Establishing a new housing cooperative sustainable accounting standard as a tool for increasing the sustainable refurbishment practices

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Abstract. A sustainable refurbishment is an important approach toward reaching the EU's climate goals. Some challenges of transforming housing areas are few high-quality standards, lack of funding, and low residential interest. This paper aims to present the process of establishing the Sustainable Accounting Standard (SAS) project, led by the Housing Federation of Norway (NBBL), representing 41 cooperative housing associations with 1,186,000 members. Therefore, a need to develop a standardized process for evaluating the possibilities of sustainable refurbishment is in focus. A triangulating combination of literature review, survey, and interview is chosen. The literature review forms a theoretical basis within the field. The design and experiences of SAS are reflected through interviews with project participants from cooperative housing associations and a survey of residential board members from selected pilot projects. The project presents the findings from developing the SAS tool and various stakeholders. The SAS tool forms an improved process for sustainable development in housing co-operatives, addressing all aspects of sustainability, the early involvement of stakeholders, and the importance of residents' participation. The SAS contributes to a smoother refurbishment process by properly prioritizing improved measures.

1. Introduction

The urgent need to mitigate climate change and reduce carbon emissions has made sustainable refurbishment and renovation imperative [1]. Despite the current Initiatives for renovation and refurbishment, such as the European Union's Renovation Wave [2], the United States Better Buildings Initiative [3], Canada's EnerGuide Rating System [4], and Australia's National Australian Built Environment Rating System (NABERS) [5], which seek to improve the energy efficiency, environmental performance, and livability of buildings through a range of policies and programs while many of them include public participation as a key component still participation remains low.

Another contributing factor is the adoption of existing sustainability assessment methods; BREEAM (by British Research Establishment) and LEED (by US Green Building Council) are both certification systems that evaluate and rate the sustainability performance of buildings which can be mainly intended or adapted for building renovation context [6]. Although professionals increasingly favor concrete climate change mitigation measures, the public favors adaptation processes only in general terms [7]. While these systems can help promote sustainable building practices, there are some potential areas for

improvement regarding public participation. These include complexity, cost, limited scope, and local context needs [8, 9]. Therefore, there is a need for sustainable refurbishment tools that are accessible, affordable, and relevant to the needs and concerns of building owners, occupants, and communities. However, some sustainability challenges for developing housing co-operatives are mentioned, e.g., reaching an agreement on upgrading and engaging residents [10]; long and repetitive processes [8]; limited finance, lack of knowledge and trust, and an inhomogeneous group of residents [11, 12].

Social engagement of citizens with public/private partners and neighbors illustrates the collective motivation for sustainable building renovations [13]. However, to achieve this, they need to be well-informed about the benefits of sustainable refurbishment and their role in the process [14]. Citizen participation provides numerous benefits, such as improving decision-making by addressing local needs and interests, promoting active citizenship, and enhancing democracy through an inclusive and transparent process [15,16]. In addition, engaging and empowering residents and end-users can lead to a sense of ownership and increase their willingness to cooperate [17, 18]. Studies have shown that the more people participate in the sustainable refurbishment process, the more likely they will cooperate and support it. Therefore, effective communication strategies are necessary to inform and educate residents and end-users on sustainable refurbishment, its benefits, and its roles in the process.

In Norway, energy consumption in buildings accounts for about 1/3 of all energy consumption [19]. Therefore, Norway has excellent potential for making residential buildings more environmentally friendly, energy-efficient, economical, and socially improved. However, existing housing could be better managed and maintained instead of leading to minimalistic scenarios resulting from low residential voting [20 21, 22, 23]. Therefore, there is a need for simplified and practical tools that facility managers and individuals can quickly adopt to motivate and engage them in the sustainable refurbishment process.

