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ESADE & Smart Engineering

# **PRIORITIZATION INDEX FOR HETEROGENEOUS URBAN INVESTMENTS**

question raised

# Which are the MOST PRIORITY INVESTMENTS FOR A SUSTAINABLE CITY?



question raised

# PIHUI

**Prioritization Index for Heterogeneous Urban Investments**  
**provides a step towards a sustainable urban planning**



# 1 decision-making supporting methods

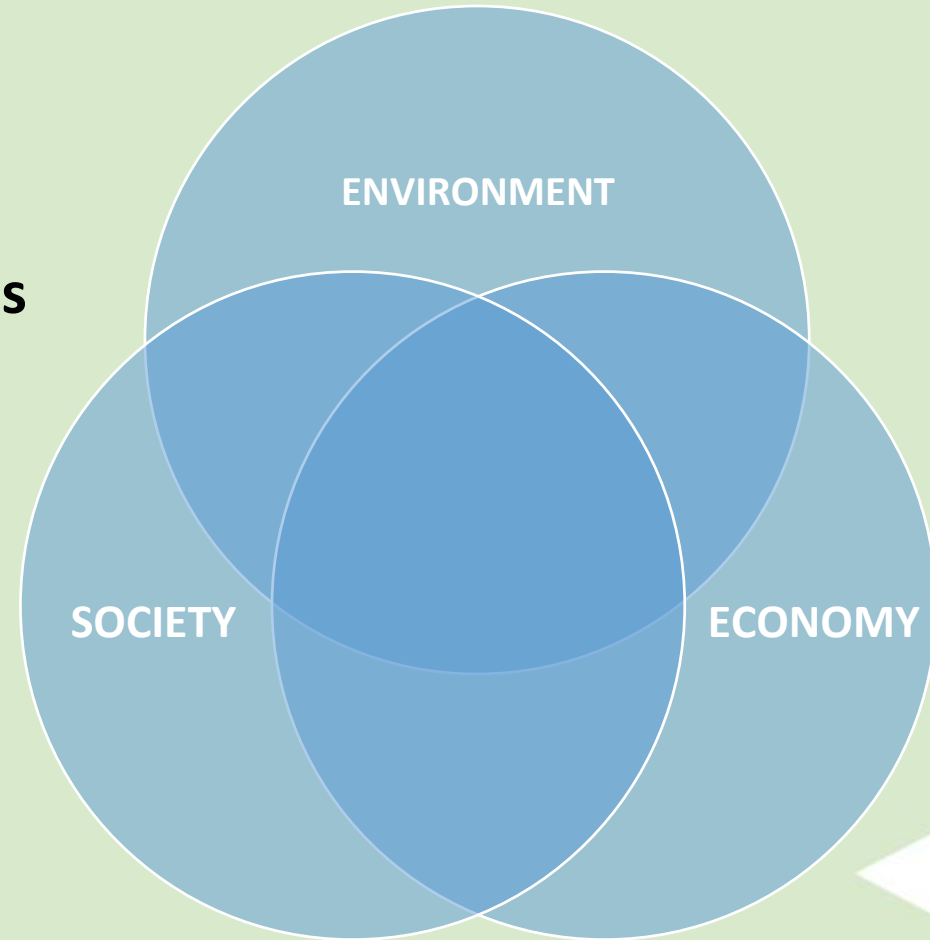


