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Revolutionizing FM Outsourcing

AI applications & case studies

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SUSTAINABILITY TECHNOLOGY

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Revolutionizing FM Outsourcing

In the facility management industry, strategic, Sustainable FM can assist in achieving the 17 United Nations Sustainable Development Goals (SDGs) across organizations.

Outsourcing Sustainable FM leads to better business decisions and helps reduce energy, water and waste in building maintenance.

However, the FM outsourcing sector faces challenges in applying these SDGs, making clear support essential for effective adoption. How does FM outsourcing contribute to the SDGs? This framework guides future research and helps measure FM's added value. An AI-based FM outsourcing system also relates to the SDGs, aiming to inspire FM professionals with new ideas about relationships among stakeholders.

Facilities management, facility management or FM



ISO 41011:2017 (1st ed.) and ISO 41011:2024 (2nd ed.) note that the terms Facilities Management and Facility Management are interchangeable and defines them as: an "organizational function which integrates people, place and process within the built environment with the purpose of improving the quality of life of people and the productivity of the core business."

UN SDGs The International Organization for Standardization (ISO) has released more than 25,000 standards and documents that provide important guidance on better business and sustainable decisions based on global collaboration. It is crucial to connect the sustainable buildings with Sustainable FM including design, construction and FM for better solutions based on life cycle assessments. There is a shift toward long-term thinking in business decisions, focusing on practices that consider social, environmental and economic benefits. The FM sector can support various issues of the 17 Sustainable Development Goals at the organizational level by using data-driven management technologies.

ISO/UNDP PAS 53002:2024 - Guidelines for contributing to the SDGs provides current insights into the relationship between ISO standards and the SDGs.

ISO 41000 series

ISO technical committee (ISO/TC 267) was established in 2012 by 26 member countries (17 participating members and nine observing members) to be responsible for progressing the international FM standards initiative. As of May 2026, the ISO/TC 267 has now published 10 FM international standards and technical reports and has five more publications (including two revisions of existing publications to second editions) under development.

Also as of May 2026, the ISO 41000 series of FM standards includes 54 countries (36 participating members and 18 observing members) and envisages the future of FM as contributing to a more productive, sustainable and liveable built environment for all.

Of specific relevance is ISO/TR 41019:2024, "FM's role in sustainability, resilience and adaptability," published on 26 June 2024. This ISO project was led by Australia, and the report was identically adopted by Standards Australia in January 2025 (AS TR ISO 41019:2025).

ISO/TR 41019:2024 is intended to provide concise and practical guidance for busy built environment professionals and stakeholders on FM practices and contributions on larger issues, including climate change, net zero emissions, the circular economy and others.

Additionally, the annexures provide SDG alignment matrix, a 10-step process, practical examples, links to related standards and a bibliography of 96 resources for more details.

Responsible use of AI

The Royal Institution of Chartered Surveyors (RICS) has released its first global professional standard for the responsible use of artificial intelligence (AI) in surveying practice across the natural and built environment sector. This standard sets requirements across four areas:

- governance and risk management
- professional judgment and oversight
- transparency and communication
- responsible development of AI

Sustainable FM incorporating SDGs

Table 1 links Sustainable FM to the 17 Sustainable Development Goals (SDGs). Table 2 shows the connection between the SDGs and ISO standards, while Table 3 lists the benefits of Sustainable FM.

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



Sustainable FM incorporating SDGs

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

Intpretation of SDGS to ISO standards

1 NO POVERTY

ISO standards offer a platform for best practices across all economic activities, ranging from agriculture to banking.

2 ZERO HUNGER

There are over 1,600 ISO standards specifically designed for the food production sector to enhance confidence in food products.

3 GOOD HEALTH AND WELL-BEING

Access to healthcare is a fundamental human right. ISO has developed more than 1,300 standards supporting safety & quality in healthcare.

4 QUALITY EDUCATION

ISO 21001 pertains to management systems for educational organizations, providing requirements along with guidance.

5 GENDER EQUALITY

Gender equality is a critical aspect of social responsibility, aiming for the empowerment of women & equality within society.

