983). These mechanisms may structure organisations within a certain field to become a community with its own norms, values and identity (DiMaggio & Powell, 1983).

As the field of healthcare inhabits a great variety of professional bodies or professional associations, these professional bodies could facilitate or stimulate the aforementioned mechanisms. Professional bodies are deemed important for several reasons. Firstly, they facilitate a space where organisations can present themselves and allow organisations within the same 'community' to interact. Understandings and shared meanings emerge from these interactions of competing interests and agreements (Greenwood et al., 2002). Therefore, the

role of professional bodies is "the construction and maintenance of intraprofessional agreements over boundaries, membership, and behaviour." (Greenwood et al., 2002, p. 62). Secondly, professional associations form representative agencies for other fields and shape and redefine appropriate interaction practices for their community members (Greenwood et al., 2002). Third, professional bodies can play a role in monitoring compliance the constructed expectations, i.e. by enabling processes of training, education, certification and celebration ceremonies (Greenwood et al., 2002). The non-isomorphic stages of institutional change, presented in the model by Greenwood et al. (2002) consist of six phases, knowing; *precipitating jolts, deinstitutionalising, pre-institutionalising, theorisation, diffusion* and finally *re-institutionalisation*. The transition from the fifth to the final phase involves the elimination of 'fads and fashions', which entail semi-institutionalised ideas that fail to become institutionalised. We can safely assume, that sustainability is not simply a concept that is currently in fashion, but is rather in the process of becoming an integral part of organisational strategy, alongside the overall competitive strategy (Hengst et al., 2020).

In sum, it can be assumed that professional bodies are important *regulatory agents*, especially in times of deinstutionalisation and institutional change. In periods of change, professional bodies can facilitate the process of discourse and interaction, by managing the debate and negotiations within the professional field, in order to legitimate change (Greenwood et al., 2002). These insights suggest the role professional bodies could portray in legitimising change, and facilitating the diffusion of the constructed understandings on sustainability and the appropriate 'behaviours' (i.e. practices) within the organisational field.

2.1.5 The social construction of accountability systems

In the global transition towards sustainability, it can be assumed that multiple stakeholders are involved in developing the Green Barometer, which implicates this change process to be a 'multi-authored' process (Tsoukas & Chia 2002), each with their own understanding of past events and visions on how future change should be realised (Buchanan & Dawson, 2007). This critical perspective on the process of 'sense making' as a characteristic of organisational change (Tsoukas and Chia, 2002), is crucial to be aware of when studying change processes by interacting with organisations. Multiple actors create inter- and intra-dynamics within the organisational field (Wolters, 2019). The research process, in order to develop the Green Barometer as accountability system, will most probably spark any form of response. These responses can be interpreted as "effects" evoked by the intervention resulting from our

interaction. The method used in gathering data in itself may influence the system which thus must be carefully considered (Schein, 1996). As a result, a change process could be brought about by the ignition of discourse on developing an accountability system for sustainability in health care; the Green Barometer itself can therefore be viewed as an instrument of change.

Given the theoretical assumptions as described earlier, the development of an accountability system can be seen as a social construction, as institutions and regulatory systems are viewed as socially constructed by the interactions of multiple stakeholders within the organisational field (Gray, 2010; Greenwood et al., 2002; Hengst et al., 2020; Wijen, 2014). Accountability practices need to be incorporated within the current practices of stakeholders within the organisational field, to integrate the sustainability strategy alongside the existing overall competitive strategy of the organisation (Greenwood et al., 2002; Hengst et al., 2020). Moreover, professional associations are deemed to portray a significant role in the legitimising process of institutional change and the diffusion of socially constructed understandings in practices and behaviours (Greenwood et al., 2002). However, little research has focussed on the way in which these accountability systems provide the interface of for these interactions, and how this affects the relation between both other actors within a professional field and between professionals. Moreover, the development of an accountability system from the initial phase has been under-examined (Wolters, 2019, p.19), specifically for the field of healthcare.

2.2 Sustainability assessment

2.2.1 Approaches to sustainability assessment

Environmental issues as climate change, pollution and the depletion of natural resources has sparked an interest in the idea of 'sustainability' or 'sustainability development'. Consequently, this growing interest brought challenges in how impact assessment was originally developed. (Pope, Annandale, & Morrison-Saunders, 2004). With the relatively general definitions that literature provides on sustainability assessment (SA), Pope, Annandale and Morrison-Saunders (2004) aimed to clarify in their article what the concept of SA should entail for it to live up to its potential as a tool for promoting sustainability. However, considering the contextual contingencies, it near impossible to define an 'ideal' SA process (Pope et al., 2004; Wijen, 2014).

So, Pope et al. (2004) reviewed two SA approaches and how likely they are to contribute to sustainable development, which results in the presentation of an alternative assessment concept which addresses the limitations existing approaches present. Firstly, *environmental*

impact driven integrated assessment can be 'applied' to already conceptualised proposals, as it identifies the social and economic impact next to the traditional environmental impacts. It compares the impacts to 'baseline conditions' after which is determined if these impacts are acceptable or how they adverse effects can be minimised (Pope et al., 2004). This results in considering accepting a proposal as positive, notwithstanding the negative impact, as long as the overall outcome is still positive (Pope et al., 2004). Secondly, *objectives-led integrated assessment* requires clear defined socioenvironmental and economic objectives as a benchmark to which the assessment can be conducted. Pope et al. (2004) suggest that the last approach is "more likely to result in 'win-win-win' outcomes, making it less likely to generate conflicts and trade-offs", aiming to maximise the objectives (p. 605). However, this implies the agreement on set objectives by multiple stakeholders within a field (Pope et al., 2004). Drach-Zahavy and Erez (2002) found that if a goal resulting from a new situation is viewed as a threat, by i.e. focussing on failure, people achieved lower performance compared to when the goal of the new situation was viewed as a challenge (as cited in Locke & Latham, 2006). Therefore, framing these abstract global and sustainability issues in the field of healthcare into more comprehendible goals with the according tasks, seems crucial for its effectiveness. Ultimately, Pope et al. (2004) provide the following recommendations based on their analysis. First, SA should assess the sustainability of an initiative, and not assess 'direction to target'. Second, SA requires a clear concept of sustainability as societal goal, defined by benchmark criteria which separate sustainable outcomes from unsustainable ones. Third, principle-based approaches are recommended, as a 'triple bottom line' view of sustainability is unlikely to be successful. (Pope et al., 2004, p. 614). Elkington (2018) confirms this in his Harvard Business Review article, where he is recalling his sustainability framework 'people planet profit' from 25 years ago. The framework is said to have become an accounting tool for companies, resulting in a trade-off mentality instead of its intended "deep thinking about capitalism and its future". As the 'planetary boundaries' as portrayed by Rockström et al (2009), further developed in the 'doughnut of social and planetary boundaries' model by Raworth (2012) show us, it could be questioned whether the triple bottom line reports that are produced annually indeed guide organisation towards sustainability.

2.2.2 A critical reflection on sustainability assessment methods

Singh, Murty, Gupta, and Dikshit (2009) provide an extensive overview of sustainability assessment methodologies. They conclude that from the various international efforts to measure

sustainability, few actually have an *integral approach* to take into account the social, environmental and economic aspects as most of them focus on one aspect alone (Singh et al., 2009). Although it could be argued that using several SA methods could supplement each other, Singh et al. (2009), among other scholars, argue that sustainability is "more than an aggregation of important issues", referring to the complexity of "interlinkages and the dynamics developed in a system", which will be excluded from the SA when using them as supplementary. (p. 209). Moreover, Singh et al. (2009) suggest that sensitive analysis may prove helpful in testing the measurements for robustness, as combined indicators of SA could lead to misleading messages when poorly constructed or wrongly interpreted. A misleading presentation of reality by SA may lead to organisations jumping to conclusions and adopt these measures in policies (Singh et al., 2009).

Therefore, Singh et al. (2009) suggest careful selection of sub-indicators, choice of model, weighing mechanism and treatment of missing values, in order to construct a framework that minimises the possibility of misrepresentation. Additionally, they point out two critical issues regarding the required quantification of data in order to measure sustainability; correlation among indicators and compensability between indicators. As an important final note, Singh et al. (2009) state that the selection of sustainable development indicators should be debated and selected by the "appropriate communities of interest", as the indicator has to be "constructed within a coherent framework" (p. 210). This construction by the appropriate actors within an organisational field, for example, would enable the indicators to change alongside the development of the interests of stakeholders and the development of sustainability itself (Singh et al., 2009).

2.2.3 Pragmatic validity

One of the recurring themes within academic literature is the translation of knowledge from theory, translated into practice. The traditional criteria for scientific validity alone do not guarantee practical benefits for practitioners, as managers seek for procedural knowledge resulting from "direct experience and trial-and-error learning" (Worren, Moore and Elliott, 2002, p. 1228). In order to properly 'practice knowledge', a more pragmatic approach is desired. As traditional criteria for scientific validity do not automatically induce pragmatic validity, the identification of characteristics that support usefulness in practice is needed (Worren et al., 2002). Previous research has studied factors that could enable pragmatically valid knowledge, i.e. the origins of research questions, employment of research techniques, the relationship

between the researcher and managers during the research process, and the different approaches to theory building (Worren et al., 2002, p. 1229), but there is little consensus in literature on how pragmatically valid knowledge is best created.

According to Worren et al. (2002) a pragmatist perspective "focuses on the role knowledge plays as a conceptual tool in professional inquiry processes". (p. 1229). However, this tool-like character of knowledge is often neglected (Perkins, 1986, as cited in Worren et al., 2002). So, in order to design a framework for pragmatic validity, Worren et al. (2002) suggest to incorporate 'cognitive ergonomics' – user friendliness, and the role of tools in (re)shaping social processes. Levine et al. (1993) argued that "tools embody accepted ways of thinking and often invisibly shape the course of both individual and group cognitive activity" (p. 1230, as cited in Worren et al., 2002).

Considering this, tools can thus be of great importance when aiming to change behaviours or practices within the organisational field. However, when using theories in management as cognitive tools, some form modification is required, which is why Worren et al. (2002) presented different *representation modes for knowledge*, viz. 'propositional', 'narrative' and 'visual'. These modes for pragmatic validity could be matched to the varying needs and context to which the knowledge is to be applied. Additionally, Worren et al. (2002) suggest different approaches to pragmatic validity. Firstly, consider the level of adoption as indicator, without neglecting the power of distribution channels to diffuse the tools. Consequently, the second is to assess pragmatic validity on a trial-error base. Third, asking users of the tools for their opinion, which ensures the tool is user friendly and matches the needs and limitations of the practitioners who end up using the tool (Worren et al., 2002). The different approaches provided by this framework for pragmatic validity can be of great use in the developing the Green Barometer.

3. Methodology

This chapter elaborates on the research methods used in this study. In the following paragraphs an outline is provided of the research approach (§3.1), case description (§3.2), data collection (§3.3), and data analysis (§3.4). The methodological quality and limitations of the research approach are addressed in (§3.5), and research ethics are discussed (§3.6).