**1** decision-making supporting methods

**2** ANALYSING - SORTING - PRIORITIZATION of investments

criteria

social  
environmental  
economical



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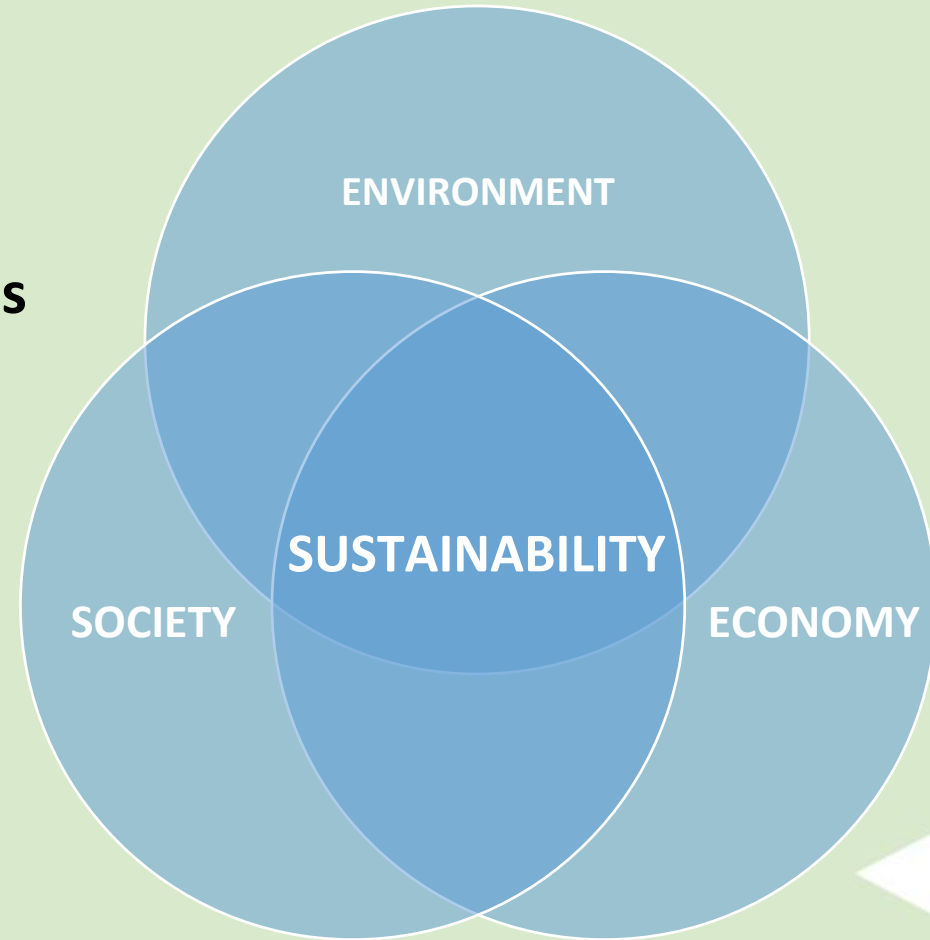
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▶ **SUSTAINABILITY**





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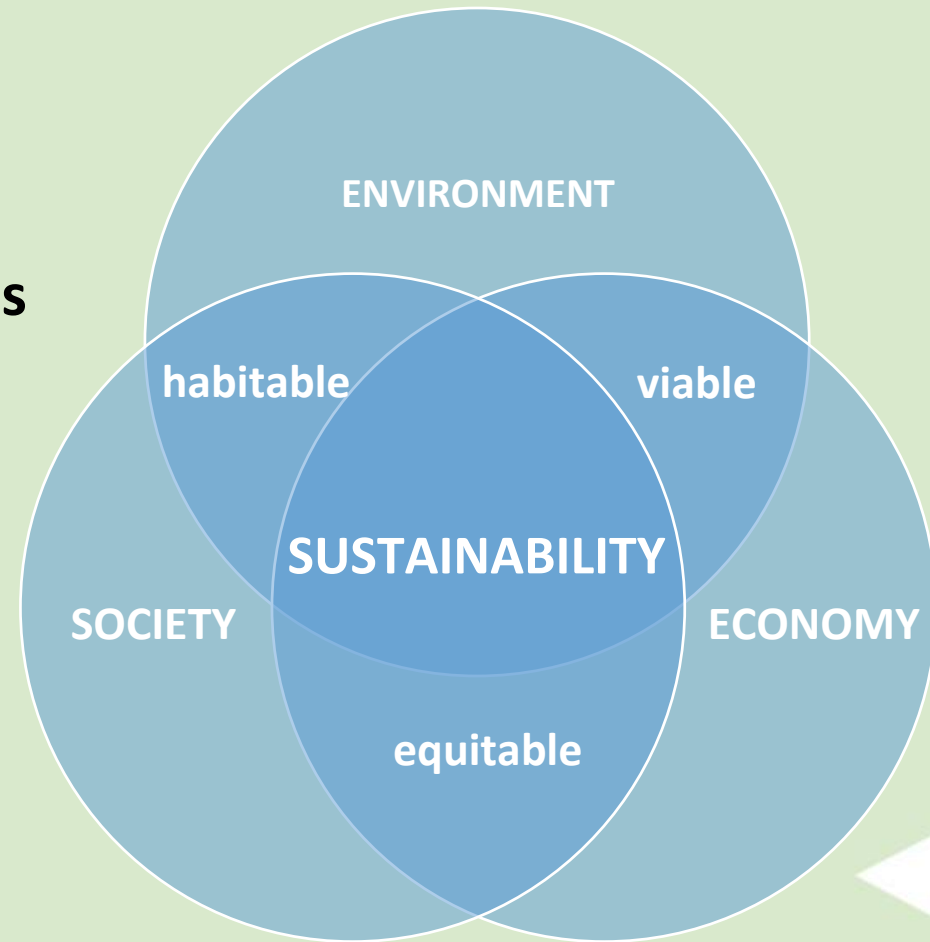
**2** ANALYSING - SORTING - PRIORITIZATION of investments



