



International Seminar on

Involving Citizens/Communities in Measuring & Fostering

**Well-being & Progress:
towards new concepts and tools**

Palais de l'Europe, Strasbourg (France)

November 27 – 28, 2008



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Workshop 3



Links between traditional systems of indicators and those developed with citizens/communities:

antagonisms,

alternatives or

complementarities?



Towards more participative methods in the construction of composite indicators

The case of weighting systems

Filomena Maggino

Università degli Studi di Firenze, Italy



filomena.maggino @unifi.it

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2. Obtaining weights:
general principles

3. Obtaining weights:
objective and subjective approaches

4. Conclusions

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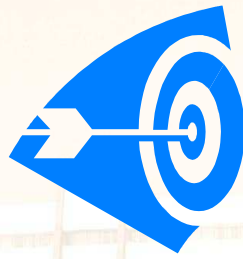


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GOAL

↪ **legitimacy** of Social Indicators

HOW ?

↪ **involving individuals** in the process



GOAL

→ Obtaining a larger **legitimacy** of social indicators ←

How to obtain this ?

By involving individuals in the process of social indicators construction



The methodology aimed at constructing indicators refers to and deals with the term “technology”, pointing out the need to have specialistic training in order to apply the procedure in a **scientific** and **objective** way.



**the procedure
is far from being
objective and
aseptic**



**Actually the procedure,
even though scientifically defined,
is far from being objective and aseptic**



Indicators construction

Stages



Decision / Choice



Technical / Value judgments



Indicators construction

is developed through different **stages**.



Each stage requires
a **decision / choice** (methodological or not)
to be taken.



*Some decisions are quite technical
others may involve value judgments*



Objective decisions : quite difficult

generally

Scientific community: accepted and shared

but

Larger community: can we share this ?

It is quite difficult to make these decisions objective

Generally

they are taken through a process accepted and shared by the scientific community

But

can we share methodological decisions /choices by a larger community?

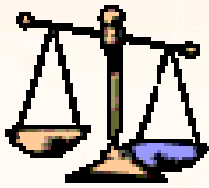
In particular ...



Choosing...

1. ... analytical approach
2. ... and obtaining weights 
3. ... and identifying the aggregating technique
4. ... models and conceptual approaches in order to assess
 - (i) robustness
 - (ii) discriminant capacity

1. **choosing analytical approach** in order to verify the underlying dimensionality of selected elementary indicators (*dimensional analysis*)
2. **choosing and obtaining weights** in order to define the importance of each elementary indicator to be aggregated (*weighting criteria*)
3. **choosing and identifying the aggregating technique** in order to synthesize the elementary indicators values into composite indicators (*aggregating-over-indicators techniques*)
4. **choosing models and conceptual approaches** in order to assess
 1. the robustness of the synthetic indicator in terms of capacity to produce correct and stable measures (*uncertainty analysis, sensitivity analysis*)
 2. the discriminant capacity of the synthetic indicator (*ascertainment of selectivity and identification of cut-point or cut-off values*)



Weights → differential importance



not simply a technical problem



Weights → **Judgment values**



Weights in indicators construction aim at assigning differential **importance** to the indicators to be aggregated.



this process does not represent simply a technical problem



Weights → **judgment values**



Weights



differential subjective weights

How to obtain subjective weights?



Determining and applying differential subjective weights



conceptual framework how to

↳ **obtain** weights

↳ **assign** weights

Determining and applying differential subjective weights



solid **conceptual framework** helping in clarifying how

➤ to **obtain** importance weights at individual-subjective level through subjective judgments

➤ to **assign** weights to the corresponding subjective scores

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General statements



$$CI_i = \sum_{j=1}^K x_{ij} w_{ij}$$

CI_i composite indicator for case i

K number of indicators to be aggregated

x_{ij} indicator j to be aggregated for case i

w_{ij} weight j to be attribute to X_{ij} for case i

General statements



Basic conditions

The identified weights

- ↪ *non negative*
- ↪ *add up to unity*
- ↪ related to the corresponding *score*
- ↪ rescaled to *identical range* (0; 1)

General basic conditions

The identified weights

are *non negative* numbers

add up to unity

are related in some way to the corresponding *score*

may require to be rescaled in order to have an *identical range* (0; 1)

General statements



Reproducing each CI sub-score's contribution

↓
criterion



weighting system



adopted measurement model
improvement & refinement

In order to reproduce as accurately as possible the contribution of each sub-score to the construction of CI

a criterion has to be adopted to define a weighting system



improvement and refinement of the adopted model of measurement.

General statements



Generic weighting system identification

needs to **take into account** :

- ↪ **rationale and theoretical framework**
- ↪ **meaning and contribution of each sub-score**
- ↪ **quality of data and statistical adequacy of indicators**

Generic weighting system identification

needs to **take into account** :

rationale and theoretical framework on which the measurement of the complex characteristics is founded and that will consequently regard the synthetic score

meaning and contribution of each sub-score to the synthesis

quality of data and statistical adequacy of indicators

General statements



Generic weighting system identification
needs **decisions**

↪ **proportional size**

a. equal or differential weighting

↪ **aggregation technique**



b. compensatory or non-compensatory

Generic weighting system identification

needs decisions to be taken

proportional size of weights

a. equal or differential weighting

aggregation technique to be adopted

b. compensatory or non-compensatory

General statements



N.B.

