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"Delivering on Expectations": The Potential of the Climate Budget to Facilitate Transformative Change

Julie Høie Nygård *, Elin Anita Nilsen and Mette Talseth Solnørdal

The School of Business and Economics, UiT The Arctic University of Norway, 9019 Tromsø, Norway; elin.nilsen@uit.no (E.A.N.); mette.t.solnordal@uit.no (M.T.S.)
* Correspondence: julie.h.nygard@uit.no

Abstract

Climate budgets are increasingly used by municipalities as a framework for monitoring emissions and aligning local actions with broader climate goals. Despite their growing use, their potential to support transformative climate change remains underexplored. This study examines the formal configuration of management controls in climate budgets and discusses their potential to facilitate transformative change. Drawing on the levers of control framework and the concept of dynamic tensions, we conducted a qualitative document study of climate budgets from eight municipalities in Norway. Our findings identify a predominance of controls centred on targets, indicators, and monitoring. By contrast, controls intended to promote dialogue and learning, establish behavioural boundaries, or articulate shared values and purpose were considerably less visible. The climate budgets are therefore well equipped to monitor predefined emission-reduction measures and support accountability, but provide a more limited formal basis for questioning assumptions, reconsidering priorities, and developing new responses. The study shows that performance information may contribute to transformative change when used as an input to dialogue and learning processes. Municipalities should therefore complement emissions monitoring with clear climate-related boundaries, shared purpose, and processes that use performance information to explore alternative responses.

Keywords: climate budget; sustainability control systems; document analysis; climate governance; transformative change

1. Introduction

Transformative change towards sustainability is receiving increasing attention in debates on responses to climate change [1,2], and it entails structural readjustment across society. Transformative change involves "a fundamental, system-wide change that includes consideration of technological, economic and social factors, including in terms of paradigms, goals, and values" [1] (p. 6). Climate mitigation commitments have been established through international agreements and ratified and implemented by member states through national policies and measures [2]. However, achieving transformative change also requires local implementation [3,4], as cities are responsible for up to 80% of greenhouse gas (GHG) emissions [5]. Cities and local governments have been at the forefront of climate actions over recent decades [3,6,7]. However, local leaders and decision-makers face policies, institutional structures, instruments, and infrastructure that hamper climate transformation [8,9]. They often lack the mandate, expertise, financial resources, and/or institutional capacity to control high-emitting activities within their jurisdiction [4,10]. This

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has led to increased focus on tools and systems to reduce local GHG emissions [9,11,12]. One such tool is climate budget tagging (CBT), which identifies and tracks climate-relevant expenditure in public budgets and has been adopted across national contexts [12]. While CBT can increase the visibility of climate spending and support accountability, lessons from practice indicate that it should be complemented by reporting systems and other governance arrangements, particularly when CBT principles extend across governmental levels and organisations with different institutional capacity [12]. Another system aimed at reducing local emissions is the climate budget (CB), which, beyond expenditure tracking, aims to integrate climate objectives into municipal planning and budgeting.

Organisations' accounting and reporting play a mediating role in connecting sustainability with organisational behaviour [13], ensuring that activities align with strategic goals [14]. Prior research highlights management control systems (MCSs) as critical mechanisms for driving strategic change [15]. MCSs shape practices and support strategies (Ahrens and Chapman, 2007; Kober et al. 2007 in [16]), encouraging organisations to focus on climate transformation when used effectively [16]. Simons [17] (p. 5) defines MCSs as "formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities". However, traditional MCSs are viewed as limited in addressing sustainability issues [16], and therefore, sustainability control systems (SCSs) have emerged to support organisational sustainability objectives [18,19]. SCSs are described as "management accounting tools that connect strategy with operations by providing information and direction, as well as monitoring and motivating employees to continually develop sustainable practices and procedures for future improved sustainability performance." [18] (p. 34). The CB falls into this description.

Introduced by Oslo Municipality in 2016, CBs extend beyond financial budget lines by bringing together emission targets and accounts, planned climate measures, responsibilities, monitoring arrangements. They also link these elements to relevant climate, energy, and land-use strategies. Their aim is to connect climate objectives with municipal decision-making, implementation, and follow-up, thereby supporting GHG emission reductions and local climate governance [6,20,21]. Since their introduction, CBs have been adopted globally in cities such as Mumbai, New York, and London [22,23]. Although individual Norwegian municipalities decide the scope, depth and focus of their climate policies [24–26], the Norwegian government expects municipalities to set "ambitious goals" and "use a wide range of roles and instruments" to reduce GHG emissions [27]. CBs are viewed as a key instrument to help Norway meet its climate targets and transform into a low-carbon society [28,29].

Despite confidence in CBs, research on their impact on municipal decision-making and climate governance remains limited [4,6]. According to Gond, Grubnic, Herzig and Moon [16], little is known about the processes by which MCSs enhance the integration of sustainability within organisational strategy, and with some exceptions, most previous research does not critically examine the enabling of the transformative potential of SCSs in organisational change [15]. In their review article, Garcia-Torea, Larrinaga and Luque-Vílchez [13] found that the accounting literature was generally inconclusive as to whether sustainability accounting practices elicit sustainable organisational change [13] (p. 24). However, studies that concluded that sustainability accounting was likely to initiate change emphasised that the potential for change was linked to whether its practices informed internal decision-making and whether addressing sustainability was mandatory [13] (p. 25). It is also important to question the degree of change taken as a standard in these kinds of studies. The classification by Hopwood et al. [30] regarding approaches to change towards sustainability shows that most prior research in sustainability accounting has adopted a "reform" approach to change [30]. The reform approach accepts the need for change

in business and governmental policy, but disagrees that the problems are urgent or that fundamental change is required [15] (p. 1211). Accordingly, on a continuum from weak to strong sustainability, the standard for assessing change is placed in the middle, meaning that most studies do not address transformative change.

Overall, empirical studies conclude that MCSs aimed at sustainability accounting generate limited change [15,31]. For instance, Narayanan and Boyce [15] found that an MCS was non-transformative in sustainability efforts, whereas other scholars [32] question whether reducing sustainability into a form of management control can be associated with transformation efforts at all.

Addressing the gap in research on the transformative potential of MCSs, we pose the following research question: How can we understand the potential of the climate budget as a sustainability control system to facilitate transformative change?

This is timely, as CBs represent a novel approach to climate mitigation, blending elements of MCSs and SCSs [16,33,34]. We conducted a qualitative document analysis of CBs from eight Norwegian municipalities, which were among the first to adopt CBs globally [35].