The Housing Federation of Norway (NBBL), NTNU, SARD, and DNV-GL developed a sustainable accounting standard for implementing sustainable strategies in housing cooperatives. NBBL represents 41 cooperative housing associations and covers approximately 23% of the total housing stock in Norway. The ambition for SAS was to prepare an innovative model based on BREEAM, following the main steps for sustainable management, sustainable refurbishment, and certification. SAS key performance indicators (KPIs) should be linked with the triple bottom line, People-Planet-Profit, and the UN's sustainability goals.

The novelty was designing KPIs from the user perspective to become understandable enough for non-professional users (residents) and informative for professionals (facility managers). Another ambition was to motivate users to be highly engaged in the process, so the resident and residential board were approached directly. Besides, the visual presentation of KPIs should show the facility's sustainable condition analysis and the sustainable ambition level of the users. In such a manner, the gap profile could be manifested and discussed among all three groups, and thus sustainable strategy is defined. Based on the results from SAS, it could be easy to indicate the gaps and prioritize areas to make the housing co-operative more sustainable.

This paper focuses on how a sustainable accounting standard can be designed and processed to effectively engage and motivate end-users to be more sustainable refurbishment oriented.

2. Methodology

This research has been based on a triangulating method to develop the sustainability accounting standards. First, a short State of the art was conducted to provide a theoretical basis for developing a sustainable refurbishment tool. Literature on sustainable renovation strategies, assessments, and FM was revealed. This mixed-methods study includes a literature review, semi-structured in-depth interviews, and a survey with fixed-answer alternatives to collect data from project participants and residential board members.

The literature review forms a theoretical basis within the field and presents a document study of the project material. The experiences with the sustainability tool are retrieved through semi-structured in-depth interviews with eight project participants from the cooperative housing associations and a survey of residential board members from selected pilot projects.

The quantitative survey provides comparable information from the perspective of residential board members and residents. Descriptive analysis is used to code and categorize the data. The survey's standard deviation is relatively low, indicating its validity. However, the research has areas for improvement and limitations, such as the broad impact field and terminology variations.

A desktop study is carried out to form a theoretical basis within the field. The search phrases could be more pointed or combined differently to delimit findings further and gain better control over existing literature. The identified literature reveals that the terminology within the chosen topic varies, and synonyms are often used.

Experiences with the sustainability tool are retrieved through semi-structured in-depth interviews with eight project participants from the cooperative housing associations. The informants are selected among the facility managers responsible for the pilot projects. A structured method is used for some interview questions to give answers that could be compared across cooperative housing associations. The interviews are developed as semi-structured, intended to create a relatively free conversation. The data is coded and categorized as described by Postholm.

A survey of residential board members from selected pilot projects is conducted to obtain comparable quantitative information. The respondents are selected among board members of various cooperative housing associations participating in the project. The survey asks respondents the same questions with fixed-answer alternatives. Descriptive analysis is used to code and categorize the data. The survey's standard deviation is relatively low, indicating its validity.

3. Developing Tools for Sustainable Housing Transformation

To develop a comprehensive sustainable accounting strategy for NBBL, the research team first identified and critically reviewed key sustainability themes and existing frameworks that could be incorporated into the strategy. The following steps were taken:

1. Overview of existing sustainable building standards related to refurbishment.
2. Key sustainability themes and programs across NBBL's global peers
3. Key sustainability themes from NBBL's documents review
4. Initial insights from the project partners
5. Case studies: sustainable refurbishment projects
6. Initial thoughts from DNV GL on frameworks and data collection tools
7. Insights from DNV GL SDG Lens (UN Sustainable Development Goals)

Desktop research has been summarized following the objectives of this study of the project and the aims of this paper.

