Sustainable Facility Management in UN Development Goals

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Abstract. Facility Management (FM) is currently focusing on sustainability through the adoption of the newly recognised United Nations Sustainable Development Goals (SDGs) when making business decisions. Strategic Sustainable FM has the potential towards the realisation of the 17 SDGs at all levels of organisation in the FM sector. However, the FM sector is also encountering potential barriers to the implementation of the relevant SDGs. Standardised and strategic level support is crucial for the smooth adoption of sustainable FM. This paper is aimed at discussing the role of facility management in achieving the Sustainable Development Goals. This viewpoint paper, whereby content is dependent on the authors' opinion and interpretation, focuses on new emerging disciplines that will affect the operations phase of buildings and the people working therein. The SDGs can help to objectively quantify the added value of FM to the core business and the global FM industry including impact of ISO standards and stakeholders (clients, service providers and researchers).

1. Introduction

Opoku and Lee (2022) [1] asserted that the emphasis of FM is moving towards a long-term focus by adopting practices that consider social, environmental and economic benefits of business decisions. They provide a discussion of how the FM sector can contribute to the realisation of various aspects of the 17 Sustainable Development Goals (SDGs) at various organisational levels, integrating data driven management technologies. The adoption of sustainable FM practices will reduce energy, water and waste in the maintenance and operation of buildings.

Facility Management (FM) is currently shifting emphasis towards a strategic focus through the adoption of the new recognised United Nations sustainable development goals that consider Sustainable Facility Management (SFM) in business decisions. However, the FM sector is encountering potential risks to the implementation of the new recognised International Sustainable Development Goals. British Standards Institution (2018) [2] clarifies that FM is a strategically important discipline to all organisations in the management, operation and maintenance of the workplace, its assets and operational efficiencies". FM is currently shifting emphasis towards a sustainable focus through the adoption of the newly recognised United Nations Sustainable Development Goals (SDGs) when making business decisions. As SDGs aim at establishing a constantly evolving baseline of proven practices, the goals can

be considered a part of sustainable FM. It is believed that strategic level support is crucial for the smooth adoption of sustainable FM. However, sustainable FM helps in objectively quantifying the added value of FM to the core business and as such recognised International Sustainable Development Goals to the FM global industry. Advanced technology and strategy can contribute to the sustainability of any profession and industry, but it also requires a community to tackle the problems.

No matter what kind of profession, sustainability can further improve the efficiency and productivity of the profession. The introduction of sustainable facility management must be beneficial to the international FM industry. However, the success of sustainable facility management should not only depend on the efforts of the FM members but also most importantly on the application of the new sustainable development goals by the international FM community. Without the use of the sustainable development goals on the daily FM services, the power of sustainable facility management cannot be developed, and the FM services cannot be comprehensively improved. Lok et al. (2018) [3] added that organisational level support is required for the smooth adoption of sustainability.

The ISO/TC 267 technical committee for facilities management first started in 2012 (ISO, 2022) [4]. In 2022, there are 51 countries participating in this FM technical committee. For example, the recent ISO FM standards which is to ensure consistency of essential features of goods and services, such as quality, ecology, safety, economy, reliability, compatibility, interoperability, efficiency and effectiveness can follow the principles of sustainable development goals (ISO/TC 267). Lee and Kang (2013) [5] include use of environmentally friendly materials that enhance indoor air quality, water reuse, efficient energy use for thermal comfort, sustainable renovation and retrofitting, flexible design and circularity. The problem is that it is believed that the effective use of sustainable facility management can further enhance the productivity and efficiency of the FM service. Although all the FM community understand the importance of sustainability, FM services may not be effectively arranged without relevant sustainable development goals. Addressing the SDGs in facility management as a driver for sustainability is of paramount importance. This may mean a paradigm shift in the way the SDGs are delivered and acquired to help enable a more resilient world and more sustainable practice in workplace and Facility management. Nowadays, no modernised people can escape the trend; It is necessary for all generations to learn and update UN goals. To have effective communication and productivity, people pursue sustainability in daily life more than ever before. What are the effects of FM Key Performance Indicators (KPIs) on sustainable facility management and SDGs?

The research question of this paper is about whether now it is difficult or not to develop sustainable facility management and implementation of sustainable development goals for facility management. This viewpoint paper, whereby content is dependent on the authors' opinion and interpretation (Emerald Group Publishing, 2022) [6] focuses on new emerging disciplines that will affect the operations phase of buildings and the people working therein. British Standards Institution (2018) [7] clarifies that FM is a strategically important discipline to all organisations in the management, operation and maintenance of the workplace, its assets and operational efficiencies". This is understanding that the aim of facilities management is to achieve a high quality of daily living and working lives. To achieve a high quality of life, we need to achieve high performance in facilities management. The research problem is about how to excel and advance the performance of FM services by sustainable development goals. The aim of this viewpoint paper is to investigate performance of FM services by sustainable development goals. This will be achieved through the following research questions: What is the significance of sustainable development goals to the built environment? What is the link between FM Key Performance Indicators (KPIs), FM services by sustainable development goals? What are the challenges in developing FM services by sustainable development goals? This viewpoint paper is to study how sustainable FM fits with the SDGs. However, there is little in-depth research or discussion on the association of FM KPIs to SDGs.

