

Assessing the barriers to the development of electric vehicles in the urban transport network of Valencia

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Index

- **Introduction**
- **ANP**
- **Case study**
- **Goals**
- **Methodology**
- **Results**



Introduction

■ Climate change

- One of the most disturbing global issues.
 - Exorbitant amounts of GHG sent to the atmosphere.

■ Transport

- One of the most polluting sectors:
 - ✓ Responsible for:
 - 25% global CO₂ emissions
 - 50% cities' GHG emissions
 - ✓ 93% of its global consumption in 2017 derived from oil products (finite reserves).



Electrification of the transport system

Introduction

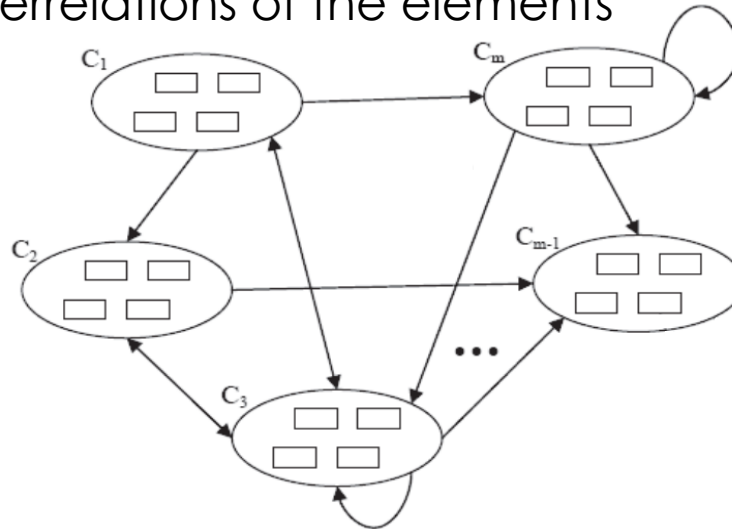
- **Slow development and integration of electric vehicles (EVs) in the urban transportation network**
 - 2017 average market share in European Union: 1,14%.
 - Wide range of barriers:
 - ✓ Some of them could seem the main drivers
 - Accessibility of charging stations
 - Charging time...
 - ✓ Some others result sometimes neglected despite its importance
 - Users' willingness to accept driving changes...
 - ✓ Can be grouped in different clusters, with interdependence between them and the different alternatives of transport system.



Multicriteria and multiple choice problem

Analytic Network Process (ANP)

- **Multi Criteria Decision Making (MCDM)**
 - Proposed by Saaty
 - Tackle problems characterized by:
 - ✓ Uncertain qualitative information
 - ✓ Lack of information
 - ✓ Complex interrelations of the elements

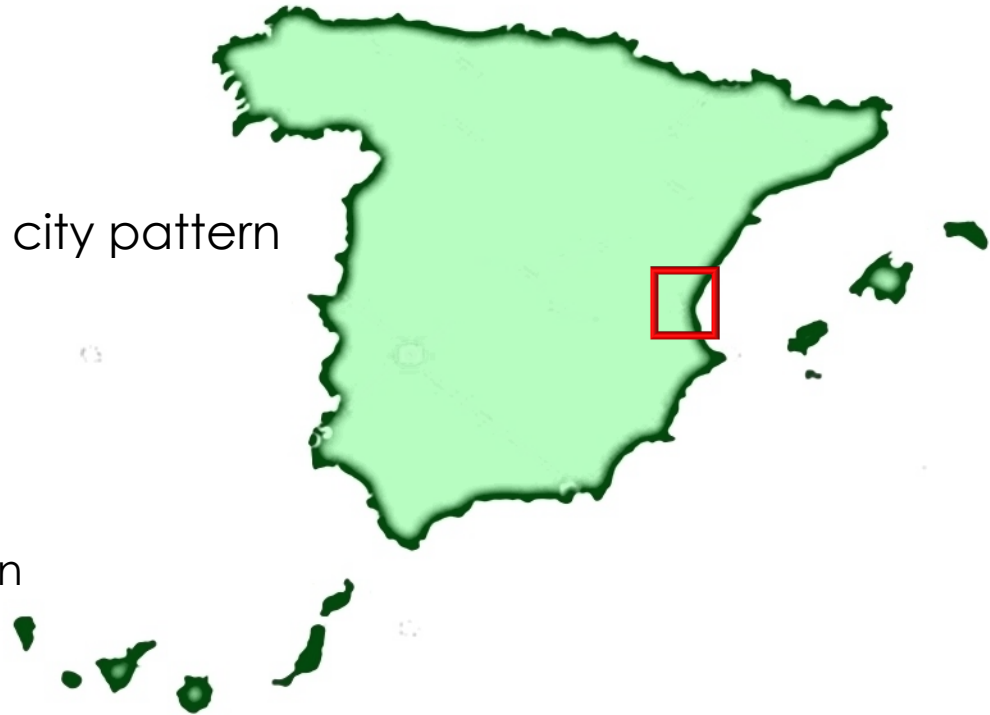


Study of the obstacles to the integration of EVs regarding different transport areas.