A whole set of weights

does not exist

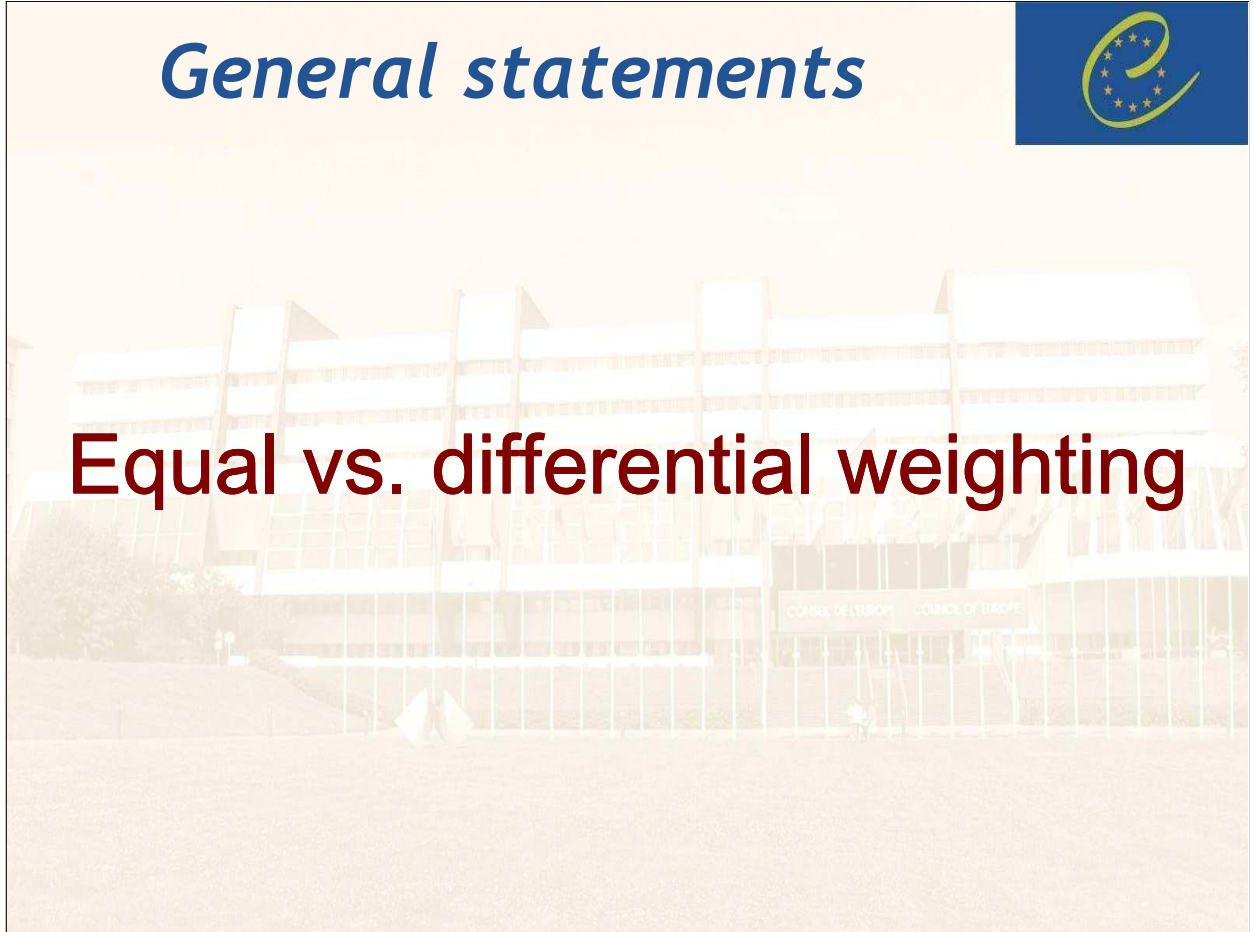
N.B.

A whole set of weights

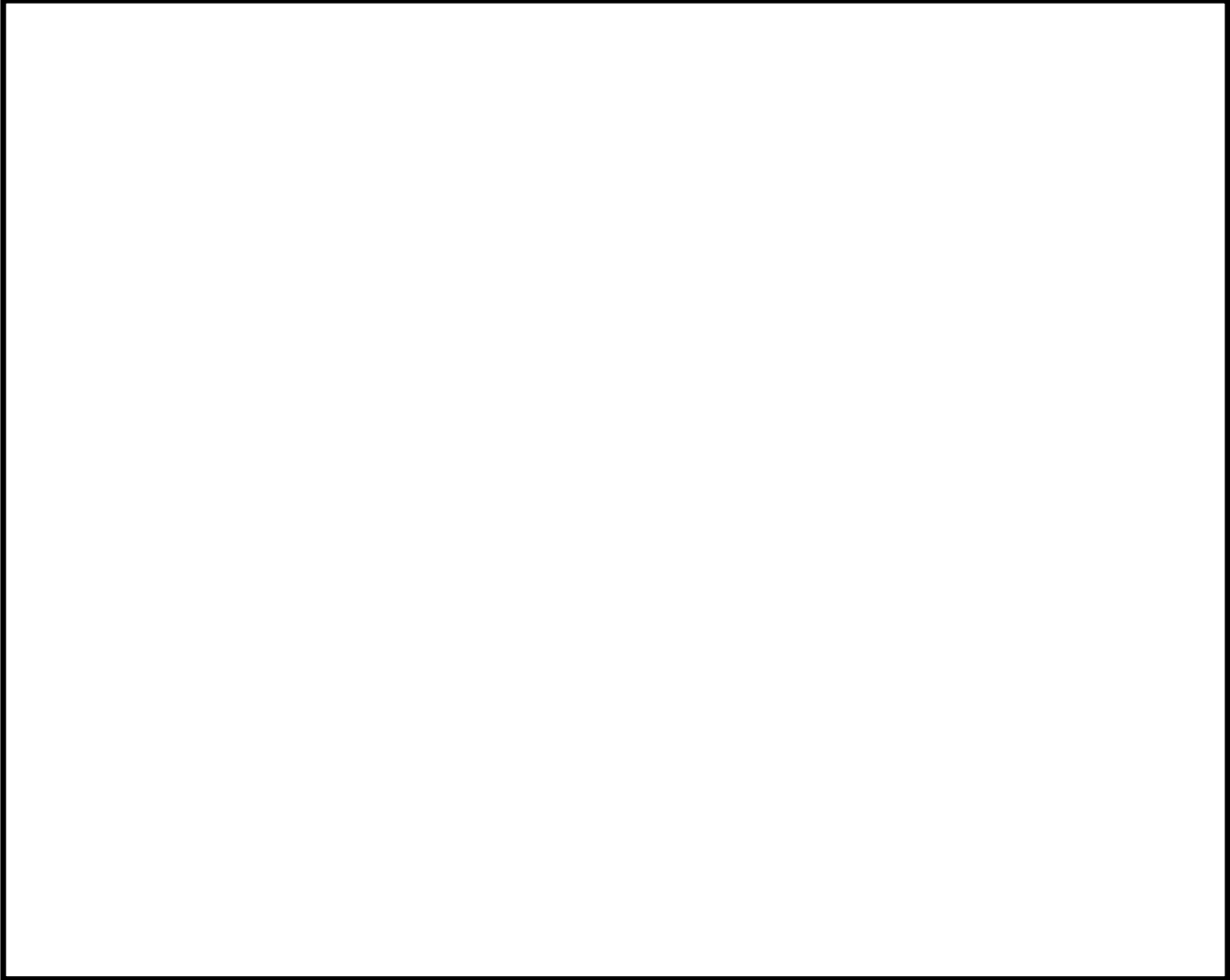
able to express in a **perfect way**
the contribution of each indicator