2. The United Nations Sustainable Development Goals (SDGs)

A study by Collins et al. (2019) [8] that explored the gap between sustainable buildings and sustainable FM found that the need to bridge the traditional gap between design, construction and FM demands

more effective solutions based on life cycle assessments. Opoku and Lee (2022) [1] asserted that the emphasis of FM is moving towards a long-term focus by adopting practices that consider social, environmental, and economic benefits of business decisions. The paper provides a discussion of how the FM sector can contribute to the realisation of various aspects of the 17 Sustainable Development Goals (SDGs) at various organisational levels, integrating data driven management technologies. The adoption of sustainable FM practices will reduce energy, water and waste in the maintenance and operation of buildings. Opoku and Lee (2022) [1] further suggested that the FM sector should be at the heart of the engagement and drive towards integrating sustainability into daily FM practice to bring improved customer service. Sustainable facility management and the Sustainable Development Goals are not only gaining importance for various building assets around the world, but they also impact (or are impacted by) sustainable development objectives. Except for security, each of them fits into environmental, social, and economic strands of sustainable development. In addition, sustainable facility management is in alignment with SDGs essentially for investigation. ISO (2022) [4] explained that ISO has published more than 22,000 International Standards and related documents that represent globally recognised guidelines and frameworks based on international collaboration, most significantly contributing to the achievement of every one of the SDGs.

2.1. Sustainable Facilities Management collaborating with SDGs

Strategic Sustainable FM has the potential towards the realisation of the 17 SDGs at all levels of organisation in the FM sector. Strategic sustainable FM is one kind of force that has shaped the management of the built environment and FM recently and rapidly, especially in the Covid-19 period. Opoku and Lee (2022) [1] assert that the concept of Sustainable Facility Management (SFM) brings together the two concepts of FM and sustainable development by adopting technology and innovative business practices that balances the social, economic, and environmental impacts of business decisions. Nielsen and Galamba (2010) [9] describe it as the consideration of the sustainability principles on core business, support function, and the impact on the local community of operation and the global community. However, Lee and Kang (2013) [5] provide a more detailed description of SFM to include the use of environmentally friendly materials that enhance indoor air quality, reuse of water, and efficient energy use that offer good thermal comfort, sustainable renovation and retrofitting, flexible design of developments that promote sustainable cities and communities, circularity, and so on. Tucker (2013) [10] adds that SFM involves the management, implementation and the delivery of an organisation's core and non-core business services that contribute to economic, social, and environmental sustainability. The FM sector should be at the heart of the engagement and drive towards integrating sustainability into day-to-day FM practices to achieve better services to customers. SFM is about the ability to make smart decisions that will minimise the negative impact of business decisions on the environment by implementing sustainable practices across the business that address the 3Cs of FM, consisting of customer experience, climate change, and competition.

Elmualim et al. (2012) [11] believe that facility managers have a critical role to play in the adoption of sustainability principles in the wider built environment, and the FM sector in particular. However, the adoption and implementation of sustainability principles in FM requires collaborative partnership with the relevant stakeholders on effective strategies that promotes health, safety, and wellbeing practices in the organisation. The adoption of sustainable FM practices could help address many FM challenges, simplifying the everyday FM work at strategic, tactical, and operational levels. This requires a more holistic plan that coordinates investment, administration, space management, operation, and service functions. Even though SFM seems to be biased towards technical and isolated environmental problems (Lok et al., 2018) [3], FM organisations are progressively addressing environmental, social, and economic sustainability of their business activities simultaneously. Opoku and Lee (2022) [1] confirm that the benefit of SFM in existing facilities such as greening building stock will offer more benefits than delivering new sustainable construction projects as SFM promotes energy savings, waste reduction, water conservation, carbon footprint controls, and so on. The decision of a facility manager

has the potential to either positively or negatively affect the planet (Aceves-Avila and Berger-García, 2019) [12].

