

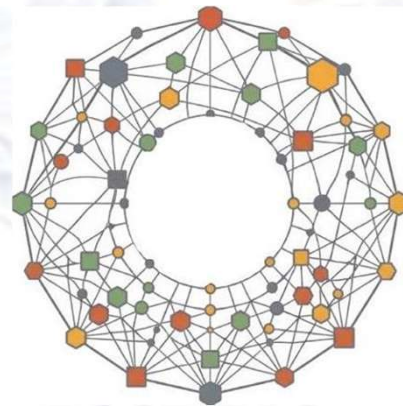


Centro italo-tedesco per il dialogo europeo  
Deutsch-Italienisches Zentrum für den Europäischen Dialog

# **Looking Back and Moving Forward in Challenging Times Trends in Well-being, Quality of Life, and Social Monitoring and Reporting**

20<sup>th</sup> Anniversary Conference on Social Monitoring and Reporting in Europe

# Analyzing BES indicators in systemic terms: A proposal for applying graph theory



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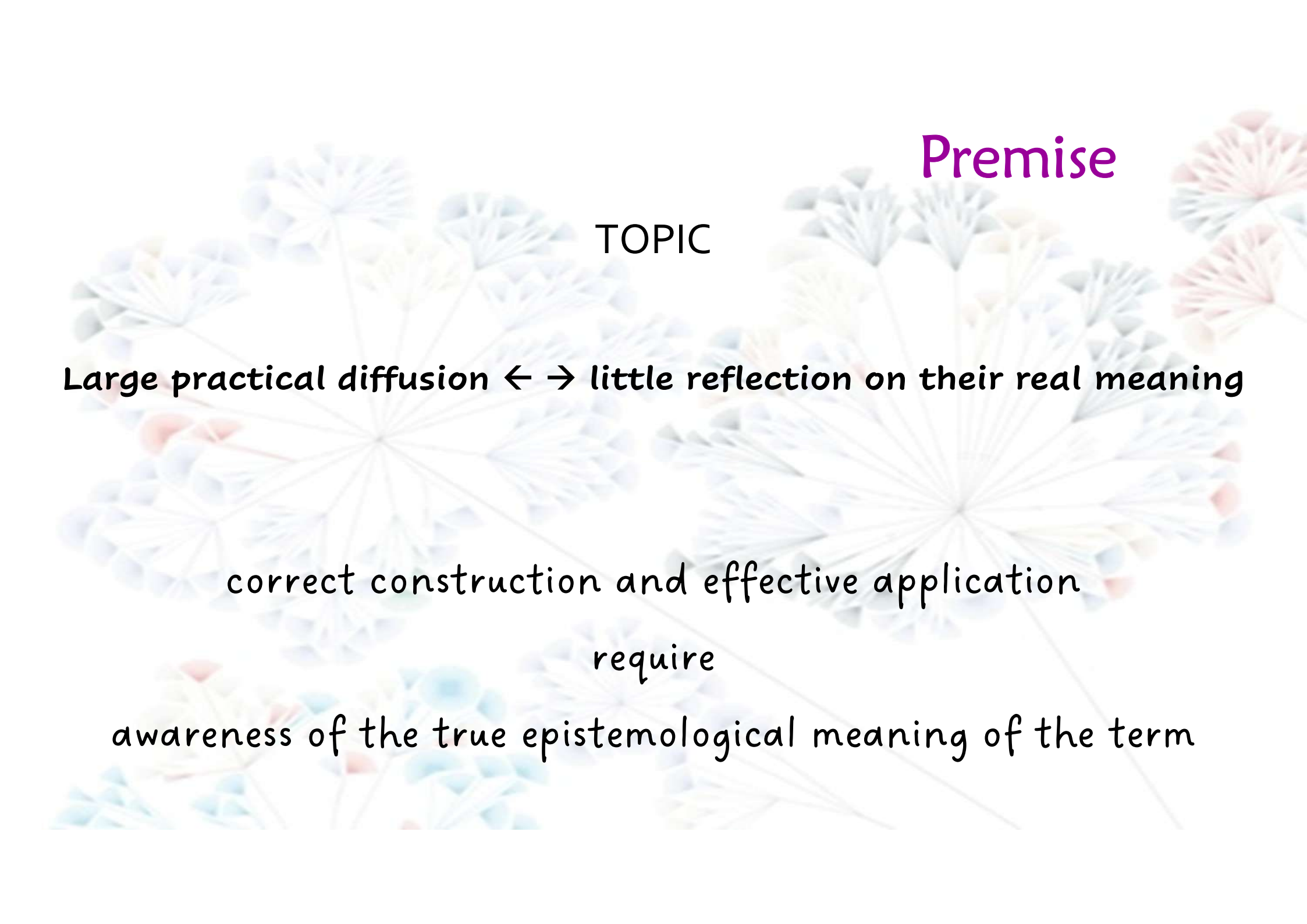
What are indicators?

# Premise

## TOPIC

«Indicator» → a term widely used to refer to

- content (social indicators, quality-of-life indicators, etc.)
- context or domain (financial indicators, health system indicators, evaluation indicators, etc.)
- role or function (impact indicators, outcome indicators, etc.)



Premise

TOPIC

Large practical diffusion  $\leftrightarrow$  little reflection on their real meaning

correct construction and effective application

require

awareness of the true epistemological meaning of the term

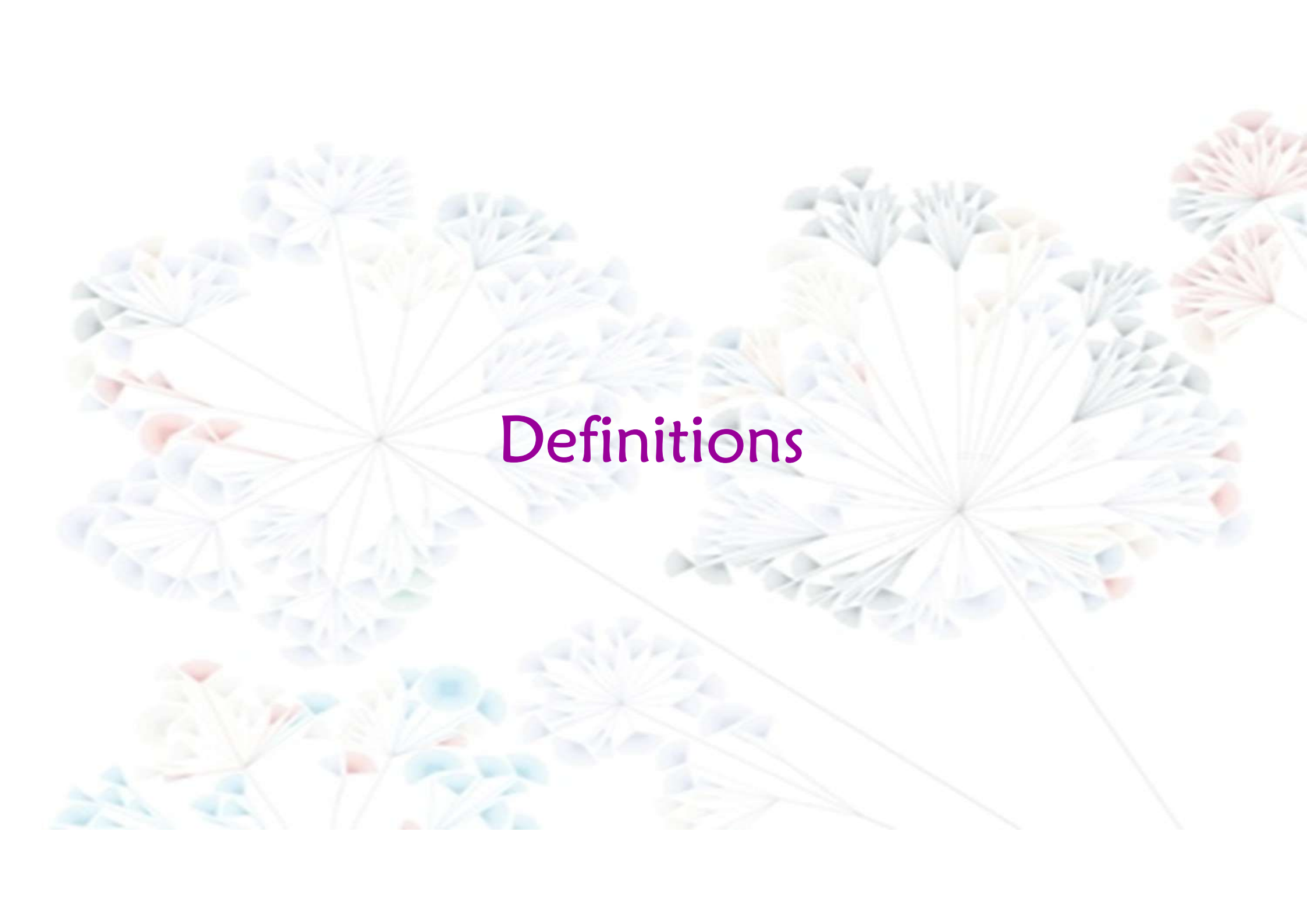
# Definitions

## (4) A normative process

normative nature of the selection of indicators  
cannot be denied

the process contains a "subjective" component

GDP is the most important example of failing in using a statistics as  
an indicator



# Definitions

# Definitions

## (1) Measurement process in science

In order to start any measurement process, a crucial guiding principle is identified ...

# Definitions

## (1) Measurement process in science

### Three approaches to measurement:

- **fundamental process** → not derived from other measures (length, volume)
- **deriving process** → derived from other measures (density, velocity)
- **defining process** → achieved as a consequence of a definition (socio-economic status) by developing **indicators**

# Definitions

## (2) Index or indicator?

**“indicator”**



*who or what indicates*

**“index”**



*anything useful to indicate*

**from Latin**

# Definitions

## (2) Index or indicator?

**Indicator**



what relates  
concepts to reality  
through observation

# Definitions

## (2) Index or indicator?

Indicator



not

a simply crude statistical information

but

a measure organically connected to a conceptual model

# Definitions

## (3) The concept of “indicator”

... but ... **what actually is an “indicator”?**

# Definitions

## (3) The concept of “indicator”

### Indicators as:

1. **sign** that communicates a concept
2. **instrument**, value resulting from a measurement aimed at monitoring a certain characteristic → monitoring, evaluation
3. **operator** of a semantic relation (relationship between concept and measure)

# Definitions

## (3) The concept of “indicator”

### 1. SIGN



Wikipedia  
File:Italian traffic signs ...



DENIOS Srl - Dispo...  
Segnale di pericolo...



BricoForniture - Disponibile  
Segnale altri pericoli - Seg...



AlVolante  
Segnali di pericolo nel codice...



eBay - Disponibile  
Cartelli Segnaletica Str...



BricoForniture - Disponibile  
Segnale discesa pericolos...



Leonori  
Cartelli stradali: la guid...



Autoscuola.net  
La categoria dei segnali di pericol...



Brico Sky - Disponibile  
Segnale pericolo generico...



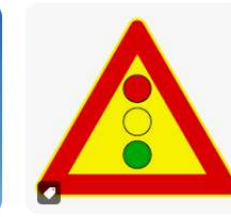
Sibeshop - Disponibile  
Vendita online di segnale ....



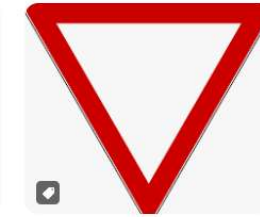
Dolcidecori.it - Disponibile  
Placchette di segnale stradali in zuc...



Virgilio  
Segnali stradali più difficili, quali sono e c...



Brico Sky - Disponibile  
Segnale preavviso di sem...



BricoForniture - Disponibile  
Segnale dare precedenza - S...



Amazon.it - Disponibile  
Segnale stradale velocità ...



