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# MIVES-VS Visualisation tool

SHS

How people  
learn

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Either if you have Windows or Mac, you need to pull the complete folder from our GitHub repository :

<https://github.com/HUM-433-Group-5/HUM-433-MIVES-VS>



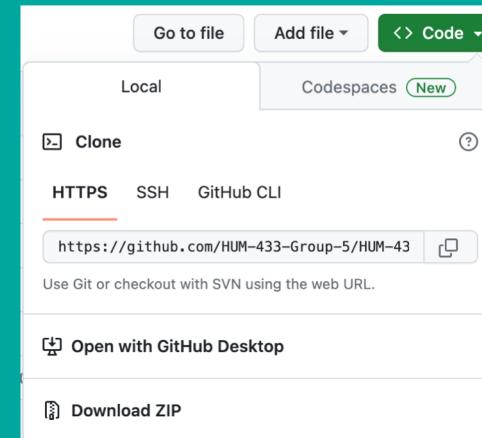
Just click on «code» and «Download zip». Open it with your preferred platform with Python (we recommend using Visual Studio Code).

Before running the file, in the terminal window write «*sudo pip install -r requirements.txt*» to make sure all the needed packages are installed. If this doesn't work for you, you can install them one by one with «*sudo pip install package*». The needed packages are (**PyQt5, ete3, six, numpy, matplotlib, and pandas**).

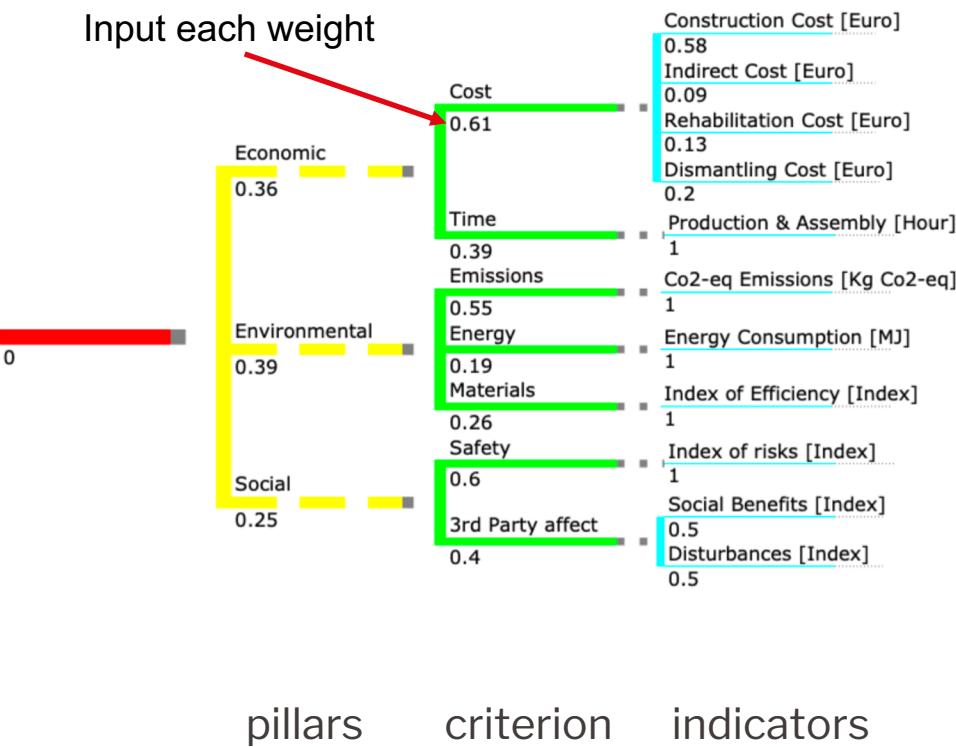
Then run ***mives.py***. The main window should appear!

# Running VS-MIVES

An interactive tool to introduce the MIVES method, a multi-criteria analysis framework to assess sustainability.



