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Facility management~~: a digital technology framework~~ — Overview of available technologies

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~~Foreword~~

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This document was prepared by Technical Committee ISO/TC 267, *Facility management*., in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 348, *Facility management*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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Introduction

This ~~framework~~ document ~~will help~~provides facility managers ~~(FMs),~~ their teams~~,~~ and stakeholders~~, to obtain a broad working knowledge~~ an overview of available facility management (FM) technologies. ~~Bill Gates, the Co-founder of Microsoft, stated "The advance of technology is based on making it fit in so that you don't really even notice it, so it's part of everyday life."~~ Only by understanding technology's diverse, evolving potential~~,~~ can the facility manager community make best use of its scope, efficiencies and benefits~~, so that it supports~~ to support its everyday operations.

The long-term benefits of FM technology are not only commercial or budgetary, relating to hard or soft services, safety or environmental objectives, or achieving process change~~:~~; they will contribute to achieving the United Nation's Sustainable Development Goals (SDGs). As a component of the ISO 41000 series ~~of publications, it~~, integrated technology also offers significant potential value by providing input to their core business strategy roadmap. It will allow ~~FMs~~facility managers to fully understand and deploy the power of technology as a business productivity enabler, to improve on their capabilities and system capacities. Those that take advantage and embrace technology will be better able to shape the vision of an enhanced, digitalised FM experience.

Globally, the FM industry continues to adapt by advancing thought leadership and creating innovative, operational digital frameworks. Applied effectively, frameworks that are designed to foster international best practices will enhance the productivity of the FM workforce and enable each FM sector keep pace with digital advancements and transformation campaigns.

Further education on achievable goals is needed, ~~and it is essential we share a~~as well as a shared common vocabulary and a collective understanding. Digital FM (DFM) is the interface between FM and technology. It presents an ideal opportunity for transformation, enhancing workforce skillsets, improving asset owners' awareness and service delivery performance capabilities, by further automating the built environment and connecting all stakeholders.

FM has become a globally recognized discipline, in which challenges are faced, be they technology-related, involving safety or environmental protection, or even from pandemics or budget constraints. It is important to note that facility management is a people-centric sector. As devices become more tech-capable, these resources need to be able to work in buildings that are categorized as SMART (specific, measurable, achievable, realistic and time-related). From the PC to the internet, SMART phones to energy management, the public has high expectations from technology and its everyday use. Well-managed facilities and carefully applied technology enable facility occupants to work effectively and safely, in a constantly changing digital environment. Facility managers need to be an integral part of this digital transformation.

Adoption of the Internet of Things (IoT), together with Building Information Modelling (BIM), the use of 5G telecoms, new software products and applications for 3D to 7D management of the life cycle of buildings (including their design, construction, operations ~~&~~and maintenance), is not a single change management programme. ~~ISO 41016~~This document gives insight into the means by

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which technology can be more understood and better incorporated:, a key part of a business strategy.

~~Part 1: Concepts & Principles of Digital FM~~

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Facility management — Overview of available technologies

1 Scope

This ~~is a technical~~ document ~~that outlines a framework to help identify, understand and deploy~~ provides an overview of the ~~latest technology changes~~ available ~~to the~~ facility management (FM ~~industry. Its aim~~) technologies. This document is applicable to ~~help~~ facility managers ~~deliver successful, comprehensive FM solutions. including the scope of work, key concepts, benefits and features for deploying a high-performance FM system by applying technology.~~, their teams and their stakeholders. It aligns specifically with ~~both~~ ISO/TR 41013 ~~and~~, the ISO 19650 series and the ISO 41000 series ~~of international standards~~ as part of an integrated framework to achieve FM best practice.

~~As a strategic FM planning guide, it also enables~~This document outlines various long-term benefits and enhanced value that can be derived progressively by the operators, occupants and owners of facilities, worldwide, via the effective application of technology. ~~It~~This document includes, defines and ~~reflects~~categorises systems, equipment, methodologies and software applications that are available ~~at the time of publication, so it will benefit from periodic reviews and future updates, to ensure it reflects further advances in technology, over the coming years.~~.

~~By considering this framework's contents and adopting the relevant components, FMs will be able to lead in the implementation of digitalization~~This framework defines how facility managers can understand and integrate digital practice and technologies in the built environment.

