Real estate valuation
Real estate economics

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Agenda

- Importance of real estate valuation
- Valuation methods
  - Traditional methods
  - Advanced methods
- Hedonic research – Budapest residential RE market
Importance of real estate valuation

Valuation methods
- Traditional methods
- Advanced methods

Hedonic research – Budapest residential RE market
Real estate development is important for several stakeholders

- Customers, users
- Investors and real estate developers
- Financial institutions
- State/government
- Architects, urbanists
# Home-ownership rate is lower in the developed countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Home-ownership rate</th>
<th>Country</th>
<th>Home-ownership rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>97%</td>
<td>Portugal</td>
<td>73%</td>
</tr>
<tr>
<td>Romania</td>
<td>96%</td>
<td>Czech Republic</td>
<td>72%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>95%</td>
<td>Italy</td>
<td>72%</td>
</tr>
<tr>
<td>Macedonia</td>
<td>95%</td>
<td>Luxembourg</td>
<td>71%</td>
</tr>
<tr>
<td>Singapore</td>
<td>90%</td>
<td>United Kingdom</td>
<td>71%</td>
</tr>
<tr>
<td>China</td>
<td>90%</td>
<td>Israel</td>
<td>71%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>89%</td>
<td>Australia</td>
<td>69%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>89%</td>
<td>Canada</td>
<td>68%</td>
</tr>
<tr>
<td>Hungary</td>
<td>87%</td>
<td>Belgium</td>
<td>67%</td>
</tr>
<tr>
<td>Nepal</td>
<td>85%</td>
<td>Finland</td>
<td>67%</td>
</tr>
<tr>
<td>Russia</td>
<td>85%</td>
<td>Cyprus</td>
<td>66%</td>
</tr>
<tr>
<td>Latvia</td>
<td>84%</td>
<td>US</td>
<td>65%</td>
</tr>
<tr>
<td>Mexico</td>
<td>84%</td>
<td>EU average</td>
<td>65%</td>
</tr>
<tr>
<td>Estonia</td>
<td>83%</td>
<td>New Zeland</td>
<td>65%</td>
</tr>
<tr>
<td>Spain</td>
<td>83%</td>
<td>Sweden</td>
<td>62%</td>
</tr>
<tr>
<td>Iceland</td>
<td>83%</td>
<td>Japan</td>
<td>60%</td>
</tr>
<tr>
<td>Oman</td>
<td>83%</td>
<td>Turkey</td>
<td>60%</td>
</tr>
<tr>
<td>Iran</td>
<td>81%</td>
<td>Denmark</td>
<td>58%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>80%</td>
<td>France</td>
<td>58%</td>
</tr>
<tr>
<td>Ireland</td>
<td>77%</td>
<td>Poland</td>
<td>58%</td>
</tr>
<tr>
<td>Malta</td>
<td>77%</td>
<td>Netherlands</td>
<td>56%</td>
</tr>
<tr>
<td>Norway</td>
<td>77%</td>
<td>South Korea</td>
<td>54%</td>
</tr>
<tr>
<td>Brazil</td>
<td>74%</td>
<td>Austria</td>
<td>52%</td>
</tr>
<tr>
<td>Greece</td>
<td>73%</td>
<td>Germany</td>
<td>46%</td>
</tr>
</tbody>
</table>

Note: Approximate figures from different surveys
Tight correlation between GDP and construction growth rate

Figure 2. A Comparison of Chinese Construction Growth Rate with GDP since 1978.

Figure 4. A Comparison of UK Construction Growth Rate with GDP since 1991.

Source: Jiang Qifa (2013) - Analysis on the Relationship between GDP and Construction Based on the Data of UK and China
## High leverage results higher ROE

<table>
<thead>
<tr>
<th></th>
<th>Low leverage</th>
<th>High leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of development</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Loan</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Own equity</td>
<td>70</td>
<td>50</td>
</tr>
<tr>
<td>Leverage ratio</td>
<td>100/70=1,428</td>
<td>100/50=2</td>
</tr>
<tr>
<td>Profit of project</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Interest rate</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Interest payable</td>
<td>30*5%=1,5</td>
<td>50*5%=2,5</td>
</tr>
<tr>
<td>Profit after interest payment</td>
<td>15-1,5=13,5</td>
<td>15-2,5=12,5</td>
</tr>
<tr>
<td>Return on Equity (ROE)</td>
<td>13,5/70=19,2%</td>
<td>12,5/50=25%</td>
</tr>
</tbody>
</table>
If profit declines, high leverage results in high risk

