BIM and its Integration with FM System

REVIT MODELING INDIA

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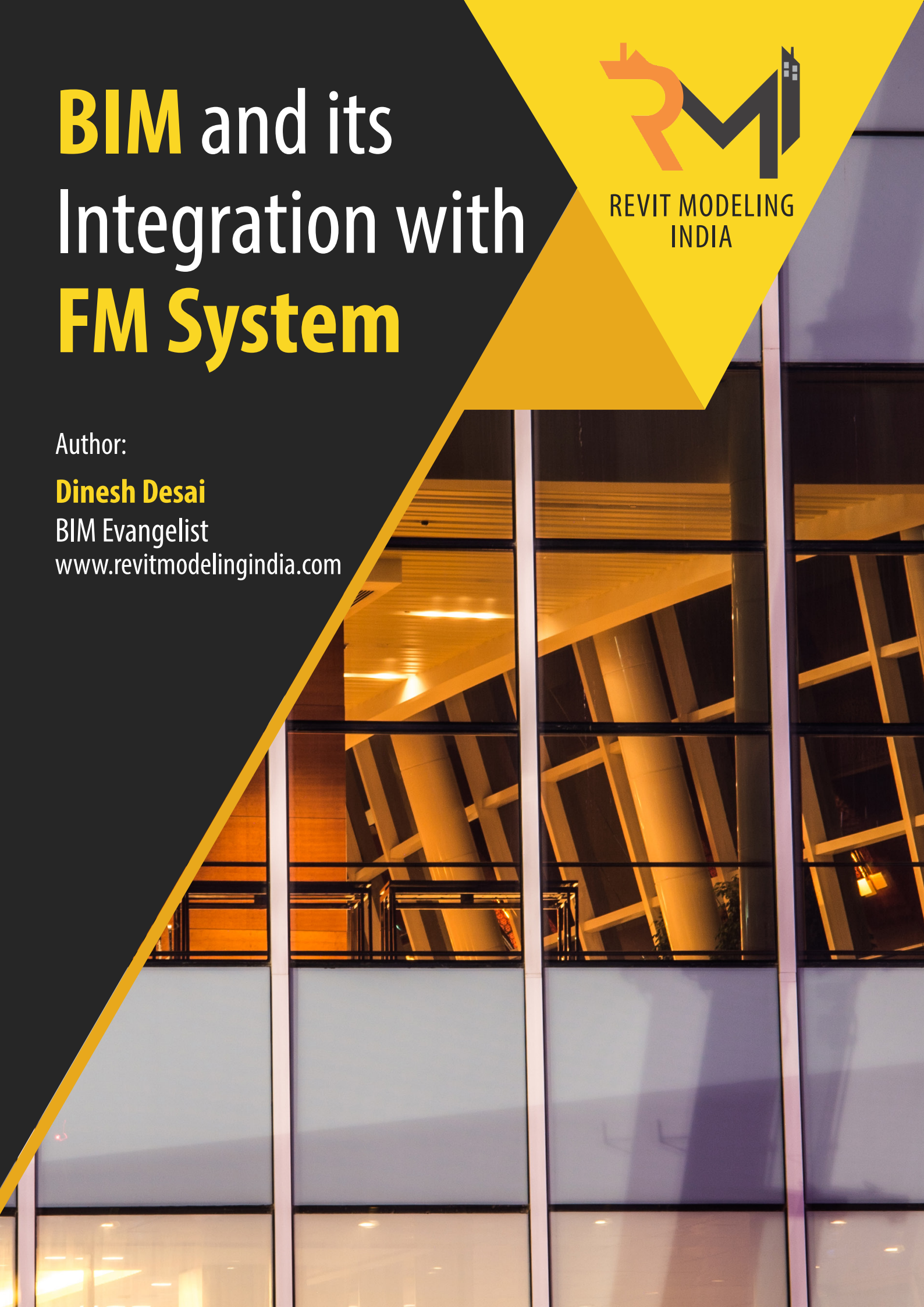


Building Information Modeling is termed as a process which involves the management and generation of 3D digital representations of functional and physical characteristics of a building or a facility. The information extracted from these models, facilitates improved quality and ensures minimum errors in any construction project. This information exchange further strengthens the communication & collaboration amongst all the disciplines of construction, speeding up the decision making process and ensuring timely completion of the project. BIM as a process has delivered various benefits throughout the project life-cycle. It is actively involved at all the stages of a buildings project from design, construction to operations phase.

In the design phase it helps with initial conceptualization & cost planning, architectural, structural & system design towards analysis, detailing, and coordination. While during construction phase BIM assists with planning & detailing, manufacturing and procurement to commissioning as-built and handovers. With BIM gaining acceptance in major government projects, a fully collaborative 3D BIM has become the need of the hour. This further indicates BIM's role within facility management or the operations phase of construction project. Under the operations phase BIM tackles with occupancy & operations of a premise, its asset management and maintenance as well as decommissioning and major reprogramming.

