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15. Sustainability

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INTRODUCTION

This chapter examines sustainability as a value parameter within Facilities Management (FM) and Corporate Real Estate Management (CREM). The overall objective is to provide a common approach for measuring and managing sustainability impacts throughout a buildings life-cycle. Public and private sector organisations, as building owners, facilities managers and users are addressed as primary internal stakeholders in the value chain; external stakeholders are considered as the wider beneficiaries of sustainability improvements at the community, regional, national and global level. The framework outlined in this chapter will enable organisations to release latent value through the transition to more sustainable FM and CREM operations whilst simultaneously helping society address its wider sustainable goals. However, the key to realising this latent value is the ability to identify the links between value parameters, sustainability and organisational goals, which will be addressed in this chapter.

The built assets owned or occupied by an organisation provide the greatest opportunity to embrace the sustainability agenda. Through effective management of buildings over their life cycle building owners and occupiers can reduce the negative impact that their buildings have on the environment, improve the impact that their buildings have on social well-being, and provide economic benefits to the business through reduced maintenance and refurbishment costs. Such an approach not only provides value to the organisation but also to the wider society of which they are an integral part of. However, for many organisations these opportunities are missed or fail to have the level of impact they could (Kwane et al., 2009, Baharum and Pitt, 2009, Emanualim et al., 2010; Durmus-Pedini et al., 2010) due, in the authors opinion, to the difficulty many organisations have in identifying and measuring the sustainable performance of their built assets. The aim of this chapter is to provide a practical framework based around key performance indicators which facilities managers and corporate real estate managers can use to develop built asset management plans that improve the sustainable performance of their built assets and deliver value to core business by aligning these plans with the organisation's strategic sustainability goals.

Hodges and Sekula (2013), Falkenbach et al. (2010) and Brown et al. (2010) identified the benefits of sustainability offered through FM. These can be summarised as:

1. *Increased productivity:* healthier buildings and better designed workplaces result in increased employee satisfaction and hence increased productivity.
2. *Lower operation and maintenance costs:* reduced demand for resources and reduced waste production results in lower annual costs.

3. *Enhanced competitive edge:* people increasingly want to purchase products and services that are sustainable, as sustainability initiatives are important to attract future customers.
4. *Improved company image**:*** positive company stories about sustainability aspirations and achievements can enhance company profile. Since more and more people want to work for companies, that have a sustainability agenda, this helps attracting the best people.

Durmus-Pedini et al. (2010) in their study of the benefits and risks of greening existing buildings identified financial risks, market risks, industry risks, performance risks and legislative risks as potential risks that need to be encountered in the FM risk management.

In considering how sustainability could be explicitly linked to organisational value, Jones and Cooper (2007) suggested that value in the context of built asset maintenance decision making goes beyond a consideration of building technology issues, to one that acknowledged the impact of the built asset on the long-term viability of an organisation.

Readers are recommended to read additional book chapters and in particular the closely related chapter 16 on Corporate Social Responsibility (CSR), which emphasises the social aspects of added value creation that compliments this chapter's emphasis on the building management perspective and the balance that needs to be achieved between the environmental economic and social dimensions of sustainability.

STATE OF THE ART

Definition of sustainability

Sustainability is a broad but contested term that has been used and misused in various ways to describe mankind's symbiotic and/or parasitic relationship with the planet. Indeed, the wide ranging definitions developed to describe the concept of sustainability provides a continual challenge when it comes to measuring and managing the added value of FM and CREM (e.g. Laedre et al., 2014; Bond and Morrison-Saunders, 2011).

Sustainability as ideal has a long history. This concept has been associated with slightly different meanings over time; but the vision of a sustainable planet is still in use and our current understanding is based on the accumulation of the various meanings. The first definitions are found in sources dating back to the 18th century (Kloepffer, 2008; Kummert et al., 2013; Von Carlowitz and von Rohr, 1732). Carl von Carlowitz and von Rohr (1732) and focus on the protection of natural resources from an organisation's perspective. Von Carlowitz developed ideas and concepts about how timber production could be achieved in a way which ensures availability of wood as needed and protects the forest as a whole system. He expressed, as superintendent of silver mines in Germany, that the mining and silver production processes were dependent on good practices for cultivating the forest. Likewise today mining and other production processes rely on good practices which sustain the resources that feed into its production.

The second meaning which evolved around 1960's focused on the world's economy and its dependence on limited resources. The concern of exponential growth in a finite and complex system was identified in the research report "The Limits to Growth" (Meadows et al., 1972). An international and interdisciplinary team of researchers developed a model to gain insight into the limits of the world system. Meadows et al. (1972) identified five key factors that determine and limit growth on earth: population, agricultural production, natural resources, industrial production, and pollution. They studied the limits of the world system by

considering different scenarios of human numbers and activities development referring to exponential growth as the main problem (Meadows et al., 1972).