Case study

■ Valencia (Spain)

- Application:
 1. Universal application
 2. Mediterranean flat medium city pattern
 - ✓ Mediterranean climatology
 - ✓ Buildings architecture
 - ✓ Flat orography
 - ✓ Medium size
 - ✓ Mature electricity distribution
 3. Valencia



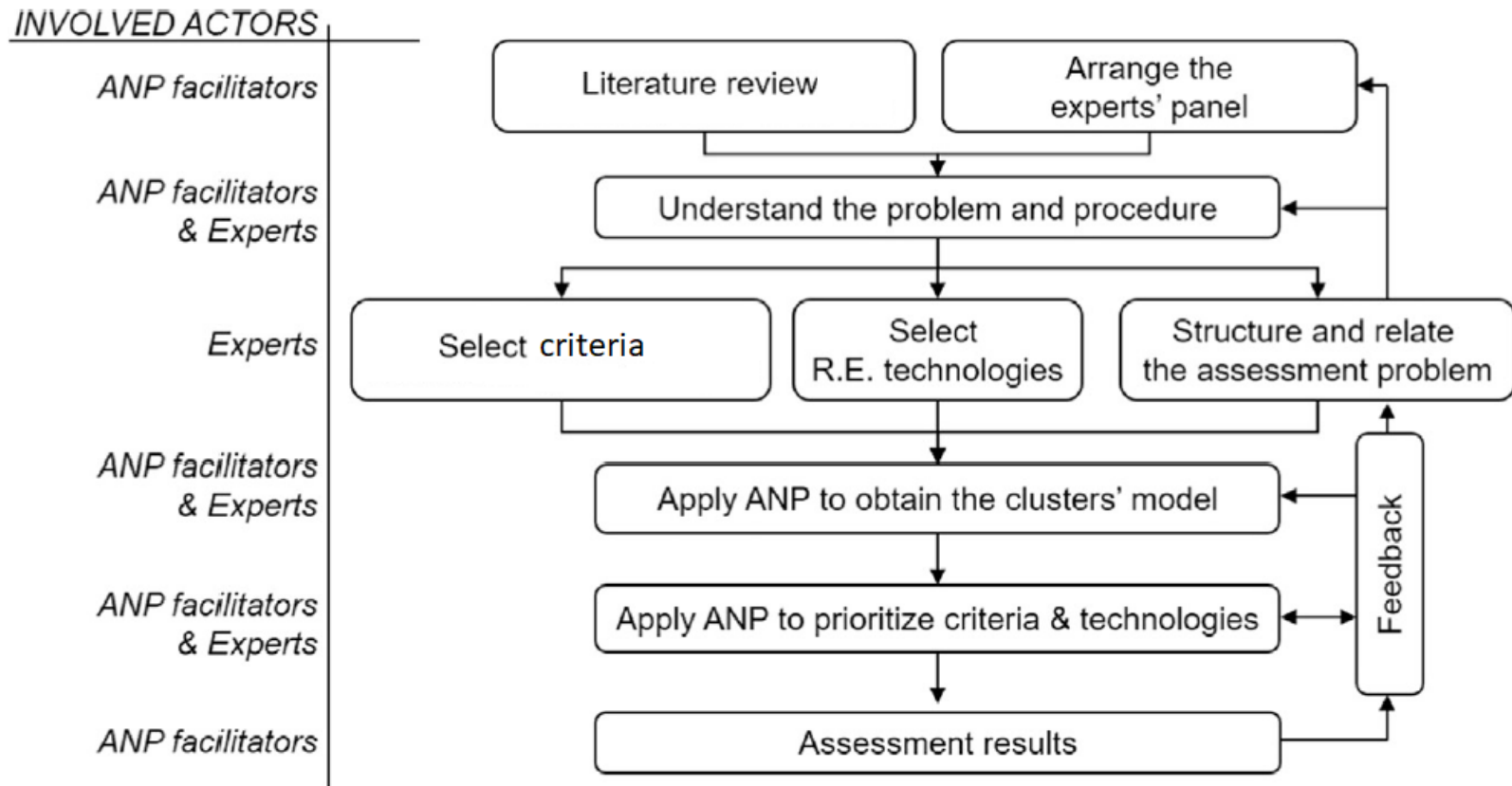
Goals

- To **identify** and **classify** all the **barriers** to the introduction of EVs in the transport system of Mediterranean flat medium cities.
- To arrange a **panel of experts** to assess the interdependences of transport alternatives and obstacle factors.
- To **rank order** the influential criteria, and the mobility alternatives accordingly, in order to inform the decision making processes of designing electric mobility in Mediterranean flat medium city patterns, specifically in Valencia city.