3.1 Research approach

This research project was a collaboration between the OR department of a large academic hospital in the Netherlands and a research team of Radboud University. The research team consisted of three master students of the master's specialisation or Organisational Design and Development and their thesis supervisor. This research adds on to the findings of previous research from Eijsackers (2018) on the development of a general sustainability assessment tool. However, we continued researching the development of the assessment tool by focussing on three specific sub-themes of sustainability; *waste, energy* and *surgical tool use* and gained more in depth theoretical insights by focussing on three organisational change perspectives; *sustainability standards*, *issue selling* and *accountability*.

The theoretical perspective held in this thesis study is **accountability**, with the specific focus on the sub-theme of **surgical tool use**. This study aims to identify *implications* of the Green Barometer as an accountability system for sustainably operating ORs in the field of healthcare, that should be considered when developing the Green Barometer. Additionally, this study aims to identify aspects that need to be taken into account when operationalising the Green Barometer for the sub-theme of surgical tool use. Hence, this study's main focus is the *diagnostic part*, while also to delivering a **prototype** for the sub-theme of surgical tool use that could serve as a basis for the further *design part* of the Green Barometer, which is beyond the scope of this study. The research questions have been studied using a qualitative research approach, to gain in-depth understanding of the implications of an accountability system relating to its context (Langley & Abdallah, 2011). Therefore, this diagnostic study can be characterized as a descriptive case study, that attempts to extent and strengthen current knowledge on accountability theory for the field of healthcare. The study was completed within the period from February 6th 2020 up until the 15th of June 2020.

The research paradigm I adopted throughout this research, has implications for the research design, data collection and analysis. This requires reflexivity to reflect on the researcher's role in it (Duberley, Johnson, & Cassell, 2012). Literature on accountability systems for sustainability have described the required relational approach when studying a complex phenomenon, such as accounting for sustainability, which construction is ever subjected to of interactions between multiple stakeholders in an organisational field (Gray, 2010; Wijen, 2014). As mentioned before, the Green Barometer itself and its development process may be viewed as an instrument of change, as our interactions with multiple stakeholders within the field of healthcare may affect the change process (Schein, 1996). Therefore, the **constructivist** research paradigm held in this study fits the assumption that our perception of reality is socially constructed (Duberley, Johnson, & Cassell, 2012).

3.2 Case description

This research project was commissioned by the OR Management of a large academic hospital in the Netherlands to further operationalise the Green Barometer for ORs, in order to monitor the progress of the hospital's sustainability strategy. This organisational change process of moving towards a more sustainably operating ORs in this academic hospital in the Netherlands, makes this research project suitable as case study to answer the two research questions.

Findings of Eijsackers' (2018) research provided general insights in the considerations concerning the development of a sustainability benchmark tool. Within his research, he studied the existing methods of benchmarking sustainability, what sustainability entails for an Operating Rooms department, and which indicators should be included in a sustainability benchmark for an Operating Rooms department. This led to the design of a framework for the benchmark tool for sustainability, which consisted of four dimensions, knowing; *sustainability ambition and vision*, *people*, *planet* and *organisational effectiveness*. Although Eijsackers' (2018) framework offers direction for strategic planning and decision-making on sustainability, it lacks focussed insights that result in recommendations on the practical implementation process and implications of the benchmark tool. Consequently, this study aims to provide more in depth insights by focussing on the implications of an **accountability system** for sustainability, like the Green Barometer, specifically for the sub-theme of **sustainable surgical tool use**. Within this study 'surgical tools' are defined as *surgical apparatus and devices used in operating rooms when performing surgery on a patient*. Surgical tools such as implants do not fall within this definition.

3.3 Data collection

The data for this study was gathered by analysing Eijsackers' (2018) secondary data, and conducting semi-structured interviews with seven respondents. Unfortunately, we were compelled to conduct fewer interviews than planned and were limited to digital communication, due to the circumstances around the COVID-19 pandemic during our research project. The Dutch academic hospital, the focus of this case study, was using all its capacity to provide the exploding demand for healthcare. At the time, we assumed this had somewhat deprioritised the development of the Green Barometer and limited the opportunities to collect empirical data through (online) interviews. To compensate, we analysed the secondary data from Eijsackers (2018) to formulate a priori concepts and themes. Fortunately, a few weeks later we found that even in times of crisis, there were people willing to contribute to our Green Barometer research project by sharing their experience and knowledge through online interviews. Our gatekeeper within the hospital was situated at a relatively high management level, which enabled our gatekeeper to act as 'broker' for our research project (Saunders, 2012). This facilitated access to the required data resources and enabled easy contact with the respondents for the interviews. The following paragraphs elaborate on the data collection method used per data resource.

3.3.1 Secondary data sources

Due to the previous explained circumstances during this research project, we analysed the existing interview transcripts (Eijsackers, 2018) in an online context analysis with the research team. Based on the literature study, the research team identified concepts and themes through this 'quick and dirty' analysing process. The insights resulting from the secondary data provided additional structure for formulating the questions in the interview guide of the seven semi-structured interviews that were conducted within this study. See **Appendix 1** for the final interview guide.

3.3.2 Interviews

Due to the aforementioned situation around the COVID-19 virus, the practicability of conducting interviews was dramatically altered. I conducted seven semi-structured interviews via Skype, Zoom, video calling or phone. This effected the non-verbal communication, and limited the interpretation of the conversation like interviews. Our broker put forward respondents who had expertise knowledge on the different subjects to be examined. Based on the insiders' knowledge of our broker, I contacted six respondents that represented a variation

of both internal and external stakeholders. This selection process aimed to improve the validity of the interviews, and remain flexible for other respondents to emerge (Alvesson & Ashcraft, 2012). I used the insights and recommendations of the first respondents to get in touch with the remaining respondent, also known as the snow-ball effect. The selection resulted in a varied sample of respondents from different organisational levels and multiple stakeholders. For example, internal stakeholders had a varying range from an OR assistant, a manager business office OR, an advisor of sustainability of the executive board, an operational manager OR, and an operational manager at a sterilisation department, all from an academic hospital. External stakeholders varied from consultants at a surgical tool manufacturer and supplier, an advisor of a Dutch medical association, a senior advisor, and a project manager at the Dutch Ministry of Health, and interim managers in the field of healthcare. This supported the search for intersubjectivity, a shared understanding among the respondents, which suits the *constructivist* research paradigm held in this study. To gain rich and novel insights regarding the research question, the interviews were semi-structured by the a priori themes and dimensions resulting from the literature study and context mapping analysis of the secondary data analysis. This benefitted the opportunity to ask follow up questions in order to get a more in depth understanding of the subject discussed (Alvesson & Ashcraft, 2012). In order to capture best what was said, I asked the respondents in advance for permission to record the interview for transcribing purposes, providing I would handle the data with care. Additionally, I ensured the respondents knew what the purpose of the study and the aim of the interviews was, by providing a concise introduction at the beginning of each interview. To close off the interviews, I provided a short recap of what had been sad, explained once more the aim and further process of the research project, and naturally left room for questions. The interviews had a varying duration between 45 minutes and one hour and were transcribed verbatim afterwards.

3.3.3 The testing of the prototype for the Green Barometer

The final data collection method used in this study concerns the development of the prototype of the Green Barometer for the sub-theme of surgical tool use. Based on the interview data, I created a draft for the design, which was discussed in a peer-review session with the research team and their supervisor. Finally, the re-design, based on the insights of this session, has been tested on an expert in the field of healthcare. This has led to the final prototype (see **Appendix 3**), which could serve as a basis for the further design of the Green Barometer, for the sub-theme of surgical tool use.

3.4 Data analysis

To enhance the empirical evidence in this research project, our research team combined the total of our (anonymised) collected empirical data. By conducting an online context mapping analysis, we aimed to improve and refine our interpretation of the interview data. Altogether, this has led to a grounded understanding of important themes and dimensions in the change processes. For the analysis of the verbatim transcripts of the interviews, I opted for the analytical technique *template analysis*, which is often used to analyse textual data. This technique lends itself to approach the data in a flexible manner from different perspectives and focusses on the "richness of the description produced" (King, p. 427, 2012). Furthermore, template analysis is seen as a flexible technique with few specified procedures, which accommodated the iterative process of sense making and thus makes it applicable to the requirements of the explorative nature of the study (King, 2012). I applied a combination of top down and bottom up approach in the template analysis, because of the a priori themes that were developed from both the theoretical framework and analysis of the both context-mapping analyses. After several iterative steps the final template was constructed. A visual presentation of the final template is provided on the next page in **Figure 1.**

3.5 Methodological quality

With qualitative research it can be studied how varying factors are interconnected with each other and which patterns come with this coherence (Bleijenbergh, 2013). Therefore, the qualitative methodological approach that has been opted for in this study suits the exploratory and diagnostic nature of the research questions, because it helps to understand change processes because it allows a rich description of the phenomenon (Langley & Abdallah, 2011). Even though qualitative research may be based on less observations, it does provide rich insights of the phenomenon due to the intensity of the data collection like for example in depth interviews (Bleijenbergh, 2013). This provides internal validation of the social phenomenon, but does not automatically imply transferability to any other context. However, the rich and detailed description assists the reader to judge whether the findings can be applied to other contexts (Symon & Cassell, 2012). The credibility of the analysis and resulting research findings are further secured by peer debriefing, the two context analyses with the other students and supervisor, the code book which shows the thought of process, and the substantiation of the interview data by quotes. The reliability of the study is secured by a detailed transparent description of the collection and analysis process of the empirical data.

1st order codes: sub-themes: Main themes:

- Prioritising sustainability.
- Creating multidisciplinary teams in hospitals.
- Role for scientific associations.
- Role for Professional bodies.

Creating commitment.

- Internal collaborations within hospital.
- External collaborations between hospitals.
- Supply-chain collaborations.
- Quality of patient care.

Involve multiple stakeholders.

Legitimisation process for sustainability assessment.

- Objective Green Barometer.
- Scope Green Barometer.
- Results Green Barometer.
- Use of Hierarchy in healthcare.
- Means of communication.

Strategic decisions on the Green Barometer.

- Insufficient oversight sustainability efforts.
- Non-committal influences support.
- Creating sense of responsibility.
- Social control perceived difficult.

Promoting compliance behaviour.

- Sustainability a complex issue.
- Measuring impact difficult.
- Pragmatic validity.
- Scientific validity.
- Software application systems.

Consideration of potential obstacles for the Green Barometer.

Green Barometer as Accountability system.

- Accounting for sustainability.
- Lack of sustainability benchmark.
- Creation of sustainability norms.
- Enforcing sustainability norms.

Institutionalising sustainability norms.

- Supply management.
- Purchase behaviour.
- Ownership surgical tools.
- Measuring abilities.

Sustainable surgical tool management.

- Disposables vs. Reusables.
- Number of re-sterilisations.
- Extending product lifespan.
- Standardising sets.
- Reclaiming of old surgical tools.
- Optimising sterilisation processes.
- Consideration of packaging materials.

Measurement indicators sustainable surgical tool use.