The third meaning of sustainability is associated with the consideration of the interdependence of society, environment and economy in complex sustainability thinking. The World Commission on Environment and Development (WCED) in 1987 published the "Brundtland report", referring to the commission's chairman, the former Norwegian Prime Minister, Gro Harlem Brundtland. In this report Sustainability was defined as: *"…development that meets the needs of current generations without compromising the ability of future generations to meet their needs"* (Brundtland et al., 1987, p.9). The United Nations (UN) Conference on Environment and Development (UNCED), commonly referred to as the Rio Conference or Earth Summit, is often cited referring to the three sustainability dimensions: social, economic, and environment, leading to three sub-parameters of sustainability and a hierarchy of sustainability strategies on global, national and regional level (UNCSD, 2012). Figure 15.1 shows the three dimensions in a FM and CREM model. These dimensions are also known as the 3-P triplet of People-Planet-Profit or People-Planet-Prosperity.

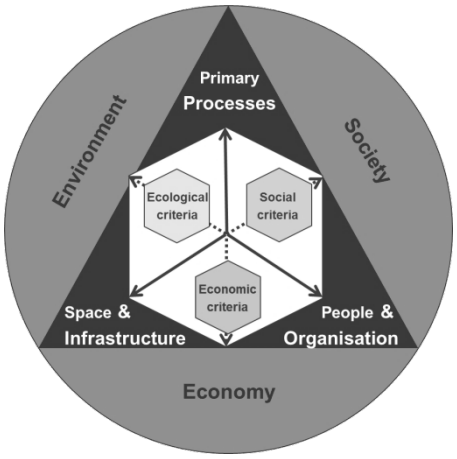

Figure 15.1 Sustainability in FM and CREM model (adapted from Junghans, 2011)

Despite the fact that sustainability is not a new concept, it is here argued that sustainability is still a vision and an ideal more than a reality especially on a global scale, whereas the UN proclaims that the Sustainable Development, which balances current needs with the needs of future generations, will be at the core of the UN's development agenda after 2015 (UN, 2015). It should also be said that massive initiatives to reduce environmental problems has to some extent changed the overall picture of environmental threats and problems. For instance local air pollution from heat and electricity production that was common e.g. 20 years ago hardly exists today. But we also see new problems arising due to e.g. the increasing use of chemical substances in various products, which complicates both waste treatment and sewage treatment, and where we do not know the long term impact on nature. Sustainability in FM seems to be an ongoing quest rather that an absolute as stated by Fennimore (2014).

Life cycle thinking and environmental impacts

The lifecycle thinking is essential when considering the sustainability of facilities and services. Figure 15.2 shows a simple structure for screening an artefact like a cup, a chair or a concert hall to identify the largest sustainability problems: what kind of materials (resources) are used, and how is the artefact produced, transported, used, and finally disposed? And what are the sustainability issues in each of the life-phases, e.g. use of scarce and non-renewable materials, energy usage, use of chemical or other sustainability issues such as health and safety issues, or hazards to vegetation and wildlife?

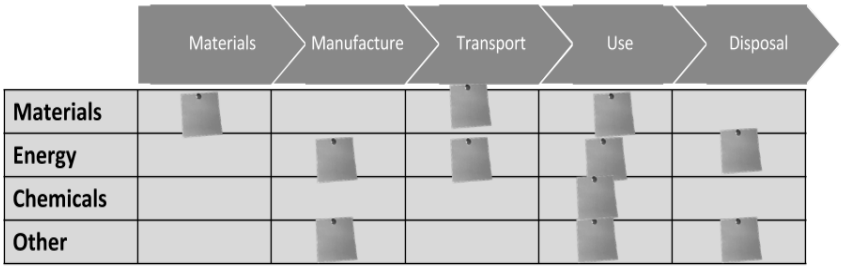

Figure 15.2 Structure for screening an artefacts lifecycle and environmental impact (materials, energy and chemicals) and other sustainability issues (adapted from McAloone and Bay, 2009)

As FM and CREM is highly related to buildings and the built environment it is obvious to consider a building focused approach to measuring and managing the added value of sustainability efforts. A variety of sustainability certifications are already available such as the "Building Research Establishment's Environmental Assessment Method" (BREEAM), "Leadership in Energy and Environmental Design" (LEED) and the "Deutsche Gesellschaft für Nachhaltiges Bauen" (DGNB) assessment methods. The common approach is to break down the sustainability parameter into a hierarchy of indicators and sub-indicators. E.g. the Danish adaptation of the German DGNB system claims to take a holistic approach to sustainability and operates with 5 main themes: Environmental Quality, Economic Quality, Socio-cultural and functional Quality, Technical Quality, and Process Quality. These 5 themes are divided into 45 main criteria which are divided into 188 sub-criteria, too lengthy to mention all in this chapter. Other certifications are available too, and they vary slightly in scope (number of indicators included), how they award points to each evaluation criteria, and how these individual evaluations add up to a specific certification class. DGNB uses the classes: Gold, Silver and Bronze. For a facilities manager the ideal certification system might seem to include as many sub-criteria as possible. However, the typical problem is lack of data (e.g. Jensen et al., 2009). As a consequence a full certification process can be time demanding. An alternative is to select a number of indicators/criteria from the certifications, which are particularly meaningful and operational in the specific context and use these for one's own balanced scorecard.

