A Tool for the Assessment of Urban-Mobility Scenarios in Climate Change Mitigation: an Application to the Granada's LRT Project

Miguel Lorenzo Navarro Ligero
Luis Miguel Valenzuela Montes

ugr Universidad de Granada

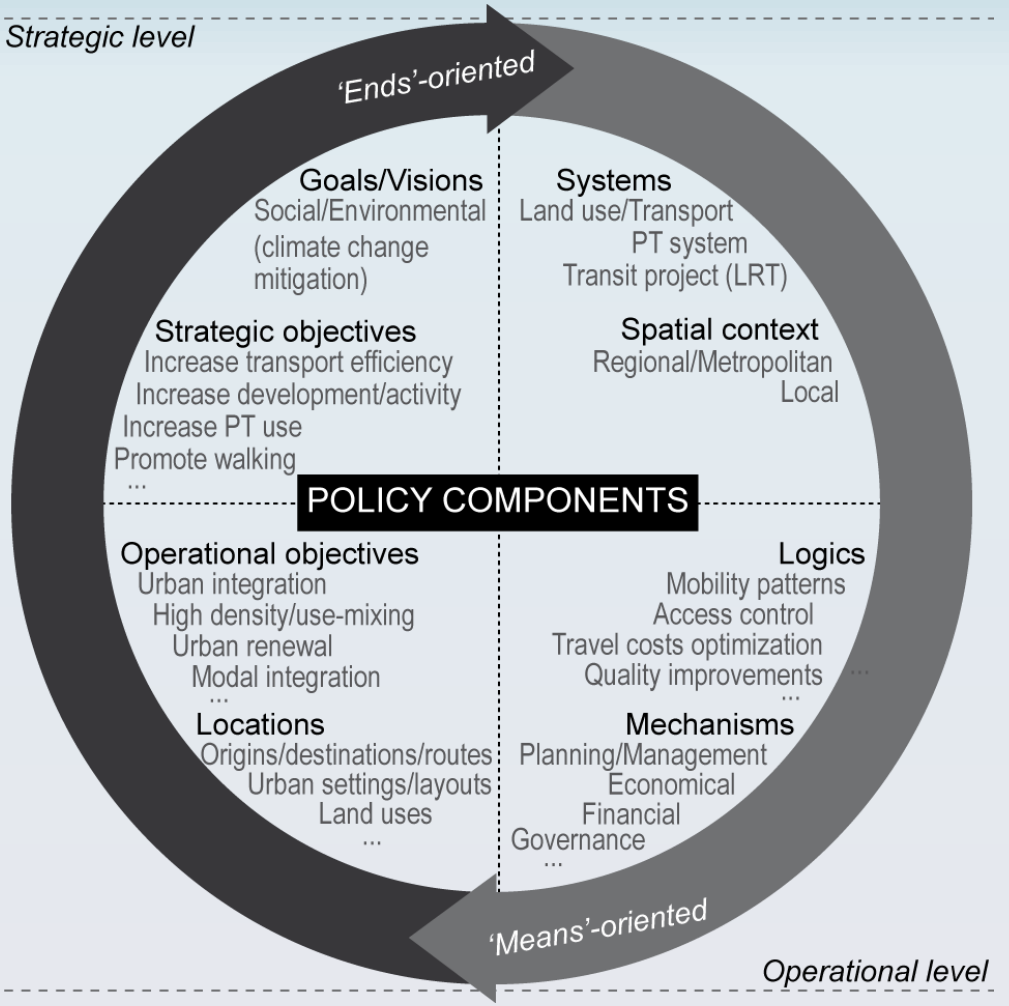
labplam Laboratorio Planificación Ambiental

Problem statement: dimensions of climate change

- New guiding concepts: *energy efficiency, resilience, adaptation capacities…*
- Multiple responses: *mitigation? adaptation? new urban-development models? alternative modes? new technologies? …*
- Strategic and systemic approaches: *policy alignments, stabilization/destabilization, transitions…*
- Long-term scope and uncertainty:
  - *What will be relevant?*
  - *Will solutions be effective?*
  - *Will effective solutions endure?*

Problem statement: barriers of mobility planning

- Two levels of in policy making *(strategic* and *operational)* + Two main *policy components*
- Gaps between levels:
  - Information
  - Thinking paradigms, approaches and methods
  - Feedback/continuity
  - Decision-making contexts (uncertainties)



Problem statement: scenarios as planning tool

- Scenarios: *internally coherent and plausible futures*.

  Plausible: "appearing worthy of belief" ≡ relevant to policy making

- Properties and dimensions considered:

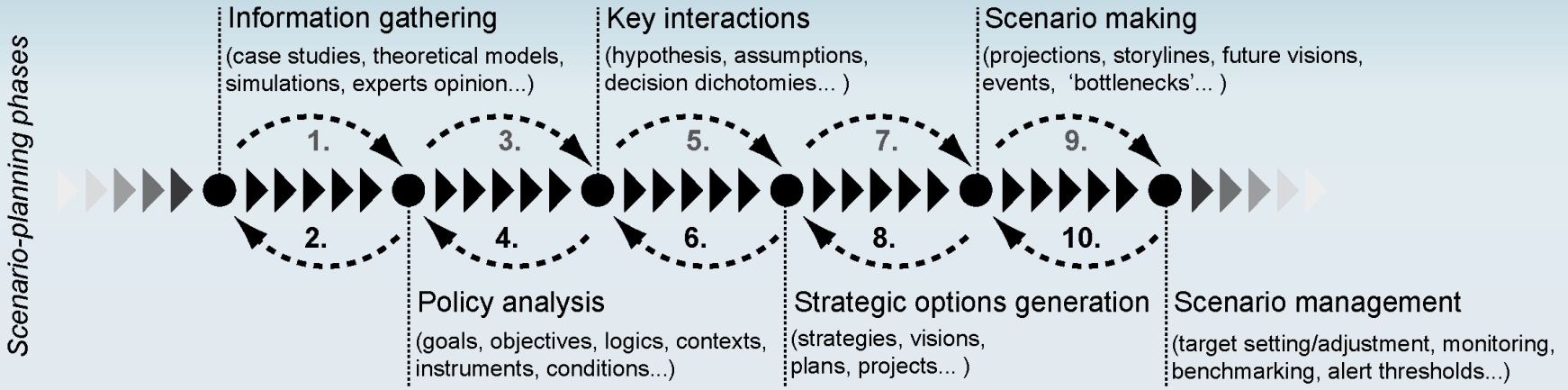
Diversity	Incremental vs. Exploratory
Transition	Trend-based vs. Trend-breaking
Consistency	Conservative vs. 'Edge-scenarios'
Performance	Structure-relevant vs. Decision-relevant