We apply Simons' [17] levers of control (LOC) framework, emphasising balance [36,37], as our analytical tool in this study. In line with Narayanan and Boyce's [15] (p. 1218), we find that this provides a comprehensive framework through which CB, as an SCS, can be theorised, and a lens through which the different types of controls that may be integrated into CBs can be identified and analysed. This framework identifies four key processes, namely belief, boundary, diagnostic and interactive controls, that organisations use to implement strategy. The reasoning is that the full potential of the four LOCs is realised when they are mobilised together to facilitate the attainment of an organisation's strategic objectives. This can be understood as management control balance [37] (p. 2), which is a prerequisite for producing change (Henri 2006b; Widener 2007 in [36] p. 499). It aligns with Narayanan and Boyce's [15] assertion that socially responsible organisations embed all four controls to drive sustainability performance. Rahi et al. [38] found that the LOC framework is highly advocated as a control tool capable of incorporating sustainability strategies. We take this as additional support for choosing LOC as our analytical framework to mirror the controls of a CB and the balance between them.

Drawing on Simons' [17] levers of control framework and Mundy's [36] elaboration of balance, we conceptualise balance not as an equal numerical distribution of controls, but as the capacity to combine controlling and enabling controls in ways that may create productive dynamic tensions. Such tensions may enable municipalities to pursue emission targets and accountability while simultaneously supporting learning, reflection, and the reconsideration of established practices. Through a qualitative document study, we examine the formal configuration of controls articulated in CB documents and discuss its potential to facilitate transformative change.

The remainder of this paper is organised as follows: First, we outline the study's theoretical framework. Second, we explain the analysis methodology. Third, we present the results. Finally, we discuss the potential of a CB as an SCS to facilitate transformative change and suggest further research.

2. Theoretical Framework

2.1. Transformative Change

Transformative change, increasingly central to climate change discussions, is applied as both an analytical and normative concept, encompassing technology, innovation, economic restructuring and societal responsibility [24,39–41].

In the field of organisational change, transformative change has been analytically addressed for decades [40,42]. There are many nuances to the discussion of what transformative change is, how it can be achieved, and how it can be distinguished from other forms of change [43]. Despite its conceptual plurality, transformative change is widely understood as a fundamental shift rather than incremental adjustments [43]. For the purposes of this study, we differentiate between first-order and second-order change [41,42], which are also conceptualised as the depth and scope of change [40]. Transformative change aligns with second-order change, involving fundamental shifts in structures, norms, and values, requiring deep interventions to reframe problems and practices [44,45]. Unlike second-order change, first-order change occurs within existing mindsets, aiming to improve existing practices without questioning whether these are suited to meet future challenges or addressing the norms and values that underlie the practices [40]. Section 5.1 illustrates the distinctions between first- and second-order change through examples from the CB documents. To further illustrate the concept of transformative change, we draw on Meadows' (1999) hierarchy of intervention points for leveraging change [46].

Meadows' (1999) leverage points range from "shallow" to "deep", with second-order change requiring interventions targeting values, goals, and system structures, while first-order change focuses on adjusting parameters within existing frameworks [46]. To understand the potential for CB to facilitate transformative change in municipalities, this study analyses whether municipalities design their CBs to target first- or second-order change.

2.2. Levers of Control as a Theoretical Lens

This study applies Simons' [47] LOC framework, which identifies four key processes through which MCSs influence organisational strategy and facilitate change [15,48].

Diagnostic controls define, measure and monitor key performance targets for the organisation [37] (p. 4). Diagnostic processes create tangible and visible activities that employees must perform to achieve the organisation's strategic goals [14], in which corrective action is taken based on feedback about performance [36].

Boundary controls are used to restrict opportunity-seeking behaviour. They communicate risks to be avoided if the organisation's objectives are to be achieved and are meant to "delineate the acceptable domain of activity for organisational participants" [17] (p. 39). Simons [49], in Martyn et al. [50] (p. 284), defines boundary systems as "formal systems used by top managers to establish explicit limits and rules which must be respected". By communicating those activities deemed acceptable and those considered off-limits, boundary processes aim to prevent employees from wasting the organisation's resources [36] (p. 501).

Belief controls are an explicit, formal set of organisational statements that managers use to communicate the organisation's values, purpose and direction in terms of a coherent strategic agenda [14,17,51]. Mission statements aim to ensure the commitment of employees towards common goals and inspire them to search for opportunities and solutions [36,52]. This form of control can be defined as efforts to persuade staff to adopt certain values, norms and ideas about what is good, important and praiseworthy in their work [53].

Interactive controls are formal two-way communication processes between managers and subordinates at different organisational levels [36] (p. 501). Simons [54] (p. 216) defines them as "the formal information systems that managers use to personally involve themselves in the decision activities of their subordinates". Interactive processes can enable managers to identify challenges to their strategic agenda by facilitating discussion of the rationale for an organisation's action plan and access to new knowledge to promote development [14]. Managers can encourage learning through open communication chan-

nels, frequent meetings and feedback. Unlike diagnostic controls, which entail single-loop feedback, interactive controls involve double-loop learning [17,50].

2.3. Balance and Dynamic Tensions

Our understanding of CBs' potential to facilitate transformative change relies on the concept of a balance between management controls. The LOC framework is explicitly concerned with the balance of MCSs to facilitate creativity while also providing constraints on employees' behaviour [36] (p. 500). Mundy [36] makes a distinction between the controlling use of diagnostic and boundary controls, associated with predictability, efficiency, formality, and meeting short-term targets, and the enabling use of belief and interactive controls, which are associated with spontaneity, transparency, adaptability, and information sharing [36].

A balanced approach to MCSs, in which controls are complementary [37], will foster innovation, learning, and adaptability, representing the potential for transformative change [36,55]. Mundy [36] and Bisbe et al. [56] further argue that an organisation's inability to balance different types of management control is associated with slower decision-making, wasted resources, instability and ultimately lower performance. Scholars also argue that the concept of interactive controls is particularly important in relation to transformative change, as interactive use of sustainability-related information could reflect a greater concern for climate change issues, compared to simple diagnostic measurement and reporting [15] (p. 1219).

In this study, balance is not understood as an equal numerical representation of Simons' four levers of control. Such an interpretation would treat balance as a static attribute and would overlook the different roles that controls may play.

Drawing on Mundy [36], we understand balance as an ongoing effort to combine controlling and enabling uses of management controls. This effort may generate dynamic tensions between predictable goal achievement, accountability and the implementation of intended strategies, on the one hand, and opportunity-seeking, learning, adaptation and the development of new responses, on the other. Rather than being produced by individual control elements in isolation, dynamic tensions emerge through the ways actors mobilise and combine controls in practice. Balance is therefore not an end-state in which all controls are equally present, but a means through which organisations keep these competing yet interdependent demands simultaneously in play [36].

3. Methodology

We conducted a qualitative document analysis of the 2023 CBs from eight municipalities to explore their content. The CBs examined are embedded in municipalities' statutory action and financial plans. They are therefore broader than sets of climate-related budget lines: they combine climate targets, emissions accounts, planned measures, monitoring arrangements, and links to implementation and budgeting. Accordingly, this method is well-suited for examining sustainability reports [57] and CBs [11], as these documents play a key role in shaping climate discourse and action. Our study focused on the final CB documents, which represent the primary public outcome.