Stakeholders

Different stakeholders may experience different sacrifices and benefits from sustainable transitions into sustainable products, services and practices in FM and CREM. The British Institute of Facilities Management (BIFM) has identified the employees, government, and clients/customers as the three main stakeholder groups, which organisations report its sustainability activities to (BIFM, 2013). A similar survey, which was conducted in Norway, confirmed the same stakeholder groups in slightly different order: the government, clients/customers, and employees (Junghans et al., 2014).

Hudges and Sekula (2013) provide a longer and general list of stakeholders who will be impacted by sustainability initiatives and highlight that the facilities manager needs to understand all stakeholders involved. Who are impacted and how are they impacted? A plan should be developed of how to meet their sustainability needs at the same time leveraging their varied interests. The stakeholder groups are listed in Table 15.1.

Table 15.1 Stakeholders impacted by sustainability initiatives (with inspiration from Hodges and Sekula, 2013, pp. 70-71)

Stakeholders impacted by sustainability initiatives	
Internal stakeholders	**External stakeholders**
• Facility Management • Real estate • Procurement • Legal • Human resources • Finance and accounting • ICT support • Marketing and sales • Senior management	• External building owners (Landlords) • Tenants • External service providers and vendors • Governing authorities • Utility providers • Neighbouring businesses and residents • The community at large • Nature, as a non-human stakeholder

When the senior management commits to the sustainable FM/CREM plan it is more likely to get the resources needed to implement it. But still other stakeholders have a say in the implementation process either because they have a formal authority like a real estate department or in the case of certifying buildings. Other stakeholders might have little or no formal authority of the decision, but still desire to influence decisions and their outcome. Depending on their motives and agendas, this might not be evident on the surface (Hudges and Sekula, 2013). This makes stakeholder management and involvement one of the core disciplines within sustainable FM/CREM.

Sustainability in European FM standards

From a generic perspective sustainability is already integrated in the European standards for FM. To the extent that the standards are in use and used to educate future generations of facilities managers, there is basis to assume that gradually sustainability will be integrated as a value parameter in FM. Sustainability in the meaning of environmental impact is addressed in the standard EN15221-7 on Performance Benchmarking (CEN, 2012), in which the indicators for Primary environmental ratios (e.g. Total CO_2 emissions in tonnes per annum), Primary energy ratios (e.g. Total energy consumption in kWh per annum); Primary Water ratios (e.g. m^3 per annum), Primary waste ratios (e.g. Total waste production in tonnes per annum), and other environmental scores are used. However, our review of all the seven European FM standards (EN15221-1-7) and particularly EN15221-4 on Taxonomy (CEN, 2011) shows that sustainability in FM is only explicitly addressed in twelve out of more than 100 facilities services categories and products, which is less than 10% of the overall scope of FM. Main focus of sustainability assessment is on the service group "Space and Infrastructure" and least within the service group "People and Organisation". The twelve facilities service and product categories, which are addressed for the collection of qualitative environmental data are: 'Building Initial Performance', 'Property Administration', 'Maintenance and Operation', 'Land, Site, Lot', 'Occupier Fit out and Adaptations', 'Health and Safety', 'Environmental

Protection', 'Mobility' and 'Procurement' and at product level 'Energy', 'Water' and 'Waste' (CEN, 2012).

Organisational integration of sustainability

The authors of this chapter claim that the generic perspective is not sufficient to ensure a fast voluntary commitment to sustainability, as the organisational context is so important for the level of commitment (Nielsen, 2012). We argue that sustainability in CREM and FM requires translations of the general sustainability definitions into context specific definitions referring to organisations value norms. So how can one align the sustainability strategy of organisations' primary activities with its strategies for supporting facilities and services management? The challenge is to develop a scalable approach which helps to break down the overall ambitions of sustainable development on an organisational level, but is still comparable with the overall sustainability understanding. The categorisation of societal, environmental, and economic impacts should be done by the organisation itself. This from inside to outside approach is visualised in Figure 15.3. However it does not mean that triple bottom line indicators have to be balanced symmetrically in each organisation. Looking back to the forestry example from the 18th century it is more important to focus on those aspects which are most important for each organisations sustainability impact (Junghans, 2011).