- Nature of scenarios:
  - Structured elements (variables, states, parameters –quantitative, qualitative –, indicators…)
  - Unstructured elements (ideas, themes, storylines, developments…)
- Use of scenarios:
  - Reactive vs. Proactive
  - Forecasting vs. Backcasting
  - Planning inputs vs. Planning products

Research objectives: a tool for mobility planning (MITIGA)

- Decision-making tool prototype for assessing strategic options, under a set of plausible futures (scenarios)
- Features:
  - Strategic options (policy packaging)
  - Assist scenario making through scenario-structure generation (morphological analysis)
  - Assessment framework embedded in scenario-making
- Underlying principles:
  - Focus on ‘right processes’ rather than ‘right answers’
  - Flexibility and modularity
  - Simplicity and transparency
  - Exploratory capacity and interactivity

Methodology: MITIGA framework & scenario-planning phases



Methodological steps

Unstructured process

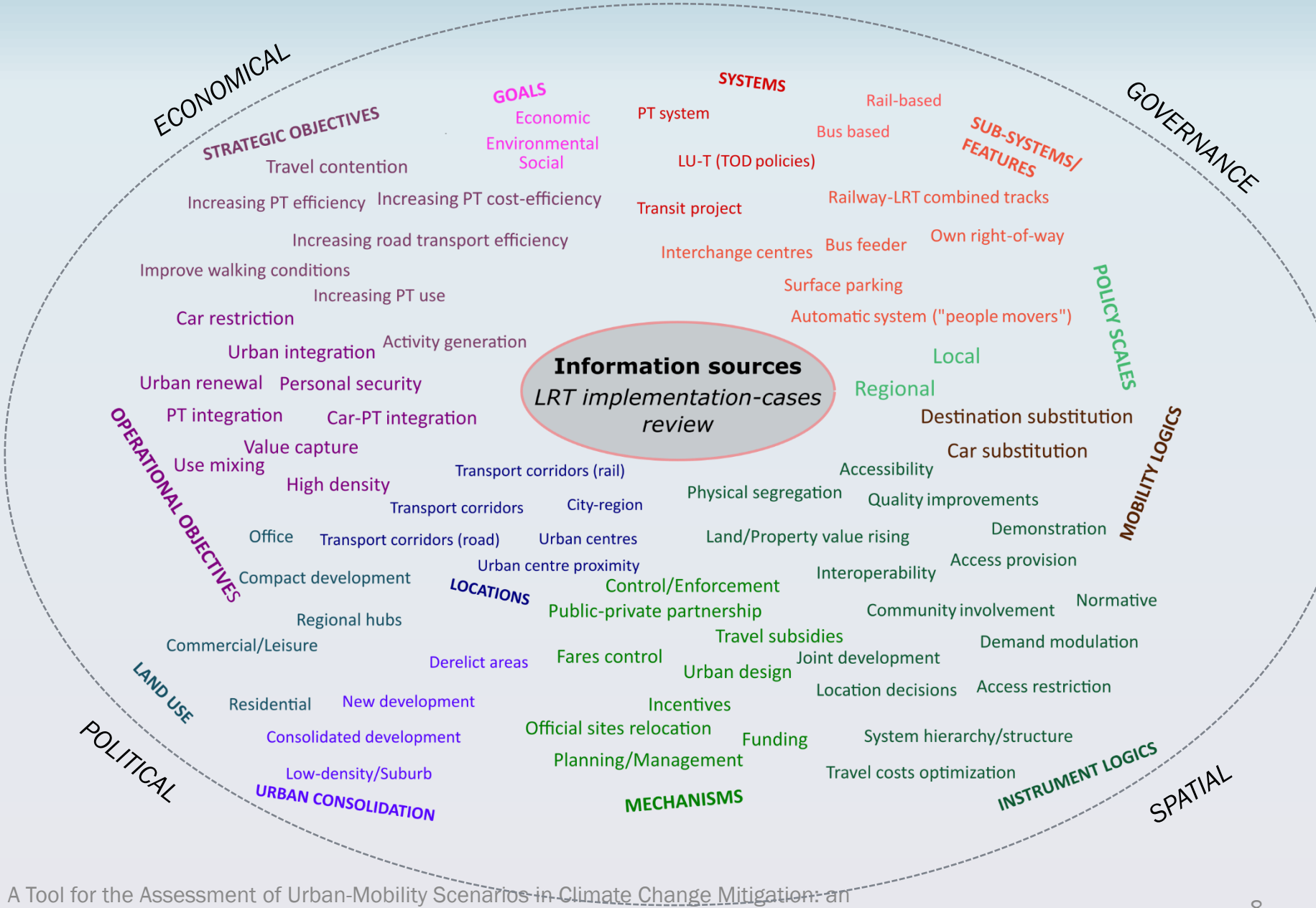
1. Policy content, context and barriers/opportunities analysis
3. Future conditions and uncertainties, in relation to policy components (*policy alignments*); formulation of hypothesis about key interactions ('how do certain policy arragments align with future conditions?')
5. Exploring alternative policy-combinations for developing strategies
7. Set scenario boundaries: base-scenario definition, trend relevance (inertia, weak/strong signals of change...) and relationships between variables (compatibility, conditionality, mutual stabilization/destabilization...)
9. Scenario outlines and elaboration of themes,arguments and developments (narratives, storylines, future visions, etc.)

Structured process (MITIGA-tool elements)

2. Indentification of representative *policy components* and scenario-structure elements: variables (*driving forces*) and states (*trends*)
4. Formalisation of *interaction rules* between *trends* and *policy instances*
6. Identification of alternative *strategic options* and *criteria*
8. Scenario generation (*morphological analysis*), scenario metrics (*performance, transition depth* and *consistency*) ans screening
10. Definition of *performance indicators* (targets), and *state indicators* (alert thresholds, signposts, etc.)