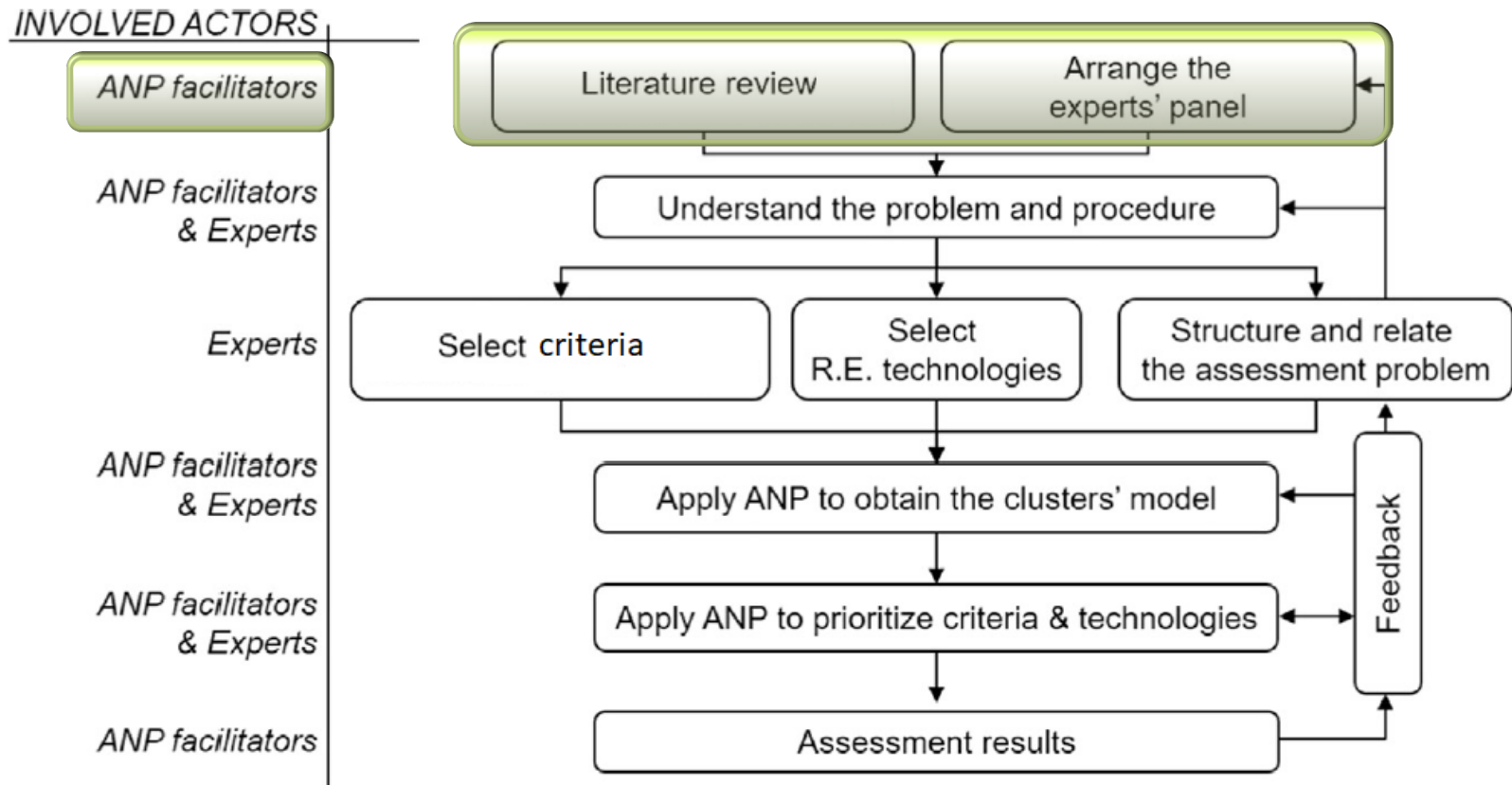
Methodology

■ Flowchart



Methodology

- Literature review and arrangement of the expert's panel**



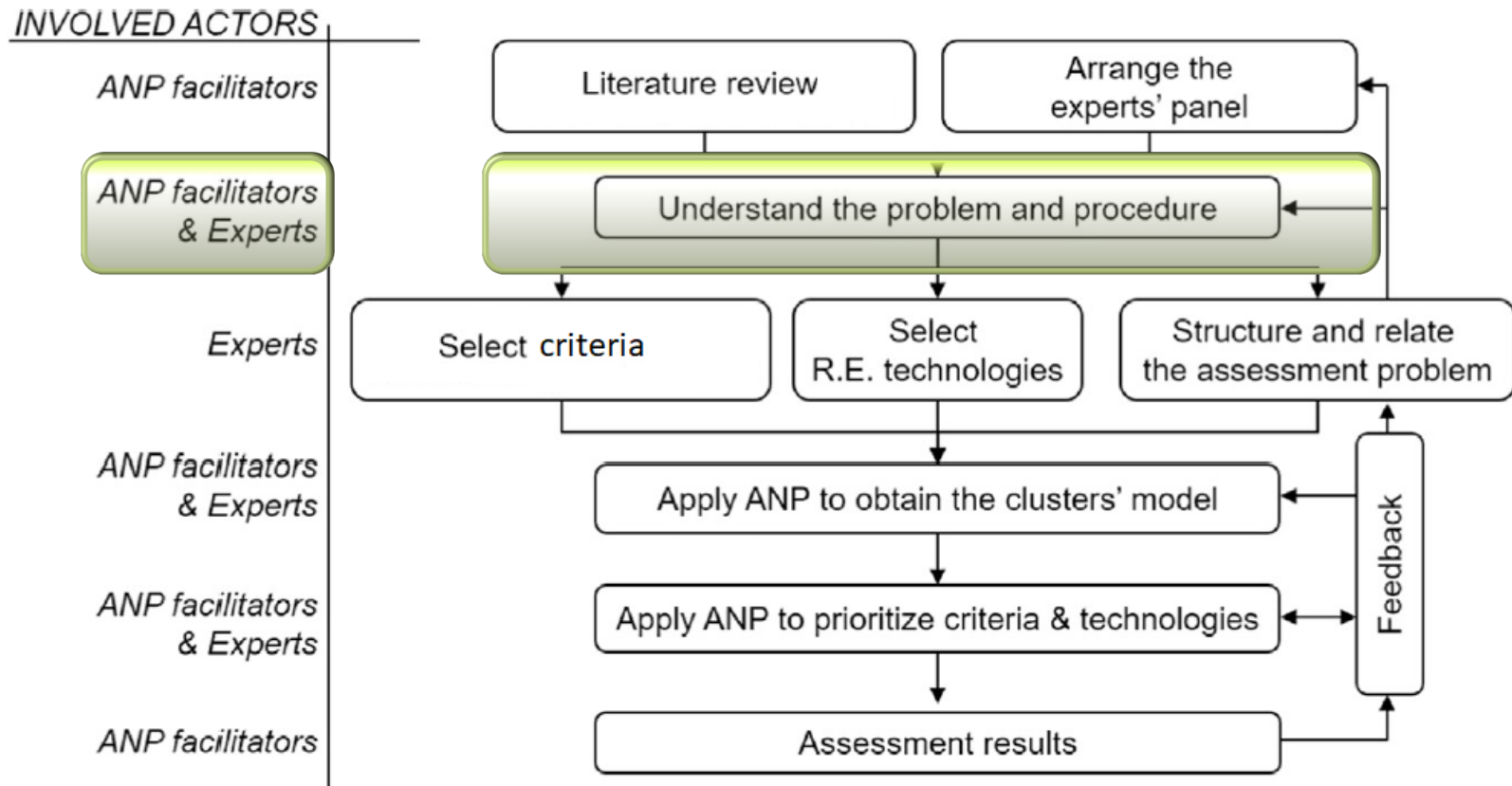
Methodology

- **Literature review and arrangement of the expert's panel**

Experts	Description
Academia	Researches have been working in the electrification of transport for a time now. Different studies deal with both the need to decarbonize transport and how to optimally do so from technical, environmental, and social perspectives. Their insight provides expertise on how systems are designed now but also the future trends.
Private sector	Vehicle manufacturers are moving fast to shift production to electric. Moreover, new companies are arising to produce elements that were not present in the fossil fuel based system such as chargers, electronic elements...
Policy makers	They have expertise in the system as a whole and promote policies and plans to decarbonise the transport sector. These include municipal, regional, and national planners that manage from daily elements of mobility such as traffic management, public transport tax to strategic planning.
Users	In the transition of transport towards sustainability, users will be key stakeholder as they benefit and have the right to mobility. Users will face not only technical but also social and behavioural barriers associated with an embedded tradition of individual car use.

