Circular City Model: Hybrid Decision-Making Processes for Sustainable Transition

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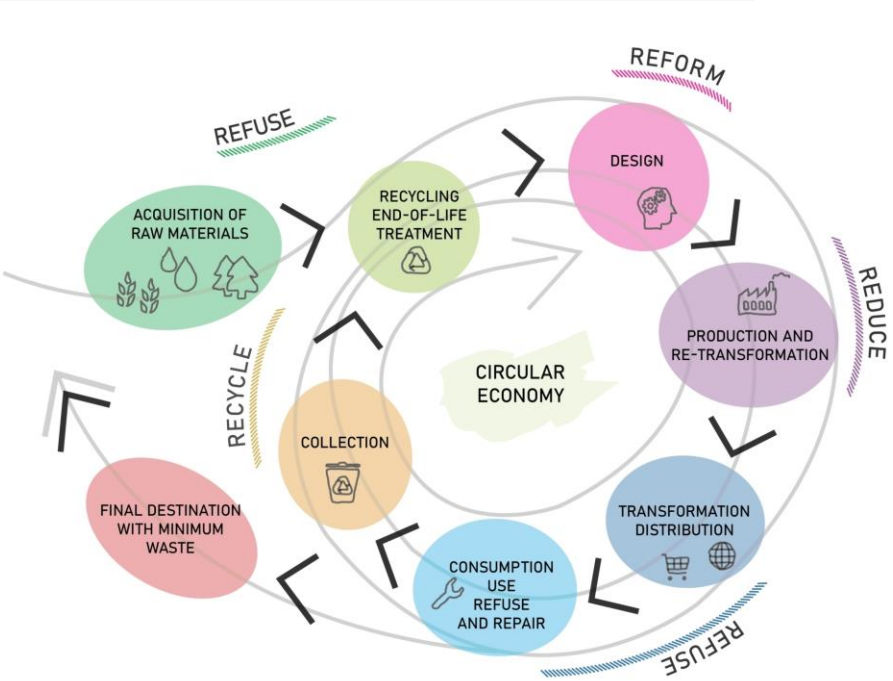
SUMMARY

1. Research goals within the theoretical background of Circular Economy
2. Hybrid methodological approach and workflow
3. The evaluation of regenerative strategies: The case study of Naples City-Port
4. Results
5. Discussion and conclusions

1. RESEARCH GOALS WITHIN THE THEORETICAL BACKGROUND OF CIRCULAR ECONOMY

CIRCULAR SCHOOLS OF THOUGHT: PERFORMANCE ECONOMY

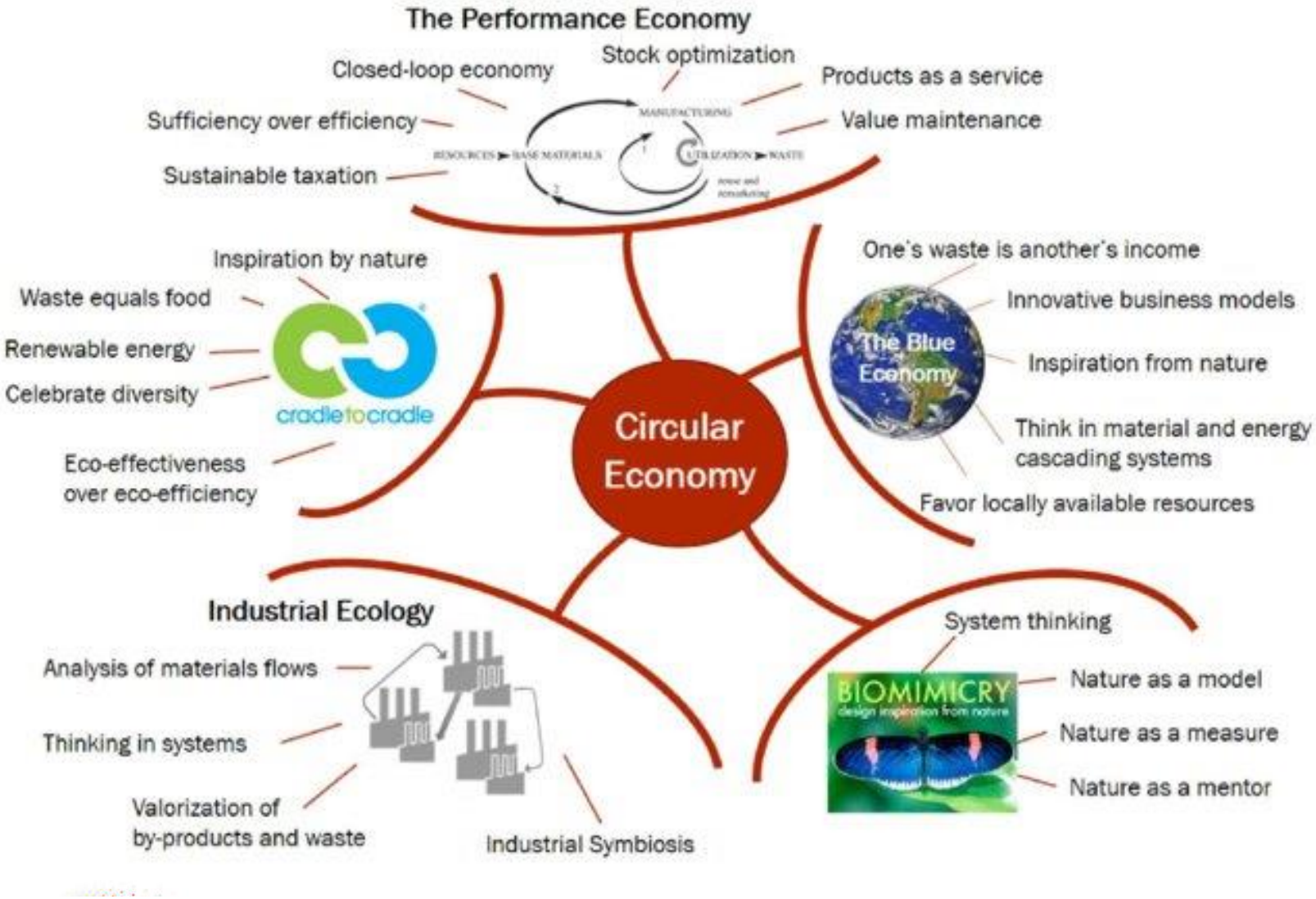
Closely associated with cradle to cradle principles is the notion of performance economy. How can we create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible?