Our research question guided us in structuring our analysis in two stages. First, we identified and analysed the different types of controls integrated into the CB documents by applying the LOC framework. We used the Gioia method [58] to structure the data analysis, which included steps such as coding text, exploring emerging themes and aggregating dimensions. Second, in our search for a balance in management control, we examined the content by frequency. The following sections provide a detailed explanation of our methodological decisions.

3.1. Data Selection

We selected eight Norwegian municipalities with varying levels of CB experience and ambitious emissions reduction goals (60–95% by 2030) [59]. The cases range from 45,891 to 709,037 residents and from category 1 to 3 on Norway's six-category centrality index [60]. They capture variation in municipal scale, urban context, major emission sources, and CB maturity, while sharing a common institutional setting. Major emission sources include road traffic, other mobile combustion, energy supply, and shipping [61] (Table 1). The first CBs were developed between 2017 and 2021. We analysed the 2023 CB documents, obtained in PDF format from municipalities' websites and through direct contact. These are embedded in statutory action and financial plans, linking climate objectives to routine municipal planning and budget processes [62]. The contextual indicators reported in Table 1 refer to 2023, unless otherwise stated.

Table 1. Case municipalities and CB documents from 2023 included in the analysis.

Municipality	Population	Centrality Index	Main Emission Sources	CB Starting Year	Document Containing the 2023 CB	CB Pages (Total Document Pages)	Emission-Reduction Target
Arendal	45,891	3	Other mobile combustion Road traffic Waste and wastewater	2021	Action and financial plan 2023–2026	11 (197)	76% by 2040
Bergen	289,330	2	Other mobile combustion Road traffic Energy supply	2018	Action and financial plan 2023–2026	25 (664)	85% by 2030
Bodø	53,259	3	Other mobile combustion Shipping Road traffic	2021	Financial plan for 2023–2026	13 (191)	70% by 2030
Fredrikstad	84,444	2	Other mobile combustion Road traffic Energy supply	2020	The municipal director's proposal for financial plan 2023–2026 and annual budget 2023	12 (157)	60% by 2030
Oslo	709,037	1	Road traffic Energy supply Other mobile combustion	2017	Budget 2023 and financial plan 2023–2026	41 (838)	95% by 2030
Stavanger	146,011	2	Other mobile combustion Road traffic Shipping	2021	Action and financial plan 2023–2026	13 (309)	80% by 2030
Trondheim	212,660	2	Other mobile combustion Road traffic Energy supply	2018	The municipal director's proposal for action and financial plan 2023–2026, budget 2023	22 (390)	80% by 2030

Table 1. *Cont.*

Municipality	Population	Centrality Index	Main Emission Sources	CB Starting Year	Document Containing the 2023 CB	CB Pages (Total Document Pages)	Emission-Reduction Target
Tromsø	77,992	3	Other mobile combustion Shipping Road traffic	2020	Action plan 2022–2025	7 (181)	85% by 2030

3.2. Data Analysis

To examine CBs' potential to facilitate transformative change, we first systematically coded the documents to capture their content. Subsequently, we applied the LOC framework to identify emerging themes and aggregated the dimensions accordingly. Finally, we analysed the balance of management controls employed within the CBs. The detailed process is described in the sections below:

The first step involved creating a broad set of open codes closely aligned with the original text. We used NVivo to analyse the CBs to capture statements, ambitions and action points. This process involved creating codes that reflected the meanings of the sentences and paragraphs in each CB document. The unit of coding was a text segment, defined as a distinct statement, ambition, action point, or passage expressing a meaningful climate activity, objective, or responsibility. Tables and figures were coded when their content conveyed such a statement or action, rather than being treated merely as formatting or numerical illustrations. Headings, quotations, and references were coded only when they conveyed something not otherwise captured in the accompanying text. Similar phrases were coded separately, resulting in a high number of codes. For example, Bergen Municipality mentions its aim to become a fossil-free city in three separate sections of its CB. Each mention is coded as a unique statement, linked to the theme "Priority areas for developing critical performance variables" and connected to the characteristics of diagnostic controls. Another example is how Arendal Municipality highlights the uncertainty surrounding the current methods and underlying figures. This was observed in three different sections of its CB, and we coded each mention uniquely to estimate the attention given to this issue. In this case, the issue relates to the theme "Acknowledging uncertainties and devising strategies to combat them," which concerns interactive controls. Each text segment was assigned to one control category. To capture frequency, we coded repeated references to the same control feature separately each time they occurred within a document, allowing us to estimate the relative attention given to different management controls. Ambiguous segments were coded according to their primary control function, as interpreted in their textual context. The same classification criteria were applied across all municipal documents. All pages of the included documents were coded, comprising 144 pages in total and yielding 1005 unique codes. Codes were merged into first-order concepts by identifying similarities in wording and meaning. For example, several municipalities emphasised their role as promoters, leaders, or frontrunners in inspiring others to address climate change. These statements were merged into the first-order concept of "Understanding roles and maintaining reputation", capturing the essential meaning of the combined codes. The first-order concepts were named with document-centric terms, similar to what Gioia, Corley and Hamilton [58] would call "informant-centric terms". The 1005 codes were merged into 24 first-order concepts summarising key meanings within the documents.

Second, the first-order concepts progressed into second-order themes. We applied an abductive approach [63], using the LOC framework as a lens. Inspired by the methodological steps of Wiersema and Mors [64], we sought emerging themes and asked questions to ascertain how the various concepts related to the chosen theoretical framework [65]. For example, our data revealed that municipalities emphasised the need for more impactful measures to meet emission targets and an improved framework to facilitate this. These findings led to the second-order theme of "Limited flexibility in implementing climate measures". Additionally, we found that municipalities were using emission calculations to guide their climate priorities and models to validate their strategies, leading to the second-order theme of "Data to support and prioritise climate measures". Through iterative cycles of analysis, moving back and forth between the 24 first-order concepts and the theoretical framework, we extracted eight second-order themes. These themes remained document-centric and closely tied to the empirical findings, although we applied the LOC framework abductively.

Third, we developed the second-order themes into aggregated dimensions (see Figure 1). We combined these themes based on their core meaning. For example, the themes "Priority areas for developing critical performance variables" and "Data to support and prioritise climate measures" agreed with the descriptions of diagnostic controls. Similarly, the themes "Responding to external climate demands" and "Integrating into the formal structure of the organisation" aligned with the characteristics of belief controls.

The three-step coding process [58,63] allowed us to develop a transparent data structure and visualisation of the analytical process, as illustrated in Figure 1. We validated our findings by triangulating the results with an expert panel of municipal employees and stakeholders, accessed through the authors' association with Include (https://www.globe.uio.no/english/include/, accessed on 5 May 2026)—Research Centre for Socially Inclusive Energy Transitions.

