



Gamechanger:

A Facility Manager's Guide to
Building a Relationship with AI

AI Talks FM — Are You Ready to Listen?



Forward

Just when we thought the pace of change could not get any faster, it did. Rapid technological advancements, particularly Artificial Intelligence (AI), are transforming numerous industries, including facility management. At the precipice of a new era, AI presents unprecedented opportunities and unique challenges for facility managers.

“Gamechanger: A Facility Manager’s Guide to Building a Relationship with AI” is an essential resource for facility managers navigating this transformative landscape. Integrating AI into facility management is not just a technological shift; it’s a paradigm change that redefines operational efficiency, enhances decision-making, and improves service quality.

This guide explores AI’s multifaceted role in facility management, delving into its capabilities and applications. From predictive maintenance and energy optimization to enhanced security and space utilization, AI offers tools to revolutionize daily operations. However, the journey to successful AI integration is not without its hurdles. This guide addresses these challenges, providing practical insights that can be immediately applied, real-world examples, and actionable strategies.

We begin with a foundational understanding of AI, breaking down its core concepts and types. Subsequent sections examine AI’s current applications in facility management, highlighting tools and technologies shaping the industry’s future. Importantly, we outline prerequisites for successful AI deployment, emphasizing data quality, organizational alignment, and strategic planning.

This guide serves as both a roadmap and a compass for facility managers. It offers step-by-step guidance on starting, scaling, and sustaining AI initiatives. The insights shared are drawn from the industry research, expert opinions, and practical experiences, making it a valuable and practical companion for any facility manager looking to stay ahead of the curve.

Understanding and leveraging AI will become a critical skill set as the facility manager’s role evolves. This guide is about seizing the opportunities that change brings and driving innovation within the facility management profession. Welcome to the new age of AI in facility management.

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Introduction

Artificial Intelligence (AI) has revolutionized decision-making processes, improved efficiency, and facilitated automation, transforming practices across numerous industries such as manufacturing and business. This report is aimed at helping professionals in the facility management industry understand the capabilities and applications of AI in their field, thereby enabling them to thrive in today's fast-paced environment.

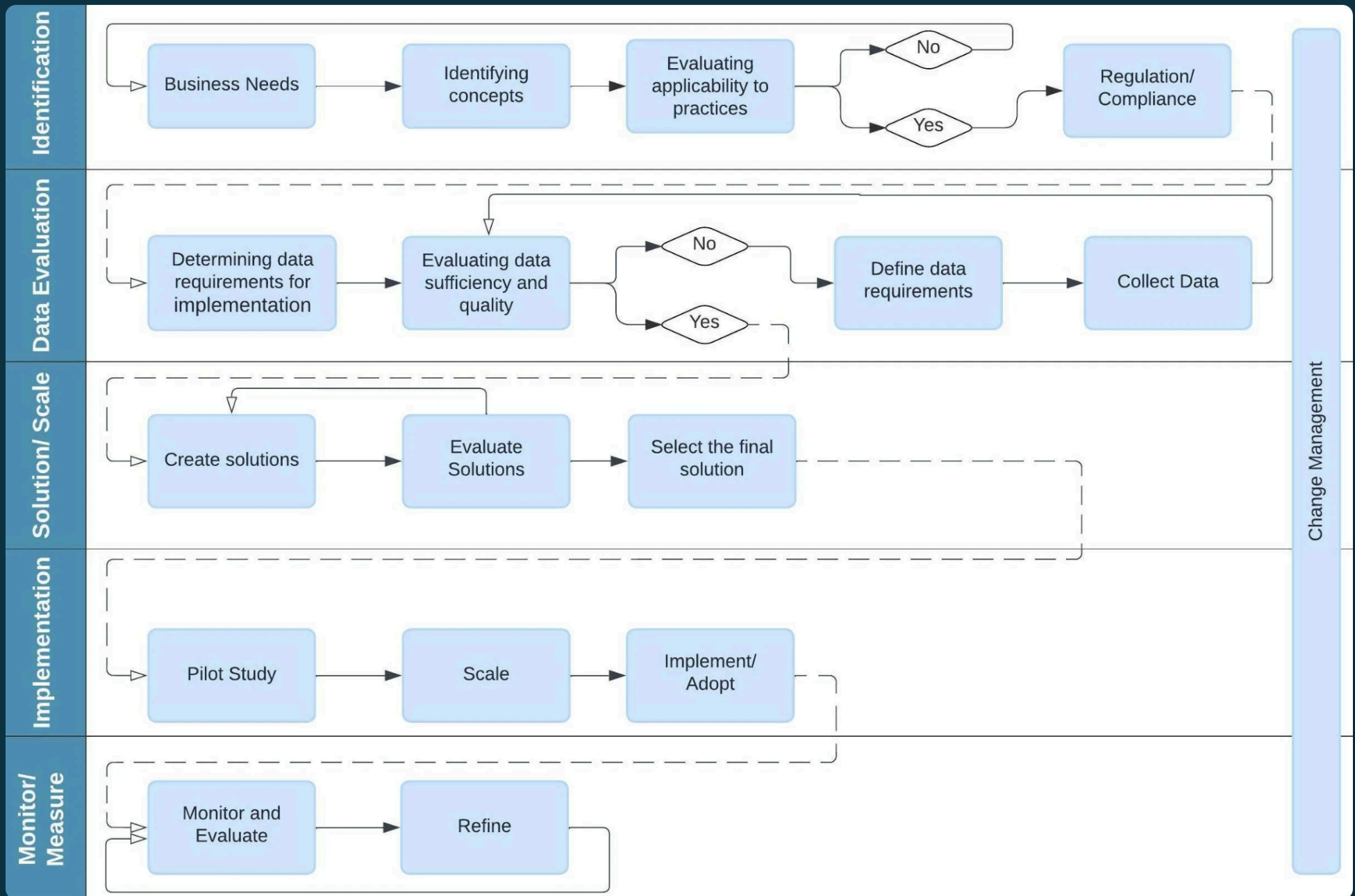
Overview

This report offers an overview of how Artificial Intelligence (AI) can be integrated into facility management (FM). It includes definitions and types of AI, evaluates the benefits of AI in FM, provides real-world examples, reviews existing tools and technologies, and outlines the prerequisites for effective AI implementation.

This report, tailored for professionals in the facility management industry, is designed to be a practical tool. It aims to help facility managers not just understand the theoretical aspects of AI, but also apply it to enhance their daily operations. For decision-makers, it provides a roadmap for understanding and adopting AI solutions within their organizations. By offering essential knowledge, highlighting current tools and technologies, and specifying the prerequisites for AI deployment, this report is a valuable resource for those looking to leverage AI for informed decision-making.

Serving as a guide, the following diagram presents a structured process for AI implementation. The process is divided into five main phases: Identification, Data Evaluation, Solution/Scale, Implementation, and Monitor/Measure. In the Identification phase, business needs are identified, concepts are developed, and their applicability is evaluated, leading to regulatory compliance if necessary. Data Evaluation involves determining and assessing data requirements, with steps to define and collect data if necessary. The Solution/Scale phase includes creating and evaluating solutions and selecting the final solution. The Implementation phase involves conducting a pilot study, scaling the solution, and full adoption. Finally, the Monitor/Measure phase focuses on ongoing monitoring, evaluation, and refinement. Change management is integrated throughout the process to ensure smooth transitions and adoption. This approach ensures that each phase is thoroughly evaluated, ensuring quality and applicability.





FUNDAMENTALS OF AI

What's AI?

Artificial Intelligence (AI) is the simulation of human intelligence in machines designed to think and learn like humans. It involves the creation of algorithms and models that allow computers to perform tasks typically requiring human intelligence. AI encompasses various subfields, including machine learning, neural networks, natural language processing and robotics. Its relevance to Facility Management (FM) lies in its potential to optimize operations, improve service quality, and reduce costs.

AI can be broken down into simpler terms:

Perception: AI systems can perceive and understand the world through sensors, cameras, or other data sources, allowing them to interpret and analyze their environment.

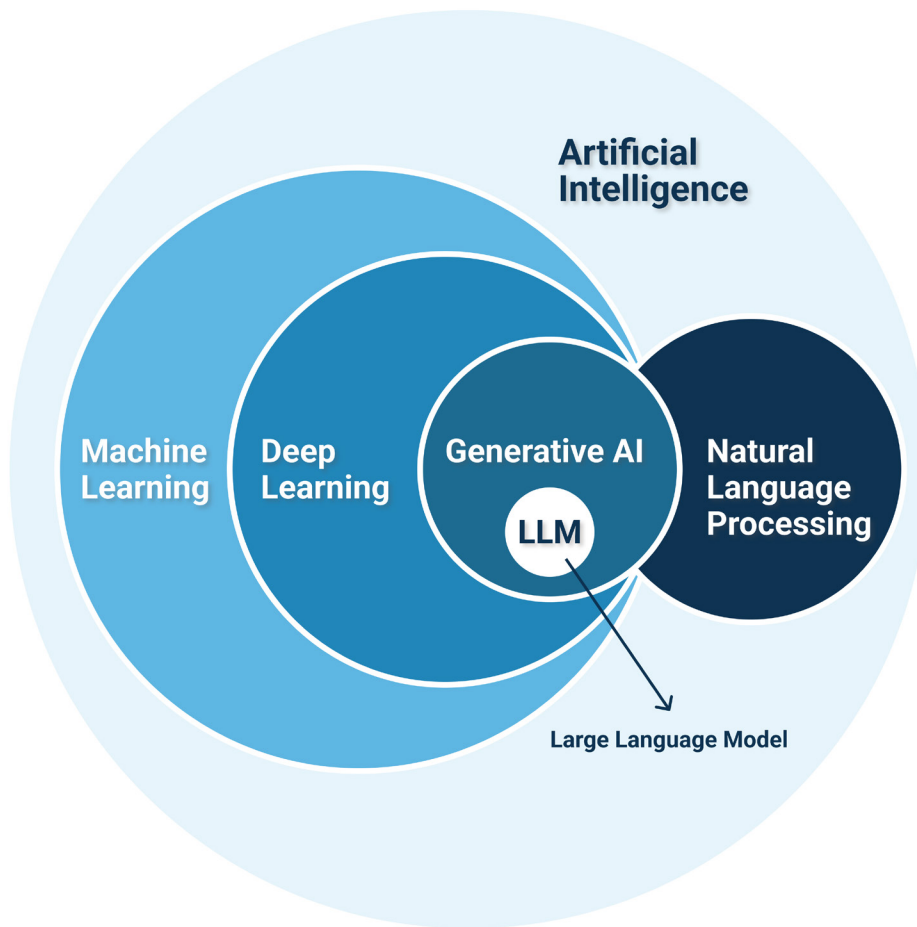
Reasoning: AI systems can process and manipulate information to make decisions or draw conclusions based on logical rules or patterns.

Learning: AI systems can automatically improve their performance by learning from data through explicit training or self-learning algorithms.

Decision-Making: AI systems can make informed decisions or take actions based on their perceptual understanding, reasoning abilities and learned knowledge.

Overall, AI aims to create intelligent machines capable of mimicking and augmenting human cognitive tasks, solving complex problems, and performing tasks that are time-consuming, tedious, difficult, or unsafe for humans.

Types of AI



Machine Learning:

Machine Learning (ML) is a subset of AI that enables systems to learn from data and improve performance over time without being explicitly programmed. ML can analyze historical data from building systems to predict maintenance needs and optimize energy usage.

Machine learning is a field of artificial intelligence that involves training computer systems to automatically learn from data and improve performance on a specific task without being explicitly programmed. It uses algorithms and statistical models to enable computers to make predictions, recognize patterns, and make decisions based on patterns identified in the data. It can be broadly classified into two categories:

Supervised Learning: This branch uses labeled data to train models, where the desired output or outcome is already known. The model learns to map input data to known outputs and can be used for tasks such as classification and regression.

Unsupervised Learning: The models are trained on unlabeled data and aim to discover patterns, relationships, or structures within the data. Some of the common unsupervised learning techniques include clustering and dimensionality reduction.

Deep Learning and Neural Networks:

Neural Networks are computing systems inspired by the human brain's network of neurons. They excel at identifying patterns in large datasets, making them ideal for applications like fault detection in HVAC systems and energy consumption analysis.

Deep learning is a subset of machine learning that trains artificial neural networks to automatically learn from and make predictions or decisions based on complex patterns and features within large datasets. It involves using sophisticated algorithms and layers of interconnected neurons to model and simulate the human brain's decision-making process.

(Source: "Deep Learning" book by Ian Goodfellow, Yoshua Bengio, and Aaron Courville)

Generative AI:

Generative AI is a branch of artificial intelligence that enables computers to generate new content, such as images, text, or music, mimicking human creativity and imagination. The "GPT" component of ChatGPT is an acronym that stands for Generative Pre-trained Transformer and refers to a family of large language models (LLMs) that can understand and generate text in natural language. It uses algorithms and neural networks to learn from existing data and produce original, innovative output without explicit programming.

Natural Language Processing:

Natural Language Processing (NLP) allows machines to understand and interpret human language. In FM, NLP can automate customer service responses, manage work orders, and even interpret maintenance manuals.

Deterministic vs. Probabilistic Systems

Probabilistic systems like AI and traditional deterministic software systems differ fundamentally in handling data and making decisions.