does not exist

General statements



Equal vs. differential weighting



General statements



First decision
Weighting

Equal ⇔ Different

The choice will strongly influence
the final results

General statements



Equal Weighting

Doubtful procedure mainly *when*

- ↪ **different components → different numbers**
→ synthetic score = unbalanced structure
- ↪ **indicators exist measuring the same component**
→ *double weighted* or *double counting*

different components have to be aggregated

by different numbers of indicators

→ synthetic score = unbalanced structure

indicators exist measuring the same component

→ *double weighted* or *double counting*

General statements



Differential Weighting

Doubtful procedure mainly *when* not supported by

↳ **theoretical reflections**

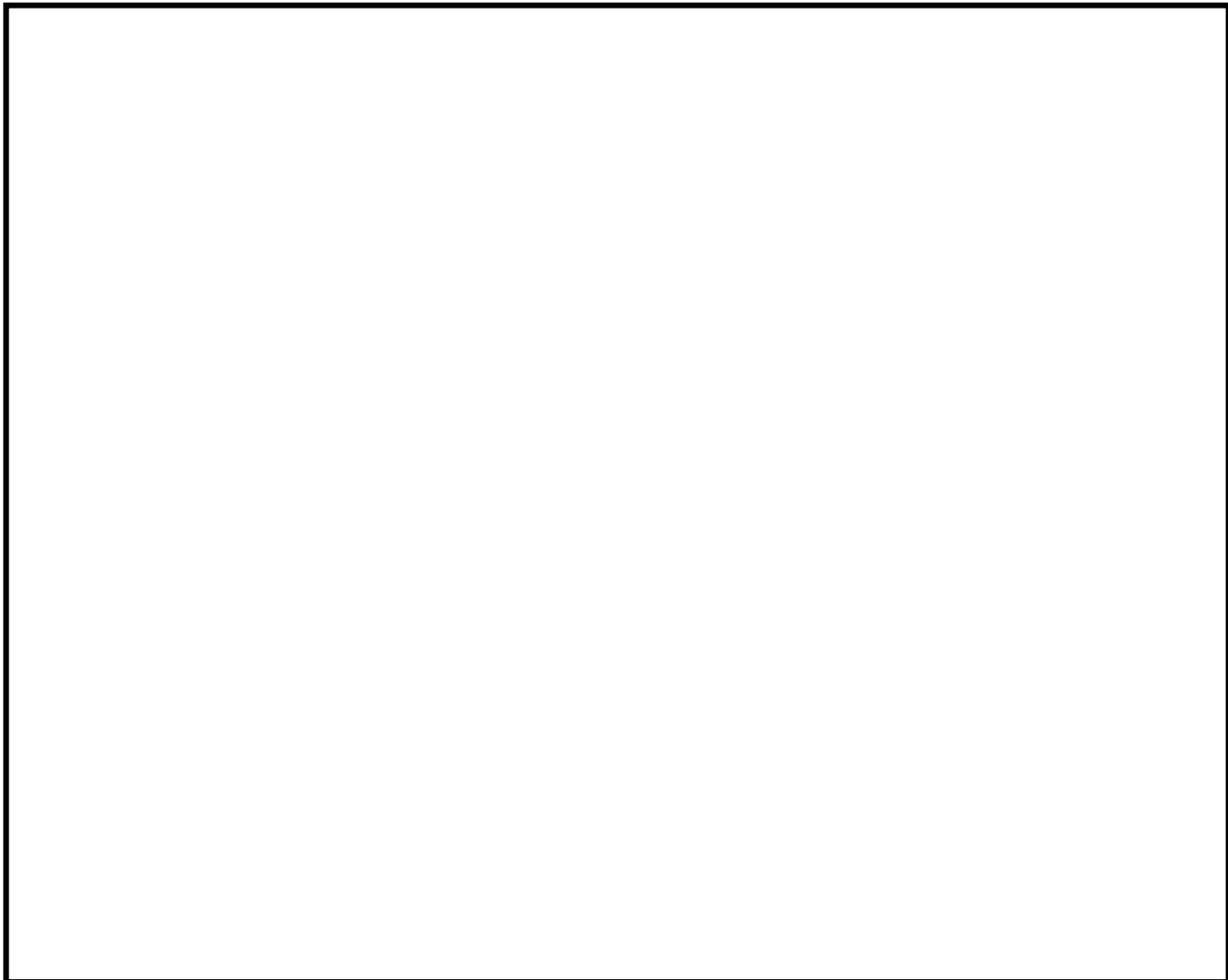
↳ **methodological concerns**

- **theoretical reflections** on the meaning and impact of each indicator on the synthesis,
- **methodological concerns** aimed at identifying proper and consistent techniques.

General statements



Compensatory and Non-compensatory aggregation techniques



General statements



In order to avoid incoherencies between

theoretical meaning
of weights



actual application
of weights



a consistent aggregating technique is needed
by considering compensability among
the elementary indicators

General statements



Compensatory aggregating approach

↪ **additive** (simple addition)

↪ **geometrical** (multiplicative technique)



low values compensated by high values



synthetic score does not allow us to return to the original individual profiles

→ **problems of interpretation** ←

Obtaining subjective weights statements



In obtaining
subjective weights
the decisions / choices
do not rely on experts

Obtaining subjective weights statements



Subjective weighting system identification
needs to **take into account** :

↪ **theoretical issue**

→ “importance” is a distinct construct ?