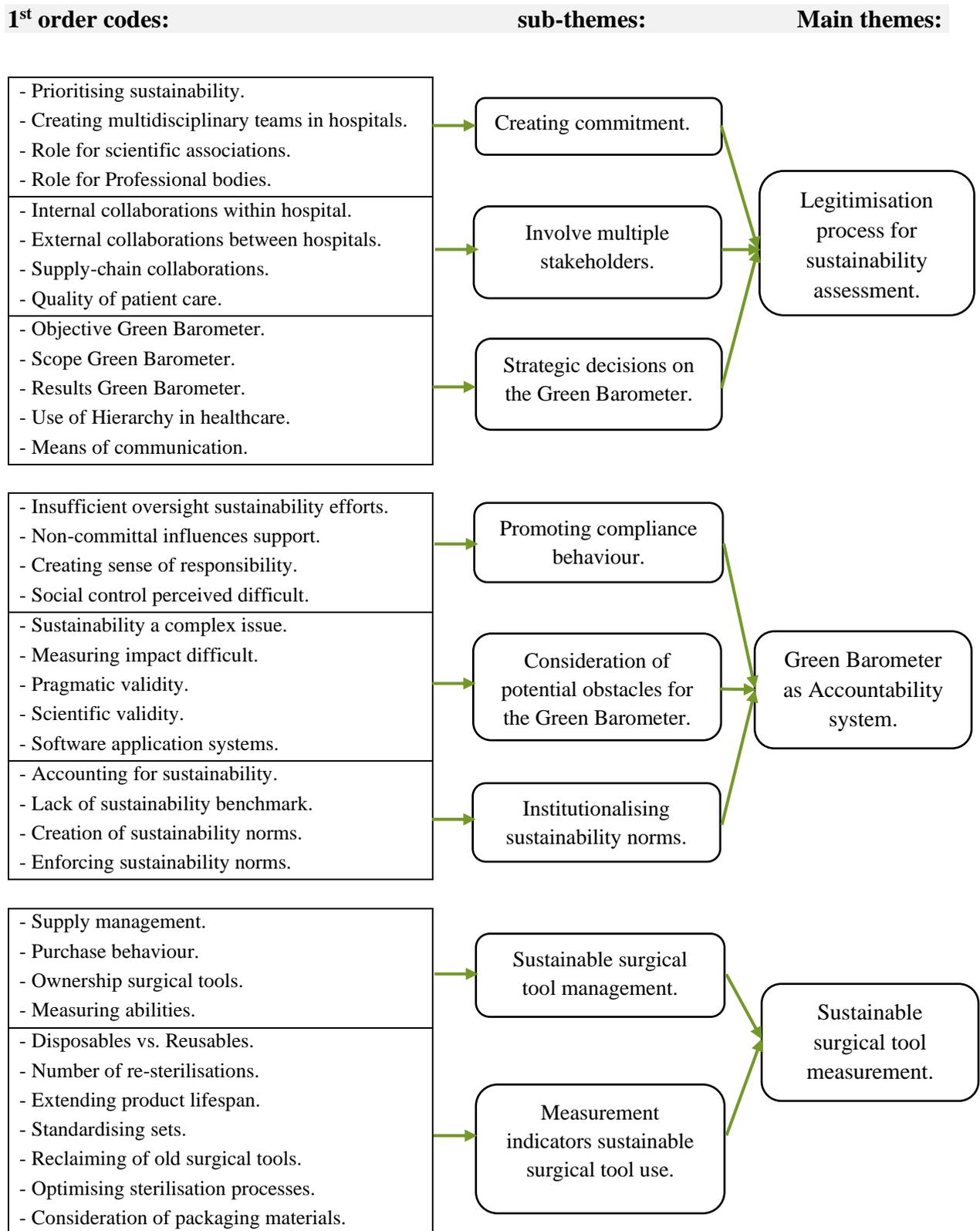Sustainable surgical tool measurement.

Fig. 1. The Final Template with the first order codes, second order codes, and main themes.

3.6 Research ethics

Throughout this research project, research ethics have been an integral part of the process as described in the 'Netherlands Code of Conduct for Research Integrity' (2018). The second and third chapter of this thesis present the theoretical grounds of why and how this study was designed and conducted the way it has been conducted. This transparency on the decision making process allows for a thorough justification of both the method and the results. For example, **Appendix 1** provides insight in the interview guide that was used and an overview of (anonymised) professions of the respondents, and the final template.

When handling personal data from respondents I secured the anonymity of respondents, stored interview data safely and professionally communicated with all the actors involved in this research project. To the best of my ability, I described and analysed the data as structured as possible, to ensure the thought process will be clear to whomever desires to apply recommendations made based on these results. Some insights have proven not to be of primal relevance within the scope of this study, leading to a selection of sub-themes to include in the final template. This selection was done after thorough analysis of the codes, justified by a sequence of steps as shown within the codebook in **Appendix 2**. I have tried to the best of my ability to be transparent in discussing uncertainties and contradictions in the discussion section, linked to the relevant and recent theories for these topics. This has led to the recommendations on further research on the field of accountability and sustainability assessment in the field of healthcare in chapter five in this thesis report, and managerial implications for the academic hospital participating in this case study.

4. Results

This chapter elaborates on the results, emerging from the analysis of the interview data. The results are described according to the two main topics of the two research questions of this study, knowing; accountability (§4.1) and sustainability assessment: the Green Barometer (§4.2).

4.1 Accountability

Several sub-themes were identified and grouped into three **main themes**: 1) *Legitimisation process for sustainability assessment*, 2) *Green Barometer as Accountability system*, and 3) *Sustainable surgical tool measurement*. The first and second main theme helped to structure the findings that answer the first research question: „Which implications of introducing an accountability system for sustainability in the field of healthcare should be considered when developing the Green Barometer?" The sub-themes within main themes one and two formed the indicators for *implications* that should be considered for the development of an accountability system. In paragraph 4.1.1 and 4.1.2 each of the indicators of the first main theme will be elaborated on and substantiated by quotes from respondents. For all quotes and the according transcript numbers see **Appendix 2** with the codebook.

4.1.1 Legitimisation process for sustainability assessment

The results of the data analysis show that the introduction of an accountability system for sustainability like the Green Barometer in the field of health care, comes with a legitimisation process. This legitimisation process was described by respondents through the **sub-themes** of 1) *creating commitment*, 2) *involve multiple stakeholders*, and 3) *strategic decisions on the Green Barometer*.

1) Creating commitment

To create commitment for sustainability assessment, respondents often mentioned the importance of creating awareness. However, this awareness already seemed to be in place to the extent that employees were found to be aware of the need for sustainable practices and products within the hospital and the OR. Yet, when other issues came in play, sustainability appeared to be not that much of a priority, while the commitment to indeed tackle these issues seemed to be a crucial aspect for sustainability efforts to follow through. As one respondent put

it: *"I think there is a real risk when there are other priorities, it becomes the first thing to drop off the list"*, continuing: *"So you have to look for the link between sustainability and patient safety. And sustainability and the quality of care or quality of life. If you are able to argument that as well, it will help"(T015).* So the **prioritising of sustainability** within the day-to-day practices of employees, is expected to be found in the integration of sustainability with the other priorities in healthcare such as patient safety, quality of care, and quality of life, to achieve commitment. The commitment to follow through sustainability efforts was found to be a crucial aspect..

Likewise, sustainability was often perceived by respondents as a complex phenomenon that was integrated in all departments and aspects of the organisation. For this reason, multiple respondents mentioned the importance of **creating multidisciplinary teams in hospitals** to stimulate sustainable initiatives: *"That integrated controlling that has been included in the strategy requires a brave translation how are we going to make sure that we will compose integrated teams. […] You know, to make sure that both facility and care workers feel connected to it because it has to do with their daily work practices"(T010).* This connectedness could bring employees together in these multidisciplinary teams to complement each other's knowledge to contribute to sustainable solutions for day-to-day work issues.

In order to create this internal and hospital transcending commitment, it was found that **the role of scientific associations** and **professional bodies** could portray were often mentioned as important implications. The OR was perceived by respondents as a 'service unit' where varying specialisms make use of the OR to perform surgery. Consequently, the number of professionals and OR employees are large and scattered among different specialisms. Hence, respondents had positive experience with creating commitment through the networks of professionals and scientific associations through network events: *"Also the large symposiums like the national surgeons' days, that's where almost all surgeons from the Netherlands come together, that's the place where you need to tell your story, because they listen to these stories and bring that back to their own hospitals"(T016).* So, looking beyond the hospital itself, making use of professional bodies and of scientific associations were experienced to be two effective ways to create commitment in the field of healthcare.

Given the above, the prioritising of sustainability, creating multidisciplinairy teams, the role of scientific associations and use of networks of professionals, are found to be important aspects to be considered in the process of creating commitment as part of the legitimisation process for sustainability.

2) Involve multiple stakeholders

The second sub-theme identified within the legitimisation process was the multiple stakeholder approach. As mentioned earlier, sustainability is perceived as a complex phenomenon, not only due to its integration within all departments of the hospital, but also because of the multiple stakeholders that have to be considered in the legitimisation process. The first group of stakeholders that was identified by the respondents was the **internal collaboration within hospitals**, and even so, the OR: *"You have to realise that you are dealing with other professionals, so nurses, paramedics, sterilisation services. These are all involved in the OR"(T015).* So, even within an OR, sustainability affects all these different stakeholders are deemed to be considered for the implementation of an accountability system, since they are the ones that have to implement it in their daily practices. For this, interdepartmental collaborations are expected to be needed for the implementation to make sure the processes function as optimal as possible.

Alternatively, the accountability system's objective is to measure sustainability within hospitals so the results can be compared between hospitals. This brings us to the second collaboration of group of stakeholders that was identified, namely, the **external collaboration between hospitals**. A nice summary of the benefits of this collaboration between hospitals which was mentioned by several respondents: *"Well, and then you can look at how are going to break it down sustainably, and how can we collaborate with other ORs. Because a waste processor will not adjust his processes for just [name academic hospital]. So that's why we have that national network to tackle these goals together and to see if we can't make a kind of fist against the big manufacturers and waste processors."(T016).* The collaborative power that would be created by this allows the hospitals to pressure the other players within the field of healthcare to work together towards more sustainable processes and solutions. So, on the one side we (ideally) have the collective front of hospitals, while on the other hand we have the manufacturers, waste processors and suppliers: the supply chain. **Supply chain collaboration** was perceived as an important bottle neck in the change process towards sustainability, as respondents experienced the lack of sustainable options or processes: *"So that business model from ownership to use - as I call it for arguments sake - they are willing to do that. But they say customers do not ask for it yet. So there's a kind of cycle that needs to be broken: the customers are waiting for suppliers to come up with it and suppliers think well those customers are obviously not interested so it's not the right time yet. So then it's necessary to come together to start the dialogue."(T010).* Suppliers are expected to play an important role in facilitating the

transition towards sustainability, by developing sustainable product innovations or processes that support hospitals in to successfully implement their sustainability efforts. So, initiating that dialogue with the stakeholders of the supply chain, may lead to a field-wide collaboration that is needed for successful sustainability initiatives.

Another aspect of the legitimisation process for sustainability is including the stakeholder perspective that is by far the most important one in the field of healthcare: the **quality of patient care**. Surfacing throughout almost all interviews was that quality of patient care and patient well-being will always and rightfully be priority number one, and therefore the patient should be included as an important stakeholder: *"...look a patient is not interested in how much costs you save, a patient is interested in what kind of care do you provide, qualitatively. And patients are becoming more and more interested in the way you deal with things. And I think that if you are able to show as a hospital how you deal with things, why you do things, what your vision is as a hospital, and how that ultimately benefits the quality of care for that patient, because in the end it's all about that patient."(T002).* Given the primal focus of patient well-being in the field of healthcare, the patient as stakeholder is certainly not one to be neglected.