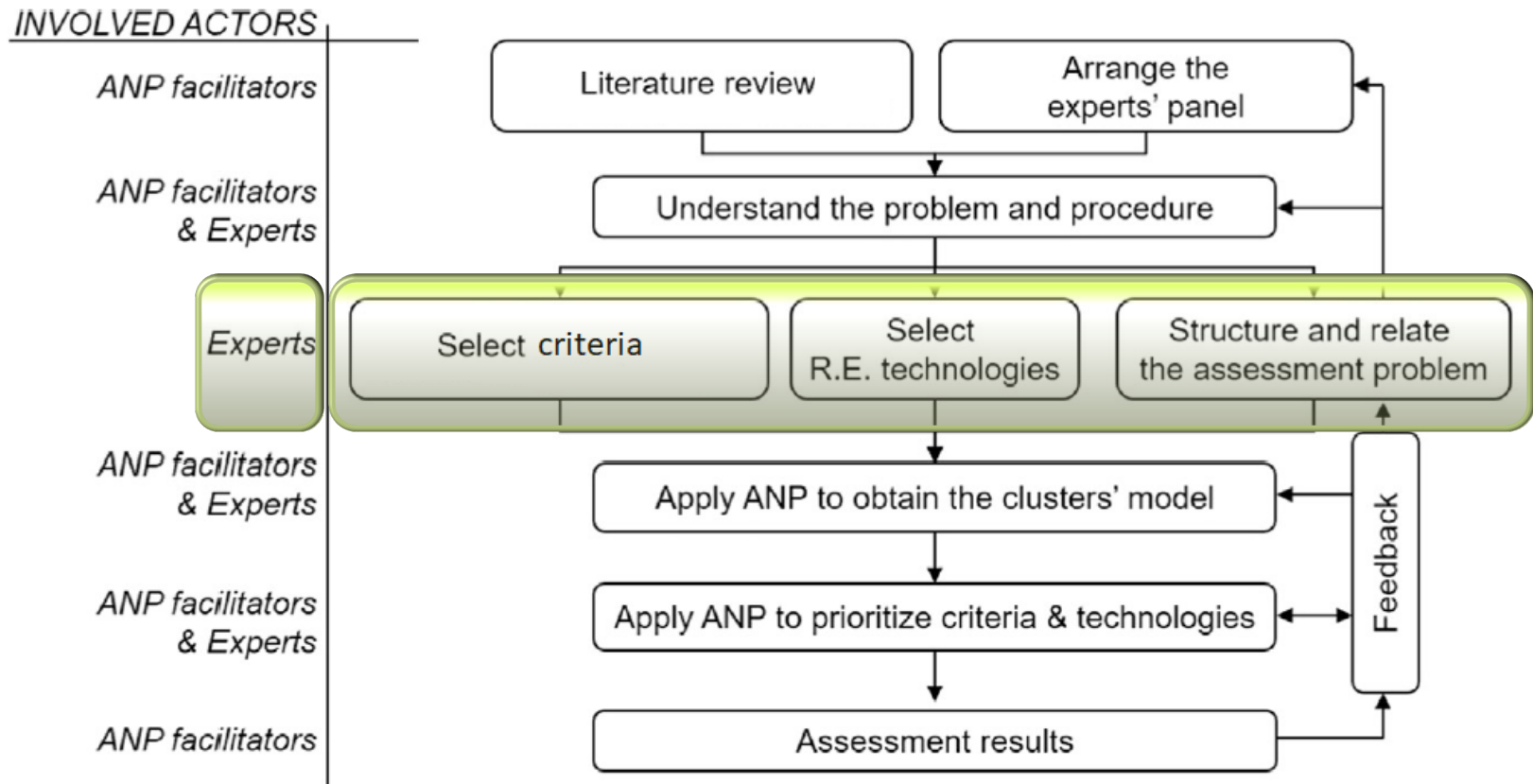
Methodology

- Understand the problem and procedure**



Methodology

- **Select barriers and alternatives. Structure and relate the problem**



Methodology

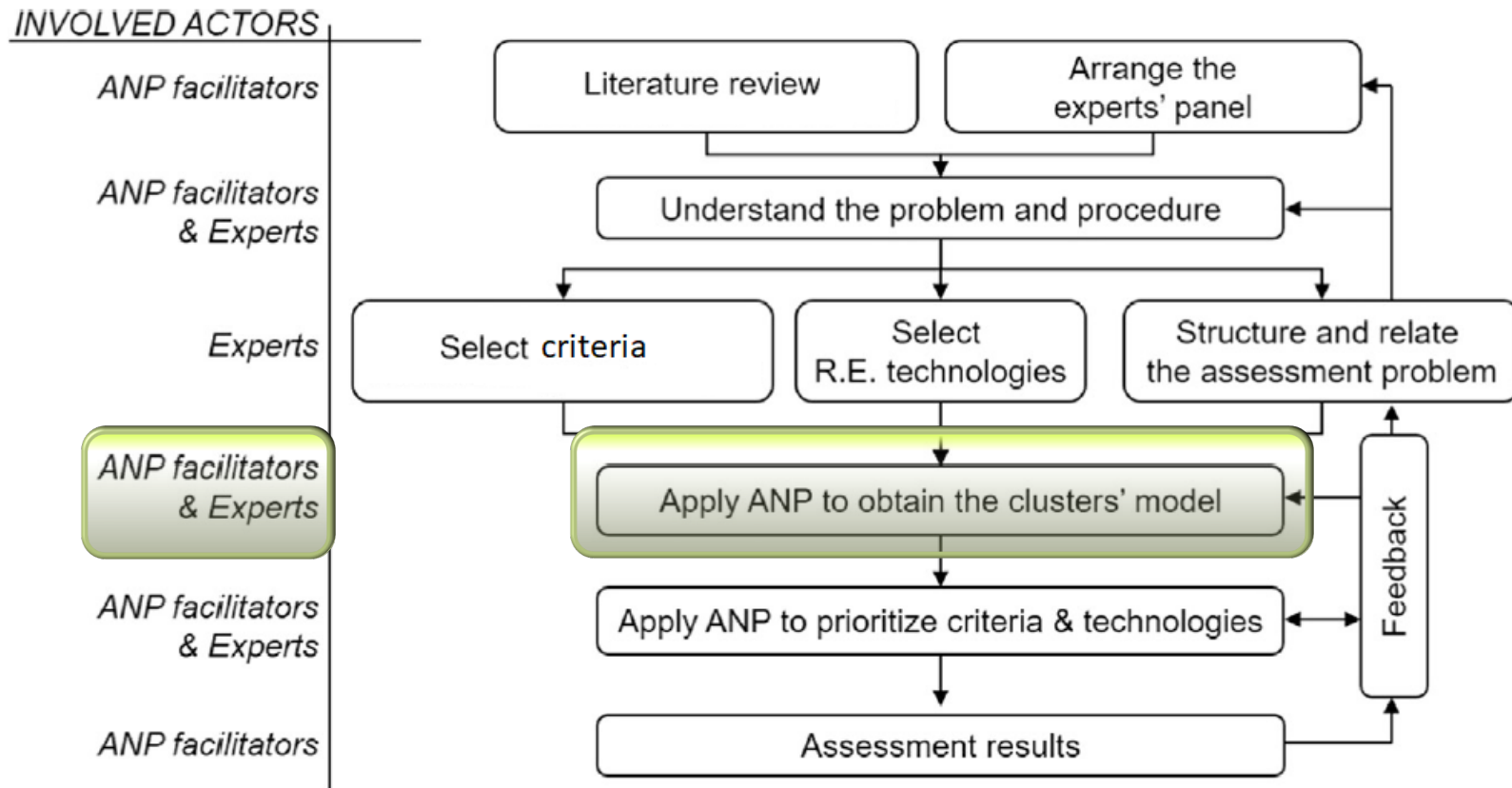
- Select barriers and alternatives. Structure and relate the problem**

Clusters	Barriers
Technical	<ul style="list-style-type: none"> ▪ Shortage of public recharging points ▪ Batteries' autonomy power ▪ Long time recharging periods ▪ Negative impact on the electrical grid of non-scheduled recharge ▪ Lack of standardization in EVs' components
Economic	<ul style="list-style-type: none"> ▪ CapEx of EVs ▪ CapEx of recharging points' structures ▪ OpEx of recharging points' structures ▪ CapEx of batteries
Social	<ul style="list-style-type: none"> ▪ Lack of previous EV models ▪ Fear of changing pre-established driving patterns ▪ Lack of knowledge of electric mobility
Environmental	<ul style="list-style-type: none"> ▪ Finite batteries resources ▪ Life cycle of the EVs' batteries ▪ Residues of the EVs' batteries
Institutional	<ul style="list-style-type: none"> ▪ Insufficient subsidies for EVs' development ▪ Insufficient traffic taxes to promote EVs
Alternatives	<ul style="list-style-type: none"> ▪ Mobility of services: ambulance, firefighters, police... ▪ Freight transport ▪ Public passenger transport ▪ Private passenger transport ▪ Private transport sharing