Input each weight

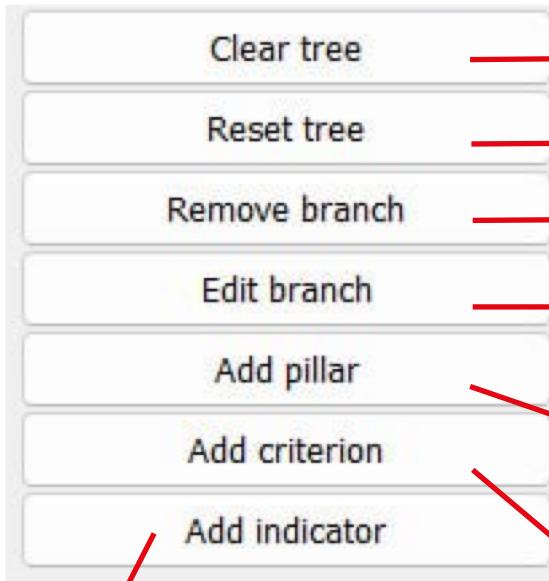


# Main tree

*The MIVES method is a set of techniques used for assessing the sustainability of design solutions. The method can be divided into several steps :*

1. *Definition of the problem and decisions to be made.*
2. *Realization of a tree diagram.*
3. *Definition of the value functions, i.e. index which expresses the degree of satisfaction.*
4. *Definition of the weights.*
5. *Definition of design alternatives.*
6. *Evaluation of the global index achieved by each design solution.*
7. *Make the right decision based on the results obtained*

# Main menu



Add branch in third generation,  
decide the weight and then it  
asks to choose the value function

Removes everything

Resets from last version

Removes one of the branches

Edits weight of one of  
the branches

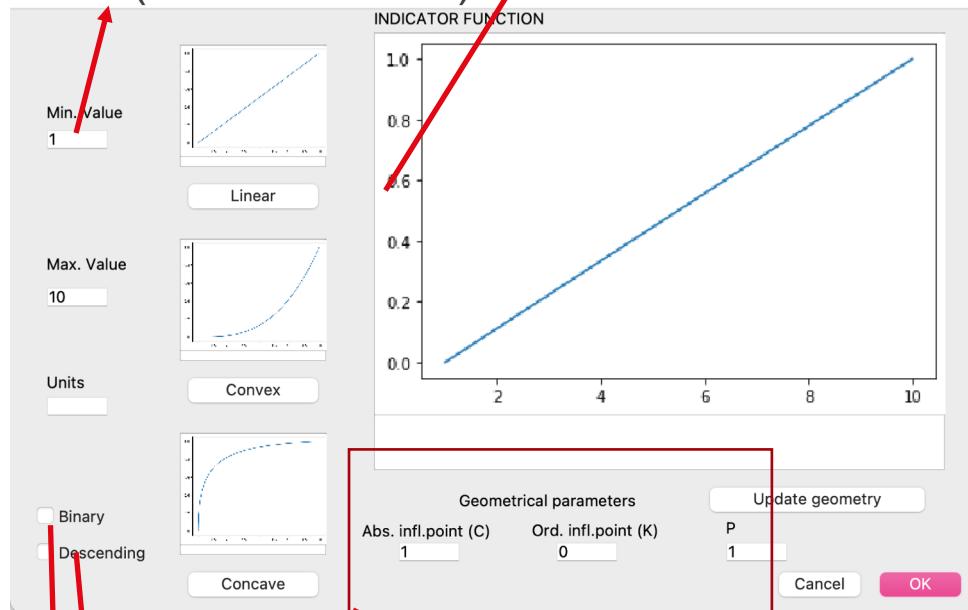
Adds one pillar at the beginning along with  
«economic», «social», and «environmental».

Adds one more criterion. First, you choose  
the pillar to add to. Then you choose  
weight.

# Indicator value function

Max/min values of x axis (indicator value)

Satisfaction value for each indicator



Yes or no

Decreasing function

To modify the curvature of the convex and concave plots. P is polynomial order, the others are inflexion points of x and y axis.

Defining each value function requires measuring preference or the degree of satisfaction produced by a certain alternative.

The shape of the functions determines how strict or lenient we need to be in meeting the requirements to fulfill a certain standard.