**3** defining our MODEL OF CITY:



**HABITABLE - EQUITABLE - VIABLE**



# methodology

**MIVES: *Modelo Integrado de Valoración de Estructuras Sostenibles***

- multi-criteria decision-making (mcdm)
- PROVEN scientific methodology:
  - 16 Doctoral Thesis since 2005
  - 20 papers in top research journals (JCR)

**REALISTIC framework:**

- considers the multidimensional nature of the real world problem
- sustainability dimensions (ecological, financial, and social (United Nations, 2005))

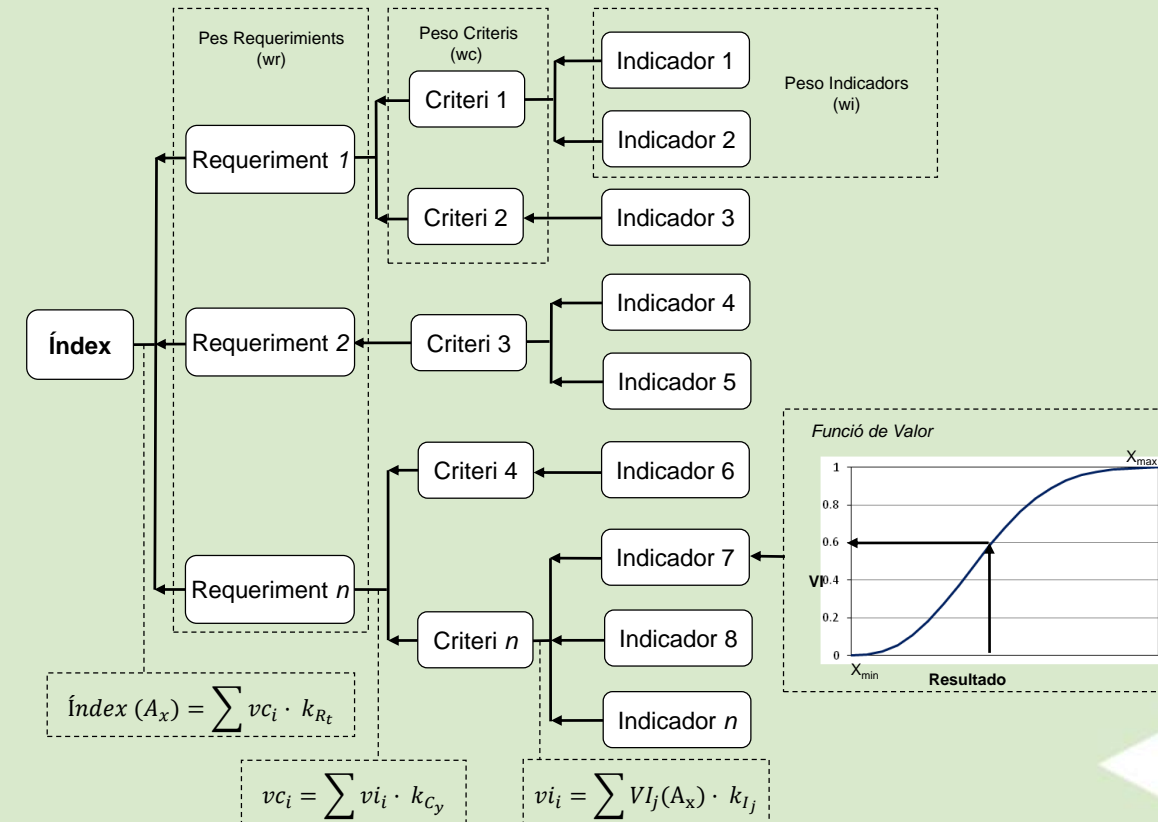
**OBJECTIVE → TRANSPARENCY**





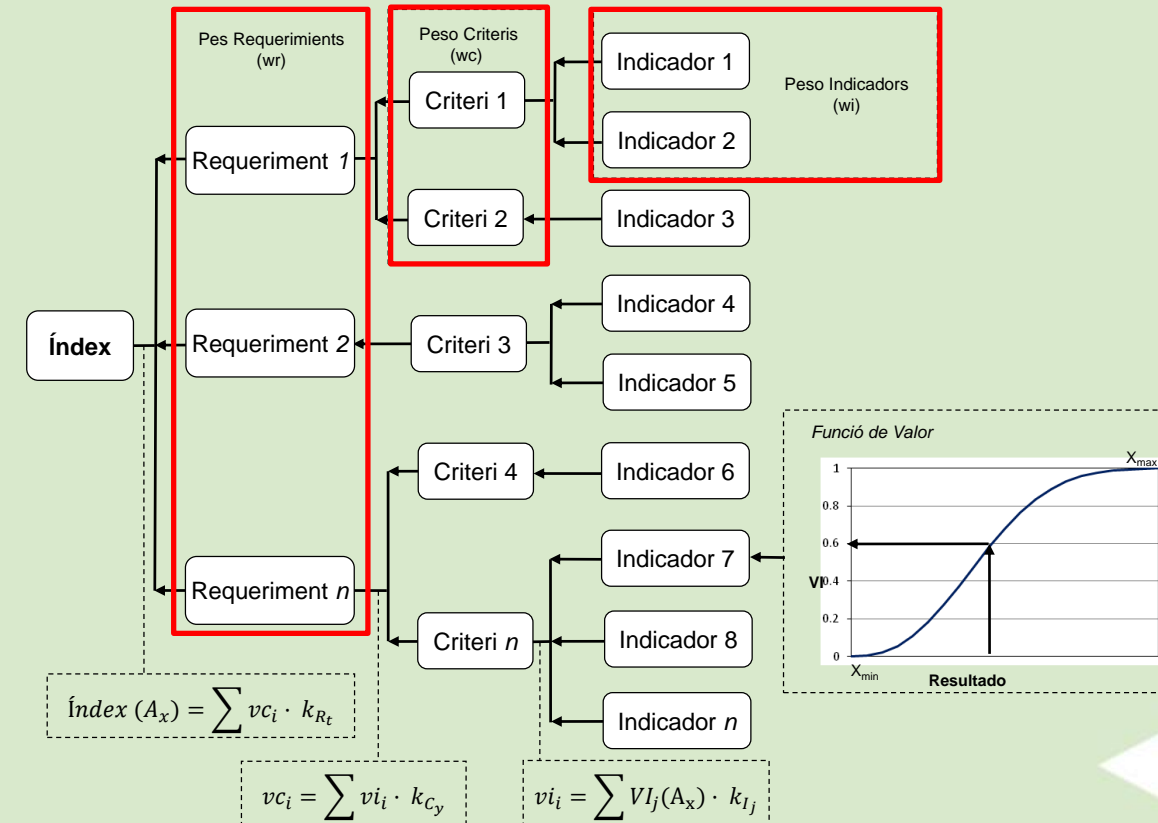
**MIVES:** structures the problem within a multi-criteria analysis framework in which different investment projects may be prioritized according to **pre-established criteria in order to satisfy a pre-defined sustainable objective**

- a MIVES 3 levels framework was here developed: **REQUIREMENTS, CRITERION and INDICATORS.**