Environment	Social	Economic
Energy (aspects related to heating, cooling, ventilation, energy consumption and on-site renewables)	**Health & Wellbeing** (inclusive design, visual comfort, acoustic performance)	**Innovation** (tailored solutions to individual projects)
Waste (waste management and recycling, storage of operational waste, use of recycled and sustainably sourced aggregates, circular economy (responsible use of resources, recycling, reuse))	**People focus** (happiness, empowerment, self-determination, responsibility)	**Cost-savings** (low energy bills, low operating and maintenance costs)
Water (water efficiency, water metering, leak detection and prevention, intelligent use of rainwater, installations, water consumption, management of water runoff)	**Community engagement** (spaces for social meetings, common areas for people of all ages)	**Increased market value of the building** (home owners can increase the rent or the sale price as a result of refurbishment)
Materials (building materials with low environmental impact, non-toxic, non-harmful, FSC certified wood and strong responsible sourcing credentials for floor, walls, furniture)	**Safety** (fire protection, water, drainage and power supply protection in emergencies, protection against criminal acts)	**Affordability** (increase housing affordability for young people and low income groups)
Air quality (indoor environment, insulation, air pollution, procurement of furniture, fixture and finishes with low VOC content to maintain healthy indoor air quality levels, new windows, CO2 sensors, NOx emissions, impact of refrigerants)	**Transport** (alternative sustainable transport options, proximity to public transport, proximity to amenities, pedestrian and cyclist safety)	**Flexibility** (possibility to make changes inside the flat to suit changing life circumstances)
Land Use and Ecology (planted area, managing negative impacts on ecology, identifying the risk and opportunities for the project)	**Diversity** (refurbished buildings made suitable for young people, families, elderly and the disabled)	**Management** (administration, construction management, home-user guides for residents)
Lighting (such as good daylight, flicker free sources)		
Resilience (such as protection against moisture damage or extreme weather events)		

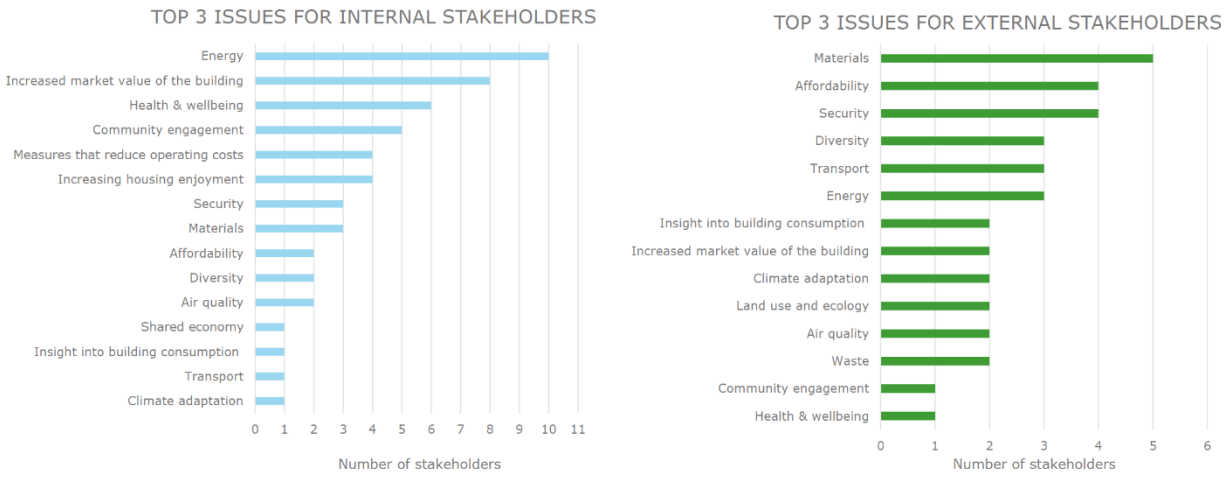
Figure 1. Consolidated list of key sustainability themes.

DNV GL consolidated all the key sustainability themes identified across the building standards selected, NBBL's global peers, and the documents provided, and the case studies were chosen to produce a long

list of issues rearranged into environmental, social, and economic issues and sub-issues. Similar issues were regrouped, aggregated, and reviewed to ensure that a wide range of stakeholders would be able to understand them. Based on experience, a list longer than 20-30 issues makes it harder to conduct stakeholder interviews as it is more difficult to focus on a list longer than this, as can be seen in Figure 1. These became the basis of the materiality assessment.