<table>
<thead>
<tr>
<th></th>
<th>Low leverage</th>
<th>High leverage</th>
</tr>
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<tr>
<td>Cost of development</td>
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<tr>
<td>Profit of project</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
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<td>5%</td>
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</tr>
<tr>
<td>Profit after interest payment</td>
<td>3-1,5=1,5</td>
<td>3-2,5=0,5</td>
</tr>
<tr>
<td>Return on Equity (ROE)</td>
<td>1,5/70=2,14%</td>
<td>0,5/50=1%</td>
</tr>
</tbody>
</table>
Developers’ main target should be to create value in the real estate market

The work of developers is to find the best solutions among the constraints,…

- In developers’ constraints are:
  - budget,
  - deadline,
  - regulation,
  - building materials,
  - environment,
  - etc.

- Good developers create the most valuable real estate among the given constraints

...but how do we know if our solution is the best?

- Users are happy to live/pass time there
- Meet the functional requirements
- Aesthetic outlook
- Sustainable
- Environmentally friendly
- Profitable operation
- Etc...

To give value to the stakeholders

Real estate valuation helps to quantify the value for stakeholders
Agenda

- Importance of real estate valuation
- Valuation methods
  - Traditional methods
  - Advanced methods
- Hedonic research – Budapest residential RE market
Value is measured through the market price

Microeconomic approach

Valuation approach

"The estimated amount for which a property should exchange
■ on the date of valuation
■ between a willing buyer and a willing seller
■ in an arm's-length transaction (independent parties)
■ after proper marketing
■ wherein the parties had each acted knowledgeably, prudently and without compulsion."

Source: RICS Red Book
Two types of valuation methods exist

Traditional valuation methods
- Simple techniques
- Valuation for individual real estate
- No sophisticated mathematical background needed
- Comparable method
- Cash flow method
- Cost method

Advanced valuation methods
- Advanced, complex techniques
- Generally used for mass appraisal
- Sophisticated, scientific approach (basic econometrics/statistics needed)
- Hedonic pricing method (regression)
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic

Note: Based on Pagourtzi et al. (2003)
Valuation methods

Traditional valuation methods
- Comparable method
- Cash flow method
- Cost method

Advanced valuation methods
- Hedonic pricing method
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic
What is the market value of the marked flat?
What is the name of the building?
Oscar Niemeyer: Edificio Copan

- 140-meter
- 38-story
- Site: 10572.80 square meters
- Construction started 1957, finished in 1966
- Largest floor area of any residential building in the world
- Copan: abbreviation of the developer (Companhia Pan-Americana de Hotéis e Turismo)
Oscar Niemeyer: Edificio Copan

- 1,160 apartments and 5,000 residents
- 100 employees to serve residents and to conduct maintenance
- Ground floor is home to 70 businesses and establishments including (since the 1990s) a church, a travel agency, a bookstore, and 4 restaurants
Comparable method compares subject real estate with comparable real estate to get the value

1. Find comparable sales
2. Identify the differences between the subject and comparables’ characteristics
3. Adjust the selling price of the subject

<table>
<thead>
<tr>
<th>Subject flat</th>
<th>Comparable flat</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>R$ xxx</td>
<td>R$350 000</td>
<td>+10%</td>
</tr>
<tr>
<td>44 sqm</td>
<td>40 sqm</td>
<td></td>
</tr>
<tr>
<td>Kitchen furniture excluded</td>
<td>Kitchen furniture included</td>
<td></td>
</tr>
<tr>
<td>- Plaster is falling down in the living room</td>
<td>New internal doors (2 pc)</td>
<td>R$5,000 – buy a kitchen furniture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R$1,500 – change the doors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R$500 – fix the plaster; paint</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R$385 000 - R$7 000 = R$378 000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Valuation methods

Traditional valuation methods

- Comparable method
- Cash flow method
- Cost method

Advanced valuation methods

- Hedonic pricing method
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic
What is the market value this building?

