# Building information modeling potential for an enhanced real estate valuation approach based on the hedonic method
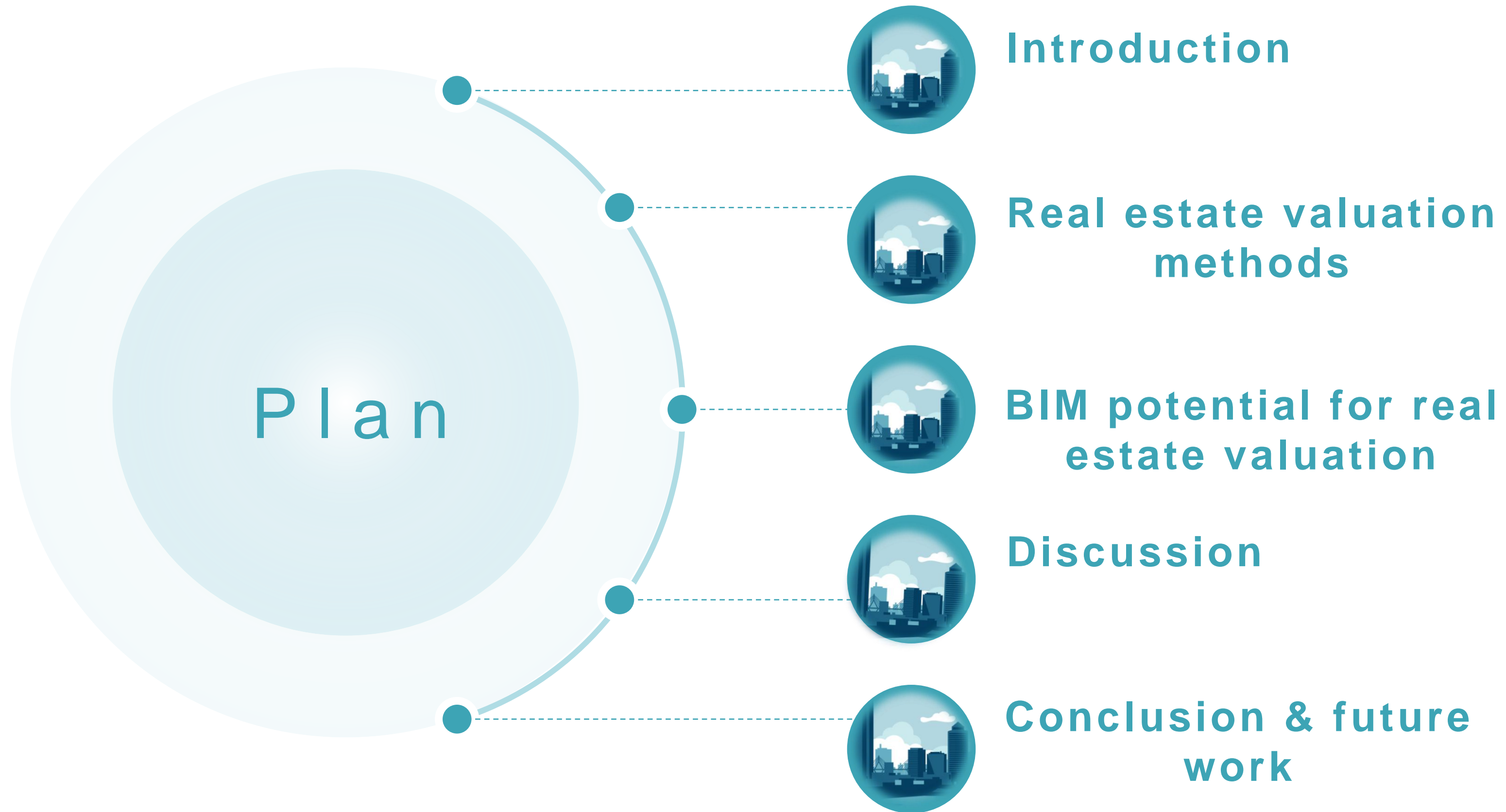
Presented by : Pr. Hajji Rafika

Supervised by :