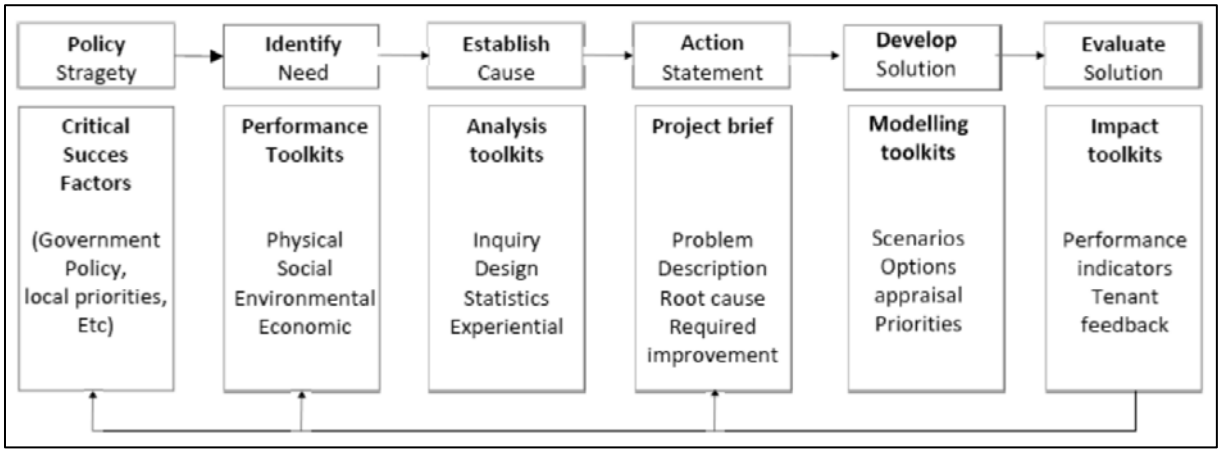

Figure 15.3 Sustainable based built asset management process model (adapted from Jones and Cooper, 2007)

In considering how sustainability could be linked to organisational value, Jones (2002) suggested that value (in the context of built asset maintenance decision making) goes beyond a consideration of building technology issues, to one that acknowledges the impact of the built asset on the long-term viability of an organisation. Jones argued that 'value' should be explicitly linked to the ability of the built asset to support organisational performance and that built asset management should be viewed as a strategic issue managed within the broader context of an organisation's strategic planning framework. In the context of sustainability Jones identified the need to define value in the context of the organisations sustainability goals, aspirations and critical success factors. These goals and aspirations will normally be informed by the organisations Corporate Social Responsibility Strategy, its Sustainability Strategy, its HR Strategy, its Environmental management strategy, its Quality management strategy, and others. These documents will provide the direction for the organisation in terms of its environmental, social and economic targets and set timescales by which the targets need

to be met. These targets provide benchmarks against which the performance of buildings can be judged. Although benchmarks will be contextually dependent upon each organisation's strategic aspirations and goals, the benchmarks are likely to be informed by national policy underpinned by sector wide key performance indicators and benchmarks, codes of practice/policy guidance, or international references such as UN sustainability goals (UN, 2015).

Jones and Cooper (2007) applied these principles to the development of a sustainable built asset management model (Figure 15.3) for UK social housing. In this model the long term strategic goals of an organisation are used to set the context within which FM needs to deliver value to that organisation. FM then can use this context to develop a series of toolkits (using Key Performance Indicators - KPIs) to measure current performance of a building or service, and to devise a series of analytical processes in order to interrogate the KPIs to establish the root cause of any underperformance or to identify process changes that are needed to improve performance. Such performance improvements can then be expressed as an action statement that will provide benchmarks (for the KPIs) against which potential solutions can be evaluated. As many KPIs used to measure performance will be inter-dependent a multi-criteria approach is needed to model the impact that various solutions have under different operating and future scenarios. Once a solution has been identified and implemented the original KPIs and benchmarks can be used to evaluate the actual performance of the solution in-use and inform long-term strategic plans. In many ways this is a Plan-Do-Check-Act framework approach (see also chapter 17).