At the forefront of organisational behavioural change is the facility manager who is in the position to influence the behaviour change of individuals working at all levels of business where they have the role to manage facilities (Elmualim et. al., 2009) [13]. Buser et al. (2018) [14] argue that 80% of a building's impact on climate change happens during the operation phase, highlighting the negative impact of a building operation on the environment. The built environment alone accounts for more than 33% of energy use, 40% of materials use, and produces 40–50% of greenhouse gas emissions globally. The SFM of existing building stock and infrastructure is essential in achieving the global agenda towards sustainability due to the volume of existing building stock (Nielsen, et al., 2009 [15]; Radebe and Ozumba, 2021) [16]. SFM can help in addressing some of the global challenges such as climate adaptation, energy efficiency, and sustainable development, developing innovative solutions for organisations and society (Nielsen et al., 2016) [17]. Even though the FM profession has a potential role to play towards the realisation of sustainable development goals, Kwawu and Elmualim (2011) [18] argue that facility managers will require the development of the relevant knowledge and skills to be able to fully embrace the opportunities of integrating sustainability principles into core FM business strategies and operations. A study by the International Facility Management Expert Centre (IFMEC, 2018) [19] in the Netherlands revealed that strategic SFM has the potential for the realisation of the 17 Sustainable Development Goals because the FM profession has the advantage of incorporating the SDGs at all levels of organisation, from corporate to the operational levels, and can influence behavioural changes at the individual level by providing the enabling environment for sustainable practices. Table 1 indicates sustainable facility management linking to the 17 Sustainable Development Goals (SDGs) in terms of scope of works. However, Table 2 indicates the link between the SDGs and ISO standards and Table 3 describes the benefits of sustainable facilities management.

In addition, they observe that the FM sector can contribute to the realisation of SDG 12 (responsible consumption and production) by promoting policies and practices that source food and other resources through sustainable and circular procurement strategies to ensure that only healthy products (eco-friendly) with no or minimum damage to health and the environment are used in the FM sector. For example, the FM sector should only buy wood-related products with a sustainable certificate to prevent the loss of biodiversity (Goal 15-life on land, biodiversity). Such policies and actions will lower the sector's CO2 emission and carbon footprint (Goal 13-climate action), which could be absorbed into oceans and seas (Goal 14-life below water), which is critical for the planet. The FM sector works in partnership with people, organisations and authorities (Goal 17-partnership for the goals) to maintain safety and security (Goal 16-peace, justice and strong institution) in and around building facilities (IFMEC, 2018) [19].

Opoku and Lee (2022) [1] claim that by providing economic and social improvement for individuals through job creation (SDG 8—Decent work and economic growth), the FM sector can also help address SDG 1 (no poverty). The FM profession is the heart of the food supply chain in many organisations including companies, schools, hospitals, and so on; co-creating the workplace and the working conditions of employees, thereby addressing SDG 2 (zero hunger) and SDG 3 (good health and well-being), respectively. The sector is also responsible for the sustainable maintenance of buildings in cities and communities (SDG 11-sustainable cities and communities), which includes managing building energy usage (SDG 7-affordable and clean energy) and the efficient management of water (SDG 6-clean water and sanitation) in buildings by reducing water losses through avoidable leakages. The FM profession is managing educational facilities globally, thereby improving quality education for all, SDG 4 (quality education). The FM sector continues to be a model for other sectors to follow in terms of its record of a diverse workforce of all nationalities (Goal 9-reduced inequalities), equal rights in wages and career opportunities for women, demonstrating gender equality (SDG 5) in the sector. The FM sector has done well by adopting relevant technologies such as artificial intelligence (AI), Internet of Things (IoT), etc., as parts of the sector's smart building agenda to support the realisation of SDG 9 (industry, innovation, and infrastructure) (IFMEC, 2018) [19]. Facility managers are urged to focus on the long-

term environmental impact of business decisions as opposed to short-term maintenance issues of buildings. The heart of the SFM practice is the creation of net-zero energy buildings and the provision of innovative energy utilisation solutions in existing building stock and integrating data-driven management technologies. Building automation through the use of smart technology in retail premises, offices and residential communities will result in efficient operation of building facilities. To ensure effective implementation of sustainability in the FM sector, the training of the workforce on best sustainability practices, policies, and procedures, and raising awareness among end-users, is essential. Sustainability practices should be incorporated into FM operations and functions, such as reducing water usage through the installation of automated toilets, waterless urinals, low flow, the use of locally grown food, waste disposal and recycling, and space use management practices, such as hot-desking (Berardi, 2013) [20].

2.2. Linking FM Key Performance Indicators to sustainable facility management and the SDGs

How are the KPIs of Facility Management related to the Sustainable Development Goals? Lok et. al (2021) [21] addressed the importance of measurement and quantification of sustainable facility management on outsourcing services through key performance indicators. The future of FM was influenced by society's need for improving efficiency following the economic crisis of the mid-1970s and the evolvement of new public management (Klungseth, 2015) [22]. Haugen and Klungseth (2017) [23] explained that since its conception, FM has focused on productivity, and, from the late 1980s, one crucial topic for discussion has been the efficiency of FM services related to their quality. Nowadays, the focus is also on cost control, customer satisfaction and service quality through using digital technology and how it is being applied in facility management. The effectiveness and efficiency of sustainable facility management are considered to have an impact on productivity in offices. Poor FM practices cannot have positive impacts on the productivity of the client (Ikediashi et. al., 2012) [24]. It is valuable to measure users' satisfaction, comfort, and productivity (Fleming, 2004) [25]. Hou et al. (2016) [26] claimed that comprehensive strategic planning and effective budget analysis are key to improving FM performance and relationships. Organisations in Europe have focused recently on cost efficiency, improvement of procedures and reduction in headcount (Ernst and Young, 2013) [27]. Quantifiable and measurable indicators are necessary as Pintelon and Puyvelde (1997) [28] suggested that performance metrics are mostly ratios demonstrating effectiveness, efficiency, or productivity.