Pr. Ettarid Mohamed
Pr. Hajji Rafika

EL Yamani Siham
Ph.D. student at IAV Hassan II Institute

Plan

- Introduction
- Real estate valuation methods
- BIM potential for real estate valuation
- Discussion
- Conclusion & future work

# Introduction

**Context 1 :**

- Housing market challenges : unaffordability, unsustainability, speculation etc.;



Moroccan Housing prices index - 2018
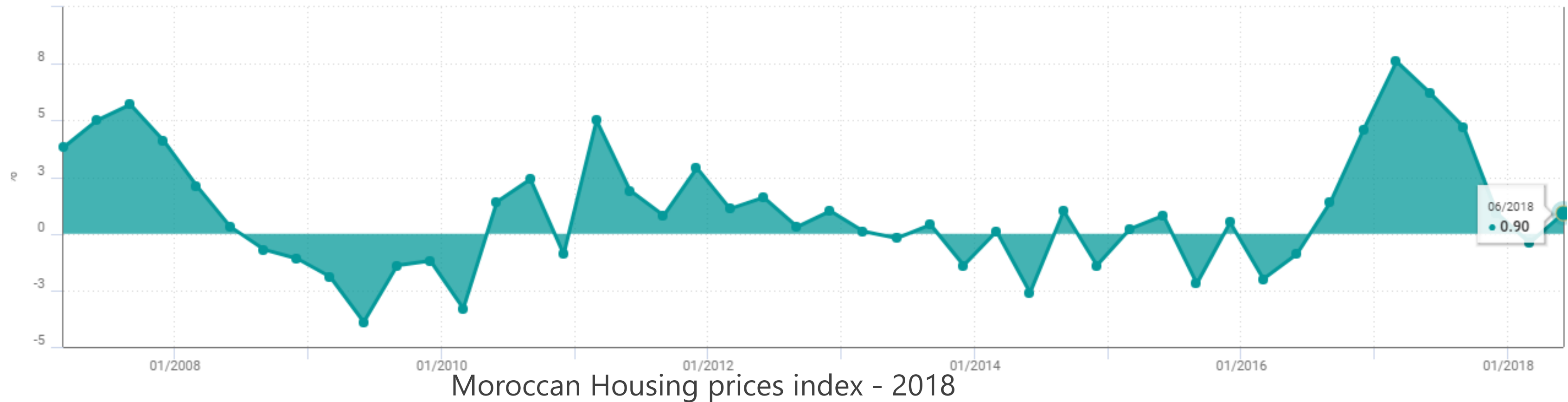
# Introduction

**Traditional approaches**

- Classical techniques
- Valuer interpretation
- Subjectivity
- Market methods

**VS**

**Advanced approaches**

- Mathematical approaches
- Advanced modelling
- Technologies integration
- Enhanced value
- Objectivity

# Introduction

- Real estate taxation reference guide is based on a classical comparative approach;

- Limits :

- Lack of legislation and transparency;
- Speculation;
- Inaccessibility : reliable and recent real estate data;
- Property heterogeneity.



Roches Noires :
9500 à 15 000 DH

Sidi Moumen :
7200 à 8500 DH

Hay Mohammadi :
8000 à 9000 DH

Sidi Bernoussi :
7500 à 10 500 DH

Sidi Belyout :
11 000 à 22 000 DH

Aïn Sebaâ :
8500 à 11 000 DH

El Fida :
9000 à 12 500 DH

Anfa : 15 500 à
35 000 DH

Sidi Bernoussi

Aïn Sebaâ

Sidi Belyout

Hay Mohammadi

Casa-Anfa

Roches Noires

Sidi Moumen

Mers Sultan

Maârif

El FIDA

Mly Rachid

Hay Hassani

BEN M'sick

Sidi Othman

Sidi Othman :
7000 à 9500 DH

Sbata

Hay Hassani :
7500 et 16 000 DH

Aïn Chock

Sbata :
7500 à 9000 DH

Mly Rachid :
7000 à 9000 DH

Maârif :
13 000 à 27 000 DH

Ben M'Sick : 7500 DH

Mers Sultan :
10 000 à 16 000 DH

Aïn Chock :
9100 à 19 000 DH

SOURCE : RÉFÉRENTIEL DES PRIX DES TRANSACTIONS IMMOBILIÈRES DE CASABLANCA, DGI, 2015

# Introduction

**Research Problem :**

<div style="background-color:#3d99a8; color:white; text-align:center; font-weight:bold;">