↪ **psychometric properties of importance ratings**

→ internal consistency and test-retest reliability

Obtaining subjective weights statements



Subjective weighting system identification :
a **model** should be chosen by considering

- ⇒ criterion
- ⇒ level
- ⇒ techniques
- ⇒ approach

Identification of a subjective weighting system:

a **model** should be chosen by considering

- ⇒ the criterion of importance or preference to be adopted
- ⇒ the level at which weights are determined and applied (**individual** or **group** weights)
- ⇒ the techniques allowing subjective evaluations and judgments to be collected (explicitly or implicitly)
- ⇒ the approach allowing a subjective importance/preference continuum to be constructed

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Obtaining weights approaches



Can produce weights:

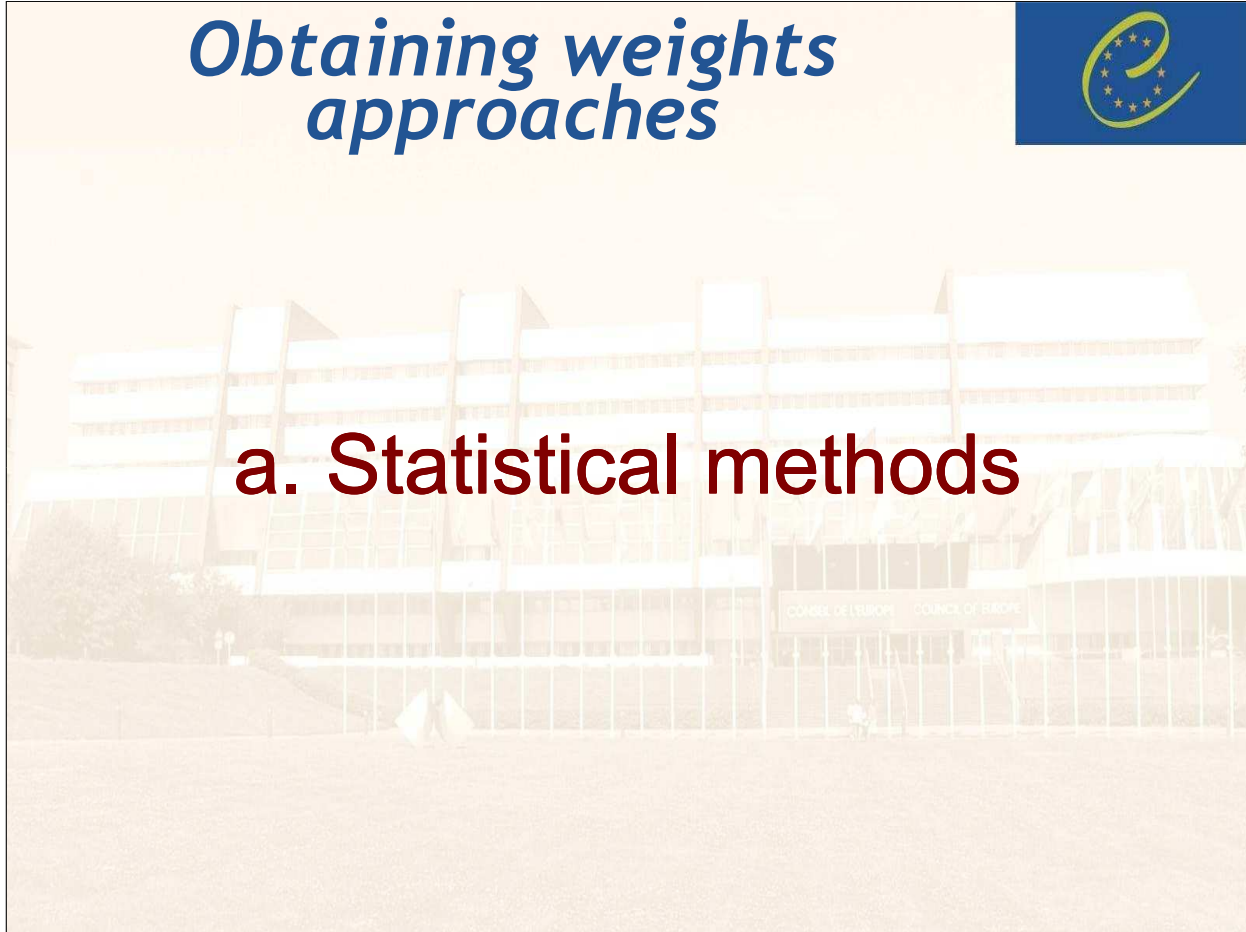
“objective” ⇒ a. statistical methods

“subjective” ⇒ b. multi-attribute approaches
c. scaling approaches

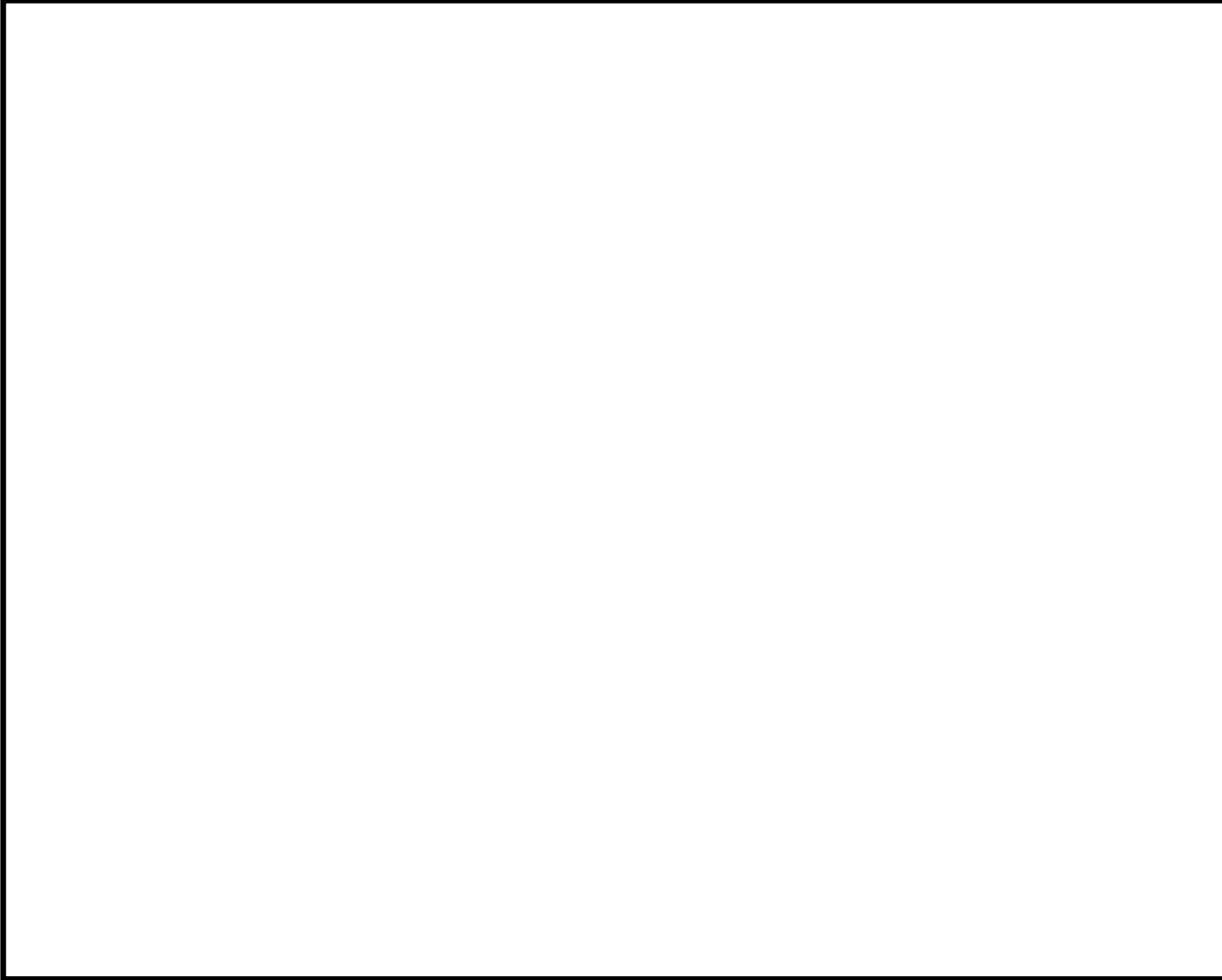