Sufficiency over efficiency
Sufficiency solutions can mean turning
a problem into an opportunity or a virtuous loop

Selling performance instead of products
Object of the sale is not the product itself
but rather the performance it provides,
and the benefits offered to the user

1. RESEARCH GOALS WITHIN THE THEORETICAL BACKGROUND OF CIRCULAR ECONOMY



1. RESEARCH GOALS WITHIN THE THEORETICAL BACKGROUND OF CIRCULAR ECONOMY

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Emerging New Civilisations

A new paradigm is essential to clarify our role as a species within the greater Earth Community. Conversations are needed to agree on core values that promote human dignity, respect for nature and protection of the commons beyond current generations. These would be foundations of a stewardship culture for all we do as a human race.

Planetary Emergency

We are in the midst of a Planetary Emergency, facing climate, biodiversity and health crises. Too often, these emergencies are viewed in siloes, when in fact there is an urgent need to address them as one integrated challenge. By bringing back balance between people, planet and prosperity through implementing the Planetary Emergency Plan, we can emerge from emergency and ensure long-term resilience and wellbeing within our planetary boundaries.

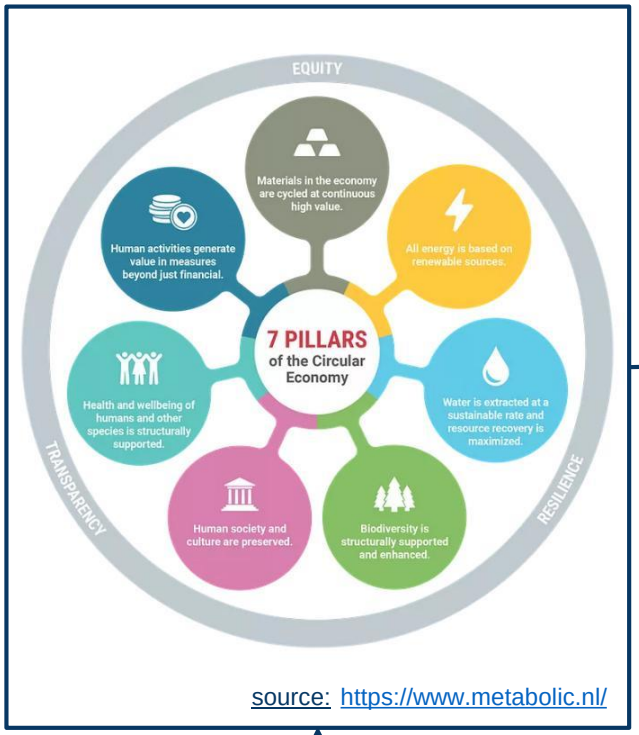
Reframing Economics

The metrics applied to human and planetary progress must extend innovatively beyond GDP to reflect the true cost, risk and opportunity of human pursuits. A new set of values and principles must be explored.

Rethinking Finance

The global financial system is currently at the service of an outdated economic paradigm. It acts as a means of wealth accumulation for a narrow elite, whilst disregarding the negative externalities of environmental damage and social inequalities. A new, sustainable finance system will be a core pillar of a new economy which serves both humanity and the planet.

1. RESEARCH GOALS WITHIN THE THEORETICAL BACKGROUND OF CIRCULAR ECONOMY



source: https://www.metabolic.nl/

ReSOLVE: an approach to Circular Economy (CE)