How to use the BIM potential for an enhanced Housing valuation approach based on the hedonic method?
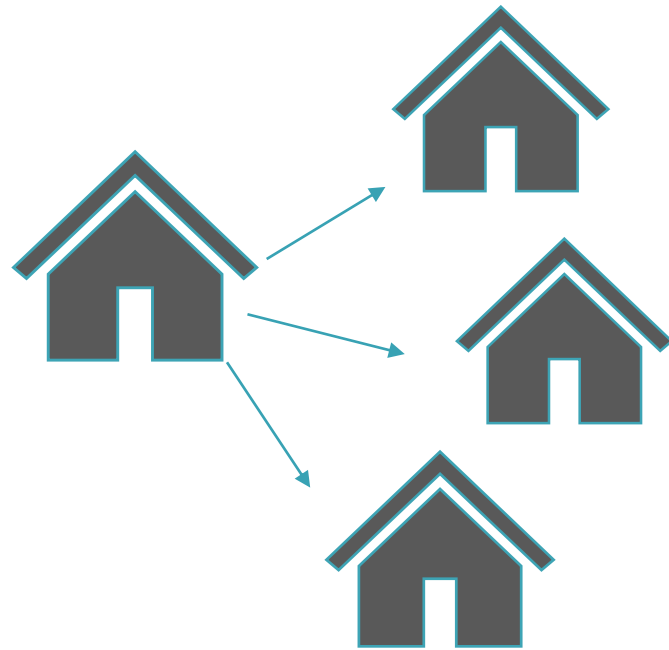
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**Research Tasks :**

- Advanced vs traditional Housing valuation approach ?
- How to integrate BIM based model?
- What are the relevant variables impacting the housing value?
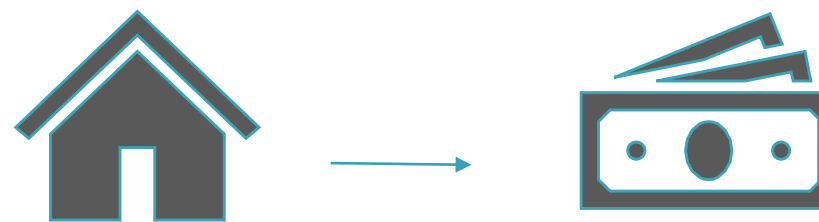
# Introduction

**Review : Real Estate Valuation Methods**

**Comparative method**

- Comparison to similar transactions;
- Used by the taxation administration

**Income method**

comparing similar properties located in the same area to estimate operating income