Methodology

- Apply ANP to obtain cluster's model



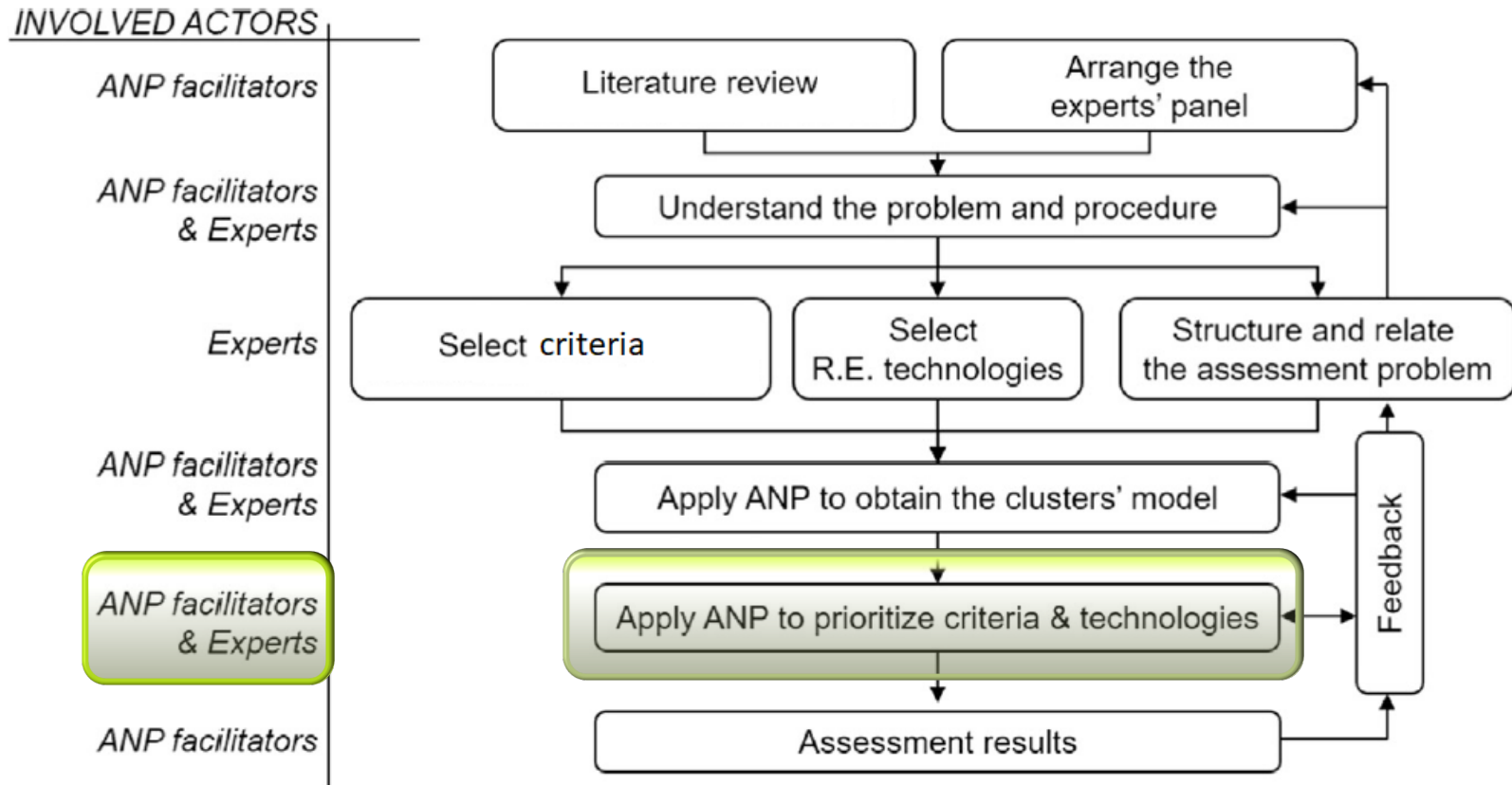
Methodology

■ Apply ANP to obtain cluster's model

		TECHNICAL					ECONOMIC				SOCIAL			ENVIRONMENTAL			INSTITUTIONAL		ALTERNATIVES					
		Shortage of public recharging points	Batteries' autonomy power	Long time recharging periods	Negative impact on the electrical grid due to non-scheduled recharge	Lack of standardization in EVs' components	CapEx of Evs	CapEx of recharging points' structures	Opex of recharging points' structures	CapEx of batteries	Lack of previous EVs models	Fear of changing driving patterns	Lack of knowledge of electric mobility	Finite batteries resources	Life cycle of the EVs' batteries	Residues of the EVs' batteries	Insufficient subsidies for EVs' development	Insufficient traffic taxes to promote EVs	Mobility of public services	Freight transport	Public passenger transport	Private passenger transport	Private transport sharing	
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Methodology