Methodology: policy analysis *(policy components)*

Methodology: policy analysis *(policy components)*



Methodology: policy analysis *(driving forces and trends)*

- Identification of *driving forces* and *trends (LRT example)*

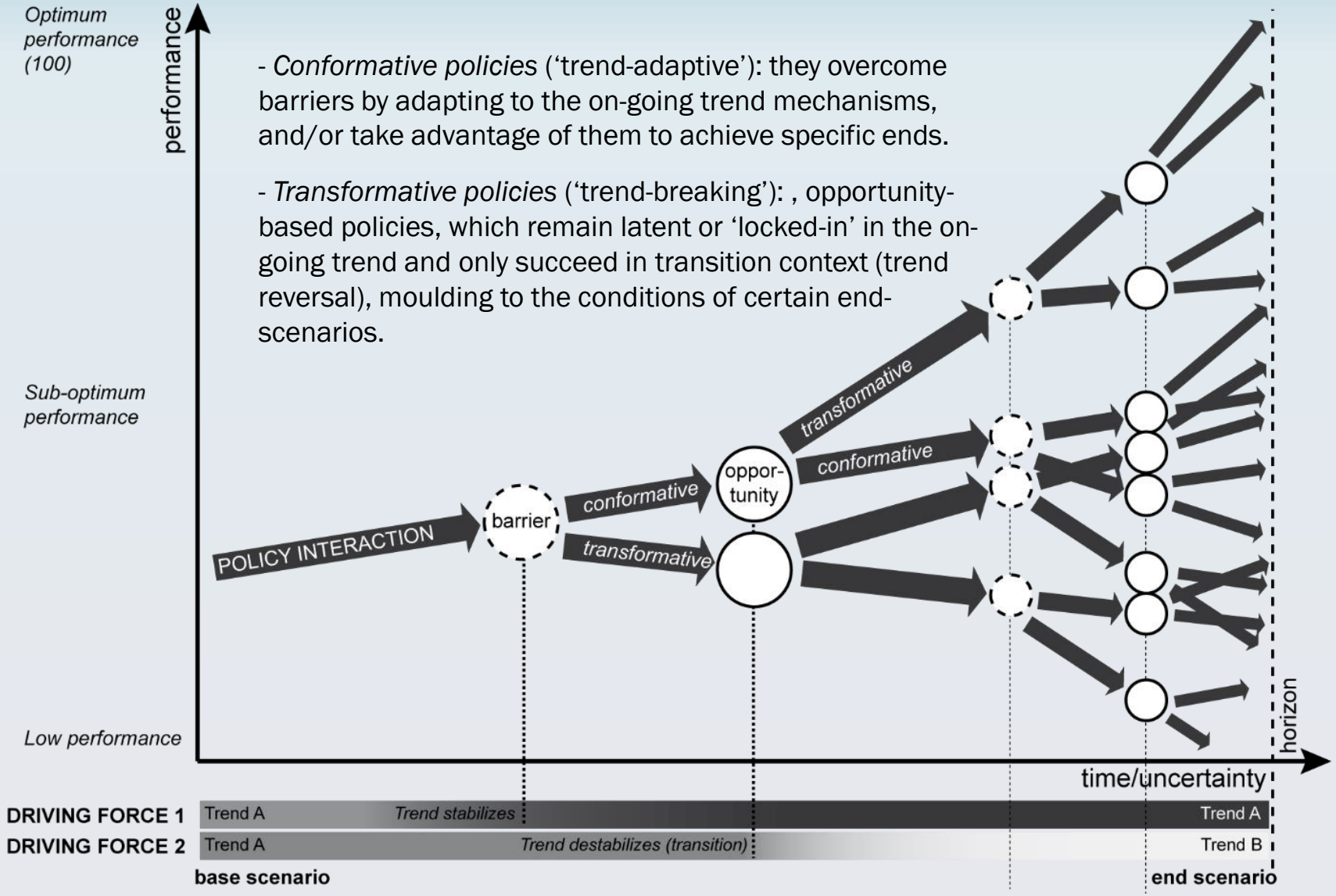
Conditions	Driving forces	Trend A	Trend B
Economic	1. Economic 'climate'	Growing	**Recessive***
Political/ Governance	2. Spatial-planning tradition	Proactive	**Reactive***
Governance	3. Transport-management context	Regulated	**De-regulated***
Governance	4. Power/Autonomy of local planning authorities	**High (decentralisation)***	Low (centralisation)
Governance	5. Coordination in planning functions	**Low***	High
Political-spatial	6. Orientation of transport policy-making	Transit-oriented	**Car-oriented***
Spatial-economic	7. Urban-centrality distribution	Centralisation	**Decentralisation***
Spatial-economic	8. Regional economies/Metropolitan functional integration	'City strongholds'	**'City clusters'***
Social-behavioural	9. Public-transport image	**'Low-class'***	'High-class'
Social-behavioural	10. Car dependency	Car-dependent	**Pro-car***
Social-behavioural	11. Urban life-styles and traditions	**'Urban vibrancy'***	Urban decadence