6 CLEAN WATER AND SANITATION

Worldwide, over 80% of wastewater generated by society is discharged back into the ecosystem without treatment or reuse.

7 AFFORDABLE AND CLEAN ENERGY

ISO standards represent internationally agreed guidelines & requirements for solutions concerning energy efficiency & renewable energy.

8 DECENT WORK AND ECONOMIC GROWTH

International standards foster economic growth by establishing a common language & framework recognized globally.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Industrialization is achieved through agreed international specifications meeting requirements for quality, safety, & sustainability.

10 REDUCED INEQUALITIES

These standards ensure market efficiency, protect public health & safety, & contribute to environmental preservation.

11 SUSTAINABLE CITIES AND COMMUNITIES

The responsible use of resources, coupled with environmental preservation, aims to enhance the well-being of citizens.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Efforts are focused on reducing environmental impact & promoting the use of renewable energy sources.

13 CLIMATE ACTION

ISO plays an essential role in addressing climate issues, helping monitor climate change & quantify GHG emissions.

14 LIFE BELOW WATER

The organization offers a unique opportunity to participate in the development of fisheries & aquaculture.

15 LIFE ON LAND

ISO standards aim to protect & promote biodiversity on land through better resource management.

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

Effective, accountable, & inclusive societies rely on strong governance at all levels.

17 PARTNERSHIPS FOR THE GOALS

These standards are developed with the consensus of a range of global stakeholders, including government representatives.

Sustainable FM incorporating SDGs

Table 3. *Benefits of Sustainability FM (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).*

Benefits of Sustainable FM		
<u>ENVIRONMENTAL</u> Evaluating profitability, productivity, energy management, waste management, employee well-being, & public perception of an organization. Promoting work-life balance by providing good and flexible working conditions. Ensuring the proper functioning of the market, protecting people's health & safety and preserving the environment. Aiming for a reduction in energy consumption, waste reduction, increased productivity, elimination of oil & air pollution, sustainable urbanization, reduction of deforestation & decreasing CO2 emissions.	<u>SOCIAL</u> Add value to organizations and customers by effectively managing sustainability issues & practices. Focus on long-term goals within organizations while maintaining continuity responsibilities. Integrate SDGs into a wide range of corporate practices. Develop a leadership network aimed at promoting gender parity in executive management.	<u>ECONOMIC</u> Technology is advancing beyond our wildest imaginations, while resources are becoming increasingly scarce. Customers are demanding higher operational efficiency. Incorporating sustainable practices in building management helps preserve the environment & reduces costs. This approach lowers the operational expenses of organizations & decreases the carbon emissions of buildings. By focusing on lifecycle cost reduction, businesses can achieve financial gains & drive investments, improving profitability, remaining competitive, & expanding their market.
<u>DRIVERS FOR SUSTAINABLE FM</u> A growing awareness of the benefits and importance of integrating sustainability into FM (FM) practices is evident. Pressure from legislation, intense market competition & rapidly changing business environments necessitate the pursuit of a competitive edge. Interestingly, influences from stakeholders, employees, and life cycle cost reduction were considered the least significant drivers for Sustainable FM (SFM) practices. The main drivers identified for SFM include job creation for local communities, waste reduction, & the enhancement of relationships with stakeholders.		

Sustainable FM outsourcing relationships: AI applications & case studies

A new model called the CORE is now used in the FM industry. The FORT model was originally created for the information technology sector. The CORE model is based on four types of outsourcing relationships identified in the FORT model. Simulated case studies have been used within the CORE model's four categories: in-house management, technical expertise, commitment and common goals. It primarily focuses on the demand organizations' perspective. It builds on earlier research into the outsourcing relationships between demand organizations and FM organizations. It also investigates using artificial neural networks (ANNs) to support sustainable practices.

The CORE model describes four main outsourcing categories (OC): OC1, OC2, OC3 and OC4. However, in real life, things often do not fit perfectly into these categories. After examining actual case studies, the research introduced three new middle categories: OC1/2, OC2/3 and OC3/4. These new categories help explain how the system works more clearly.