3) Strategic decisions on the Green Barometer

The *what*, the *how*, to *whom* and *by what means*, were found as critical strategic decisions to consider for the legitimisation process. Mentioned by near all respondents was, depending on the **objective of the Green Barometer**, you can derive what to communicate to your stakeholders. Varying objectives were mentioned, considering the aim being a self-evaluation or rather being a benchmark, or the (intrinsic) motives to pursue the objective. One of the arguments to start with self-evaluation was that: *"Hospitals aren't fond of lists you know, so they wouldn't be fond of a kind of ranking. Definitely not, they will say our hospital cannot be compared to another hospital. […] So as I mentioned earlier, you should not connect judgement to it. […] it's okay if you're not doing it at the moment, you know, so you need to introduce it right, what do we want with the Green Barometer. Without pointing fingers, so to speak."(T016).* The emphasis in this argument lies in there being no judgement. Though, another respondent argued to begin with a self-evaluation, and to rather quickly develop it to become a benchmark between hospitals. Then again, another respondent mentioned cost reduction as an objective to stimulate sustainability: *"I very much believe that people are triggered when sustainability is accompanied by cost reductions. […] And I think it is powerful when you connect the two." (T007).* Also: *"The 'green side' at [name] I noticed to be very*

intrinsic, at a controller it will become a signboard. You know, a poster 'we are green' "(T007). The latter quote showing how the objective can be determining for the image and support of the Green Barometer.

Relating these considerations to the **scope and communication of results of the Green Barometer** several questions were expected to be important: *"Look, are you making a Green Barometer for hospitals to use among themselves, or will it soon become a barometer that patients can also access? Well, those are things that could be very important in determining what we want to do with it and how we want to design it"(T002).* Also, the aim and scope of the communications of **results of the Green Barometer** could play a role in creating commitment as well: *"[...] to show, look we are making progress. Every time you turn off the light switch has an effect. It can especially be of great help in communicating about the impact of the initiatives we implement"(T009).*

So, strategic choices have to be made for the objective; will it be a self-evaluation tool, a benchmark or a combination of both depending on the phase within the change process? Relating that to the scope, if it is to be a benchmark, will hospitals only use it among themselves or will external parties like patients and insurance agencies gain insights as well? Consequently, when communicating the results of the benchmark, who will have insights in these results and what do these findings imply for hospitals? These are all found to be important strategic decisions that are expected to have implications for the Green Barometer as accountability system.

Various interactive **means of communicating** these strategic decisions have been identified: *"We are hands-on people at the OR, not too much behind a computer. I don't mind it that much, but the majority chose to not do an office job"(T004).* For this reason, respondents preferred posters, a short presentation or an app so it is up to them how much and how often you want to check on the results. A final aspect that recurred throughout the interviews was that one should **make use of the hierarchy** that exists within healthcare in general, and especially in the OR: *"The moment a surgeon says 'I don't feel like doing this', it gets very complicated for assistants to say 'you know doctor, and yet we are still going to do it'. Because if that surgeon is a bit of a dominant personality, then it's more complicated, definitely with new initiatives that haven't been 100% proven to lead to improvements. You need a certain faith to initiate change, and for that you need commitment. Really through all layers but especially those people who hierarchically seen have a higher position."(T006).* So, specifically those higher up the hierarchy were perceived to have high influential power in forwarding the sustainability message, both negatively (hinder) and positively (promoting).

4.1.2 Green Barometer as Accountability system

The results of the data analysis show that an accountability system for sustainability like the Green Barometer in the field of health care has several implications. These implications were structured through the sub-themes of 1) *promoting compliance behavior*, 2) c*onsidering obstacles for the Green Barometer*, and 3) *institutionalising sustainability standards*.

1) Promoting compliance behaviour

Compliance behaviour was found to be influenced by **insufficient oversight** of the actual implementation of sustainability efforts by employees in their daily work. As one respondent explained: *"We are not each other's nannies in that perspective and it is somewhat expected that people take responsibility themselves for that."(T004).* Further, **non-committal** was perceived to **influence the support** of hospital employees. One-man actions were found to have less support if not communicated from the head of department, and little long term impact. *"Sometimes, when it looks like it's a one-an action there is little support, so it has to be communicated from the head of department for instance"(T005).* Another implication mentioned by several respondents was that some employees felt a high sense of responsibility towards execution of the sustainability initiatives, resulting in them actively contributing to these initiatives, while others employees did not felt the need or responsibility to actively contribute or did so half-heartedly. The **sense of responsibility** was expected to positively influence and promote the compliance behaviour and long term impact of the accountability system: *"I also think it's important that there's someone who feels somewhat responsible for it. So if we would have a green barometer, I can imagine saying oh, I'll make sure I discuss this with you and then we'll get the picture as a whole. And if you don't have that, who's going to make sure you are measuring that."(T010).* This seemed to create some tension, since **social control was perceived difficult**. For one because it was assumed that employees should take their own responsibility, and second, due to the different hierarchy levels it was perceived difficult to speak up to colleagues about sustainability higher up the hierarchy ladder: *"...you have a certain hierarchy in the OR, so the surgeon has quite a lot to say. And when the surgeon says 'I think it's nonsense', for an operating assistant it's very difficult to then say 'you may think it's nonsense but that's how we are going to do it now'."(T009).* These implications were found to affect the compliance behaviour, which in turn was deemed to have a crucial effect on the Green Barometer as accountability system.

2) Considering potential obstacles for the Green Barometer

Among respondents there were several aspects that were viewed as potential obstacles for the sustainability assessment tool itself: the Green Barometer. For instance, **sustainability was found to be a complex issue,** touching every organisational aspect *"...if you look at it from an organisational perspective, I would say that its indeed corporate because it is so integral. It has to do with facility it has to do with care processes it has to do with construction, everything. Actually, there's nothing that doesn't touch the theme of sustainability."(T010).* This complexity was perceived to make **measuring the impact of sustainability efforts difficult**, due to the numerous aspects that have to be taken into account, and due of the lack of insights in the results that was currently the case: *"Because we do say that 'measuring is knowledge', but actually we cannot quantify and express that much at the moment"(T009).* Therefore, in order to measure and monitor the sustainability impact, one big implication was found in the **software application systems**. Internal assessment could be achieved, may it be with some technical adjustments, according to some respondents. Conversely, external comparison of the assessments between hospitals was expected to be bigger a challenge, due to the expected incompatibility of the measurements and systems: *"So if you build a Green Barometer for [name academic hospital], it could look great, but whether it can be transplanted to another hospital is the question."(T007).* This could be a rather important implication, since the Green Barometer will serve as a benchmark at some point in time, which is why it is expected to be an important implication to consider when developing the Green Barometer.

The argumentation on the validation of the assessment tool is an extension of the aforementioned transferability to other hospitals, and to what extent it is communicated internally or also externally. When used internally as self-evaluation tool, **pragmatic validity** seemed to be the most relevant condition: *"I think that what is most difficult with a graduation study is the link between research and practice [...]From a care point of view you hear 'a whole research is done on it and what can we do with that?' And from the university, 'yes it must be more scientific and which scientific construct is there?' [...] And then the tip is from us, try to make it as practical as possible for us. And I don't think that's what the university asks, but what's most useful to us."(T009).*

Alternatively, one respondent argued the **scientific validity** would be important as well, when the results of the assessment are externally accessible by for example insurance companies. They could use it as competitive advantage and manage their buying behaviour accordingly. When hospitals are judged and could experience negative impact from the measurement results, the scientific validity is expected to become more conditional: if the

measurements are not 100% scientifically valid, hospitals will argue they cannot be judged based on invalid measurement. On the other hand, one respondent pointed out *"It doesn't have to be scientifically proven down to the smallest details. For starters it would be nice if you were to get a very educational thing in the first phase"(T015).* This may suggest that scientific validity becomes more important when the assessment tool arrives at a later stage in the development process and the results are communicated externally, and thus may affect the hospital's image.

3) Institutionalising sustainability norms

Implications were identified that could influence the institutionalisation of sustainability norms in the field of healthcare, the first being **accounting for sustainability**: *"So we made participation in the network a precondition for signing the Green Deal and vice versa. So you can't just sign the Green Deal, because then you are automatically in the network. And if you are in the network, you basically say we do this because we think this is important, but also because we want to implement the Green Deal"(T015).* What this quote beautifully portrays, is that accountability embodies the conditionality of your actions, meaning they have consequences because you committed to something (in this case the Green Deal and a sustainable OR). In addition to signing the Green Deal, associations can write up a 'pledge' to specify how they will contribute to a more sustainable OR. Signing the Green Deal was seen as a formalisation but it meant more than just a signature, as the signing party was publicly committed and promising with the pledge: *"It is a commitment, you will have to put in effort."(T015).* However, as of today, these efforts remain difficult to verify, also due to the **lack of a sustainability benchmark:** *"I think that a lot of hospitals, I found at the last meeting, are searching. […] I think that everyone is really looking at each other like 'how do you do it' and 'how do you not do it'? What works and what doesn't? A Barometer could only help with these questions, because then you provide a tool like 'see, these are the important aspects'."(T009).*

Further, it was found that the benchmarking of sustainability efforts was expected to boost sustainability initiatives and efforts. The effect of comparing and benchmarking sustainability efforts and the impact of hospitals, would facilitate a degree of transparency in the 'best practices' for more sustainable ORs. The effect of this process of benchmarking and structural improvements is believed to (ideally) lead to the **creation of new norms** within the field of healthcare: *"It's got to be the case that as a hospital you want to be part of the group. That it would actually suck if you weren't part of that national network , if you don't do anything*

for sustainability. That it would become kind of awkward, that would be nice"(T011). However, the creation of these norms is viewed as the responsibility of the field of healthcare itself, as in the past, Dutch healthcare has been introduced to free market function. This means *"...you have to let it depend on private institutions and that there is little steering you can do from the government. That's what the people at the ministry of Healthcare on the Green Deal say, they say we can facilitate, we can encourage, but we cannot enforce it."(T010).* Agencies were found to be willing to monitor and **enforce these new norms**, as part of audits and inspections, provided that the field of healthcare is to put forward these new norms. Regulatory agencies have reportedly said *"[…] 'yes of course', the inspection says 'we don't make the standards. Those are field standards. The field creates the norms themselves and we will monitor and perhaps even enforce them if they are deviated from'."(T010).*

In sum, the aforementioned implications are expected to influence the institutionalising process of sustainability as a new norm within the field of healthcare, and therefore deemed important to be considered in order to secure the endurance of the accountability system.

4.2 Sustainability Assessment: the Green Barometer

4.2.1 Sustainable surgical tool measurement

The third and final main theme *sustainable surgical tool measurement* helped to create a concrete framework to answer the second research question: „How can sustainable surgical tool use in ORs be measured by the Green Barometer?" The implications on how to measure sustainable surgical tool use were described by respondents through the sub-themes of 1) *surgical tool management* and 2) *measurement indicators*.