Further, the research team contacted 43 stakeholders (24 internal – belonging to the project members and 19 external - no project members) and scheduled interviews with 34 (20 internal and 14 external). The interviews provided valuable insights into stakeholder perspectives on sustainable refurbishment. In addition, they allowed the research team to identify the most pressing issues and topics related to sustainable refurbishment from the stakeholders' point of view (Figure 2).

Figure 2. Engagement overview: The Internal/External stakeholders engaged (Telephone interviews).



To complement the interviews, the research team designed two online surveys, one for BBL Board Members and another for residents, to understand their position and experience of sustainable refurbishment. The surveys were designed to gather quantitative data and provide a broader perspective on stakeholder attitudes toward sustainable refurbishment (Figure 3).

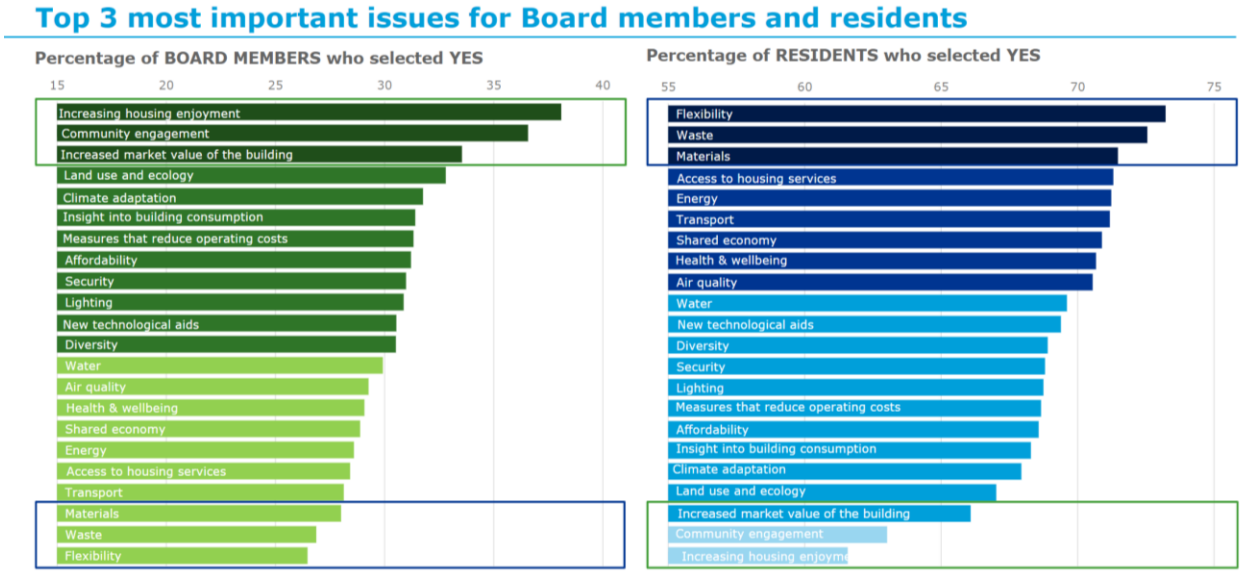


Figure 3. Online survey-demographic results.

The data analysis from the interviews and questionnaires aimed to achieve three main objectives. First, to identify the relative prioritization of the key issues and topics across different stakeholders. Second, to assess the levels of agreement in prioritization among the other stakeholders. And third, to determine and compare the drivers, such as costs or information, needed to accelerate sustainable refurbishment of existing buildings.

Analyzing the data makes it possible to identify the most pressing issues and topics related to sustainable refurbishment from the perspective of the different stakeholders. They also determined the extent of agreement among stakeholders on these issues, providing valuable insights into potential areas of conflict and collaboration. Additionally, the research team identified the drivers most likely to accelerate sustainable refurbishment, providing vital information for policymakers and other stakeholders interested in promoting sustainable building practices.