# Definitions

## (3) The concept of “indicator”

### 2. OPERATIONAL TOOL

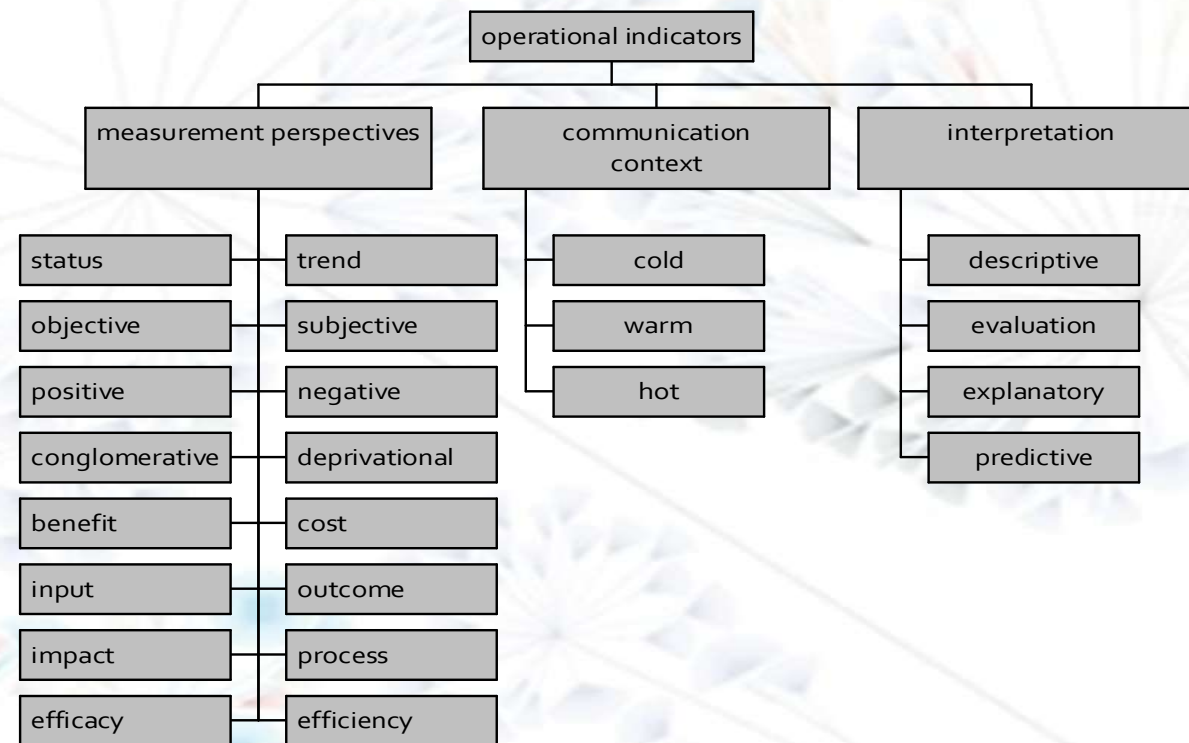
**Indicators developed and managed so that they ...**

... represent different aspects of the reality,  
... picture the reality in an interpretable way, and  
... allow meaningful stories to be told

# Definitions

## (3) The concept of “indicator”

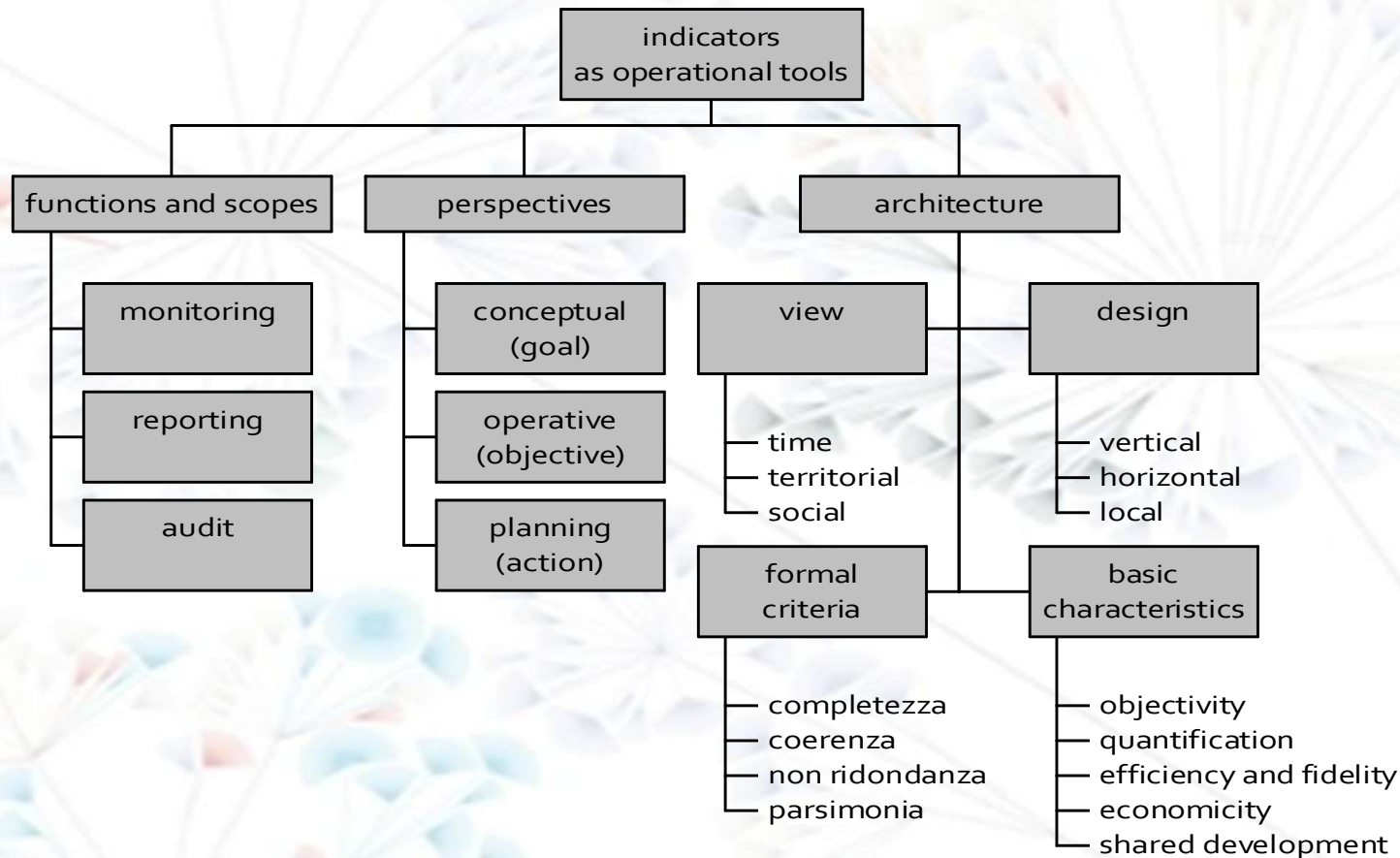
### 2. OPERATIONAL TOOL



# Definitions

## (3) The concept of “indicator”

### 2. OPERATIONAL TOOL



# Definitions

## (3) The concept of “indicator”

### 3. SEMANTIC OPERATOR



By Carlos Martin

# Definitions

## (3) The concept of “indicator”

### 3. SEMANTIC OPERATOR

Indicators require:

- a robust *conceptual definition*
- a consistent *collection of observations*
- a consequent *analysis of the relationship* between observations and defined concepts.