scaling approaches can

- handle subjective evaluations and judgments, explicitly or implicitly expressed
- obtain subjective weights at group level and at individual level.

Obtaining weights approaches



a. Statistical methods



Statistical methods



Weights are determined through

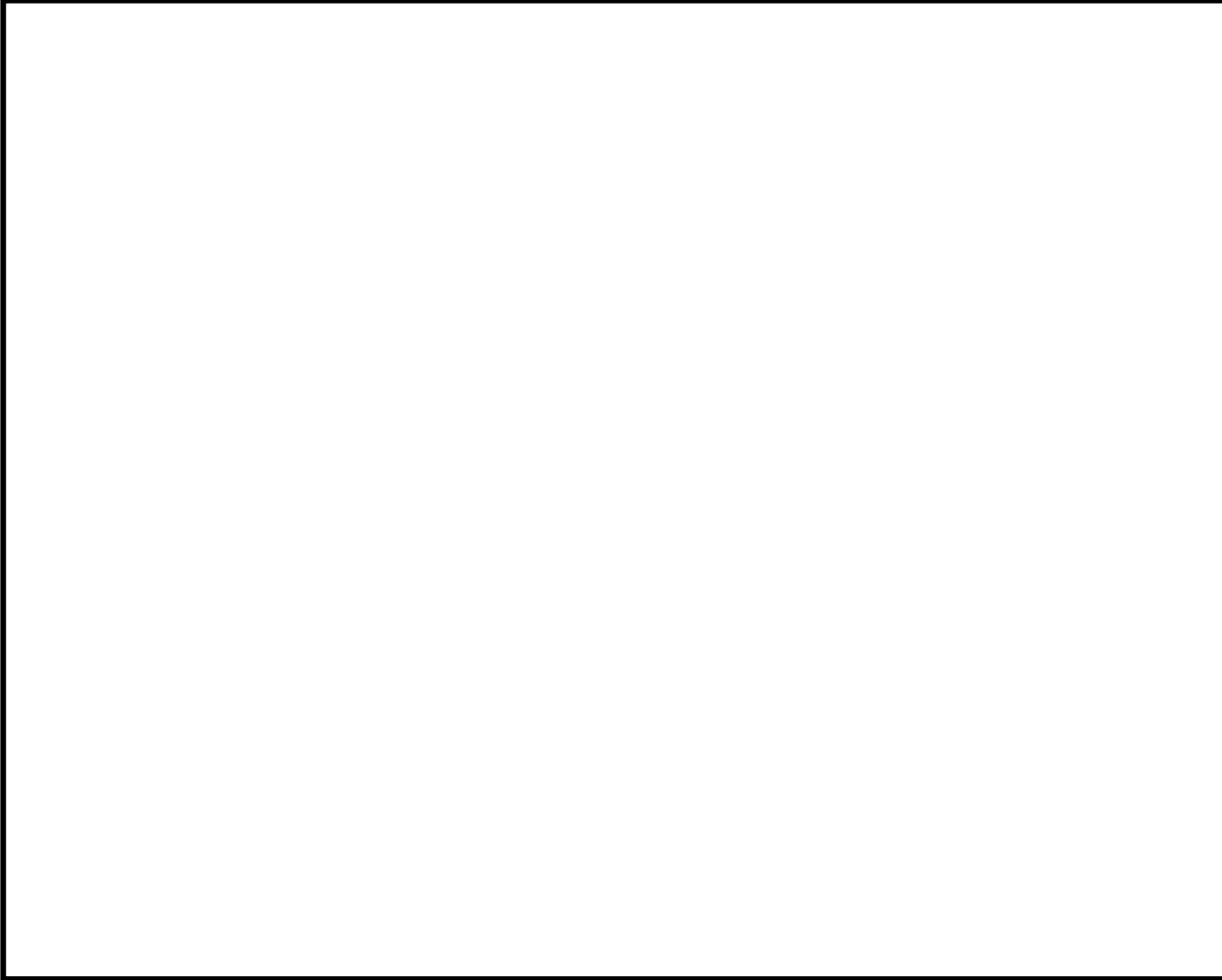


- 1. Correlation Analysis** the same data on which weights will be applied
- 2. Principal Component Analysis** the same data on which weights will be applied
- 3. Data Envelopment Analysis** the concept of efficient performance

Obtaining weights approaches



b. Multi-attributes approaches



Multi-attributes approaches



Multi-Attribute Models

allow
subjective importance weights to be identified at
subjective level
through an indirect approach
by

- managing a certain number of **combined comparisons**
- applying methods aimed at **making decision among different available alternatives**

Weights obtained through these methods are considered more stable than those produced by direct evaluations.