# Database

- You can find a short version of the ICE database based on *ICE V2.0 (Hammond & Jones, 2011)* in the main window.
- There are 12 material categories with many subcategories. Choose up to 5 materials and note down the values of Energy [Mj/kg] and GHG [Co2 eq/]. You need to know the amount of material that will be used or each category and then multiply it.
- Add everything together and input this value in the next window

The screenshot shows a software interface for material selection and database lookup. At the top, there is a dropdown menu labeled "Use Database" with options: Concrete, Cement, Precast, Steel, Aggregate, and Aluminium. The "Aluminium" option is selected and highlighted with a pink background. A red arrow points from the "Aluminium" selection down to the "Database for Aluminium" table. Below the dropdown is a list of sub-categories under "Aggregate": Bricks, Cement, Clay, Concrete, Reinforced concrete, Precast, Concrete blocks, Nominal proportions method (Cement:Sand:Aggregate), Soil, and Steel. Another red arrow points from the "Database for Concrete" table down to the "Database for Aluminium" table, indicating that the same table is being used for both materials.

| 1             | 2              | 3               |
|---------------|----------------|-----------------|
| Material      | EE - M J / k g | E C - ( G H ... |
| General       | 155.0          | 9.16            |
| Virgin        | 218.0          | 12.79           |
| Recycled      | 29.0           | 1.81            |
| Cast Products | 159.0          | 9.22            |
| Virgin        | 226.0          | 13.1            |
| Recycled      | 25.0           | 1.45            |
| Extruded      | 154.0          | 9.08            |
| Virgin        | 214.0          | 12.5            |
| Recycled      | 34.0           | 2.12            |
| Rolled        | 155.0          | 9.18            |
| Virgin        | 217.0          | 12.8            |
| Recycled      | 28.0           | 1.79            |

| 1                            | 2              | 3               |
|------------------------------|----------------|-----------------|
| Material                     | EE - M J / k g | E C - ( G H ... |
| General                      | 0.75           | 0.107           |
| General 16/20 Mpa            | 0.7            | 0.1             |
| General 20/25 Mpa            | 0.74           | 0.107           |
| General 25/30 Mpa            | 0.78           | 0.113           |
| General 28/35 Mpa            | 0.82           | 0.12            |
| General 32/40 Mpa            | 0.88           | 0.132           |
| General 40/50 Mpa            | 1.0            | 0.151           |
| GEN 0 (6/8 MPa) 0% Fly ash   | 0.55           | 0.076           |
| GEN 0 (6/8 MPa) 15% Fly ash  | 0.52           | 0.069           |
| GEN 0 (6/8 MPa) 30% Fly ash  | 0.47           | 0.061           |
| GEN 1 (8/10 MPa) 0% Fly ash  | 0.7            | 0.104           |
| GEN 1 (8/10 MPa) 15% Fly ash | 0.65           | 0.094           |

# Input of the database parameters

|                              |           |         |               |
|------------------------------|-----------|---------|---------------|
| Construction Cost [Euro]     | Euro      | Default | new structure |
| 0.58                         | 1 : 10    | 1.00    | 2.00          |
| Indirect Cost [Euro]         | Euro      | 5.00    | 3.00          |
| 0.09                         | 1 : 10    | 1.00    | 1.00          |
| Rehabilitation Cost [Euro]   | Euro      | 5.00    | 4.00          |
| 0.13                         | 1 : 10    | 1.00    | 1.00          |
| Dismantling Cost [Euro]      | Euro      | 5.00    | 4.00          |
| 0.2                          | 1 : 10    | 1.00    | 1.00          |
| Production & Assembly [Hour] | Hour      | 1.00    | 1.00          |
| 1                            | 1 : 10    | 1.00    | 1.00          |
| Co2-eq Emissions [Kg Co2-eq] | Kg Co2-eq | 5.00    | 4.00          |
| 1                            | 1 : 10    | 1.00    | 1.00          |
| Energy Consumption [MJ]      | MJ        | 1.00    | 1.00          |
| 1                            | 1 : 10    | 1.00    | 1.00          |
| Index of Efficiency [Index]  | Index     | 7.00    | 1.00          |
| 1                            | 1 : 10    | 1.00    | 1.00          |
| Index of risks [Index]       | Index     | 7.00    | 1.00          |
| 1                            | 1 : 10    | 1.00    | 1.00          |
| Social Benefits [Index]      | Index     | 10.00   | 4.00          |
| 0.5                          | 1 : 10    | 1.00    | 1.00          |
| Disturbances [Index]         | Index     | 3.00    | 1.00          |
| 0.5                          | 1 : 10    | 1.00    | 1.00          |