What is the name of the building?
Sydney Opera house
Opened 1973, October
Hosting over 1,800 performances each year attended by 1.2 million people
More than seven million people visit the site each year
300,000 people participating annually in a guided tour of the facility
UNESCO World Heritage Site on 28 June 2007
Utzon received the Pritzker Prize, architecture's highest honor, in 2003
Cost $102 million
The original cost and scheduling estimates in 1957 projected a cost of £3,500,000 ($7 million) and completion date of 26 January 1963
CF methodology gives a value for the building based on the revenues and costs using the Net Present Value

Net Present Value: \[ NPV = -C_0 + \frac{C_1}{1 + r} + \frac{C_2}{(1 + r)^2} + \ldots + \frac{C_T}{(1 + r)^T} \]

- \( C_0 \) = Initial Investment
- \( C \) = Cash Flow
- \( r \) = Discount Rate
- \( T \) = Time

- The CF method says that the value of the building is equal with the CF it generates.
- Method is applicable for office buildings, cinema, theater, hotel, restaurants.
- Secondary/indirect CF effects should also be taken into consideration to be applicable for non profit generating functions. (museum, swimming pool, culture house)
4 steps to value buildings with the CF method

1. **HBU (highest and best use)**: define the operation of the building that is the most beneficial/generates most profit

2. **Estimation of CF – profit calculation**: collect all the CF elements (revenues & costs) that will occur during the operation of the building

3. **Analyze risks, define discount rate (opportunity cost of capital)**: Analyze all the investments that have similar risk level and check their yield

4. **NPV calculation**: Use the NPV formula to calculate the present value of the CF

\[ NPV = -C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_T}{(1+r)^T} \]
Higher risk results higher yield

- Cash
- Government bond
- Bank deposit
- Corporate bond
- Real estate
- Shares
Sample question

- Hotel of 100 rooms in Budapest
- 70% average usage
- EUR 49/room/night net revenue
- Operates 365 days/year
- HR costs: 25 employees with average gross cost of EUR 1500/month/employee
- FM costs: EUR 400 000/year
- Other costs: EUR 200 000/year
- Calculate with perpetuity
- Expected yield for similar investments is 10%

Annual revenues

- 100 rooms * 70% * EUR49 * 365 days = ~EUR 1 250 000

Annual costs

HR:
- 25 Employees *
- EUR 1500 salary *
- 12 months = EUR 450 000

FM:
- EUR 400 000

Other:
- EUR 200 000

Total: EUR 1 050 000

Annual profit is EUR 200 000 with 10% discount rate perpetuity results:

200 000 / 10% = EUR 2M market value
Valuation methods

Traditional valuation methods
- Comparable method
- Cash flow method
- Cost method

Advanced valuation methods
- Hedonic pricing method
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic
Cost method, the last resort

- The cost method is applicable, when:
  - In case there are no comparable real estate nearby
  - The generated CF can not be easily defined

- Define the cost of the construction, creation of the building, deducting the damages and amortization

- Could also be used as a control for the previous methods (Comparable, CF)

- Applicable for special buildings: special residential buildings, industrial buildings, factories, not finished constructions, etc...

- This method represent least the market value, as the usage is supported as a last resort
3 steps to use to get value with cost method

Cost method:

1. **Define the land value**
   - Use comparable or CF method

2. **Define the re-construction costs**
   - All the cost to create the same utility function including all related costs

3. **Calculate the amortization value**
   - Urban brick buildings: 60-90 years
   - Urban not brick: 40-70 years
   - Suburban housing: 50-80 years
   - Industrial and agricultural: 20-50 years

1. Figures are proposed by Hungarian regulation
## Valuation methods

<table>
<thead>
<tr>
<th>Traditional valuation methods</th>
<th>Advanced valuation methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparable method</td>
<td>Hedonic pricing method</td>
</tr>
<tr>
<td>Cash flow method</td>
<td>Artificial Neural Networks</td>
</tr>
<tr>
<td>Cost method</td>
<td>Spatial analysis method</td>
</tr>
<tr>
<td></td>
<td>Fuzzy logic</td>
</tr>
</tbody>
</table>
\[ r = 0.791 \]
\[ P < 0.0001 \]
Hedonic regression is focusing on the value components

- Real estate value is determined by its characteristics
- Characteristics should be valued separately
- Value of real estate is the sum of the components’ value