More research studies in providing quantifiable KPIs for strategic decision-making in organisations are vital (Shohet, 2003) [29]. The performance indicators to measure facilities and/or organisations need to be quantifiable to make valid analysis and references (Augenbroe and Park, 2005 [30]; Cable and Davis, 2004 [31]; Chan et al., 2001 [32]; Gumbus, 2005 [33]; Ho et al., 2000 [34]; Shohet, 2003 [29]). For example, advanced quantifiable and measurable methodology with digitalisation technology such as ANN is used to measure the performance metrics of FM outsourcing services (Lok et al., 2021) [21]. In the daily operational process, the artificial intelligence approach using Artificial Neural Networks (ANN) can quantify and measure the intangible FM outsourcing services objectively and robustly (Lok et al., 2022) [35].

Among major facility performance measurement practices are benchmarking, the balanced scorecard approach, post-occupancy evaluation and measurement through metrics of key performance indicators (KPIs) (Lavy et al., 2014a & b) [36, 37]. To express the performance of the facility in a holistic manner, developing performance metrics is an imperative step in the process of performance evaluation (Amaratunga et al., 2000a [38]; Brackertz, 2006 [39]; Cable and Davis, 2004 [31]; Lebas, 1995 [40]; Varcoe, 1996 [41]). Cable and Davis (2004) [31] critically asserted that the senior management team can make strategic decisions for performance measurement by using established KPIs. This is the cause and effect between key performance indicators and high-quality service performance. It is also believed that KPIs can measure the effectiveness of facility management services even if SDGs are applied. However, there is little in-depth discussion on the association of FM Key Performance Indicators to sustainable facility management and SDGs.

Table 1. The role of FM in achieving the SDGs (Source: United Nations, 2015 [a]; IFMEC, 2018 [b]).

The role of the FM	SDGs		SDG Targets
- Provide individual economic and social improvement for these people in need	1	No poverty	1.2, 1.4
- Catering influences sourcing of food products, food security, nutritional value and waste	2	Zero hunger	2.1, 2.4
- The co-creators of the workplace and they take responsibility for the working conditions of the employees.	3	Good health and well-being	3.7,3.8
- Improving education around the world is the supply of proper school equipment and enabling new ways	4	Quality education	4.3,4.4
- Facility Management contribute to the home-work balance by providing good and flexible work conditions	5	Gender equality	5.5,5.6
- Responsible for Water Management reducing water losses by controlling leakages, increasing water efficiency	6	Clean water and sanitation	6.2,6.4
- The real task is to implement and maintain the innovations. This in a continuous improvement process.	7	Affordable and clean energy	7.2,7.3
- Facility managers around the world can greatly contribute to the overall working conditions of the employees	8	Decent work and economic growth	8.3
- Important tech innovations are often related to smart buildings and workplaces.	9	Industry, innovation and infrastructure	9.5
- More and more multinationals tender their maintenance and facility services on a European and/or global scale.	10	Reduced inequalities	10.2,10.6
- Contribute to sustainable growth by maintaining buildings, districts cities.	11	Sustainable cities and communities	11.3,11.6
- Source their food resources with a circular procurement strategy.	12	Responsible consumption and production	12.4,12.5
- Sustainable business management has a high priority within the field of Facility Management.	13	Climate action	13.3
- Pollution by plastic is a big issue. FM can help by circular procurement policy and waste control.	14	Life below water	14.2,14.4
- Often in direct contact with a large portion of animal products and can therefore try to decrease the usage.	15	Life on land	15.1,15.5
- Peace and justice are not only responsibilities for the government in line with their strong institutions	16	Peace, justice and strong institutions	16.2,16.10
- FM can play an important role in bringing together all supporting departments of organisations	17	Partnerships for the goals	17.7,17.9

Notes

[a] United Nations (2015) Transforming our world: the 2030 Agenda for Sustainable Development.

[b] IFMEC (2018) "Facility Management Approach to Realizing the Sustainable Development Goals", International Facility Management Expert Centre (IFMEC), Roden, The Netherlands.

Table 2. Interpretation of SDGs to ISO standards (source: United Nations, 2015 [a], International Organization for Standardization, 2018 [b]).