A recent survey conducted by FM Awareness in partnership with Liverpool John Moores University and the Zurich University of Applied Sciences, states that, 83% of FM professionals believe that BIM will support the delivery of Facilities Management. The white paper focuses on the importance of BIM FM Model and its interoperability with various FM Software's along with its potential benefits to the facility management industry.

Deborah Rowland, Head of Facilities Management, Government Property Unit, Cabinet Office states that "The FM community is becoming increasingly aware of BIM, but not totally sure of the benefits to them. There are many benefits that BIM can bring FM by aligning the construction and design to the operational use of the asset. This is a real opportunity to make a difference to the way we manage our projects and work collaboratively with the construction and design industry."

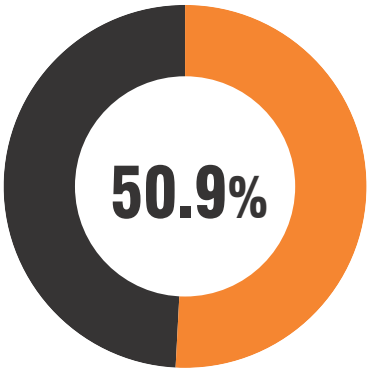
With the increasing interest of Governments of various countries in mandating BIM for most of their upcoming projects, an early engagement of FM executives in the BIM life cycle process, has become the need of the hour. To consider it in simple words, the overall purpose of using BIM for facility management is enabling the company to leverage facility data with the help of facility life cycle to provide healthy, safe, effective and efficient work environment for the clients. Facility data is generated all through the design and construction process and is updated throughout the facility life cycle with the help of small projects, maintenance and operation and also major alteration and renovation. This maintenance of data and records leads to greater efficiency like having accurate as-built information in order to curtail cost and time required for the purpose of renovation and customer satisfaction and also for optimising the maintenance and operation of building systems with the view of reducing the excessive use of energy.

What major challenges are addressed by FM Industry?

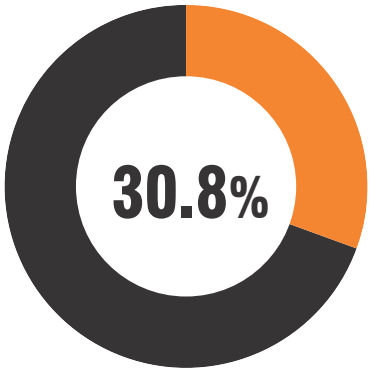
Facilities Management (FM) is 'a business practice that optimises people, process, assets and the work environment to support delivery of the organisation's business objectives' (FMA 1998). Facility Management as an industry face numerous challenges everyday which are obstacles in their work and their progress. Considering the differences of distinctive elements which they have to bring together these obstacles is no surprise at all. One of the key challenges in FM industry is the intensive amount of data that should be captured and managed during the life cycle of the facility. BIM can facilitate and accelerate data accessibility to facility managers. "

BIM is something that Facilities Management must engage with, and that engagement must begin as soon as possible". Although it is estimated that BIM can achieve about 20% Capital Expenditure savings, "the largest prize for BIM lies in the operational stages of the project life- cycle" Flexibility and diligence while handling every aspect, defines their success and that of the company as a whole.

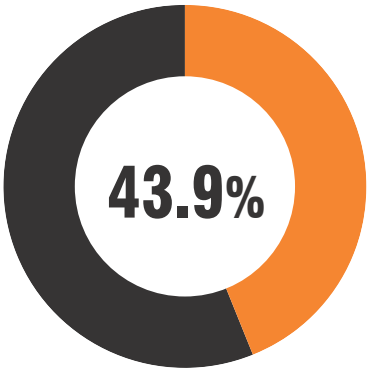
FACILITIES MANAGEMENT HAVEN'T EMBRACED BIM



The most common way that facilities management/ building owners are tracking space and assets is in Microsoft Excel with **43.9%** indicating that they used spreadsheets for this task.



30.8% reported that cost in terms of time and/or money was the biggest challenge in using BIM data in facilities management systems.



50.9% facilities management/building owners indicated that BIM is rarely or never integrated into their facilities management systems.

Most of the facility operators are expected to manage their work with fewer resources and investments and thus the industry witness the compromising position in relation to the quality of work and management. This had lead most of the companies to choose alternative and advanced technologies like BIM to support their management of the facilities and also to address the challenges.
The major task of the facility management industry is to ensure the physical security and fitness of the properties to assure their smooth working. But with this they also need to make sure that these facilities are able to adjust with the fresh demands of the evolving world. Thus the industry is expected to stay alert to judge the trends which may affect their responsibilities.