Cooper and Jones (2009) further developed this approach in an action research project with a UK social housing landlord. During this project Cooper (2015) identified the issues that facilities managers need to consider when operationalising the sustainability framework. In particular facilities managers have to:

- Consult organisational strategy documents to identify strategic goals and, through discussions with senior managers, express these goals in terms of critical success factors;
- Map the critical success factors against a range of possible KPIs taken from existing (generic) toolkits and develop bespoke solutions to specific organisational challenges that were not covered by the generic approaches;
- Develop a survey methodology to apply the KPIs to a service or built asset. Whilst the generic KPI toolkits have survey instruments included as part of the toolkit, the bespoke KPIs require survey instruments to be developed.
- Develop analytics to analyse levels of performance. The analytics draw on quantitative assessments (e.g. operational research techniques) supplemented with qualitative assessments (e.g. focus groups) to establish the root cause of any performance issues.
- Use the action statement as the basis for the design brief or service specification for commissioning new, more sustainable, solutions.
- Develop a multi-criteria scoring method to rank the sustainability indicators. This requires consultation with all key internal stakeholders and a consideration of the importance that the organisation placed on the wider implications of their sustainability agenda (e.g. social responsibility, image etc.).
- Develop a scoring mechanism to prioritise individual solutions against the sustainability agenda. This involves developing complex multi-criteria assessment models that could accommodate future business and environmental scenarios (e.g. future climate change impacts on internal building temperatures and the link this could have on productivity) as

part of the decision making process and support detailed options appraisal against each scenario to identify the most business critical solutions over any given timescale.
- Develop and implement a continuous review process that provides actual data on performance of a solution in use.

Whilst it was clear from the study that facilities managers could operationalise the sustainable built asset management framework, the amount of work required to do so was significant and required the collection of a large amount of data that was routinely gathered by the organisation through its stock condition survey process. As such facilities managers need to be aware of the scope of the challenge they face when addressing the sustainability agenda.

HOW TO MEASURE AND MANAGE

Key Performance Indicators

In this section the overall perspective is broken down to a smaller scale of single organisations or business corporation units. We look at FM/CREM with a focus on an organisations demand for sustainable buildings and facilities services in the total building life-cycle. This management perspective includes all life-cycle phases, like development, production, management and redevelopment of buildings. The management phase includes the operation, maintenance and service provision.

The section will provide a practical framework based around KPIs which facilities managers can use to develop built asset management plans that improve the sustainable performance of their built assets whilst simultaneously improving the value of these assets to core business. Once the value criteria have been established these can be used to develop organisation specific KPIs that can be used to assess the current performance of a building (performance toolkits). The KPIs need to cover the range of value criteria (notionally physical, environmental, social and economic performance) and should be informed by existing KPIs where available (e.g. DGNB, standards etc.). However, when developing (or selecting) KPIs the facilities manager needs to be aware of potential inter-relationships between indicators. In any multi-criteria decision making framework those factors or variables that influence the final decision should only be measured once and should be independent of each other. When considering sustainability this condition is rarely satisfied due to significant overlap and interference between the factors.

One of the largest challenges in measuring and managing sustainability in FM is to establish the scope and align with the organisations strategic goals. It is useful to see how others are dealing with reducing complexity and defining a focus. One example is Laedre et al. (2014) who is using Sustainability Impact Assessment (SIA) methodology (OECD, 2010) as an analytic assessment tool in the context of project management. They applied SIA on assessment of an infrastructure project in the early phases of a construction process. As part of the findings they suggest a prequalification approach to identify the most relevant assessment categories. Sustainability impact assessment is in this study structured in strategic, tactical and operational level and economy, society and environment categories, see Figure 15.4. The nine category structure aims to capture the economic, social and environmental effects of a construction project, which seems less technical and process oriented than building certifications like BREAM, LEED and DGNB, but adds an interesting consideration of time perspectives and risk management to the process of setting goals and value parameters. The

time and risk perspectives can be helpful for identifying strategic goals and guiding eventual simplification of lifecycle evaluations of intervention options.

