MAPPING OF INNOVATIVE GOVERNANCE MODELS TO OVERCOME BARRIERS FOR NATURE BASED URBAN REGENERATION

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IN CO-OPERATION WITH

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NBS

"Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions"

EUROPEAN COMMISSION, "ENVIRONMENT - RESEARCH & INNOVATION POLICY TOPICS - NATURE BASED SOLUTIONS," 2017.

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Objectives

- Improve the Integration of NBS in urban and spatial planning
- Build a new and active community network around NBS
- Offer high quality decision-support tools for re-naturing cities
- Build a holistic assessment framework for NBS
- Develop a reference knowledgebase on NBS and Best Practice sharing
- Propose new governance, business and financial models for NBS implementation

IMPLEMENTATION MODELS FOR NBS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730468

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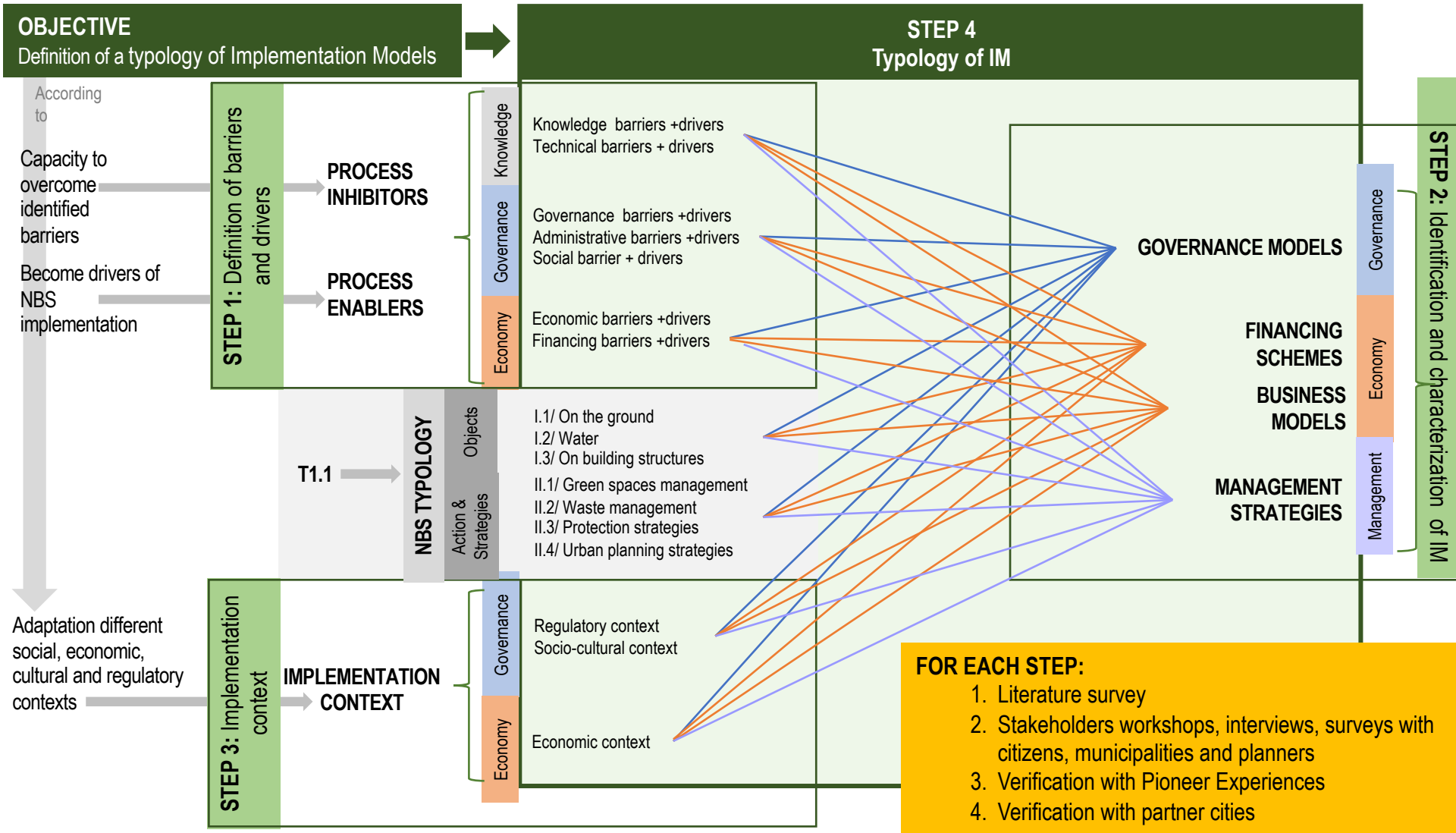
Definition of a typology of Implementation Models



FOR EACH STEP:

1. Literature survey
2. Stakeholders workshops, interviews, surveys with citizens, municipalities and planners
3. Verification with Pioneer Experiences
4. Verification with partner cities

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Barriers for NBS implementation

BARRIERS	Knowledge	Uncertainty	Operational unknown	BK1
			Performance unknown	BK2
		Accesibility to information	Information overload	BK3
			Incomprehensible presentation of results	BK4
		Technical inadequacy	Lack of ready-to-apply scientific results	BK5
	Governance	Disconnection between short-term actions and long term goals	Short-term decision-making cycles	BG1
			Long term responsibilities	BG2
			Gentrification	BG3
		Institutional barriers	Lack of coordination	BG4
			Lack of flexibility of decision making	BG5
			Unsupportive legal frameworks	BG6
		Complexity of governance structure	Goal misalignment	BG7
			Apathy	BG8
			Role ambiguity	BG9
		Participation and awareness	Perception	BG10
			Lack of participation	BG11
	Economy	Perception of the benefits	Appreciation of non-economic benefits	BE1
			Uncertain economic feasibility	BE2
			Short term vision	BE3
			Vandalism	BE4
		Budget constraints	NBS not a priority	BE5
			Lack of funding knowledge	BE6
		Risk perception		BE7

- ✓ **The implementation of NBS projects is deeply determined by the novelty of the concept**
- ✓ **Its innovation is both an opportunity and a challenge for its implementation**

Knowledge barriers

→Uncertainty

→Technical inadequacy

- ✓ **Operational unknown:** Due to the **newness of the approach**→ lack of protocols for design, implementation and maintenance for NBS projects