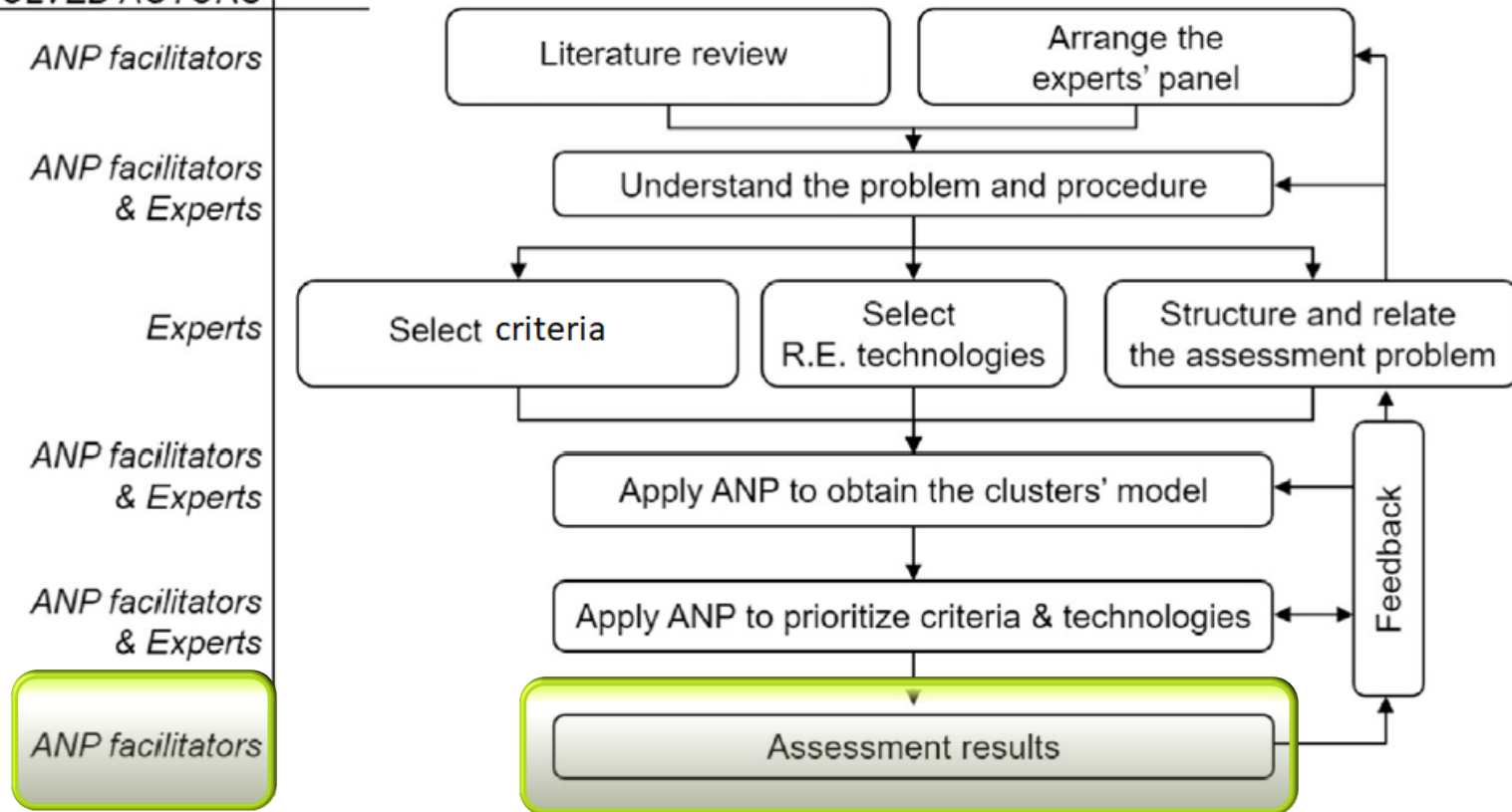
- Apply ANP to prioritize criteria and technologies



Methodology

Assessment results

INVOLVED ACTORS



Results

■ Research in progress

- To **identify** and **classify** all the **barriers** to the introduction of EVs in the transport system of Mediterranean flat medium cities.



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Results

- **Research in progress**

- To arrange a **panel of experts** to assess the interdependences of transport alternatives and obstacle factors.



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Results

■ *Research in progress*

- To **rank order** the influential criteria, and the mobility alternatives accordingly, in order to inform the decision making processes of designing electric mobility in Mediterranean flat medium city patterns, specifically in Valencia city.



Thank you very much for your attention

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