Multi-attributes approaches



Among these models we can distinguish:

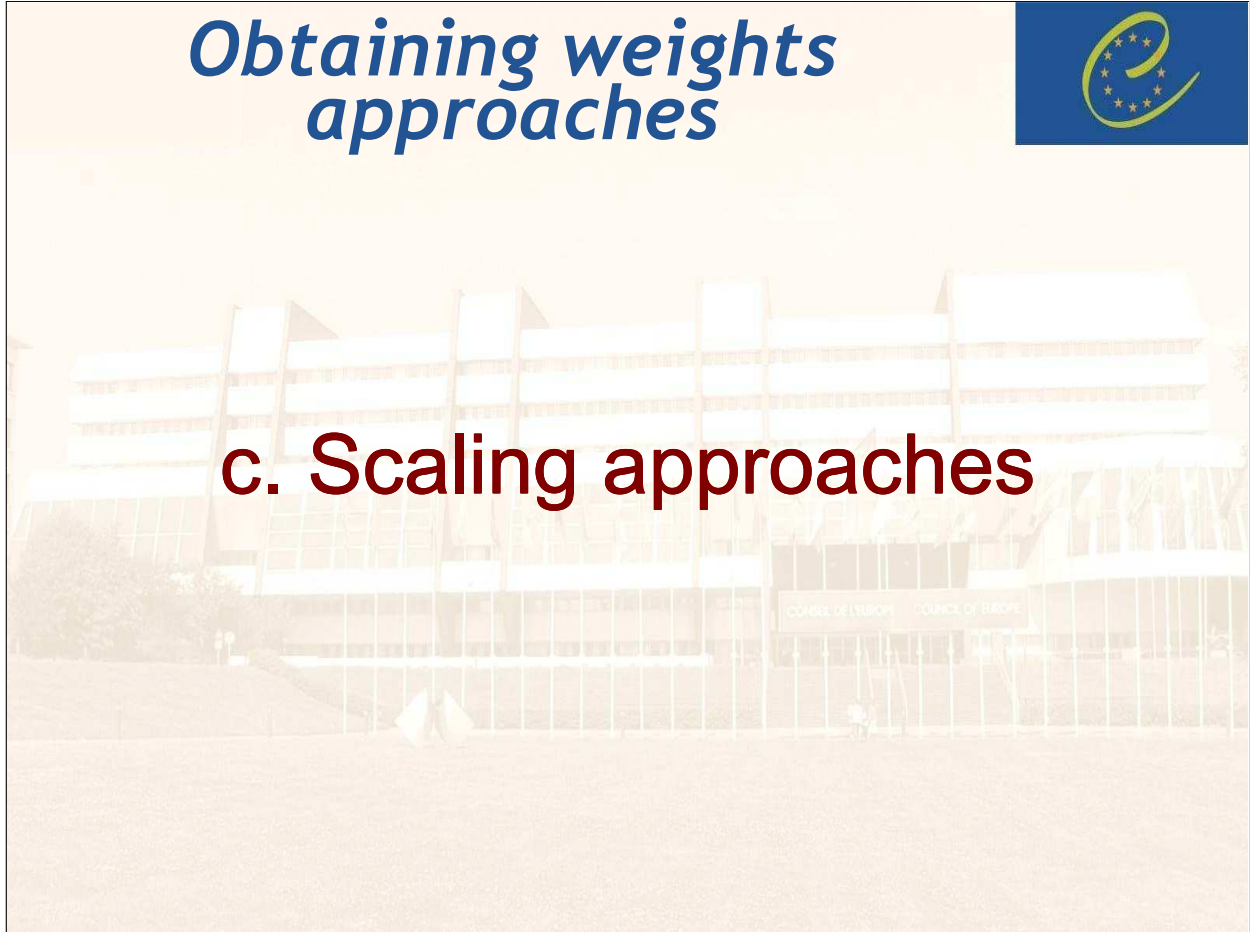
1. Multi-Attribute Decision Making:

↳ Analytic Hierarchy Process (AHP) pairwise comparison

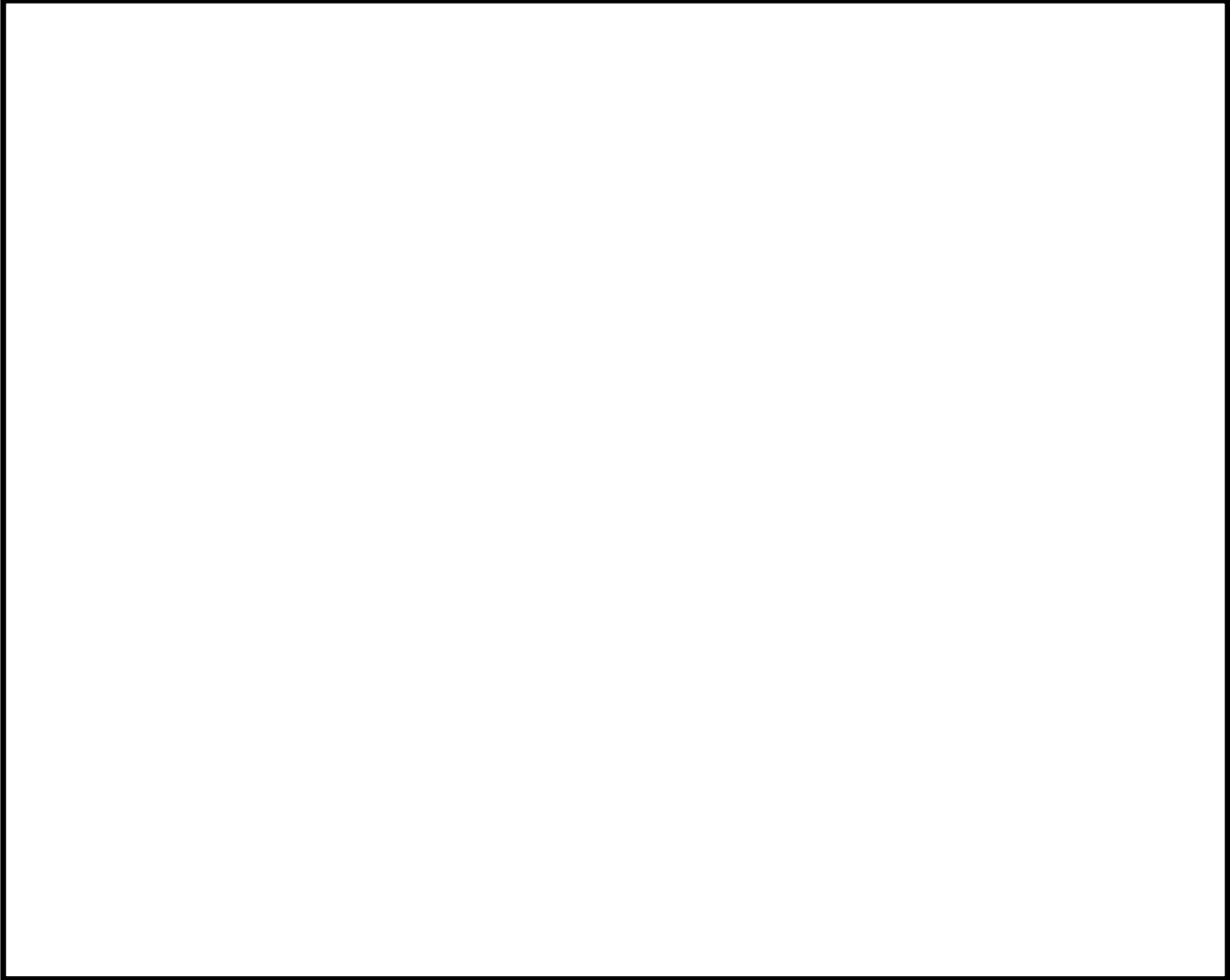
2. Multi-Attribute Compositional Models:

↳ Conjoint Analysis (CA)

Obtaining weights approaches



c. Scaling approaches



Scaling approaches



They can be classified through their features:

- ↪ Dimensionality
- ↪ Nature of data
- ↪ Scaling technique
- ↪ Criterion for testing the model
- ↪ Standard of measurement
- ↪ Contribution to the measurement of each multiple measures

Scaling approaches



Scaling model		Dimensionality	Nature of data	Scaling technique	Criterion for testing the model	Standard of measurement: final (synthetic) score assigned to		
Additive	Uni-dimensional	Uni	Single-stimulus	Not-comparative	Internal consistency	Cases		
	Multidimensional	Multi	Single-stimulus	Not-comparative	Dimensionality of the items	Cases		
Cumulative	Thurstone model (differential scale)		Uni	Stimulus comparison	Comparative (pair comparison or rank-order)	Metrics between items	Items	
	Q methodology		Uni	Stimulus comparison			Comparative (rank-order or comparative rating)	Items
	Deterministic	Guttman		Uni	Single-stimulus	Not-comparative	Scalogram analysis: reproducibility, scalability and ability to predict	Cases and items
		Multidimensional Scalogram Analysis (MSA)		Bi			Regionality and contiguity	Cases and items
		Partial Ordered Scalogram Analysis (POSA)		Bi			Correct representation	Cases and items
	Probabilistic	Monotone (one or more parameters)			Single-stimulus	Not-comparative	<ul style="list-style-type: none"> parameters estimation (maximum likelihood) goodness of fit (<i>misfit</i> and residuals analysis) 	Cases and items (without condensation)
Perceptual Mapping	Multidimensional scaling		Multi	Similarities	Comparative (pair comparison)	Goodness of fit of distances to proximities (stress, alienation)	Items	
	Unfolding		Uni & Multi	Preferential choice	Comparative	Goodness of fit of distances to ordinal preferences	Cases and items	
Conjoint model		Multi	Preferential choice	Comparative (rank-order)	Goodness of fit of the model (part-worth) to the ranking	Items at individual level		

Scaling approaches



Among all these approaches we need to select those approaches that utilize data:

↪ whose nature is comparative or preferential

↪ (in yellow in the previous table)

↪ produced by a comparative scaling technique

↪ (in pink in the previous table)

Scaling approaches



Scaling models allowing subjective weights to be obtained are

↳ **group weighting:**

↳ *Thurstone model (differential scale)*

↳ *Unfolding model (perceptual mapping)*

↳ **individual weighting:**

↳ *Conjoint model*

In our perspective, these models can be distinguished with reference to the possibility to define subjective weights at individual level or at group level (last column of the previous table), in particular:

- **group weighting:** *Thurstone model (differential scale), unfolding model*

- **individual weighting:** *conjoint model (see above)*

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Conclusions



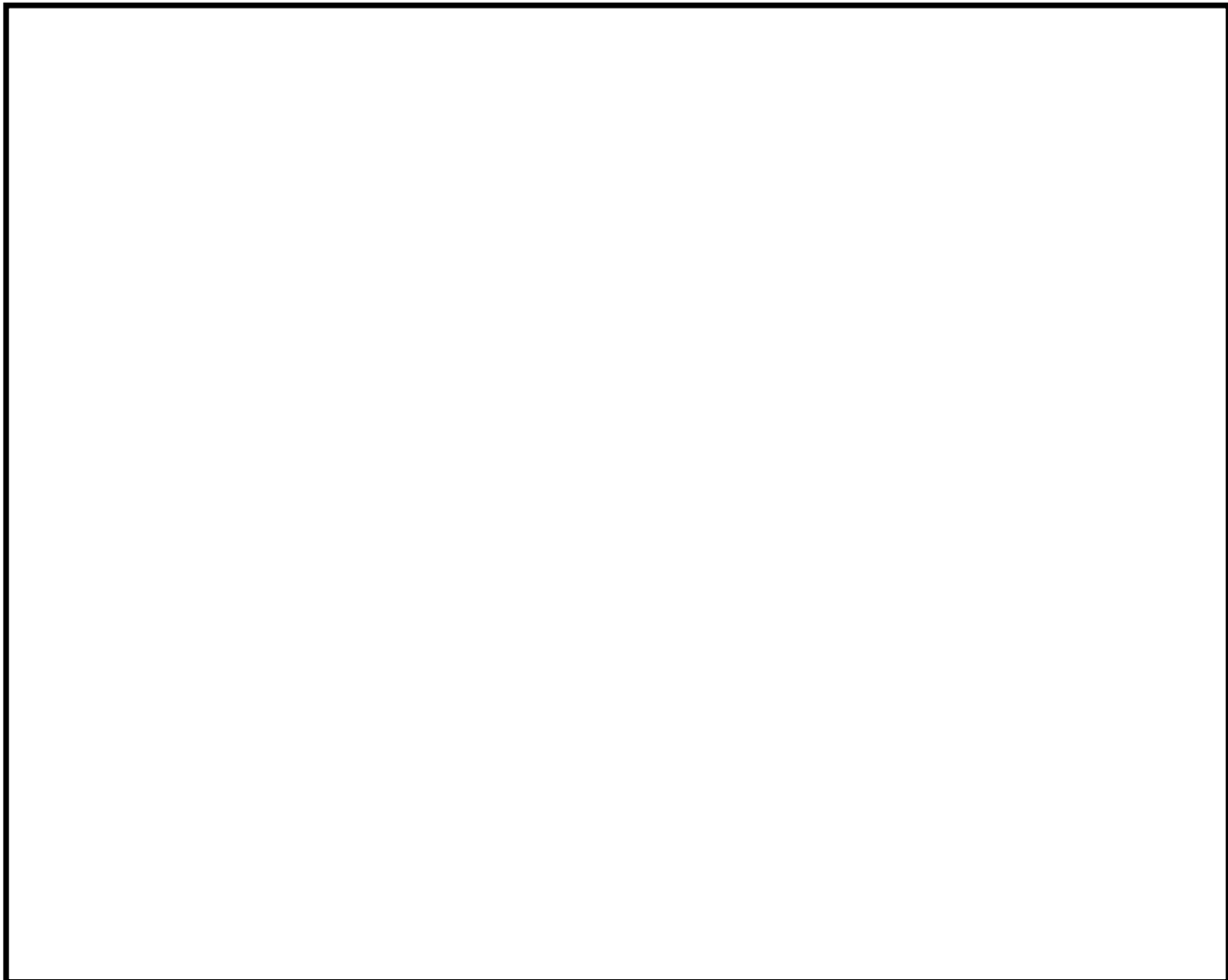
This work aims at systematically framing the issue and showing the possible approaches in order to obtaining weights in a subjective perspective