Traditional deterministic software is characterized by its adherence to a set of predefined rules and instructions. It processes input data in a manner that always yields the same output for the same input, akin to the predictability of a calculator. This predictability is a result of the system's design to function in a precise, predictable manner.

On the other hand, probabilistic systems like AI use statistical methods to analyze data and make decisions based on probabilities. Instead of following fixed rules, AI models learn from large amounts of data, recognizing patterns and making predictions even when the exact rules are not known. For instance, an AI might analyze thousands of medical images to learn how to identify tumors. It doesn't follow a strict set of rules but rather uses probabilities to determine the likelihood that an image contains a tumor, which is why the output can vary.

ANALOGY:



Think of traditional software as a train that follows a fixed route, stopping at the same stations every time. It's predictable and consistent.



In contrast, AI is like a taxi driver who adapts routes based on traffic and road conditions, making each journey unique but efficient.

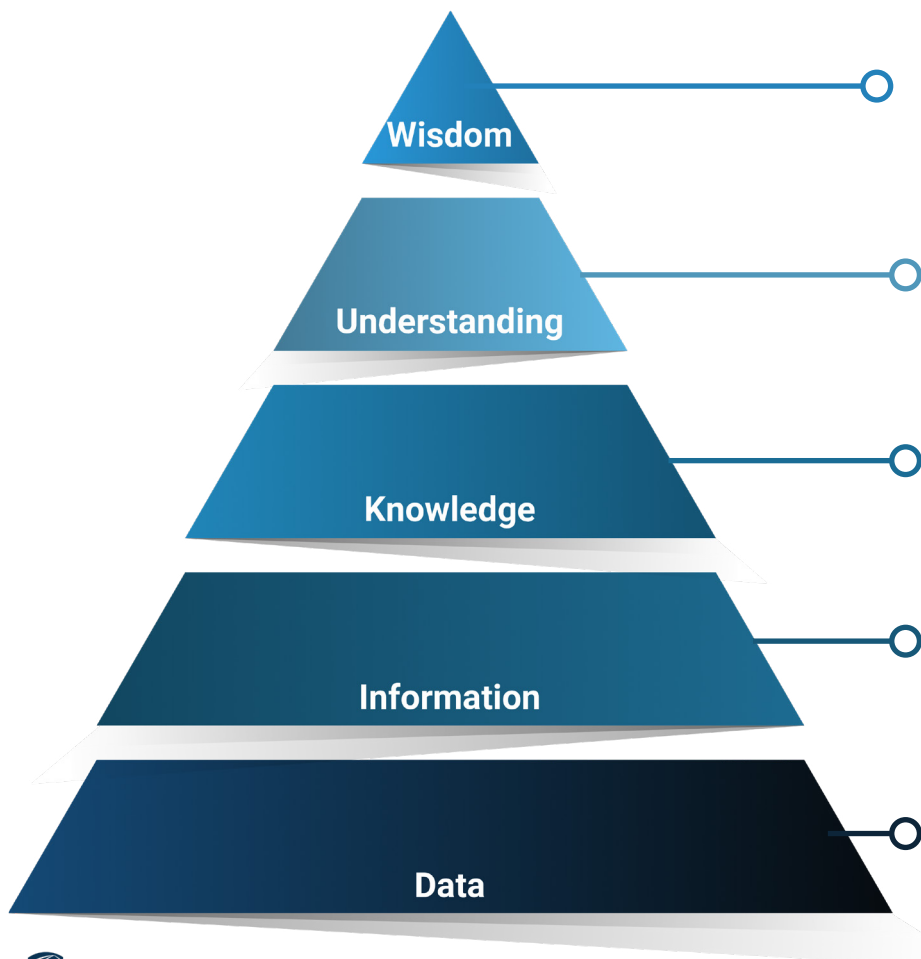
However, just as a taxi driver might occasionally take a wrong turn due to incorrect information, AI can sometimes "hallucinate," producing inaccurate or implausible outputs. In summary, traditional software is predictable, while AI is adaptive but occasionally prone to errors.

Understanding the differences between traditional deterministic software and probabilistic AI systems is crucial for making informed decisions about which technology to use for specific tasks. It helps set realistic expectations by highlighting that while AI can adapt and learn from data, it might also make mistakes, known as hallucinations. This knowledge enhances problem-solving by identifying the right tools for different challenges, improves team communication by explaining the rationale behind technology choices, and fosters innovation by encouraging exploration of AI's flexibility. Additionally, it aids in risk management by emphasizing the need for monitoring and validating AI outputs, ultimately enabling users to leverage each system's strengths effectively.

The DIKUW Pyramid Model

The DIKUW pyramid model, which stands for Data, Information, Knowledge, Understanding, and Wisdom, provides a structured framework for understanding how raw data can be transformed into valuable insights. One of the earliest and most influential discussions on the hierarchical nature of data to wisdom was presented by Russell Ackoff, a systems theorist and professor of organizational change, in his 1989 paper, “From Data to Wisdom.”

Each layer represents a different stage in the process of extracting meaning and value from data. For the AI novice, understanding the DIKUW model offers a structured path from raw data to actionable wisdom, illustrating how AI transforms information into valuable insights. The model provides a clear foundation, emphasizing the importance of high-quality data and its contextual significance, enhancing decision-making and ethical awareness. By following the progression from data to wisdom, one can appreciate the interdisciplinary relevance of AI, learning to apply techniques effectively across various fields. This comprehensive approach not only builds a solid understanding of AI concepts but also fosters responsible and informed usage, making the transformative power of AI accessible and practical.



Wisdom

The pinnacle of the pyramid, wisdom, involves making judicious decisions based on a profound understanding of the knowledge acquired. It incorporates ethical considerations, experience, and judgment. In AI, achieving wisdom means creating systems that not only make decisions but do so in a way that aligns with human values and ethical principles. Some consider this the achievement of Artificial General Intelligence (AGI), where AI equals or surpasses human cognitive capabilities.

Understanding

This layer involves comprehending the relationships and patterns identified within the knowledge layer. Understanding allows for the development of deeper insights and the ability to explain why certain patterns or relationships exist. AI contributes to understanding by employing advanced analytics and deep learning models that can interpret complex datasets, providing explanations and rationale for decisions made by AI systems.

Knowledge

Knowledge is the assimilation and application of information to answer questions or solve problems. In the context of AI, knowledge involves using machine learning models to understand complex relationships within the data and apply this understanding to specific domains, such as predictive maintenance in facilities management or personalized recommendations in e-commerce.

Information

At this layer, data is processed, organized, and structured to provide context and meaning. Information represents data that has been analyzed and interpreted. AI transforms data into information through techniques such as data mining, natural language processing, and image recognition, turning raw data into actionable insights.

Data

This is the foundational layer, consisting of raw, unprocessed facts and figures without context. In AI, data is the essential input that algorithms analyze to detect patterns and make predictions. Quality and quantity of data significantly impact the performance of AI models.

CONVERSING WITH AI

In recent years, artificial intelligence (AI) has made significant strides, transforming how we interact with technology. One of the most exciting developments is the ability to have conversations with AI. This is different from traditional search engine interactions, where users type in a query and receive a list of links or brief answers. Conversing with AI involves a more interactive and dynamic exchange, where the AI can understand context, ask follow-up questions and generate detailed responses.

How Conversing with AI Differs from Using Search Engines

Interactivity and Engagement: Unlike search engines, which typically provide static results, conversational AI engages in a dialogue. It can follow up on your questions, ask for clarification, and adapt its responses based on the flow of the conversation. This makes the interaction feel more like a conversation with another person rather than simply retrieving information.

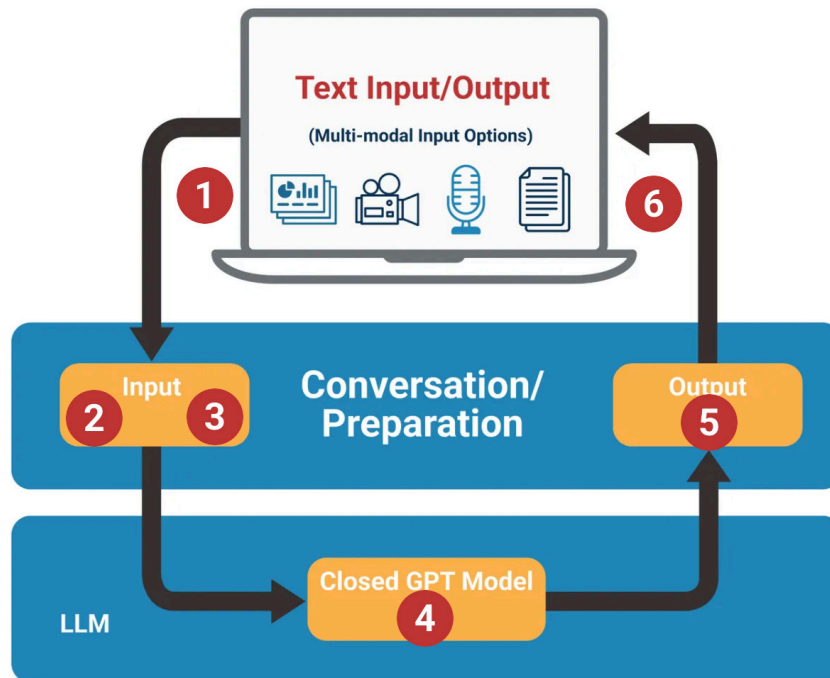
Generative Responses: Instead of just pulling up existing information, AI can generate new content based on patterns it has learned. This means it can create explanations, summaries, or even creative content, offering more personalized and nuanced answers than a typical search engine.

Contextual Understanding: AI conversation models are designed to understand the context of your questions. For example, if you ask about a specific topic and then follow up with a related question, the AI can often connect the dots and continue the discussion seamlessly. In contrast, search engines usually treat each query independently, without considering the previous ones.

Learning from Conversation Flow: Conversational AI can tailor its responses based on the way the conversation evolves. It might adjust its tone, simplify explanations, or dive deeper into a topic depending on how you interact with it. This adaptability is a key difference from the more rigid, keyword-based results you get from a search engine.

How the Conversation Works

When you interact with a GPT-based application, like ChatGPT, here's what happens behind the scenes (select the numbered items for more details):



- 1. You type a prompt:** This is the question or statement you input into the chat. The prompt could be, “Explain how a car engine works” or “What’s the weather like today?” For more complex questions, provide context for the AI, such as “Act as a facilities management operations and maintenance subject matter expert.” Most AI applications can now accept multi-modal input, including images, video, audio, and documents, as part of your prompt question.
- 2. Processing the prompt:** When you send the prompt, the application first ensures that the input is safe and appropriate by applying filters. These filters check for harmful content, offensive language, or anything that violates the application’s guidelines.
- 3. Understanding the prompt:** Once it is cleared, it goes to the GPT model. The model breaks down your words to understand what you’re asking (this is where the context you provided is essential). It uses patterns learned during training (on vast amounts of text) to determine the context and meaning of your request.
- 4. Generating a response:** The GPT model then predicts a good response based on the patterns it knows. It doesn’t “know” facts like a human does, but it has seen so many examples during training that it can generate knowledgeable and relevant responses.
- 5. Final checks:** Before the response is sent back to you, another filtering round ensures the output is safe, clear, and aligns with the application’s rules.
- 6. Delivering the response:** The processed and filtered response is displayed to you as if the application is “talking” back, providing the information or answer you requested.

In essence, the process is a combination of understanding your input, generating a likely good response, and ensuring everything stays within safe and useful boundaries before you see the answer.

Key Points of Understanding from Conversing with AI

- **Prompting and Clarification:** The way you phrase your questions, or "prompts," significantly impacts the AI's responses. Clear and specific prompts usually lead to better, more relevant answers. If needed, the AI can ask for clarification to ensure it understands your request correctly.
- **Response Generation:** AI generates responses by predicting what might be the most appropriate answer based on patterns in the data it was trained on. This means it doesn't have direct knowledge of facts but rather generates plausible answers based on what it has "seen" during training.
- **Limitations and Bias:** While conversational AI is powerful, it has limitations. It doesn't have real-time knowledge and might produce outdated or incorrect information. It also reflects the biases present in the data it was trained on, so it's important to critically evaluate its responses.
- **Ethical Considerations:** Engaging in conversations with AI raises questions about privacy, data security, and the ethical use of AI. Users should be aware that while AI can be incredibly helpful, it is essential to use it responsibly and understand its limitations.