A survey was conducted to examine eight outsourcing strategies across seven different outsourcing relationships. It introduces rules for CORE related to four simulated outsourcing systems. In the effective application of seven outsourcing categories in FM relationships, using scientific AI can be beneficial. The results from the ANN validation offer useful insights into the relationships between stakeholders. By following these rules, demand organizations can better design their FM outsourcing strategies, referring to ISO 41012:2017. This can lead to improved productivity, efficiency and overall service in FM. In summary, categorizing FM outsourcing helps clarify the right relationships within these systems, referring to ISO 41001.

Materials & methods

ANN is used to analyze raw data after collection. This was important for identifying the type of outsourcing relationship in a specific case study. In examining the cases, it was noticed that some outcomes did not fit neatly into the four main outsourcing categories: OC1, OC2, OC3 and OC4. These outcomes often fell near the borders between two categories. To solve this, there are three new hybrid categories: OC1/2, OC2/3 and OC3/4. For example, OC1/2 includes cases that are between OC1 and OC2. Now, there are a total of seven outsourcing categories. The final data about these categories is noted in the analysis section.

Summary

Four kinds of outsourcing relationships can exist between the demand organization and the FM organization:

- OC1: This type is called Support/In-house. It greatly affects hard FM by tackling challenges related to flexible facility and offering a competitive edge.
- OC2: This type is known as Alignment/Technical Expertise. It is important for soft FM by helping build flexible relationships in service delivery and improving the value of the FM portfolio and business processes.
- OC3: This type is called Reliance/Commitment. It has a strong impact on how managers control operations and make decisions about planning and development. It also involves replacing in-house FM staff, which adds to competitive advantage.
- OC4: This type is known as Alliance/Partner. It significantly boosts long-term competitiveness through strong partnerships and strategic relationships, leading to new revenue opportunities.

Each category highlights different aspects of the service relationship and its effects on FM.

Table 4 - Profile of details of the eight case studies of the seven outsourcing categories during COVID-19 period (Data Collection period: 3.5 months)

Case Study	Sector/Size/Number of employees/ Number of respondents/Level of respondent/Business nature	FM Outsourcing services	Nature of FM services providers of the case/ Characteristics of Outsourcing Category	Final Raw Output	Confir (OC)
	Private (Building maintenance)/regional/Below 50/2/ Assistant Manager/ Provision on Maintenance services to residents	Maintenance works; services	Repair and maintenance on building assets The Outsourcing Category 1/2 (OC1/2) is that the relationship between the Client (C) and Service Provider (SP) belongs to a group in-between support/inhouse and SP's alignment/technical expertise. The SPs can provide in-between medium standards of tailor-made professional knowledge for the building assets and can maintain a general level of customer's general routine productivity for monthly operations, including security management, waste management,	1.573 1.449	1/2

			cleanliness of the workplace and indoor environmental quality.		
2	Private (Property development)/International/500-1000/2/ Senior officer/Provision on property development and management services	Office Maintenance; IT Hardware; Cleaning and Security	Builder; E&M works; Office Supporting; Hygiene and Security system The Outsourcing Category 3 (OC3) is that the relationship between the C and SP belongs to a group in SP's reliance /commitment. SP's can maintain monthly performance and value of customers' satisfaction concerning health, safety, maintenance and operation management.	3.261 3.487	3

3	Public (Leisure and culture of Government)/regional/ Below 50/3/Manager/ Provision on quality cultural services commensurating as a world-class city and events capital	Security; Cleaning and Antimicrobial	**Building Management Responsibilities: Patrol buildings and inspect visitors; Respond to emergencies; Vacuum, sweep, and mop floors; Empty trash cans; Spray antimicrobial coatings** - The Outsourcing Category 4 (OC4) is that the relationship between the C and SP belongs to a group in alliance/partner. The SPs can maintain yearly performance and value of customers' satisfaction on emergency planning, business continuity and sustainability	3.889 3.875 3.907	4
4	Public (Construction and Maintenance)/ re-gional/500 - 1000/2/Property Officer/	Security; Cleaning	**General Property Management Services** The Outsourcing	2.529 2.478	2/3