1) Surgical tool management

One of the sub-themes that was mentioned by near all respondents as an overarching aspect of surgical tool measurement, was *surgical tool management*. One of the reasons for this, put forward by several respondents was unnecessary stock: *"...there's a lot of dead stock in hospitals. That's party old, that's partly unnecessary stock. Large ORs are often segment oriented, thorax at thorax, trauma at trauma, and Jan Piet and Klaas just order away, to put it bluntly."(T007).* By means of **supply management**, departments were expected to be able to have 'a helicopter view' over the existing stocks and manage it more efficiently. Consequently, the next aspect of surgical tool management that was perceived as important, was the change in **purchase behaviour** towards a more efficient one: *"... in some hospitals, for example, every*

department or specialty is allowed to place orders. Well, they've all got, they all order scissors, every department, for example, but that's no efficient use."(T002). When being ignorant of the available stocks within the hospital, this could lead to inefficient supply management, which costs the hospitals precious square metres, purchase budget and re-sterilisation processes as result of the expiring unused surgical tool sets.

Another aspect put forward by several respondents was the **ownership of surgical tools**, which means that surgical tools can be owned or leased by the hospital. One of the proponents for leasing surgical tools stated: *"At the end of the day, it doesn't matter what product you have or whether that product is yours. What's more important is that you can get a hole when you need it. And how that's organized at the back, that shouldn't be your cup of tea."(T007).* According to different respondents, opting for ownership or a lease contract with a supplier was perceived to be depended on the willingness of the surgeons to let go of their ownership of the tools, the reliability of having the right surgical tools at the right time, and being able to work with the most innovative tools. All these factors imply that there is to be a measuring system available that facilitates to monitor, check and plan all the processes in the most optimal manner. For surgical tool use, the **measuring abilities** of these processes proved to be manageable, due to the tracking system that is already in place at the sterilisation departments within hospitals and the ORs: *"Well, we know when a set comes in it's scanned, and then we know it's been in the washing machine and it's been assembled and it's been sterilised and it's going back to the OR. So the process on the CSA is pretty clear. So, you know, you can see how many sterilization rounds, say, processing rounds a set has had."(T001).* So, the processes were found to be rather transparent and measuring surgical tool use was found feasible, up until surgical tool-set level. In order to measure the sustainability of surgical tool use, several measurement indicators are identified within the next sub-theme.

2) Measurement indicators sustainable surgical tool use

Seven measurement indicators were identified (see **Figure 2.**), starting with the **standardisation of sets** to reduce unnecessary stock and sterilisation costs like water, energy and chemicals. As one respondent explained: *"If you get the process right, you could coordinate the contents of your instrument sets. So you make sure that different specialties can work with one basic set for example. That would mean that you don't have to make different basic sets for each specialty, but that you can cover different specialties with one basic set, so you need fewer instruments, and therefore less storage, less reprocessing costs."(T001).* By law, unused sets need to be re-sterilised after one year, to secure the sterility of the tools and the safety for the

patient. The reduction that can be achieved by the standardisation of sets may reduce the **number of re-sterilisations** (and therefore water, chemicals and energy) of unused surgical tools, as would other efficient ways of managing surgical tool stocks, like the earlier mentioned option to lease surgical tools from a supplier instead of **ownership**.

1.	Disposables vs. Reusables
2.	Number of re-sterilisations
3.	Extending product lifespan
4.	Standardising sets
5.	Reclaiming of old surgical tools
6.	Optimising sterilisation processes
7.	Consideration of packaging materials

Fig. 2. Overview of the identified measurement indicators for sustainable surgical tool use.

Another indicator was the choice between **disposable and reusable** surgical tools, as disposables generate more waste and could be reduced to the necessary minimum. When opting for reusable, the **extension of product lifespan** could be achieved through maintenance and the optimisation of sterilisation processes. At the end of their lifespan, surgical tools could be **reclaimed for circular purposes**. A reduction of **packaging materials** could be achieved by alternative ways to pack the surgical tools when leaving for the OR. For example, alternative mentioned to the current packaging material that is a mix of paper and plastic (making it un-recyclable), was the reusable iron containers: *"Well, look, that's an interesting question we're looking into right now, because in the end a container like that will last about 15 years. And after 6 or 7 years you've actually already recovered the costs that you would have spent on paper per year. So that's the cost. [...] how much paper do you use and throw away during the lifetime of 1 container over 15 years."(T002).* In line with this, the differentiation between disposable and reusable surgical tools was often made. Well weighed choices considering what can actually be gained or saved when opting for one or the other.

Ideally, all seven measurement indicators should be considered when measuring sustainable surgical tool use. For this reason, a **prototype** for the Green Barometer has been created by means of a concrete checklist for sustainable surgical tool use (see **Appendix 3**). However, to be able to measure the impact of these sustainability efforts, the measurability of these indicators should be further specified in measurement units, criteria and definitions, which need to be constructed and generally accepted by the stakeholders within the field of healthcare.

5. Discussion

This final chapter begins with the presentation of a conceptual framework as visualisation of the key findings (§5.1) of this study. Thereafter, the theoretical contributions of this study are discussed (§5.2), followed by directions for future research (§5.3). The managerial implications and recommendations are presented (§5.4). Finally, I provided a reflection on the learning process of this master thesis study (§5.5).

5.1 Key findings

The identified implications for introducing an accountability system within the field of healthcare form a *roadmap* of implications that should be considered in different stages of the change process. **Figure 3.** presents this roadmap in the conceptual framework as a visualisation of the change process through the main themes of this study, knowing; 1) *Legitimisation process for sustainability assessment*, 2) *Green Barometer as Accountability system*, and 3) *Sustainable surgical tool measurement*.
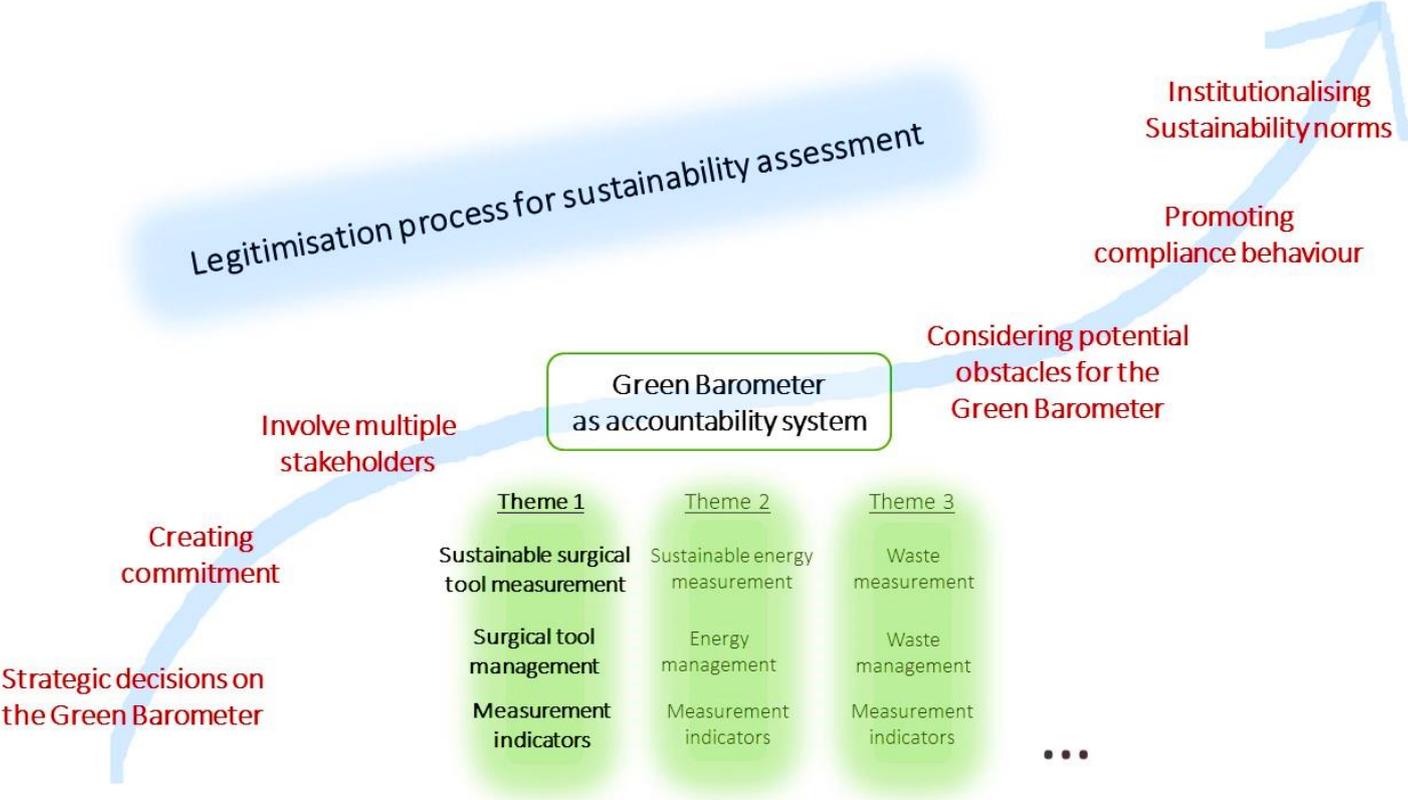

Fig 3 . Conceptual framework of the implications for the introduction of an accountability system in the field of healthcare through a legitimisation process for sustainability.

5.1.1 Legitimisation process for sustainability assessment

The findings of this study have led to a *roadmap* for the legitimisation process of sustainability assessment and the development of a prototype of the Green Barometer. However, the roadmap should be seen as an iterative process which may be subject to change due to contextual contingencies. Hence, the aim of the framework is to provide an overview of the implications of introducing an accountability system in the field of healthcare that were found in this study, which can serve as a guideline to develop a better understanding of the change process.

The blue arrow visualises the legitimising process for sustainability assessment. The two bends indicate the two different development phases of the accountability system in the legitimising process. The first phase encompasses the first three identified implications (shown in red). First, **strategic decisions on the Green Barometer** were deemed important implications, like the objective, the scope, who will have access in the results, the means of communicating these strategic decisions and the use of hierarchy in the field of healthcare in order to promote the Green Barometer as accountability system. Second, it was found that the **creation of commitment** could be achieved by prioritising sustainability and by creating multidisciplinairy teams in hospitals. Scientific associations and professional bodies were perceived to be able to play an important role in the spreading of commitment nationwide. Third, after the strategic decisions have been made and commitment is successfully created, the **involvement of multiple stakeholders** comes in. It has been suggested to centralise quality of patient care as primal focus, while creating internal collaboration within hospitals, but also the creation of external collaborations between hospitals around it to facilitate collaborations. Moreover, collaborations with the supply chain were perceived to be crucial for the development of innovative sustainability products and processes in the field of healthcare, that ideally should benefit the patient.

5.1.2 Green Barometer as Accountability system

The first phase merges in to the second phase, as soon as the legitimacy for sustainability assessment has been (mostly) realised. The second phase in the legitimisation process involves the implications for the Green Barometer as accountability. The accountability system will undergo a second development process with its own implications (shown in red) that were perceived to be crucial when transferring the accountability system nationwide (and perhaps even further in the future). **Potential obstacles** were identified as implications, like how the complex phenomenon of sustainability could be measured to assess the impact of sustainability

efforts. The decision on the type of software application system to facilitate the monitoring of the measurements was found to be essential for the transferability of the accountability system nationwide. The shift from pragmatic validity to scientific validity is expected to bring with it reconsiderations in the strategic decisions as discussed in the first phase. After this, **compliance behaviour** was expected to be promoted by providing oversight in sustainability efforts (i.e. the software application system), by creating a sense of responsibility by making (groups of) employees responsible for the monitoring of sustainability, and by facilitating social control amongst employees, regardless of the perceived hierarchy. Finally, the development of the Green Barometer from a self-evaluation towards a benchmark, is expected to ideally lead to the creation of new norms in the field of healthcare, concerning sustainability. This is thought to be the responsibility and collaborative endeavour of all stakeholders within the field of healthcare. Regulatory agents are found to be willing to enforce these new sustainability norms, which, ideally, leads to **the institutionalisation of sustainability norms** in the field of healthcare.