- ✓ **Performance unknown:** **Lack of evidence** regarding the quantitative benefits of NBS → Designers may encounter difficulties in implementing NBS solutions when compared to traditional solutions→ investors may prefer more "proven" solutions

- ✓ **Lack of ready-to-apply scientific results, concepts and technologies**→ Makes the adoption of NBS more difficult (even if a certain policy receptiveness exists)

Governance barriers

- **Local government**
  - **Disconnection between short-term actions and long term goals→** The usual short-term action and decision-making cycles →not always match with the long-term requirements of the whole life cycle of NBS projects (planning, implementation, maintenance processes, but also sustainable financing)
  - **Bureaucracy and unsupportive legal frameworks→** Excessive legal rigidity, bureaucracy and lack of specific regulations. "Knowledge silos"

- **Local stakeholders:**
  - **Goal misalignment:** Different goals of stakeholders within partnership arrangements could hinder collaboration
  - **Apathy and role ambiguity:** A high number of stakeholders could generate inertia, apathy and lack of clarity in responsibilities

Economic barriers

- **Budget constraints:**
  - **Not a priority:** City budgets for green development and maintenance often face severe budget constraints, while staff and related expertise is decreasing
  - **Lack of funding knowledge→** Financing mechanisms (such as EU-funding instruments) are available for cities, but they are complicated to apply for (requiring additional administrative staff and time resources) and **require co-financing**, which many cities cannot afford
- **Perception of the benefits**
  - Under appreciation of non-economic benefits→ not directly related with economic growth and perceived as "soft"
  - Short term vision
  - Risk perception→ Lack of incentives and motivation to attract private investment

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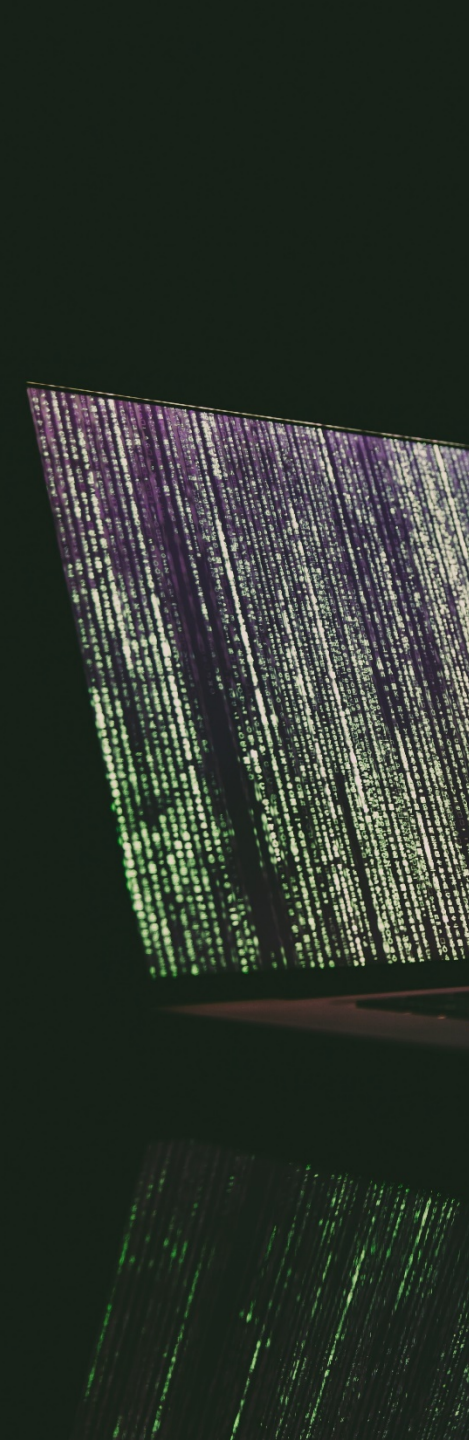
Drivers for NBS implementation

- ✓ **As new concept, allows innovative approaches, new ways to address (and consider) old problems and more inclusive practices**

DK1	Lesson learnt through projects	Generation of evidence	Knowledge	DRIVERS
DK2	Research on benefits			
DK3	Research on cost effectiveness			
DK4	Networks	Collaboration		
DK5	Co-creation			
DK6	Knowledge platforms	Information accessibility		
DK7	NBS ambassadors	Awareness		
DK8	Climate Change			
DK9	Ecological memory			
DG1	Collaboration	Process efficiencies	Governance	
DG2	Coordination			
DG3	Action- thinking approach			
DG4	Capacity building			
DG5	Emerging partnerships	Self governance		
DG6	Grassroots and transition initiatives			
DG7	Reflexive/adaptive governance	Co-creation and participation		
DG8	Involvement of urban government			
DG9	Cross sectorial spaces and partnerships			
DG10	Co-production			
DG11	Tools to build a common vision			
DE1	Sharing risks	De-risking	Economy	
DE2	Public de-risking strategies			
DE3	Provisioning of incentives to private investment	Government support		
DE4	Removal of administrative barriers			
DE5	**Public-private partnerships**			
DE6	**Conditions for new business models and finance schemes**			
DE7	**Cooperative competition**			
DE8	**Mid-Long term financing**			
DE9	**Real estate**			
DE10	**Self-financing and self-management**			