4. Developing a Sustainable Accounting Standard model - SAS

To address the challenges associated with climate change and a desire for homeowners to live in safe, comfortable, and enjoyable homes that retain their financial value, it is essential to provide a tool that helps FM to incorporate a sustainable refurbishment process resulting in analysis with clear targets, KPI's, and ambitious. A road map as an In-step model for implementing the program was developed (Figure 4), regarding the ambition to ensure that the principles of people, profit, and the planet are incorporated into the refurbishment of existing homes with a long-term aim of creating carbon-neutral homes by 2030 [24, 25, 26, 27]. The strategy was shaped to contribute to global and national climate goals by providing them with SAS sustainability tools.

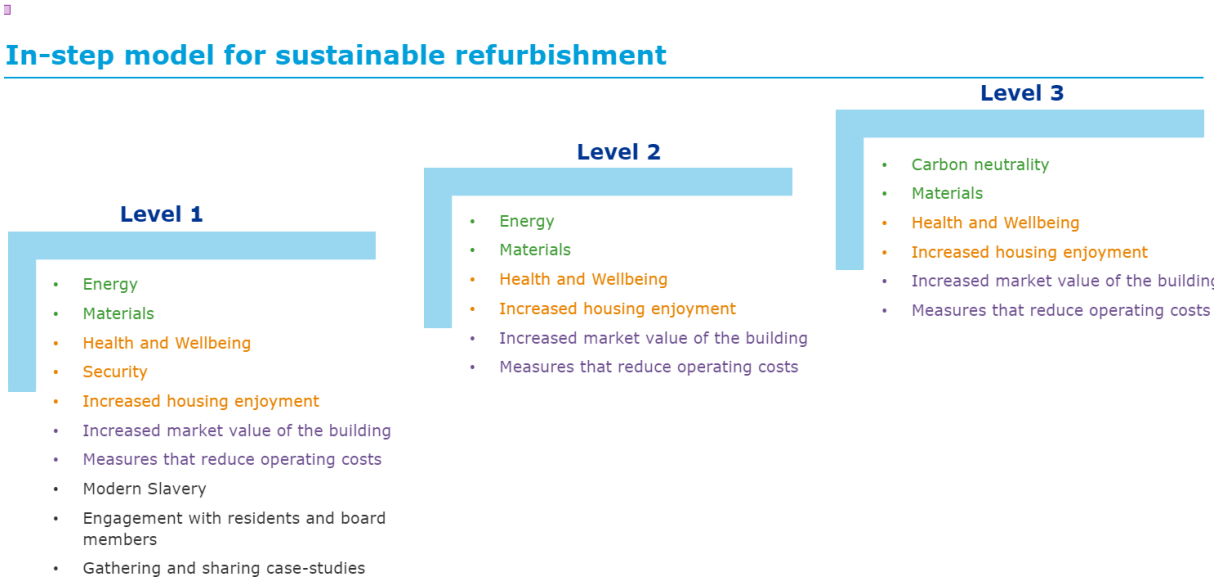


Figure 4. In-step model.

4.1 Development of the standard

The process involves several steps, including dividing the KPIs into each step of the In-step model, The process involves several steps, including splitting the KPIs into each step of the In-step model, updating the KPI set with missing data, sending the version 1 KPIs to the task force for feedback, deciding on changes in FM strategy, updating the KPI master with sustainability issues, SDGs, grades, and questions, creating templates for each step in the In-step model and report, and holding workshops with the GBA and Task force/Iron ring/NBBL.

The report suggests that the organization is refining and improving KPIs and strategy to meet its sustainability and business goals. The report also highlights the importance of stakeholder engagement and feedback in this process, as evidenced by the workshops with the task force, GBA, and Iron

ring/NBBL. Overall, the report provides a comprehensive overview of the steps in developing and refining KPIs and strategies for a company or organization.