	Provision on construction and maintenance services to districts		Category 2/3 (OC2/3) is that the relationship between the C and SP belongs to a group in-between SP's alignment/technical expertise and reliance/commitment. The SPs can also provide at least sufficient or even a higher standard of mutually agreed working timeframe for work orders and progress of concern for confirmation of monthly operations to the Cs' requirement and can also maintain good relationships with the Cs each day. E.g., diligent work, professional manner, warm hospitality, close co-ordination and understanding the needs of customers. Also as similar as Case Study 2 of Year 2021.		
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5	Public (Education and exhibition)/ regional/ Below 50/2/ Manager/Provision on teaching and learning platform about the sustainable environment to the local community	Cleaning; building maintenance and catering	**Cleaning Service; Maintenance/Building Management** The Outsourcing Category 3/4 (OC3/4) is that the relationship between the C and SP belongs to a group in-between SP's reliance/commitment and alliance/partner. The SPs have the OC3 characteristic as Case Study 2 of Year 2021. The SPs also have the OC4 characteristic as Case Study 3 of Year 2021.	1.054 1.147	1
6	Public (Property management)/ national/500 - 1000/2/ Works supervisors/ Provision of housing supply services	Security, cleaning, customer and maintenance services/ General Building maintenance	**Cleaning Service; Maintenance/Building Management** The Outsourcing Category 3/4 (OC3/4) is that the relationship between the C and SP belongs to a group in-between	3.695 3.410 3.370 3.435	3/4

7	Private (Building surveying consultancy)/ International/50 - 100/2/ Assistant building surveyor/ Building surveying consultancy	works	SP's reliance/commitment and alliance/partner. The SPs have the OC3 characteristic as Case Study 2 of Year 2021. The SPs also have the OC4 characteristic as Case Study 3 of Year 2021.		
8	Private (Property management)/ regional/100 - 200/2/ Associate Director/ Provision of property management services	Security, cleaning, renovation	Comprehensive hard and soft PFM services - ditto	1.058 1.107	1
X	X	X	The impacts of SO2 concerning Ownership Substitution and CP2 regarding the Strategic Influence of FM (FM) outsourcing strategies are	X	X

			considered quite significant. Service Providers can offer sufficient or even superior levels of customized professional knowledge for managing building assets. It is crucial for the Client and Service Provider to mutually agree on the daily operations to ensure they meet the Client's requirements. The Service Provider can maintain a high level of general routine productivity for the Client on a monthly basis. Examples of this include security management, waste management, workplace cleanliness, and maintaining indoor environmental quality.		
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Remark: Detailed raw data of the eight case studies of the seven outsourcing categories are recorded in the Year 2022's research paper.

Discussion

This well-trained ANN was applied to eight real-world cases, confirming the effectiveness of the approach. The results matched the outsourcing categories identified by the ANN. FM organizations can improve their outsourcing services continuously based on these categories. The CORE model assists in assessing and managing FM outsourcing relationships with an eye on sustainable performance in environmental, social and economic areas. This model supports both short-term and long-term FM plans, enhancing service delivery results.

Valuable insights have been drawn from the firms tested, allowing facility owners to use the CORE model to measure and evaluate outsourced services systematically. This ensures a substantial database for further analysis and helps increase service productivity while reducing costs linked to FM arrangements.

FM sector incorporation with SDGs

The SDGs can assist in showing the added value of FM to core business operations and the FM industry as a whole. This is especially true regarding ISO standards and the roles of demand organizations, FM organizations and researchers. However, the pace of developing Sustainable FM has been still slow. The connection between Sustainable FM and the SDGs is still developing. Several ISO standards for FM exist, but these pose challenges for international stakeholders. Aligning ISO standards with the SDGs aims to improve FM services. However, how to implement these standards and goals is still unclear. Potential risks exist for stakeholders, making it crucial to understand these issues thoroughly.