As a part of this challenging industry one may come across vital challenges and a few of them being:

1. Use of Paper based files for building and asset information:

To a fact when it comes to facility management industry in particular it is highly paper driven. They require documentation of almost everything, from building designs, to changes and renovations. Managing such ever growing abundance of documents requires a system which can ensure that the information is retrieved to found whenever it is needed. But as major part of the industry is still paper based there are several challenges which are faced by facility managers. A few of these may be considered as follow:

Lack of Storage Space: The paperwork mostly occupies a lot of space and the requirements keep on enhancing with the increasing count of the documents. Also due to bundling of the documents it is very difficult to access them at the time of need. On the other hand, updating these documents becomes a cumbersome and messy task. BIM application in FM phase alternates the conventional methods of documentation, control, maintenance, and analysis. BIM helps facility manager accessing facility information within minutes, while it may take hours of efforts to achieve the same information without BIM.

Prone to Damage: The paper works are prone to natural and unnatural damages. They may get lost in the piles or just get the pest eating them all. Also, they are highly prone to the risk of theft and other related destruction. BIM acts as an information backbone for FM systems, which if it combines with advanced technologies, it can enhance operational workflows efficiencies

Supply Cost: Another problem which cannot be denied is the supply cost of these documents. While the documents and reports are to be sent to the management for approval and for the purpose of updating, their supply cost may burden the management as well. FM departments utilize BIM technology in order to reduce the operations maintenance costs, enhance control systems suitability, and perform cost effective services constantly for the facility occupants.

Limited Collaboration: Collaborating the documents and evidence with each other while taking decision becomes a major concern while the company chooses to manage documents on paper. Electronic records ease the mode of communication and authorisation and also assure easy access at the time of need. It is believed that the key for effective BIM implementation in FM industry is to enhance collaboration among different parties in project lifecycle. BIM is a computerized approach that involves applying and maintaining an integral digital representation of all building information for different phases of the project lifecycle in the form of a data repository". It is a set of information and communication technologies able to insert, extract, update or modify information of the facility model, and supports stakeholders' collaboration over the projects life cycle.

Inaccuracy: The authenticity of the paper work cannot be assured. They are mostly restricted to electronic and automated calculation which makes the data less reliable at times. BIM can automate a preventive maintenance program through a connection to the existing software package, and supply the information. With the building equipment information stored in BIM models, little efforts are

required to accurately occupy maintenance systems, and it is a valuable tool in decommissioning process as well.

Editing Problems: As these documents are difficult to access all the time and especially at the time of emergency, it is difficult to edit them. Also, as these documents are ink based, as editing is mostly not possible in regards to paper documents. 6D BIM model assists the immediate and effective access to all building components information. Hence labour-intensive data entry processes for transferring the attributes to a CMMS are avoided, and time is saved for retrieving the appropriate data. BIM has a large amount of data to process such as schedules, asset information, and etc. However, better data management is achievable when BIM is integrated with FM software.

2. Cost and Time needed to develop input for CMMS and CAFM files:

CAFM software is meant to provide the facility managers with the administrative tools which are needed to track, report, manage and plan the facility management and operations. This function is mostly associated with administrative functions and not with the technical activities.

Whereas, not to confuse CAFM with CMMS, take the example of the hospital room. Ensuring that Nurse Call System is properly working, inspected, repaired and maintained is covered under the activities defined under CMMS.

Considering the importance of both it had been noticed that they involve a significant cost and time especially just after the start-up which can be around $1-$3 per gross SF. Managing such a cost and keeping the track of time is another major challenge which is faced by Facility management industry at this point of time.

3. Cost and Time needed to refer to paper files when FM problems occur:

Even with the advancement of the industry and coming-up of variety of technological reforms number of companies in the facility management industry rely on the paper documents to track and mange the records. It had been noticed that it is quite a time consuming and difficult task to refer the paper file each time management, reconstruction or renovations are to be conducted in relation to the facilities and buildings already in use.

These papers are always at the risk of getting misplaced, destroyed and stolen. Even the cost involved in referring to the documents and payments to be employees for managing the paper based records can add to the burden of the facility manager. Also, as mistake or inaccurate discussion may spoil the reputation of the company for the life time.

As facility management is a National concern and involves the development and management of national and governmental property, it is very well needed that the records are kept secured and updated. Paper work is of less use in such regards.

4. Poor Building and Asset Performance:

The continuation of the use of physical maintenance of the records it had been noticed that there is poor management of records of the facilities due to the lack of adequate data which is required for preventive maintenance of the structures. Also, it can be noticed that due to heavy paper work and inaccessibility at the time of need the work is delayed and thus the facilities remain under-managed. Also, at the time of reconstruction and renovations as the paper defining the same are hard to find and manage, the management come across certain major problems.

What are the prevailing Facility Management solutions available?

Considering the negatives of the current facility management system, the industry has evolved itself with variety of software and programs to support the management of the facilities and related documents. It is very important to understand the impact of all such software to decide with software best suits your needs and demands.