# Definitions

## (3) The concept of “indicator”

### 3. SEMANTIC OPERATOR

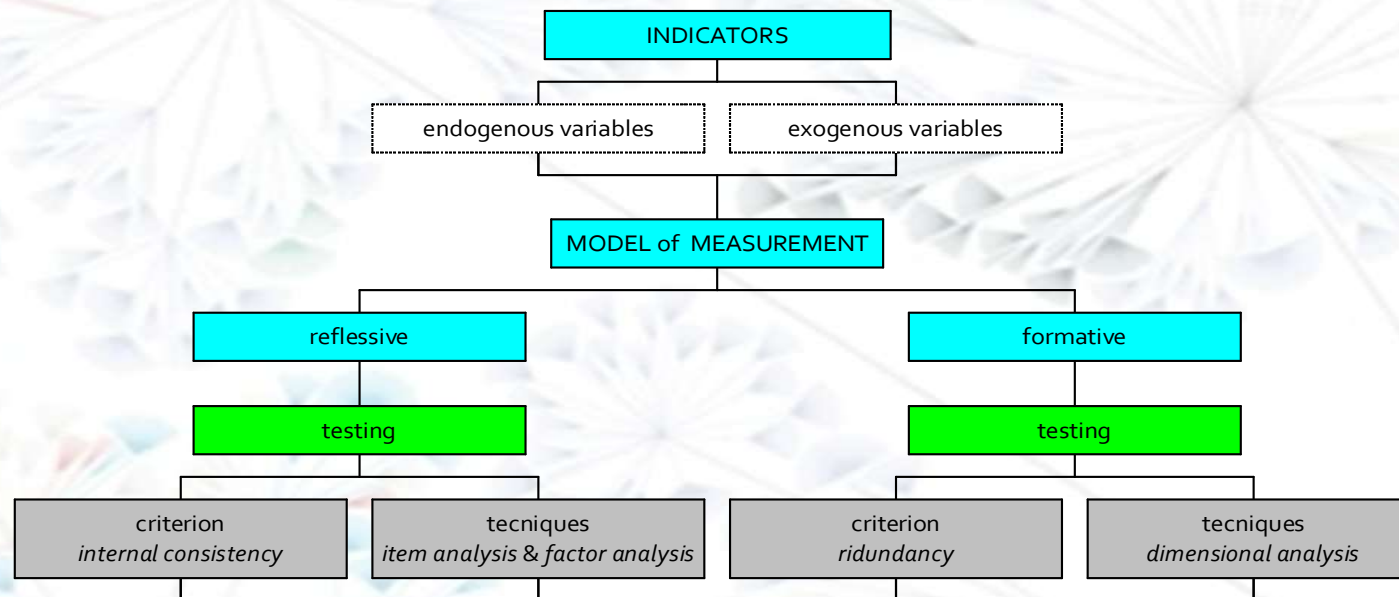
## Model of measurement

# Definitions

## (3) The concept of “indicator”

### 3. SEMANTIC OPERATOR

## Model of measurement: assessment

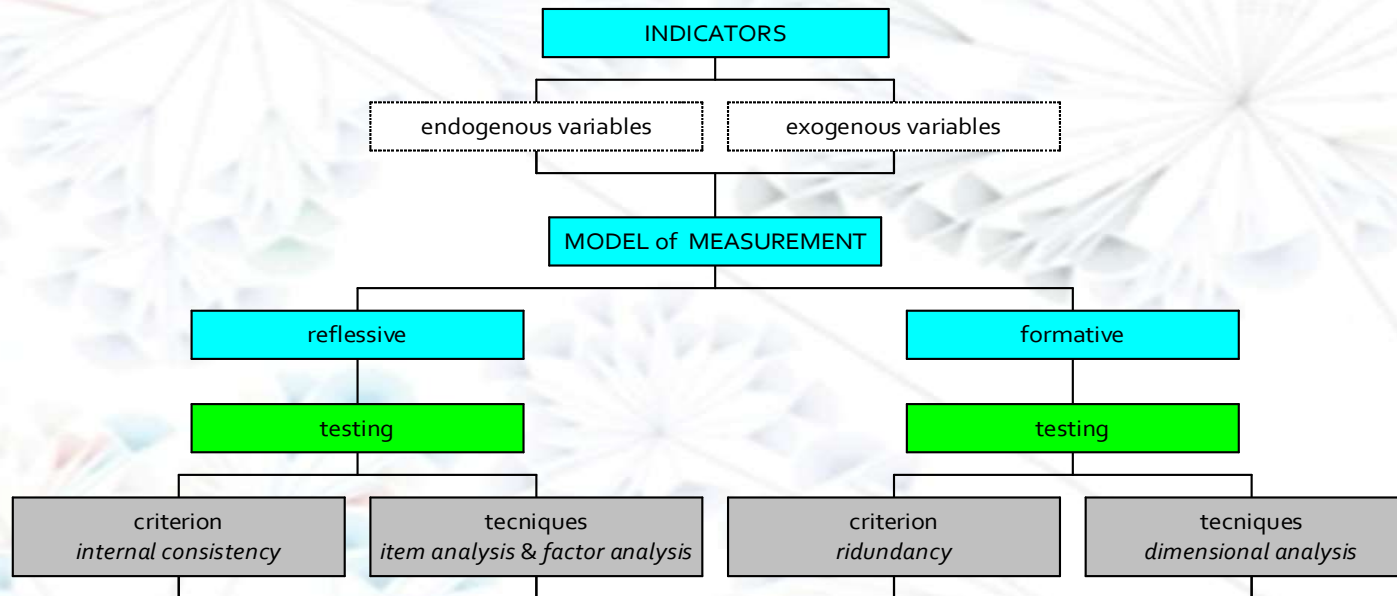


# Definitions

### (3) The concept of “indicator”

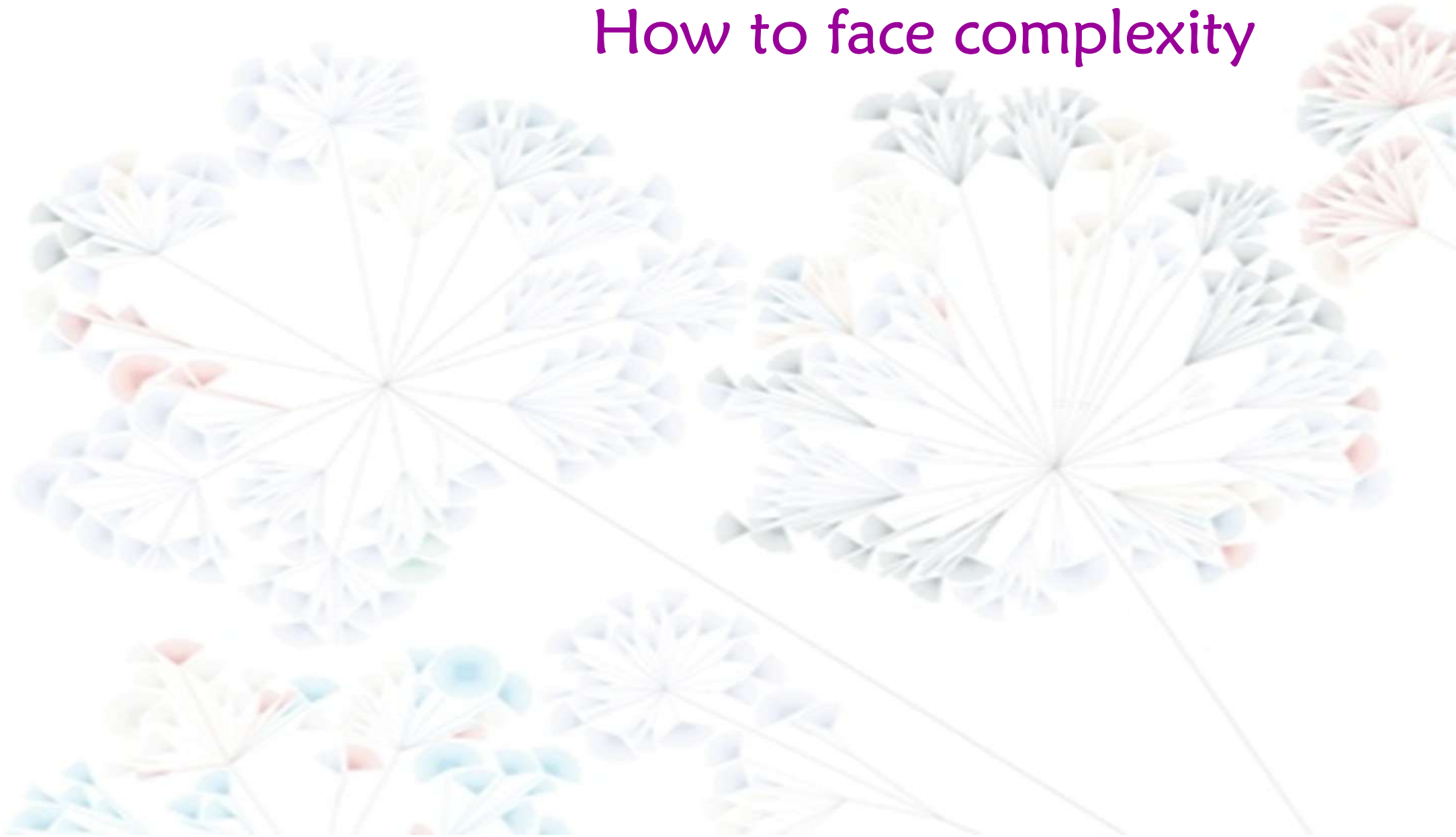
### 3. SEMANTIC OPERATOR

## Model of measurement: assessment



Mixed models  
(PLS, MIMIC,  
etc.)

# How to face complexity

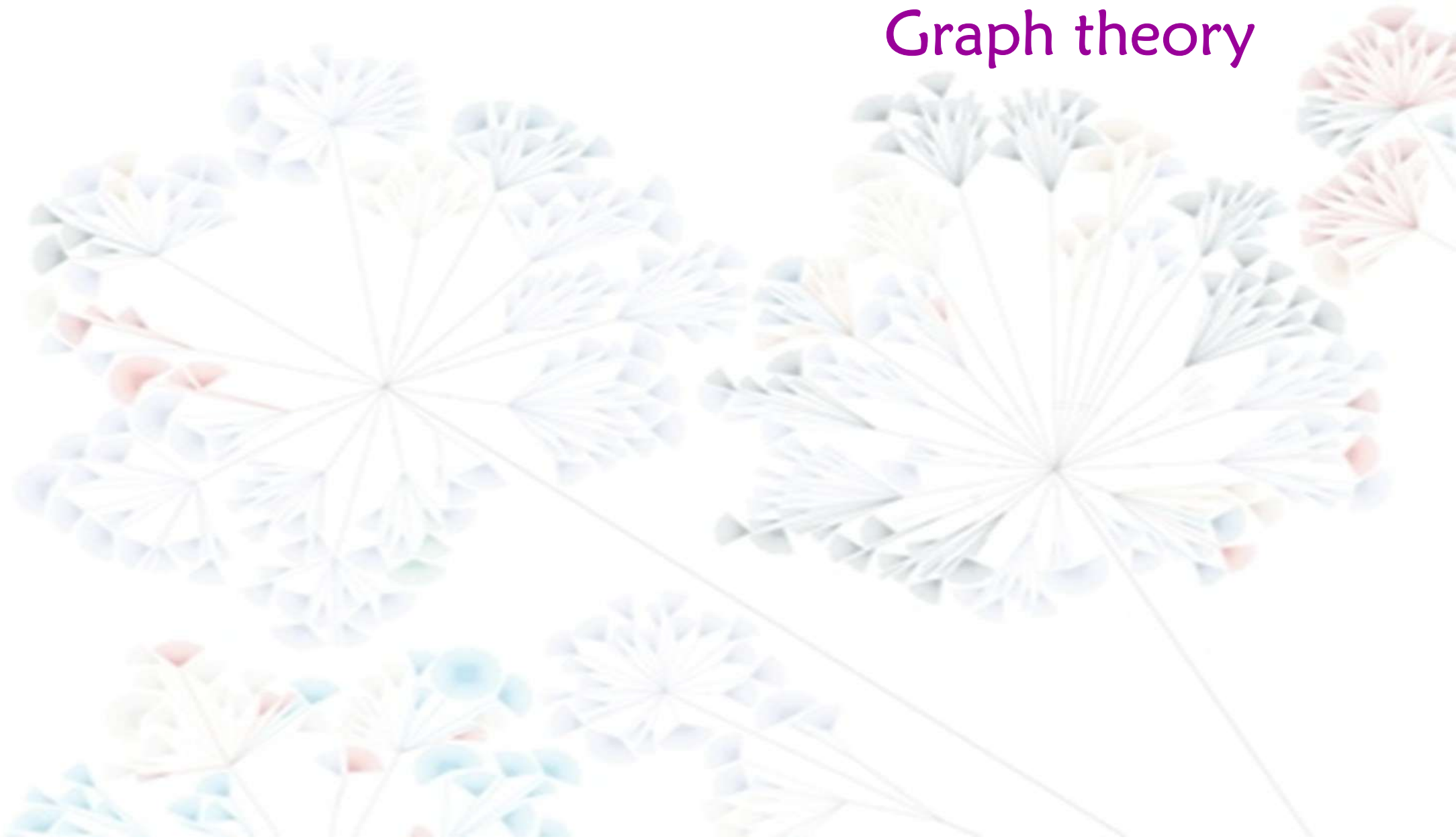


# How to face complexity

## Approaches to analysis

1. **Operational objectives** → evaluation, benchmark, assessment, ...
2. **Testing the measurement model and modelling indicators**  
(FA, SEM, PLS, MIMIC, etc.)
3. **Syntesis of indicators** (scaling models, aggregative approaches, non-aggregative approaches)
4. **Relational analysis** (Network Science, ...)

# Graph theory



# Graph theory

A complex system can be represented as a **network**, or in mathematical terms, as a graph.

What is a GRAPH?

A simple, undirected graph is defined as a pair  $g = (v, e)$  where:

- V: = VERTEX/ NODE
- E: = EDGE / ARC

AT A GRAPHICAL LEVEL, A GRAPH CAN Be REPRESENTED THROUGH SIMPLE GEOMETRIC FIGURES, USING POINTS TO DENOTE THE VERTICES AND LINES OR CURVES TO DENOTE THE EDGES.

# Graph theory

In cases where the analysis concerns a system of indicators:

- the **network boundary** is determined at the outset (the set of indicators comprising the system);
- the **anchoring** depends on the type of analysis to be conducted.

# Graph theory

Approaches to analyzing the network of indicators can be classified based on:

- the **object of analysis**: the node (or vertex), the group (a subset of vertices or nodes), or the global system or network (the set of vertices or nodes);
- the **perspective** adopted to study the relationships, which can be:
  - i. **positional**, when focusing on an indicator's relationships to determine its position within the network under study;
  - ii. **relational**, when focusing on the relationships between the indicators.

# Graph theory

## Value of the edges

value representing the statistical relationship between the nodes by drawing on observations of the other elements.

# Graph theory

## Different analytical perspectives

From this perspective, given indicators observed

- across various cases (individuals, regions, cities)
- at different points in time (months, years, etc.),

a variety of analyses can be performed on these indicators:

# Graph theory

|   | NODES      | EDGES enhanced through the statistical relationship between nodes, using as observations |                         | The finale GRAPH represents a synthesis for |
|---|------------|------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------|
|   |            | over all                                                                                 | by using                |                                             |
| 1 | indicators | cases                                                                                    | association coefficient | each year                                   |
| 2 | indicators | years                                                                                    | association coefficient | each case                                   |
| 3 | years      | indicators                                                                               | profiles' association   | each case                                   |
| 4 | years      | cases                                                                                    | association coefficient | each indicator                              |
| 5 | cases      | indicators                                                                               | profiles' association   | each year                                   |
| 6 | cases      | years                                                                                    | association coefficient | each indicator                              |

# The application

# The application

bes

benessere  
equo  
sostenibile

**fair** and **sustainable** wellbeing

# The application

**BES** is a joint initiative

**CNEL** (National Council for Economics and Labour)

and

**ISTAT** (Italian National Institute of Statistics)

**Launched in 2010**

# The application

## Two committees

### Steering Committee

CNEL & ISTAT



unions and management, civil  
society, ...

April 2011 – December 2012

### Scientific Committee

ISTAT



ISTAT researchers and academics  
professors

May 2011 – December 2012

# The application

## Two committees

### Steering Committee

CNEL & ISTAT



defining domains

**12 domains were defined**

### Scientific Committee

ISTAT



selecting indicators



**134 indicators**

# The application

## Public consultation



# The application

## Domains

|           |                                    |           |                         |
|-----------|------------------------------------|-----------|-------------------------|
| <b>1</b>  | HEALTH                             | <b>5</b>  | SOCIAL RELATIONSHIPS    |
| <b>2</b>  | EDUCATION AND TRAINING             | <b>6</b>  | POLICY AND INSTITUTIONS |
| <b>3</b>  | WORK AND LIFE BALANCE              | <b>7</b>  | SECURITY                |
| <b>4</b>  | ECONOMIC WELL-BEING                | <b>8</b>  | SUBJECTIVE WELL-BEING   |
| <b>9</b>  | LANDSCAPE<br>AND CULTURAL HERITAGE | <b>11</b> | RESEARCH AND INNOVATION |
| <b>10</b> | ENVIRONMENT                        | <b>12</b> | QUALITY OF SERVICES     |