SDGs			Interpretation of SDGs to ISO standards
1	No poverty	-	By providing a platform for best practice in all areas of economic activity, from agriculture to banking, ISO International Standards
2	Zero hunger	-	ISO has over 1 600 standards for the food production sector designed to create confidence in food products
3	Good health and well-being	-	Access to quality healthcare is an essential human right. ISO has over 1300 standards supporting safe, quality
4	Quality education	-	ISO 21001, Educational organizations, Management systems for educational organizations Requirements with guidance
5	Gender equality	-	Gender equality is a key component of social responsibility, and the empowerment of women and their equality in society
6	Clean water and sanitation	-	Globally, over 80% of wastewater generated by society flows back into the ecosystem without being treated or reused
7	Affordable and clean energy	-	Represent internationally agreed guidelines and requirements for solutions to energy efficiency and renewable sources.
8	Decent work and economic growth	-	International Standards, by their very nature, promote economic growth by setting a common language and internationally
9	Innovation and infrastructure	-	Sustainable industrialization through internationally agreed specifications that meet quality, safety and sustainability requirements.
10	Reduced inequalities	-	Ensure proper functioning of the market, protect people's health and safety and preserve the environment.
11	Sustainable cities and communities	-	Responsible use of resources, preserving the environment and improving the well-being of citizens are the end goal
12	Consumption and production	-	Reducing our environmental impact, promoting the use of renewable sources of energy
13	Climate action	-	Essential role in the climate agenda, helping to monitor climate change, quantify greenhouse gas emissions
14	Life below water	-	Provides a unique opportunity to participate in the development of fisheries and aquaculture
15	Life on land	-	Protecting and promoting life on land through better use of resources is the objective of hundreds of ISO standards.
16	Peace, justice and institutions	-	Effective, accountable and inclusive societies and institutions rely on good governance at all levels
17	Partnerships for the goals	-	Consensus of a wide range of stakeholders from all corners of the Earth, including representatives from government

Notes
[a] United Nations (2015) Transforming our world: the 2030 Agenda for Sustainable Development.
[b] International Organization for Standardization (2018) Contributing to the UN sustainable development goals with ISO standards, Switzerland.

Table 3. Benefits of Sustainability Facilities Management (Source: Abigo, et al , 2012 [a]; Elmualim, et al., 2012 [b]; Baaki Kurannen, et al., 2016 [c]; IFMEC, 2018 [d] and International Organization for Standardization, 2018 [e]).

Perspectives	Benefits of Sustainable Facilities Management
Social	- Add value to their organisations and customers through efficient management of sustainability issues and practices; - A long-range focus in organisations and has continuity responsibilities; - Incorporate the SDG's from a corporate level into a broad scope of enabling practices; - A leadership network working to advance gender parity in executive management. - Determining profitability, productivity, energy management, waste management, employee wellbeing and public perception of an organization; - Home-work balance by providing good and flexible work conditions
Environmental	- Ensure proper functioning of the market, protect people's health and safety and preserve the environment; - Reduction in energy consumption, Waste reduction Increase productivity, Elimination of oil and air pollution, Sustainable urbanization, Reduction of deforestation and Reduction of carbon dioxide emissions - Technology advances beyond our wildest imaginings; resources becoming more scarce; higher efficiency of operations demanded by customers; - Preserving the environment, incorporating sustainable practices in the management of buildings comes with the benefit of reduced cost;
Economic	- Reduces the running/operational cost of the organisation and carbon emissions of buildings; - Lifecycle cost reduction, financial gain, investment drive, Life cycle cost reduction, profitability, to remain competitive and Market expansion - A wide recognition of the benefits and importance of incorporating sustainability into FM practice; Pressure from legislation, fierce market competition and constantly changing business environments warranting the need to seek competitive edge;
Drivers for SFM	- Interestingly, pressure from stakeholders, employees and lifecycle cost reduction were regarded as the least of the drivers to SFM practice; Identified job creation for local communities, waste reduction and enhancing relationships with stakeholders as the main drivers to SFM

Notes

[a] Abigo, A., Madgwick, D., Gidado, K., & Okonji, S. (2012) "Embedding sustainable facilities management in the management of public buildings in Nigeria", In EPPM 2012, pp. 369-380, University of Brighton.

[b] Elmualim. A., Valle, R. and Kwawu, W. (2012) "Discerning policy and drivers for sustainable facility management practice", Journal of Sustainability Built Environment, 1, 16–25.

[c] Baaki Kurannen, T., Rizal Baharum, M. and Shah Ali, A. (2016) "A review of sustainable facilities management knowledge and practice", University of Malaysia, 50603 Kuala Lumpur, Malaysia.

[d] IFMEC (2018) "Facility Management Approach to Realizing the Sustainable Development Goals", International Facility Management Expert Centre (IFMEC), Roden, The Netherlands.

[e] International Organization for Standardization (2018) Contributing to the UN sustainable development goals with ISO standards, Switzerland.