**Cost method**

the building replacement cost including the appropriate depreciation

**Building+ Land = Cost**

- Property homogeneity
- Market transparency
- Balance Demand/Supply

# Introduction

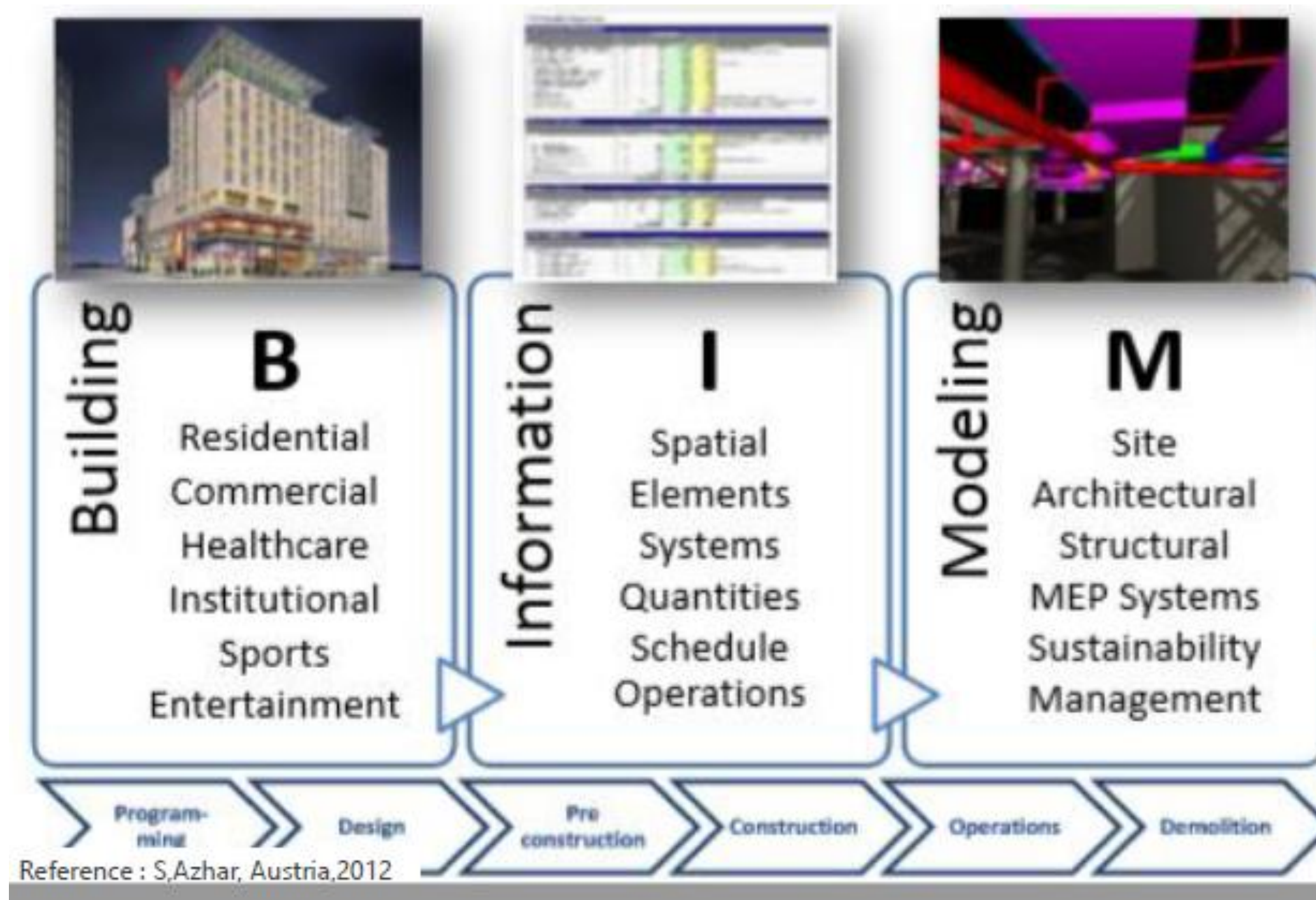**Review : Real Estate Valuation Methods**

Hedonic method

- ''Hedonic approach decompose the house price into its constituent characteristics , and obtains estimates of the value of each characteristics"

- Estimation of the variables impacting the property value (sunlight, neighborhood, location etc.)

''**Sale Price = a + b1(Building size) + b2(Lot Size) + ..+bn(x) + residual**

# Introduction

**Why BIM ?**



| | B | | I | | M |
|---|---|---|---|---|---|
| **Building** | Residential<br>Commercial<br>Healthcare<br>Institutional<br>Sports<br>Entertainment | **Information** | Spatial<br>Elements<br>Systems<br>Quantities<br>Schedule<br>Operations | **Modeling** | Site<br>Architectural<br>Structural<br>MEP Systems<br>Sustainability<br>Management |

Program-ming → Design → Pre construction → Construction → Operations → Demolition