## Le tendenze del benessere

| INDICATORE                                                                                                     | PERIODO<br>CONSIDERATO | FINO<br>AL 2008 | DAL 2008<br>IN POI |
|----------------------------------------------------------------------------------------------------------------|------------------------|-----------------|--------------------|
| <b>Salute</b>                                                                                                  |                        |                 |                    |
| Speranza di vita alla nascita (Maschi)                                                                         | 2004-2011              | ↑               | ↑                  |
| Speranza di vita alla nascita (Femmine)                                                                        | 2004-2011              | ↑               | ↑                  |
| Speranza di vita in buona salute alla nascita (Maschi)                                                         | 2009-2010              |                 | ↑                  |
| Speranza di vita in buona salute alla nascita (Femmine)                                                        | 2009-2010              |                 | ↑                  |
| Indice di stato fisico (Pcs)                                                                                   | 2005                   |                 |                    |
| Indice di stato psicologico (Mcs)                                                                              | 2005                   |                 |                    |
| Tasso di mortalità infantile                                                                                   | 2004-2009              | ↑               | ↓                  |
| Tasso standardizzato di mortalità per incidenti di trasporto                                                   | 2004-2009              | ↑               | ↑                  |
| Tasso standardizzato di mortalità per tumore                                                                   | 2004-2009              | ↑               | ↑                  |
| Tasso standardizzato di mortalità per demenza e malattie del sistema nervoso                                   | 2004-2009              | ↓               | ↓                  |
| Speranza di vita senza limitazioni nelle attività quotidiane a 65 anni (Maschi)                                | 2008-2010              |                 | ↑                  |
| Speranza di vita senza limitazioni nelle attività quotidiane a 65 anni (Femmine)                               | 2008-2010              |                 | ↑                  |
| Eccesso di peso                                                                                                | 2005-2011              | ↑               | ↑                  |
| Fumo                                                                                                           | 2005-2011              | ↑               | ↑                  |
| Alcol                                                                                                          | 2007-2011              | ↑               | ↑                  |
| Sedentarietà                                                                                                   | 2005-2011              | ↑               | ↑                  |
| Alimentazione                                                                                                  | 2005-2011              | ↑               | ↓                  |
| <b>Istruzione e formazione</b>                                                                                 |                        |                 |                    |
| Partecipazione alla scuola dell'infanzia                                                                       | s.a. 2010/11           |                 |                    |
| Persone con almeno il diploma superiore                                                                        | 2004-2011              | ↑               | ↑                  |
| Persone che hanno conseguito un titolo universitario                                                           | 2004-2011              | ↑               | ↑                  |
| Uscita precoce dal sistema di istruzione e formazione                                                          | 2004-2011              | ↑               | ↓                  |
| Giovani che non lavorano e non studiano (Neet)                                                                 | 2004-2011              | ↑               | ↓                  |
| Partecipazione alla formazione continua                                                                        | 2004-2011              | ↑               | ↓                  |
| Livello di competenza alfabetica degli studenti                                                                | s.a. 2011/12           |                 |                    |
| Livello di competenza numerica degli studenti                                                                  | s.a. 2011/12           |                 |                    |
| Persone con alti livelli di competenza informatica                                                             | 2004-2012              | ↑               | ↑                  |
| Partecipazione culturale                                                                                       | 2004-2012              | ↑               | ↓                  |
| <b>Lavoro e conciliazione dei tempi di vita</b>                                                                |                        |                 |                    |
| Tasso di occupazione 20-64 anni                                                                                | 2004-2011              | ↑               | ↓                  |
| Tasso di mancata partecipazione al lavoro                                                                      | 2004-2011              | ↑               | ↓                  |
| Percentuale di trasformazioni nel corso di un anno da lavori instabili a lavori stabili                        | 2005-2011              | ↑               | ↓                  |
| Percentuale di occupati in lavori a termine da almeno 5 anni                                                   | 2004-2011              | ↑               | ↓                  |
| Incidenza di lavoratori dipendenti con bassa paga                                                              | 2008-2011              |                 | ↑                  |
| Incidenza di occupati sovraistruiti                                                                            | 2004-2010              | ↓               | ↓                  |
| Tasso di infortuni mortali e inabilità permanente                                                              | 2005-2010              | ↑               | ↑                  |
| Incidenza di occupati non regolari sul totale degli occupati                                                   | 2004-2010              | ↑               | ↑                  |
| Rapporto tra tasso di occupazione delle donne 25-49 anni con figli in età prescolare e delle donne senza figli | 2004-2011              | ↑               | ↑                  |
| Quota di popolazione 15-64 anni che svolge più di 60 ore settimanali di lavoro retribuito a/o familiare*       | 2002/03-2008/09        |                 | ↑                  |
| Indice di asimmetria del lavoro familiare*                                                                     | 2002/03-2008/09        |                 | ↑                  |
| Soddisfazione per il lavoro svolto*                                                                            | 2003-2009              |                 | ↑                  |
| <b>Benessere economico</b>                                                                                     |                        |                 |                    |
| Reddito disponibile aggiustato reale pro-capite                                                                | 2004-2011              | ↑               | ↓                  |
| Indice di disuguaglianza del reddito disponibile                                                               | 2004-2011              | ↑               | ↓                  |
| Indice di rischio di povertà relativa                                                                          | 2004-2011              | ↑               | ↓                  |
| Ricchezza a netta nominale pro-capite                                                                          | 2004-2010              | ↑               | ↑                  |

Le frecce rappresentano i miglioramenti e i peggioramenti significativi degli indicatori del Benessere negli anni precedenti e successivi al 2008. Le nuove elaborazioni realizzate per il rapporto Bes 2013, per cui non sono ancora disponibili confronti temporali, sono segnalate con il simbolo **NUOVO**.

| INDICATORE                                                          | PERIODO<br>CONSIDERATO | FINO<br>AL 2008 | DAL 2008<br>IN POI |
|---------------------------------------------------------------------|------------------------|-----------------|--------------------|
| <b>Indice di vulnerabilità finanziaria</b>                          |                        |                 |                    |
| Indice di povertà assoluta                                          | 2005-2011              | ↓               | ↑                  |
| Indice di grave deprivazione materiale                              | 2004-2011              | ↑               | ↓                  |
| Indice di qualità dell'abitazione                                   | 2004-2011              | ↑               | ↑                  |
| Indice di valutazione soggettiva di difficoltà economica            | 2004-2011              | ↓               | ↓                  |
| Incidenza di persone che vivono in famiglie senza occupati          | 2004-2011              | ↓               | ↓                  |
| <b>Relazioni sociali</b>                                            |                        |                 |                    |
| Molto soddisfatti per le relazioni familiari                        | 2005-2012              | ↑               | ↑                  |
| Molto soddisfatti per le relazioni amicali                          | 2005-2012              | ↑               | ↑                  |
| Persone su cui contare*                                             | 2003-2009              | ↑               | ↑                  |
| Attività ludiche dei bambini da 3 a 10 anni svolte con i genitori   | 2005-2011              |                 | ↑                  |
| Aiuti gratuiti dati*                                                | 2003-2009              | ↑               | ↑                  |
| Partecipazione sociale                                              | 2005-2012              | ↑               | ↓                  |
| Attività di volontariato                                            | 2005-2012              | ↑               | ↑                  |
| Finanziamento delle associazioni                                    | 2005-2012              | ↓               | ↓                  |
| Organizzazioni non profit                                           | 2001                   |                 |                    |
| Cooperative sociali                                                 | 2009-2010              |                 | ↑                  |
| Fiducia generalizzata                                               | 2010-2012              |                 | ↓                  |
| <b>Politica e istituzioni</b>                                       |                        |                 |                    |
| Partecipazione elettorale*                                          | 2004-2009              | ↓               |                    |
| Partecipazione civica e politica                                    | 2011-2012              |                 | ↑                  |
| Fiducia nel Parlamento italiano                                     | 2011-2012              | NUOVO           | ↑                  |
| Fiducia nel sistema giudiziario                                     | 2011-2012              | NUOVO           | ↑                  |
| Fiducia nei partiti                                                 | 2011-2012              | NUOVO           | ↑                  |
| Fiducia nelle istituzioni locali                                    | 2012                   | NUOVO           |                    |
| Fiducia in altri tipi di istituzioni                                | 2012                   | NUOVO           |                    |
| Donne e rappresentanza politica in Parlamento                       | 2008                   | NUOVO           |                    |
| Donne e rappresentanza politica a livello regionale                 | 2012                   | NUOVO           |                    |
| Donne negli organi decisionali                                      | 2011                   | NUOVO           |                    |
| Donne nei consigli d'amministrazione delle società quotate in borsa | 2004-2011              |                 | ↑                  |
| Età mediana dei parlamentari italiani                               | XVI legislatura        |                 |                    |
| Lunghezza dei procedimenti civili                                   | 2008                   |                 |                    |
| <b>Sicurezza</b>                                                    |                        |                 |                    |
| Tasso di omicidi                                                    | 2004-2011              | ↑               | ↑                  |
| Tasso di furti in abitazione                                        | 2004-2011              | ↓               | ↓                  |
| Tasso di borseggi                                                   | 2004-2011              | ↓               | ↑                  |
| Tasso di rapine                                                     | 2004-2011              | ↑               | ↑                  |
| Tasso di violenza fisica sulle donne                                | 2004                   |                 |                    |
| Tasso di violenza sessuale sulle donne                              | 2004                   |                 |                    |
| Tasso di violenza domestica sulle donne                             | 2004                   |                 |                    |
| Preoccupazione di subire una violenza sessuale*                     | 2002-2009              | ↓               |                    |
| Percezione di sicurezza camminando al buio da soli*                 | 2002-2009              | ↓               |                    |
| Paura di stare per subire un reato in futuro                        | 2009                   |                 |                    |
| Presenza di elementi di degrado nella zona in cui si vive*          | 2003-2009              | ↑               |                    |
| <b>Benessere soggettivo</b>                                         |                        |                 |                    |
| Soddisfazione per la propria vita                                   | 2010-2012              |                 | ↓                  |
| Soddisfazione per il tempo libero                                   | 2005-2012              | ↑               | ↑                  |
| Giudizio sulle prospettive future                                   | 2012                   |                 |                    |

# The application

↑ MIGLIORAMENTO

↓ PEGGIORAMENTO

↑ STABILITÀ

| INDICATORE                                                                                                                  | PERIODO<br>CONSIDERATO | FINO<br>AL 2008 | DAL 2008<br>IN POI |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------|--------------------|
| <b>Paesaggio e patrimonio culturale</b>                                                                                     |                        |                 |                    |
| Dotazione di risorse del patrimonio culturale                                                                               | 2012                   |                 |                    |
| Spesa pubblica comunale corrente pro capite destinata alla gestione del patrimonio culturale                                | 2004-2010              | ↑               | ↑                  |
| Tasso di abusivismo edilizio                                                                                                | 2004-2011              | ↑               | ↓                  |
| Tasso di urbanizzazione in aree sottoposte a vincolo paesaggistico                                                          | 2001                   | NUOVO           |                    |
| Erosione dello spazio rurale da dispersione urbana                                                                          | 2001                   | NUOVO           |                    |
| Erosione dello spazio rurale da abbandono                                                                                   | 2001                   | NUOVO           |                    |
| Presenza di paesaggi rurali storici                                                                                         | 2010                   | NUOVO           |                    |
| Valutazione della qualità della programmazione dello sviluppo rurale (Per regionali) in relazione alla tutela del paesaggio | 2010                   |                 |                    |
| Densità di verde storico e parchi urbani di notevole interesse pubblico                                                     | 2011                   | NUOVO           |                    |
| Consistenza del tessuto urbano storico                                                                                      | 2001                   | NUOVO           |                    |
| Inadeguatezza per la qualità del paesaggio del luogo di vita                                                                | 2012                   | NUOVO           |                    |
| Preoccupazione per il deterioramento delle valenze paesaggistiche                                                           | 2012                   |                 |                    |
| <b>Ambiente</b>                                                                                                             |                        |                 |                    |
| Acqua potabile erogata                                                                                                      | 2005-2008              | ↑               | ↑                  |
| Qualità delle acque costiere marine                                                                                         | 2004-2009              | ↑               | ↑                  |
| Qualità dell'aria urbana**                                                                                                  | 2003-2011              |                 |                    |
| Disponibilità di verde urbano**                                                                                             | 2003-2010              |                 |                    |
| Aree con problemi idrogeologici                                                                                             | 2012                   |                 |                    |
| Siti contaminati                                                                                                            | 2012                   |                 |                    |
| Aree terrestri protette*                                                                                                    | 2003-2010              | ↑               | ↑                  |
| Aree marine protette*                                                                                                       | 2003-2010              | ↑               | ↑                  |
| Aree di particolare interesse naturalistico                                                                                 | 2006-2012              | ↑               | ↑                  |
| Preoccupazione per la perdita di biodiversità                                                                               | 2012                   |                 |                    |
| Flussi di materia                                                                                                           | 2004-2010              | ↑               | ↑                  |
| Energia da fonti rinnovabili                                                                                                | 2004-2011              | ↑               | ↑                  |
| Emissioni di CO <sub>2</sub> e altri gas clima alteranti                                                                    | 2004-2009              | ↑               | ↑                  |
| <b>Ricerca e innovazione</b>                                                                                                |                        |                 |                    |
| Intensità di ricerca                                                                                                        | 2004-2010              | ↑               | ↑                  |
| Propensione alla brevettazione                                                                                              | 2004-2010              | ↑               | ↑                  |
| Incidenza dei lavoratori della conoscenza sull'occupazione                                                                  | 2004-2010              | ↑               | ↑                  |
| Tasso di innovazione del sistema produttivo                                                                                 | 2004-2010              | ↑               | ↑                  |
| Tasso di innovazione di prodotto/servizio del sistema produttivo nazionale                                                  | 2004-2010              | ↑               | ↑                  |
| Specializzazione produttiva nei settori ad alta intensità di conoscenza                                                     | 2008-2011              | ↑               | ↑                  |
| Intensità d'uso di internet                                                                                                 | 2008-2012              |                 | ↑                  |
| <b>Qualità dei servizi</b>                                                                                                  |                        |                 |                    |
| Posti letto nei presidi residenziali socio-assistenziali e socio-sanitari                                                   | 2009-2010              |                 | ↑                  |
| Liste d'attesa                                                                                                              | 2004-2010              | ↑               | ↑                  |
| Pressa in carico dell'utenza per i servizi per l'infanzia                                                                   | 2004-2010              | ↑               | ↑                  |
| Pressa in carico degli anziani per il servizio di assistenza domiciliare integrata                                          | 2004-2010              | ↑               | ↑                  |
| Irregolarità del servizio elettrico                                                                                         | 2004-2010              | ↑               | ↑                  |
| Famiglie allacciate alla rete di distribuzione di gas metano                                                                | 2004-2011              | ↑               | ↑                  |
| Irregolarità nella distribuzione dell'acqua                                                                                 | 2005-2012              | ↑               | ↑                  |
| Conferimento dei rifiuti urbani in discarica                                                                                | 2004-2010              | ↑               | ↑                  |
| Raccolta differenziata dei rifiuti urbani                                                                                   | 2004-2010              | ↑               | ↑                  |
| Indice di sovraccarico degli istituti di pena                                                                               | 2004-2012              | ↑               | ↓                  |
| Tempo dedicato alla mobilità*                                                                                               | 2002/03-2008/09        |                 | ↑                  |
| Densità delle reti urbane di TPL**                                                                                          | 2004-2010              |                 |                    |
| Indice sintetico di accessibilità ad alcuni servizi                                                                         | 2009/11                |                 |                    |