*Granada's base-scenario

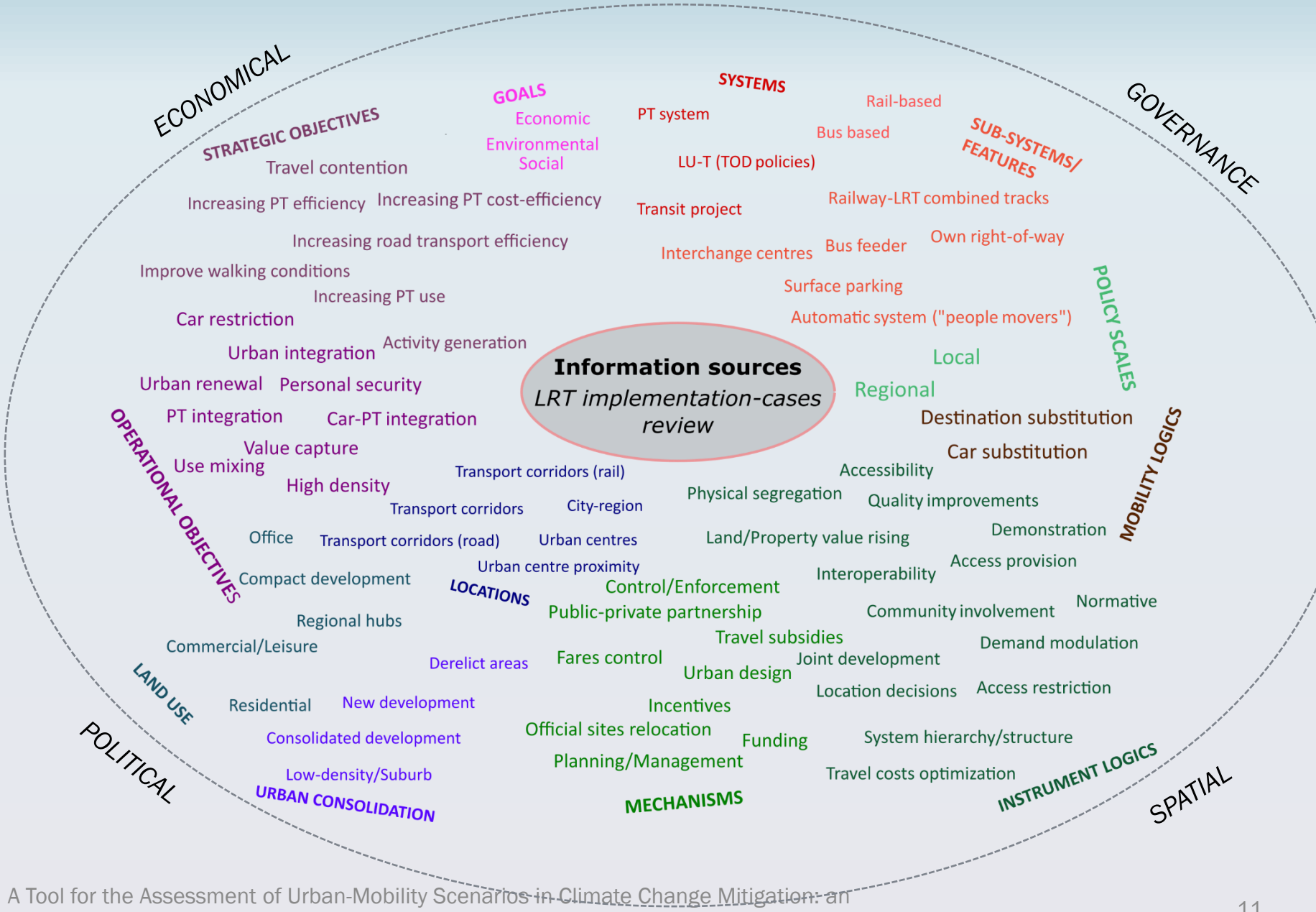
Methodology: *policy alignment* assessment

- *Conformative policies* ('trend-adaptive'): they overcome barriers by adapting to the on-going trend mechanisms, and/or take advantage of them to achieve specific ends.

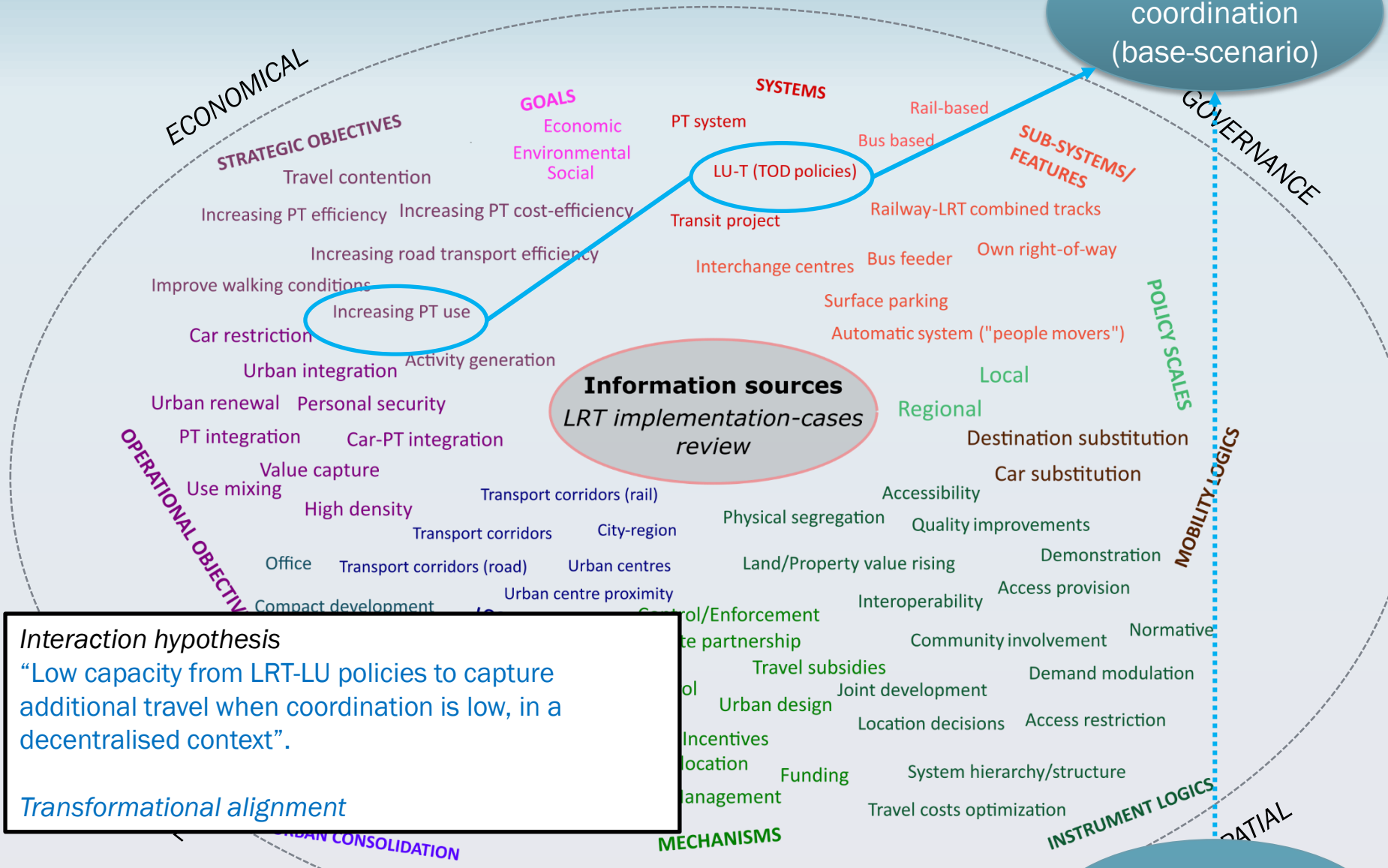
- *Transformative policies* ('trend-breaking'): , opportunity-based policies, which remain latent or 'locked-in' in the on-going trend and only succeed in transition context (trend reversal), moulding to the conditions of certain end-scenarios.