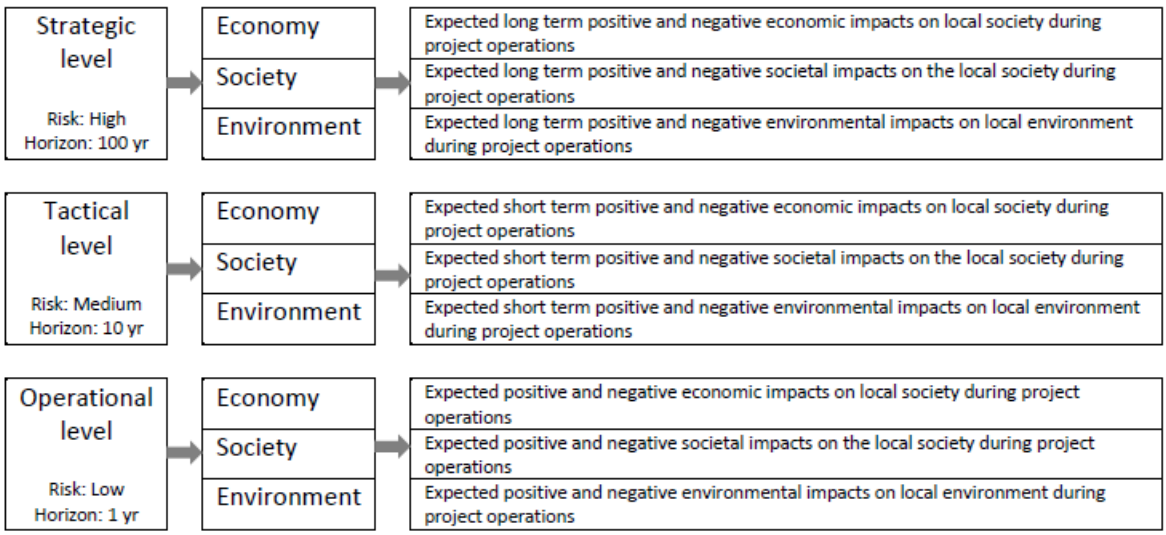

Figure 15.4 Nine categories of Sustainability Impact Assessment - SIA of large construction projects (adapted from Laedre et al., 2014)

Häkkinen et al. (2012) provide an overview of indicators and issues, which are covered by most of the buildings sustainability assessment tools, like BREEAM, LEED, DGNB and others. Based on the review of existing tools and interviews the following Key Performance Indicators are presented (Häkkinen et al., 2012, p.23):

- Environmental core indicators:
  - Primary energy consumption,
  - Water management, Materials (rational use and low impact),
  - Waste (construction and operation),
  - Global warming potential (CO2 emissions),
  - Land use and Ecological value of the site
- Economic core indicators:
  - Building adaptability,
  - Ease of maintenance,
  - Life cycle costs,
  - Process quality (planning and preparation),
  - Innovation
- Social core indicators:
  - Indoor air quality,
  - Access to transport (for building users),
  - Comfort (visual, thermal, acoustic),
  - Access to public services and amenities,
  - Access for users with physical impairments, and
  - Safety and security.

The above listed environmental core indicators can be organised in the categories energy (ENE), management (MAN), water (WAT), waste (WAS), land use (LUE), material (MAT), health and safety (HEA), pollutants protection (POL), and transport (TRA), which were used in the European Standard (EN15221-7). Table 15.2 shows the alignment between EN15221-7 and Häkkinen 2012. A similar comparison can be made to specific building certifications. The difference is likely to be the inclusion of non-building-related indicators like work related transportation or to what extent a full life-cycle perspective is applied.

Table 15.2 Short list of environmental KPIs

No	Short name	Indicator	Häkkinen et al. (2012)	EN 15221-7 (CEN, 2012)
1	ENE	Energy	X	X
2	MAT	Material	X	X
3	WAT	Water	X	X
4	WAS	Waste	X	X
5	LUE	Land use	X	X
6	POL	Pollution	X	X
7	TRA	Travel	X	X
8	HEA	Health	X	X

A slightly different approach on how to structure sustainability in FM assessment has been developed within the German research project Return on Sustainability System (ROSS). KPIs were structured according to the triple bottom line of sustainability into economy, ecology, and socio-cultural and in addition divided into management and process related KPIs. Research findings were published in the book "Nachhaltiges Facility Management" (Sustainable Facilities Management) which is available in German language (Kummert et al., 2013). The overview in Table 15.3 has been translated into English to provide an impression of the overall structure and KPIs which were considered most relevant.

Table 15.3 KPIs overview (adapted and translated from Kummert et al., 2013)

	Management KPIs	**Process KPIs**
Economy	1. Earnings Before Interest & Taxes (EBIT), (EUR)	1. Land/area consumption quota, (%)
	2. Equity ratio, (%)	2. Process additional expenditure, (%)
	3. Customer complaint, (%)	3. Process rework, (%)
	4. Customer relation duration, (month)	
Ecology	5. Water consumption, (m^3/employee)	4. Green suppliers ratio, (%)
	6. Heating energy consumption, (kWh/m^2 GFA)	5. Green operating equipment and material, (%)
	7. Electricity consumption (kWh/m^2 GFA)	
	8. Fuel consumption (l/km)	
	9. Waste generation, (kg/employee)	
Socio-cultural	10. Health rate, (%)	6. Accident rate, (%)
	11. Labour turnover, (%)	7. Personal contribution quota, (%)
	12. Training effort, (EUR/employee)	

In addition to the above mentioned suggestion for qualitative data collection, the focus on energy, waste and water is used to provide the following examples for quantitative environmental data collection (CEN, 2012):

1) Primary environmental ratios: total CO_2 emissions (tonnes per annum), and CO_2 emissions per annum per full time equivalent (fte) and per m^2 Net Floor Area (NFA).
2) Primary energy ratios: total energy consumption (kWh per annum), and kWh per annum per fte, and per m^2 NFA.
3) Primary water ratios: total water usage (m^3 per annum), and water usage per fte.
4) Primary waste ratios: total waste production (tonnes per annum), and waste per fte and per m^2 NFA.