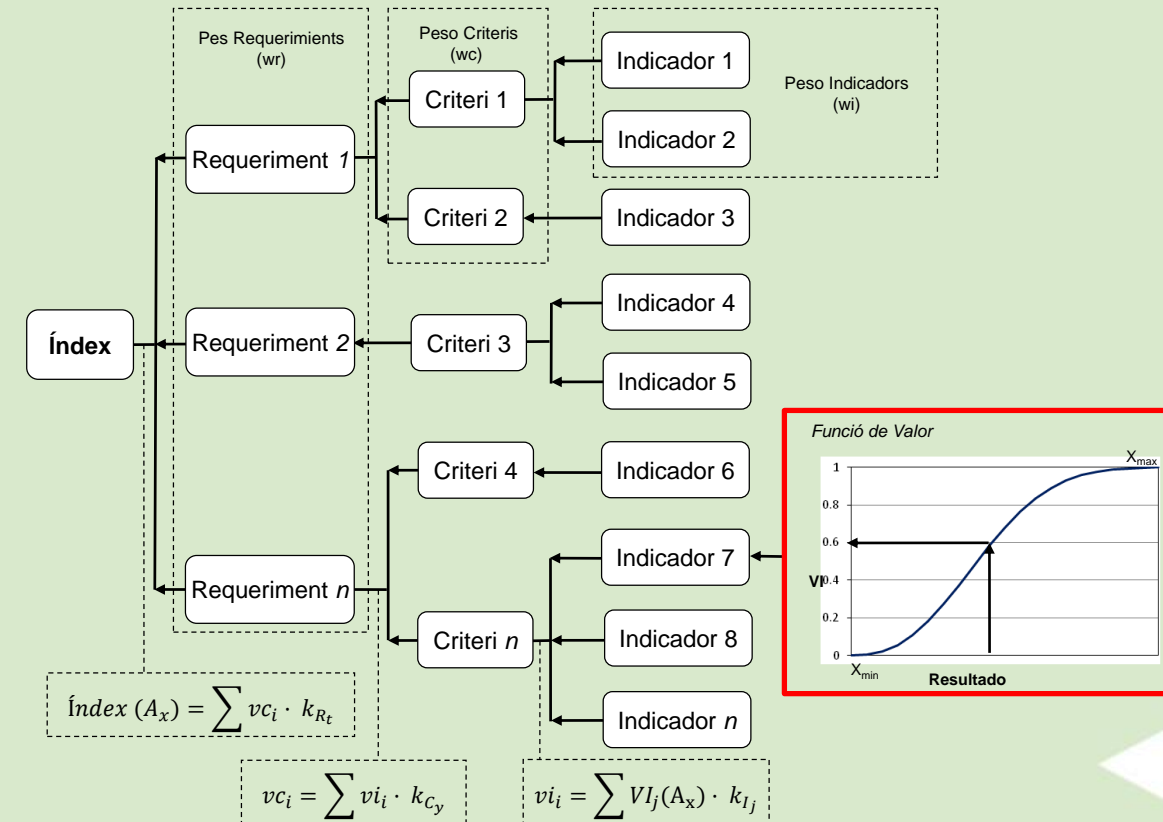
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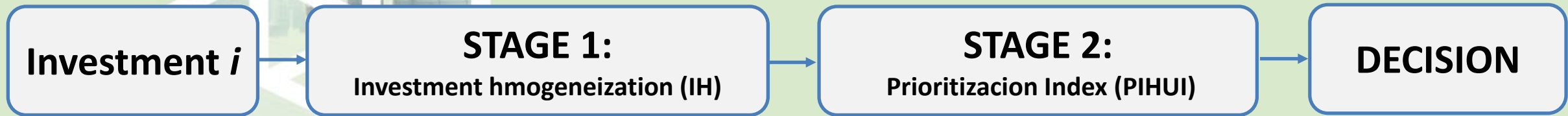


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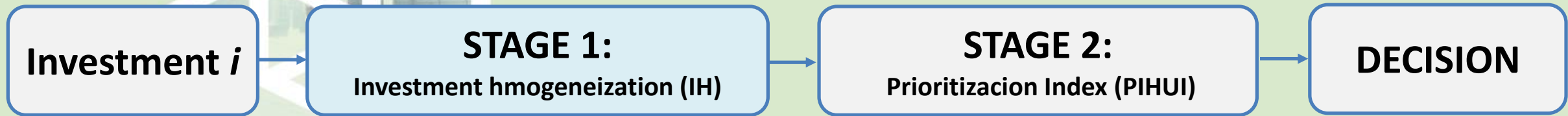
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- uses **AHP (Analytic Hierarchy Process)** to reflect the relative importance of each requirement, criterion and indicator level on the prioritization
- uses **VALUE FUNCTION:** a single mathematical function that converts the qualitative and quantitative variables of the indicators, with their different units and scales, into a single scale from **0 to 1**