Methodology: *interaction rules*



Methodology: *interaction rules*

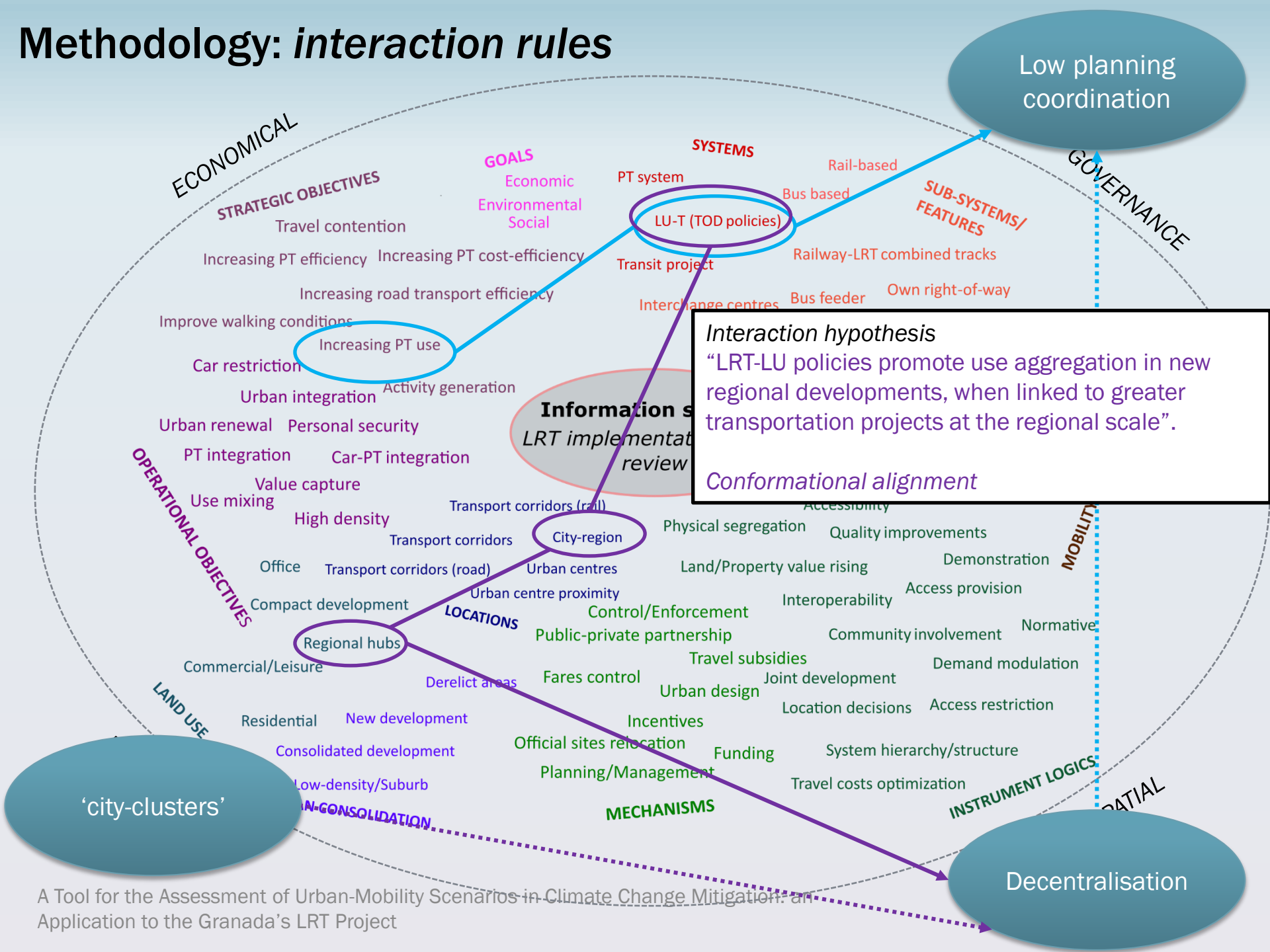


Interaction hypothesis

"Low capacity from LRT-LU policies to capture additional travel when coordination is low, in a decentralised context".