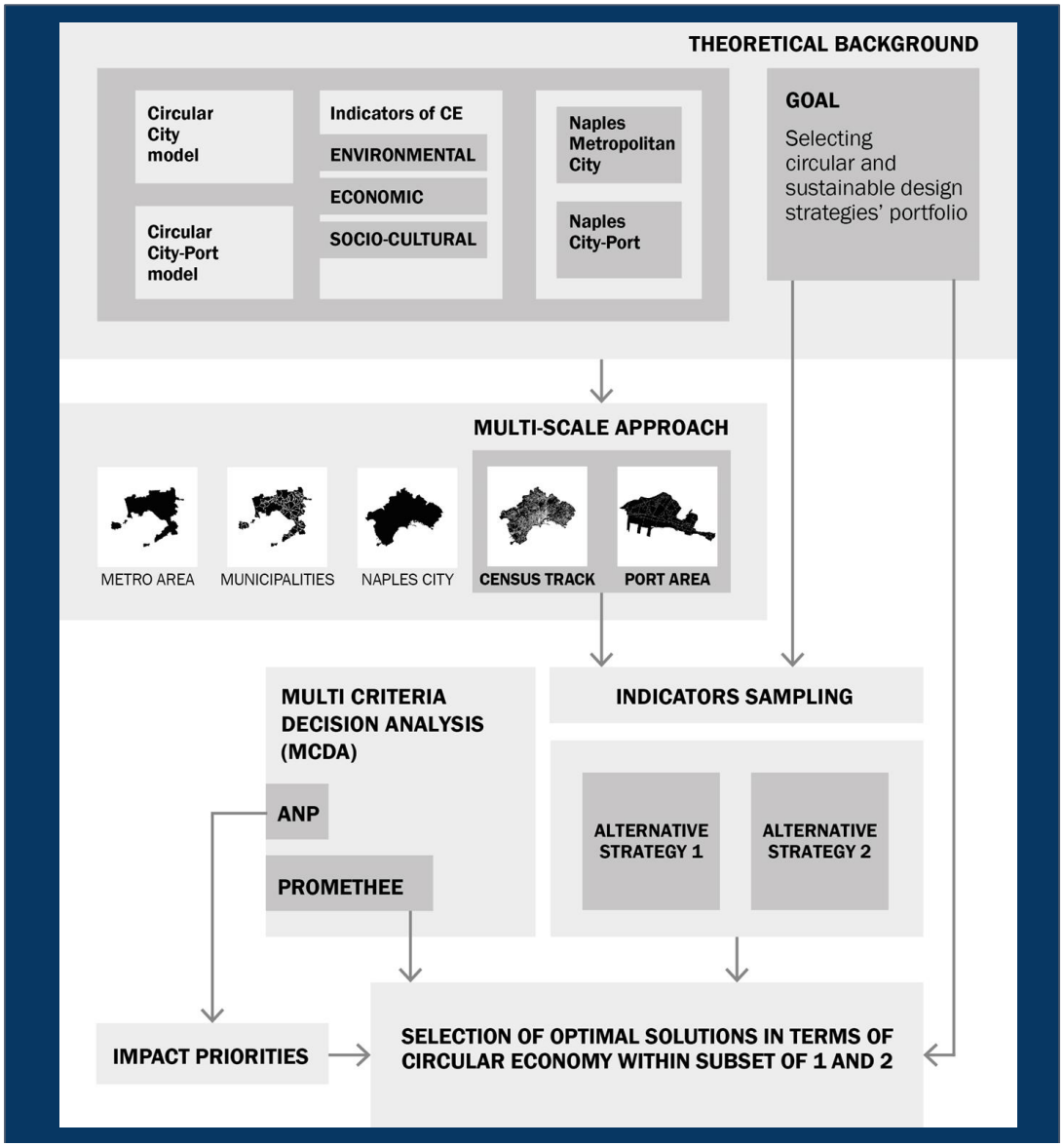
REGENERATE	• Shift to renewable energy and materials • Reclaim, retain, and restore health of ecosystems • Return recovered biological resources to the biosphere
SHARE	• Share assets (eg cars, rooms, appliances) • Reuse/secondhand • Prolong life through maintenance, design for durability, upgradability etc
OPTIMISE	• Increase performance/efficiency of product • Remove waste in production and supply chain • Leverage big data, automation, remote sensing and steering
LOOP	• Remanufacture products or components • Digest anaerobically • Recycle materials • Extract biochemicals from organic waste
VIRTUALISE	• Dematerialise directly (eg books, CDs, DVDs, travel) • Dematerialise indirectly (eg online shopping)
EXCHANGE	• Replace old with advanced non-renewable materials • Apply new technologies (eg 3D printing) • Choose new product/service (eg multimodal transport)

source: McKinsey & Company, https://www.mckinsey.com/

GOAL

Selecting a sustainable **design strategies' portfolio** related to Naples City-Port in order to boost a Circular City-Port Model for the Metropolitan Port-Cities. The specific objective focuses on the comparison of two urban regenerative alternatives and it intends to foster an exportable and robust **methodology for** other **maritime cities**, which must deal with CE processes and resource allocation troubles, and, so that, need multidimensional impacts assessment.

2. HYBRID METHODOLOGICAL APPROACH AND WORKFLOW



3. REGENERATIVE STRATEGIES EVALUATION: THE CASE STUDY OF NAPLES CITY-PORT

METROPOLITAN CITY OF NAPLES

Area: 1.171 km^2

Population:
3.084.890 inhabitants

Density: 2.617
inhabitants/km^2
(1° in Italy)