New      Copy      Redo

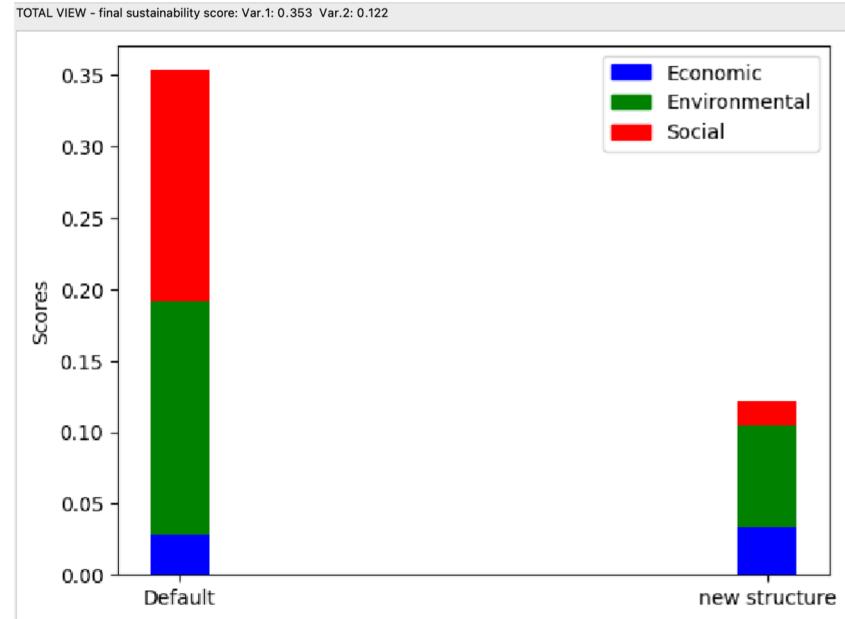
Input values (from min. to max.)

Here you need to multiply your total mass by the value found in the database for each material. These are your inputs.

Different options can be implemented and compared

# Final results and analysis

Table of total scores.  
Inputs and outputs



Results per pillar or total view

|    | Name 1           | Weight 1 | Input value 1 | Computed value 1 |
|----|------------------|----------|---------------|------------------|
| 1  | Construction...  | 0.58     | 1.0           | 0.0              |
| 2  | Indirect Cost    | 0.09     | 5.0           | 0.446            |
| 3  | Rehabilitatio... | 0.13     | 1.0           | 0.0              |
| 4  | Dismantling ...  | 0.2      | 5.0           | 0.446            |
| 5  | Production ...   | 1        | 1.0           | 0.0              |
| 6  | Co2-eq ...       | 1        | 5.0           | 0.446            |
| 7  | Energy ...       | 1        | 1.0           | 0.0              |
| 8  | Index of ...     | 1        | 7.0           | 0.668            |
| 9  | Index of risks   | 1        | 7.0           | 0.668            |
| 10 | Social ...       | 0.5      | 10.0          | 1.0              |
| 11 | Disturbances     | 0.5      | 3.0           | 0.223            |
| 12 | Cost             | 0.61     |               | 0.129            |
| 13 | Time             | 0.39     |               | 0.0              |
| 14 | Emissions        | 0.55     |               | 0.446            |
| 15 | Energy           | 0.19     |               | 0.0              |
| 16 | Materials        | 0.26     |               | 0.668            |
| 17 | Safety           | 0.6      |               | 0.668            |
| 18 | 3rd Party ...    | 0.4      |               | 0.612            |
| 19 | Economic         | 0.36     |               | 0.079            |
| 20 | Environmental    | 0.39     |               | 0.419            |
| 21 | Social           | 0.25     |               | 0.645            |
| 22 | Final score      |          |               | 0.353            |

indicators

criterion

pillars

Contact us if you need any technical support:

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**Have fun :)**