1. CAFM: Computer Aided Facility Management

As we can make out of the name, CAFM could be defined in a number of ways. Any software that is meant to aid the facilities are considered to be CAFM, though the main function of CAFM is planning and space management, work order requests, move management, and also sometimes some modules for assets and maintenance. The software can be helpful in managing the facilities in three important ways. First, it can help the users to maximise space. Second, it helps

in keeping the track of people and assets. Third, it helps in eliminating the use of multiple PDF database, spreadsheets, files, PDF floor plans and much more.

2. CMMS: Computerised Maintenance Management System

As one can understand from the name the facility Management software helps in keeping the track of the maintenance which includes surveying how often does the equipment undergoes any kind of repairs and also other major check-ups. CMMS is considered to be critical for the company's responsibility in regards to equipments like boilers, chillers or even the HVAC system being the part of their leases. In case company has a complete ownership of any building, then CMMS is considered to be one of the must have software which is required to ensure that all the equipments are maintained properly to avoid any kind of catastrophic failures.

3. EAM: Enterprise Asset Management

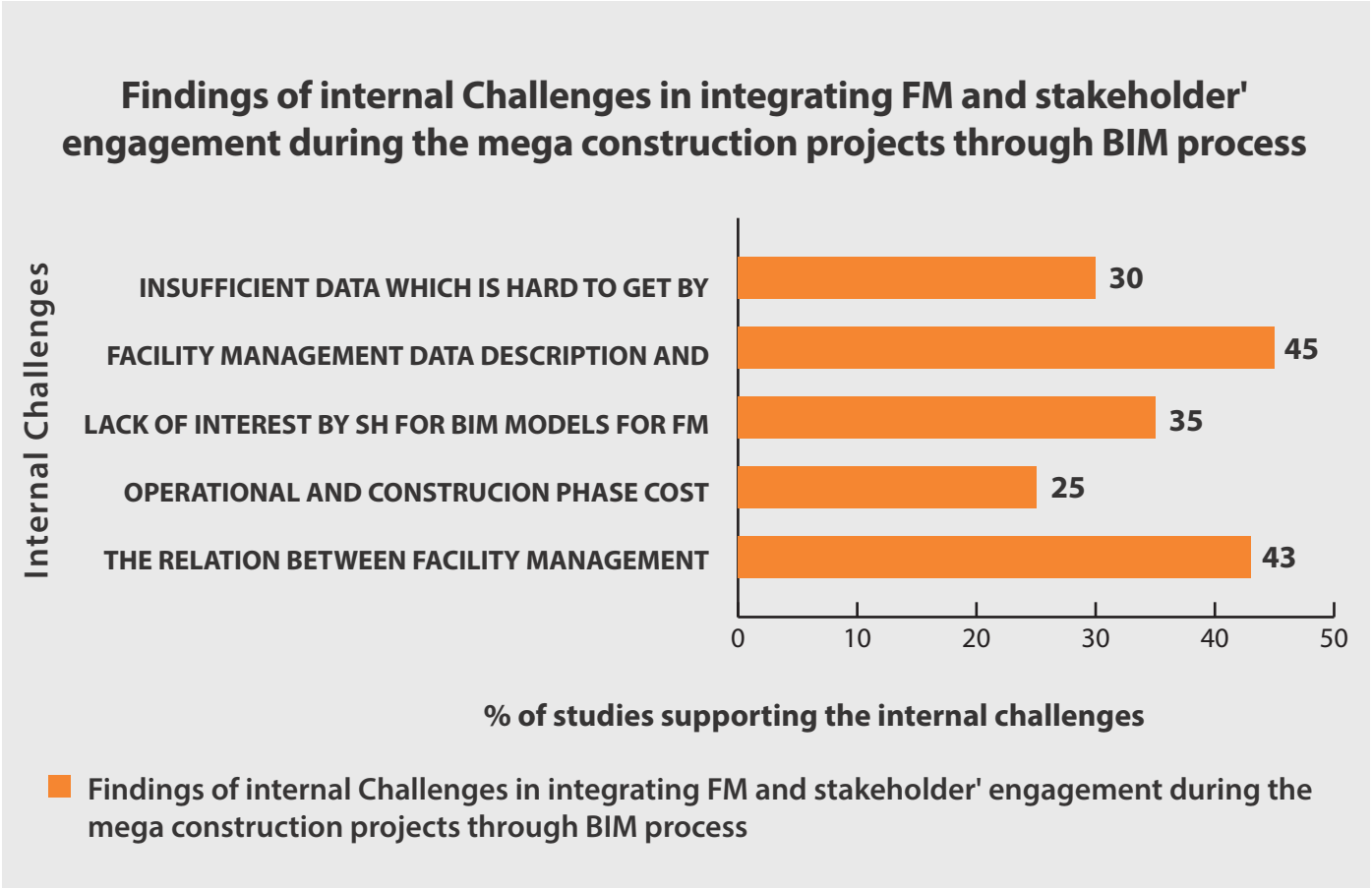
EAM software has been designed to keep a track of the various assets in the company including furniture to mechanical equipments which are considered to be part of CMMS system. Many of the defined solutions provide bar coding in order to assist in tracking the location and information. However, just like any other piece of software one should be very careful of the assets which are being tracked as "garbage in and garbage out" take over a lot once the bar coding is put to use, especially in the case the equipments are moved quite a lot many times. This information is very useful in managing the space wisely and putting the equipments to most potential use. Also auditors and finance mangers use the data drawn from the EAM solution to keep a track of the financial value of the assets.