Transformational alignment

Methodology: *interaction rules*

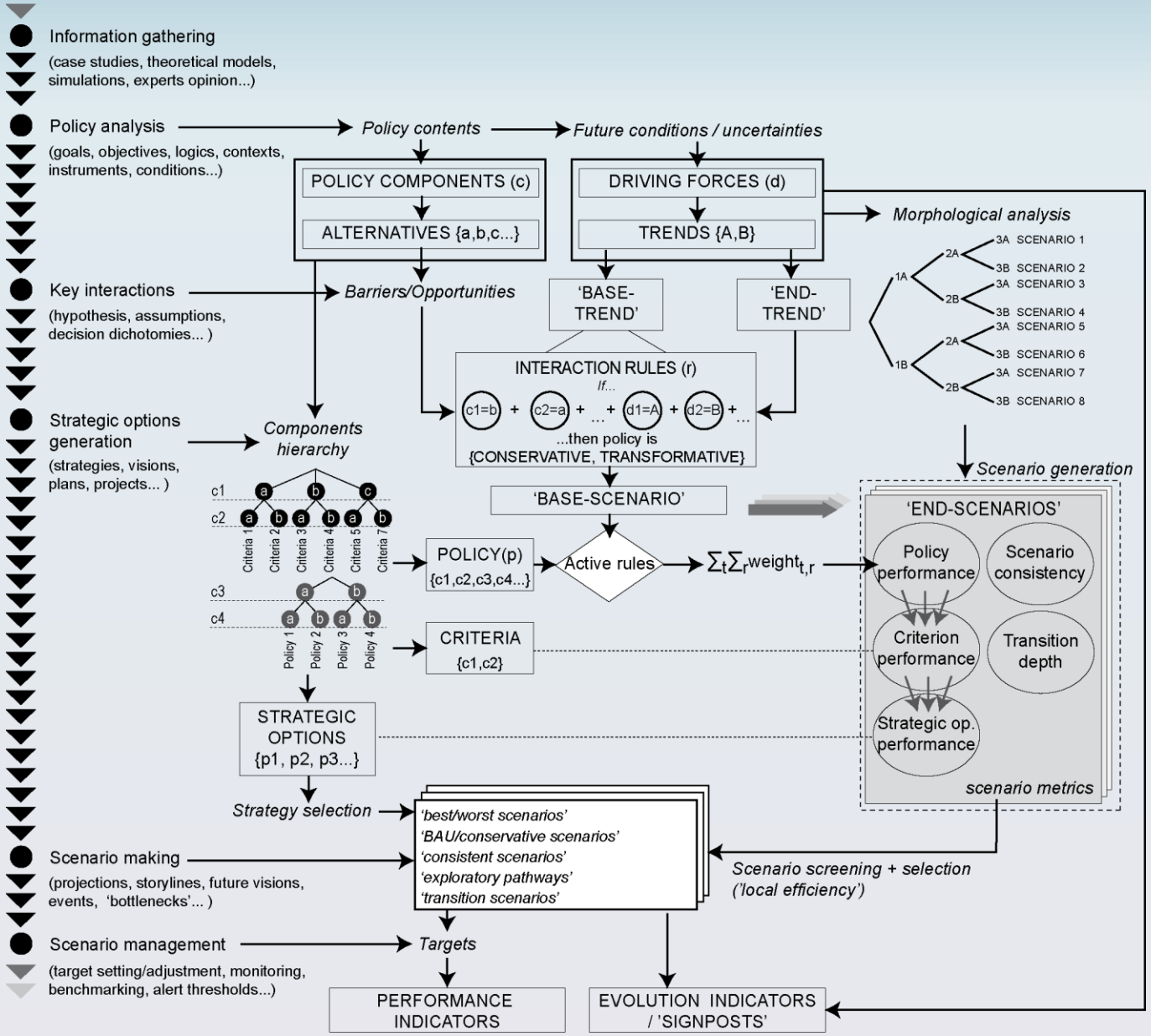


Interaction hypothesis

"LRT-LU policies promote use aggregation in new regional developments, when linked to greater transportation projects at the regional scale".

Conformational alignment

Methodology: building the structure



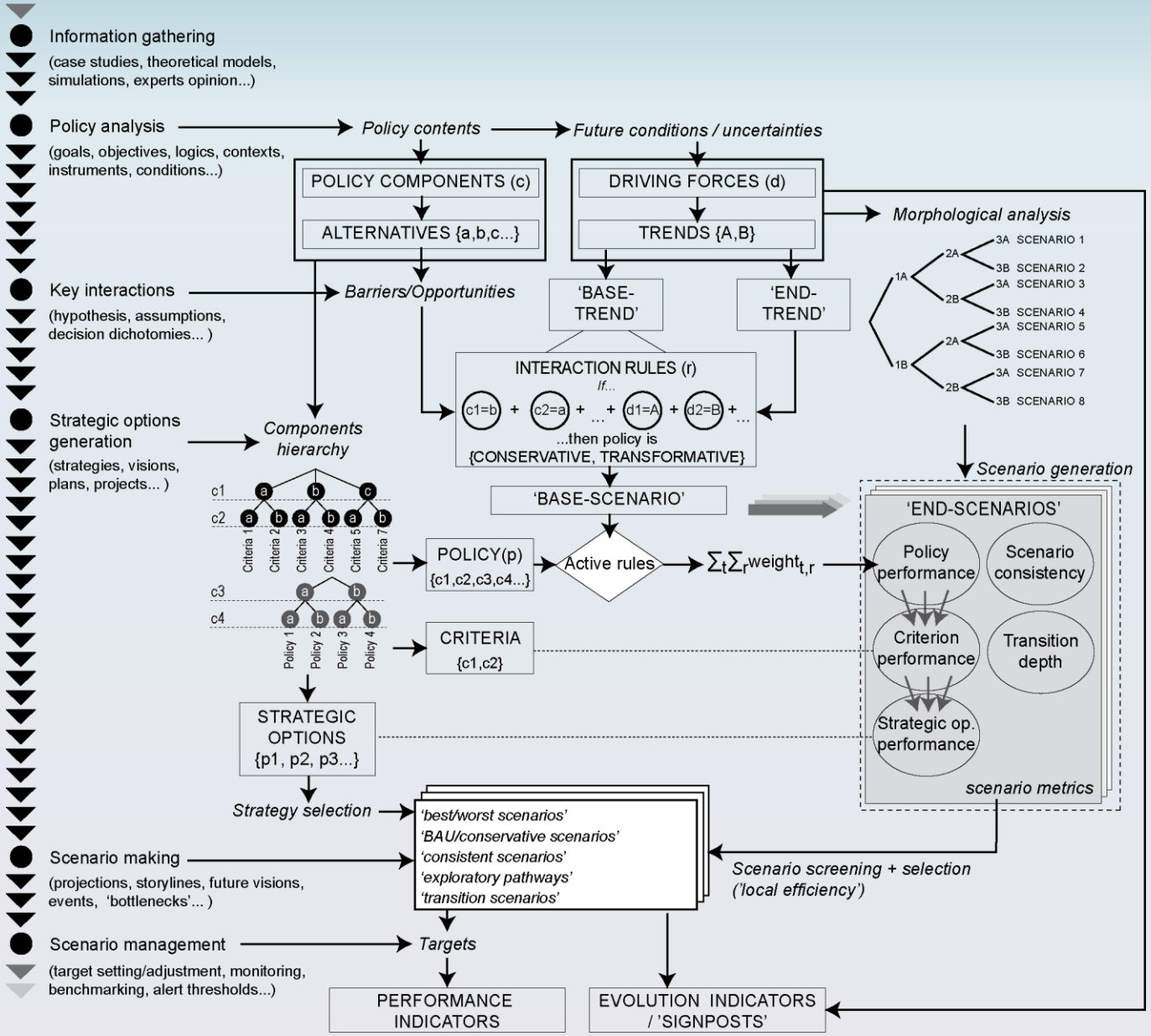
Methodology: *criteria* for mitigating climate change