Municipalities: 92

NAPLES CITY

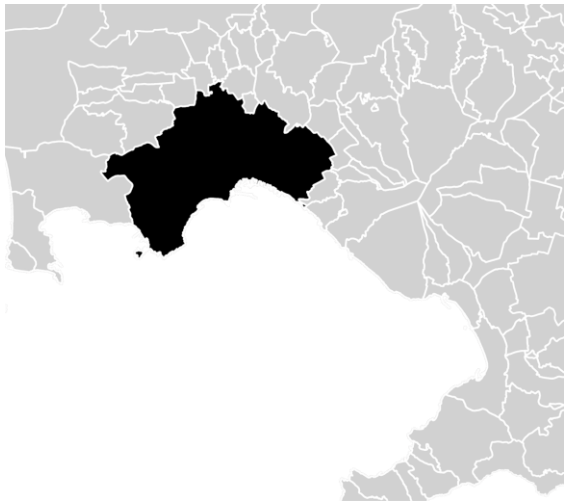
Area: 119,02 km^2

Population:
959.188 inhabitants

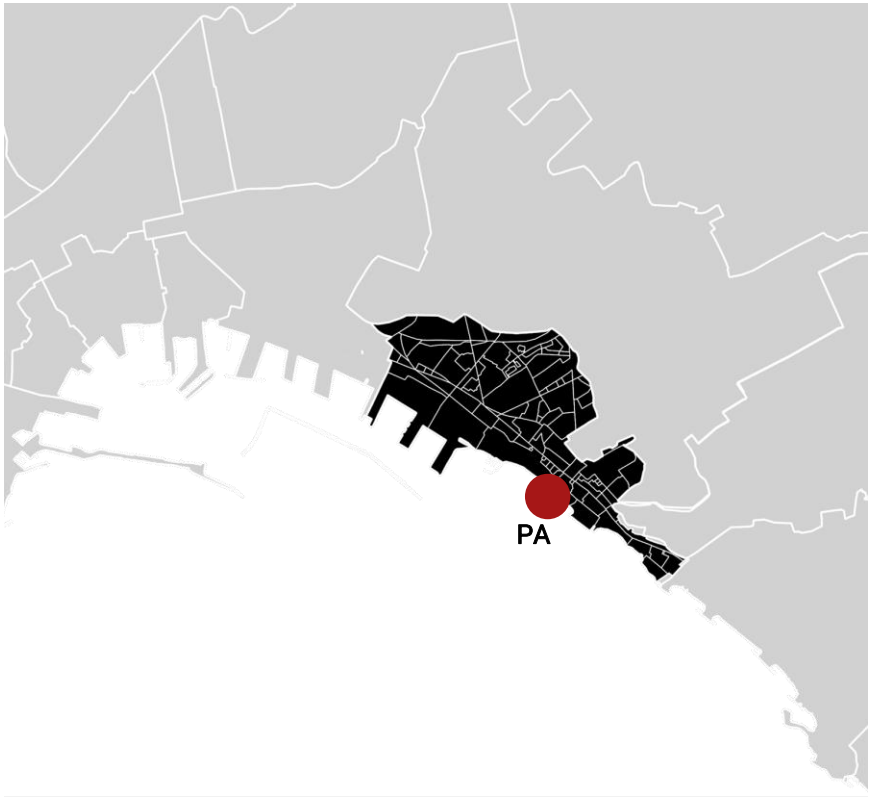
Density: 8.058,83
inhabitants/km^2
(1° in Italy)

Districts: 30

Unemployment rate:
27,8% (2011)



SAN GIOVANNI A TEDUCCIO DISTRICT AND PORT AREA (PA)



Area: 2,35 km^2

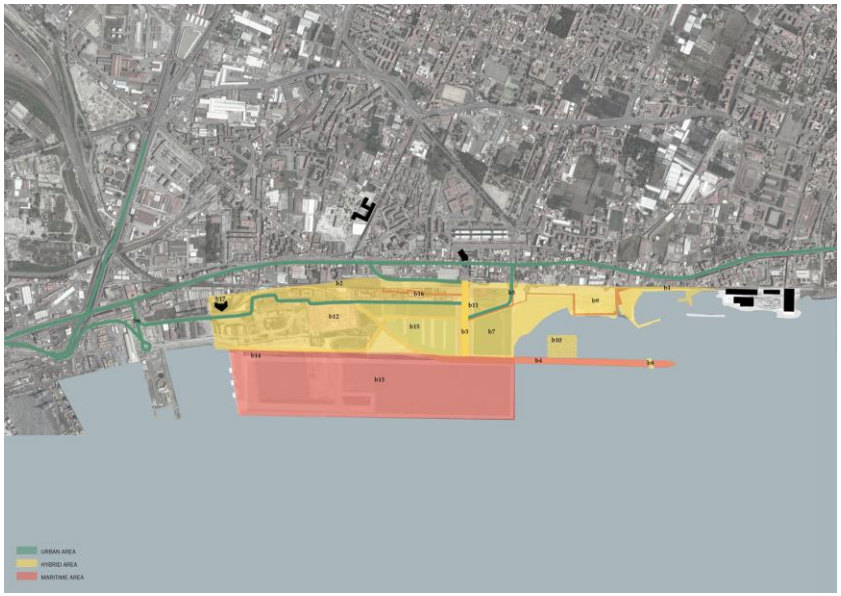
Population:
23.839 inhabitants

Density: 10.144,26 inhabitants/km^2

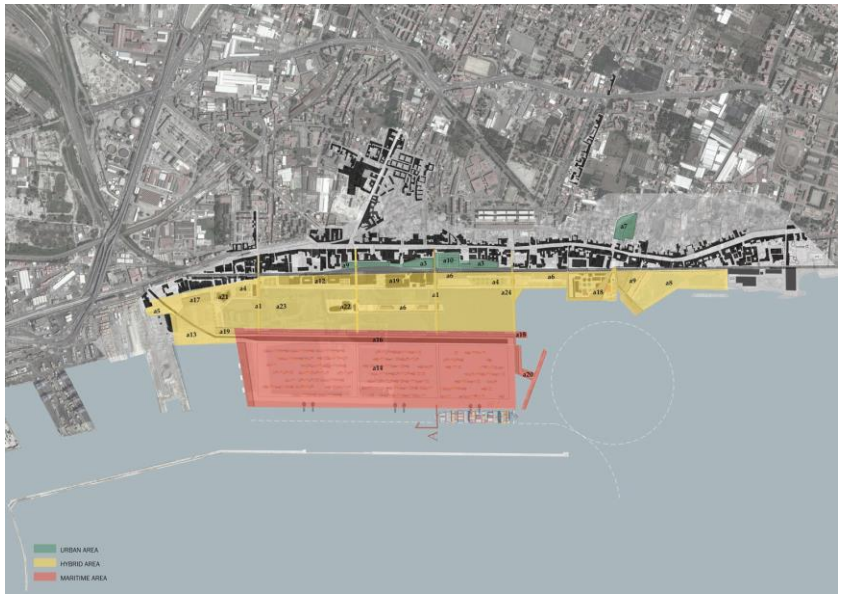
3. REGENERATIVE STRATEGIES EVALUATION: THE CASE STUDY OF NAPLES CITY-PORT

The Alternative Strategies by comparison

Two alternative strategies have been selected within some studies of the Department of Architecture, University of Naples Federico II.