The quantification of environmental impact, as described in EN15221-7 (CEN, 2012), is based on calculation of CO_2 emissions. First, quantities in each category are recorded based on typical units, like kWh, litre, and tonne. Second, impact factors are used to convert quantities into CO_2 emissions.

Reflections on using these KPIs

Three questions or issues for discussion regarding this approach are: 1) Availability of qualitative and quantitative date, 2) Demand of appropriate factors for sustainability impact calculation, 3) Workload and qualification for sustainability assessment and management.

The first question is how to acquire exact quantities in partly very abstract categories, which might not be documented in the FM registrations. Concerning energy management, for example how to differentiate the measurement of the non-renewable energy consumption and the renewable energy consumption? Concerning waste management, how to identify different types of waste within regular, recyclable, and biodegradable waste categories and how to measure the amounts? Can all relevant information about the basic processes be considered? For example, how is renewable energy supply managed? Is it done in a sustainable way? For example zero carbon electricity can be produced with hydropower, which has strong impact on the ecosystem and biodiversity etc., and its extensions are limited. Other examples are biofuel, or wood pellets etc.

Second, how to proof availability of correct impact factors for conversation of quantities into CO_2 emissions? How can the changing technology within the converting processes and national varieties of ways of production etc. and how should it be considered? Within the European standard it is suggested: “In calculating CO_2 emissions from energy related data, please ensure you use the right CO_2 conversion factors… CO_2 emission factors differ from country to country, especially for electricity. Therefore, it is important to verify the CO_2 conversion factor provided with the relevant authorities or your energy provider.” (CEN, 2012, Annex E)

Thirdly, how to evaluate the additional work load for data collection and calculation and communication of results, and all reporting efforts? Who is doing this and who has the needed qualification? Ideally, a data collection template is completed by an environmental expert of the facility management team or the appropriate building manager, and data is collected on a building by building basis (CEN, 2012, Annex E). Within this standard and referring to qualitative environmental data collection it is further suggested that “Ideally, this data

collection template is completed by a representative focus group which includes the environmental expert of the facility management team and/or the appropriate building manager. Data is collected on a building by building basis." (CEN, 2012, Annex E). Some organisations have implemented sustainability offices. However, challenge might also be the internal and external services provision and availability of complete documentation.

PERSPECTIVES

Sustainable FM and CREM in practice is not a simple matter but includes complex challenges with numerous dilemmas, such as how to prioritise energy savings in comparison with quality, economy, wellbeing and health. This is a part of the everyday life of FM and CREM professionals. When it comes to measuring and managing sustainability in FM/CREM it is important to:

1. Be context specific in formulation of strategic goals and KPIs, as sustainability challenges as well as implementation possibilities and barriers vary between locations, buildings, businesses and organisations.
2. Apply a lifecycle perspective when you plan your next FM and CREM task.
3. Use a balanced scorecard for structuring an evaluation and comparing between the current situation and intervention options. Expect that possible benefits and disadvantages might be estimates to begin with; and build up your knowledgebase to improve the validity.

Strategic Sustainable FM and CREM calls for a leadership perspective on the integrated whole, consisting of a building/facility, the processes (operation and use), and management practice in its specific context. It calls for FM change agents who acknowledge that however FM is performed, FM has an impact beyond the internal organisation; and has to take a part of the responsibility of contributing to sustainable development also beyond the organisation. Facilities managers needs to learn new concepts which reflects the sustainability values and they need to learn how to best implement and operate and manage the new and updated building assets as well as the FM services.

Future research should investigate if and how the FM and CREM sector is developing into the potential change agents for sustainable development on societal scale to qualify policies and regulation in the field. This includes research on building performance and studies of the application of building certifications, the CEN standards and other enablers of making the built environment more sustainable. Another important role is to support the change management of FM practices on organisational level. This can be done by evaluating the outcome of more sustainable practices at front runner organisations; and disseminate learning points of general interest. Finally research should lead to development of new management tools and FM services; which can be the very general tools for wider application; knowing that an adaptation is needed to fit the tools to every unique context.

REFERENCES

Baharum, M. R., & Pitt, M. (2009) 'Determining a conceptual framework for green FM intellectual capita.' *Journal of Facilities Management*, 7 (4), pp. 267–282.

BIFM 2013. *Sustainability in Facilities Management Report 2013*. United Kingdom.

Bond, A. J. and Morrison-Saunders, A. (2011) 'Re-evaluating sustainability assessment: aligning the vision and the practice.' *Environmental Impact Assessment Review*, 31, pp. 1-7.

Brown, Z., Cole, R. J., Robinson, J., and Dowlatabadi, H. (2010) 'Evaluating user experience in green buildings in relation to workplace culture and context.' *Facilities*, 28 (3/4), pp. 225–238.