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 41011:2017, *Facility management — Vocabulary*

- ~~ISO/TR 41013:2017 – Facility Management: Scope, key concepts and benefits~~
- ~~ISO 19650 Parts 1-5 – Organization and digitization of information about buildings and civil engineering works, including building information modelling~~

~~5~~3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 41011~~:2017 apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:~~ apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

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— IEC Electropedia: available at https://www.electropedia.org/

64 Scope of FM technology

6.14.1 Definition of FM technology

The Encyclopedia Britannica defines technology as "… the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human." IBM, long associated with the integration of computer systems with the built environment, alternatively states: "The technology in facilities management includes both software and systems. Vast amounts of data are generated by built environments through Internet of Things sensors, Wi-Fi, meters, gauges, and SMART devices".

The most effective solutions enable FM departments to make good use of this data by infusing analytics and Artificial Intelligence into an Integrated Workplace Management System (IWMS). These technologies deliver cognitive capabilities that make computer-aided facilities management possible, so one can analyze and learn from data, enabling real-time visibility, predictive facilities maintenance, and more productive, cost-efficient environments."

A digital ecosystem is a distributed, adaptive, open socio-technical system with properties of self-organization, scalability and sustainability inspired from natural ecosystems. Digital ecosystem models are informed by knowledge of natural ecosystems, especially for aspects related to competition and collaboration among diverse entities.

There has been a significant increase in the introduction of innovative technologies used within the built environment. These technologies are often a key enabler to achievingachieve better outcomes that were previously unimaginable due to legacy work practices and other human factor constraints. As the cost of storage per Mb of data has diminished progressively, the volume of data needing to be stored securely has increased, almost exponentially.

FM is defined by ISO 41011 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". Technology is becoming an intrinsic part of this industry through realized opportunities, competitive differentiators and in response to market demands for cost efficiencies. Technological equipment and operating applications, like SMART devices and building management system (BMS) sensors, continues to decrease Iin price, and the positive impact of these advanced technologies has expanded exponentially.

One such example is the real-time engagement with facility owners, building occupants and service providers, to enhance the user experience via SMART-phone applications and cloud-based data storage. Other potential benefits to users include improved safety and security, better wayfinding and communications, enhanced service response and key performance indicators (KPIs), in addition to streamlined). Additionally, communications and information flow, are streamlined through such technologies such as digital signage, touchless kiosks, geofencing and push notifications. Although this document focuses on such technologies, it is not meant to be an

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information, communication and technology ITC-centric document. It is designed to bridge technical knowledge and process gaps with FM operations.

~~This document provides guidelines on how people with a FM background can transform their FM processes and information, aligning them with available digital technologies. Although it is focused on such technology, it is not meant to be an ICT-centric document. It contains the core components of a methodology to create a strategy and associated road map towards FM digital transformation, bridging technical knowledge and process gaps with FM Operations.~~

~~6.3~~4.2 Impact of application on FM ~~– Business Goals~~ business goals

Technology touches almost every aspect of an FM practice. Increased access to information and data empowers better planning of many FM activities. Sensors and other devices can provide real-time feedback for improved decision-making, helping to speed up responses. Foot traffic, congestion and people-movements can be ~~analyzed~~analysed in real-time with increasing levels of automation.

Universal foundational elements include preferences for finding and using evidence in FM, the acquisition of data, and drawing evidence from data: This is the external validation process. The internal validity of data, also foundational, is comparable to quality assurance (QA). ~~So,~~ The data collated and stored is of known and consistent origin, validated in form and value, complete (or with known omissions), and uncorrupted (hopefully). From this verifiable position, data ~~may be~~are usually selected by the FM exponent in context, from a variety of sources.

The impact of technology on FM provides a foundation for numerous additional benefits, including more target-based resource efficiency, optimizing the life and usability of assets streamlined facility operations, and improving the quality and reliability of outcomes. The use of technology can assist in mitigating risks.

~~6.4~~4.3 Golden thread initiative

~~Due to the tragic events~~ In 2017 in West London, the Grenfell Tower fire spread rapidly upwards through the entire building~~,~~ due to its flammable exterior cladding. ~~As an example in the UK the "Building a Safer Future" report recommended~~Reference [9] suggested the implementation of a "golden thread of information". This golden thread, in its association with the built environment, ~~received a definition from the UK's BRAC (Building Regulations Advisory Committee): The abstract summarises this is a term "that is both~~ provides "the information that allows you to understand a building and the steps needed to keep both the building and people safe, now and in the future~~".~~"[10].

The term has grown in its potential application to the built environment into one which applies not just to building safety but to whole life value and user experience~~,~~. There are several international activities already underway looking to further extend this concept into ~~our~~existing information models and digital environments.