Reference : S,Azhar, Austria,2012

*Structure :*

1. BIM for indoor impact factors

2. BIM based cost approach – 5D BIM

3. Guidelines for the proposed approach

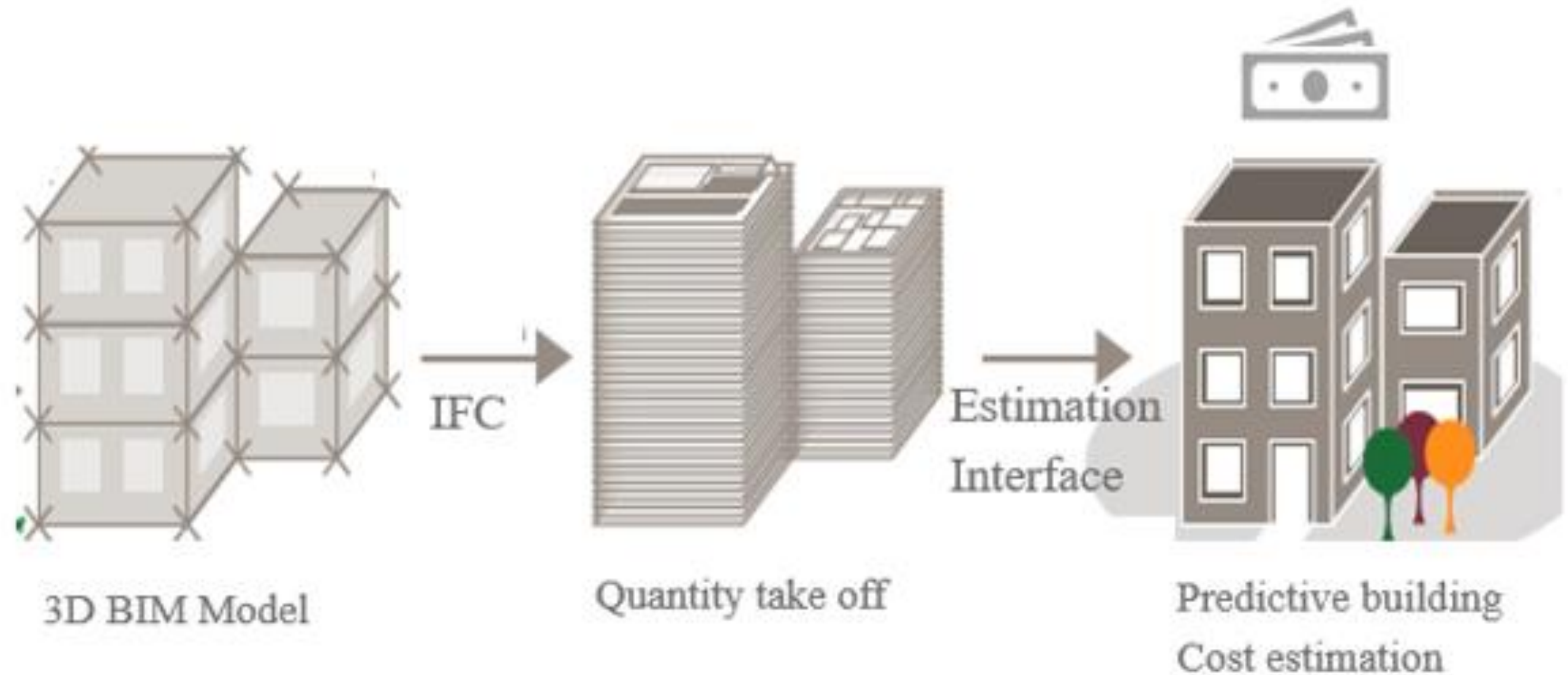**BIM – Indoor impact factors**
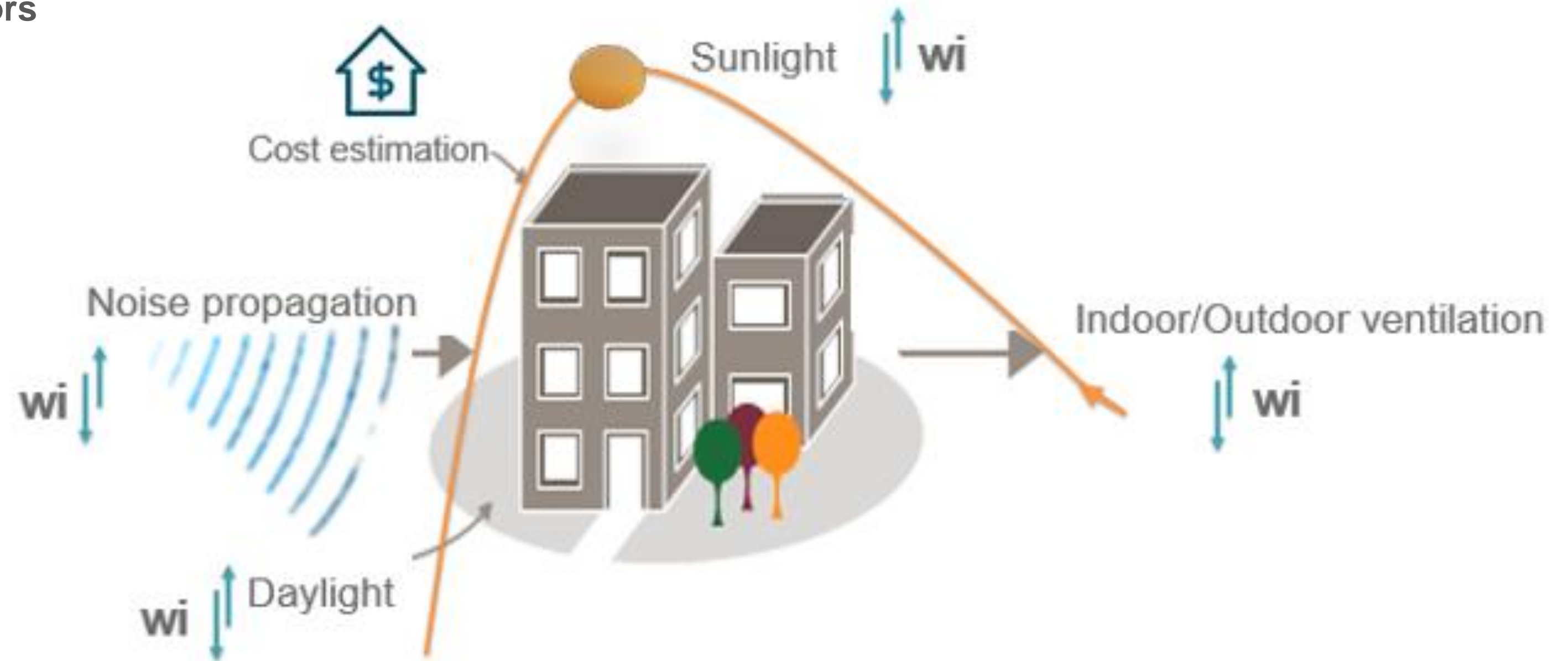
**BIM – Indoor impact factors**
**(data/tools/source)**