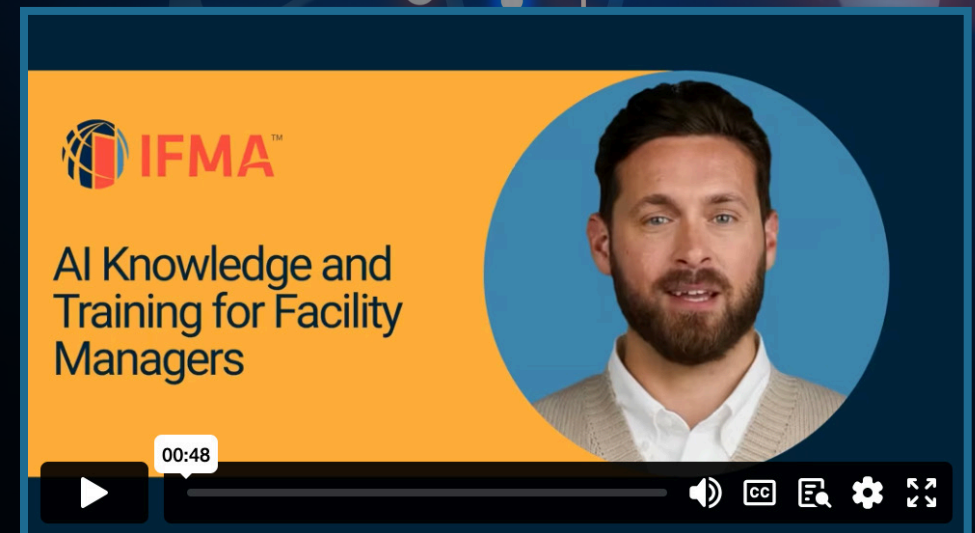
In summary, conversing with AI offers a more interactive, context-aware, and personalized experience than traditional search engine use. However, it also requires an understanding of how AI works, its limitations, and the ethical considerations involved in its use. As this technology continues to evolve, the way we interact with information—and with machines—will continue to change, offering both new opportunities and challenges.

II. AI Knowledge & Training

This section will explore the transformative potential of AI in Facility Management (FM). It covers the essential knowledge and training needed to leverage AI effectively, detailing its applications in enhancing operations, optimizing costs, and improving safety and security. The section provides practical guidance on identifying suitable AI applications, understanding the importance of AI awareness, and crafting effective prompts for AI tools to maximize their benefits in various FM tasks. Additionally, it highlights the limitations of AI and offers examples of its successful integration into FM practices.

LEARNING OBJECTIVES

- 1. Understanding AI in FM:** Learn the fundamentals of how AI can enhance facility management operations, including its applications in maintenance, energy management, and safety.
- 2. Effective AI Prompting:** Master the art of crafting clear and concise AI prompts to maximize the benefits of AI tools in daily FM tasks.
- 3. Identifying AI Opportunities:** Gain insights into where and when AI can be effectively applied within facility management, from predictive maintenance to space optimization.
- 4. Recognizing AI Limitations:** Understand the scenarios where AI may not be suitable, ensuring balanced and informed decision-making in AI adoption.



Value of AI in Facility Management — The Five “W’s” of AI

WHAT

What Can AI Do, and How Can It Improve or Optimize Facility Operations, Services and Reduce Costs?

AI can perform various tasks that enhance facility operations, improve service delivery, and reduce costs. For example, AI can automate routine maintenance tasks, predict equipment failures, and optimize energy consumption. In HVAC systems, AI can automatically analyze real-time data to adjust settings, ensuring optimal performance and energy efficiency. AI can also streamline work order management by prioritizing tasks based on urgency and resource availability, reducing response times and labor costs. Additionally, AI-driven predictive maintenance can minimize downtime and extend the lifespan of equipment, leading to significant cost savings. The benefits and risks associated with applying AI to these opportunities will vary by industry and organization. The FM must evaluate these benefits and risks with the appropriate leadership/functional owners.

WHO

Who in the FM Profession Can Benefit from AI?

Various roles within the FM profession can benefit from AI, including facility managers, maintenance technicians, energy managers, and security personnel. Facility managers can leverage AI to gain insights into operational efficiency and make data-driven decisions. Maintenance technicians can use AI tools for predictive maintenance, reducing the frequency of reactive repairs. Energy managers can utilize AI to optimize energy usage and implement sustainability initiatives. Security personnel can benefit from AI-enhanced surveillance and access control systems, improving safety and security within the facility. AI empowers FM professionals to extend and enhance their performance, achieving better outcomes.

WHY

Why is Awareness and Understanding of AI Important?

Awareness and understanding of AI is a crucial first step toward effective adoption and implementation in facility management. Without a solid grasp of AI concepts and applications, facility managers may miss opportunities to improve efficiency and reduce costs. Understanding AI enables FM professionals to identify suitable AI solutions for their specific needs and ensures that they can effectively integrate these technologies into their existing systems. Additionally, knowledge of AI helps facility managers stay ahead of industry trends and maintain a competitive edge. Awareness also fosters a culture of innovation and continuous improvement within the organization.

WHERE

Where Can AI Be Applied to FM Practice (as an Input, Process, or Output)?

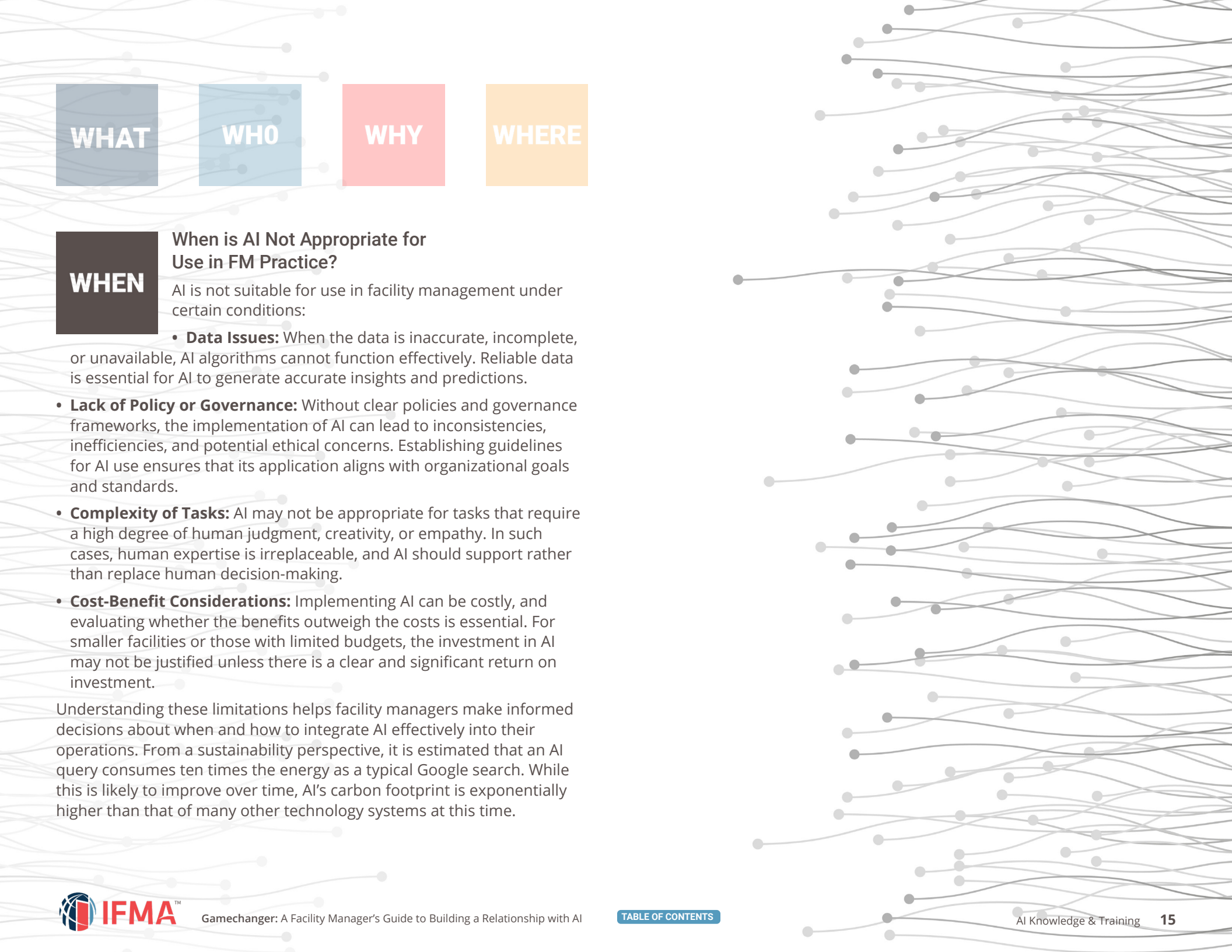
AI can be applied across various stages of FM practice:

- **Input:** AI can analyze data collected from IoT sensors, building management systems, and other sources.

This data can include occupancy patterns, energy consumption, equipment performance, and environmental conditions.

- **Process:** During the processing stage, AI algorithms analyze the collected data to identify patterns, detect anomalies, and make predictions. For example, AI can process data from HVAC systems to predict maintenance needs or optimize energy settings.
- **Output:** The output stage involves implementing AI-generated insights and recommendations. This can include automated adjustments to building systems, generating maintenance work orders, and providing real-time alerts for security incidents.

By leveraging AI at each stage, facility managers can enhance decision-making, improve operational efficiency, and deliver better services.



WHAT

WHO

WHY

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WHEN

When is AI Not Appropriate for Use in FM Practice?

AI is not suitable for use in facility management under certain conditions:

- **Data Issues:** When the data is inaccurate, incomplete, or unavailable, AI algorithms cannot function effectively. Reliable data is essential for AI to generate accurate insights and predictions.
- **Lack of Policy or Governance:** Without clear policies and governance frameworks, the implementation of AI can lead to inconsistencies, inefficiencies, and potential ethical concerns. Establishing guidelines for AI use ensures that its application aligns with organizational goals and standards.
- **Complexity of Tasks:** AI may not be appropriate for tasks that require a high degree of human judgment, creativity, or empathy. In such cases, human expertise is irreplaceable, and AI should support rather than replace human decision-making.
- **Cost-Benefit Considerations:** Implementing AI can be costly, and evaluating whether the benefits outweigh the costs is essential. For smaller facilities or those with limited budgets, the investment in AI may not be justified unless there is a clear and significant return on investment.

Understanding these limitations helps facility managers make informed decisions about when and how to integrate AI effectively into their operations. From a sustainability perspective, it is estimated that an AI query consumes ten times the energy as a typical Google search. While this is likely to improve over time, AI's carbon footprint is exponentially higher than that of many other technology systems at this time.



The Value of AI in Facility Management

The future of AI in facility management looks promising, with trends indicating expanded generative capabilities that will drive broader adoption of faster and more accurate AI technologies. Multi-system connectivity will become more prevalent, integrating various building systems like HVAC, IoT sensors, and financial systems, enhancing predictive capabilities and overall building efficiency.

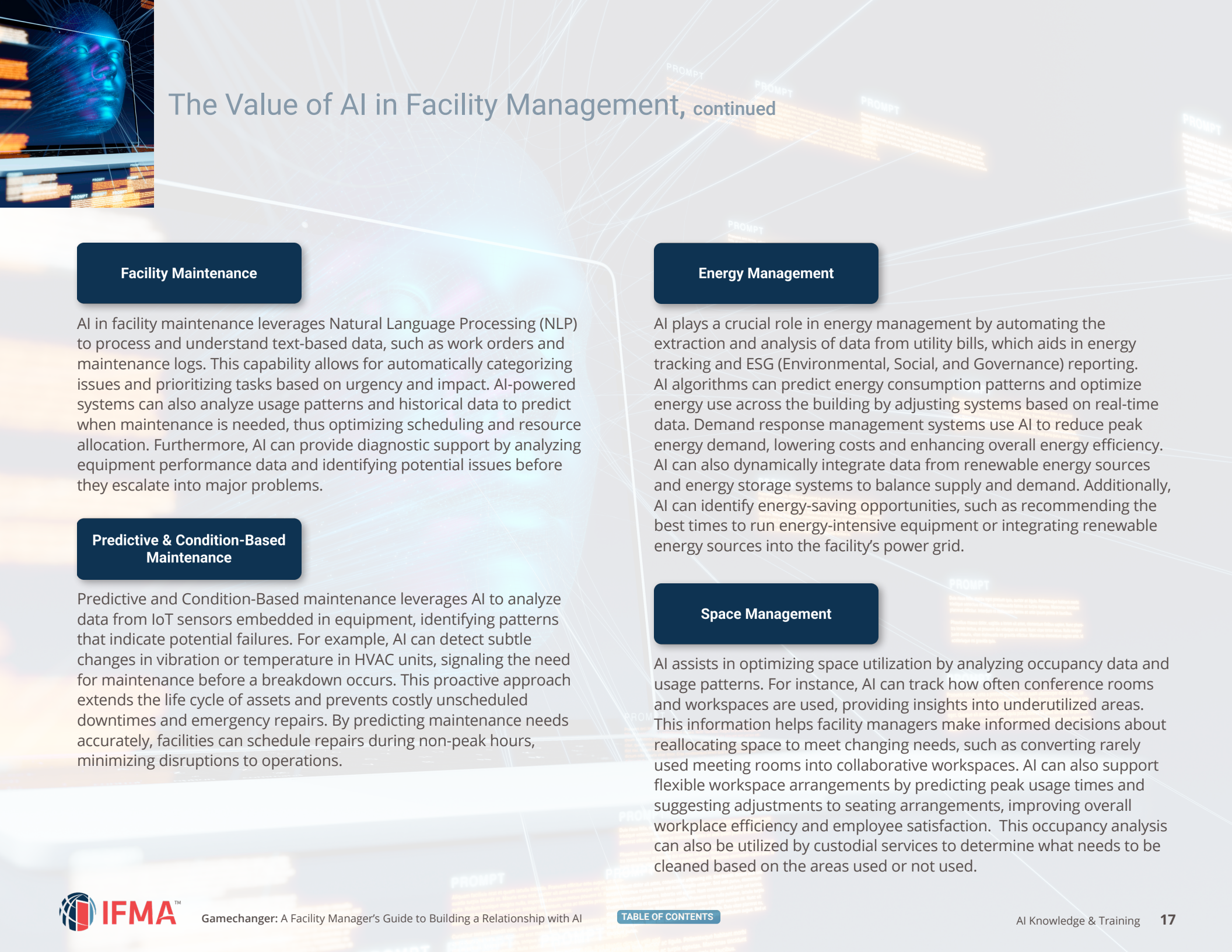
These AI-integrated capabilities significantly enhance the technologies used in facility management, improving efficiency, reducing costs, and enhancing occupant comfort and safety. AI is already enhancing Facilities Management technologies in the following areas:

Efficiency & Productivity

AI enhances efficiency and productivity by automating time-consuming tasks and optimizing operational processes. For instance, AI can manage work orders by prioritizing and assigning tasks to maintenance personnel based on their availability and skill set. It can also streamline inventory management by predicting which supplies are needed and when which reduces excess inventory and minimizes stockouts. Additionally, AI-driven systems can monitor equipment in real-time, identifying inefficiencies and suggesting adjustments to improve performance, such as recalibrating HVAC systems to optimal settings.