Knowledge drivers

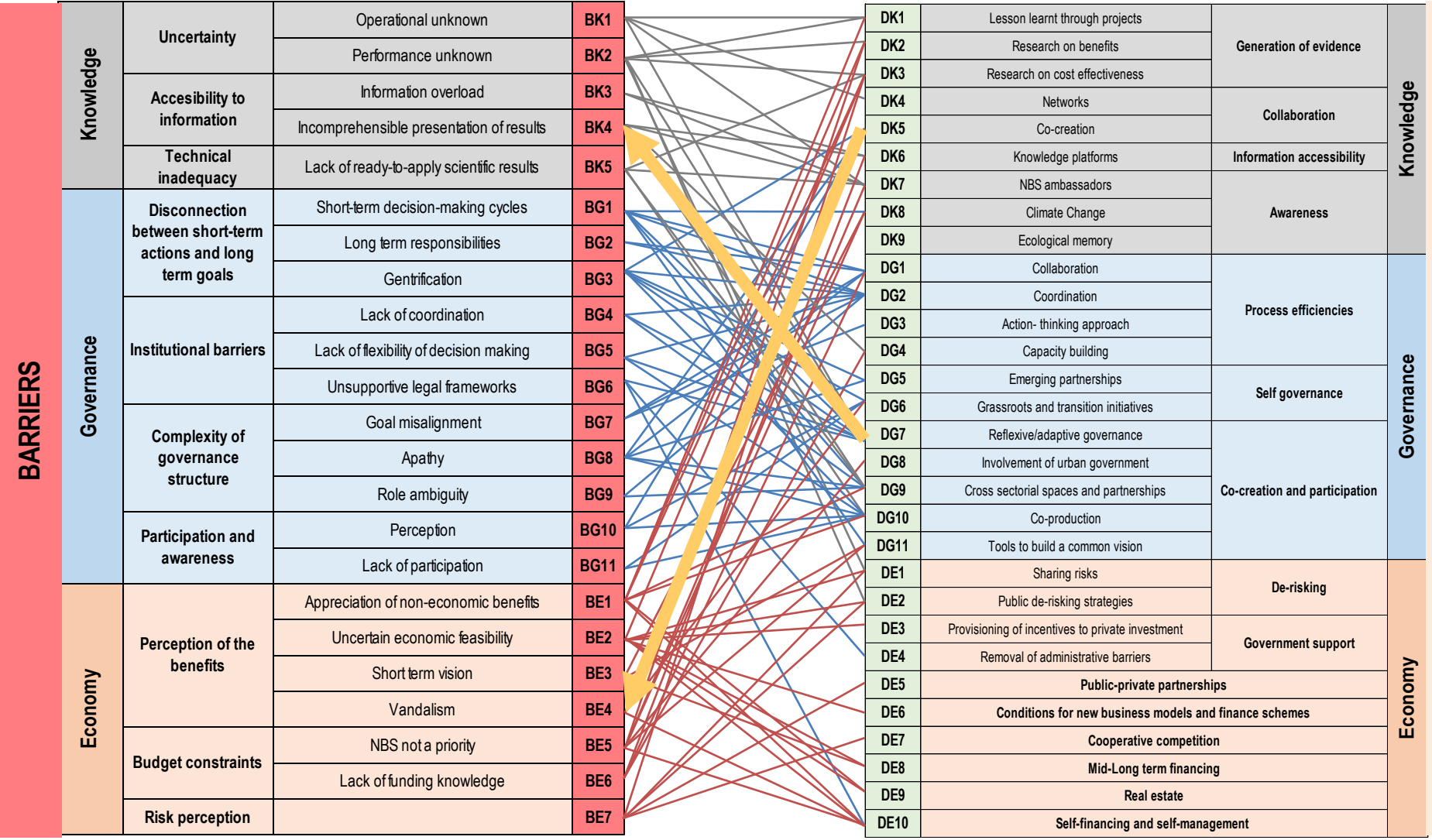
- ✓ **Generation of evidence→**
  - ✓ Lesson learnt in implemented projects
  - ✓ research on benefits→ to generate quantified information
  - ✓ Research on cost effectiveness → to justify new investments and to promote long-term funding and public-private arrangements
- ✓ **Collaboration→** Networks & Co-creation
- ✓ **Information sharing→** through knowledge platforms
- ✓ **Awareness→**
  - ✓ NBS ambassadors
  - ✓ **Climate change as a new criterion for changing priorities in decision making**
  - ✓ Ecological memory can improve the understanding of different perceptions of urban nature and lead to higher levels of ownership of NBS projects by local communities.

Governance drivers

- ✓ **Process efficiencies**→ Collaboration (combination of the different strengths)+ Action- thinking approach (problem-based governance) + Capacity building (to balance the uncertainty)
- ✓ **Self- governance**→ Emerging partnerships between civil societies in cities & Grassroots innovations/transition initiatives→ as collaborative networks providing on-the-ground evidence of the multiple benefits
- ✓ **Co-creation and participation**→
  - ✓ Reflexive/adaptive governance to include flexible ways to maximize learning opportunities and experimentation to overcome barriers related with uncertainty, complexity and system dynamics
  - ✓ The involvement of local governments is crucial for a rapid transfer from concepts to action

Economic drivers

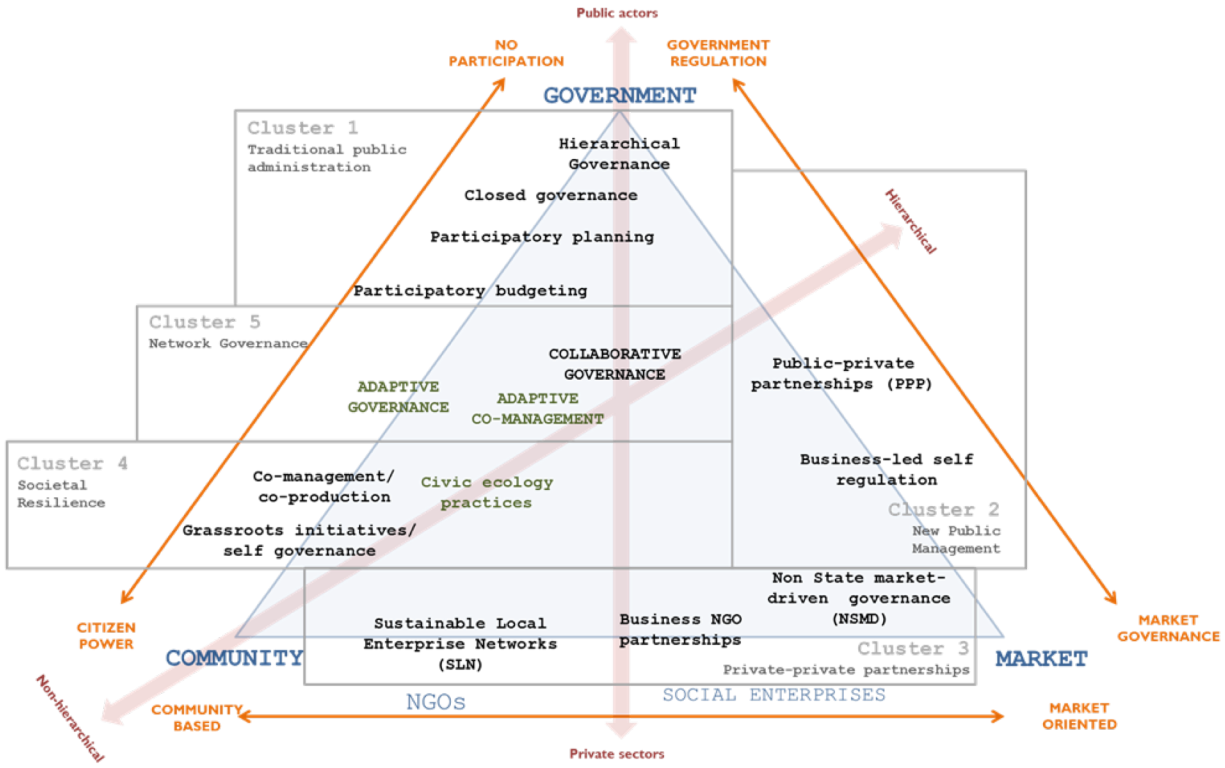
- ✓ **De-risking**→
  - ✓ **Sharing risk through collaborative arrangements to** enable the **distributed responsibilities**
  - ✓ **Public de-risking strategies**→ beginning phase requires a great **government support**, due to methodologies and ways are not yet completely defined.
- ✓ **Government support**
  - ✓ Provisioning of incentives to attract private investment + Removal of administrative barriers
  - ✓ Public-private partnerships→ to overcome budget constraints and limitation of resources.
- ✓ **Mid-Long term financing**
- ✓ **Real estate**