4. IWMS: Integrated Workplace Management System

IWMS is considered to be a combination of all the above stated systems. It not only allows the users to keep a track of the space and equipments but also helps in keeping the track of the impact of environment and lease management. IWMS may be considered to be a great solution for very large organisations with team and central department managing most of the information but it had been noticed that local facilities and teams struggle due to its complexity.

Due to the scope of the features of this software often it is referred to as a jack of all traders and master of none. Also many consider it to be a point solution or should say the best breed system of all listed above. It can be noticed that number of medium and smaller sized enterprises may not have the need or basically the budget to implement or use IWMS solutions. However, due to the adoption of web based technology in today's world even the large companies had been re-evaluating their IWMS strategy and requirements. More SaaS and modern web based solutions offer faster up-start, lower risk and also the possibility to integrate while it is required versus trying managing all the information under one system.

BIM Interoperability with each FM Solution

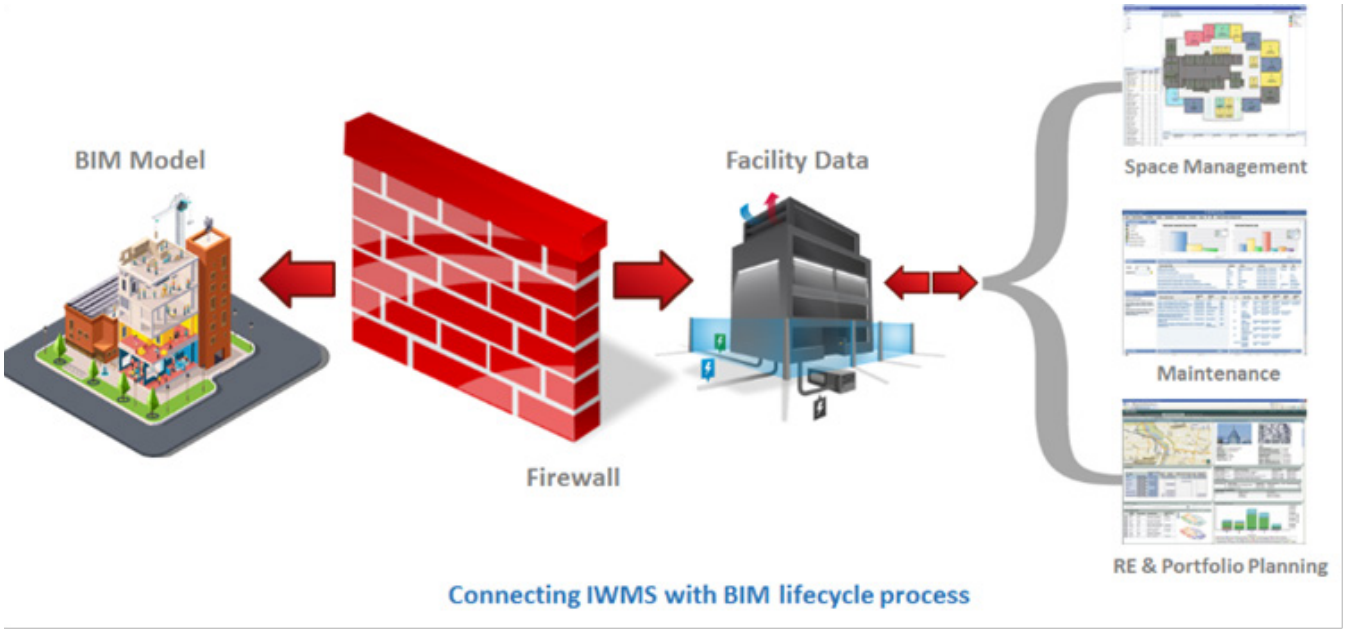


Integrating BIM with IWMS

Integration of BIM into facility management has always been a targeted goal for numerous corporations and industries. There had been reported to be a few cases of the early endeavours towards integration over the existing IWMS offerings. Considering the fact that these technologies and features have been accessible for a long period of time, the adoption rate of it in the industries is comparatively lower. It had been noticed that engineering and design teams which manages the process of BIM model creation and prevention while in construction phase leads to numerous advantages in relation to multiple resources management and updating the models.