Each KPI has four grades, and each grade is connected to a strategic level in the FM strategy, based on the classification system from the Norwegian Standard (NS 3424 Condition survey of construction works, Figure 5) and the strategy level of FM (Figure 6) [24]. This way, ambition and performance can be seen directly interlinked to strategy level without translation. Goals, purpose, and performance can all be seen in comparison.

Grad	Interval	Simple key-word	Explanation
0	0,00 - 0,75	Excellent (or very good)	Satisfies all laws and regulations. Almost all aspects are sustainable and appear as new (the standard appears as if it is less than 5 years old)
1	0.76 - 1,50	Good	Same as grade 0, but with some more wear. No action is required
2	1,51 - 1,25	Poor	Does not require immediate action, but the condition is in such a condition that remediation must be planned
3	2,26 - 3,00	Very poor	The condition deviates from laws and regulations, creates a risk to life and health and requires unmistakable measures

Figure 5. Classification system according to NS 3424.

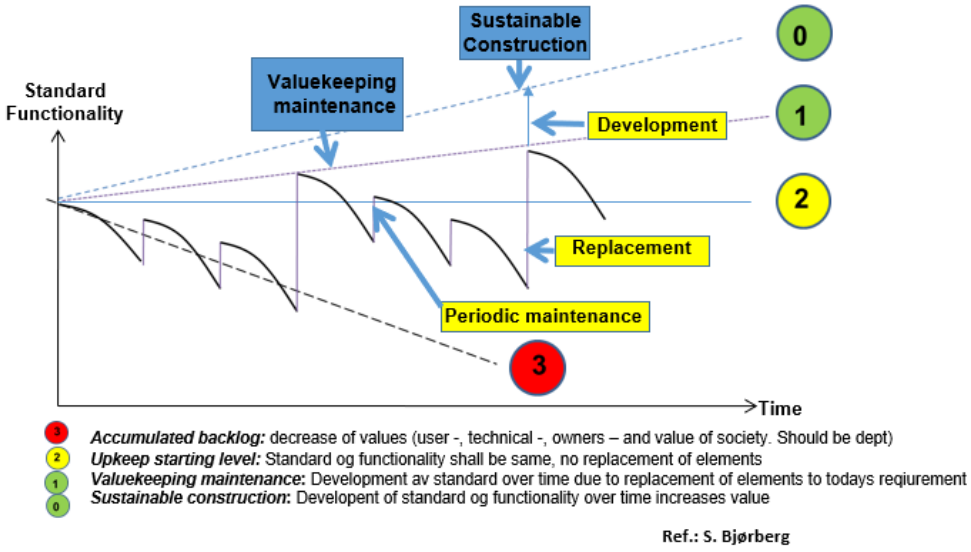


Figure 6. Classification of FM strategies (Bjørberg).

To develop a simplified standardize tool for facility managers to lead the process by engaging people and making a result, an entry-level model is developed. This model breaks down the tasks into manageable steps, supported by e-learning courses and guides where the steps are visualized. The entry-level model enables boards to take one action at a time toward implementing the sustainability account and sustainability report.

The standardized SAS step activities were set as follows (Figure 7):

1. *Sustainable Management Plan (establish residents' ambition)*
   Step 1: Plan indicators as questions for state of the art on performance (how they feel) and ambition (how they want it)

Step 2: Involvement of residents (information, get their answers on indicators)
Step 3: Establish a plan for sustainable upgrading according to data from step 2.

2. *Sustainable Refurbishment (deliver on ambition)*
Step 4: Plan for a short and medium-long period (something can be done quickly, others' need; some time for planning for maintenance)
Step 5: Long-term planning (more time for planning, finance, and approval from authorities)
Step 6: Upgrading