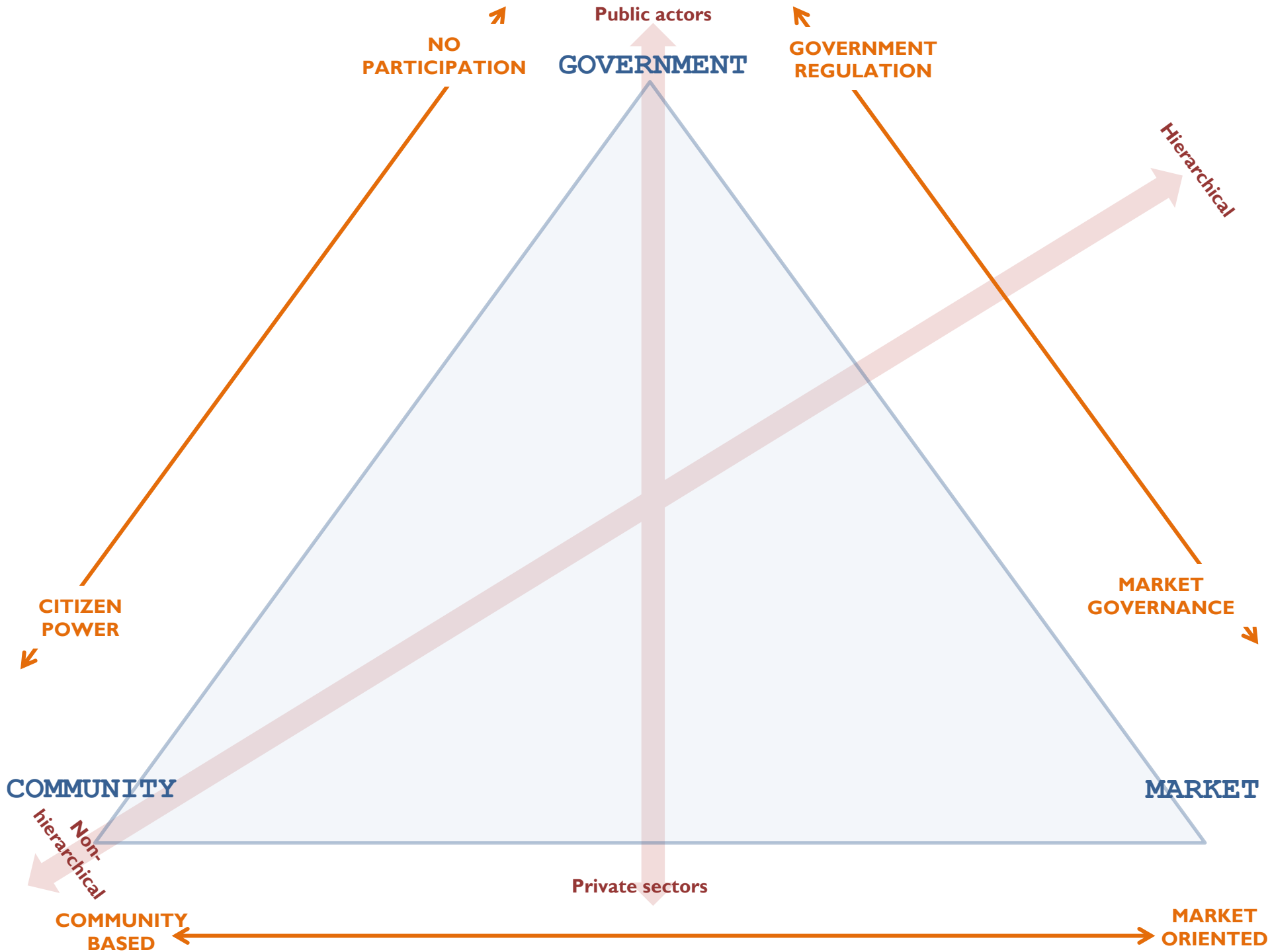


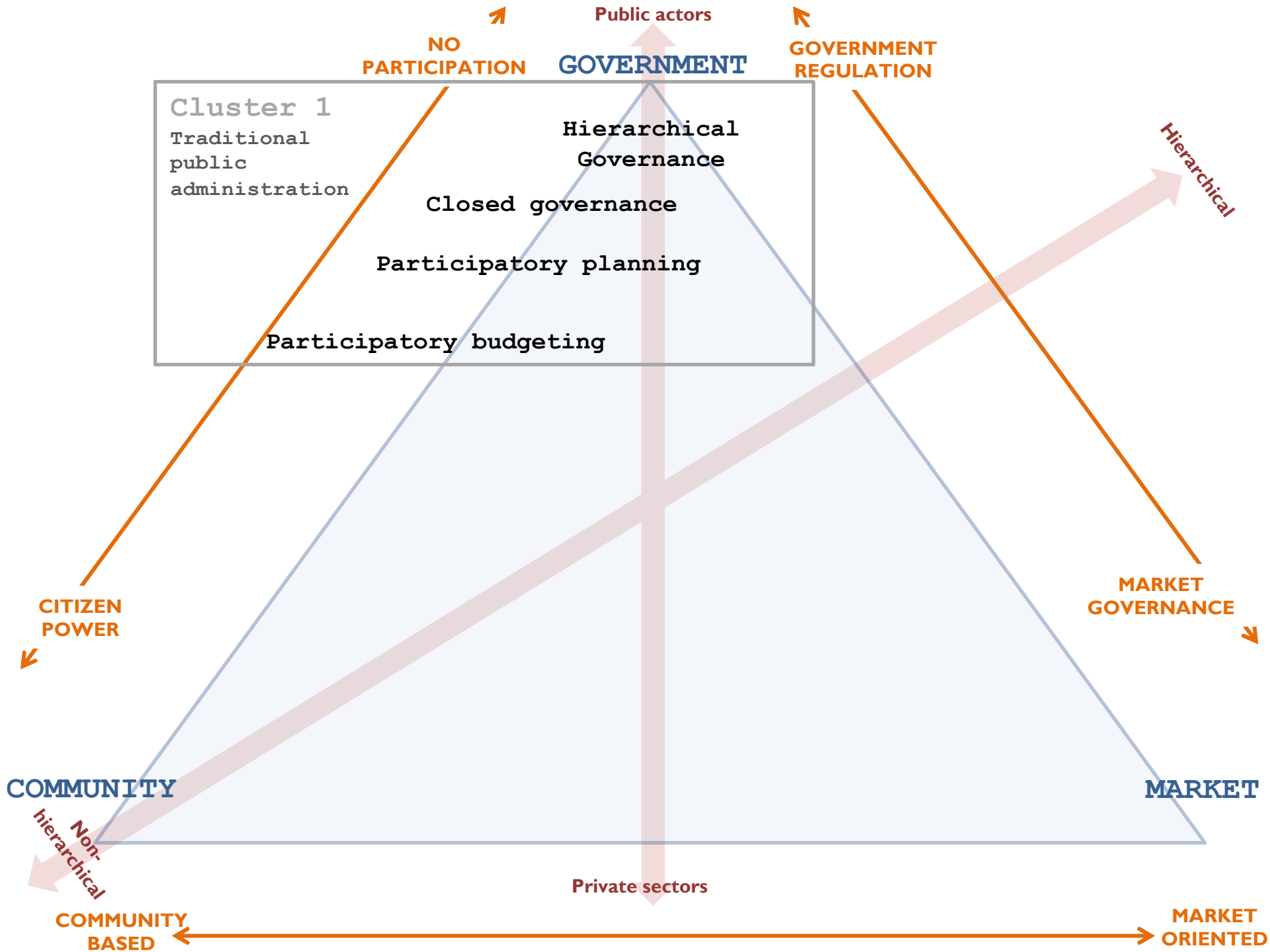
- ✓Links between barriers and drivers are **cross-domain**
- ✓Link between **economic barriers and knowledge drivers**→ Uncertainties in a new field as NBS could generate significant barriers that can be addressed by more research and evidence.
- ✓Link between **governance drivers and knowledge barriers**→ governance models that are based on mutual learning and cross-sectorial spaces

Governance Implementation Models→

- ✓ Review of urban and environmental governance models
- ✓ mapped and characterized
- ✓ assess their suitability
- ✓ Five clusters have been identified and distributed according to: involved actors, their position in the spectrum from high to low government involvement and their level of participation




Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Hierarchical
CITIZEN POWER
MARKET GOVERNANCE
COMMUNITY
MARKET
Non-hierarchical
Private sectors
COMMUNITY BASED
MARKET ORIENTED


Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Cluster 1
Traditional public administration
Hierarchical Governance
Closed governance
Participatory planning
Participatory budgeting
Hierarchical
CITIZEN POWER
MARKET GOVERNANCE
COMMUNITY
MARKET
Non-hierarchical
Private sectors
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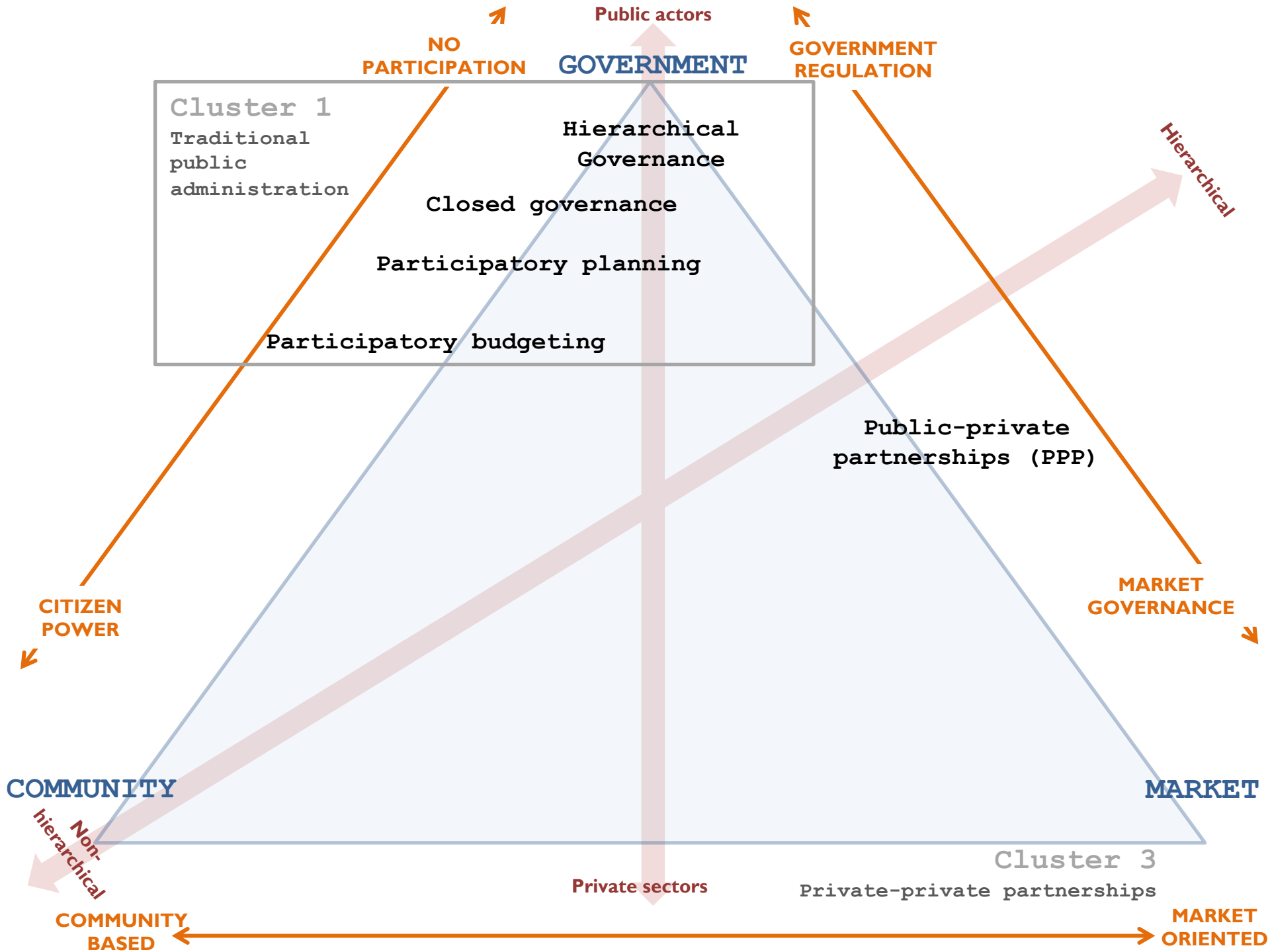
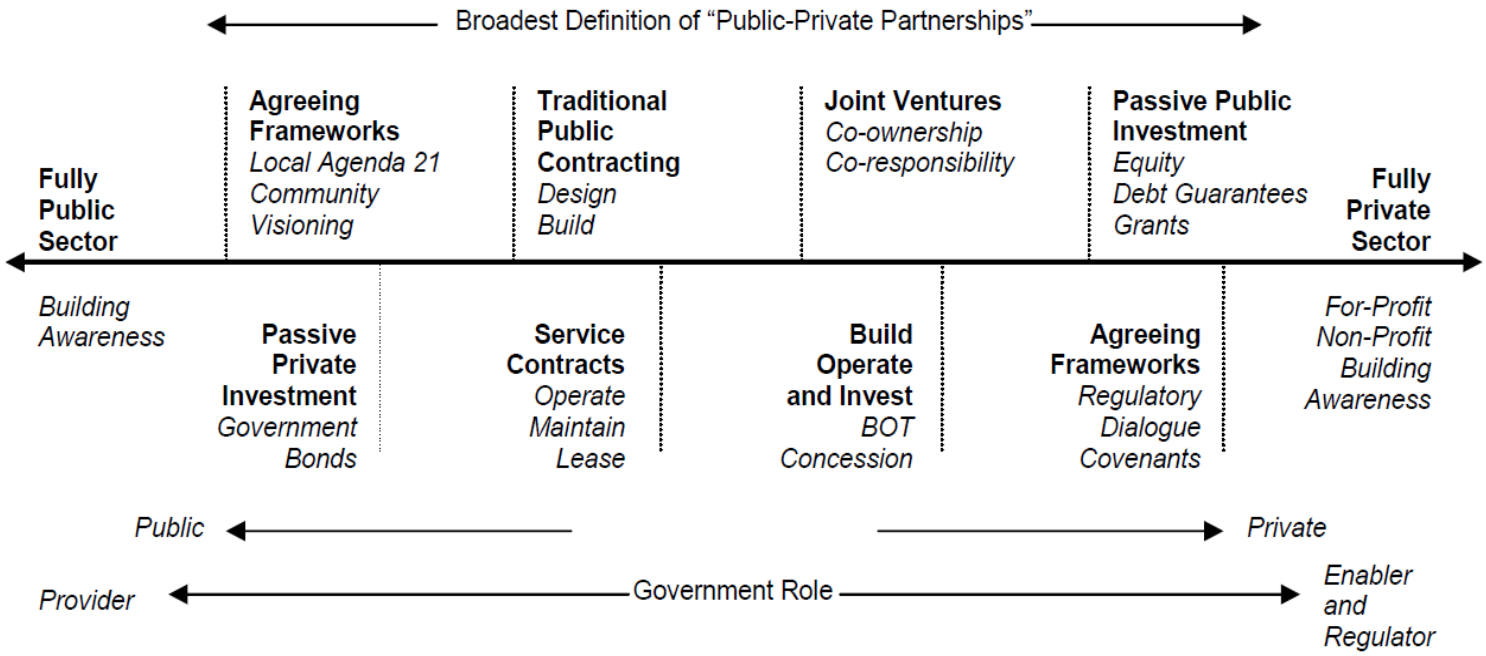
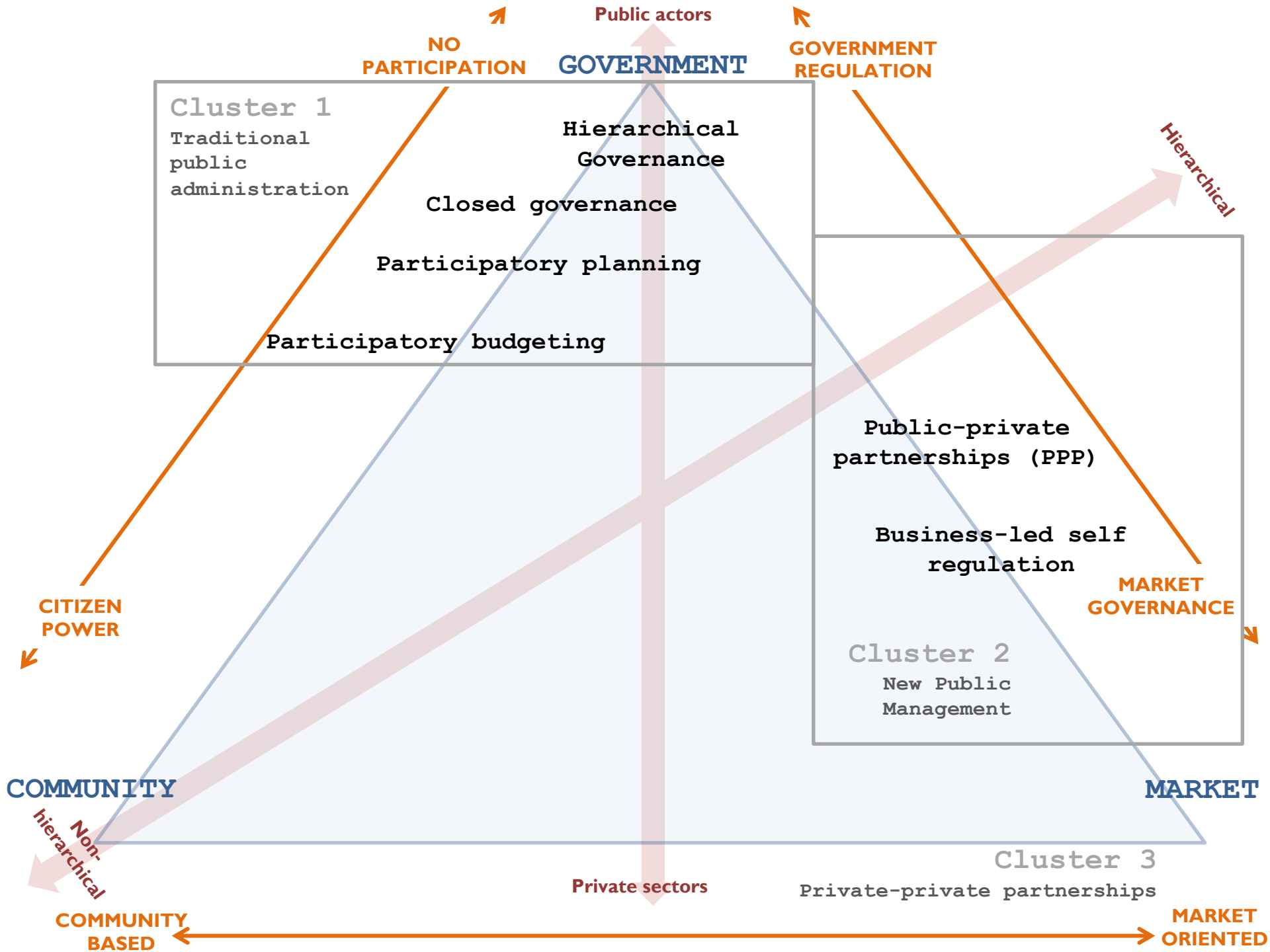
	CLUSTER 1: Traditional Public Administration		
	Hierarchical governance	**Closed governance**	**Participatory planning & budgeting**
KEY WORDS	Centralized, government led, top-down, hierarchical	Hierarchical, closed participation, top-down	Hierarchical, open participation
HOW EMERGES	Default governance regime	Government defines the problem and the participants	Usually required by law.
INVOLVED ACTORS	Government. Citizens and community are always at the receiving end.	Access is restricted. Governmental actors are organised and complemented with a few non-governmental selected actors.	Government, citizens, NGOs
GOVERNMENT INVOLVEMENT	Leading role	Leading role	Very high
RULES	Instrumental vision on policy Administrations hierarchically controlled by electorally accountable governments. The interaction rules give government a leading role, whereas non-governmental actors follow. Coercion by the government is the predominant interaction type	Government has the power because it controls the resources that can be mobilised. The non-governmental actors can influence if the government allows it. Restricted cooperation. Government assigns certain tasks to the involved nongovernmental actors and then monitors them.	