Alternative Strategy 1
Interdepartmental Research
Center in Urban Planning “Alberto Calza Bini”

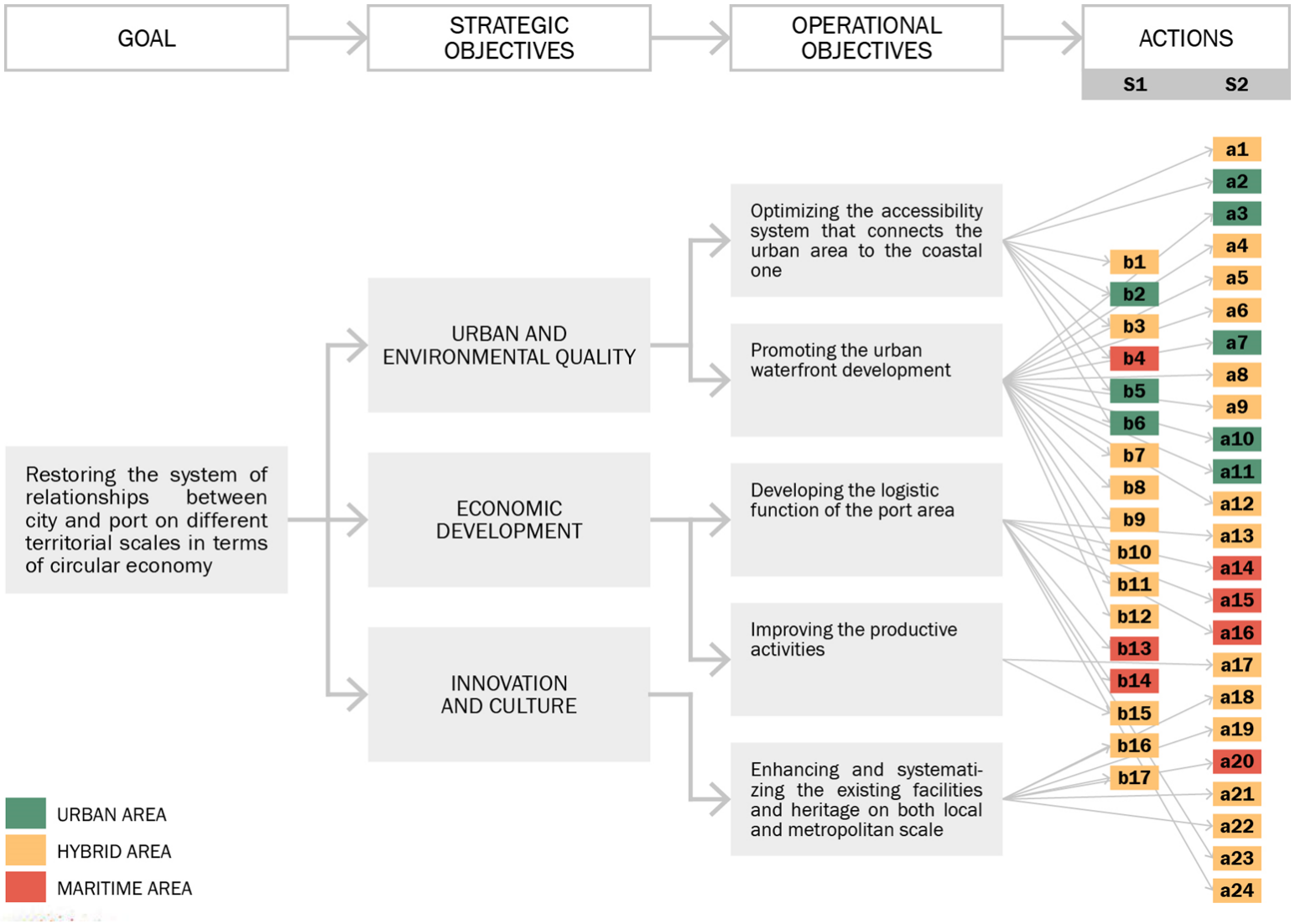


Alternative Strategy 2
II Level Master in Planning and Sustainable Design of Port Areas