\* Tendenze relative all'intero periodo considerato

\*\* Dato non disponibile a livello nazionale

# The application

The set of indicators allows us a cross-sectional and integrated picture by showing a wide view of citizens' quality of life by monitoring also inequalities, and risks.

# The application

## 9 DOMAINS:

- HEALTH (15 INDICATORS)
- EDUCATION AND TRAINING (15 INDICATORS)
- WORK AND WORK-LIFE BALANCE (11 INDICATORS)
- ECONOMIC WELL-BEING (9 INDICATORS)
- SOCIAL RELATIONSHIPS (9 INDICATORS)
- SECURITY (7 INDICATORS)
- SUBJECTIVE WELL-BEING (4 INDICATORS)
- ENVIRONMENT (15 INDICATORS)
- LANDSCAPE AND CULTURAL HERITAGE (9 INDICATORS)

TARGET OF BES: TO SUPPORT PUBLIC POLICY ACTION.

# The application

## ANALYSIS OF EQUITABLE AND SUSTAINABLE WELL-BEING

REFERENCE YEAR: 2021

9 DATASETS: DOMAIN INDICATORS – REGIONS

IDENTIFICATION OF THE INDIVIDUAL INDICATORS OF THE 9 DOMAINS UNDER EXAMINATION

CALCULATION OF THE COEFFICIENT OF DETERMINATION  $R^2$  ∈ TO MEASURE THE EXPLANATORY STRENGTH OF THE RELATIONSHIPS BETWEEN BES INDICATORS

CONSTRUCTION OF THE UNDIRECTED GRAPH

- NODES: BES Domain Indicators
- EDGES: Coefficient of Determination  $R^2$

# The application

## ANALYSIS OF EQUITABLE AND SUSTAINABLE WELL-BEING

REFERENCE YEAR: 2021

### Three indexes

| Index                         | Formula                                                              | What it measures                                                              | A node has a high value if...                                              |
|-------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <b>Betweenness centrality</b> | $C_B(v) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}}$ | How often a node lies on the shortest paths between other pairs of nodes      | It acts as a bridge or intermediary between different parts of the network |
| <b>Closeness centrality</b>   | $C_C(v) = \frac{n-1}{\sum_{u \neq v} d(v, u)}$                       | How close a node is to all the other nodes in terms of shortest-path distance | It can reach the other nodes quickly                                       |
| <b>Eigenvector centrality</b> | $x_i = \frac{1}{\lambda} \sum_j A_{ij} x_j$                          | The importance of a node, taking into account the importance of its neighbors | It is connected to other highly important nodes                            |

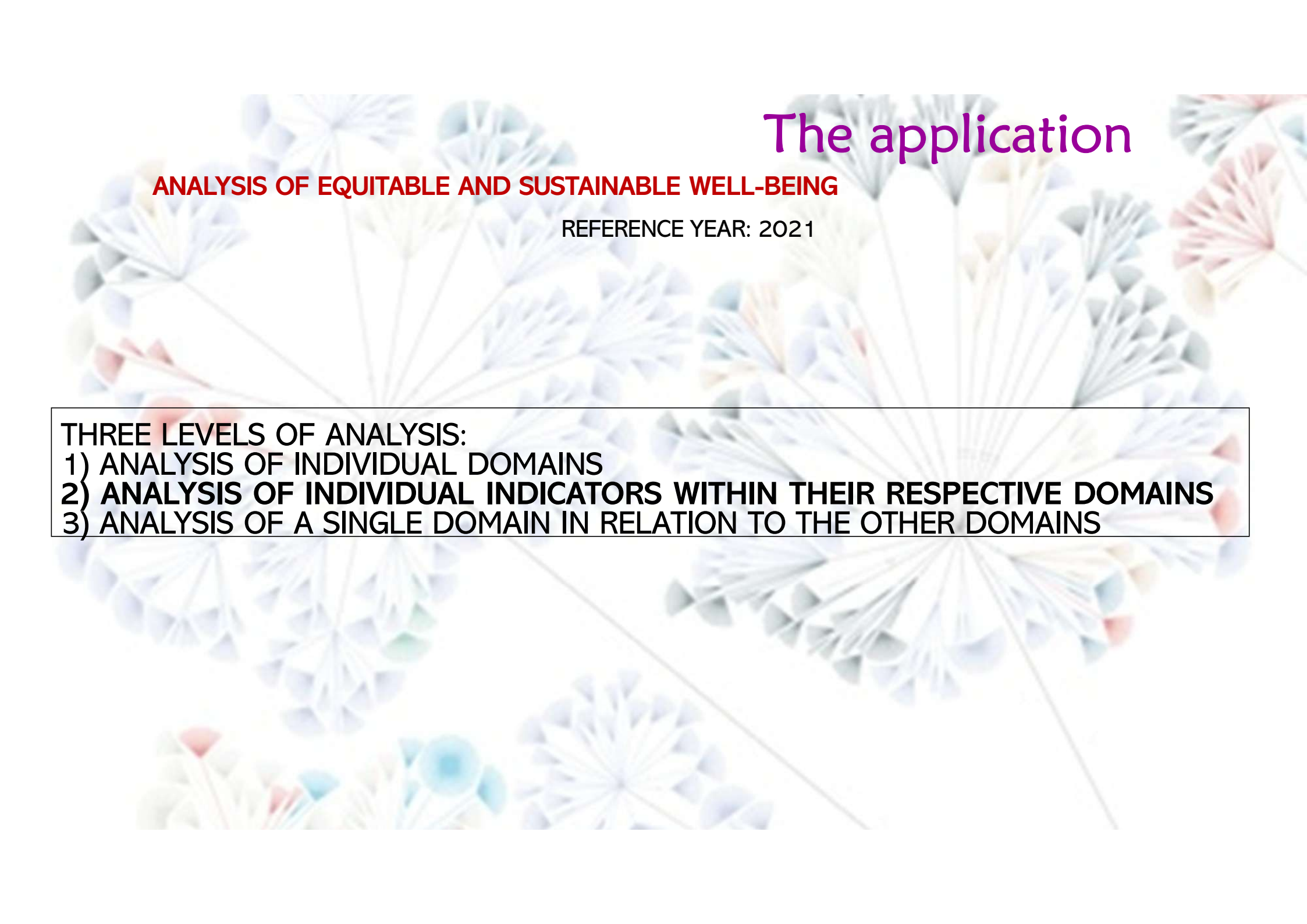
# The application

## ANALYSIS OF EQUITABLE AND SUSTAINABLE WELL-BEING

REFERENCE YEAR: 2021

### THREE LEVELS OF ANALYSIS:

- 1) ANALYSIS OF INDIVIDUAL DOMAINS
- 2) ANALYSIS OF INDIVIDUAL INDICATORS WITHIN THEIR RESPECTIVE DOMAINS
- 3) ANALYSIS OF A SINGLE DOMAIN IN RELATION TO THE OTHER DOMAINS



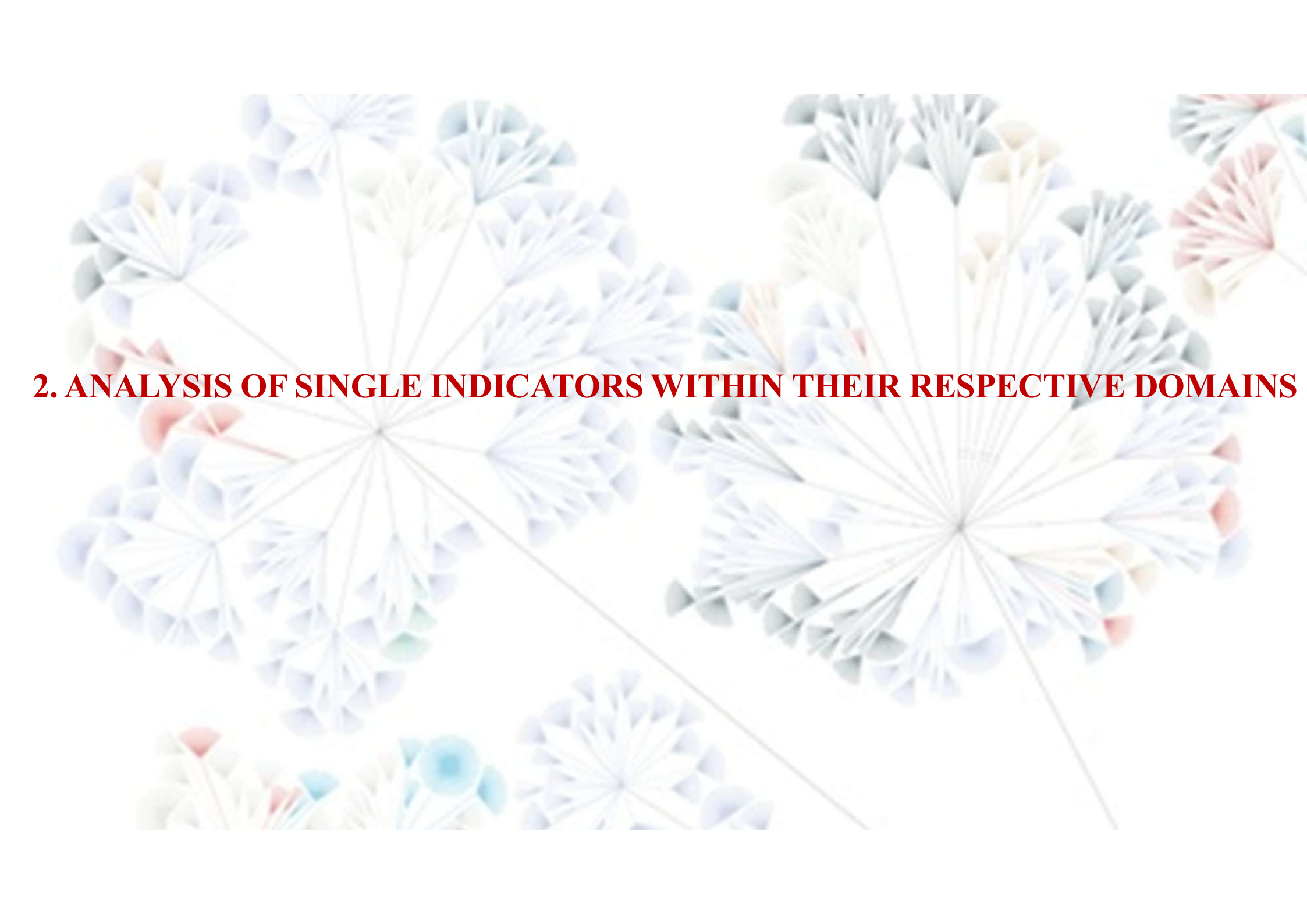
# The application

## ANALYSIS OF EQUITABLE AND SUSTAINABLE WELL-BEING

REFERENCE YEAR: 2021

### THREE LEVELS OF ANALYSIS:

- 1) ANALYSIS OF INDIVIDUAL DOMAINS
- 2) **ANALYSIS OF INDIVIDUAL INDICATORS WITHIN THEIR RESPECTIVE DOMAINS**
- 3) ANALYSIS OF A SINGLE DOMAIN IN RELATION TO THE OTHER DOMAINS