## PIHUI: Prioritization Index for Heterogeneous Urban Investments

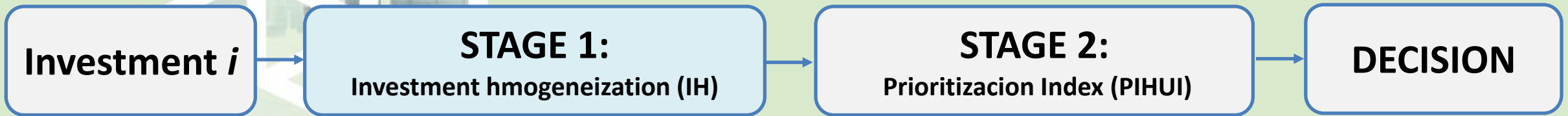


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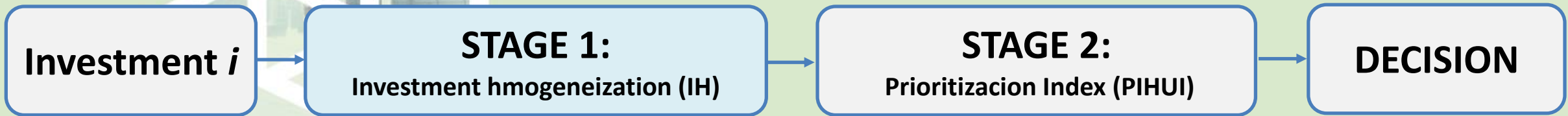
## PIHUI: Prioritization Index for Heterogeneous Urban Investments



**STAGE I: HOMOGENEIZATION of the investments** - infrastructures, services and solutions for: mobility, energy, waste, urban planning, water, biodiversity and social cohesion



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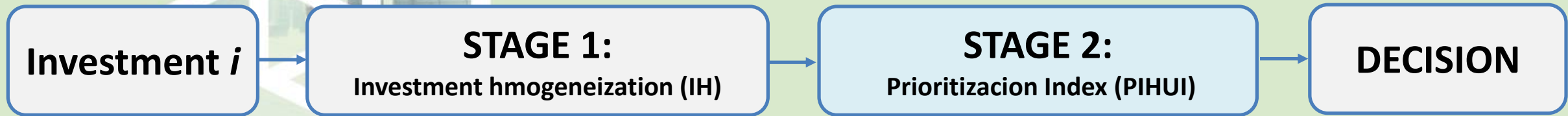


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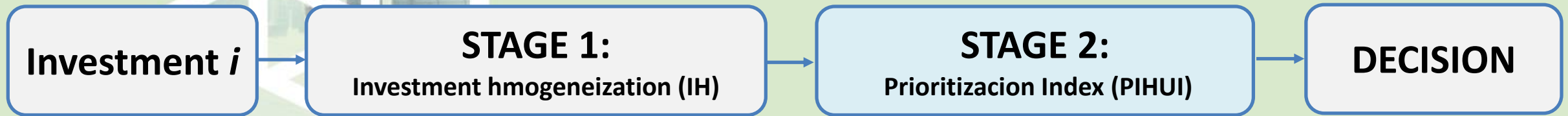
what do  
we consider?

INDICATOR	FACTOR / VARIABLES CONSIDERED
Contribution to the regional Balance (48%)	Population density - Rent Level Investments over the last 8 years
Investment scope (21%)	Population that can benefit from the new service Service Importance
Evaluation of the current situation (10%)	Condition of the current alternatives Saturation of the current alternatives
Values of the City (21%)	Progress Level of the Unfinished projects Alignment with the strategic concerns of the city

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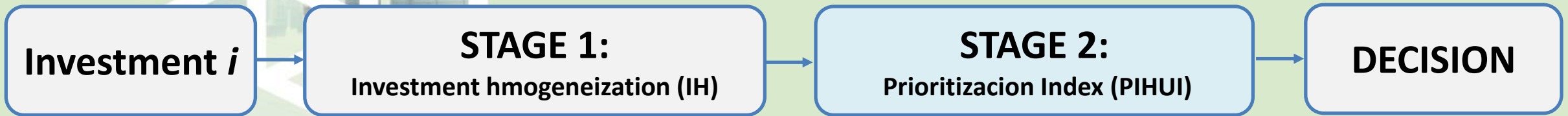


## PIHUI: Prioritization Index for Heterogeneous Urban Investments



Once the investment are homogeneous, in STAGE II we asses the social, financial and ecological REQUERIMENTS