3. Measurement of FM Services by Key Performance Indicators (KPIs)

The measurement of performance as KPIs depends on who actually uses the performance assessment (e.g., executives, managers or supervisors), the public or private nature of the organisation, the assessment objectives (financial, functional, or physical) and prevailing trends in the industry (Amaratunga et al., 2000b [42]; Cable and Davis, 2004 [31]; Cripps, 1998 [43]; Eagan and Joeres, 1997 [44]; Hinks, 2004 [45]; Lebas, 1995 [40]). Lavy et al. (2010) [46] list four categories of KPIs in FM

such as financial, functional, physical and user satisfaction. For instance, the financial category of KPIs may include operating, occupancy, utility, and capital costs of FM outsourcing services. The functional category includes building physical condition, resource consumption—energy, water, property and real estate, waste, health and safety, indoor environmental quality, and security of FM outsourcing services. The physical category includes productivity and space utilisation of FM outsourcing services. The user satisfaction category includes customer/building occupants' satisfaction with products or services of FM outsourcing services. Lavy et al. (2014a) [36] reminded that the current assessment of facility performance measurement emphasises financial aspects such as business, organisational goals, job satisfaction, work environment, environmental issues, and other non-financial qualitative aspects in a detailed manner holistically. It is generally accepted that the FM services can be assessed by both non-financial aspects and financial qualitative aspects of KPIs through the utilisation and implementation of ISO FM standards.

3.1 Non-financial Qualitative Aspects

Mendell and Heath (2004) [47] addressed Indoor Environmental Quality (IEQ) of a building as a primary concern today as it reflects and influences the health and well-being of its occupants. According to Fowler et al. (2005) [48], IEQ has major impacts on occupant health and productivity and eventually could adversely influence occupants' turnover rate, absenteeism, and satisfaction. Furthermore, IEQ-related problems possess economic implications, as Prakash (2005) [49] suggested that IEQ-related problems, such as sick building syndrome, other building-related illnesses, and absenteeism result in increased costs. Kockat, et al. (2018) [50] explained that buildings can efficiently operate with high indoor environmental quality and facilitation on digitalisation of knowledge-sharing. Digitalisation of the built environment is considered as a significant factor for innovation in the Architecture, Engineering, Construction and Operation sector (Mannino et al., 2021 [51]). Improved IEQ performance of a facility enhances the satisfaction and productivity level of its occupants (Heath, and Mendell, 2002 [52]; Fisk, 2000 [53]; Ford, 2006 [54]; Fowler et al., 2005 [48]; Mozaffarian, 2008 [55] and Prakash, 2005 [49]). An enhanced IEQ not only increases productivity and reduces the financial burden; it also enhances confidence in the organisation's ability to provide a safe, comfortable and healthy atmosphere (Fowler et al., 2005 [48]; Prakash, 2005 [49] and Mozaffarian, 2008 [55]). Mendell and Heath (2004) [47] concluded that the performance of students in school or non-school indoor atmospheres demonstrates a direct relationship to indoor pollutants, thermal comfort and building characteristics because of health-related problems. Bakker and Van der Voordt (2010) [56] and Smith, Tucker and Pitt (2011) [57] discovered that plants can have a positive impact on the productivity of human beings. Those studies indicate that the non-financial qualitative aspects of the IEQ relate to Lavy et al.'s (2010) [46] three categories of KPIs in FM including functional, physical and user satisfaction. The issue of indoor environmental quality has direct impacts on the quality of all kinds of FM services.

3.2 Financial Aspects

Facility Management (FM) provides supportive services to core businesses for companies (CEN, 2006) [58] such as infrastructure maintenance, equipment repair, etc. Companies (especially large ones) that are faced with the challenge of maximising business productivity and reducing costs are increasingly considering outsourcing their non-core activities such as FM (Maechling and Bredeson, 2005 [59]). Cui and Coenen (2016) [60] argued that FM service suppliers can add potential value in this dimension by improving employees' productivity, increasing user satisfaction, and innovating customers' business processes in business relationships. Haugen (2003) [61] explained the client–supplier model regarding long-term gains in productivity. The client–supplier model had a greater focus on the core business of the local authorities and was anticipated to reduce the administrative and operational aspects of organisations. From the perspective of Facility management, key performance indicators of facility management can be used to measure the FM performance. Lavy et al. (2014b) [37] explained that the current assessment of facility performance measurement emphasises financial aspects.

3.3 Productivity

Clements-Croome and Kaluarachchi (2000) [62] discussed the occupant productivity measurement and how the various factors that affect it can be quantified into measurable entities. Table II indicates the factors affecting productivity in modern offices. There are also other factors that affect productivity; Bradley (2002) [63] proposed that the business measures that can be derived from the balanced scorecard, and are specific to real estate and workplace, are as follows: productivity (e.g., space utilisation, process speed and quality, waste levels). Productivity is generally defined as the ratio of output (produced goods and services) and input (consumed resources/corresponding offers) in the production transformation process (Oeij, 2012 [64]; Tangen, 2002 [65] and Van der Voordt, 2004 [66]). As a result, productivity is closely linked to the available resources; this means that productivity is reduced if the resources are not used properly or if there is a lack of appropriate resources. On the other hand, productivity is strongly linked to the creation of value. This means that high productivity is obtained when adding value to the produced goods and services in the production transformation process (Tangen, 2002) [65]. The built environment has incontrovertible effects not only on the health, safety, and productivity of building occupants, but also on the elemental systems ecology of the natural world (Lavy, 2014b) [37]. It is widely understood that measurable and quantifiable efficiency of the built environment can affect the FM performance. The SDGs can help to objectively quantify the added value of FM to the core business and the global FM industry including impact of ISO standards and stakeholders (clients, service providers and researchers). The paper also defines and identifies the challenges of adopting the SDGs in the FM sector.