The major drawback with the same that had been noticed is that AEC groups are normally temporary in nature which means they meet up only for task regularly but disband after the completion of the venture; leaving the building occupants and owners with the confusion that how will the building be managed after the occupancy. These kinds of models are mostly rejected by the facility management teams as they do not have enough capability to maintain BIM.

IWMS has been complete answer to such issues which safely circulate obligations of keeping up with BIM throughout the building life cycle. The process accomplished with the help of cloud technology and is executed using geometry of the model of the data in such a way that they give access to effectively viable digital operating and reporting manual for the building.



Connecting IWMS with BIM lifecycle process

The methodology also guarantees that BIM models remain solid and give a system which allows particular subject matter expert group a direct path to share unique knowledge and ability while dealing with a BIM based life cycle approach.

Integrating the use of IWMS in the workplace gives several benefits that are inclusive of effective management of the space and regulation of asset's data which results to better cost saving and tracking, managing maintenance cost, productivity and other related matters.

Integrating CAFM with BIM

The major challenge faced by facility managers today is in regards to the rising needs of better quality and standard use of operational data. It is critical to their ability to meet with the constant changes in the nature of the modern day FM. Also, there can been seen increasing volume of the pressure from the owner's end and also from the stakeholder's end to get more reliable facility information for the purpose of better overall planning of the organisations.

Although there are wide variety of data system which already exists in the facility and asset management industry, which includes CAFM as well, but their application is highly varied based on the diversity of the requirements. Digital models which are sourced from construction or design phase documents often need a lot of painstaking synchronisation and also re-designing before they can be any kind of use of the FM team. Integration of BIM with CAFM has filled such holes thus making CAFM to be a much more efficient and robust FM automation platform.

BIM for CAFM IMPLEMENTATION

direct data exchange
COBie Excel or XML

XLSX

ftp or web services

Concept Evolution

BIM PROTOCOL & STRATEGY

Employer Information Requirements	What, When, How
Asset Information Model	Basic Info: Life Cycle: Energy & Performance Data; Operational Info: Classification
Asset Management Strategy	Classification, Categorisation & Hierarchy of Systems and Assets
Contract Requirements & Maintenance Strategy	SLAs; KPIs; Reporting; Service Management; Maintenance Regime
Web based CAFM Management of Assests, Facilities Contracts & Service Delivery	

Integration of BIM has also espoused a consolidated view about all operational and functional aspects in the FM industry, which projects the holistic view of FM business. It helps with:

- Planning and budgeting of the construction projects
- Building of reliable data
- Management of property and lease
- Management of Portfolio
- GIS integration
- Knowledge on asset maintenance, tracking, occupancy etc
- Management of Fleet
- Facility Moving Management
- Staying prepared in Emergency situations

Integrating BIM with EAM

With the modernisation of facility management industry most of the organisation have started using multiple methods and systems in order to track the physical assets which are crucial for doing business. It had been noticed at the organisation with a lot of assets need to take proper care and keep a track of their assets. Today BIM consolidated with enterprise management software holds a great importance and use in the same regards.

As the traditional computerised maintenance management system focus with the limit of work orders, inventory control, preventive maintenance and asset records EAM software are required to expand their functions across departments and thus offer robust history on the entire life cycle of the asset. In simple words EAM configured with BIM offers better solutions and their scope of operation also reaches further. A few of the major benefits of putting together EAM with BIM are as follow:

- There is quite huge amount of reduction in risk because EAM software helps in tracking tools, documentation and provides reminder support.
- EAM software integrated with BIM software reduces the burden in regards to paper handling by assigning each asset to certain physical location and also all documents to an association.
- As EAM and BIM are put together there is quite a reduction in cost and avoid downtime. This helps in improving organisations responsiveness, quality, reliability and safety.
- This also reduces the total amount of time which is spent on searching the information of equipments, facilities and other physical assets by streamlining the communication channels.

Thus, to put is all together the combination of the two will help in saving money, improving the bottom line and also optimising the ROI of the assets.

Integrating BIM with CMMS

Data had been considered to be a key to successful management and maintenance as expected under facility management industry. Here, CMMS is one of the most essential computerised tools which are essential for storing and gathering the resources.
Also with the technological updates the managers are incorporating other major technologies like BIM with CMMS for enhancing the power and results by CMMS.

The rise in the open industry data exchange standards and information exchange methods which are enabled by BIM provides a standard structure for transferring and collecting maintenance data which results in better understanding of the conditions of the building and assets. Also by incorporating the two the managers can also improve the performance of the facilities and departments.