High correlation between housing characteristic and price

<table>
<thead>
<tr>
<th>Price (M HUF)</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
</tr>
<tr>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>120</td>
<td>300</td>
</tr>
<tr>
<td>140</td>
<td>350</td>
</tr>
<tr>
<td>160</td>
<td>400</td>
</tr>
<tr>
<td>180</td>
<td>450</td>
</tr>
<tr>
<td>200</td>
<td>500</td>
</tr>
</tbody>
</table>

Hedonic regression
Several characteristics can influence price

Grouped by the real estate life-cycle

<table>
<thead>
<tr>
<th>Investment</th>
<th>Design/planning</th>
<th>Construction</th>
<th>FM</th>
<th>Transaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Plan</td>
<td>Construction method, technical parameters</td>
<td>Technical</td>
<td>Selling method</td>
</tr>
<tr>
<td>Place:</td>
<td>Orientation</td>
<td>Internet</td>
<td>Date of renovation</td>
<td>RE agent</td>
</tr>
<tr>
<td>City / district</td>
<td>Nr. of rooms</td>
<td>TV</td>
<td>Repainted</td>
<td></td>
</tr>
<tr>
<td>Distance from:</td>
<td>Room sizes</td>
<td>Air-conditioning</td>
<td>Cladding reparation</td>
<td></td>
</tr>
<tr>
<td>transportation</td>
<td>Floor plan layout</td>
<td>Cladding</td>
<td>New doors/windows</td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>Convertibility</td>
<td>Heating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>commercial</td>
<td></td>
<td>Safety door</td>
<td></td>
<td></td>
</tr>
<tr>
<td>leisure</td>
<td></td>
<td>Door phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>healthcare</td>
<td></td>
<td>Wall thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulatory constraints</td>
<td>Constr. date</td>
<td>Railing</td>
<td></td>
<td>Payment</td>
</tr>
<tr>
<td>Floor number</td>
<td>Style</td>
<td>Suspended ceiling</td>
<td>Rented</td>
<td></td>
</tr>
<tr>
<td>Build-in area</td>
<td>Ceiling height</td>
<td>Alarm</td>
<td>Mortgage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Architect</td>
<td>Window type</td>
<td>Perpetual lease</td>
<td></td>
</tr>
<tr>
<td>Market need</td>
<td>Extras</td>
<td>Build-in cupboards</td>
<td></td>
<td>Macroeconomics - Timing</td>
</tr>
<tr>
<td>Flat size</td>
<td>Sauna</td>
<td>Kitchen equipments</td>
<td>Condominium costs</td>
<td>GDP</td>
</tr>
<tr>
<td>Number of flats</td>
<td>Jacuzzi</td>
<td></td>
<td></td>
<td>CPI</td>
</tr>
<tr>
<td>Parking</td>
<td>Etc.</td>
<td></td>
<td></td>
<td>Unemployment rate</td>
</tr>
<tr>
<td>Elevator</td>
<td>Etc.</td>
<td></td>
<td></td>
<td>Interest rate</td>
</tr>
<tr>
<td>Etc.</td>
<td></td>
<td></td>
<td></td>
<td>Exchange rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Taxation</td>
</tr>
</tbody>
</table>

Legal

- Rented
- Mortgage
- Perpetual lease

Economic

- Condominium costs
- Overhead

Social

- Community
- Warden
Example

- Calculate the value of a flat of 80 sqm having an alarm system, given the following transactions in the neighborhood.

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Transaction price (HUF)</th>
<th>Area (sqm)</th>
<th>Alarm</th>
<th>Subject (HUF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20M</td>
<td>70 sqm</td>
<td>Yes</td>
<td>?? M</td>
</tr>
<tr>
<td>2.</td>
<td>20M</td>
<td>80 sqm</td>
<td>No</td>
<td>18M</td>
</tr>
<tr>
<td>3.</td>
<td>18M</td>
<td>60 sqm</td>
<td>No</td>
<td>20M</td>
</tr>
</tbody>
</table>

Price = \( b_0 + b_1 \times \text{area} + b_2 \times \text{alarm system (0/1)} \)

- The difference between the 2nd and 3rd flat is just the area. The value of 1 sqm is:
  \( \frac{(20-18)}{(80-60)} = \text{HUF 0.1 M/sqm} \)
- Based on this the 10 sqm difference between the 1st and 2nd flat results in 1M HUF. This is compensated by the Alarm system, thus the value of the alarm system is 1M HUF.
- Thus the subject flat with 80 sqm and alarm system is 20+1=21 M