Main strategy	Main approach (A-S-I)	Criterion	Instance{components} = {strategic objectives, mobility-patterns logics } (<ns>: not specified)
1. 'Urban contention'	Avoid	Walkable city	*{improve walking conditions, destination substitution}*
		Travel contention	*{reduce travel need, destination substitution}*
		Compact city	*{generate activity/development, destinations substitution}*
	Shift	Modal shift (walk)	*{improve walking conditions, car substitution}*
		VMT-reduction	*{reduce travel need, car substitution}*
2. 'Transit shift and efficiency'		Modal shift (PT)	*{increase PT-use, car substitution}*
	Improve	Effective PT	*{increase PT use, <ns>}*
		Efficient PT	*{increase PT efficiency, <ns>}*
		Efficient road-transport system	*{increase transport efficiency, <ns>}*

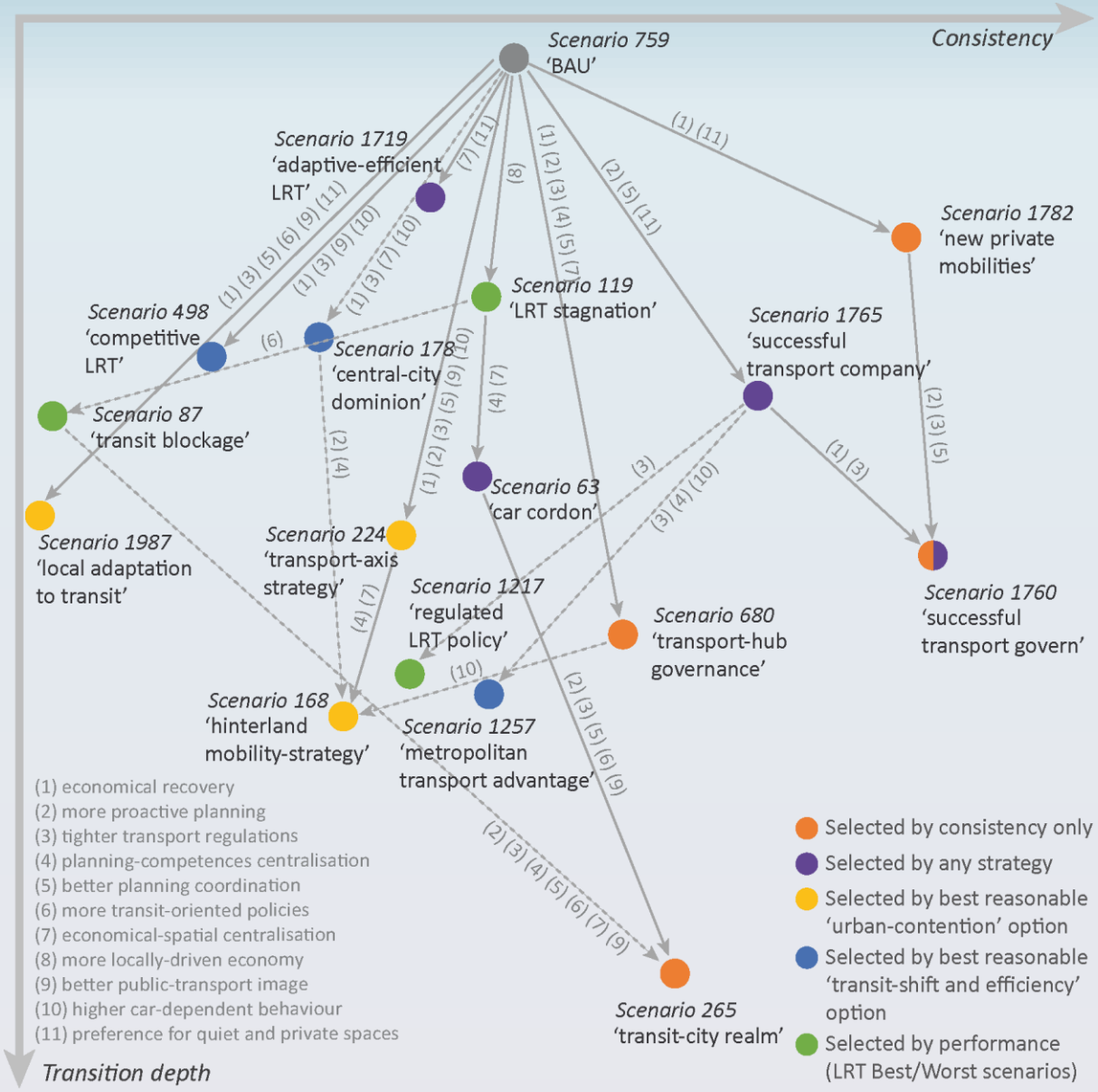
Methodology: *policies in Granada's metropolitan area*

Strategic options (planning approaches)	Description	Policy instances examples Instance = {system, operational aim, implementation logic, mechanism, urban consolidation level, location, main land-use, formulation-scale} <ns>: non specified
1. Metropolitan spatial planning	Mixing of general guidelines at metropolitan scale and directions for land-use, infrastructure and public transport system at specific strategic locations.	Commercial joint developments through local consortia {*land-use/transport, high density, joint development, public-private partnerships, new development, metropolitan, commercial, regional*} Land reserves for metropolitan facilities and activities {*land-use/transport, high density* OR *use mixing*, normative* OR *location decisions*, planning/management* OR *official-sites relocation, new development, urban centre proximity* OR *metropolitan, office/industrial, regional*} Peripheral 'Park and Ride' systems {*PT system(surface parking), Car-PT integration, access provision, planning/management,* <ns>*, urban centre proximity,* <ns>*, regional*}
2. Urban master-planning	Dominance of normative planning instruments at local scale, with a high proportion of urban mobility and land use instruments in the city centre context.	Urban renewal in derelict areas of Granada city, near rail-station {*land-use/transport, urban renewal, normative, planning/management, derelict areas, urban centre proximity,* regional hub*, local*} Car-access restriction in city centre / pedestrianisation {*land-use/transport, car restriction, access restriction, planning/management, consolidated development, urban centre, mixed use, local*} Parking reduction in new urban development { *land-use/transport, car restriction, location decisions, planning/management, new development, metropolitan,,* <ns>*, local*}
3. Metropolitan transportation governance	Economic, managerial and collaboration instruments for the metropolitan transport system, including LRT.	Coordination of metropolitan public-transport operators ('metropolitan consortium') {*PT system, PT integration,* <ns>*, public-private partnership,* <ns>,<ns>,<ns>, *regional*} LRT-local bus interoperability {*transit project (LRT-bus feeder), PT integration, interoperability, public-private partnership,* <ns>,<ns>,<ns>, *local*} Unified metropolitan PT-system image {*PT system, PT integration ,quality, improvements, public-private partnership,* <ns>,<ns>,<ns>, *regional*}
4. LRT project management	Specific interventions and features of LRT project.	Urban project along LRT route {*transit project, urban integration, access provision, urban design, consolidate development*,<ns>,<ns>, *regional*} Integration with traffic through reserved platform {*transit project(own right-of-way), urban integration, physical segregation, planning/management,* <ns>, <ns>, <ns>, *regional*} Integrated ticketing and fare control {*transit project,* <ns>*, quality improvements, fares control,* <ns>, <ns>, <ns>, *regional*}