Fig. 4. Concept visualisation of the Green OR dashboard with the results. Design by Bouwzaken Radboud UMC (2020).

5.1.3 Sustainable surgical tool measurement

One of the main takeaways found in this study is that when accounting for sustainability, one has to be specific in *what* is being measured, *how* it is being measured, and *for what purpose*. The identified aspects on how sustainable surgical tool use can be measured, have been shown in **Figure 2.** in bold under 'Theme 1'. The integral approach of sustainability assessment is emphasised by including the other sustainability sub-themes like energy and waste under 'Theme 2' and 'Theme 3' in **Figure 2.**, even though energy and waste fall outside the scope this study. The three dots indicate room for other sub-themes to be added to the Green Barometer, like for example the sub-theme mentioned by several respondents; anaesthesia damps. The identified aspects of **surgical tool management** and **measurement indicators** for surgical tool use have been worked out in the *prototype checklist* with questions for surgical tool use measurement (see **Appendix 3**). **Figure 4.** on the previous page presents a concept visualisation of the *Green OR dashboard* as a communication device for the results of the measurement indicators that are to be monitored by the Green Barometer. The prototype developed within this research project could serve as a starting point for further development of the Green Barometer, by iteratively testing the prototype checklist and dashboard on stakeholders in the field of healthcare.

5.2 Theoretical contributions

The main theme of *legitimisation process for sustainability assessment* has been found to be at the core of the change process towards a more sustainable OR. This is in line with existing theories on the integration of sustainability strategies alongside the overall competitive strategy (Hengst et al., 2020). Within this legitimisation process, the development of an accountability system was found to be a collaborative effort that involves multiple stakeholders to ensure integration and substantive implementation, opposed to a mere symbolical adoption (Haack and Schoeneborn, 2015). So, the determination process on strategic decisions should include the involvement of multiple stakeholders. Within this study it was found that the communication of objectives, scope and results, were indeed ways to create the required commitment to follow through with sustainability efforts. The creation of (internal) commitment in the case of ORs within hospitals, showed a trade-off in priorities that was found to come down to sustainably operating and the quality of patient care. However, instead of making sustainability an objective that has to compete with quality of patient care, the integration were expected to be found in

finding sustainable practices and processes that add to the quality of patient care. It was expected that the tension between these seemingly different priorities could be reduced by using existing procedures to incorporate the sustainability strategy into daily practices of employees. The tight integration of sustainability into the daily practices of hospital workers was found to be one of the ways to create commitment. Moreover, the communication of results of the Green Barometer and the progress made in sustainability efforts were found to be drivers for commitment. In order for sustainability to be widely carried and integrated in organisational practices, collaborations on multiple levels in- and outside the organisation need to be considered (i.e. supply-chain collaborations, multidisciplinary teams in hospitals and collaborations between hospitals).

The aforementioned implications that were found within this study, show parallels with 'compliance barriers' known in accountability theory (Wijen, 2014). *Lack of attention* can be referred to the awareness and commitment that needs to be created in the first identified phase of the roadmap. *Lack of motivation* can be referred to the promotion of compliance behaviour by creating a sense of responsibility, and to the facilitating of social control amongst employees regardless of the hierarchy. *Lack of knowledge* can be referred to the provision of oversight in sustainability efforts by for example the software application system or dashboard. These parallels show the linkage between theory and findings of this study, yet, what this study specifically has found, is the importance of timing and the reconsiderations that need to be done during the process, in order to create legitimacy for sustainability assessment within the field of healthcare. Again, this highlights the iterative and explorative character of the process of legitimacy creation for what is to be the introduction of the first accountability system for sustainability in the (Dutch) field of healthcare.

Due to complexity and contextual contingencies of sustainability, which were confirmed within this study, it is perceived hard to define the 'ideal' sustainability assessment process (Pope et al., 2004; Wijen, 2014). However, this study found that by signing the Green Deal and additionally writing up a pledge, these contingencies could be tackled by specifying objectives and efforts for the specific organisational context and capabilities. These findings are supported by research of Pope et al. (2004), who argued that objectives-led integrated assessment requires clear defined socioenvironmental and economic objectives as a benchmark to which the assessment can be conducted. This approach is assumed to be "more likely to result in 'win-win-win' outcomes, contrary to a 'triple bottom line' view of sustainability, which is deemed unlikely to be successful (Pope et al., 2004; Elkington, 2018).

The social construction of measurement indicators, measurement units and weighing mechanism, were found to be important according to the respondents in this study, and is also supported in sustainable assessment theory (Singh et al., 2009). This social construction is supposed to enable the sustainability assessment system to continuously develop parallel to the interests and demands from stakeholders and the field itself.

Resolving the gap between theory and practice was found to be crucial for the effectiveness of the Green Barometer. 'Propositional', 'narrative' and 'visual' modes for pragmatic validity could be matched to the varying needs and context to which the knowledge is to be applied at that specific phase of the change process (Worren et al., 2002). This can be linked to the essential role of software application systems that need to be considered when deciding upon the scope of the Green Barometer (self-evaluation or benchmark). One of the findings in this study, is the shift from pragmatic validity in the first phase to scientific validity in the second phase. Once the pragmatic validity seems to be in place and the scope could be expanded from internal to external, the scientific validity was expected to increase in importance.

Furthermore, the different types of isomorphism as defined by DiMaggio & Powell (1983) were found in this study. The signing of the Green Deal could be seen as *coercive isomorphism*, as it formally pressures hospitals, associations and suppliers within the field to commit to sustainability goals. The demand for a benchmark for sustainability could be seen as *mimetic pressures*, as the lack of knowledge on sustainability assessment within the field of healthcare creates comparison behaviour between hospitals, since everyone is looking how to contribute to the ambiguous sustainability goals. However, *normative pressures*, emerging from 'professionalisation', was found to be one of the most crucial type of isomorphism. The field of healthcare was found to inhabit a great variety of professional associations which could facilitate the integration of sustainability assessment in the field of healthcare. These professional bodies could also play a role in monitoring compliance to the constructed expectations, i.e. by enabling processes of training, education, certification and celebration ceremonies (Greenwood et al., 2002), like for example the publicly signing of the Green Deal.

In sum, this study has contributed to the existing theories of accountability and sustainability by applying them to the field of healthcare. The legitimisation process for an accountability system for sustainability in this field was found to be characterised by different phases within this process that require reconsiderations of strategic decisions on the Green Barometer and a shift from pragmatic validity towards scientific validity. Finally, the legitimisation process found to be based on the social construction of the accountability system,

and compliance behaviour was found to be promoted by the signing of the Green Deal and through the potential role of professional bodies that transcend hospitals.

5.3 Directions for future research

This study on accounting for sustainability with the specific focus on the field of healthcare has certain limitations. Firstly, with the consultation of our 'gatekeeper' and based on previous research (Eijsackers, 2018), the sub-themes of waste, energy and surgical tool use had been chosen as specific focus. However, several respondents have mentioned the inclusion of anaesthesia damps as another sub-theme the Green Barometer, because it was thought to be relatively easy to quantify and define. Consequently, the quantification and definitions of measuring units could be another aspect that needs further research, perhaps through a (quantitative) survey study among several hospitals to come to an agreement on these specifics.

Secondly, as of today, there is no accountability system in place within the field of healthcare. We found ourselves in the middle of a sustainability transition in a very dynamic field with multiple players pushing and pulling. Since we found ourselved only at the initial phase of the development of an accountability system like the Green Barometer, the focus may have primarily been on the creating awareness and legitimisation process, simply because that was all the experts and stakeholders we have consulted could have experienced up until now. When looking further in the process, one can only speculate about what is expected to happen, or what has been seen in other organisational fields. So, the institutionalisation of sustainability norms or standards, created by accountability system, remains underexamined within the field of healthcare. Recommendations for future research would be to continue a (longitudinal) research from where the Green Barometer research project left off, and study the development of the change process that only time can tell.

Third, another important finding of this study has been the possible role professional bodies and associations could play in both the legitimisation process and the enforcement of new sustainability norms within the field of healthcare. Combined, these two insights could be the focus of future research, by specifying further how professional bodies influence the transition towards sustainability within the field of healthcare.

Finally, the hierarchy that has been perceived in healthcare, could be viewed as both an opportunity and a threat in creating commitment for sustainability. Therefore, studying how the process of creating commitment for sustainability could be influenced by the perceived hierarchy in the field of healthcare is presented as the final recommendation for future research.

5.4 Managerial implications and recommendations

The identified implications are perceived to be important considerations in the development and eventually introduction of an accountability system in the field of healthcare. However, it may be helpful to look at specific implications at different phases of the legitimisation process for sustainability assessment.

First of all, it is suggested to clearly state what the **objective and scope** of the Green Barometer as accountability system is intended to be. It is suggested to achieve this, preferably through a process of social construction in a collaborative effort of all stakeholders in the field of healthcare. This is expected to increase the positive perception of legitimacy. For the first phases in the change process a **self-evaluation** behind closed doors is advised, since hospitals were found to be 'not fond of lists' and the impact of monitoring sustainability have not yet to been proven. This way, hospitals can develop the **pragmatic validity** of the Green Barometer in a relatively 'safe' environment, without judgement. In the second phase in the legitimisation process **scientific validity** was found to increase in importance, due to the external extension of the scope and benchmark function of the accountability system, meaning judgement and ranking are included as characteristics. For this, the formulation of specific measurement indicators and measurement units should be socially constructed, in a collaborative effort of all the stakeholders within the field of healthcare. This has to be as concrete as possible to increase the validity of the measurements, in order to ensure the comparability of the data from different hospitals. After a period of self-evaluation and internal developments, the Green Barometer could undergo a second round of considerations on strategic decisions to enable the transfer nationwide. Ideally, after that period of trial error, the rough edges will be polished and the transformation towards a nationwide benchmark will be possible.

Secondly, when the objective and scope of the Green Barometer are clear, the communication of the accountability message needs to be spread among hospitals within the Netherlands. The use of **professional bodies** in both phases of the legitimisation process would be a smart move to consider, as scientific associations and professional bodies were found to transcend hospitals and form nationwide networks for all kinds of specialisms and professions that deal with the OR. Meaning, they are perceived and expected to play an essential role in **creating commitment** in the initial phase and **promote compliance behaviour** in the latter phase, or act as regulatory agent to enforce the newly created sustainability norms within the field of healthcare.

Third, it was found that insufficient oversight in sustainability efforts and non-committal negatively was perceived to influence the support of sustainability initiatives. Therefore, compliance should be promoted by **creating a sense of responsibility** among health professionals by assigning groups of people within the organisation with the important task of sustainability assessment. Moreover, they should have the means to manage and control the implementation, to stimulate proactiveness amongst hospital workers.