3. *Certification*
Step 7: Ceremony for certification

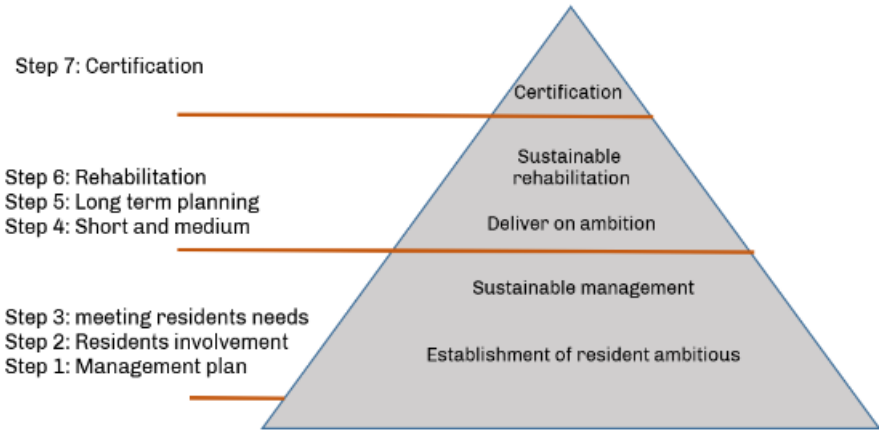


Figure 7. The standardized SAS step activities.

Different standards were considered to design the right KPIs (BREEAM Refurbishment and Fit-Out Technical Standard, LaSalle Sustainability Development and Refurbishment Standard, BREEAM-NOR. DGNB System (issues and criteria), LEED Residential BD+C Multifamily Homes, and Well Building Standard). The KPIs were tested by conducting a survey with 4700 answers from residents and their board members. The conclusion was 21 central sustainability main KPI issues; see Figure 5. Each of the main KPIs was given several sub-indicators, a total of 88 indicators to be checked out in the SAS model.

Indicators, divided into three stakeholders (cohorts), were examined to find central – and sub-indicators, as shown in Figure 8.

Figure 8. Cohort groups of stakeholders.

	Cohorts of stakeholders	Main KPI´s	Number of sub indicators
	People KPI 1	Inside flat	9
	People KPI 2	Building	5
	People KPI 3	Outdoor area	4
	People KPI 4	Communication to and from board	5
	People KPI 5	Service offer near by	2
	Consultant KPI 6	Documentation	1
	Consultant KPI 7	Inspection routines tecnical systems	1
	Consultant KPI 8	Technical inspection of buildings	14
	Consultant KPI 9	Technical inspection of P- buildings	5
	Consultant KPI 10	Inspection of environmental aspects	10
	Consultant KPI 11	Inspection of outdoor areas	6
	Consultant KPI 12	Upgrading plans for buildings	4
	Consultant KPI 13	Upgrading plans for out door areas	4
	Board KPI 14	Feed back	1
	Board KPI 15	Maintenance	3
	Board KPI 16	Cleaning	3
	Board KPI 17	Operation routine security	1
	Board KPI 18	Inspection routines tecnical systems	1
	Board KPI 19	Social elements	3
	Board KPI 20	Environmetal development plans	4
	Board KPI 21	Competence	2
Total 21 main KPI´s		Sub indicators	88

Figure 9. Groups of sustainable values (NBBL).

Each cohort's main KPI (Key Performance Indicators) is established with a set of sub-indicators. All indicators are classified within the community of housing (figure 9).

Figure 10. Indicator 1.1. Draft with marks shows the gap between performance and ambition (NBBL).

To help the project participants, the questionnaire for each sub-indicator is prepared on two levels, one for performance today and one for ambition, with explanatory keywords for grades, see figure 10.