The coding and relative distribution of control elements provided a descriptive mapping of the formal controls made visible in the CB documents. Frequency was not treated as a direct measure of balance. Instead, it indicated the relative prominence of different control forms in the documents. Document prominence does not necessarily correspond to practical significance or impact. Because balance depends on how controlling and enabling uses of controls are combined in practice [36], the document-based design cannot establish whether municipalities generate dynamic tensions. We therefore use the observed distribution as a basis for discussing the transformative potential of the formal CB configuration.

The findings should be interpreted in light of two limitations. First, the analysis is based on eight Norwegian municipalities and may not be directly generalisable to other institutional contexts. Second, although the LOC framework is well established and appropriate to the study's aims [47,50], its use as an analytical lens may direct attention towards control-related features while giving less prominence to other relevant aspects of the CBs.

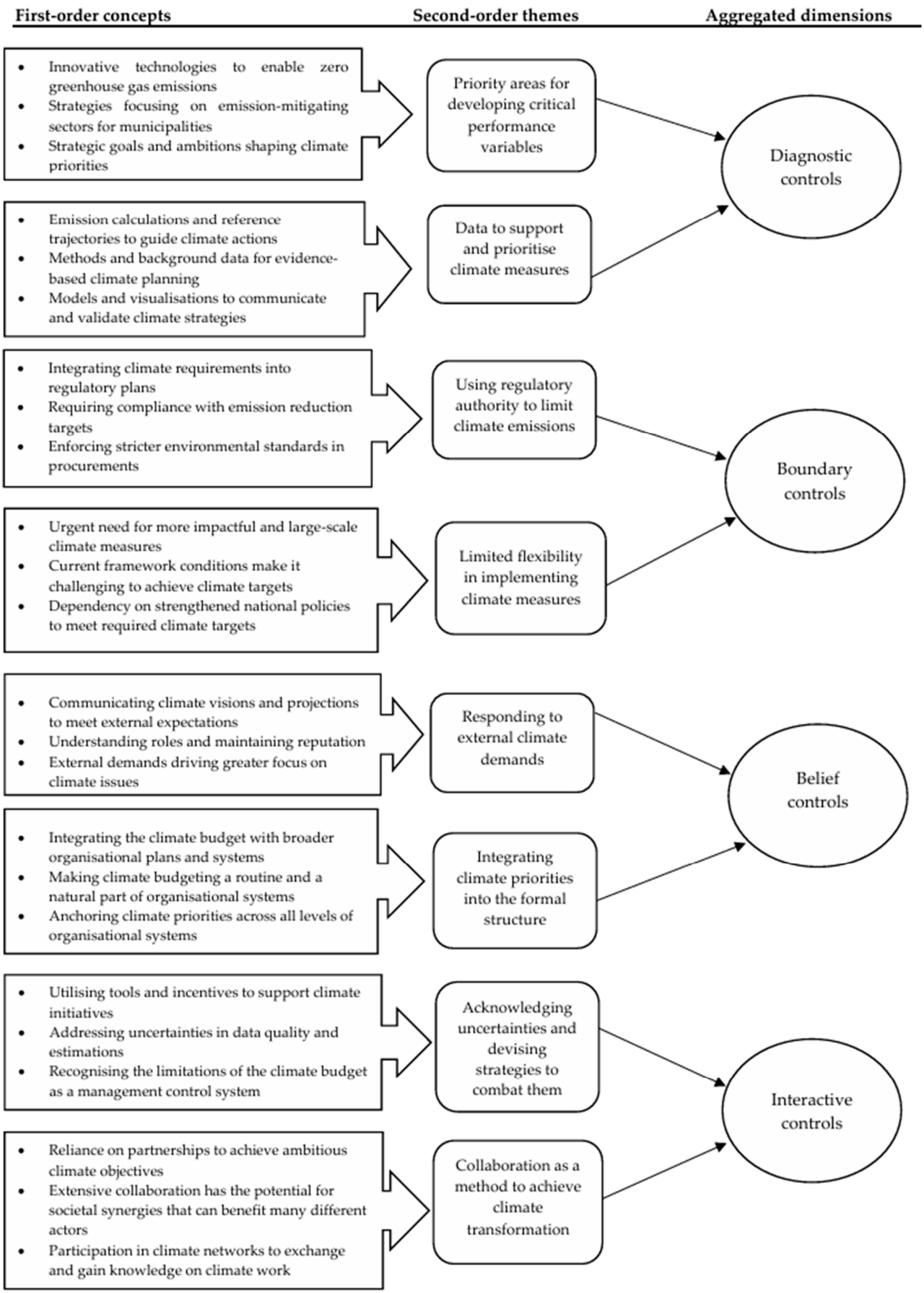

Figure 1. Data structure.

4. Results

This section presents findings from our analysis of eight municipalities' CBs, highlighting connections among concepts, themes, and aggregated dimensions (Figure 1). The results are structured into two sections: management controls in CBs and their frequency across the data.

4.1. Management Controls in CBs

4.1.1. Diagnostic Elements of Climate Budgets

Our analysis shows that CBs focus on critical performance variables and data to manage GHG emissions. Municipalities primarily target sectors under their jurisdiction, using data from the Norwegian Environment Agency to assess current emissions, prioritise mitigation efforts, and track progress.

Alongside municipalities' focus on emission-mitigating sectors, there is a pressing need to enable the adoption of zero-emission technologies, given municipalities' role as service providers. Many municipal services are linked to mobility and transport, as well as buildings and energy use, with mobility and transport receiving the most attention in CBs. Examples of zero-emission technologies, such as electrified car parks, renewable energy and passive houses, are among the solutions mentioned to address these challenges. All the municipalities in this study have clear climate goals and ambitions. Examples of climate goals include Trondheim's aim to double the cycling share of all journeys by 2024 [66], Arendal's goal to be fossil-free by 2030 [67], and Stavanger's zero-growth target for personal traffic by 2029 [68]. These examples represent different concepts with a common focus on measuring and monitoring specific areas that municipalities regard as priorities.

Another theme that reflects diagnostic controls is found among first-order concepts that emphasise calculations, evidence-based data and visualisations to guide climate planning and actions. Municipalities use reference trajectories and data from the Environmental Agency to calculate emissions, design models, and visualise climate measures. These examples represent various strategies employed to prioritise and monitor climate measures. The municipalities use diverse data and methodologies to assess their emission situation and subsequently support their climate priorities:

> "This [a reference path] attempts to quantify the future development of emissions if no new measures are taken." ([69] p. 59)

> "The table of direct emissions shows an overview of the measures that will have an effect on our climate accounts (. . .). These are measures that address emissions within the municipality's geographical boundaries." ([70] p. 18)

To summarise, diagnostic elements are demonstrated through municipalities' monitoring of key emission goals and their estimation of the impact of climate measures. The diagnostic elements identified in CBs represent different approaches to measuring and controlling critical areas of concern.

4.1.2. Boundary Elements of Climate Budgets

For municipalities, the climate crisis necessitates setting clear limits on what is accepted and what is not within their jurisdiction. Two overarching themes emerge within the aggregate dimensions of boundary controls in CBs.