Building Automation System (BAS) / Building Management System (BMS)

AI significantly enhances Building Automation Systems (BAS/BMS) through sophisticated pattern recognition algorithms that analyze historical and real-time data from various sensors and control systems. These algorithms detect anomalies and trends that human operators might miss, allowing for proactive maintenance and timely interventions to prevent equipment failures. AI also optimizes energy consumption by adjusting HVAC and lighting systems based on occupancy patterns, weather forecasts, and other relevant factors. By predicting maintenance needs, AI helps in scheduling repairs before failures occur, reducing downtime and extending the lifespan of building systems.



The Value of AI in Facility Management, continued

Facility Maintenance

AI in facility maintenance leverages Natural Language Processing (NLP) to process and understand text-based data, such as work orders and maintenance logs. This capability allows for automatically categorizing issues and prioritizing tasks based on urgency and impact. AI-powered systems can also analyze usage patterns and historical data to predict when maintenance is needed, thus optimizing scheduling and resource allocation. Furthermore, AI can provide diagnostic support by analyzing equipment performance data and identifying potential issues before they escalate into major problems.

Predictive & Condition-Based Maintenance

Predictive and Condition-Based maintenance leverages AI to analyze data from IoT sensors embedded in equipment, identifying patterns that indicate potential failures. For example, AI can detect subtle changes in vibration or temperature in HVAC units, signaling the need for maintenance before a breakdown occurs. This proactive approach extends the life cycle of assets and prevents costly unscheduled downtimes and emergency repairs. By predicting maintenance needs accurately, facilities can schedule repairs during non-peak hours, minimizing disruptions to operations.

Energy Management

AI plays a crucial role in energy management by automating the extraction and analysis of data from utility bills, which aids in energy tracking and ESG (Environmental, Social, and Governance) reporting. AI algorithms can predict energy consumption patterns and optimize energy use across the building by adjusting systems based on real-time data. Demand response management systems use AI to reduce peak energy demand, lowering costs and enhancing overall energy efficiency. AI can also dynamically integrate data from renewable energy sources and energy storage systems to balance supply and demand. Additionally, AI can identify energy-saving opportunities, such as recommending the best times to run energy-intensive equipment or integrating renewable energy sources into the facility's power grid.

Space Management

AI assists in optimizing space utilization by analyzing occupancy data and usage patterns. For instance, AI can track how often conference rooms and workspaces are used, providing insights into underutilized areas. This information helps facility managers make informed decisions about reallocating space to meet changing needs, such as converting rarely used meeting rooms into collaborative workspaces. AI can also support flexible workspace arrangements by predicting peak usage times and suggesting adjustments to seating arrangements, improving overall workplace efficiency and employee satisfaction. This occupancy analysis can also be utilized by custodial services to determine what needs to be cleaned based on the areas used or not used.



The Value of AI in Facility Management, continued

Safety & Security

AI significantly enhances safety and security measures within facilities. AI-powered surveillance systems can monitor large areas continuously, using advanced algorithms to detect unusual activities or unauthorized access in real time. For example, facial recognition technology can identify individuals and match them against a database of authorized personnel, automatically denying access to unknown individuals. AI can also predict potential security threats by analyzing patterns and trends in security data, enabling proactive measures to prevent incidents. Additionally, AI can manage emergency responses by coordinating with building systems to control access, guide evacuations, and notify emergency services.

Tenant/Occupant Experience

AI-driven insights can improve tenant and occupant satisfaction by personalizing the indoor environment. For example, AI can learn individual preferences for lighting, temperature, and other environmental factors, automatically adjusting settings to enhance comfort. AI systems can also analyze data from occupant input devices and other feedback mechanisms, identifying common issues and suggesting improvements to facility management. Additionally, AI chatbots can provide instant support for common queries, such as reporting maintenance issues or booking amenities, enhancing the overall occupant experience, and ensuring that concerns are addressed promptly and efficiently.

Visitor Management

Visitor management systems benefit from AI through automated check-in processes that streamline visitor registration and reduce wait times. AI-driven systems can verify visitor identities using facial recognition or other biometric methods, enhancing security. Additionally, AI can analyze visitor data to optimize staffing levels and improve the overall visitor experience by predicting peak times and ensuring adequate resources are available. This data analysis also helps identify frequent visitors and tailor services to meet their specific needs.

Waste Management

In waste management, AI-powered smart bins with sensors monitor fill levels and optimize collection schedules, reducing operational costs and improving efficiency. Machine learning algorithms analyze waste generation patterns and suggest ways to minimize waste production and increase recycling rates. AI can also enhance waste sorting processes by using computer vision to automatically identify and separate different types of waste, ensuring more effective recycling and reducing the volume of waste sent to landfills.



The Value of AI in Facility Management, continued

Indoor Environmental Quality (IEQ) Monitoring

AI systems in IEQ monitor continuously and track air quality parameters such as temperature, humidity, and pollutant levels, providing real-time alerts and automated responses to maintain healthy indoor environments. Predictive analysis capabilities allow AI to foresee potential air quality issues by analyzing trends and making necessary adjustments to HVAC systems before problems arise. AI can also integrate data from various sources, such as weather forecasts and outdoor air quality monitors, to optimize indoor air quality proactively.

Parking Management

AI transforms parking management by implementing dynamic pricing models that adjust parking fees based on demand, maximizing revenue and optimizing space utilization. Occupancy detection systems use AI-driven sensors to provide real-time data on parking space availability, guiding drivers to open spots and reducing congestion. AI can also analyze parking patterns and predict peak usage times, allowing for better planning and management of parking resources. Additionally, AI can integrate with other smart city infrastructures, such as traffic management systems, to enhance overall urban mobility.

Prompt Engineering 101:

Understanding the Power of AI in FM

Effective use of Generative AI tools like ChatGPT, Copilot, Claude, etc. in facility management (FM) depends on writing clear, concise and specific prompts. The following guide helps facility managers craft better prompts to enhance their day-to-day operations.

INCLUDE RELEVANT CONTEXT

Providing context and a persona helps generative AI understand the background and nuances of your request. If you ask AI to “describe a bat,” it has no way of knowing if you mean the flying mammal or a bat used in the game of baseball — it needs context. Include necessary details like location, frequency and specific conditions.

EXAMPLE

Without Context: “Create a maintenance schedule.”

With Context: “Act as a facilities maintenance scheduling subject matter expert. Create a monthly maintenance schedule for a 50,000 square foot office building, including HVAC, plumbing and electrical systems.”

BE CLEAR AND SPECIFIC

Ensure your prompts precisely describe the task or question, avoiding ambiguity to ensure the GPT understands exactly what you need.

EXAMPLE

Unclear Prompt: “Create a checklist.”

Clear Prompt: “Create a detailed HVAC inspection checklist for a commercial building.”

SPECIFY THE DESIRED OUTCOME

Clearly state what you expect as the result of GPT’s response.

EXAMPLE

General Prompt: “Analyze energy usage.”

Specific Prompt: “Analyze the energy usage of our office building and suggest three ways to reduce energy consumption by 10%.”

USE SIMPLE AND DIRECT LANGUAGE

Avoid complex sentences and jargon. Simple, direct language makes it easier for the GPT to process the prompt accurately.

EXAMPLE

Complex Prompt: “Could you potentially examine the efficiency metrics for the heating units and ascertain if there are any significant deviations?”

Simple Prompt: “Analyze the heating units’ efficiency and report any issues.”

BREAK DOWN COMPLEX TASKS

Break complex requests down into smaller, manageable tasks. This ensures that each part of the request is addressed thoroughly.

EXAMPLE

Complex Prompt: “Optimize the facility’s overall energy consumption.”

Broken Down Prompt:

“List the primary energy-consuming systems in a commercial building.”

“Suggest methods to reduce energy consumption for each system.”

PROVIDE EXAMPLES WHEN NECESSARY

If the task involves specific formats or details, provide examples to guide the GPT.

EXAMPLE

Without Example: “Generate a maintenance report.”

With Example: “Generate a maintenance report including the following report line item details: Date, Time, Issue, Action Taken, Technician Name.”

Prompt Engineering 101:

Understanding the Power of AI in FM, *continued*

ASK FOR ACTIONABLE INSIGHTS

Ensure your prompts seek actionable insights that can directly inform decision-making.

EXAMPLE

General Prompt: “Review security protocols.”

Actionable Prompt: “Review the current security protocols for a commercial office building and suggest three improvements.”

ITERATE AND REFINE PROMPTS

Prompts may not always yield the desired results on the first try. Review the GPT’s responses, refine your prompts and iterate until you get the required output.

EXAMPLE

Initial Prompt: “List maintenance tasks.”

Refined Prompt: “List all pending maintenance tasks for HVAC systems, including task details, assigned technicians and expected completion dates.”

Iteration: Try varying the wording of prior prompts within the same GPT conversation and comparing the responses. Sometimes, minor wording changes or changes in order of appearance can materially alter the response received.

Practical Examples for ChatGPT Prompts

Here are practical examples of how facility managers can use ChatGPT in daily operations. These are basic examples, so iteration on the initial response may be required to achieve the desired results.

Creating an HVAC Inspection Checklist

Prompt: “Act as an HVAC maintenance subject matter expert. Create a detailed HVAC inspection checklist for a commercial building that includes tasks for both monthly and quarterly inspections.”

Generating a Maintenance Schedule

Prompt: “Act as a facilities maintenance scheduling subject matter expert. Generate a monthly maintenance schedule for a 50,000 square foot office building, including HVAC, plumbing, electrical and general upkeep tasks.”

Energy Consumption Analysis

Prompt: “Act as an energy management subject matter expert. Analyze the energy consumption data provided for our office building and suggest three ways to improve energy efficiency and reduce costs.”

Security Protocol Review

Prompt: “Act as a security planning and operations subject matter expert. Review the current security protocols for our commercial office building and suggest three improvements to enhance security.”

Space Utilization Report

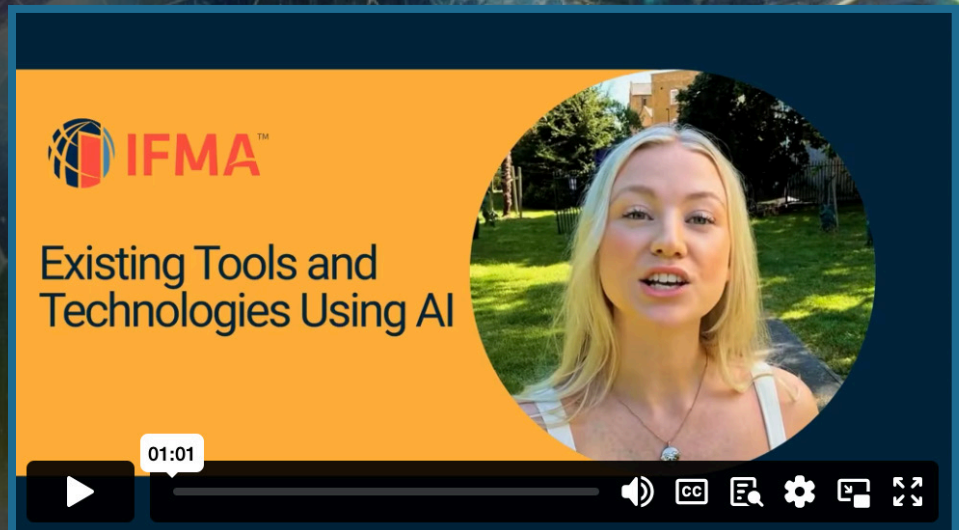
Prompt: “Act as a building space and occupancy planning subject matter expert. Create a report on space utilization in our office building, highlighting underutilized areas and suggesting ways to optimize space usage.”

III. Existing Tools & Technology

This section will explore AI's diverse capabilities and applications in general business and facility management. The discussion will cover how AI enhances productivity through content creation, data analysis, and automation of business tools while also addressing FM-specific challenges such as work order tracking, scheduling, and maintenance planning. Additionally, the section will provide insights into the future implications of AI in the FM industry, highlighting advancements in generative capabilities, multi-modal interactions, and system integration.