Role of the Demand Organization

Demand organization(s)

The ISO 41000 series of FM standards uses the term "demand organization" rather than "client." ISO 41011:2017 (1st ed.) and ISO 41011:2024 (2nd ed.) define the demand organization as: the "entity which has a need and the authority to incur costs to have requirements met." This is distinct from the "FM organization," defined as the "entity responsible for FM," which may be provided by an in-house team or an external service provider.

Role of the Demand Organization

Regardless of whether they are private, public or nongovernmental organizations, it is essential to consider the requirements of their facility. To align with the recently published FM ISO standards, organizations must grasp these standards fully and implement them effectively. However, integrating FM standards into their operations can be challenging. Moreover, the SDGs hold significant value for organizations. The relationship between ISO standards and SDGs can be mutually beneficial, allowing organizations to align their strategies with both sets of criteria. Unfortunately, some demand organizations are hesitant to adopt these standards and goals, as they view them as a potential waste of short-term resources, which can hinder their overall business improvement. Establishing a connection between these standards and goals can be complex.

Role of FM organization

First, organizations must prepare to adopt both internal and external goals and standards that match their demand organization requirements. Second, they need to recognize that different clients may have different concerns related to these goals and standards.

Therefore, it is important to create comprehensive plans and strategies to meet clients' complex requirements sustainably.

Psychological barriers can lead people to overlook development goals. Some individuals may be reluctant to invest time and effort in supporting the SDGs within their businesses. This reluctance can prevent them from understanding what users need and expect from these goals. End users may feel that their experiences are not valued, leading to a lack of trust in the SDGs and their potential to improve business success. They may also worry about changes from new technologies. However, it is essential to establish standardized and strategic support for adopting Sustainable FM successfully.



Recommendations on Sustainable FM outsourcing in SDGs

The SDGs are important for the FM community. However, the SDGs have not been implemented as quickly as expected. One reason for this delay is the connection between FM and other sectors like IT and HR, especially when focusing on Sustainable FM. Collaboration among all stakeholders is key to successfully implementing the SDGs in this area. The demand organization and the FM organization should integrate the SDGs into their FM policies and strategies. By working together, they can find effective ways to meet these goals, knowing that communication and trust are essential.

Recently, FM has increasingly prioritized sustainability by incorporating the newly recognized UN SDGs into business decisions. The AI-based outsourcing relationship system for FM is validated by

examining various real business cases, including building maintenance, property development, leisure and cultural services, construction, education, exhibitions and building survey consultancy, all within the context of sustainability.

Big data is important for improving AI-driven FM outsourcing systems. Analyzing more case studies helps provide better advice to FM service providers. By testing more case studies, this can make the model more accurate. The AI model's results help to analyze the current outsourcing relationships between clients and service providers.

Demand organizations with clear and integrated FM outsourcing relationships can expect better services from FM organizations.

Conclusions

The introduction of the SDGs into the practice of FM is a vital component to achieving Sustainable FM; FM professionals need to do more to integrate ESG principles and the SDG targets into FM performance benchmarks and reporting. The use of the SDGs, ISO standards, FM experts and academics can improve Sustainable FM practices and enhance facility life cycle performance and costs.

The SDGs can also help connect sustainable practices with FM systems and emphasize the need to reduce waste in a sustainable way.

Several important performance indicators related to FM and Sustainable FM have been identified through literature reviews. These include aspects like functionality, user experience, physical features and financial factors.

Research mainly focuses on efficiency, productivity, resource allocation, customer service, asset management and cost control.

It is essential that Sustainable FM utilizes a uniform model that reflects the importance of services for all stakeholders. Sustainable FM should not only optimize performance based on functionality; but should also look at how FM services impact routine facility operations and long-term outcomes. Given how crucial FM services are in achieving the SDGs, FM professionals should use established standards and innovative strategies in the practice of Sustainable FM worldwide.

In conclusion, understanding Sustainable FM and the SDGs can lead to improved resource efficiency and cost effectiveness. It can also improve user satisfaction through optimized quality of life and productivity of the core business outcomes.

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