URBAN AREA
HYBRID AREA
MARITIME AREA

3. REGENERATIVE STRATEGIES EVALUATION: THE CASE STUDY OF NAPLES CITY-PORT

The decision tree



3. REGENERATIVE STRATEGIES EVALUATION: THE CASE STUDY OF NAPLES CITY-PORT

The actions of Alternative Strategies

Alternative Strategy 1

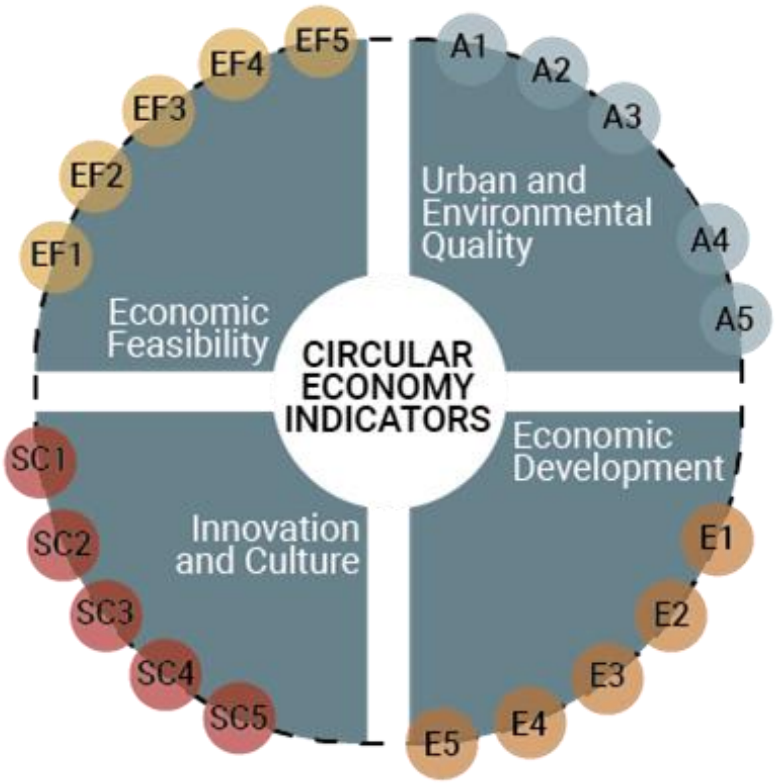
- **b1** Extension of the pedestrian walk from Pietrarsa to the beach of San Giovanni a Teduccio
- **b2** Construction/recovery of the cycle-pedestrian over/underpasses system
- **b3** Pier/terrace from Piazza Nardella
- **b4** High walkway
- **b5** Realizzazione di sovrappassi carrabili in prossimità dell'alveo
- **b6** Driveways overpasses
- **b7** Green areas
- **b8** Tower (services, restaurants, luxury hotel)
- **b9** Swimming pools
- **b10** Marina
- **b11** Leisure services
- **b12** Conversion of ex Tirreno Power into a music arena
- **b13** Terminal container
- **b14** Railway track serving the logistic/commercial function
- **b15** Special Economic Zones (ZES)
- **b16** New university equipment in the ex Corradini industry
- **b17** Urban planning of Vigliena's Fort

Alternative Strategy 2

- **a1** Pedestrian overpass system
- **a2** Driveway connection
- **a3** Support infrastructure for the existing railway station
- **a4** Urban park
- **a5** Green areas
- **a6** Leisure services
- **a7** Market area
- **a8** Swimming pools
- **a9** Open-air theatre
- **a10** Parking lots
- **a11** Underground parking
- **a12** Residential buildings
- **a13** Retroporto
- **a14** Terminal container
- **a15** Control tower
- **a16** Railway track serving the logistic/commercial function
- **a17** Distripark
- **a18** Relocation of the decommissioned treatment plant and its conversion in an eco-gym
- **a19** Recovery of the ex Corradini industry and conversion into an innovation hub
- **a20** Technological urban park
- **a21** Urban planning of Vigliena's Fort
- **a22** Environmental planning of the power plant
- **a23** Escavo of urban basin
- **a24** Submarine conduct in extension of the artificial riverbed

4. RESULTS

The core-set of indicators



QUANTITATIVE INDICATORS

- EF1 Overall cost
- EF2 Revenue
- EF3 Operating cost
- EF4 Ordinary maintenance cost
- EF5 Extraordinary maintenance cost

QUALITATIVE INDICATORS

- A1 Sustainable energy
- A2 Air pollutant emission
- A3 Public green space
- A4 Amount of municipal separate waste by sector
- A5 Stormwater runoff control by green roofs
- E1 Port trade balance
- E2 Port companies
- E3 Innovative start-up companies in the circular economy
- E4 Cruise passengers
- E5 Residential real estate listings
- SC1 Employment rate
- SC2 Percentage of employees in cultural and creative industries
- SC3 Innovative cultural associations
- SC4 Tourism intensity
- SC5 Demand for cultural heritage

4. RESULTS

The MCDA methods

How to derive multidimensional priority impacts related to a portfolio of regenerative design strategies for the Naples' port area?

↓

ANP method
(Analytic Network Process):

This method allows to set and compute **inner** and **outer dependencies** among criteria (nodes) belonging to different subsets (clusters) in order to perform the pairwise comparisons in a more inclusive way.

↓

The evaluation output produced a ranking of the indicators, which represents the priority impacts with respect to the achievement of a single intervention for each of them.

+

How to rank, and thus select, the optimal interventions by both the strategies of regenerative design for the Naples' port area?

↓

PROMETHEE method
(Preference Ranking Organisation METHod for Enrichment of Evaluations):

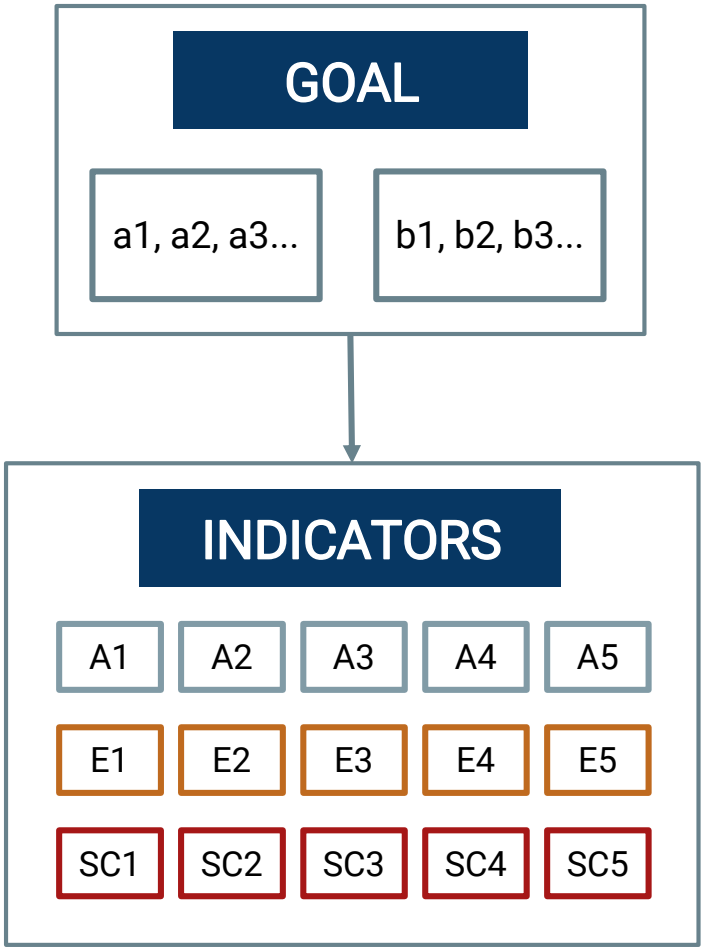
This method provides a **ranking ordering** of the decision alternatives through pairwise comparison among each alternative and the set of criteria (indicators).