LEARNING OBJECTIVES

- 1. Understanding Machine Learning and Machine Vision:** Learn how these AI technologies can enhance facility management by automating tasks, predicting maintenance needs, and optimizing resource use.
- 2. Practical Applications in FM:** Explore real-world examples of how Machine Learning and Machine Vision can solve common facility management challenges, such as work order tracking, cleaning optimization, and equipment maintenance.
- 3. Future Implications:** Gain insights into how these AI tools will continue to evolve, offering even more robust solutions for integrated and efficient facility management.



AI Capabilities and Applications

In a sea of AI features and functionality, it's helpful to consider AI's capabilities and applications in one of two buckets: General Business and FM-specific.

GENERAL BUSINESS

Consider “General Business” as the kind of Generative AI use cases you’ve undoubtedly heard of, become familiar with, and likely used with some frequency over the past year. Imagine your daily life with AI, be it feeding prompts into GPT, conversing with customer service chatbot agents, creating new images from scratch, interacting with a voice assistant, or some other consumer-focused activity. From a workday or “business” perspective, we highlight the following use cases you might consider for boosting your general business productivity in activities not necessarily tied to FM:

- **Content Creation:** One of the most common uses of Generative AI has been using prompts to create written content. Popular uses include emails, report outlines, presentation copy, and more.
- **Meeting Notes and Recaps:** as an FM, you no doubt spend a significant amount of time engaged in live collaborative meetings via technology platforms like Zoom, Microsoft Teams, or Google Meet. The corporate market has seen a rise in 2024 in note-taking and summarization tools meant to capture the overall intent of your live discussions. Many of these apps can not only capture transcripts of a video call in real-time, but they can also distill the action items and consensus of the discussion down to a handful of manageable points.
- **Data Analysis:** Generative AI tools can easily and quickly make sense of structured data sets (picture an Excel table of asset information) and, in many cases, can offer a succinct analysis of what the data contains. Further, with some prompting and prodding, an effective user can get GenAI to produce analyses both simple (e.g., averages, peaks, etc.) and complex (e.g., trends, outliers, regression analysis, etc.).
- **Business Tool Coding:** with very little (if any) context, you can prompt GenAI to help you create and troubleshoot standard “business tool” coding with which you might need help. The most common uses tend to include Excel functions (“for every row, parse out any text that looks like a Trane chiller and place it in column F”) and structured query language (SQL or similar). If you work with or employ data analysts in SQL regularly, you’ll want to introduce them to GenAI, especially for complex multi-source queries. For example, if your analyst tends to query underlying CMMS tables directly as part of their regular analysis work, they could cut query writing time significantly by prompting GenAI with something like:
Data Queries & Coding — Write an SQL query that finds all the records from table “work orders,” matches them on WO_ID in table “assets,” and calculates the overall SLA adherence by response and resolution time for each. Caution: The use of AI for data queries or coding should be limited to qualified individuals.
- **Translation:** if you collaborate with folks who speak a variety of languages beyond English, GenAI can help you with both quick, ad hoc translations (“How do I say, ‘good morning’ to a new colleague in Poland?”) as well as lengthier bodies of text like emails or reports. As with any GenAI functionality, however, it’s not perfect. While newer flavors of GenAI (like ChatGPT-4) have made strides in their translation accuracy, you might want to consider vetting more critical, lengthier text with a native speaker.
- **Research:** if you’ve not yet started leveraging some flavor of GenAI for internet research, give it a shot. GenAI not only understands the context of your request and simplifies results into a focused response, but it also allows you to ask follow-up questions based on initial results. Once you get used to it, the process can bring clarity to your question much faster than what you’ve tried.

AI Capabilities and Applications, continued

FM-SPECIFIC

Beyond the basics of generative AI that applies to all work activities regardless of industry, we next consider elements of AI specific to common FM pain points and use cases. We do caution that the discussion below is intended as general guidance. In recognition of how quickly this technology is advancing, FMs are encouraged to continue to conduct research independently and with trusted vendor partners to understand which technologies can best fit their specific goals and objectives.

- **Pattern Recognition:** as discussed in this paper, much of AI and its underlying technologies specialize in pattern recognition, a programmatic method of leveraging advanced statistical concepts to identify trends in related data sets. As we'll discuss later, this ability holds excellent promise for FM platforms that tend to be defined by massive, disconnected, structured, and unstructured data sets describing a finite list of objects (i.e., assets and buildings).
- **LLM for Work Orders:** some teams have started leveraging Natural Language Processing (NLP) and Large Language Models (LLM) — both components of AI — to assist with processing text-based data like work orders or service tickets. Properly trained, LLM algorithms can crawl large work order sets in search of contextual meaning or sentiment based on ticket comments. Words like “hot,” “cold,” “sweltering,” “stale,” and more could be automatically flagged as proxies for identifying HVAC issues in tickets that otherwise might go unnoticed if miscategorized.
- **Utility Bill Extraction for ESG Reporting:** AI can automate “reading” and extracting similar pieces of data on large piles of input for highly standardized digital documents. For FMs tasked with tracking building-specific energy consumption as part of Scope 1 and Scope 2 greenhouse gas (GHG) emission reporting, combining optical character recognition (OCR) and trained ML models can fully automate a historically tedious, time-consuming process.
- **Machine Learning (ML) for Lease Abstraction:** Some real estate and FM teams presently leverage similar OCR and ML technology to automate the lease abstraction process. In this process, a lease administration team parses lengthy lease contract documents to extract and store critical information like renewal dates, terms, lease rates, tenant improvement allowances (TIA), and more. Such solutions offer time efficiency and increased accuracy in data capture.
- **Smart Cleaning:** one of the lasting, positive outcomes of the FM response to the COVID-19 pandemic included a more intelligent approach to janitorial services. Often called “smart cleaning” or “dynamic cleaning,” some current solutions take signals from IoT occupancy sensors spread across a floor and feed that data into an ML model. Over time, the model learns occupancy patterns and can alert janitorial teams to high-traffic areas needing immediate attention and lower-utilized areas that can be rescheduled. In effect, the model learns how to prioritize services based on actual space consumption — it's like initiating condition-based maintenance based on the actual equipment runtime as opposed to traditional “every quarter” preventive maintenance scheduling.

Addressing FM challenges with AI

In addition, the section below highlights some of the common challenges faced in the FM industry that can be solved using AI.

Tracking Work Order Requests:

CHALLENGE

Facility managers often struggle with tracking work order requests, leading to uncertainty about when tasks are assigned, their completion status, and the time to complete them. This lack of transparency makes it difficult to set and adhere to standards for repair and maintenance tasks.

AI SOLUTION

AI-enabled tools can automate the tracking and management of work order requests. Using machine learning algorithms, AI can analyze historical data to predict the time required for maintenance tasks. Like resource-based scheduling in Project Management, these tools can assist in setting realistic standards for task completion by providing insights based on past performance. Additionally, AI can generate real-time reports on the status of work orders, track progress, and highlight any delays, ensuring that all tasks are completed within the set timeframes.

Scheduling & Event Management:

CHALLENGE

Scheduling activities in a facility, especially for end-users like teachers and faculty, can be complex. Coordinating the resources needed before, during, and after events, and sequencing these activities to avoid conflicts is a significant challenge.

AI SOLUTION

AI can streamline event management by automatically integrating calendar systems to load and review schedules. These tools can analyze the calendar and generate a detailed list of required resources and activities, including setup, event execution, and teardown tasks. By predicting potential conflicts and suggesting optimal sequencing, AI ensures smoother event pre-planning and execution. Additionally, AI can assist with automated reminders and updates to all stakeholders, reducing the burden on facility managers and event organizers.

Project Management for Refurbishments & New Construction:

CHALLENGE

Managing refurbishment and construction projects involves coordinating multiple activities, avoiding resource conflicts, and maintaining communication with vendors and stakeholders. Traditional project management tools can be complex and cumbersome.

AI SOLUTION

AI can enhance project management by providing a more intuitive and automated approach to organizing activities. AI tools can assist in creating detailed project plans, understanding precedents & dependencies, identifying potential conflicts, and suggesting resolutions. These tools can track milestones, manage resource allocation, and provide real-time updates to vendors and stakeholders. Using natural language processing, AI can facilitate better communication, automatically generating and distributing progress reports and ensuring all parties are informed of any issues or changes.

Addressing FM challenges with AI, continued

Responding to Customer Concerns:

CHALLENGE

Facility managers need to address customer concerns promptly and effectively. Managing and responding to a high volume of inquiries can be challenging.

AI SOLUTION

AI-powered chatbots and virtual assistants can handle routine customer inquiries, providing instant responses and freeing facility managers to focus on more complex issues. AI can analyze customer feedback and identify common concerns, allowing facility managers to address these issues proactively. By integrating AI with maintenance management systems (CMMS) and customer relationship management (CRM) systems, facility managers can ensure that activity progress is communicated, and all customer interactions are logged and tracked, providing timely and satisfactory resolutions.

Reviewing Project Data:

CHALLENGE

Facility managers often deal with large amounts of project data, which can be time-consuming to review and analyze manually.

AI SOLUTION

AI can automate the data review by quickly analyzing large datasets and extracting key insights. These tools can summarize project reports, highlight critical issues, and provide recommendations based on data analysis. By using AI to review project data, facility managers can make informed decisions more efficiently, ensuring that projects stay on track and within budget.

Planning Maintenance Activities:

CHALLENGE

Effective maintenance planning requires predicting when equipment will need servicing, coordinating maintenance tasks, and ensuring minimal disruption to facility operations.

AI SOLUTION

AI can enhance maintenance planning by predicting needed maintenance and possible equipment failures and suggesting optimal servicing times. Using predictive analytics, AI can analyze equipment performance data to identify required maintenance, reducing the risk of unexpected breakdowns. AI tools can assist in scheduling maintenance activities and coordinating with other facility operations to minimize disruptions. AI ensures that all maintenance tasks are completed on time and within budget by providing real-time updates and reminders.

Future Implications

Ironically, it is difficult to predict how and when AI technology will profoundly impact FM in the future. A few anticipated focus areas include,

- **Expanded generative capabilities:** the rapid pace at which the market has adopted GenAI will only continue to accelerate. Faster, more accurate AI technology will grow along with corporate governance and maturity, accelerating adoption globally.
- **Improvements in multi-modal capabilities:** AI's ability to integrate text, images, voice/ audio, and vision interactions is improving exponentially, along with its ability to respond multi-modally. While this is second nature to humans interacting with each other, it is a new type of relationship between humans and machines.
- **Multi-system connectivity:** Today's more commonly deployed functionality primarily focuses on single systems — CMMS (work orders), sensors, and, in some early cases, HVAC optimization. As time goes on and more owners build out data architectures more conducive to multi-system (think HVAC, calendar, asset systems, financial systems, IoT occupancy, etc.) integration, you'll likely see more in-depth predictive capabilities across entire buildings and portfolios.

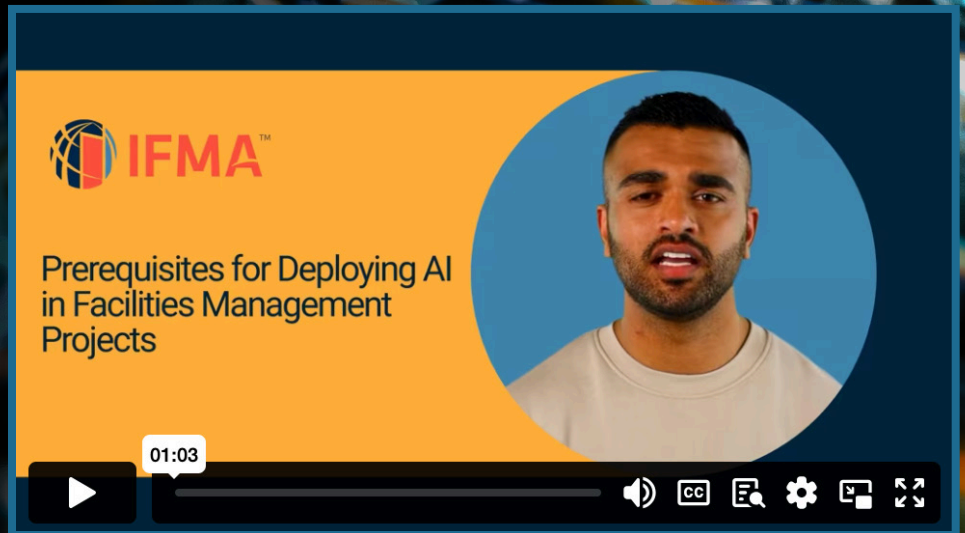
Prerequisites for AI Deployment

As organizations aim to leverage AI tools to either automate processes or improve analytical capabilities, among many other applications, business leaders or key stakeholders can be better prepared to implement, manage, and utilize these tools by adopting a few of the best practices listed.

This section will explore the foundational prerequisites necessary for deploying AI in organizations, focusing on alignment with business strategies, defining objectives, and identifying key stakeholders. It also covers the importance of establishing clear use cases and measurable KPIs. Additionally, the section delves into change management best practices, staff competencies, data governance, AI governance, risk management, and the technical infrastructure required for successful AI implementation. Through practical examples and detailed analysis, readers will understand the critical factors that influence the effective integration of AI technologies in facilities management and other sectors.