Methodology: building the structure

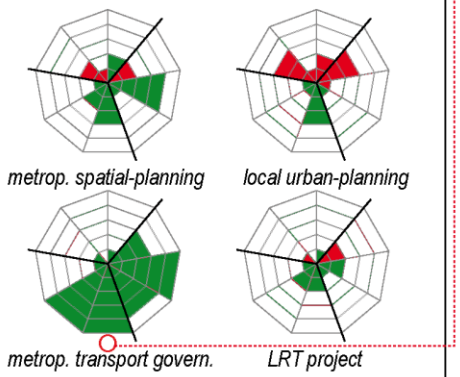


Results: ‘mapping’ scenarios



Results: 'mapping' scenarios

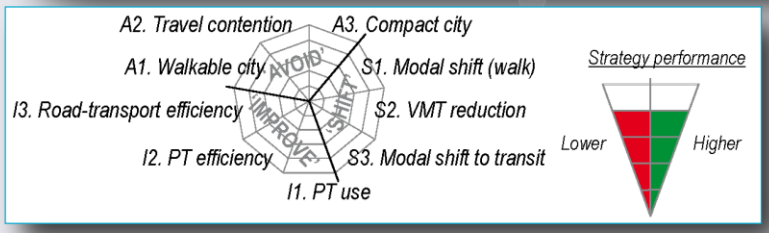
Scenario (ID) / Driving forces	Scenario 1760
1. Economic climate	*Growth*
2. Spatial-planning trad.	*Proactive*
3. PT management	*Regulated*
4. Local autonomy	*High auton.*
5. Planning coordination	*High coord.*
6. Transp. policy-making	*Car-oriented*
7. Centrality distribution	*Decentralisation*
8. Regional economies	*City clusters'*
9. Public-transport image	*Low-class*
10. Car dependency	*Pro-car*
11. Urban life-styles	*Urban decadence*
Consistency	2.00
Transition index	0.45
Local eff. (consistency)	11
Local eff. (transition)	6
Local eff. (performance)	11

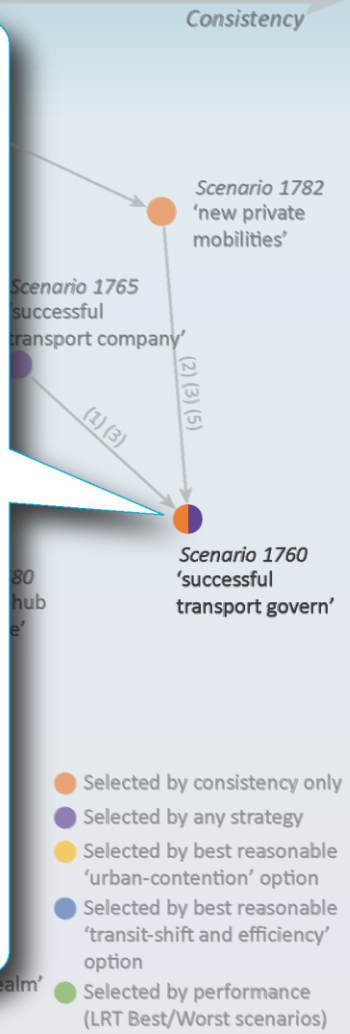


Strategic options performance

metrop. transport govern
'*Increasing PT Use*'

Impact	Key interaction (hypothesis)	INTERACTION RULE
5,152	Lower interaction between new development and transit (low capacity for transit projects to capture additional travel), in decentralized policy context [2]	If policy instance{System='LU-T (TOD policies)', Strategic objective='Increasing PT use'} AND base-scenario{PLANNING COORDINATION='Low coord.'} AND end-scenario{URB. CENTRALITY PATTERN='Decentralisation'}, policy is TRANSFORMATIVE.
5,152	Lower interaction between new development and transit (low capacity for transit projects to capture additional travel), in a car-oriented policy context [2]	If policy instance{System='LU-T (TOD policies)', Strategic objective='Increasing PT use'} AND base-scenario{PLANNING COORDINATION='Low coord.'} AND end-scenario{POLICY-MAKING='Car-oriented'}, policy is TRANSFORMATIVE.
3,392	Low coordination hinder PT integration aims in any instrument (fare schemes, feeder systems for rail transit, etc.) [2]	If policy instance{Operational objective='PT integration'} AND base-scenario{PLANNING COORDINATION='Low coord.'}, policy is TRANSFORMATIVE.
2,72	Enhance the effect of new TOD developments over PT success in transit-oriented policy context [1].	If policy instance{System='LU-T (TOD policies)', Strategic objective='Increasing PT use', Urban context='New development'} AND base-scenario{REGIONAL AUTONOMY="City clusters"}, policy is CONSERVATIVE.
-1,15	Joint development (TOD policies) of retail uses may be hindered in this context [2].	If policy instance{System='LU-T (TOD policies)', Logic_instruments='Joint development', Land use='Commercial/Leisure'} AND base-scenario{POLICY-MAKING='Car-oriented'}, policy is TRANSFORMATIVE.
0,96	TOD policies, promote use aggregation in new suburban and new 'edge-city' spaces, when linked to greater transportation projects (regional hubs) [1].	If policy instance{System='LU-T (TOD policies)', Urban context='New development', Urban location='Region'} AND base-scenario{URB. CENTRALITY PATTERN='Decentralisation'} AND end-scenario{REGIONAL AUTONOMY="City clusters"}, policy is CONSERVATIVE.





Conclusions:

- Does scenario-making end here?
  - MITIGA does not use scenarios, but give a structure to its generation
  - It assists planning, but does not bound planning (give more degrees of freedom, complement, interaction)
  - The “scaffolding” idea: interplay between structured and unstructured elements
- Orientation toward a collaborative-planning tool
  - Different user levels (technical to policy makers)
  - Different thematic customizable modules