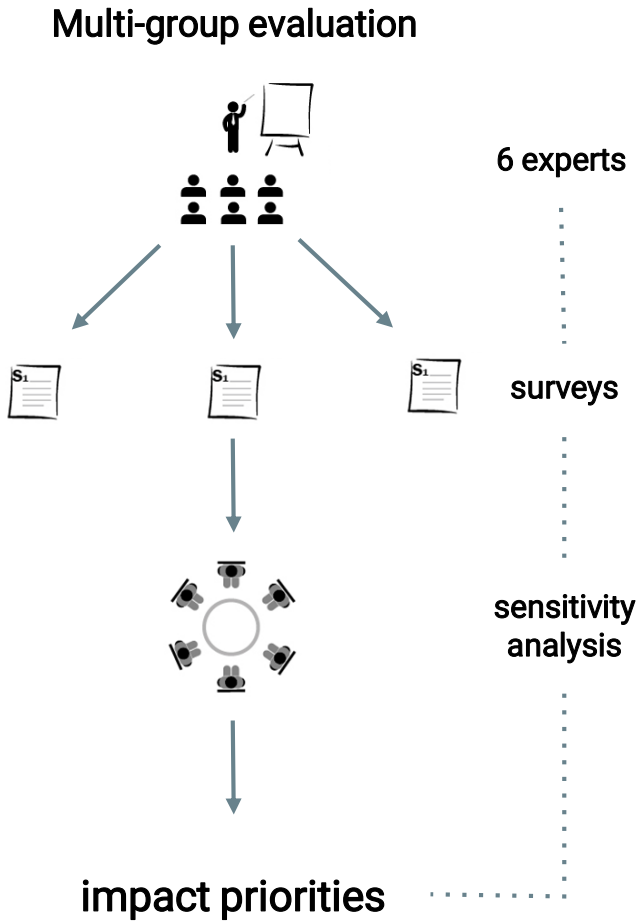
↓

The evaluation output allowed to identify optimal and non-optimal solutions within both the analysed strategies considering the performance of each solution respect to the operative objectives.