Municipalities play a key role in land use and transport planning [71], setting boundaries through emission-free procurement requirements and zero-tolerance policies for natural-area destruction [72,73]. Another way to establish these boundaries is through their legal frameworks, such as urban development plans. This is evident in how municipalities define specific limits and minimum standards within their jurisdiction:

> "Oslo municipality has required all new urban development plans to have fossil-free building and construction activities." ([73] p. 17)

Moreover, by introducing zero-emission districts into their plans, municipalities can define boundaries for entire areas within their jurisdiction:

> "Nyhavna is to be built as a zero-emission district with sustainable use of resources. Both private developers and the municipality must follow the plans." ([66] p. 70)

While these examples highlight the opportunities available to municipalities, our analysis also shows the need for more explicit regulations within their legal framework to establish the climate requirements necessary to reduce emissions. The following quote reflects how municipalities recognise that more stringent measures, along with greater national support, are necessary to meet climate targets:

> "(. . .) an underlying problem has long been that the national targets for emission cuts have been significantly lower than the targets in Bergen. (. . .) This means that national measures are insufficient to reach Bergen's emission targets, and much of the greenhouse gas emissions in Bergen are controlled by national and international policies, rather than local policies." ([74] p. 60)

Bergen Municipality criticises weak national climate ambitions, highlighting how they undermine local policies and reflect the interdependence between local and national authorities.

Another variant of a municipality lacking room to manoeuvre to achieve its climate objectives is the CB of Trondheim Municipality [66] (p. 56), which states that the barriers it faces in achieving its climate objectives are connected to its role as a regulatory authority: "For Trondheim municipality to achieve its climate goals, municipalities need to be given leeway in the Planning and Building Act to set climate requirements in urban planning".

In summary, boundary controls are evident throughout the CBs. However, there is also a pressing need for stronger boundary control processes to enhance municipalities' flexibility in implementing more stringent measures to achieve their emission targets.

4.1.3. Belief Elements of Climate Budgets

Norwegian municipalities present new climate-friendly directions for their organisations through their CBs. The analysis reveals examples of municipalities acknowledging external demands and demonstrating how they respond to these. Additionally, we observe how municipalities attempt to integrate climate priorities into the formal structure of their organisations. These two themes represent different strategies to ensure the desired behaviour among municipal employees and are considered here as belief elements of CBs.

Municipalities acknowledge external expectations to prioritise the climate crisis and aim to position themselves as pioneers in climate solutions [66,74]. Furthermore, they demonstrate an understanding of what is required by emphasising their role as authorities at the local level within the broader context: "The long-term goal is to become a 1.5-degree city by 2050 in line with the UN climate goals in the Paris Agreement" [74] (p. 38). This illustrates how Bergen Municipality takes account of external expectations, such as the UN climate goals, and attempts to align its vision and climate ambitions with global agreements. Municipalities also communicate the importance of their role in the local community, underscoring how they must lead by example and set a precedent for climate-friendly actions:

> "Tromsø Municipality wants to take the lead in reducing CO_2 emissions in everything we do, as municipal authority, service provider, facilitator, purchaser

> and owner. (. . .) it is important that Tromsø, as the Arctic capital, becomes a pioneering municipality in the north." ([72] p. 73)

Throughout the CBs, it is evident that external demands, from both national authorities and the public, are driving a greater focus on climate work and related issues. Overall, these examples summarise the concepts behind the theme "Responding to external climate demands".

The second theme related to belief controls illustrates how municipalities incorporate CBs into their existing management systems, such as budget reports or municipal plans. Municipalities integrate CBs into existing systems, aligning climate reporting with financial reporting [66,70]. Other municipalities demonstrate how their CBs are connected to internal documents by ensuring that climate measures are based on subgoals from their overarching municipal plans [67] (p. 22).

Our data reveal how municipalities work to anchor CBs in their organisation, such as through policymaking that advises their employees on how to perform their tasks and determine key considerations:

> "The City Council must assess the climate consequences in all relevant matters that are presented to the City Board and will not make decisions that conflict with the municipal climate and environmental goals." ([74] p. 38)

Since climate measures span many municipal areas of responsibility (e.g., healthcare and road planning), these areas are also expected to report on them. This again demonstrates how the entire organisation plays a crucial role in achieving the ambitions outlined in the CB.

4.1.4. Interactive Elements of Climate Budgets

Municipalities address uncertainties and collaborate strategically, though they express frustration with the weaknesses in CB data and estimates for mitigating emissions. For example, some climate measures that municipalities emphasise as critical to their overall climate ambitions show no visible decrease in emissions within the framework of the CBs:

> "Indirect emissions are just as important to address and work on reducing as direct emissions, but they are difficult to track. A key limitation to the climate budget is precisely this: the effects of many effective measures cannot be measured or included in the climate accounts. This also applies to some of the most cost-effective climate measures a municipality can implement: climate-friendly procurement and land-efficient urban development." ([70] p. 16)

Municipalities highlight the limitations of incomplete and uncertain data for estimating emissions, reflecting challenges of operating in an unpredictable field. Municipalities are aware of the shortcomings of the data they use for estimating future emissions:

> "The climate budget is fraught with uncertainties because it is forward-looking, and several assumptions must be made to estimate the effects of measures. The uncertainty is related to the emission inventory, to the reference path, and to the assessments of the effects of planned climate measures." ([68] p. 19)

For municipalities, collaboration with local businesses, participation in climate networks, and engagement in national projects are strategies to counteract these uncertainties. They emphasise that such collaborations can create synergistic effects by engaging a larger group in effective climate work, as many important climate measures require cooperation among multiple actors. Participation in climate projects enables municipalities to develop new ideas and solutions:

> "Oslo Municipality must facilitate climate-friendly innovation and transformation through close cooperation between the municipality and the city's business community, researchers, organisations and residents." ([73] p. 23)

The analysis demonstrates how municipalities are aware of the uncertainties associated with CBs as SCSs for climate work.

4.2. Frequency of Management Controls

Narayanan and Boyce [15] emphasise that all four LOCs are required to facilitate transformative change, with diagnostic controls being just one component, as originally conceptualised by Simons [47]. Our analysis examined how management controls in the CBs were distributed across the eight municipalities, as shown in Table 2.

Table 2. Frequency and distribution of coded management controls across municipalities.