LEARNING OBJECTIVES

1. **Organizational Alignment:** Understand the importance of aligning AI deployment with your business strategy, defining clear objectives, and identifying key stakeholders.
2. **Change Management:** Learn how to effectively manage the transition to AI by providing training, appointing change agents, and maintaining clear communication.
3. **Data Governance:** Gain insights into the importance of data quality, governance, and management for successful AI integration.
4. **Technical Infrastructure Readiness:** Assess the readiness of your technical infrastructure, including hardware, software, and network systems, to support AI deployment.



Organizational Alignment and Strategy

Business Objectives & Use Cases

- **Organizational Alignment and Strategy:** Just like embarking on any other new IT initiative, when considering a new AI initiative, ensuring your organization is ready for change and has a strategic plan to take advantage of the effort is imperative. As Benjamin Franklin said, “If you fail to plan, you are planning to fail!”

- **Defining the Overall Business Objective:** First, you should identify why you want to implement AI. Too often, technology is implemented because of hype or the shiny new object. A clearly identified business driver will help you create the container you will continue to refine to get to a plan. Some standard business drivers for facility management are:

1. Lean Initiatives
2. Operational Efficiencies
3. Productivity Gains
4. Enhanced Tenant Experience

These are not the only drivers, but they give you an idea of the level you are trying to examine.

- **Defining Key Stakeholders:** Once you have defined the overall business objective, you will want to start building the team to help further define this effort and program. These are the people affected, as well as experts who will provide guidance. Some stakeholders you should or may want to include are:

5. Legal — more about this in Regulatory Compliance and Ethical Considerations
6. IT — This is, after all, an IT-oriented project, and you will need their expertise and guidance.

7. Business Line Leaders affected

8. User Base Lead that will be utilizing the tool — This could be tenants if for tenant enhancement

9. Key vendor partners — If you have an ongoing relationship with a vendor and it would be beneficial to have them involved

10. Leasing — Is what you are doing going to help or hinder leasing

11. Human Resources — Will training be involved? Do you need new skill sets? Also, does your Authorized Use of Technology Policy need to be updated?

- **Use Cases and KPIs:** Once your team is together, it is time to start narrowing down exactly what you want to accomplish. Do you want to reduce the FM time requirement to 10 hours monthly? Do you want to reduce energy usage by 30%? The effort is to define a specific goal or goal with measurable outcomes so that you can identify the success of the effort and ensure that everyone understands the goal.

- **Next, look at use cases that could get you to that goal.**

Use cases will help you further define the actions that will lead to the stated objectives, who will take those actions, what technology will need to be in place to support those actions, and who will need to be involved in making the use case come to fruition. Note that organizational guidelines regarding ethics and compliance should be incorporated as well.

Change Management

Change management is a structured methodology to successfully transition from the current state to a desired future state. Based on various research publications, a formal change management process can help alleviate resistance, maintain productivity, ensure a smooth transition, and achieve the intended benefits from the change initiative. While most organizations tend to implement the change successfully, a good proportion of change initiatives fail during the early phase of adoption due to the poor change management process. Based on the maturity of change implementation, the framework below provides some of the best practices that can be utilized as a part of a comprehensive change management process.

- **Change Management Best Practices**

Key practices that can be initiated before the change implementation

1. Necessary Knowledge & Training Resources
2. Ensure all stakeholders have adequate training to learn about the change and its direct or indirect impacts on the end user. Additionally, these stakeholders should have access to a knowledge library as a reference to learn more about the change and its implications. Such resources should be developed and shared with the stakeholders before the change's implementation.

- **Leadership Support**

Assuming organizational leaders support the change, their active involvement helps overcome change resistance and boost employee morale. The leadership's ability to effectively communicate the benefits of change on a personal level throughout the change implementation process can be a key to the successful implementation of the change.

- **Change Agent**

A change agent can be considered a "champion of the change" who is involved throughout the change process and acts as a primary Point of Contact (POC) for all stakeholders. For larger organizations with cross-functional teams, having multiple change agents as POCs for different teams can be a highly effective strategy to enhance communication during the transition and impact the overall adoption of the change.

- **Communication**

Clear and regular communication throughout the change process is one of the most critical strategies that can help to reduce resistance, increase transparency, and improve overall understanding of the change. Some key areas to highlight during such communications include but are not limited to why the change is being implemented, how it will impact end users, intended benefits and outcomes, key milestones, and timeframe. Organizations should aim to be innovative with their communication strategies and may utilize tools like emails, meetings, newsletters, websites, and webinars. Don't forget to include feedback mechanisms to capture and address any anomalies or unexpected results occurring along the way.

- **Other Key Strategies**

3. **Workload Adjustment:**

For complex change initiatives requiring training or learning, the organization should make necessary workload adjustments to allow a smoother transition for employees.

4. **Realistic Timeframe:**

While it is difficult to accurately predict the ideal change management process timeframe, it is recommended that a realistic timeline be developed for each major milestone in the change journey.

5. **Clear Vision and Objectives:**

Establish a clear vision and specific objectives for the change and effectively communicate it with all stakeholders.

6. **Identification & Documentation of Key Objectives:**

Identifying critical objectives is crucial for successfully implementing AI initiatives for any organization. It allows key stakeholders to have a clear understanding of the intended outcomes and ensures sufficient resources are available to implement the initiative. The documentation of key objectives should aim to capture the specific tasks AI will perform or the problems it will aim to solve. It also allows organizations to identify key stakeholders or teams engaged during various phases of its implementation.

7. Risk Management: Risk management has long been a critical step in the Construction and Facilities Management industry. It is instrumental in identifying potential risks or challenges, assessing their impact, and developing strategies to better plan or mitigate them. To further enhance the risk management process, organizations can prioritize the identified risks based on their impact and likelihood of occurrence. Additionally, organizations should aim to implement monitoring systems to detect or track highly prioritized risks.

8. Scalability: To leverage an AI tool's full potential, organizations should ensure that the AI system or solution can handle increased workload, data volumes, and user demands without significantly losing performance or efficiency. Hence, organizations can initiate a pilot project to understand the current capabilities and estimate future requirements for broader applications.

- **Change Implementation to Adoption**

Once the change has been implemented, organizations should aim to develop a mechanism to quantify the change performance to ensure long-term adoption and continuous improvement. Organizations can quickly identify critical shortcomings and opportunities to facilitate continuous improvement by using technology or surveys to collect feedback. In summary, organizations need to be more agile with their methodology and develop the necessary tools to leverage the best practices for change management.

- **Practical Examples to Implement Change Management:**

EXAMPLE 1:
Upgrading to an AI-Powered Building Management System (BMS)

Challenge: Facility managers are accustomed to traditional BMS interfaces and workflows. Switching to an AI-powered system introduces a steep learning curve and potential resistance due to fear of job displacement or loss of control.

Change Management Solution:

- **Necessary Knowledge & Training Resources:** Conduct comprehensive training sessions on the new AI-BMS. Provide detailed manuals, online tutorials, and access to technical support to empower staff.
- **Leadership Support:** Facility managers actively champion the new system, emphasizing its benefits, such as improved energy efficiency, predictive maintenance, and enhanced occupant comfort.
- **Change Agent:** Appoint a tech-savvy facility manager or a dedicated AI specialist as the change agent to guide and support the team during the transition.
- **Communication:** To build momentum, regularly update staff on the project's progress, address concerns transparently, and celebrate early successes.
- **Workload Adjustment:** Allow for dedicated training time and gradually phase in new features to avoid overwhelming staff.

EXAMPLE 2: Implementing AI-Based Predictive Maintenance

Challenge: Maintenance teams are accustomed to reactive or scheduled maintenance routines. Shifting to a predictive model requires a change in mindset, trust in the AI's recommendations, and potentially new skill sets (e.g., data interpretation).

Change Management Solution:

- **Necessary Knowledge & Training Resources:** Offer training on how AI-based predictive maintenance works, how to interpret its outputs, and how it can improve their daily work.
- **Leadership Support:** Highlight the potential for reduced downtime, cost savings, and improved asset longevity that predictive maintenance offers.
- **Change Agent:** Identify a maintenance technician who is enthusiastic about technology and eager to learn as a change agent to advocate for the new system.
- **Communication:** Explain how the AI model works, address any concerns about job security, and showcase success stories from other facilities.
- **Realistic Timeframe:** Set achievable milestones for adopting predictive maintenance, starting with pilot projects on non-critical assets.

EXAMPLE 3: Introducing AI-Powered Chatbots for Tenant Support

Challenge: Front-line staff may feel threatened by chatbots, fearing they'll be replaced, and tenants may be hesitant to use a new communication channel.

Change Management Solution:

- **Necessary Knowledge & Training Resources:** Train staff on how to use the chatbot to augment their work (e.g., handling routine queries, freeing them for complex issues).
- **Leadership Support:** Emphasize that chatbots are tools to enhance, not replace, human interaction. Highlight the potential for improved tenant satisfaction and staff efficiency.
- **Change Agent:** Designate a customer service representative who is comfortable with technology as a change agent to promote the chatbot to both staff and tenants.
- **Communication:** Roll out the chatbot gradually, starting with a limited set of features and functionalities. Gather feedback from tenants and staff to improve its performance.
- **Clear Vision and Objectives:** Clearly define the chatbot's role in tenant support and set measurable goals for its adoption and impact.

Staff Competencies and Skills Assessment

• Skills Inventory

This inventory helps identify current employee skills and potential areas for development, especially as AI technology becomes more integrated into facility management.

Instructions:

1. List all relevant employees in the table below.
 2. For each employee, assess their skills in the following categories:
 - (a) **Technical Skills:** Specific knowledge or abilities related to their role (e.g., HVAC systems, electrical repair, data analysis)
 - (b) **Soft Skills:** Interpersonal and communication abilities (e.g., leadership, teamwork, problem-solving)
 - (c) **Certifications:** Relevant professional credentials
 - (d) **Technology/AI Skills:** Any existing knowledge or experience with enterprise systems, data analysis, programming, AI, etc. (crucial for future AI adoption)
 3. **Rate skills:** To assess proficiency levels, use a simple rating scale (e.g., beginner, intermediate, advanced) or a numerical system (1-5).
 4. **Update regularly:** This inventory should be a dynamic document that's reviewed and updated as employee skills evolve, and new technologies emerge.
- ### • Training Needs Analysis
- Training needs analysis is a process that helps to identify gaps between the skills your workforce currently has and the skills required for effective technology/AI integration. This analysis should consider the specific applications being implemented and the changes in processes that will occur. It helps prioritize training efforts to ensure that staff are equipped with the necessary knowledge to work alongside AI systems or manage them effectively.

Employee Name	Position	Technical Skills	Soft Skills	Certifications	AI/Tech Skills
John Doe	Building Automation Systems Manager	HVAC (Advanced), Building Automation Software (Advanced)	Leadership (Advanced), Communication (Advanced)	CEM, BOC	IoT Integration (Intermediate)
Jane Smith	Maintenance Technician	Electrical Systems (Intermediate), Plumbing (Beginner)	Attention to Detail (Advanced), Time Management (Intermediate)	CMRT, OSHA Safety	CMMS (Beginner)
Alex Johnson	Data Analyst	Data Analysis (Advanced), SQL (Advanced), Python (Intermediate)	Analytical Thinking (Advanced), Technical Communication (Intermediate)	CAP, Data Science	AI/ML Algorithms (Intermediate)

• Recruitment Plans

Based on the skills inventory and training needs analysis findings, recruitment plans can be developed to address the skill gaps. This may involve acquiring staff with expertise in AI, data science, or other relevant fields. Recruitment plans should align with the strategic direction of the AI initiatives, ensuring that new hires can effectively contribute to the organization's goals.

• Continuous Learning

Digital transformation is rapidly evolving in the commercial real estate industry, and continuous learning is essential to keep up with the latest developments. Organizations should foster a culture of lifelong learning where employees are encouraged to update their skills regularly. This could be through formal training programs,

Data & Governance

Data Governance

Data is the lifeblood of all technology systems, and proper data management is crucial for their success. Data governance refers to the overall management of the availability, usability, integrity, and security of the data used in an organization. This includes establishing policies and procedures for data handling, quality control, and compliance with relevant data protection regulations.

- **Data is the Foundation of Success**

Imagine trying to bake a delicious cake with spoiled ingredients. No matter how talented the baker is, the result will be a disaster. The same principle applies to AI in facility management: feed it bad data, and you'll get bad results. This is the essence of the "garbage in, garbage out" concept — the quality of your output is only as good as the quality of your input.

All technology implementations rely on high-quality, well-prepared data. Just as a chef meticulously selects and prepares ingredients, data professionals must carefully curate and refine the data fed into any technology or AI system. This is where data governance and meticulous data preparation become essential.

- **Data Governance and Management**

Data governance acts as the head chef, overseeing the culinary process, from sourcing ingredients (data acquisition) to plating the final dish (AI outputs). This includes:

1. **Data Governance:** The executive chef sets the policies and standards for data quality, availability, and security. This is an organizational leadership role and responsibility.
2. **Data Management:** The sous chefs handle the day-to-day tasks of preparing, storing, and maintaining the data ingredients. The organization needs a road map guiding enterprise data management practices.

3. **Data Stewardship:** The quality control inspectors ensure each ingredient meets the highest standards of freshness and purity. Departments or Application Owners must implement controls and audit processes to meet data quality objectives.