Stimulating benefits of integrating BIM with FM Solutions

It had been noticed that BIM had played a crucial role in organising and managing the Facility Management Industry. Though it involves cost and effort to put both of them together and to action, yet the results are mesmerising. There are various benefits that one makes out by integrating the both, here are a few of the major ones:

1. The first benefit comes while integrating BIM with FM. If the preventive maintenance program with the organisation is not automated BIM helps in doing the same. In case BIM is able to connect to the existing software package to supplement the information and data which already exists it ensure even more robust maintenance program. To simplify, it becomes an electronic owner manual and thus a valuable tool when facility manger takes re-commissioning process.
2. BIM helps in improving space management. BIM helps in locating quickly and visually where the space can be utilised more effectively and efficiently and also helps in making it.
3. BIM also helps in building analysis, especially in relation to sustainability initiatives which includes LEED-EBOM. The BIM model can be updated continuously repository for data collected and all programs developed in combination with green goals. This way when it is time for LEED-EBOM recertification, BIM can be considered as one stop shop for identifying the new credentials required to tackle or the credits to be improved upon.
4. BIM helps in streamlining change management. Facility managers can opt to use the BIM models to plan the scenarios and configure space more effectively. BIM also helps in identifying conflicts when purpose and space requirements changes.
5. There are varieties of new packages which are getting created and put out in the market which allows the BIM models to connect with a facility's building automation system. This leads to number of benefits in relation to information management and system efficiency.

Case Study: Adoption of BIM for Facility Management

Facility management is considered to provide healthy, safe and efficient work environment for the clients. But achieving as a work environment requires a kind ability to track facility components accurately, identify the inefficiencies in regards to building operations and also responding quickly to clients requests. Each of the facility assets and components have cost associated with the installation, scheduled maintenance and replacement of the components. An accuracy in relation to asset inventory is very essential for budgeting the repairs and maintenance cost. Facility management activities are highly dependent on the accessibility and accuracy of the facility data which is created in facility design and while in construction phase and is then maintained throughout the maintenance and operation phase. Lack of such information can lead to cost overruns, untimely resolution of the request of the clients and insufficient building operations.

In order to overcome such challenges it was needed to adopt BIM in facility management.

BIM as a part of facility management provides visualising access to the precise relationships and location of the building system and equipments and also give access to accurate existing condition attributed data. BIM have large variety of advantages over the traditional 2D drawing. It is data rich, intelligent, object-based and also parametric digital representation of the facility.

To take into the picture the actual impact of involving BIM into Facility Management, we are considering the example of Sydney Opera House. Sydney Opera House is one of the most complex structures and also the housing equipments and activities are also complex. The building is comprised of 7 theatres, 37 plant rooms, 1000 rooms and 12 lifts. The building has employed 300 full time staff with 500-600 part time workers who deliver over 1500 performances and 1000 other events each year.

The building is considered to have a life of 250 years and also high quality construction which is finished appropriately.

Due to complexity of the construction having 2D design was of no use. It was rather practically impossible to study such design to take care of the structure and provide proper maintenance support. Thus, considering the facts and problems the authority decided to incorporate BIM as the software for the purpose of facility management. The major benefit of BIM in this case was its accurate geometrical representation of the part of the building in an integrated data environment.

Other major benefits of opting BIM for facility management are as follow:

1. **Faster and effective processes:** The information related to management can be shared easily. Also, it can be value-added and reused.
2. **Better Design:** The proposal of the building can be critically analysed, stimulation can be conducted quickly and performance benchmarked which leads to innovative and improved solutions.
3. **Controlled Cost and environmental data:** Performance of the environment is quite predictable and lifecycle cost is also maintained and understood.
4. **Production Quality:** The output of documentation is flexible and thus exploits automation.
5. **Better Customer Service:** The proposals can be understood by accurate visualisation.
6. **Lifecycle Data:** Design, requirements, operational and construction information can be used in relation to FM.
7. **Integrating and planning process of Implementation:** Industry, government and manufacturers can have common data protocols.

This finally results to a more competent and competitive industry.