| Factors | Variables | Relevant data/Source | Potential Software |
|---|---|---|---|
| **Building components** | Area, floor level, number of units, materials, heating system. | -BIM model (conception plans) | BIM Revit |
| **Building elements** | Wall, roof, stairs/elevator, materiel | -BIM model (conception plans) -IFC standard | BIM Revit |
| **Cost information** | Building cost | -Building elements -Building components -Quantities Take- off -Fabrication cost per m² | -BIM Revit -Green Building Studio |
| **Indoor Environment** | Indoor daylight Shading/lightning Sunlight duration | -BIM model -Weather, Location -Orientation -Sunshine time -Façade materials | -Insight plugins -360 rendering& lightning analysis |
| | Indoor/ Outdoor Ventilation (Air flow) | -Building geometry -Weather/Materials  (wind speeds) -Orientation -Thermal comfort | -Green Building Studio -Autodesk  flow design -Autodesk CFD |
| | Noise propagation | -Materials -Building Volume -Absorbance coefficient | -Rhino/Revit |

**BIM – Cost estimation**



3D BIM Model → IFC → Quantity take off → Estimation Interface → Predictive building Cost estimation

**Guidelines for the methodology approach**
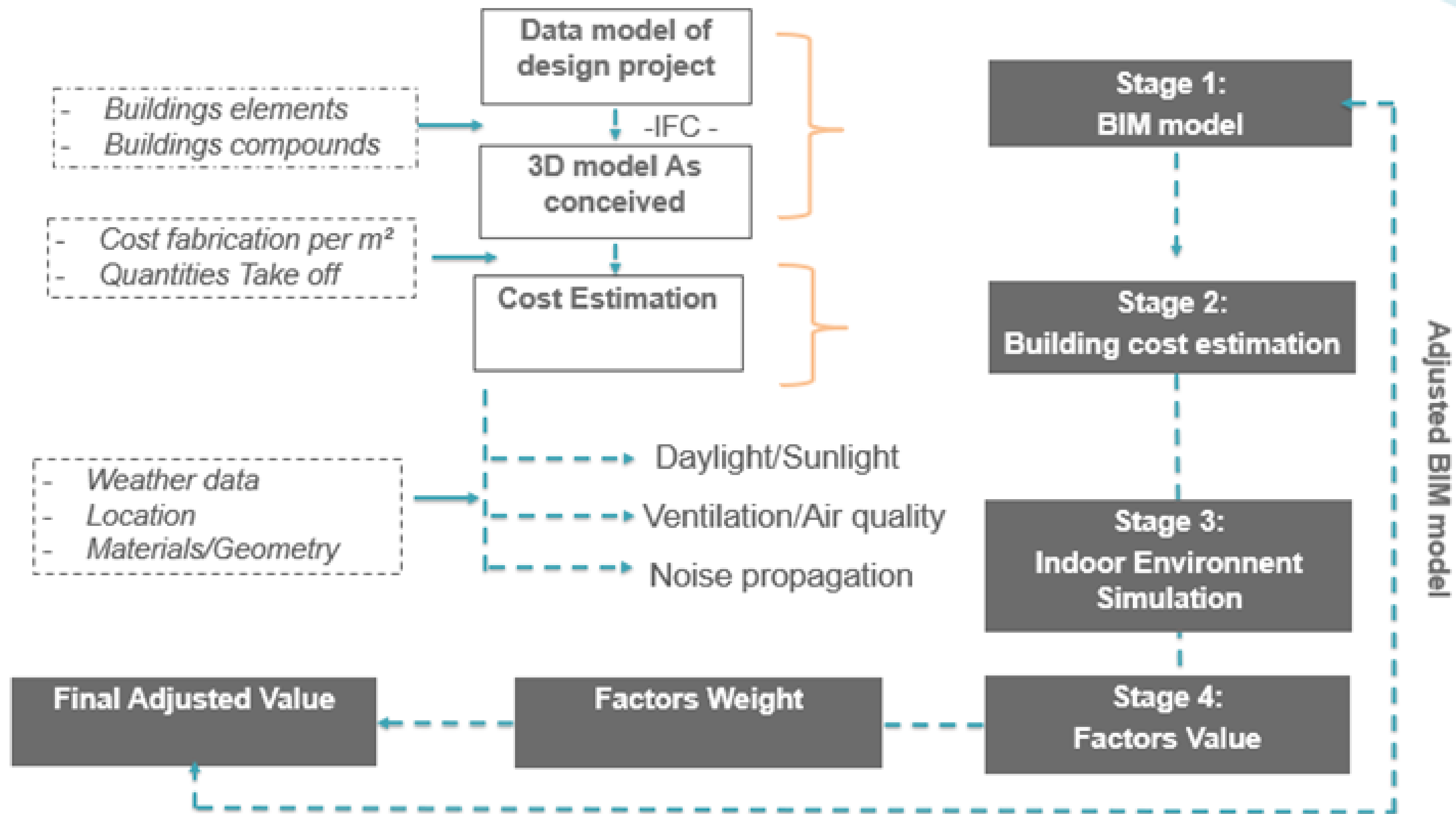
| Grade | Description (average value of daylight factor c) |
|-------|---------------------------------------------------|
| 0 | $c < 1\%$ |
| 1 | $1\% \leq c < 2\%$ |
| 2 | $2\% \leq c < 3\%$ |
| 3 | $3\% \leq c < 4\%$ |
| 4 | $c \geq 4\%$ |

Performance analysis based on the value of daylight factor *(Source: Yu, 2014.)*

# Discussion

Approach Implementation – Moroccan context :

- Presenting significant results for the enhanced property valuation;

- Interoperable tools and frameworks;

- BIM-based real estate valuation method VS the traditional ones.

- Awareness of decision makers;

- 'BIM- real estate valuation' training and education programs.

# Conclusion

- The first reflections of the BIM-hedonic approach, are presented;
- The conceptual workflow of the new approach, is proposed.
- Limits : IFC extension; BIM model implementation; interoperability for factors simulation.

# What's next?

- Cas study : testing the proposed workflow;
- The BIM-3D GIS integration environment;
- Modeling extrinsic factors impacting the housing value;

# Thank You!

Any Questions?