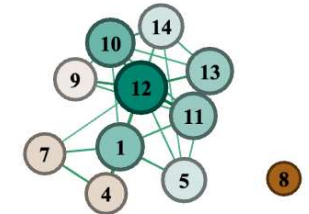
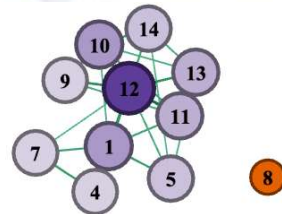
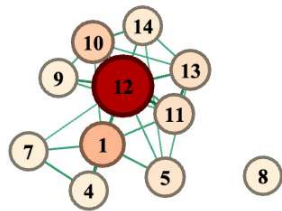
## **2. ANALYSIS OF SINGLE INDICATORS WITHIN THEIR RESPECTIVE DOMAINS**

# FIRST DOMAIN: HEALTH

## BETWEENNESS CENTRALITY

## CLOSENESS CENTRALITY

## EIGENVECTOR CENTRALITY



## BETWEENNESS CENTRALITY

node 12 - *Sedentariness* - normalized value 1.0  
node 10 - *Life expectancy without activity limitations at 65 years* - 0.780  
node 1 - *Life expectancy at birth* - 0.722

## EIGENVECTOR CENTRALITY

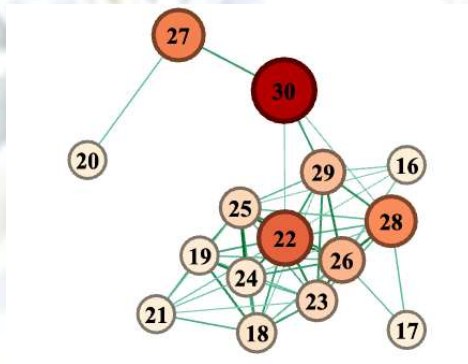
node 12 - *Sedentariness* - normalized value 0.139  
node 1 - *Life expectancy at birth* - 0.038  
node 10 - *Life expectancy without activity limitations at 65 years* - 0.032

## CLOSENESS CENTRALITY

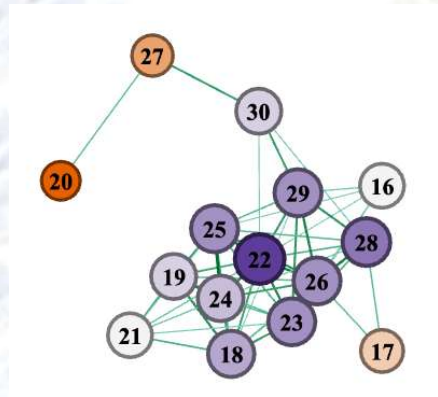
node 12 - *Sedentariness* - normalized value 1.0  
node 1 - *Life expectancy at birth* - 0.750  
node 10 - *Life expectancy without activity limitations at 65 years* - 0.750

## SECOND DOMAIN: EDUCATION AND TRAINING

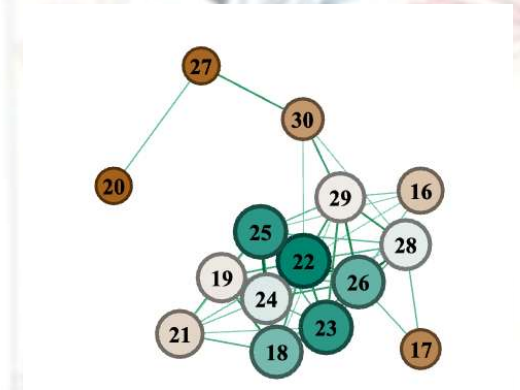
BETWEENNESS CENTRALITY



CLOSENESS CENTRALITY



EIGENVECTOR CENTRALITY



### BETWEENNESS CENTRALITY

- node 30 - *Use of libraries* - normalized value 0.263
- node 22 - *Young people neither in employment nor in education or training (NEET)* - 0.171
- node 27 - *People obtaining a tertiary STEM degree in the year* - 0.142

### EIGENVECTOR CENTRALITY

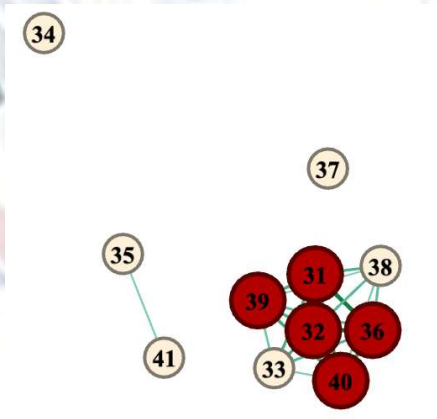
- node 22 - *Young people neither in employment nor in education or training* - normalized value 1.0
- node 23 - *Participation in lifelong learning* - 0.965
- node 25 - *Inadequate numeracy skills* - 0.965

### CLOSENESS CENTRALITY

- node 22 - *Young people neither in employment nor in education or training (NEET)* - normalized value 0.777
- node 28 - *Cultural participation outside the home* - 0.700
- node 25 - *Inadequate numeracy skills* - 0.666
- node 26 - *At least basic digital skills* - 0.666
- node 29 - *Reading of books and newspapers* - 0.666

# THIRD DOMAIN: WORK AND WORK-LIFE BALANCE

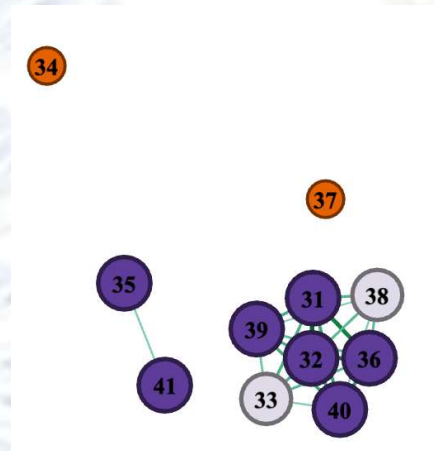
## BETWEENNESS CENTRALITY



### BETWEENNESS CENTRALITY

node 31 - *Employment rate 20-64 years* - normalized value 0.2  
 node 32 - *Rate of non-participation in work* - 0.2  
 node 36 - *Non-regular employment* - 0.2  
 node 39 - *Perception of job insecurity* - 0.2  
 node 40 - *Involuntary part-time* - 0.2

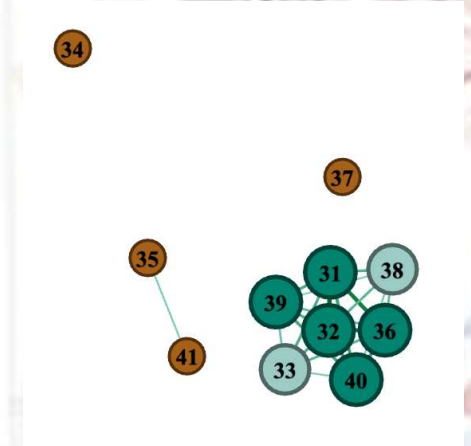
## CLOSENESS CENTRALITY



### CLOSENESS CENTRALITY

node 31 - *Employment rate 20-64 years* - normalized value 1.0  
 node 32 - *Rate of non-participation in work* - 1.0  
 node 36 - *Non-regular employment* - 1.0  
 node 39 - *Perception of job insecurity* - 1.0  
 node 40 - *Involuntary part-time* - 1.0

## EIGENVECTOR CENTRALITY

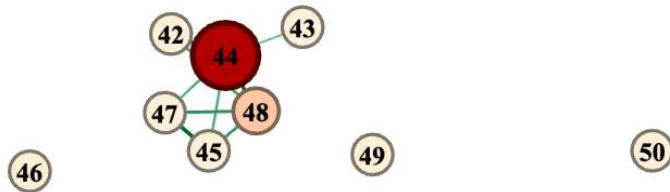


### EIGENVECTOR CENTRALITY

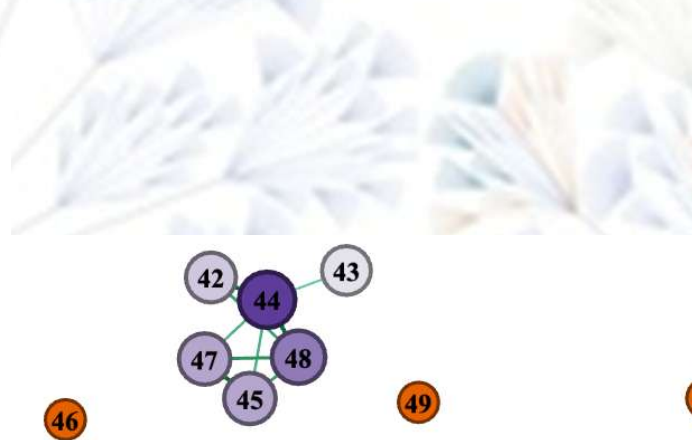
node 31 - *Employment rate 20-64 years* - normalized value 1.0  
 node 32 - *Rate of non-participation in work* - 1.0  
 node 36 - *Non-regular employment* - 1.0  
 node 39 - *Perception of job insecurity* - 1.0  
 node 40 - *Involuntary part-time* - 1.0

# FOURTH DOMAIN: ECONOMIC WELL-BEING

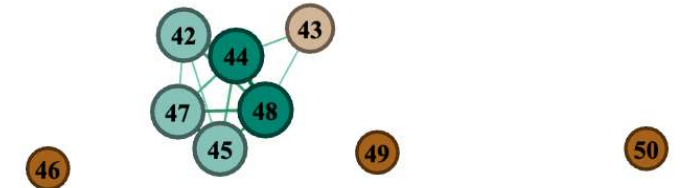
## BETWEENNESS CENTRALITY



## CLOSENESS CENTRALITY



## EIGENVECTOR CENTRALITY



## BETWEENNESS CENTRALITY

node 44 - *Risk of poverty* - normalized value 0.178  
node 48 - *Low work intensity - Europe 2030* - 0.035

## EIGENVECTOR CENTRALITY

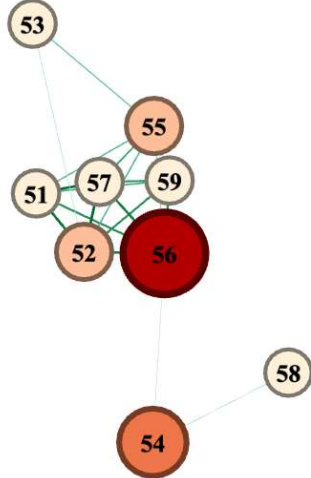
node 44 - *Risk of poverty* - normalized value 1.0  
node 48 - *Low work intensity - Europe 2030* - 0.932  
node 45 - *Severe material and social deprivation - Europe 2030* - 0.803  
node 47 - *Great difficulty making ends meet* - 0.803

## CLOSENESS CENTRALITY

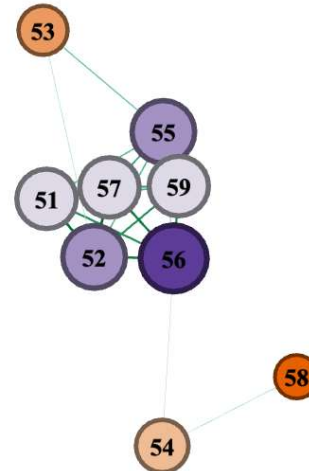
node 44 - *Risk of poverty* - normalized value 1.0  
node 48 - *Low work intensity - Europe 2030* - 0.932  
node 45 - *Severe material and social deprivation - Europe 2030* - 0.718  
node 47 - *Great difficulty making ends meet* - 0.714

# FIFTH DOMAIN: SOCIAL RELATIONSHIPS

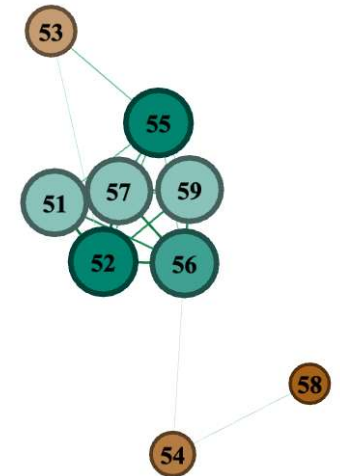
BETWEENNESS CENTRALITY



CLOSENESS CENTRALITY



EIGENVECTOR CENTRALITY



## BETWEENNESS CENTRALITY

node 56 - *Voluntary activity* - normalized value 0.428  
 node 54 - *Social participation* - 0.250  
 node 52 - *Satisfaction with friendships* - 0.170  
 node 55 - *Civic and political participation* - 0.130