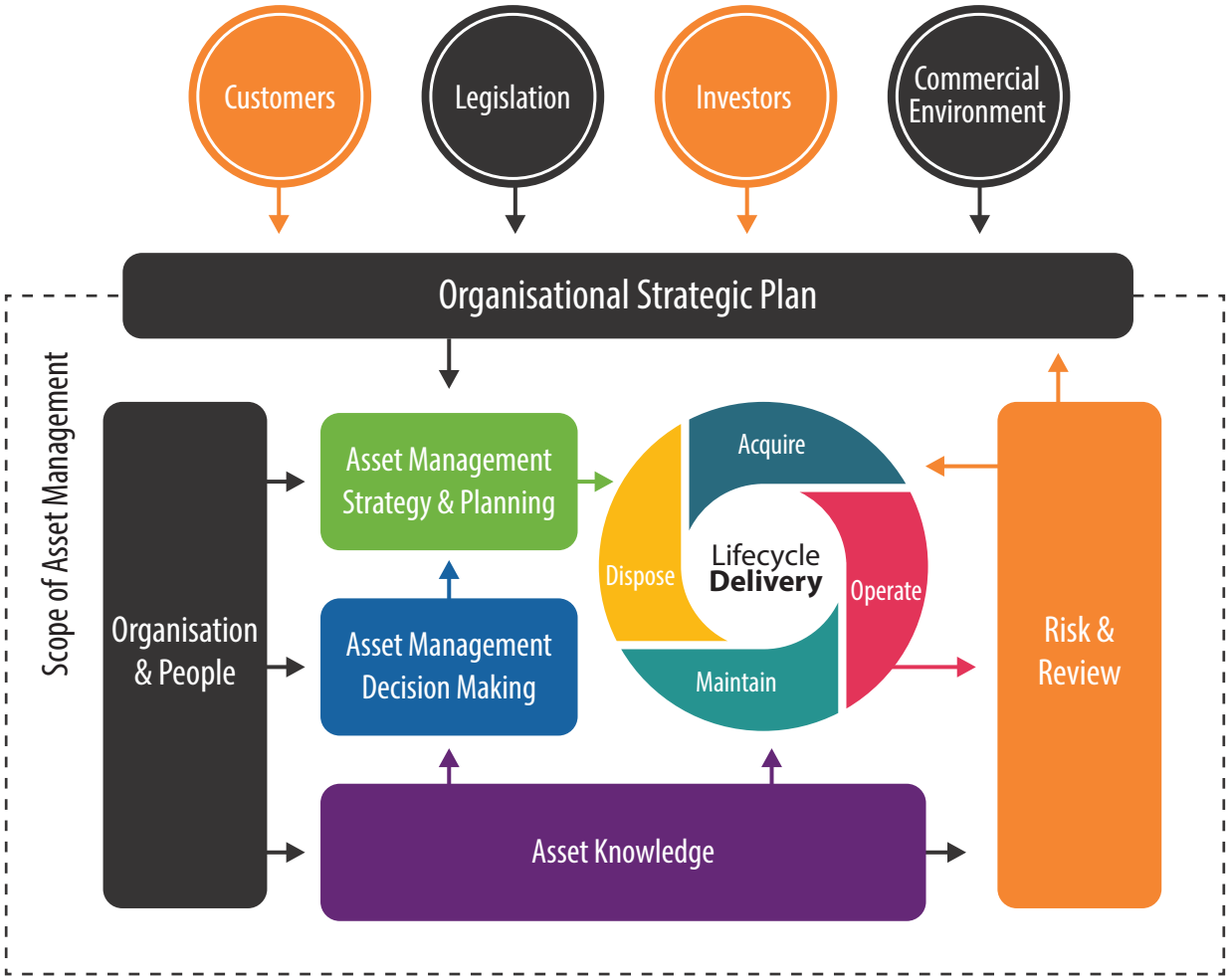
Role of BIM in Asset Data Management

The primary intent of the BIM strategy is to maximise whole life value of construction project along with minimising whole life costs and risks associated. Similarly, a good asset management strategy can optimise operational performance, minimise whole life costs and support an organisation's corporate goals. Proactive asset management provides a holistic view of what the organisation owns or

leases, its condition, location and when it will next be maintained or replaced. This simplifies the budget planning process for facilities managers and enables effective Planned Maintenance as well as reducing backlog liabilities. Many building owners currently utilize asset management or maintenance management software's like Maximo, TMA Systems and eMaintenance for Asset management.

"The data contained in the asset management software will help the facilities manager to ascertain whether, for example, investing 10 per cent more per annum in maintenance costs would double the life of an asset."

The expanding use of BIM models for design, analysis, construction planning, 4D coordination, and fabrication creates an opportunity to capture and unify the information in these models into a record model of the as-built facility. Using information in a BIM record model, facility managers can: evaluate the cost implications of changing or upgrading building assets; track the use, performance, and maintenance of a building's assets for the owner, maintenance team, and financial department; produce accurate quantity takeoffs of current company assets for financial reporting and estimating the future costs of upgrades or replacements.



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About Revit Modeling India:

Revit Modeling India (RMI) is a BIM technology specialist for AEC and Design/ build industry. With years of practice and experience in Building information modelling, RMI offers BIM related solutions covering 3D BIM modelling, Clash detection, 4D scheduling and simulation up to 5D cost estimation services and Facilities Management. We are extensively using Revit as a BIM process supporting application and are profound with all methodologies and functionalities of Revit as a BIM tool.

Our consultative approach and customer first attitude has earned the company accolades from its customers and an impressive rate of customer retention. We have a strong team of 30+ BIM technology experts, who accompany great exposure in serving different industries on various projects such as Residential, Commercial, Educational, Healthcare, Hospitality, Workplaces and Retail. To learn more on our BIM solutions or for any question related to this white paper, write to our BIM Experts on **info@revitmodelingindia.com.**