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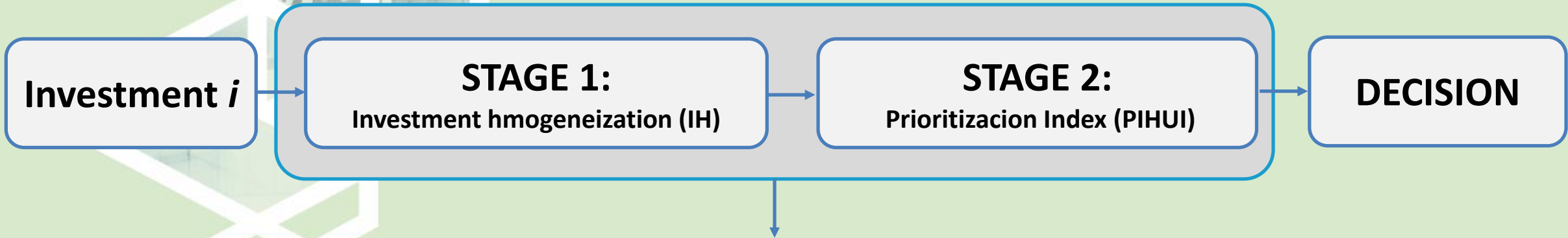


Once the investments are homogeneous, in STAGE II we assess the social, financial and ecological REQUIREMENTS

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REQUIREMENTS (%)	CRITERIA (%)	INDICATORS (%)
Financial (20)	Investment (80)	Annual Unitary Cost (70)
	Co-funding (20)	Implementation Cost (30)
Ecological (40)	Environmental contribution (100)	Co-funding (100)
		Environmental contribution (100)
Social (40)	Service changes (50)	Service quality improvement (50)
		Service capacity improvement (50)
	Surrounding Impacts (50)	Creation of Employment (30)
		Social Agreement (70)

## PIHUI: Prioritization Index for Heterogeneous Urban Investments



...for each investment...

...fill in a FORM

**THOROUGH and RIGOROUS** evaluation  
but at the same time **QUICK and EASY**



# Barcelona Case Study

Which are the **MOST PRIORITY INVESTMENTS** for the  
**Barcelona Ecology, Urban Planning and Mobility Area?**



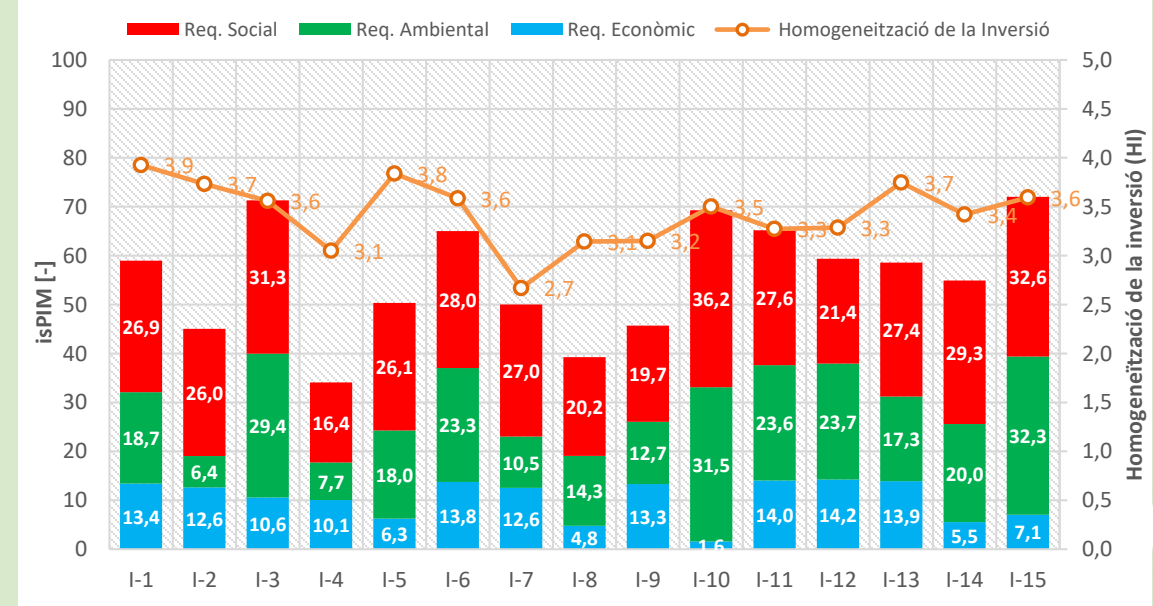
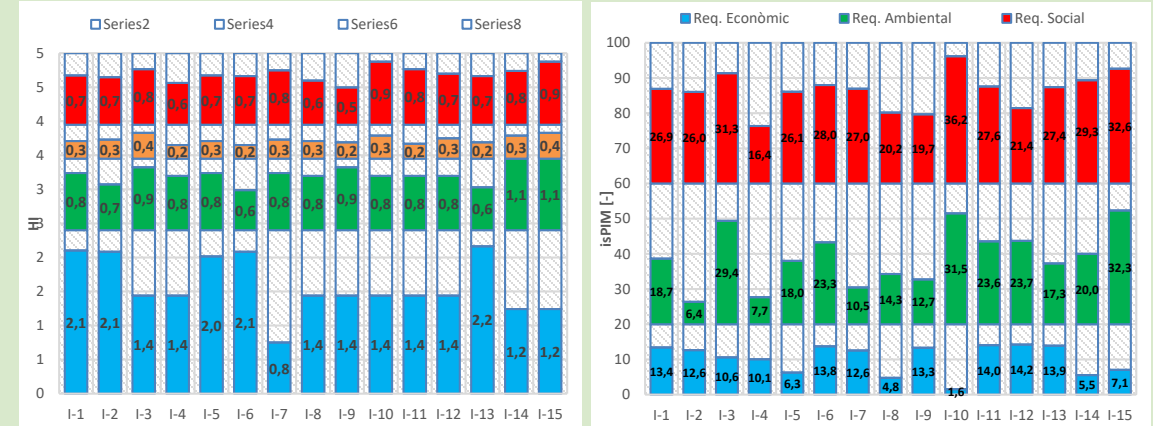