4. **Data Custodians:** The kitchen staff is responsible for maintaining the cleanliness and organization of the kitchen (data storage systems). Individuals with data input or process roles are accountable for ensuring the data they handle is complete, accurate, and timely.

(a) Data Preparation Process

This is like when a chef gets everything ready before starting to cook. It ensures that the data fed into your AI models is clean, reliable, and prepared for analysis:

Data Exploration (Inspecting the Ingredients):

- (i) **Data Quality:** Like checking for rotten produce and assessing your data's accuracy, completeness, and consistency. Ideally, you would like 100% of your data items to be complete, accurate, and timely. That may not be practical, but is 70% of your data trustworthy enough? That is an organizational target below which the confidence in the data for decision-making purposes is compromised.
- (ii) **Data Distribution:** Understand the flavor profile of your ingredients—the statistical properties that will influence the final dish. Is the data evenly spread or skewed in one direction or another? For example, if 5% of work orders are closed late, that may not sound like a big issue, but if all the late work orders are attributed to a single person, that tells a different story.
- (iii) **Amount of Data:** Ensure you have enough ingredients to create a satisfying meal for your AI approach. Say you have millions of work order records in your history archive. Would you provide one hundred work order records to AI to sufficiently analyze the work order performance and distribution?

Data Cleaning (Prepping the Ingredients):

- (i) **Missing Data:** Deal with missing values, like substituting a missing spice with a suitable alternative. How do you know if data is missing? It's like asking to "raise your hand if you're not in the room." For buildings, how do you know if you have all of the building assets recorded in the asset inventory? If you have a trusted as-built set of drawings, you could compare all assets found on the drawings against the asset inventory, but that is time-consuming and still error-prone. Establish a standard for what "must" be in the inventory. Then, you will have something to compare against. Detection of missing data is a data science domain. Consulting with a relevant subject matter expert may be appropriate, depending on the complexity of your data challenges.
- (ii) **Data Type Conversion:** Make sure all ingredients are correct for cooking — convert categorical data to numerical if needed. What data items are labeled in one system is not necessarily the same in another, even though they refer to the same item of information. For example, a "Type" field in one system may be labeled a "Category" field in another system. Data type conversions are common. What's important is that the data item has the same meaning and definition from one system to another.
- (iii) **Outlier Detection and Removal:** Remove any spoiled ingredients (outliers) that could ruin the entire dish. What if you have extraneous information in your system that is not required and never used? Only maintain records for what matters. Is it important to track the paint color on the walls in your CMMS system? If not, consider removing those records from the system and update the record standard that caused the collection of the information in the first place.

By following these steps, you ensure that your AI models are fed the finest data ingredients, resulting in delicious and nutritious outcomes. Remember, "garbage in, garbage out" is not just a saying — it's a fundamental principle of data-driven decision-making. Practice robust data governance and preparation, and your AI initiatives will flourish.

AI Governance

Implementing and deploying AI without governance considerations can lead to significant factual or ethical concerns, such as biases and discrimination, leading to societal inequalities. AI applications may lead to misuse and potential legal challenges without clear regulations and accountability. In addition to complex algorithms, a lack of governance and transparency can result in false information, data privacy violations, and/or security threats.

- **What is AI governance?**

Various definitions have often been used interchangeably in discussions concerning AI, leading to confusion. Some mistakenly confuse AI governance with data governance, but they have distinct focuses. Data governance is focused on managing data to ensure data quality, accuracy, security, and usability. It also includes data preparation for different AI implementations. AI governance is narrower and focused on the ethical, responsible, and transparent use of AI.

- **Basic Concepts of AI Governance (responsible, transparent, ethical)**

In AI governance, three principles guide the responsible development and deployment of artificial intelligence: accountability, transparency, and ethics.

- **Responsible/accountable**

Individuals or organizations are accountable for the decisions made by the AI applications/tools. As a result, it is essential to determine the entity responsible for developing, deploying, or managing the AI system/tool to hold them accountable when AI implementation results in negative impacts or outcomes.

- **Transparent**

The process and outcome of the AI tools and systems should be clear and understandable to stakeholders/users. This includes algorithms, methods, and the source of data to ensure trust and accountability.

- **Ethical**

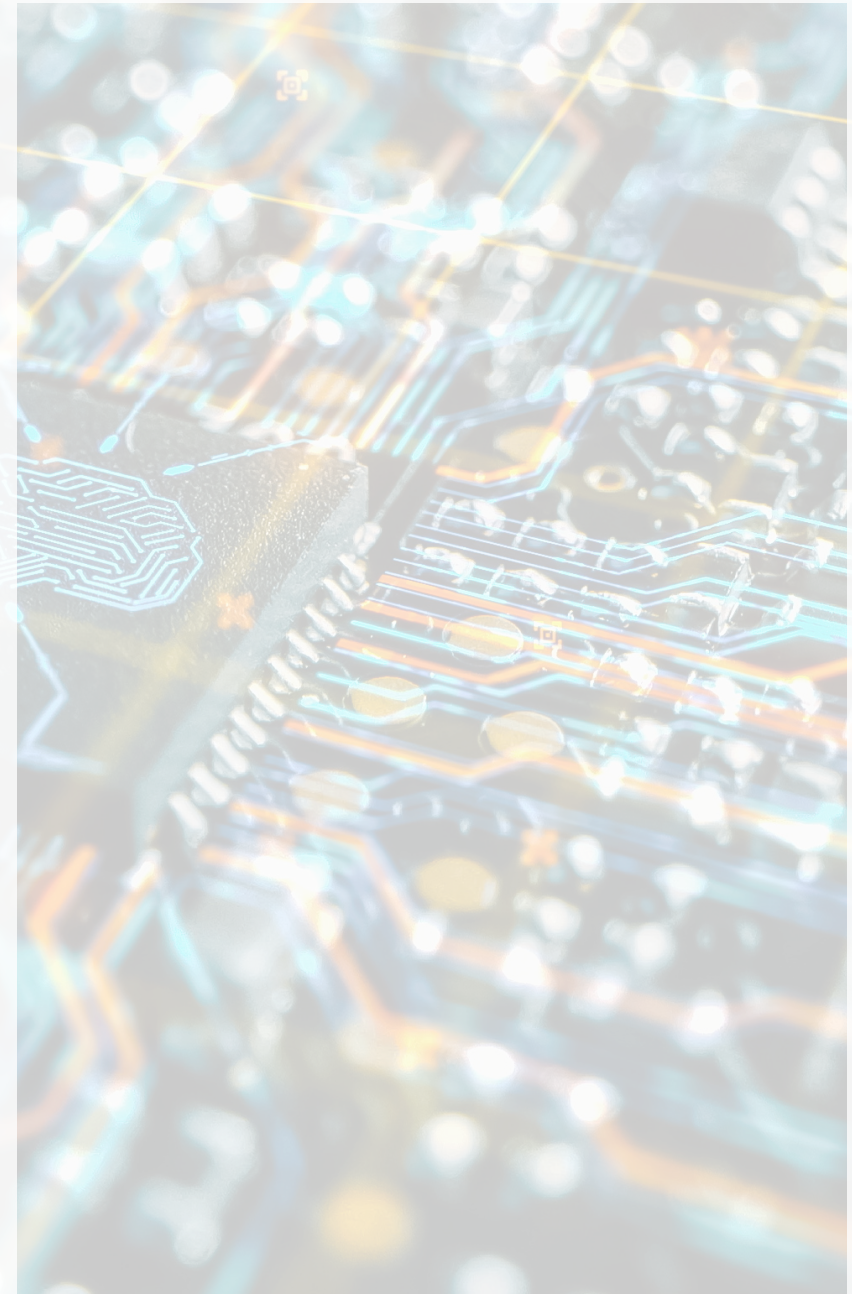
Biases: Like any other decision-making process, AI is susceptible to biases. It is significant to ensure that AI treats all groups and individuals equally. AI is trained on data; if the training data is biased, the results of the AI model will echo the flaws and biases. To prevent AI from discrimination (e.g., gender, race), AI models should identify and mitigate biases. Unconscious bias exists in many forms and sources of information. If these information sources are used in training an AI model, unconscious bias will likely surface in the AI output.

- **Privacy**

Privacy allows individuals to control how their data is collected, shared, or used. It also protects personal information from unauthorized access.

Examples of existing regulations and guidelines

1. Different U.S. states have taken approaches to address regulations supporting AI governance. For emerging legislation in the U.S., the following website is a helpful resource:
<https://www.csg.org/2023/12/06/artificial-intelligence-in-the-states-emerging-legislation/>
2. The EU Artificial Intelligence Act provides updates on regulations in the EU area:
<https://artificialintelligenceact.eu/the-ai-office-summary/>
3. The following website is an example of a resource for the UK:
<https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response>



Risk Assessment / Cyber Security

As with any technology or action we take in business, risks are always involved, which must be evaluated and mitigated to the greatest extent possible.

- **IT Cyber Security Risks:**

As mentioned before, you should involve your IT department as a Key Stakeholder in this effort. To mitigate your risks, you should follow all required IT policies and industry best practices.

- **Data quality and Bias:**

The data quality or bias may give misleading results, which could cause your system to fail to function as you intended.

- **Model Performance and Robustness:**

Is the model appropriate for your application? Does it allow you to do what you need to do? Is it trained on data like what you will be using? Will it struggle or improve depending on the data you have available? Don't overlook the probability of model decay over time. The data used to train a model may become outdated. Plan for periodic "maintenance" of the model to avoid this entropy.

- **Interpretability and Explainability:**

See above

- **Scalability and Performance:**

Is the solution scalable, and will it continue to perform as it grows? This starts with well-defined and executed policies, standards, and procedures. Keep in mind that chaos does not get better as it gets bigger.

- **Resource Constraints:**

AI can be very resource intensive. Have you considered the requirements for continuing to scale needed resources and your impact on your company's sustainability goals? No one has an unlimited supply of people, time, or money.

- **Regulatory Compliance:**

See above

- **Integration and Compatibility:**

Will it work with your current systems? Have you ensured that it will be easy to integrate? Is it "future proof" for the foreseeable future? Many failures can be attributed to issues with the interfaces between systems, not the individual systems themselves.

- **Dependency on External Providers:**

Will you require support from outside providers and vendors? What are their security procedures? Are they stable and reliable?

- **Data Governance and Management:**

See above.

- **Unauthorized use of your AI for illicit purposes.**

You want your platform to be used for the right purposes. Mitigating this risk will limit your liability. This should be included in the Authorized Use documentation and legal disclaimers.

Technical Infrastructure Readiness

An organization's technology infrastructure provides the foundation for data management, computational power, scalability, security, and reliability, which are critical components for developing and deploying AI solutions effectively. Engage with IT early to ensure these infrastructure components and capacities are planned. It's also important to consider the upfront acquisition and ongoing operational costs to assess the total cost of ownership.

• Hardware Assessment

Completing a hardware assessment is vital to ensure you have the necessary performance, scalability, compatibility, efficiency, reliability, and cost-effectiveness. Evaluate your needs for:

- (i) Processing power, memory, storage, scalability, high-speed networking capabilities, software compatibility and energy efficiency.
- (ii) Acquiring your hardware or utilizing compute power via a cloud service (e.g., Azure, AWS, GCP).

• Software Compatibility

Software compatibility is essential for seamless integration, interoperability, deployment, and maintenance. Evaluate your organization's current:

- (i) Software frameworks (e.g., web application, mobile application, containerization frameworks) to ensure compatibility with machine learning and other AI frameworks.
- (ii) Software programming languages to evaluate the integration of your AI project into current applications utilizing common AI programming languages (e.g., Python, R).
- (iii) Deployment environment to ensure compatibility with current cloud platforms, edge devices, and on-premises infrastructure.

• Network Infrastructure

Network infrastructure assessment is focused on network performance, scalability, security, and reliability; identifying potential bottlenecks and vulnerabilities ensures your AI project operates securely and efficiently across your network. Evaluate your network's current and future state needs for:

- (i) Bandwidth and latency to ensure it can handle data volume and any real-time processing requirements.
 - Consider the network required topology as well. Are there needs for both wired and wireless infrastructure? Is there sufficient bandwidth available for both?
- (ii) Scalability to ensure growing data volume and computational demands.
- (iii) Redundancy and resilience to minimize the risk of downtime and data loss.
- (iv) Security to protect against unauthorized access, data breaches, and cyber threats.
- (v) Edge computing and Internet of Things (IoT) integration if your project requires low-latency communication, reliable connectivity, and/or secure data transmission between edge devices and central servers or cloud platforms. Are you collecting raw data and transmitting it directly to a cloud platform, or is some data aggregation or summarization occurring near the source (Edge) before being transmitted to the cloud?

- **Data Storage and Processing**

Adequate data storage and processing enable organizations to derive actionable insights more efficiently and optimize decision-making processes as a part of their AI projects. **Evaluate your:**

- (i) Data access patterns, performance requirements, and data consistency should determine your storage needs (data volume and velocity).
- (ii) Data ingest, retrieval, and lifecycle management to determine your data management needs (data veracity and value).
- (iii) Data compatibility with common data formats, protocols, and integration mechanisms to facilitate data exchange and interoperability across different platforms and tools (data variability).