Municipality	CB Starting Year	Pages of CB	Diagnostic Controls	Boundary Controls	Belief Controls	Interactive Controls	Total of Types of Control
Oslo	2017	41	166	37	28	45	276
Trondheim	2018	22	67	23	33	24	147
Bergen	2018	25	133	24	17	6	180
Tromsø	2020	7	43	7	15	12	77
Fredrikstad	2020	12	55	6	6	6	73
Stavanger	2021	13	34	6	6	5	51
Arendal	2021	11	58	7	17	14	96
Bodø	2021	13	72	13	4	16	105

Table 2 reveals that CB lengths vary from 7 to 41 pages. Earlier adopters, such as Oslo (2017), Bergen, and Trondheim (2018), generally produce longer CBs. In contrast, municipalities starting in 2020–2021 have shorter CBs. The number of coded measures also varies, ranging from 51 to 276, often correlating with CB length. For example, Oslo's CB, with the most pages, also has the highest number of codes. Additionally, CB design elements, such as font size and the use of tables or illustrations, influence the amount of text available for coding. Figure 2 illustrates the percentage distribution of codes across the aggregated dimensions of management controls.

Figure 2 shows that all four aggregated dimensions of management controls are present in every CB. However, the distribution of coded content is consistently weighted towards diagnostic controls, which account for 45% to 75% of the codes. Boundary, belief and interactive controls receive comparatively less explicit attention, although the precise distribution varies across municipalities. This predominance does not, in itself, establish whether controls are balanced in practice. Rather, it indicates that the CB documents are formally configured primarily around diagnostic controls.

Our findings reveal a consistent diagnostic-heavy configuration of management controls across all cases, regardless of the CB's starting year (see Table 2). For example, both Oslo's CB (2017) and Bodø's CB (2021) devote a comparatively large share of coded content to diagnostic controls, while boundary controls receive less explicit attention.

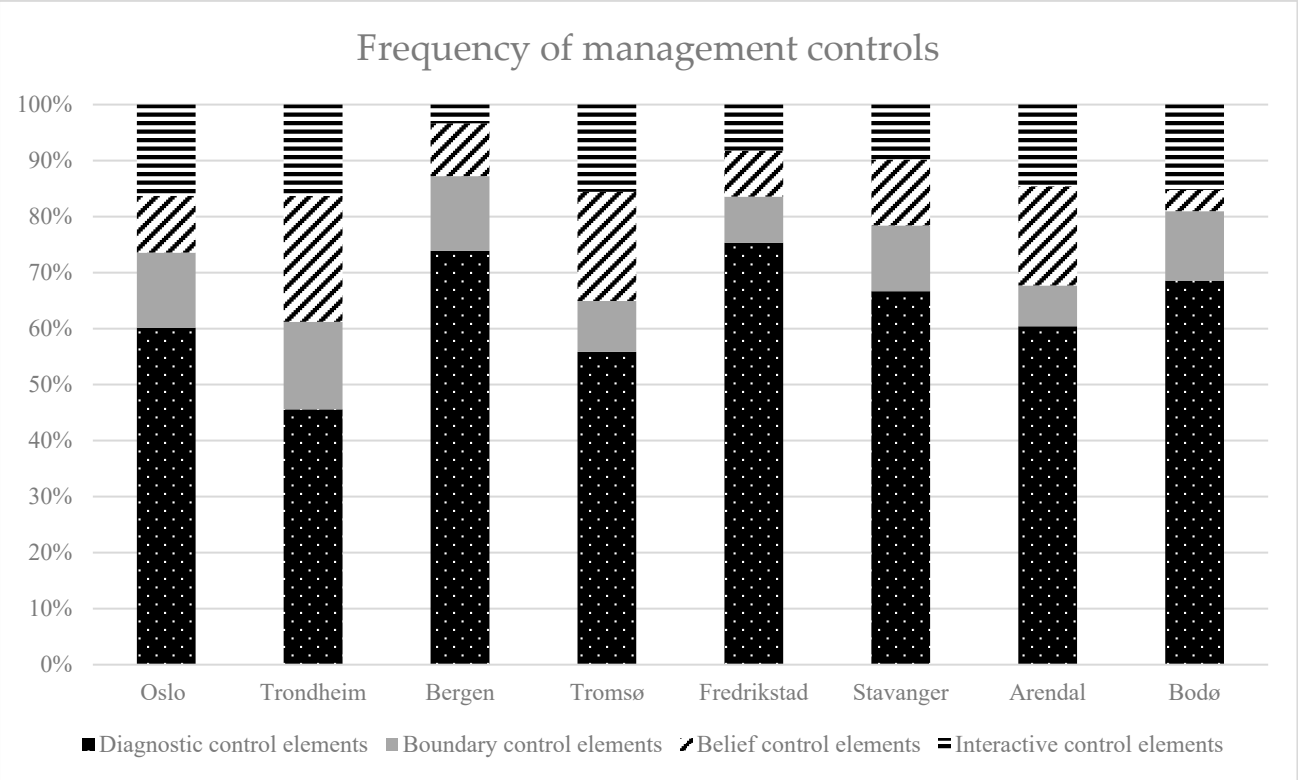

Figure 2. Distribution of coded LOC statements by municipality. Percentages show relative documentary attention, not an ideal equal distribution of controls.

Figure 3 shows substantial variation in sector-specific attention in the CB documents. Transportation receives the highest number of coded text segments, followed by energy and waste/recycling, whereas procurement and biodiversity receive comparatively limited attention. The prominence of transportation is consistent with municipalities' ability to influence transport-related emissions through land-use planning, local infrastructure, and measures supporting walking, cycling, and public transport [59,75,76]. As the former chair of the board of the Norwegian Association of Local and Regional Authorities (KS) stated, "The municipal sector can make the greatest contribution to climate goals through reductions in transportation and land use" [76]. Biodiversity is similarly an area in which municipalities have substantial influence, particularly through land-use planning. However, it receives comparatively limited attention.

Diagnostic controls predominated across the sector-coded text segments. Some tentative sectoral variation was nevertheless observed: construction-related segments contained relatively more boundary controls, whereas zero-emission technology included a comparatively higher share of interactive controls. Biodiversity also showed relatively more value-based controls and, to a lesser extent, interactive controls. However, this category comprised only six coded text segments. These patterns should therefore be interpreted as descriptive indications, rather than systematic differences between sectors or of controls in practice.