4. Impact of ISO standards and stakeholders (clients, service providers and researchers) on the adoption of the SDGs in the FM sector

SDGs have become prevalent and facility managers can use the standards to truly improve their operational services. However, the FM sector is also encountering potential barriers to the implementation of the SDGs. Both sustainability and security/emergency management has gained such an organisational tailwind that, if managed properly, they will be at the forefront of all facility managers' practices (Roper and Richard, 2014) [67]. This section explains sustainable development in terms of facility management in the context of this research and why this may be related to sustainable facility management and SDGs. In recent studies in sustainability research, Olawumi and Chan (2018) [68] focus on various subject categories such as green and sustainable technology and construction and building technology. They also observe that the emerging research and global trends in sustainability research are in the areas of sustainable urban development, sustainability indicators, environmental assessment, and public policy. Nielsen et. al. (2016) [17] provide an overview of theoretical and practical knowledge which can guide: how to document and measure the performance of building operations in terms of environmental, social, and economic impacts systematically such as sustainability tools and standards.

The SDGs can help to objectively quantify the added value of FM to the core business and the global FM industry including the impact of ISO standards and stakeholders (clients, service providers, and researchers). However, the global development of sustainable facility management is sluggish. Sustainable FM and the Sustainable Development Goals are not good happenings currently. In general, there is a number of FM ISO standards published for use since development. The standards are new and challenging to all FM international stakeholders. It is without a doubt that FM services can be developed and planned more effectively and efficiently in accordance with the ISO standards for the adoption of the SDGs. However, this is a question of how to well develop the FM services with the standards and goals. There are possible risks referring to the three perspectives of FM stakeholders. It is important to understand their problems.

4.1. Clients' perspective

No matter what kind of public, private, or non-governmental organisation, there is a requirement to understand their facilities' needs. They need to confirm and work in alignment with the recently

published FM ISO standards if they wish to follow the standards. However, it is a difficult process from understanding the FM standard to implementing the standards in their organisations. If they are planning to work effectively by following the standards, they are required to fully understand the standards and also effectively implement them. In addition, they are also necessary to recognise the SDGs which are useful and significant to their organisations. Both ISO standards and SDGs can mutually benefit their organisations which can effectively link the standards and goals in their strategies. Some clients are not willing to implement both the standards and goals because they consider wastage of short-term resources, and their business cannot be further improved. It is rather difficult to link the standards and goals effectively.

Some conservative clients perhaps do not understand or neglect or pay little attention to the importance of new FM international Sustainable Development Goals to the benefits of their assets or organisations and their steps are behind the global schedule. Generally, long-established companies may consider that they can run their business well as usual without the SDGs. The fact is that ISO FM practitioners are still pushing the relevant sustainable development goals. The ISO 41001 Annex ("Guidance on the use of this document") facilitates productive use of the standard, explaining and listing specific functions to assign and assess. Each organisation and each solution are different, but the universal framework applies to all (Reynolds, 2022) [69]. However, some stakeholders have only shown little interest in the importance of these SDGs to their businesses. This has an adverse impact on the productivity of the FM on the global track. In fact, various industries of business clients, especially international companies or organisations, are suitable to implement the new FM international Sustainable development Goals. However, they may consider these goals not on their top urgency or even as not important and may be unwilling to invest substantial finance and resources in implementing the standards. The fact is that most organisations already have implemented various mature ISO management system standards, such as 9001, 14001, 55001 etc. As long as the primary focus for FM is on cost reduction instead of creating strategic value, this issue will remain (Lok and Baldry, 2015) [70]. In many cases, the added value of goals is not directly seen and the business case for implementing yet another Management System is not positive.

4.2. Service providers' perspective

If the service providers are planning to understand and implement the standards and goals, they need to prepare and organise the effective use of resources. This is a challenging task for them to understand and implement even if they can work internally. However, the most critical task for them is to work on both standards and goals for their clients' needs. This may be more difficult to achieve a positive outcome from both standards and goals as they need to work inside their organisations and also outside of their organisations to fulfill the needs and policies of their clients. They may consider these SDGs not on their top urgency or even as not important in the life cycle of building assets. The SDGs can develop a new environmental ecosystem for the industry globally. If companies are willing to join and utilise new digitalised techniques for the data under appropriate governance measures, the stakeholders may have sufficient incentive and financial support to overcome potential economic and/or social challenges (Linkov et al., 2018) [71]. All the stakeholders' investments are sustainable with extra finance, resources, and technology during the process. Those problems can be constituted as barriers to the environment. This is a competition whether the companies can have a positive return and better productivity after overcoming the implementation of the SDGs.