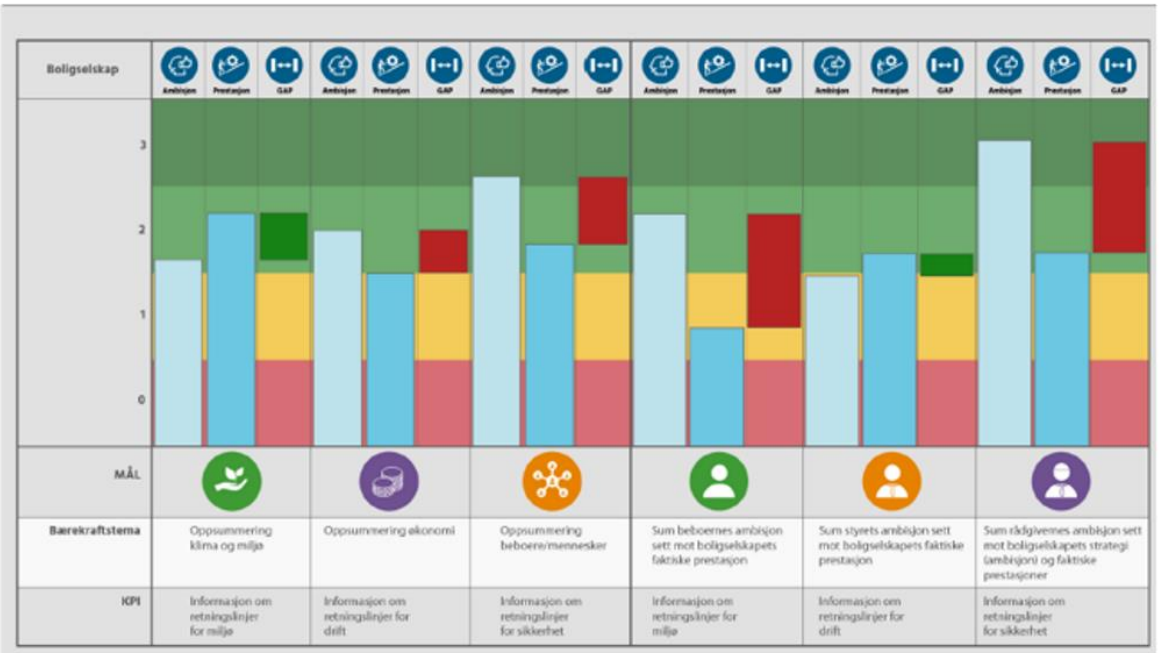


Figure 11. Presentation of KPIs, goals, and sustainability topic (NBBL).

At the end of the performance, ambition levels and gaps were presented in graphic form for discussion. It also includes the presentation of goals and sustainability topics, see Figure 11. In addition, the SAS tool shows the contribution to standardization and developing guidelines in collaboration with practitioners [28, 29].

5. Conclusion

Even though many assessment tools exist focusing on energy efficiency, environmental performance, and well-being, they need to be more understandable for the end-users to involve them in transformation projects. The SAS tool is developed by and for the facility managers to focus on transformation by approaching the involvement of the residents with two aims: to understand the sustainable condition of their asset better and increase their sustainable ambition goals. Besides being more aware of the physical condition, energy efficiency, and environmental performance, the aim was also to approach liveability, well-being, and social components necessary for their local environment [10]. The tool is designed to be more accessible, affordable, and relevant to the needs and concerns of building owners, occupants, and communities, by using the standards which facility managers are familiar with [24], linking the results with SDGs, and using visual presentations to better communicate with end-users. The result is to improve decision-making by addressing local needs and interests, promoting active citizenship, and enhancing democracy through the inclusive and transparent process [16] to empower residents to increase their willingness to cooperate [17].

From the study, we also found that the early involvement of residents has a positive effect and reduces uncertainties of the upgrading process [21, 22], the increased feeling of project ownership, and increased values ambition associated with sustainability goals [18]. Simply disseminating information from the SAS tool, using various icons, colors, and graphs, a reasonable basis was formed for constructive and comprehensive discussion between facility managers and the end-users (residents and residential boards). As a result, residents, the board, and the housing cooperation associations get a common perception and understanding of what needs to be improved. For further research, comparing the SAS cases to measure the impact of the refurbishment process through the years is fascinating. That includes following all stakeholders through their process of selecting measures, discussions, and the type of

decisions at the end. To better evaluate the standard, the number of cases can better assess how social elements are prioritized in the proposals.

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