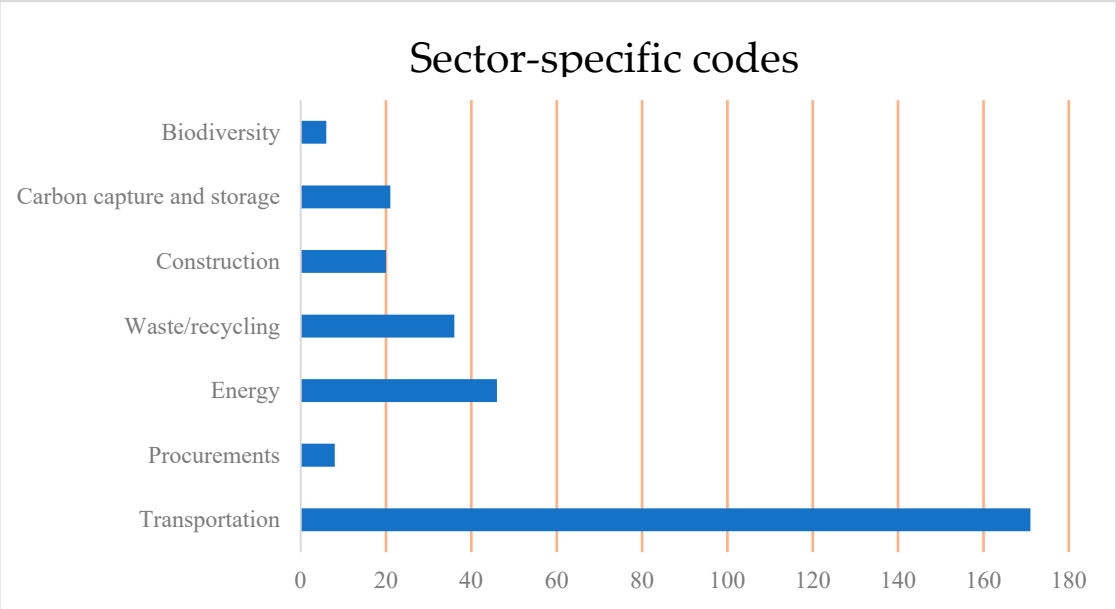

Figure 3. Distribution of sector-specific codes.

5. Discussion

In this study, we began by asking how we could understand the potential of the CB as an SCS to facilitate transformative change. CBs have emerged as a promising system for addressing climate change at the local level. They provide a structured framework for municipalities to monitor and manage GHG emissions while aligning local actions with broader climate goals. By integrating climate considerations into financial and operational planning, CBs help municipalities track progress, identify gaps, and prioritise emissions-reduction measures.

To assess the transformative potential of CBs, we first examine how the four controls are represented and what forms of change they may enable when considered separately. This control-specific analysis is important because diagnostic, boundary, belief, and interactive controls provide different resources for shaping organisational attention, behaviour, learning, and direction. Their relative presence or absence may therefore indicate whether CBs primarily support incremental adjustments within existing structures or create conditions for more fundamental change. However, the transformative potential of an SCS cannot be determined solely from the characteristics or prevalence of individual controls. In Mundy's [36] framework, transformation also depends on the dynamic tensions created through the interplay between them. The descriptive results of this study reveal a formal emphasis on diagnostic controls, which in turn provides a basis for discussing whether CBs, when formally designed, have the potential to create dynamic tensions and, thereby, transformation.

5.1. Individual Controls and First- and Second-Order Change

Diagnostic controls became evident through the use of numerous quantifiable measures in prioritised areas, combined with a focus on systems for monitoring outcomes.

This is reflected in the ambition to closely integrate CBs with municipalities' financial budgets. However, the predominance of diagnostic control elements has been widely criticised, as static, quantifiable measures may oversimplify complex issues [77–80]. Many relevant aspects are not readily quantifiable. Our data provide clear examples: municipalities report that effective climate actions cannot always be measured and are therefore excluded from climate accounting [68–70]. This may lead to an overemphasis on quantifi-

able elements at the expense of equally important issues, resulting in a narrow focus that neglects municipalities' broader goals [37]. Such a focus is particularly counterproductive when addressing a grand challenge such as climate change, which requires interdisciplinary efforts [81].

This diagnostic orientation may also help explain the sectoral priorities observed in Figure 3. Transportation, energy and waste management receive substantial attention, possibly because the emissions associated with these sectors and the anticipated effects of related measures can more readily be quantified and monitored. These sectors therefore align closely with a CB framework centred on emissions accounting and follow-up. Conversely, procurement and biodiversity may be more difficult to link directly to short-term GHG emission reductions and consequently receive less attention. This does not mean that these areas cannot be assessed; rather, assessment may need to extend beyond tonnes of CO_2e and short-term emission effects. Process-oriented parameters, such as implementation of climate requirements, cross-sectoral collaboration, stakeholder participation, organisational learning, and integrating climate considerations into decisions, could complement emissions accounting. Such parameters may retain accountability while making visible conditions that can enable transformative change (see also Hills and Maharaj [82]).

Although diagnostic controls are relatively easy to develop and record [15], they are often criticised for their static nature [77] and for leaving limited room for learning, participation, and change [76]. They also tend to encounter little stakeholder resistance [15]. Taken together, these characteristics suggest relatively shallow interventions. Abson et al. [46] (p. 33) argue that policy instruments that adjust parameters, by setting targets or providing incentives within existing structures, correspond to what Meadows terms shallow leverage points. While such interventions can produce beneficial outcomes, they are unlikely to generate transformative change on their own [46]. Thus, although diagnostic controls are important, when used in isolation they are likely to produce only first-order change.

Boundary controls are the least formally visible category in the documents, which may reflect municipalities' limited ability to enforce climate policies. Some municipalities, such as Oslo Municipality [73], enforce boundary controls, for example, by protecting bogs for carbon sequestration and biodiversity. These constraining and incentivising characteristics of boundary controls could be argued to hold transformative potential, as shown in Meadows' deep leverage points [46,83]. However, such examples are rare, despite municipalities' significant role in land-use planning. The lack of boundary control elements may lead to organisational uncertainty in decision-making and in determining how to avoid implementing policies that run counter to climate goals. It might also reflect the conflicting considerations and priorities of municipalities. Westskog, Aarsæther, Hovelsrud, Amundsen, West and Dale [24] argue that "transformative policies compete with other pressing, mandatory and short-term tasks" in Norwegian municipalities [24] (p. 14).

In this way, the potential for diagnostic and boundary controls to complement one another is reduced [38]. As these controls jointly perform the controlling function of an MCS, associated with predictability, efficiency, and formality, an imbalance between them in CBs may weaken the overall coherence and effectiveness of this function.

Belief controls are sparsely represented in our analysis and vary considerably across the CBs. Limited use may create ambiguity and weaken organisational direction [37]. Some municipalities, such as Trondheim Municipality [66], and Tromsø Municipality [72] emphasise the need to anchor climate goals across all units. However, the documents contain few statements directed at changing citizens' values towards more sustainable behaviour. Without a clear sense of purpose, procedures without direction may become inefficient [37]. The limited emphasis is analytically significant. In a municipal climate context, belief systems may help legitimise departures from established sectoral priorities and mobilise

commitment to long-term and uncertain change processes. Leadership is important not only in communicating a climate vision, but also in translating it into priorities, resource allocations, routines, and incentives that make new values actionable [84,85]. However, value statements in CBs cannot be equated with changed organisational values or practices. Organisations may formally endorse ambitious environmental commitments while everyday decisions continue to reflect established assumptions and priorities. Climate commitments may therefore remain symbolic or decoupled from operational practice [86,87]. This is consistent with research showing that climate ambitions are often accommodated within existing institutional arrangements rather than producing deeper changes in routines and practices [15,30]. The limited formal articulation of belief systems may consequently restrict the capacity of CBs to frame climate action as organisational and societal transformation. At the same time, CBs may be less suited to capture value-oriented, relational, or behavioural-change efforts whose effects are difficult to document. Alternatively, the limited articulation of such efforts may indicate that municipalities have not yet operationalised these intentions into concrete initiatives. Nevertheless, by formally articulating climate ambitions and priorities, CBs may contribute to a sustainability discourse to which municipal actors must relate, and may therefore perform a limited belief system function even where this role is less explicitly developed.