Brundtland, G. H., Khalid, M., Agnelli, S., Al-Athel, S. A., Chidzero, B., Fadika, M. L., Hauff, V. & AL., E. (1987), *Our Common Future - Report of the World Commission on Environments and Development*. The World Commission on Environments and Development

CEN (2011): *Facility Management – Part 4: Taxonomy of Facility Management – Classification and Structures*. European Standard EN 15221-4. European Committee for Standardization.

CEN (2012): *Facility Management – Part 7: Guidelines for Performance Benchmarking*. European Standard EN 15221-7. European Committee for Standardization.

Cooper, J. (2015) Sustainable building maintenance within social housing. PhD thesis, University of Greenwich.

Cooper, J. and Jones, K. (2009) `Measuring performance in-use in UK social housing´. In: RICS 2009: *Proceedings of the Construction and Building Research Conference of the Royal Institution of Chartered Surveyors.* Royal Institution of Chartered Surveyors (RICS), London, UK, pp. 916-928. ISBN 978-1-84219-519-2.

Durmus-Pedini, A. and Ashuri, B. (2010) 'An Overview of the Benefits and Risk Factors of Going Green in Existing Buildings'. *International Journal of Facility Management*, 1 (1), pp. 1–15.

Elmualim, A., Shockley, D., Valle, R., Ludlow, G., and Shah, S. (2010) 'Barriers and commitment of facilities management profession to the sustainability agenda'. *Building and Environment*, 45 (1), pp. 58–64.

Falkenbach, H., Lindholm, A.L., and Schleich, H (2010) 'Environmental Sustainability: Drivers for the Real Estate Investor'. *Journal of Real Estate Literature,* 18 (2), pp 203-221.

Fennimore, J. (2014) *Sustainable Facility Management: Operational Strategies for Today*. Pearson, USA.

Häkkinen, T., Antuña, C., Mäkeläinen, T., Lützkendorf, T., Balouktsi, M. and Al., E. (2012) 'Sustainability and Performance Assessment and Benchmarking of Buildings'. In: Häkkinen, T. ed. Final report. Espoo: VTT Technical Reserach Centre of Finland.

Hodges, C. and Sekula, M. (2013) *Sustainable Facilities Management: The facility Manager´s guide to optimzing building performance.* VisonSpotsPublishing, USA.

Jensen, J.O, Kjærulf, A., Wilhelmsen, C. and Nielsen, S.B. (2009) *Bæredygtighedsprofiler for bydele i København.* SBi Danish Building Research Institute.

Jones, K and Cooper, J. (2007) 'The Role of Routine Maintenance in Improving the Sustainability of Social Housing'. In: *Proceedings of the European Network for Housing Research*, Rotterdam.

Junghans, A. (2011) 'State of the art in sustainable Facility Management'. In: *Proceedings of the 6th Nordic Conference on Construction Economics and Organisation – Shaping the Construction/Society Nexus. Volume 2: Transforming Practices.* CIB Publication. SBi Danish Building Research Institute, Aalborg University.

Kloepffer, W. (2008) 'Life cycle sustainability assessment of products'. *The International Journal of Life Cycle Assessment*, 13, pp. 89-95.

Kummert, K., May, M. and Pelzeter, A. (2013) *Nachhaltiges Facility Management*. Springer.

Kwane, A-D., Liow, K. H., Neo Yen Shi, S. (2009) 'Sustainability of Sustainable Real Property Development'. *Journal of Sustainable Real Estate*, 1 (1), pp. 203-225.

Laedre, O., Haavaldsen, T., Bohne, R. A., Kallaos, J. and Lohne, J. (2014) 'Determining sustainability impact assessment indicators'. *Impact Assessment and Project Appraisal*, 33 (2), pp. 99-107.

Nielsen, S.B. (2012) `Claims of Sustainable FM: Exploring current practices´. In: Jensen and Nielsen eds. *Facilities Management Research in the Nordic Countries: Past, Present and Future*. Copenhagen, Polyteknisk Forlag.

Nielsen, S.B. and Jensen, J.O. (2010) 'Translating sustainable development to the domain of a local authority: the case of urban districts in Copenhagen'. In Proceedings from *EASST 010: Practicing Science and Technology, Performing the Social. Track 38: Towards Zero Emission Buildings, Settlements and Cities.* 1-2 September Trento, Italy.

OECD (2010) *Guidance on Sustainability Impact Assessment (SIA)*. OECD

Shah, S. (2007) *Sustainable Practice for the Facilities Manager*. Blackwell Publishing, UK.

UNCSD (2012). Institutional framework for sustainable development. Available at: http://www.uncsd2012.org/isfd.html / [Accessed 4 August 2015]

Von Carlowitz, H. C. and Von Rohr, J. B. (1732). *Sylvicultura oeconomica.*