anticipating a **research proposal** we are going to define



clarifying many technical issues



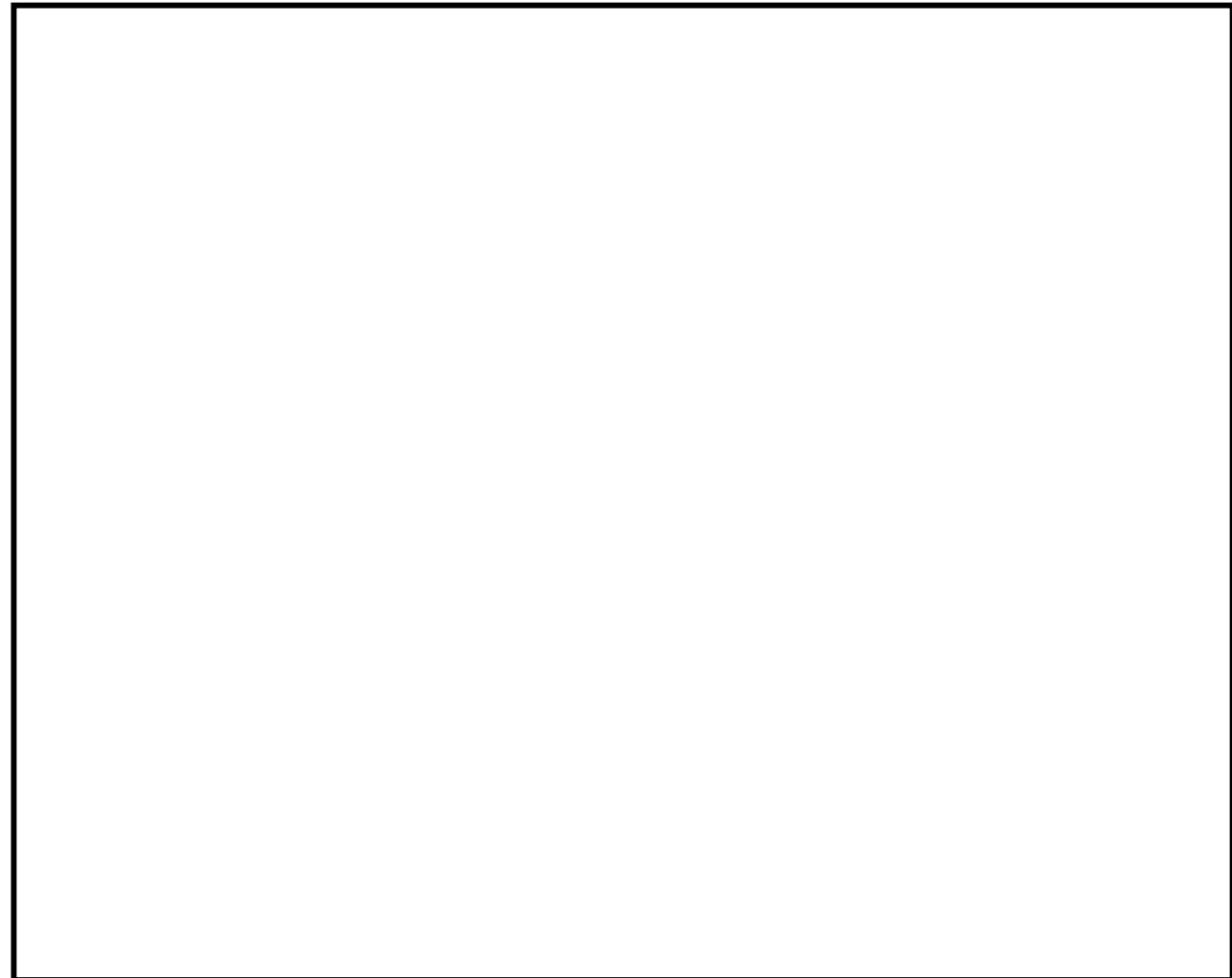
Conclusions



Difficulties

Obtaining subjective weights requires and relies on the accomplishment of large survey projects aimed at collecting “importance” data

- ↪ Time
- ↪ Resources
- ↪ Sampling
- ↪ Field work
- ↪ ...



Conclusions



«Constructing composite indicators should take into account the agreement among citizens concerning the importance to be assigned to each indicator»

(Hagerty and Land, 2007)

Seen in this perspective, this topic can be placed in the ambit of an improvement of democratic participation to decisions (“res publica”)



That's all folks!

Thank you for your attention

Presentation designer: trapani.marco@gmail.com