~~6.5~~4.4 Asset and ~~Facility Management~~FM applications

Applications and systems that provide functionality to cover all asset management (AM) and FM ~~Lifecycle~~life cycle processes and related data include those providing functionality such as

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incident logging, work order management, asset management, corrective and preventive maintenance, material, contract, vendor, project and financial management.

~~6.6~~4.5 Interfacing

Back-office systems such as computer maintenance management systems (CMMS) and computer aided facility management (CAFM) rely on and maintain valuable historical data required to generate any report or KPI understanding. Some are promoted as being a complete software solution for all instances and activities. However, there are three types of interfaces that ~~need to be~~are usually considered when formulating an FM technology strategy and action plan: input, output and visualization~~:~~ (see Table 1).

Table 1 — Types of interfaces for consideration when planning

Interface type	Description
Input related interfaces	Input related interfaces allow systems to ~~on-line~~online or batch receive information for further processing. Such interfaces include BMS system, IoT devices, mobile devices / applications collecting information from the field.
Output related interfaces	Output related interfaces provide silos of FM and AM information to BI and artificial intelligence (AI) related tools for further analysis and decision-making. Output related interfaces are also required to synchronize CMMS~~/~~/CAFM systems with back office financial and human resources systems such as enterprise resource planning (ERP) systems.
Visualization interfaces	Visualization interfaces are required to project FM and AM data to computer aided design and mapping systems such as GIS, 2D architectural designs, energy sustainability management systems and BIM models.

~~6.7~~4.6 Optimization systems

These are the digital systems that allow ~~the~~ transformation of raw data and transactions into FM and AM knowledge. Examples of these systems include AI, BI, prediction analysis, capital planning, and energy management systems, amongst others.

~~6.8~~4.7 FM technology drivers

For a facility manager to achieve the optimal outcome from using technology, there is a need for clarity, communication and collaboration with technology providers in facility management consulting services. It is challenging for a facility manager to have an in-depth working knowledge of every aspect of the facilities they manage.

~~So,~~ It is therefore of critical importance to know the right questions to ask when evaluating or selecting a technological solution to ensure it will achieve its intended outcome. The compelling reasons for adopting such technology is the increase ~~the~~in likelihood of adoption when facility ~~manager~~managers can identify and communicate relevant drivers~~.~~ (see Table 2).

Table 2 — Selection of technology-based drivers of change

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~~Subject~~Technology-based driver of change	~~Definition~~Description
Health ~~&~~and safety	From wellbeing to building safety, technologies afford new ways to bring enhanced insight and support across the function's life cycle.
Commercial pressures	COVID-based, adversely-impacted commercial activities have meant, for many developers, building owners and business operators, a three-year reduction in revenues, additions to operating costs and lowering of profits that need to be redressed. This can be achieved by various means including raising productivity per resource, savings in utility cost outlay and enhanced competitiveness through business process efficiencies. Implementing technology can offer opportunities for each solution.
Data capture	Data capture is not a technology, per se, but an ongoing process which can be applied throughout various technologies.
Digital transition	Increasing digital integration from design, engineering and construction (DEC) through ~~to~~ FM operations and maintenance (O&M~~)~~).
Commercial competitiveness	By implementing new processes, systems, infrastructure, protocols and raising training standards, organizations can demonstrate recognizable international qualifications (e.g.~~:~~. the ISO 41001 series), building sustainability status (e.g.~~:~~. LEED platinum) and resource-based certifications and qualifications (e.g.~~:~~. certified FM qualifications~~)~~).
Risk register	From a collated list of business continuity planning (BCP) criteria and disaster recovery planning (DRP) topics, identify what are the key issues that ~~could~~can impact ~~and~~an organization's ability to deal with potential built environment-related crises and identifiable risks~~?~~.
Technology value	~~What~~ User stories and customer journeys are critical to assess the value of new technologies~~?~~.
Corporate social responsibility (CSR)	Many companies, by their articles of association, have a duty of care for the wellbeing of their employees and sections of the wider community. These responsibilities extend far beyond the workplace and boards are responding increasingly to the social and welfare needs of the less privileged~~:~~. Recycling surplus ICT equipment to local schools is ~~but~~ one proactive example.
Grids and networks	~~What~~ Practical or theoretical means of environmental sustainability and ways of limiting carbon emissions can help stimulate interest in and use of SMART grids.
Global sustainability campaigns	Global sustainability campaigns provide growing international requirements to reduce carbon footprints and improve water utilization.

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