Fourth, another managerial implication that needs to be considered is the perceived hierarchy that was found to limit the **social control** to a top-down one-way street. Within this study, social control was perceived difficult in the field of healthcare. For this, it is advised to facilitate a social control culture where all hospital workers are being integrated in sustainability efforts so they feel safe to speak up against unsustainable practices, regardless of the hierarchy.

Finally, in order to accurately measure the indicators for the sustainability sub-themes, certain adjustments or extensions of **software application systems** have to be considered to make the monitoring doable. Pragmatic validity was found the be essential in the first phase of the legitimisation process. Therefore, it is recommended to keep this application as close to existing systems and work processes as possible, to maximise the effectiveness of data input. As discussed earlier, in a later phase in the legitimisation process, these software application systems should be transferrable to enable the spreading of the Green Barometer nationwide, and the shift towards a more scientifically valid accountability system is expected to increase in importance. Therefore, it is recommended to keep these implications in mind when deciding on a software application system that should be applicable on the long term, in both phases.

5.5 Reflection

Looking back at the last few months of doing research for this master thesis, I can safely say that I had to alter expectations and planning schedules more often than one can imagine. Agreeing upon contributing to such a large project within an academic hospital was quite out of my comfort zone. Before this research project, I had no idea of the organisational challenges to promote sustainability within the field of healthcare. As I could experience the dynamics of a hospital from up close by interacting with people from within and outside the hospital, I slowly began to see the organisational relations within the hospital, and later on within the field of healthcare. I remember feeling like a rookie, diving into the new and abstract theoretical field of accountability. Where to start? Maybe more importantly, where to stop? Only after conducting all the interviews and starting to see the connections within the data, I started to get

a sense of direction. That may be one of the biggest lessons for me this master thesis project: to force myself to focus on one certain direction to prevent getting lost in the many theories and perspectives on accountability and sustainability assessment.

Furthermore, doing a master thesis research in Corona times has also brought its challenges. For this research project, the healthcare sector being thrown in a global pandemic could not have come at a worse timing. At a certain point we were not even sure we would be able to collect our own empirical data, so we started to work with existing secondary data to at least keep making progress. Later on, I was moved that apparently so many people were willing to share their thoughts and experiences with us about a subject that was certainly not a number one priority during the Corona crisis. It is nice to see that even in times of crisis, people are still willing to look at the bigger picture and busy themselves with how we can move forward from this, preferably in a sustainable direction.

I am glad that I had the opportunity to learn how interesting, dynamic and most of all how inspiring the field of healthcare is, especially concerning sustainability. I liked how being part of this research project made me realise how sustainability really touches everything. Even though I am proud of what we were able to contribute to this project, I would say it felt more like being part of the change process itself, even if it was just a tiny part. I feel thankful for everyone who let us peek in to the field of healthcare and look forward to see how the sustainability transition in healthcare will unfold.

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Appendices

Appendix 1.   Interview guide

Interview-guide Green OR: Change process

Introduction: We are trying to contribute to the development of a barometer for the green OR in the Netherlands. For my contribution to the research, I focus specifically on making surgical instruments more sustainable and the possible reactions and obstacles concerning the implementation of the Green Barometer in the field of healthcare.

1) Can you explain what your role is in the green OR / barometer so far?
2) What are your experiences in this process so far?
3) What has helped to create support so far?
4) What have you done to make the message understandable?
5) Who needs to be convinced (of this message)?
6) What would be the best way of communication concerning the implementation process?
7) What reactions do you expect from stakeholders within the field of healthcare?
8) What obstacles would you expect when implementing a green barometer (in other hospitals)?
9) Do you have any final advice for me?

Interview-guide Green OR: Surgical tools

Introduction: For my contribution to the research, I focus specifically on the sustainability of surgical tools and the possible reactions and obstacles concerning the implementation of the Green Barometer in the field of healthcare.

1) What does the whole process regarding surgical tools involve?
2) In which aspects of the use of surgical tools could sustainability play a role? Can you give examples? (e.g. design, use, cleaning, packaging, lifespan etc.)
3) How could the sustainable use of surgical tools be measured? Can you give examples of this? (How feasible do you think this is for employees in their daily work? Why?)
4) Could this be applied to all hospitals (because of the benchmark)? Which aspects are important, for example, for a national implementation of the benchmark?
5) How will the field of healthcare react to making sustainable use of surgical tools measurable? (Which aspects do you think play a role in this?)

Combined interview guide Green OR (Change process & Surgical tools)

Introduction:
As described in the mail, together with Vera and Ruby, I try to contribute to the development of a barometer for the Green OR in the Netherlands.

For my contribution to the research, I focus specifically on making surgical tools more sustainable, and the possible reactions and obstacles to the introduction of the 'Green Barometer' in the field of healthcare.

The goal is to gain insight into the possibilities for sustainable use of surgical tools in the hospital and how this could best be monitored by means of a 'Green Barometer'.

In order to be able to analyse the interview properly for the research, I would like to ask your permission to record the interview. This way, I have all the attention for our interview and by transcribing the audio recording directly afterwards I am sure that I have not missed anything. Your data will be treated confidentially, the results will be anonymized and used exclusively for this research.

1) Can you explain what you / your company does and what the role of you / the company is in the field of sustainable use of surgical tools?
2) What are your experiences in this process so far?
3) What has helped to create support for this so far?
4) In which aspects of surgical tool use could sustainability play a role? Can you give examples? (e.g. design, use, cleaning, packaging, durability, etc.)
5) How could the sustainable use of surgical tools be measured? Can you give examples of this? (How feasible do you think this is for employees in their daily work? Why?)
6) Could this be applied to all hospitals (because of the benchmark)? Which aspects are important, for example, for a national implementation of the benchmark?
7) How will the field of healthcare react to making sustainable use of surgical tools measurable? (Which aspects do you think play a role in this?)
8) What would be the best way of communication concerning the implementation process of the Green Barometer?
9) Who needs to be convinced (of this message)?
10) What reactions do you expect to making sustainability measurable within the field of healthcare?
11) What obstacles would you expect when implementing a Green Barometer (in other hospitals)?
12) Do you have any final advice for me?

Closing of the interview:

I would like to thank you for your time and cooperation in this interview about how sustainability can be measured in a 'Green Barometer'. Do you have any questions for me?

Appendix 2. Codebook

Main theme 1. Legitimisation process for sustainability assessment.		
Sub-themes / 2nd order code	**1st order code**	**Quote:**
1.1 Creating commitment.	1.1.1 Prioritising sustainability.	*"I think there is a real risk when there are other priorities, it becomes the first thing to drop off the list. [...] So you have to look for the link between sustainability and patient safety. And sustainability and the quality of care or quality of life. If you are able to argument that as well, it will help"* – Transcript 015.
	1.1.2 Creating multidisciplinary teams in hospitals.	*"That integrated controlling that has been included in the strategy requires a brave translation how are we going to make sure that we will compose integrated teams. [...] You know, to make sure that both facility and care workers feel connected to it because it has to do with their daily work practices"* - Transcript 010.
	1.1.3 Role for scientific associations.	*"... I was thinking, okay, we want to create a more sustainable OR, whom to call? Well I figured the staff who work in the OR, so that's mainly the surgeons, anaesthesiologists, but also for example plastic surgeons or gynaecologists or ophthalmologists. So through the scientific associations of the medical specialists, [...] that's where I knocked on the door and that's where the national network for the green OR emerged from."* - Transcript 016.
	1.1.4 Role for professional bodies.	*"Also the large symposiums like the national surgeons' days, that's where almost all surgeons from the Netherlands come together, that's the place where you need to tell your story, because they listen to these stories and bring that back to their own hospitals"* - Transcript 016.
1.2 Involve multiple stakeholders.	1.2.1 Internal collaboration within hospitals.	*"You have to realise that you are dealing with other professionals, so nurses, paramedics, sterilisation services. These are all involved in the OR".* - Transcript 015.
	1.2.2 External collaboration between hospitals.	*"Well, and then you can look at how are going to break it down sustainably, and how can we collaborate with other ORs. Because a waste processor will not adjust his processes for just [name academic hospital]. So that's why we*

		have that national network to tackle these goals together and to see if we can't make a kind of fist against the big manufacturers and waste processors." - Transcript 016.
	1.2.3 Supply-chain collaborations.	*"So that business model from ownership to use - as I call it for arguments sake - they are willing to do that. But they say customers do not ask for it yet. So there's a kind of cycle that needs to be broken: the customers are waiting for suppliers to come up with it and suppliers think well those customers are obviously not interested so it's not the right time yet. So then it's necessary to come together to start the dialogue."* - Transcript 010.
	1.2.5 Quality of patient care.	*"...look a patient is not interested in how much costs you save, a patient is interested in what kind of care do you provide, qualitatively. And patients are becoming more and more interested in the way you deal with things. And I think that if you are able to show as a hospital how you deal with things, why you do things, what your vision is as a hospital, and how that ultimately benefits the quality of care for that patient, because in the end it's all about that patient".* - Transcript 002.
1.3 Strategic decisions on the Green Barometer.	1.3.1 Objective Green Barometer.	*"Hospitals aren't fond of lists you know, so they wouldn't be fond of a kind of ranking. Definitely not, they will say our hospital cannot be compared to another hospital. [...] So as I mentioned earlier, you should not connect judgement to it. [...] it's okay if you're not doing it at the moment, you know, so you need to introduce it right, what do we want with the Green Barometer. Without pointing fingers so to speak."* – Transcript 016. *"I very much believe that people are triggered when sustainability is accompanied by cost reductions. [...] And I think it is powerful when you connect the two."* – Transcript 007. *"The 'green side' at [name] I noticed to be very intrinsic, at a controller it will become a signboard. You know, a poster 'we are green' ".* - Transcript 007.
	1.3.2 Scope Green Barometer.	*"Look, are you making a Green Barometer for hospitals to use among themselves, or will it soon become a*

		barometer that patients can also access? Well, those are things that could be very important in determining what we want to do with it and how we want to design it". – Transcript 002.
	1.3.3 Results Green Barometer.	*"[…] to show, look we are making progress. Every time you turn off the light switch has an effect. It can especially be of great help in communicating about the impact of the initiatives we implement".* – Transcript 009.
	1.3.4 Use of Hierarchy in healthcare.	*"The moment a surgeon says 'I don't feel like doing this', it gets very complicated for assistants to say 'you know doctor, and yet we are still going to do it'. Because if that surgeon is a bit of a dominant personality, then it's more complicated, definitely with new initiatives that haven't been 100% proven to lead to improvements. You need a certain faith to initiate change, and for that you need commitment. Really through all layers but especially those people who hierarchically seen have a higher position."* – Transcript 006.
	1.3.5 Means of communication.	*"We are hands-on people at the OR, not too much behind a computer. I don't mind it that much, but the majority chose to not do an office job"* . – Transcript 004.

Table 1. Main theme 1. Legitimisation process for sustainability assessment.