# validation with 15 investments

## LLISTAT D'INVERSIONS A AVALUAR


Nº	NOM INVERSIÓ	OPERADOR	DISTRICTE
I-1	BARRIS EN TRANSFORMACIÓ: BON PASTOR FASE E	BAGURSA	SANT ANDREU
I-2	PACIFICACIÓ CARRER MARINA	DIRECCIÓ DE PROJECTES	EIXAMPLE
I-3	RENATURALITZACIÓ DE LA CIUTAT	MASU	BARCELONA CIUTAT
I-4	DESPLEGAMENT DEL PLA DIRECTOR D'IL·LUMINACIÓ	ICU	BARCELONA CIUTAT
I-5	BARRIS EN TRANSFORMACIÓ: COLÒNIA CASTELLS_EXPROPIACIÓ FASE 2B I URBANITZACIÓ	BAGURSA	LES CORTS
I-6	SOLAR MECAPLAUTO_ARAGÓ-LEPANT	DIRECCIÓ DE PROJECTES	EIXAMPLE
I-7	DRENATGE AVINGUDA PARAL·LEL_CARRER VILA I VILÀ_FASES 2 I 3	MASU	SANTS MONTJUÏC
I-8	DESPLEGAMENT DEL PLA DIRECTOR DE PAVIMENTS	ICU	BARCELONA CIUTAT
I-9	GESTIÓ DE SÒL PER HABITATGE	BAGURSA	BARCELONA CIUTAT
I-10	PROGRAMA SUPERILLES	DIRECCIÓ DE PROJECTES	BARCELONA CIUTAT
I-11	IMPLANTACIÓ ACCIONS PREVISTES EN L'ESTRATÈGIA DE MILLORA DE QUALITAT DE L'AIRE HORITZÓ 2018	MASU	BARCELONA CIUTAT
I-12	BARCELONA AUTOSUFICIENT: PLA DE CONSCIENCIACIÓ DE L'AUTOSUFICIÈNCIA ENERGÈTICA	ICU	BARCELONA CIUTAT
I-13	VALLCARCA URBANITZACIÓ AA4	DIRECCIÓ DE PROJECTES	GRÀCIA
I-14	GLÒRIES_TÚNEL VIARI	DIRECCIÓ DE PROJECTES	SANT MARTÍ
I-15	GLÒRIES_PARC	DIRECCIÓ DE PROJECTES	SANT MARTÍ



# conclusions

- The **simple** and **straightforward** methodology presented in this paper allows the homogenization of the alternatives, and its subsequent **sorting** and **prioritization**.
- The PIHUI index provides a step towards a **sustainable urban planning** in which decisions are made according to **clear, consistent** and **transparent** criteria.
- The case study conducted yielded very **satisfactory results**, showing that **accurate, consistent, and repeatable** evaluations can be performed.
- The method can be simply adapted if the decision-makers criteria changes **Moreover** the robustness of the proposed approach allows its application to other **cities**.





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**THANK YOU FOR YOUR ATTENTION!**