## EIGENVECTOR CENTRALITY

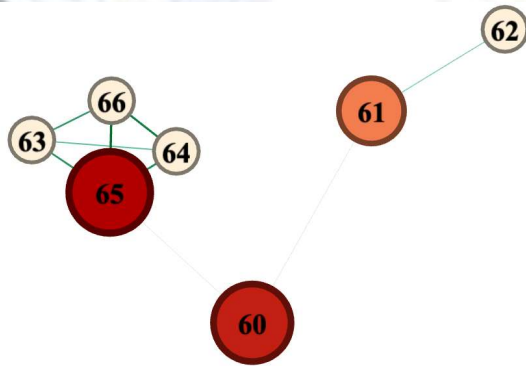
node 52 - *Satisfaction with friendships* - normalized value 1.0  
 node 55 - *Civic and political participation* - 1.0  
 node 56 - *Voluntary activity* - 0.971

## CLOSENESS CENTRALITY

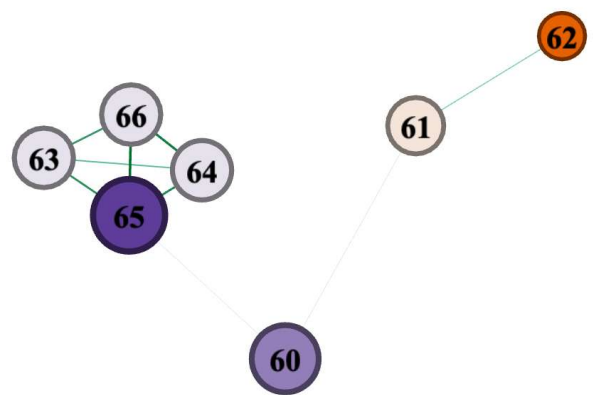
node 56 - *Voluntary activity* - normalized value 0.800  
 node 52 - *Satisfaction with friendships* - 0.800  
 node 55 - *Civic and political participation* - 0.727

# SIXTH DOMAIN: SECURITY

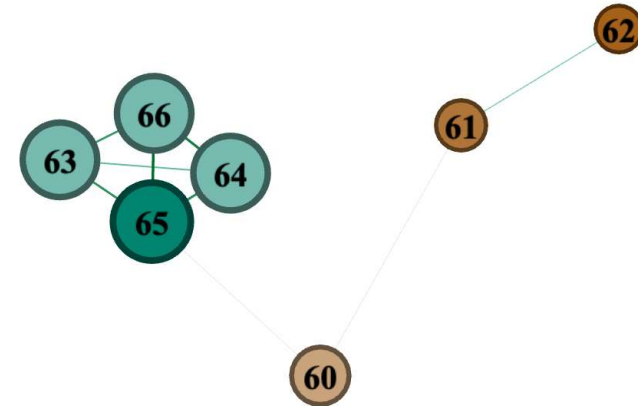
BETWEENNESS CENTRALITY



CLOSENESS CENTRALITY



EIGENVECTOR CENTRALITY



BETWEENNESS CENTRALITY

node 65 - Presence of elements of degradation in the area of residence - 0.600  
 node 60 - Intentional homicides - 0.333  
 node 61 - Burglaries / Home thefts - 0.333

EIGENVECTOR CENTRALITY

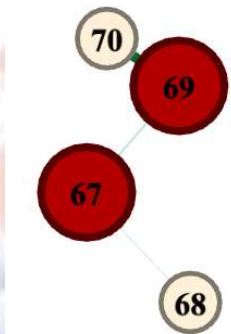
node 65 - Presence of elements of degradation in the area of residence - 1.0  
 node 63 - Robberies - 0.899  
 node 66 - Perception of crime risk - 0.899  
 node 64 - Perception of safety walking alone in the dark - 0.899

CLOSENESS CENTRALITY

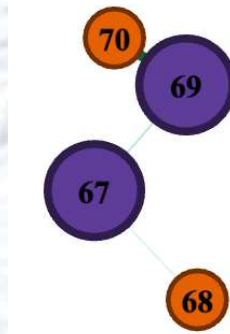
node 65 - Presence of elements of degradation in the area of residence - 0.666  
 node 60 - Intentional homicides - 0.600  
 node 63 - Robberies - 0.500  
 node 64 - Perception of safety walking alone in the dark - 0.500  
 node 66 - Perception of crime risk - 0.500

# SEVENTH DOMAIN: SUBJECTIVE WELL-BEING

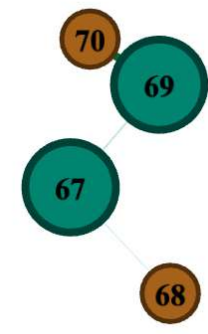
## BETWEENNESS CENTRALITY



## CLOSENESS CENTRALITY



## EIGENVECTOR CENTRALITY



### BETWEENNESS CENTRALITY

node 67 - *Negative judgment on future prospects* - normalized value 0.666  
node 69 - *Satisfaction with leisure time* - 0.666

### EIGENVECTOR CENTRALITY

node 67 - *Negative judgment on future prospects* - normalized value 1.0  
node 69 - *Satisfaction with leisure time* - 1.0

### CLOSENESS CENTRALITY

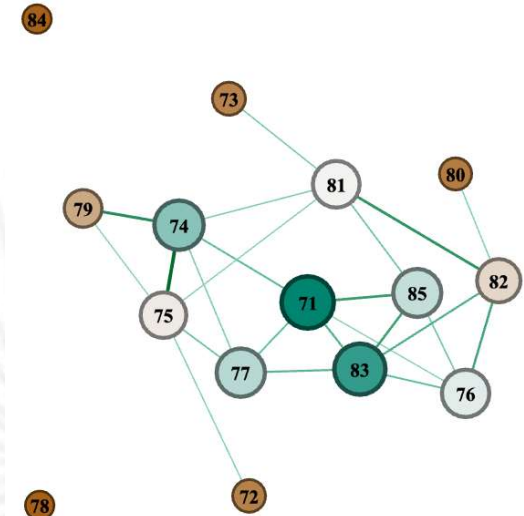
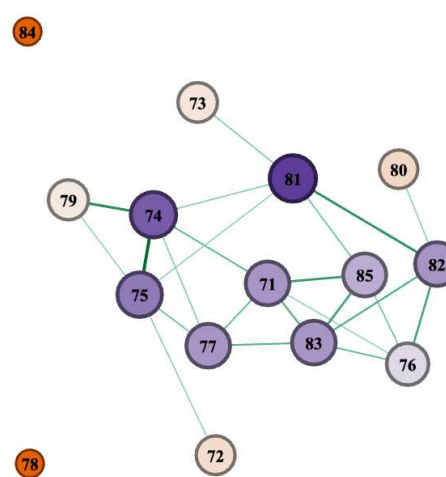
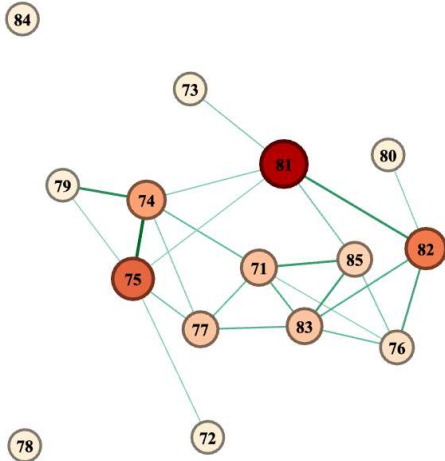
node 67 - *Negative judgment on future prospects* - normalized value 0.750  
node 69 - *Satisfaction with leisure time* - 0.750

# EIGHTH DOMAIN: ENVIRONMENT

## BETWEENNESS CENTRALITY

## CLOSENESS CENTRALITY

## EIGENVECTOR CENTRALITY



### BETWEENNESS CENTRALITY

node 81 - *Satisfaction with the environmental situation* - normalized value 0.299  
 node 75 - *Domestic material consumption* - 0.166  
 node 82 - *Concern about loss of biodiversity* - 0.147

### EIGENVECTOR CENTRALITY

node 71 - *Air quality - PM2.5* - normalized value 1.0  
 node 83 - *Heatwave duration index* - 0.952  
 node 74 - *Soil sealing from artificial land cover* - 0.875

### CLOSENESS CENTRALITY

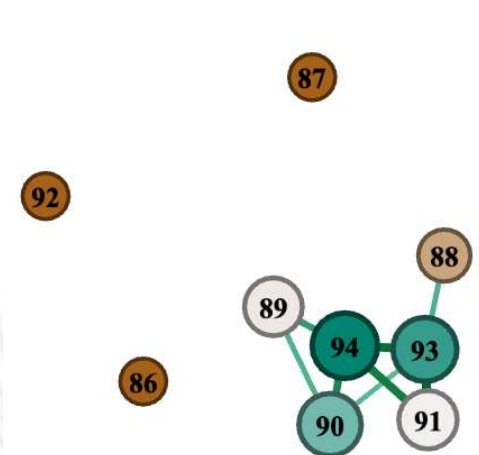
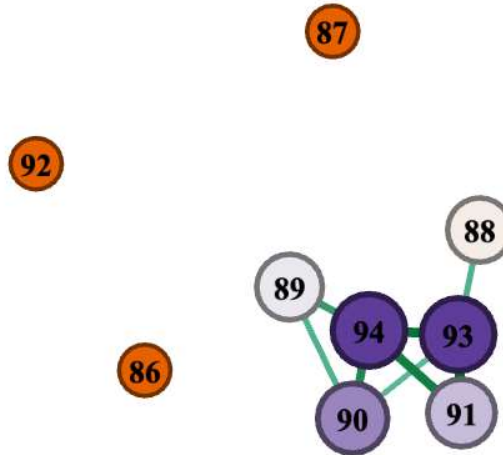
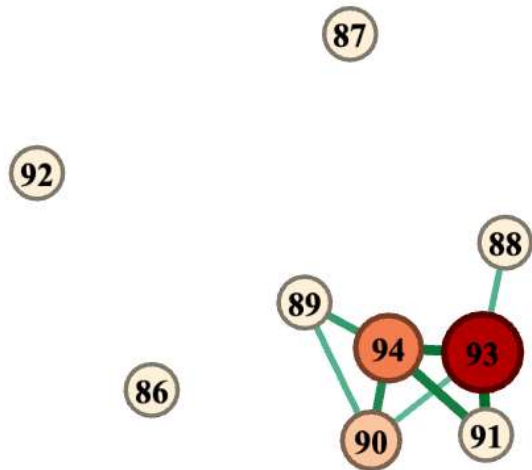
node 81 - *Satisfaction with the environmental situation* - 1.0  
 node 74 - *Soil sealing from artificial land cover* - 0.952  
 node 75 - *Domestic material consumption* - 0.833

# NINTH DOMAIN: LANDSCAPE AND CULTURAL HERITAGE

## BETWEENNESS CENTRALITY

## CLOSENESS CENTRALITY

## EIGENVECTOR CENTRALITY



### BETWEENNESS CENTRALITY

node 93 - *Current expenditure of Municipalities* - normalized value 0.160  
 node 94 - *Illegal building / Unauthorized construction* - 0.089  
 node 90 - *Dissatisfaction with the landscape of the place of life* - 0.035