Main theme 2. Green Barometer as Accountability system.		
Sub-themes / 2nd order code	**1st order code**	**Quote:**
2.1 Promoting compliance behaviour.	2.1.1 insufficient oversight sustainability efforts.	*"We are not each other's nannies in that perspective and it is somewhat expected that people take responsibility themselves for that."* - Transcript 004.
	2.1.2 Non-committal influences support.	*"Sometimes, when it looks like it's a one-an action there is little support, so it has to be communicated from the head of department for instance".* - Transcript 005.
	2.1.3 Creating sense of responsibility.	*"I also think it's important that there's someone who feels somewhat responsible for it. So if we would have a green barometer, I can imagine saying oh, I'll make sure I discuss this with you and then we'll get the picture as a*

		whole. And if you don't have that, who's going to make sure you are measuring that." – Transcript 010.
	2.1.4 Social control perceived difficult.	*"...you have a certain hierarchy in the OR, so the surgeon has quite a lot to say. And when the surgeon says 'I think it's nonsense', for an operating assistant it's very difficult to then say 'you may think it's nonsense but that's how we are going to do it now' ".* - Transcript 009.
2.2 Considering potential obstacles for the Green Barometer.	2.2.1 Sustainability a complex issue.	*"...if you look at it from an organisational perspective, I would say that its indeed corporate because it is so integral. It has to do with facility it has to do with care processes it has to do with construction, everything. Actually, there's nothing that doesn't touch the theme of sustainability."* - Transcript 010.
	2.2.2 Measuring impact difficult.	*"Because we do say that 'measuring is knowledge', but actually we cannot quantify and express that much at the moment."* – Transcript 009.
	2.2.3 Pragmatic validity.	*"I think that what is most difficult with a graduation study is the link between research and practice [...]From a care point of view you hear 'a whole research is done on it and what can we do with that?' And from the university, 'yes it must be more scientific and which scientific construct is there?' [...] And then the tip is from us, try to make it as practical as possible for us. And I don't think that's what the university asks, but what's most useful to us."* – Transcript 009.
	2.2.4 Scientific validity.	*"It doesn't have to be scientifically proven down to the smallest details. For starters it would be nice if you were to get a very educational thing in the first phase".* – Transcript 015.
	2.2.5 Software application systems.	*"So if you build a Green Barometer for [name academic hospital], it could look great, but whether it can be transplanted to another hospital is the question."* – Transcript 007.
2.3 Institutionalising sustainability standards.	2.3.1 Accounting for sustainability.	*"So we made participation in the network a precondition for signing the Green Deal and vice versa. So you can't just sign the Green Deal, because then you are automatically in the network. And if you are in the network, you basically say we do this because we think this is important, but also because*

		we want to implement the Green Deal". – Transcript 015.
		"It is a commitment, you will have to put in effort." – Transcript 015.
	2.3.2 Lack of sustainability benchmark.	*"I think that a lot of hospitals, I found at the last meeting, are searching. [...] I think that everyone is really looking at each other like 'how do you do it' and 'how do you not do it'? What works and what doesn't? A Barometer could only help with these questions, because then you provide a tool like 'see, these are the important aspects' "* - Transcript 009.
	2.3.5 Creation of sustainability norms.	*"It's got to be the case that as a hospital you want to be part of the group. That it would actually suck if you weren't part of that national network , if you don't do anything for sustainability. That it would become kind of awkward, that would be nice".* – Transcript 011. *"...you have to let it depend on private institutions and that there is little steering you can do from the government. That's what the people at the ministry of Healthcare on the Green Deal say, they say we can facilitate, we can encourage, but we cannot enforce it."* - Transcript 010.
	2.3.6 Enforcing sustainability norms.	*"...'yes of course, if the inspection says 'we don't make the standards. Those are field standards. The field creates the norms themselves and we will monitor and perhaps even enforce them if they are deviated from'."* - Transcript 010.

Table 2. Main theme 2. Green Barometer as Accountability system.

Main theme 3. Sustainable surgical tool measurement.		
Sub-themes / 2ⁿᵈ order code	**1ˢᵗ order code**	**Quote:**
3.1 Surgical tool management.	3.1.1 Supply management.	*"...there's a lot of dead stock in hospitals. That's party old, that's partly unnecessary stock. Large ORs are often segment oriented, thorax at thorax, trauma at trauma, and Jan Piet and Klaas just order away, to put it bluntly."* – Transcript 007.
	3.1.2 Purchase behaviour.	*"... in some hospitals, for example, every department or specialty is allowed to place orders. Well, they've all got, they all*

		order scissors, every department, for example, but that's no efficient use." - Transcript 002.
	3.1.3 Ownership surgical tools.	*"At the end of the day, it doesn't matter what product you have or whether that product is yours. What's more important is that you can get a hole when you need it. And how that's organized at the back, that shouldn't be your cup of tea."* – Transcript 007.
	3.1.4 Measuring abilities.	*"Well, we know when a set comes in it's scanned, and then we know it's been in the washing machine and it's been assembled and it's been sterilised and it's going back to the OR. So the process on the CSA is pretty clear. So, you know, you can see how many sterilization rounds, say, processing rounds a set has had."* - Transcript 001.
3.2 Measurement indicators.	3.2.1 Disposables vs. Reusables.	*"Personally I think you have to consider are some things just better to have reusable or disposable. [...] so is it more convenient to pack some things in laminate, so just, per piece, or do you choose to put it on a large set where there are more instruments?"* – Transcript 004.
	3.2.2 Number of re-sterilisations.	*"R1: On the one hand of course because it takes up space, because it takes up finances, but for a third, eh of what happens constantly on those surgical complexes when material as surgical tools is sterilized, it has a certain expiry date. [...] And after that it has to be re-sterilised. [...] And if that is never used then eh what you actually do is you put unnecessary capacity on sterilisation centres, but you also sterilise things that are not used at all, so you only make costs, unnecessarily, for those instruments."* - Transcript 007.
	3.2.3 Extending product lifespan.	*"When you are able to maintain it well, the objective must be [...] to handle it as optimal as possible so it has a longer lifespan and you throw it away less quickly".* - Transcript 002.
	3.2.4 Standardising sets.	*"If you get the process right, you could coordinate the contents of your instrument sets. So you make sure that different specialties can work with one basic set for example. That would mean that you don't have to make different basic sets for each specialty, but that you can cover different specialties with one basic set, so you need fewer instruments, and therefore less*

		storage, less reprocessing costs." - Transcript 001.
	3.2.5 Reclaiming of old surgical tools.	*"And the old set of instruments that we collect, we sort it out and let it be melt down, and we buy this sheet metal to make things out of. So the second objective, apart from the fact of eh repair maintenance and durability, is also to make products circular"*- Transcript 003.
	3.2.6 Optimising sterilisation processes.	*"[…] we work with standard baskets of 60 by 30, if you could shrink them for those sets, then you could pack more sets in the autoclave. You do not have more sterilisation possibilities, but the capacity increases a bit because the sets are smaller. You could theoretically calculate that you would get a more efficient process with less materials and chemicals. That could be possible, but if you would ever be able to substantiate that… I doubt it."* - Transcript 001.
	3.2.7 Consideration of packaging materials.	*"Well, look, that's an interesting question we're looking into right now, because in the end a container like that will last about 15 years. And after 6 or 7 years you've actually already recovered the costs that you would have spent on paper per year. So that's the cost. […] how much paper do you use and throw away during the lifetime of 1 container over 15 years."* - Transcript 002.

Table 3. Main theme 3. Sustainable surgical tool measurement.

Appendix 3. Prototype Green Barometer: surgical tool use

3.1 Prototype general instruction leaflet

Instruction leaflet: prerequisite information

General information:
- This hospital concerns a(n):
    - Academic medical centre
    - Community hospital
    - District hospital
    - Government hospital
    - Clinic

- The number of operating rooms of the hospital:
  … ORs

- The number of surgeries per month / per year:
  … per month / … per year.

Disclaimers:
- All question in the checklist refer to "to what extent" precautions are being taken. This means that answering them with "yes" or "no" is not sufficient.

- In the case of there being no information available on a certain measurement indicator, this will result in zero points for the corresponding indicator.

- Measurement indicators will be compared per operating room to secure the comparability and transparency. Meaning: measurement indicators have to be measured in the specified measuring unit per month / per year. These numbers need to be calculated per operating room in order to be comparable.

- The type of hospital will be included in the comparison with a correction factor for more complex surgeries (is yet to be determined, based on empirical data).

- The aim of the self-evaluation is data collection to obtain a zero reading of the momentarily status. Based on this zero reading, a comparison scheme has to be created to benchmark the data.

Definitions sub-themes:
- **Energy:**
  "All the electricity consumed in an operating room".
- **Waste:**
  "surgical apparatus, devices, material or other articles that are used in the operating rooms, that will be thrown away".
- **Surgical tools:**
  "surgical apparatus and devices used in operating rooms when performing surgery on a patient". *Surgical tools such as implants do <u>not</u> fall within this definition.

Self-evaluation:
- Please attach a short summary (textual, visual, video, be proud and creative) of how sustainability efforts have been initiated and how this compares to the situation to a year prior. This may help to visualise your achievements and a source of inspiration for other hospital to promote sustainability.

3.2 Prototype checklist for surgical tool use

Surgical tool use (10 points)

General

1.   Who is owner of the surgical tool sets?
   o   The hospital itself own the surgical tool sets.
   o   The hospital does not own the surgical tool sets, but makes use of a lease contract with a supplier.

2.   Who is responsible for the surgical tool management?
   o   The central sterilisation department.
   o   The assigned surgical tool manager.
   o   A dedicated team for surgical tool management, *consisting of ...*
   o   The supplier of the lease contract.
   o   Each department is responsible for its own surgical tool management.

3.   On which aspects are surgical tools managed?
   o   Procurement
   o   Supply
   o   Repairs & replacements (maintenance)
   o   Reclaiming of old surgical tools

4.   What percentage of the total amount of surgical tools in the operating room is disposable?
   … %

5.   What has been done so far to reduce the number of surgical tool sets?
   *Please select the box(es) that is/are applicable:
   o   Standardisation of surgical tool sets
   o   Standardisation of surgical tool sets + composition of additional sets per specialism.
   o   Standardisation of surgical tool sets + few separately packed surgical tools on the OR.
   o   Otherwise, namely …

Lifespan surgical tools
6.   In what way(s) is attempted to extend the lifespan of surgical tool sets?
   …

7.   In what way(s) is sustainability taken into account at the sterilisation process of surgical tools?
   o   Water consumption is monitored

- o Environmentally friendly chemicals are considered, such as …
- o Energy consumption is monitored
- o By deliberately selecting a certain sterilisation technique, namely …
- o Not known.

8. **What percentage of the total amount of surgical tool sets are sterilised each year as a result of the expiration of the expiration date for sterility?**
… %

Reclaiming of old surgical tools
9. **What percentage of surgical tools are being reclaimed for circular use?**
… %

10. **To what extent is the OR part of an "surgical tool pool" for exchanging excess surgical tools?** *If so, how did this come about?*
…

Awareness
*Please select the box(es) that is/are applicable and provide an elaboration:
- o There is a sustainability policy regarding the management of surgical tools, *namely*
  …
- o The sustainability policy with regard to the surgical tool management is transparent and accessible for all groups of OR staff, *by means of*
  …
- o There is training to educate all groups of OR staff about sustainable use of surgical tools, *such as*
  …
- o All groups of OR staff know how sustainable tool use can be achieved, *this awareness is achieved by*
  …
- o All groups of OR staff have the opportunity to share their ideas on sustainability for surgical tool use, *through*
  …