With regression:
- Price = \( b_0 + b_1 \times \text{area} + b_2 \times \text{alarm system (0/1)} + \text{error term} \)
- \( P = 12 + 0.1 \times \text{area} + 1 \times \text{alarm system (0/1)} + \text{error term} \)
Example: Using transaction sales, the regression function can be determined

\[ P = \beta_0 + \beta_1 \cdot \text{Area} + \beta_2 \cdot D_{\text{metro}}(\text{km}) + \beta_3 \cdot \text{Alarm sys:0/1} + \beta_4 \cdot \text{H_district:0/1} + \beta_5 \cdot \text{H_central:0/1} + e \]

<table>
<thead>
<tr>
<th>P</th>
<th>Area</th>
<th>D_metro</th>
<th>Alarm sys</th>
<th>H_district</th>
<th>H_central</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>60</td>
<td>1,2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>82</td>
<td>3,1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>78</td>
<td>0,7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>45</td>
<td>6,1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>65</td>
<td>110</td>
<td>0,6</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>67</td>
<td>2,3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>94</td>
<td>4,2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Regression finds values for all \( \beta \), to have the smallest values for \( \sum e^2 \)

\[ P = 3,1 + 0,45 \cdot \text{Area} + 0,01 \cdot D_{\text{metro}}(\text{km}) + 1,2 \cdot \text{Alarm sys:0/1} + 2,2 \cdot \text{H_district:0/1} + 3,2 \cdot \text{H_central:0/1} \]

By putting the characteristics of the subject RE to the function, the price can be determined!!

Note: Regression result's figures are only for explanation, not based on appropriate calculation.
Agenda

- Importance of real estate valuation

- Valuation methods
  - Traditional methods
  - Advanced methods

- Hedonic research – Budapest residential RE market
Supply prices from internet were used
Panel or brick

- Value of panel building is significantly less than non-panels
Floor

- Not significant for the whole sample
- Only significant for panel buildings (10-story buildings)
- The higher the flat is, the less value it has
- Potential breakdown of elevators
- 1 storey means -1% in value, but possible correlation with panorama to compensate effect
Existence of balcony results additional value to the house
Heating

- Convector
- Electro or Hera
- District
- Central heating
- Circulation
- Fain coil
Condition

- Bad
- Average
- Good
- Very good
- New
Panorama

- Panorama (~+13%)
- Garden (~+7%)
- Courtyard or street view
Parking

- Existence of a garage results in HUF 2,5M in value
Zone

- Luxurious Buda
- Pest city
- Buda
- Pest
- Pest suburb
The longest the distance from Liszt Ferenc Airport, the higher the value of the residential real estate.
People prefer not to live next to the cemeteries
Market

- But they do like to stay close to a market
Nearby parks are preferred
Stadium

- But nearby soccer stadiums are not
Trainstation

- Nor the trainstations
Results

\[ \ln(y) = \beta_0 + a_1 \cdot \ln(x_1) + a_2 \cdot \ln(x_2) + a_3 \cdot \ln(x_3) + \cdots + a_n \cdot \ln(x_n) + \beta_1 \cdot z_1 \\
\quad + \beta_2 \cdot z_2 + \beta_3 \cdot z_3 + \cdots + \beta_m \cdot z_m \]

- Positive coefficients mean positive effect to the value
- 3 groups and total sample were observed: historic (392), panel (285), other (1129)
- R-squared of 85% means a good estimator equation
How could the results of the research be used by the stakeholder?

**Landlords and tenants** (owners, users)
- Where to buy? How much is it worth if I sell? Worth renovation?

**State/Government** (owner, regulator (tax), etc.)
- Equation can be the base of property tax; Cost-benefit calculation for infrastructure development: park, subway, etc. As a secondary CF, property value might rise in the area.

**Architects, urbanists** (design/create real estate, plan cities)
- Where to locate infrastructure, commercial area; leisure facilities, parks, etc...?; What are the characteristics that give value to owners.

**Financial institutions** (financing, mortgage, insurance fee)
- Valuate real estate portfolio, when traditional methods not applicable.

**Investors and real estate developers** (potential business makers of the real estate sector)
- Where to locate residential housings? Create parking? Which heating to choose? ; Where to locate new infrastructure to avoid facing resistance (airport, market, etc.)
Thank you for your attention!