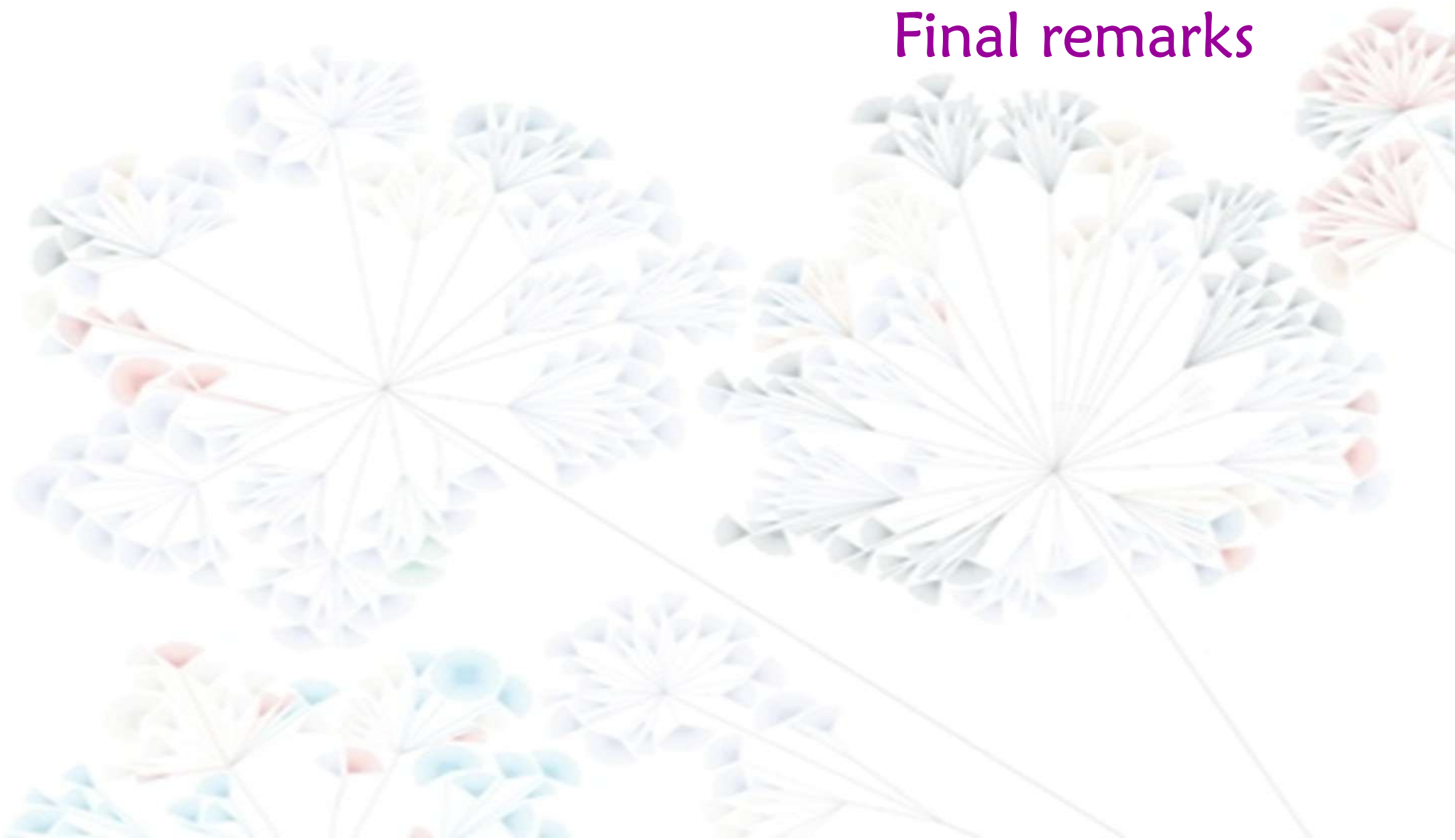
### EIGENVECTOR CENTRALITY

node 94 - *Illegal building / Unauthorized construction* - normalized value 1.0  
 node 93 - *Current expenditure of Municipalities for culture* - 0.25  
 node 90 - *Dissatisfaction with the landscape of the place of life* - 0.840

### CLOSENESS CENTRALITY

node 93 - *Current expenditure of Municipalities for culture* - 0.833  
 node 94 - *Illegal building / Unauthorized construction* - 0.833  
 node 90 - *Dissatisfaction with the landscape of the place of life* - 0.714

## Final remarks



## Final remarks

all indicators are  
organically related to each other



they cannot be chosen and analyzed  
independently

## Final remarks

statistical approaches should be able to rebuild  
the conceptual framework / the complex reality



this cannot be obtained through subsequent  
approximations of the whole process





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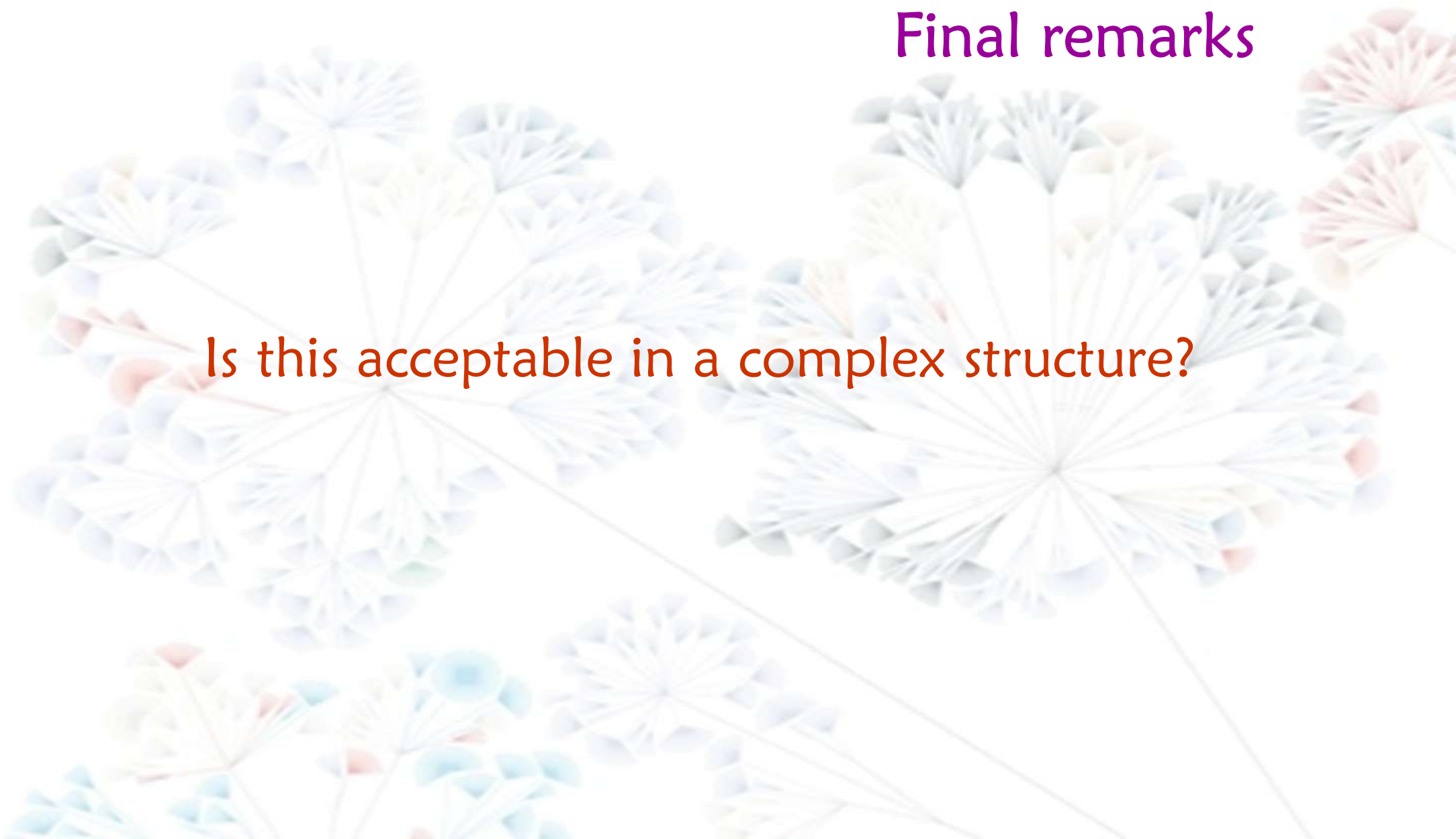


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## Final remarks

Is this acceptable in a complex structure?

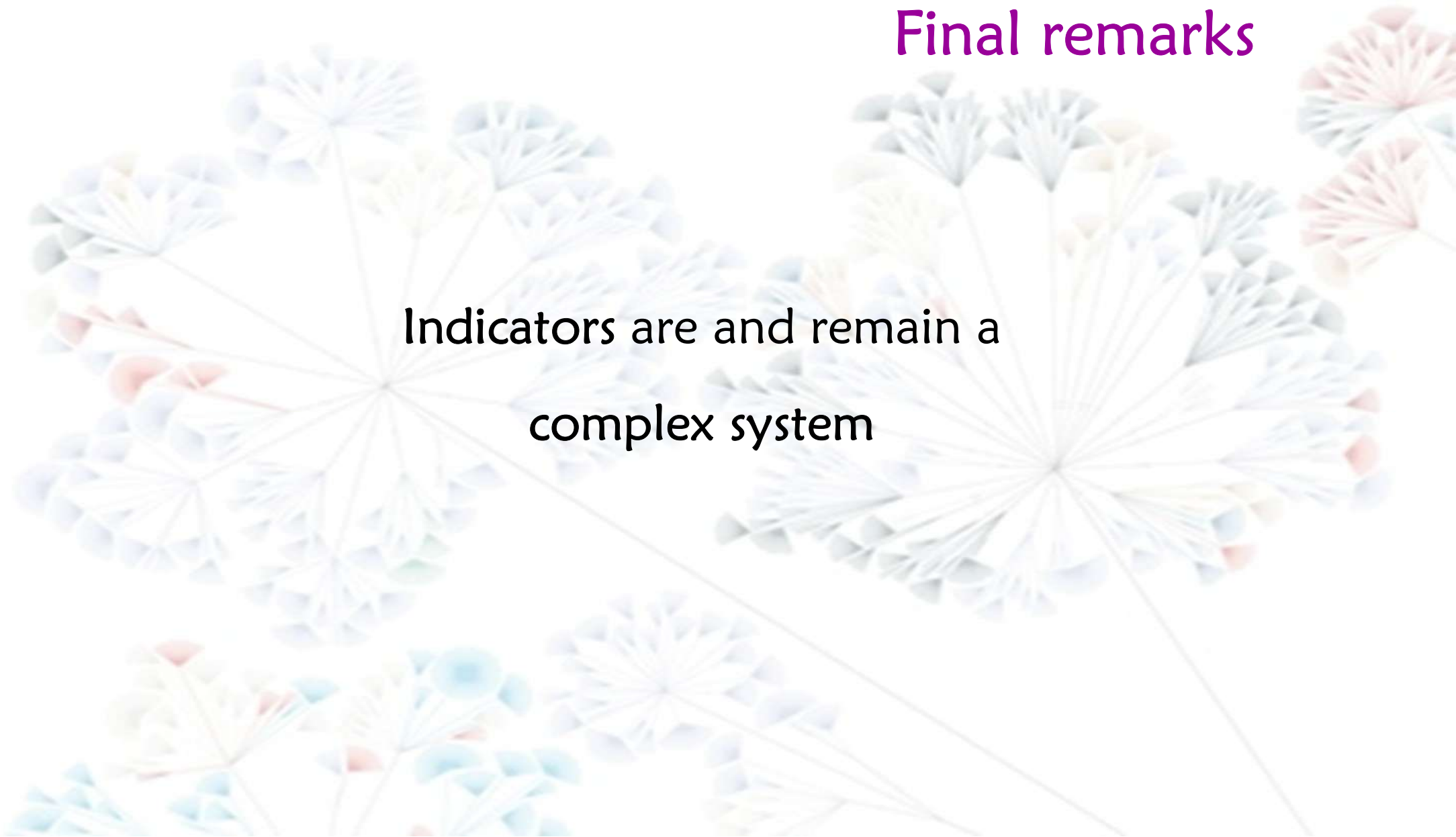


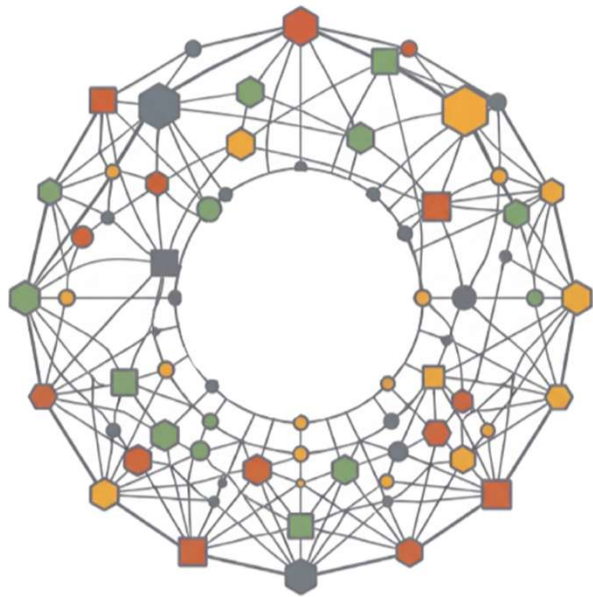
## Final remarks

In order to obtain a meaningful and  
interpretable picture  
data should be managed in some way...  
in other words ...

## Final remarks

Indicators are and remain a  
complex system





# MOSAIC

Multidisciplinary Observatory of Social  
Analysis, Indicators and Complexity



**MANY THANKS**

**FOR YOUR ATTENTION**