4. RESULTS

The ANP network within the decision-making problem

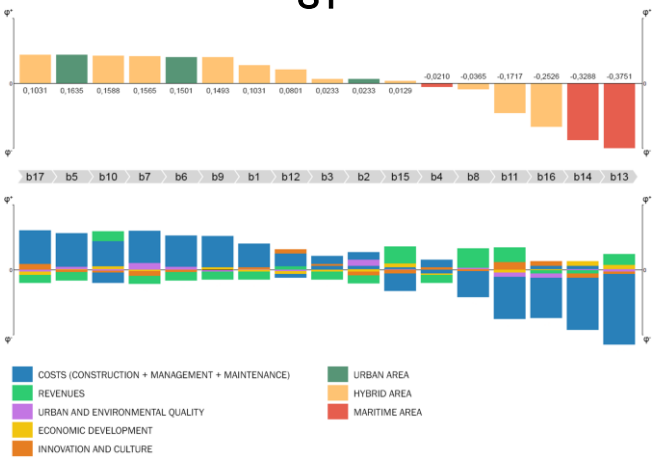


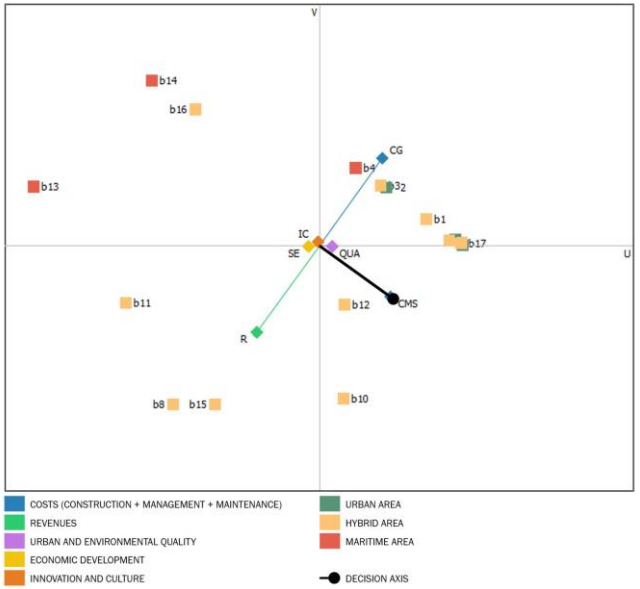


4. RESULTS

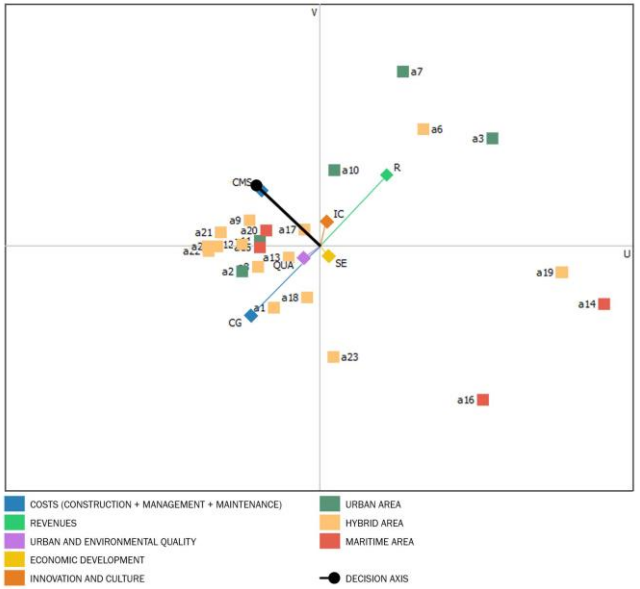
The optimal solutions by PROMETHEE method

S1





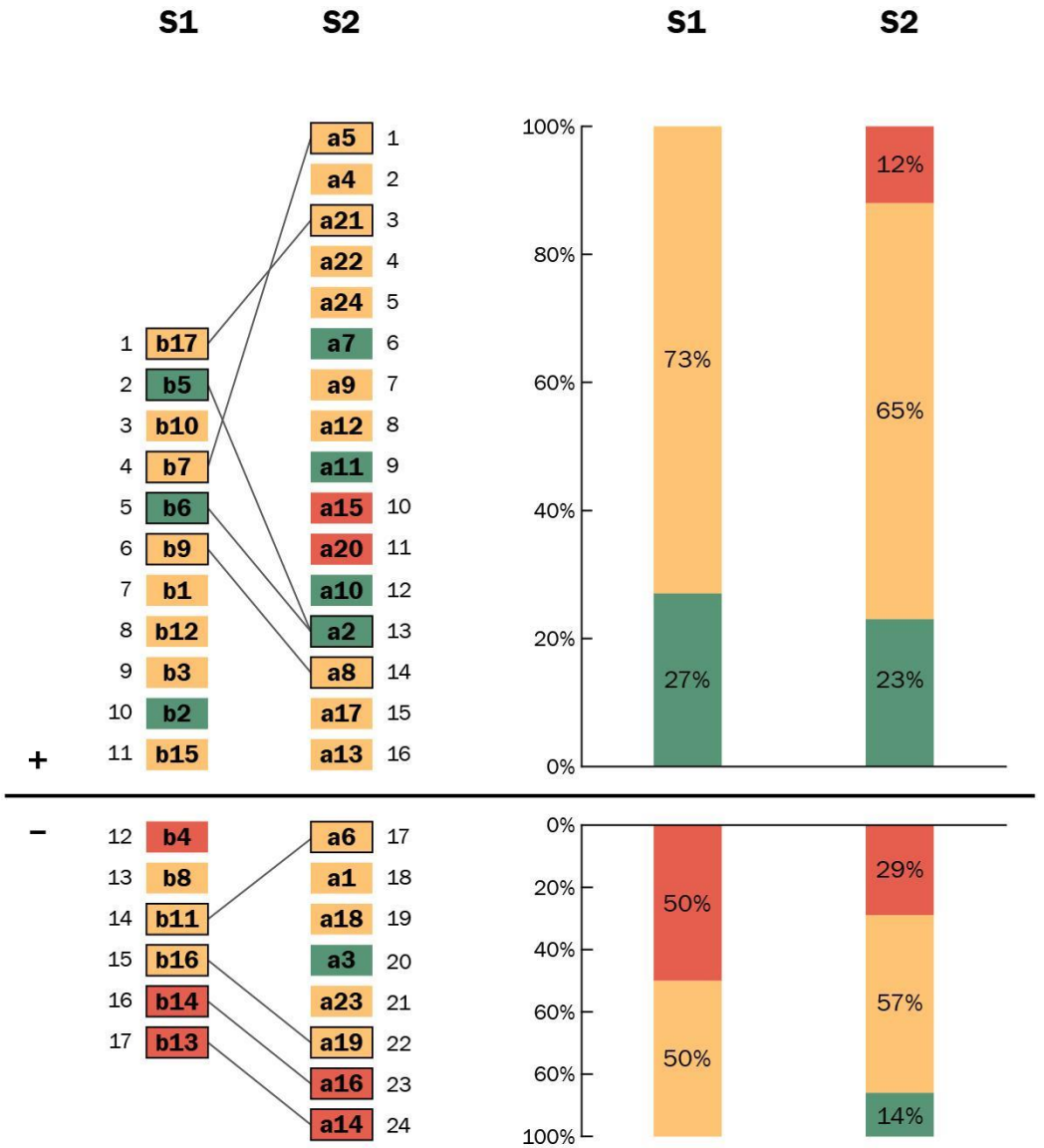
S2



4. RESULTS

- **Ranking** of **preferable actions** in terms of CE, for each Scenario and distinguished by areas. Connections between similar actions across the two scenarios are shown.

- **Preferable actions' concentration** within each area in percentage terms.



URBAN AREA
HYBRID AREA
MARITIME AREA

5. DISCUSSION AND CONCLUSIONS

The **selection of sustainable design strategies' portfolio** related to Naples City-Port represents a suitable process to boost a Circular City-Port Model for the Metropolitan Port-Cities. The selection procedures have been addressed to **operationalise CE principles** through the assessment of the **multidimensional impacts** of regenerative solutions.

The outcomes highlight that the **hybrid areas**, as interfaces among harbour's functions and city's facilities, are the most important spaces in which the **stakeholders need to converge** in terms of **allocation of sustainable and circular solutions**.

thank you

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