Conclusion

Artificial Intelligence (AI) will significantly transform the commercial real estate industry and facility management profession. Within the next decade, AI is expected to become an integral part of both sectors, driving efficiency, enhancing decision-making, and reducing operational costs. AI will enable predictive maintenance, optimize energy usage, and improve space utilization, making buildings more sustainable and cost-effective. This transformation not only promises a future where buildings are smarter and more economically viable but also one where they are more environmentally friendly. Additionally, AI-driven analytics will provide deep insights into tenant behaviors and preferences, allowing property managers to enhance occupant experience and tailor services to meet evolving demands. The integration of AI in facility management will lead to more intelligent, more responsive buildings, where systems autonomously adjust to real-time data, ensuring optimal performance and comfort.

According to some estimates, the widespread adoption of AI in commercial real estate and facility management is projected to be realized by 2035. By this time, AI technologies will be seamlessly integrated into personal and professional spheres, fundamentally altering how we interact with the built environment. Homes and workplaces will be equipped with advanced AI systems that anticipate needs, manage resources efficiently, and enhance overall quality of life. As AI continues to evolve, its role will expand beyond operational efficiencies to include strategic planning and innovation, solidifying its presence as a cornerstone of the industry. The convergence of AI with other emerging technologies will create a dynamic, interconnected ecosystem, driving the next wave of commercial real estate and facility management advancements.

In the short term, facility managers must focus on three critical actions to leverage AI effectively.

- ✓ First, ensuring the accuracy and completeness of data is foundational for AI success. FM organizations should implement robust data governance frameworks to maintain high-quality data inputs, which will enable reliable AI-driven insights and predictions. This meticulous approach to data governance is crucial for the success of AI initiatives.
- ✓ Second, investing in training programs to upskill facility management teams on AI technologies is essential. This includes understanding AI capabilities, interpreting AI outputs, and integrating AI tools into daily operations. Comprehensive training will help overcome resistance to change and build confidence in using AI.
- ✓ Third, FM organizations should start with small-scale pilot projects to mitigate risks and demonstrate value. By testing AI solutions in controlled environments, managers can gather insights, refine approaches, and gradually scale successful initiatives across the organization.

Organizations can assess their readiness for implementing AI solutions by evaluating the following key areas.

- ✓ Evaluating the current technical infrastructure is crucial to ensuring it supports AI applications. This includes assessing computational power, data storage capabilities, and network infrastructure. Upgrading these components may be necessary to handle AI workloads effectively.

Conclusion

- ✓ Reviewing and enhancing data management practices, including data collection, storage, and procedural protocols, to ensure clean, accurate data availability for AI applications.
- ✓ Establish AI governance processes to address bias, ethics, and trust considerations. Governance should also address emerging regulatory concerns or constraints.
- ✓ Conducting a skills inventory to identify gaps in AI-related knowledge and competencies within the FM team is also vital. Developing targeted recruitment and training plans to address these gaps ensures the team is equipped to manage and leverage AI technologies.

The International Facility Management Association (IFMA) may consider several options further to explore AI's impact on the FM profession.

- ✓ Conducting comprehensive research on the application of AI in FM by evaluating case studies, best practices, and emerging trends to gain valuable insights.
- ✓ Advocacy for the application of AI by showcasing successful implementations and their benefits that will drive industry-wide acceptance.
- ✓ Offering specialized educational programs focused on AI in FM to prepare FM professionals for an AI-driven future. These programs should include technical aspects, practical applications, and change management strategies.
- ✓ Fostering collaborations with technology providers, academic institutions, and industry experts that drive innovation and knowledge sharing. This may include future AI-focused working groups or consortiums to facilitate the development of new AI methodologies and best practices tailored to FM needs.

- ✓ Participating in developing industry standards and ethical guidelines for AI use in FM, addressing potential ethical concerns, and building stakeholder trust.

By taking these actions, IFMA will guide the FM industry through the coming AI transformation, enhancing the profession's overall efficiency, sustainability, and value.

CALL to ACTION

Facility managers and industry leaders are encouraged to embrace AI's transformative potential with enthusiasm and foresight. By integrating AI into facility management practices, professionals can unlock unprecedented efficiencies, enhance occupant satisfaction, and lead the way in sustainable building operations.

The journey towards AI adoption is about keeping pace with technological advancements and pioneering a brighter, more responsive future for the built environment. As AI continues to evolve, those who proactively incorporate these innovations will position themselves at the forefront of the industry, setting new standards for excellence and innovation.

Now is the time to explore, invest, and lead with AI, shaping a future where intelligent systems and human expertise work together to create exceptional spaces.

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Acknowledgements

The AI in FM Working Group consists of a diverse group of industry leaders with experiences spanning artificial intelligence (AI), academia, service providers, leading-edge FM operations, and IFMA's Research and Benchmarking. These perspectives will help deliver an informed and balanced assessment of the current AI landscape relevant to the facility management profession.



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Drew DePriest is a Director of Real Estate Operations Technology at McKesson. Prior to joining McKesson, Drew worked as a Facilities Management Technology for a large technology client at CBRE, where he previously led Digital Solutions globally for the firm's workplace experience platform, Host. Prior to CBRE, Drew headed the global Collaboration Services team at Aon, led business development at workplace technology startup Comfy (acquired by Siemens), and spent 12 years in operations and business development at building automation firm Automated Logic. He earned his undergraduate degree in Systems Engineering from the University of Illinois at Urbana-Champaign, as well as an MBA and a master's in finance from DePaul University's Kellstadt Graduate School of Business (where he also had a blast as an adjunct professor of marketing for a while). He's credentialed as a Master of Corporate Real Estate (MCR.W) through CoreNet, a WELL AP, a Leesman AP, and previously served on the board of the Chicago Chapter of CoreNet Global.



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Mahnaz Ensafi is an Application Manager at Planon, where she leverages her background and experience to support customers and improve operational efficiency. Prior to her role at Planon, she worked as a Technology Consultant and Researcher focusing on data analytics and technology implementation for facility management. She holds a Ph.D. from Virginia Tech, where she researched various topics including digital twins and applications of artificial intelligence and virtual/augmented reality in facility management.



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Director of Global Product Strategy & Innovation, Planon Software

Erik Jaspers' career in IT spans over 40 years, starting in manufacturing automation at Philips Electronics. For the last 25 years, he has been working for Planon, the leading smart building management software vendor. Having held senior management positions in developing Planon's software solutions, Erik is currently working on product strategy and innovation policies.

Erik contributed to multiple publications on IT and facility management (FM) subjects, including IFMA publications 'Work on the Move' (2011, 2016, 2021), 'Technology for Facility Managers' (2012, 2017), GEFMA publications 'CAFM-Handbook' (2018) and 'BIM in Immobilienbetrieb' (2022). He authored articles on technology for FM for magazines like FMJ and the Corporate Real Estate Journal and is a regular speaker at real estate and FM conferences around the world.

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Dipin Kasana is a transformational leader in the Facilities Management (FM) / Corporate Real Estate (CRE) industry and is currently working for JLL as the Director of Engineering Operations Transformation. As Director, Dipin supports the Global Engineering Transformation team to drive business growth and mitigate risks using advanced data analytics, resource optimization, performance measurement and benchmarking, all supported through an effective organizational change management strategy. Dipin is a Civil Engineer with a PhD in Infrastructure & Environmental Systems, a master's in Construction & Facilities Management, and a master's in Data Science & Business Analytics. Dipin's doctorate focused on Evaluating Organizational Readiness to Implement Change using Advanced Data Analytics.

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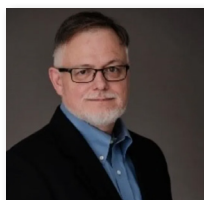
Acknowledgements



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Scott Lanigan is the Vice President of Operations for Intelligent Buildings, LLC, overseeing all Smart Buildings advisory work for the Government and private sectors. Prior to his current role, Scott ran IB's GSA engagement, including their initial deployment and multiple years of growth of their GSALink analytics platform. He has over 32 years of experience leading multi-functional teams across several industry verticals, including Technology, Construction and Real Estate.



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Adam McClung is a Managing Consultant at Intelligent Buildings, LLC, currently serving as the U.S. General Services Administration (GSA) account lead. He oversees a team of engineering and smart buildings subject matter experts, providing strategic guidance on policy, program governance, and operations. With 19 years of experience in facilities management and operational technologies, Adam has been a key player in the administration of the GSALink program, driving energy and mechanical expense savings through advanced fault detection and diagnostics. His extensive background spans roles in both public and private sectors, including positions with CBRE, Valvoline, and various banking institutions where he managed large-scale facilities and implemented significant cost-saving measures. Adam holds degrees in Electronic Engineering Technology and Interdisciplinary Studies from West Virginia State University, is a Certified Energy Manager (CEM) and a Certified Facilities Manager (CFM).



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Anoop is a visionary digital transformation leader in the smart buildings space with a passion for innovation. His expertise lies in conceiving, implementing, and managing IoT solutions that create smarter, more connected spaces, buildings, and cities. He has a knack for uncovering the intricate interplay between an organization's operations, its people's experiences, and its physical assets, which sets him apart in the world of digital transformation.

His journey has led him to tackle the IoT challenges of iconic structures, vehicles, and even man-made islands in vibrant cities like New York, Dubai, and Sydney. Through these experiences, he has gained a profound understanding of how IoT shapes the future of work, enhances life safety, and drives sustainability. He is dedicated to pioneering solutions that usher us into this exciting new era of connectivity and efficiency in the built environment.

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Rob Murchison
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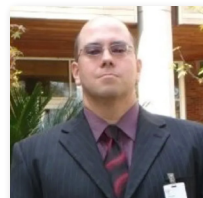
Rob Murchison co-founded Intelligent Buildings, LLC (IB) in 2004 with the aim of intelligently impacting the world's built environment. IB offers a comprehensive suite of services designed to simplify the management of complex technology assets within facilities. Our direct-to-owner 24x7 proactive services free facility operators from the burden of managing technology, immediately contributing to the bottom line, which is a rarity in PropTech. As a Principal of IB and a Duke University alumnus with a BA in Economics, I firmly believe in ongoing learning and collaboration.



Cathy Pavick
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Cathy Pavick joined the International Facility Management Association (IFMA) in February 2008 and currently serves as the Senior Director, Professional Development. Under her current position, Cathy is responsible for overseeing the strategic direction of IFMA's credentials and continuing education programs including: updating the certificate program credentials, developing the comprehensive competency map and body of knowledge, overseeing the ANSI/ASTM E2659-09, Standard Practice for Certificate Programs for the two certificate programs and the development of continuing education programs. In 2016, Cathy was awarded the Board of Director Chair Citation for creating IFMA's quality educational programs and maintaining global accreditation standards.

Cathy graduated from Waynesburg University in Waynesburg, Pennsylvania with a Bachelor's degree in Business Administration and from Michigan State University with a Master's in Higher Education Administration.



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- Develops and manages Resource Advantage Platform products.
- Leads subject matter expert recruitment for benchmarking and applied research projects.
- Oversees courses and initiatives within benchmarking and applied research.
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Dr. Jake Smithwick
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Dr. Jake Smithwick is an associate professor at the University of North Carolina in Charlotte. His research focuses on organizational performance benchmarking within facility management, construction, and business services. He has conducted numerous benchmarking studies in facility management, talent development, project performance, and knowledge management. His industry experience also includes work on more than \$500M of procured services, field inspection of nearly 2,000 roofing systems across the United States, and six years in the US Air Force Reserve (civil engineering squadron).

Acknowledgements



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Dean Stanberry has more than 20 years of broad-based experience in facility management, real estate portfolio management, process and quality improvement, procurement, workplace services, program and project management, space and occupancy planning, sustainability, information systems implementation, and critical environment operations.

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Elizabeth Transier has spent 20+ years in software, with first exposure to AI in 2013 with IBM's Watson. Her software background is broad with roles in operations, services, contract negotiation, sales, corporate strategy, product management and business development. Currently she is VP of sales and delivery for BigBear.ai's Supply Chain Management practice, focused primarily on warehouse and manufacturing efficiency.

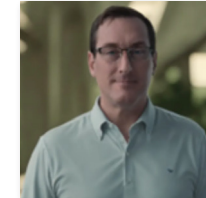


Matt Tucker, MSc, PhD
Director of Research, IFMA Professor of Workplace and Facilities Management, LJMU

Matt Tucker is responsible for collaborating with IFMA's Research Advisory Committee — an international panel of multidisciplinary subject matter experts — to examine global trends shaping the future of FM; define IFMA's research agenda; and disseminate information to assist facility management professionals address and evolve alongside ongoing industry transformations.

Conferred as Professor of Workplace and Facilities Management by the University Conferment Panel having achieved an outstanding record and reputation beyond LJMU at both a national and international level as a researcher and scholar.

Responsible for making outstanding contributions to the furtherance of knowledge in workplace and facilities management through research projects, outputs, supervision/mentoring, creative activity, professional practice and performance as well as developing international recognition for this activity.



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James Waddell is a globally recognized leader in the field of AI and Facility Management (FM). He currently serves as the President and CRO at Cognitive Corp. James is also a co-founder of the AI Innovators Collective, a community-driven association that provides exclusive access to cutting-edge technologies, AI use cases, best practices, and ethical guidelines. This collective is dedicated to facilitating connections between like-minded professionals and focuses on the use of AI and Machine Learning in everyday life. In addition to his roles at Cognitive Corp and the AI Innovators Collective, James is a board member of the IT Community of IFMA.