Interactive controls vary across CBs, with municipalities highlighting uncertainty about the impact of measures and frustrations with poor data quality, which hinders decision-making and prioritisation. Municipalities propose collaborations with stakeholders to access new knowledge and promote learning, but these efforts are hindered by a lack of strategic information on climate mitigation. At the same time, paying less attention to interactive controls risks reducing access to essential information and data, which are crucial for informed decision-making and further development. Our analysis reveals that municipalities perceive weak data as a significant limitation in CBs. However, one could expect more focused attention on how to utilise available information interactively in day-to-day work, enabling corrective action through learning by doing. Hence, the relatively limited focus on interactive elements in the CBs raises concerns about whether the transformative potential of interactive controls is being explored. Interactive processes, understood as communication processes and arenas for knowledge sharing and learning, play a crucial role in creating and maintaining a balance between the three other controls, because they enable the potential of the remaining controls to be realised as they determine the nature of the interrelations between all four [36]. This point is particularly relevant when considering Meadows' hierarchy of intervention points for driving change, which ranges from shallow to deep [46]. Within this framework, belief controls and interactive controls are identified as crucial for achieving the deeper shifts required for transformative change. This underscores the need for close collaboration between state and local governments, as well as interactive engagement with the community, to achieve transformative change.

Taken together, the analysis of the four different controls suggests that CBs may contain elements with varying potential to support first- and second-order change. Yet, this assessment remains incomplete if the controls are considered in isolation. Whether such potential is realised depends on how the controls interact in practice and whether their interplay generates the productive dynamic tensions that Mundy [36] identifies as central to transformative change.

5.2. The Potential for Dynamic Tensions and Transformative Change in Climate Budgets

The observed predominance of diagnostic controls raises questions about CBs' potential to generate the dynamic tensions associated with transformative change. The predominance of diagnostic controls is understandable in the context of CBs. The prominence of

diagnostic controls in the CBs may reflect their integration with municipal budgets and reporting systems, which rely heavily on diagnostic forms of control. Municipalities need to specify emission targets, define indicators, allocate responsibilities, monitor implementation and follow up on deviations from plans. These features may strengthen accountability and provide an organisational focus for climate action. In this sense, diagnostic controls are a necessary part of making climate ambitions governable. However, on their own, they do not ensure that actors question whether the targets, indicators, measures or underlying assumptions remain adequate considering emerging climate challenges. Their transformative potential depends on whether they are connected to control arrangements that enable actors to challenge underlying assumptions, share knowledge across organisational boundaries, and revise priorities or actions [36]. Such connections may enable diagnostic information to become an input to interactive processes rather than merely a basis for corrective action. Through this interplay between control and enablement, CBs may create conditions for the dynamic tensions associated with organisational transformation [36].

To further problematise the predominance of diagnostic controls, we draw on Mundy's [36] concept of dominance. Dominance is not merely a matter of one control element being used more frequently; it occurs when one control shapes the role and significance of the others, thereby potentially constraining or "closing" dynamic tensions. Where diagnostic control is dominant, belief systems may become rhetorical ambitions, and interactive processes may become meetings focused on target achievement. A CB may thus appear balanced, while still failing to generate genuine dynamic tensions. The crucial issue is not whether dialogue occurs, but what it does. Meetings that focus solely on indicator achievement extend diagnostic control, whereas meetings that use emissions data to question assumptions, reconsider responsibilities, or explore changes in transport or land use may serve an interactive function.

6. Conclusions and Implications

Given the increased focus on climate budgeting as an SCS for climate governance, and the limited research in this area, this document study provides insights into the potential of CBs to facilitate transformative change. Using the LOC framework as the analytical lens for studying the content of the CBs, the study found that all four management controls were present. However, diagnostic controls were predominant. Combined with the prevalence of climate measures oriented towards first-order change and the limited formal potential for generating dynamic tensions, this suggests that the municipalities' CBs are primarily configured to support a reform-oriented approach to change. This is consistent with prior research suggesting that municipal climate efforts often do not reach a transformative level [13].

The study's main theoretical contribution concerns the condition under which CBs may facilitate transformative change. Diagnostic controls should not only be understood as instruments for performance follow-up; they may also provide input to interactive processes that can generate productive dynamic tensions. Our document study cannot establish whether such tensions are generated in municipal practice, nor how municipal actors use CBs in meetings, political processes or cross-sectoral collaboration. Nevertheless, the strong formal visibility of diagnostic controls indicates that CBs are particularly well equipped to monitor and account for predefined climate action. Their transformative potential may be constrained where this diagnostic orientation is not accompanied by opportunities to use performance information for dialogue, learning and the reconsideration of established assumptions.

The findings also have practical implications for organisations, especially municipalities. CBs provide an overview of municipal emissions and can serve as an important account of the municipality's climate-related activities and priorities. For municipalities, the findings suggest that CBs should not be treated solely as instruments for monitoring target achievement and holding individual sectors accountable. Although indicators, targets, and reporting routines are necessary to coordinate climate action, excessive reliance on diagnostic controls may limit CBs' capacity to support learning and adaptation. Municipalities should therefore design follow-up processes that use emissions data not only to identify deviations from predefined plans, but also to critically examine the assumptions, responsibilities, and measures underlying those plans. This requires allocating time and creating cross-sectoral arenas in which administrative staff, political representatives, and relevant stakeholders can discuss whether current actions remain adequate, which organisational or policy barriers inhibit progress, and whether more fundamental changes in different areas are required. To avoid climate ambitions becoming merely symbolic, municipalities should also link their stated climate values to concrete priorities, resource allocations, decision-making criteria, and accountability structures. In this way, CBs may function not only as diagnostic tools for performance monitoring, but also as platforms for dialogue, organisational learning, and the reconsideration of established practices.

Future research could explore whether the predominance of diagnostic controls in CBs reflects design features or implementation challenges. This would help determine whether improvements are needed in the conceptual framework of CBs or in the processes and capacities required for their effective use. Another important area for investigation is the long-term impact of CBs on transformative change, especially whether they evolve to better balance management controls to facilitate second-order change, such as shifts in organisational values, norms, and systemic structures. Such research could guide policymakers and managers in deciding whether to revise the framework's design or instead focus on strengthening municipal capacity, providing resources, and encouraging knowledge sharing.

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Abbreviations

The following abbreviations are used in this manuscript:

CB	Climate budget
GHG	Greenhouse gas
MCS	Management control system
LOC	Levers of control
SCS	Sustainability control system
CBT	Climate budget tagging

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