Integrating Building Information Modeling (BIM) and Conceptual Design Towards Effective Facilities Management (FM)

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Presentation Outline

1. Problem Statements
2. Overview & Objectives
3. Methodology & Development
4. Validation
5. Conclusion
1. Problem Statements

- No comprehensive platform that allows the supplement of professional inputs from facility managers during the conceptual design stage through Building Information Modeling (BIM) concept towards a more efficient FM that will:
  - Minimize the possible waste
  - Access to the entire life-cycle
  - Offer the essential tools …

So far, the authors were not able to find any research that has studied this possibility.
2. Objectives

To develop a model that integrates Building Information Modeling (BIM) and conceptual design towards Facilities Management (FM) practice that will be effective in cost, quality and time...
Expected Results

The expected results of the integrated BIM-FM model include:

1. An effective enhancement of the overall FM practice.
Description of Methodology

- Literature review
- Data collection
- Conceptual design of the model
- Developing the model
- Validation & testing
- Specialists Feedback
Building Information Modeling (BIM) is an intelligent model-based process that provides insight to help project participants plan, design, construct, and manage buildings and infrastructure.


Visualization, Simulation & Analysis …
3. Methodology _ Life Cycle of BIM

3. Methodology _ Why conceptual design stage?

2. Methodology _ Why FM?

Average Share of LCC in buildings

3. Methodology


1. Energy management
2. Maintenance and repair
3. Space management.
3. Methodology _ Propose Model Components
3. Methodology

Propose Model Architecture

**INPUT**
- **Project Information**
  - Project type
  - Project program
  - Conceptual plans (BIM Supporting format)
  - Site constrains
  - Key issues & guidelines
  - Budgets

- **Technical Standard**
  - Equipment specifications
  - Replacement Circulation
  - Special Equipment

- **Maintenance**
  - FM team requirements
  - Systems data
  - Equipment's info.
  - Operational instructions
  - Maintenance manuals
  - Maintenance schedules

**DATA ANALYSIS**
- **O&M**
  - Scheduling
  - Building systems
  - Parts/Replacement
  - Operational Instructions
  - Cost

- **Space Management**
  - Utilization
  - Classification
  - Circulation
  - Space standards
  - Building Codes
  - Standards
  - Equipment spec.
  - Accessibility
  - Expansion
  - Technical Requirements
  - Special equipment allocation
  - Time & Cost Saving

- **FM Impacts**

**CRITERIA**
- **Productivity**
  - Equipment performance rates
  - Integration (systems compatibility)
  - Zoning flexibility & safety
  - Input source (owner/designer or FM)
  - FM Historical Report

- **LCC**
  - Energy consumption
  - Overhead cost
  - O&M cost
  - Salvage
  - Inflation rates
  - Taxation
  - Other Expenses

- **FM in BIM Guidelines**
  - COBie
  - National BIM Standards
  - GSA BIM Guideline for FM
  - National BIM Library

**OUTPUT**
- List of recommended design alternative/solutions through design simulations
- FM effectiveness report (time, cost & quality)
- Systems LCCA, market availability, recommendations and comparison reports
- 3D Integrated Design (throughout project LC)
3. Case Project

- A 3D model is created into BIM tool (Autodesk Rivet).

- An **actual case project** is used to test the models’ capability and workability, (Al Dammam Four Seasons Hotel), which is located in the eastern province of the Kingdom of Saudi Arabia.

- This project is currently at the **conceptual design stage** (30% of the design is completed).
3. Model Development

- The proposed model will be implemented as a plug-in into Autodesk Rivet Architecture.
- Applying numerical programming to support the proposed decision support system (DSS) machine learning.
- Space management module will be tested as part of the ongoing overall model validation.
- It will generate an alert system after analysing the knowledge acquisition database.
- Alert source, criteria, recommended action and more info. Will be provided to support decision making.
4. Validation  

Move Management Alert

FM Alert — Suspended scaffold equipment
Data Input: FM Team
Impact: Space Management_Move Management
Criteria: FM in BIM Guidelines.
Permanently-installed suspended scaffolds for window cleaning anchors and machine must be allocated in the building roof.
Recommended action(s):
- Replace all Windows with automatic window cleaning systems
- Allocate space for scaffolds and anchors
- Read More >>> (LCC, Vendors...)

Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
4. Validation _ Future Expansion Alert

FM Alert _ Future Expansion
Data Input: Owner
Impact: Space Management, Expansion
Criteria: Productivity
Future expansion will occur in two (2) years prior to project completion.
Recommended action(s):
- Provide double A/C capacity and no fixed furniture to be installed.
  - Read More >>> (LCC, Vendors...)
4. Validation _ Energy Consumption Alert

FM Alert _ Space Utilization
Data Input: Designer
Impact: Space Management_Usable Spaces
Criteria: Energy consumption
Lack of natural lighting, which will increase the energy consumption in the atrium by 30% during daylight.
Recommended action(s):
- Replace the space allocated in the middle of the top floor restaurant by a large dome.

- Read More >>> (LCC, Vendors...)
5. Conclusion

- The proposed methodology to develop a model that integrates BIM tools (Autodesk Revit) has been described.

- The limitations of the current practice in providing a clear role for FM into the design process have been emphasized.

- An illustration of the capabilities of one of the four proposed modules, the space management module, has been presented.
References

Questions / Comments

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