Firstly, they need to well prepare themselves and then implement both standards and goals internally and externally matching the client's needs. Secondly, they also need to be aware that different kinds of clients may have different concerns about both standards and goals. Therefore, they are necessary to have various plans and strategies to fit various clients' complicated needs in a sustainable approach. Perhaps the existence of psychological obstacles for individuals or communities leads to the FM practitioners not understanding or neglecting the importance of development goals. They may be unwilling to put effort into the development of SDGs in their businesses. The problem is that they cannot understand the need and expectations of the users in terms of SDGs. Users' experience cannot be

satisfied. They do not believe that SDGs can improve or even make their more success for their business. They are afraid of any change with the use of new things. However, new standardised and strategic level support is crucial for the smooth adoption of a sustainable FM.

4.3 Researchers' perspective

The researchers can develop a full picture of both standards and goals and explain the significance of both in terms of investigation and examination. They can support the clients and service providers to understand and realise the importance of the standards and goals through research. The challenging task for the researcher is to objectively promote both standards and goals in terms of scientific values, but it is rather difficult to find out useful data to analyse and to explain the significance of the standards and goals. They can consider conducting more research on the two aspects and to use those updated data for an explanation. They require to have real valid examples to analyse and to explain scientifically, but there is a need to have more collaborations between the researchers and practitioners. The former can conduct objective and scientific research and the latter can support the real-world valid case study. The researchers understand that individuals may have their own problems in facing the SDGs. Questions are such as "How to change the FM to SDGs around the FM world?" "How to make the FM people understand the importance of SDGs on the business?" "How to connect the FM people understanding the importance of new FM Sustainable development goals to their services?". However, the researchers may face insufficient support and valid case studies for their research.

5. Recommendations on the role of facility management in achieving the SDGs

New SDGs are useful and beneficial to the FM community for their reference and use. The goals can be achieved not only to maintain the quality but also to improve the FM services in the built environment systematically if risks can be managed. It is understood that the sustainable development goals are not adopted as quickly and widely as expected. The barriers that are considered are at the fringe of FM, where FM can make further horizontal managerial connections with other business columns such as IT, HR etc., especially when discussing sustainable facility management. Sustainable facility management and implementation of Sustainable Development Goals for facility management are necessary to the industry. Collaboration is a crucial key to supporting the implementation of SDGs to sustainable facility management among the stakeholders. The clients and service providers can consider incorporating the SDGs into their own FM policies and strategies. Both parties can negotiate on how to work out effective SDGs with their partners as communication and trust are also important. They can regularly review their working SDGs in their companies to ensure the validity of the implementation. The researchers can conduct and put efforts into an investigation into the relationship between the SDGs and FM. However, this is a challenging task to achieve those objectives.

6. Conclusion

This paper is an initiative to discuss the SDGs throughout the FM world. Although there has been already an emphasis on SFM, it is inevitable that the FM professionals will need to solve different and new problems during the process of implementation of these goals. More effectively and efficiently applying the new innovative international SDGs, academics and FM professionals can understand and use SFM. The SDGs can provide the possibility for easing access between sustainable management and FM systems. In addition, it is important to reduce waste sustainably. According to the literature review, several issues of FM KPIs which affect sustainable facility management and FM SDGs were identified, including function, user experience, physical and finance. To address some of these issues, FM research has emerged in productivity, efficiency, customer service, resource allocation, assets, and cost. In this sense, we organised this paper into two sections: The first one provided a review of FM key performance indicators. The second section focused on the discussion of the implementation of sustainable facility management and FM SDGs. In the end, we should reiterate the fact that understanding the implementation of sustainable facility management and FM Sustainable Development Goals not only leads to cost and resource efficiency gains but also elevates the satisfaction of users by increasing the

quality and reliability of FM services. We have identified several areas that need an update and further research. The development of sustainable facility management and implementation of Sustainable Development Goals for facility management should be systematically linked through an integrated model that considers the criticality of services, from the three FM stakeholders. Further, sustainable facility management should go beyond assessing the performance based on the functionality of FM services and should link the performance of the FM services to its impact and contribution to the efficiency and effectiveness of the routine daily operations in the building assets. In addition, the implementation of sustainable development goals for facility management, owing to its criticality of services, should consider adopting availability-based strategies, currently in practice in the global FM industry, to ensure service continuity while avoiding over-expectation or under-expectation of efficiencies. However, the limitations of this study are that the research is based only on literature reviews on recent FM-related and published Sustainable Development Goals and the potentially narrow viewpoints of the researchers. The existing outcome is rather limited. To have more generalised results or outcomes, it is recommended to conduct a large-scale research study on this topic of SFM and implementation of the new FM international SDGs. This paper contributes to the FM industry by making recommendations for improvement in the use of SDGs on sustainability. In summary, the significance of this paper is to explore how sustainable FM offers both possibilities and problems to the application of the new recognised international Sustainable Development Goals in the FM industry.

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