Hierarchically participation. There is a need to formalise the rules of the game and provide well established supporting tools (like websites, guidelines) to rebalance the information asymmetry. The stage when the stakeholders are involved depends of the level of collaboration.
CONTEXTUAL CONDITIONS	Often fails to provide effective solutions for highly contextualized situations	In cases of environmental issues with potentially catastrophic impacts, the predominance of “less than democratic” expert politics could be justified	Some countries have adopted national level instruments to promote different forms of public consultations at local levels providing guidelines and tools.
TOOLBOX	Top-down directives or command-and-control policies.	Top-down directives or command-and-control policies.	Neighbourhood planning. Participatory budgeting. E-tools for citizen involvement Workshops, professional moderation of debates. Interactive mapping
REFERENCES	[57] [75]	[57] [62] [76]	[23] [74] [77] [78]
BARRIERS	BG3, BG3, BG7, BG9, BE1, BE3		
DRIVERS	DG2, DG8, DE4, DE8, DE9		
SUITABILITY FOR NBS	**Low.** Often falls short in efforts to coordinate governance across large-scale ecosystems that cross multiple jurisdictional boundaries. Innovation is limited to some large-scale national and universal innovations being **not enough for local innovation required**. Large step-change improvements could be possible initially, but **less capability for continuous improvement**		


Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Cluster 1
Traditional public administration
Hierarchical Governance
Closed governance
Participatory planning
Participatory budgeting
Hierarchical
Public-private partnerships (PPP)
CITIZEN POWER
MARKET GOVERNANCE
COMMUNITY
MARKET
Non-hierarchical
Cluster 3
Private-private partnerships
Private sectors
COMMUNITY BASED
MARKET ORIENTED

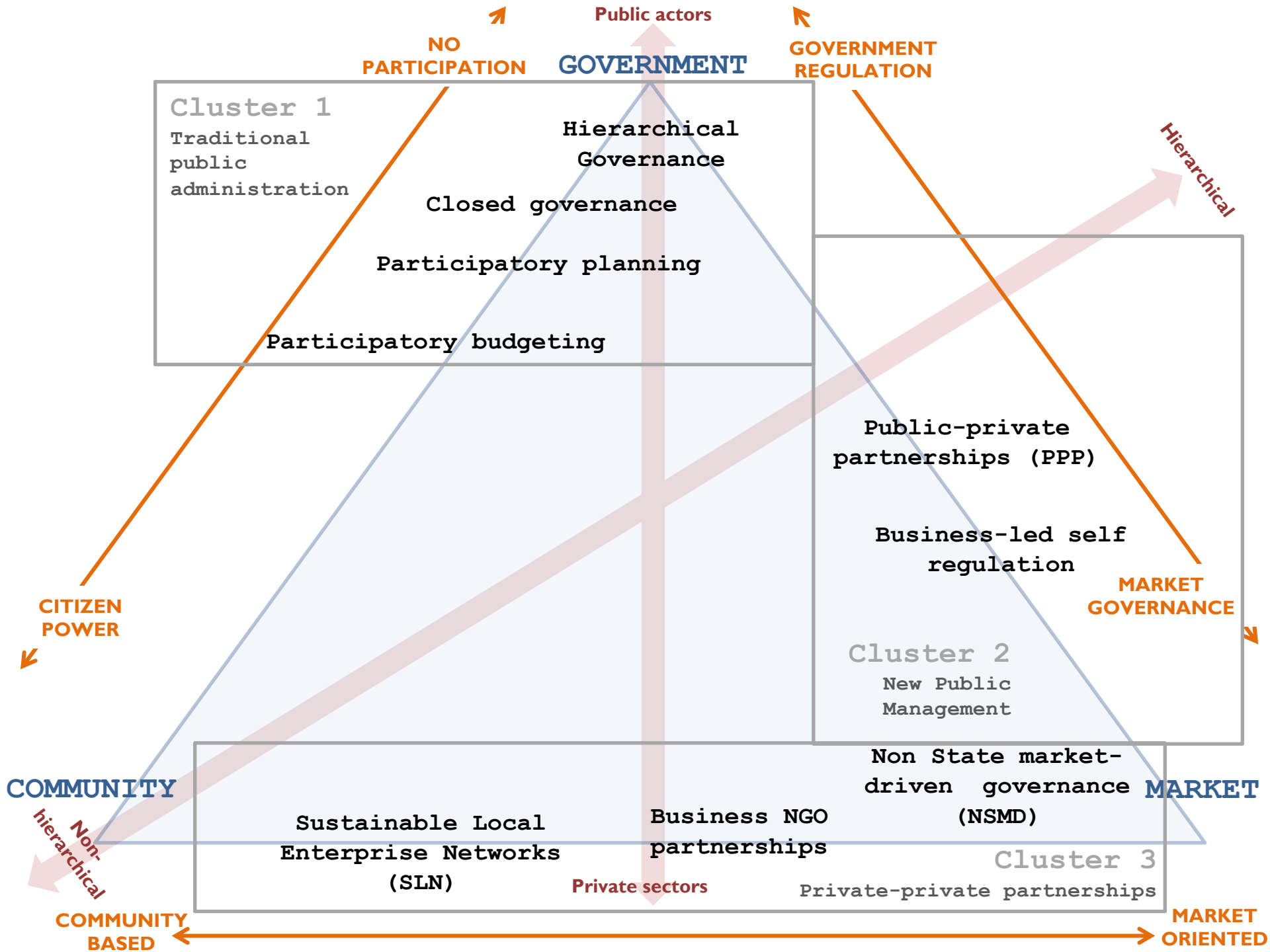
Spectrum of PPP types



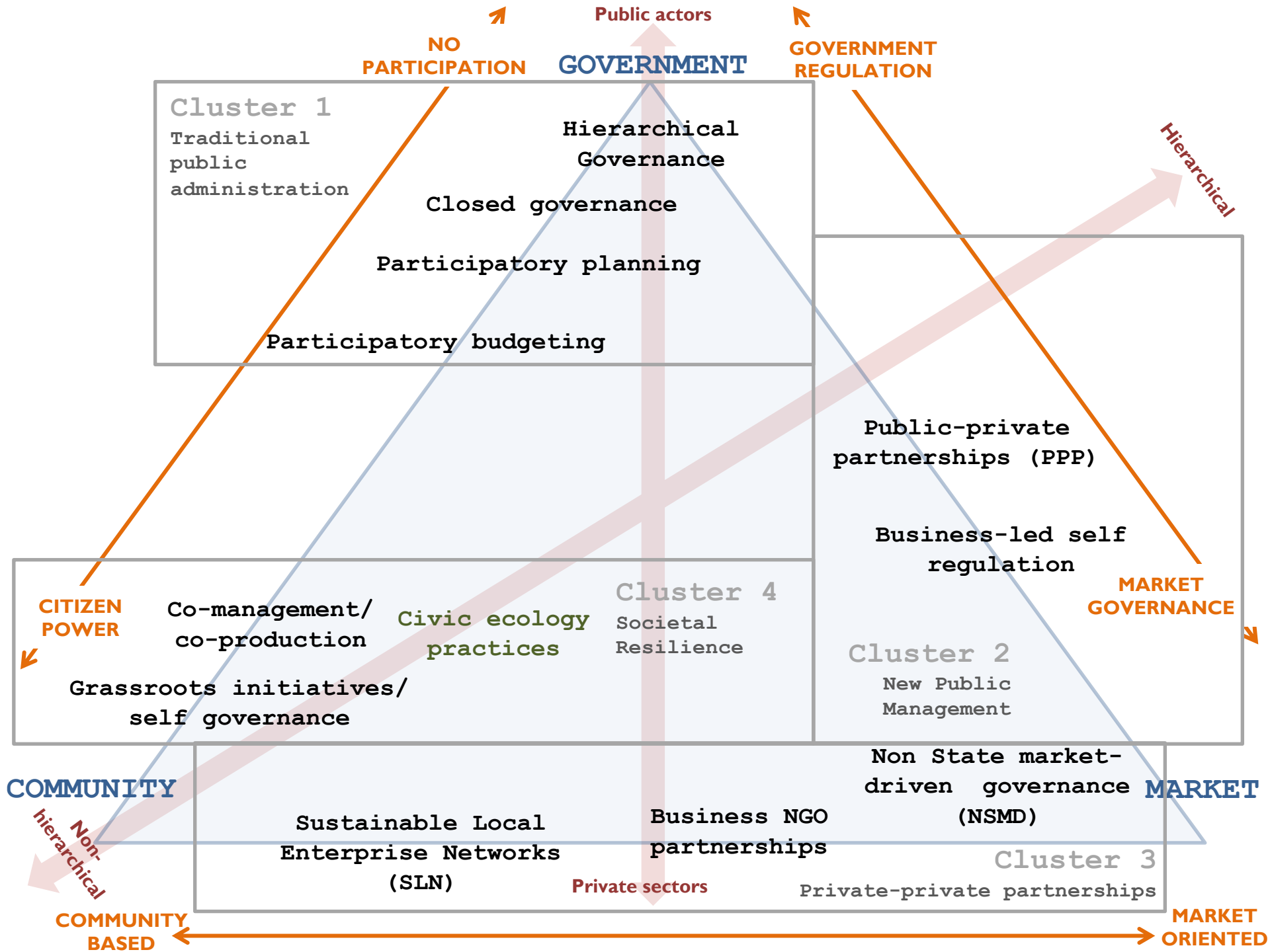
Source: UNDP, Pppue, Joint Venture Public- Private Partnerships for Urban Environmental Services Report on UNDP / PPPUE ' s Project Development Facility, II (2000).


Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Cluster 1
Traditional public administration
Hierarchical Governance
Closed governance
Participatory planning
Participatory budgeting
Hierarchical
Public-private partnerships (PPP)
Business-led self regulation
MARKET GOVERNANCE
CITIZEN POWER
Cluster 2
New Public Management
COMMUNITY
MARKET
Non-hierarchical
Cluster 3
Private-private partnerships
Private sectors
COMMUNITY BASED
MARKET ORIENTED

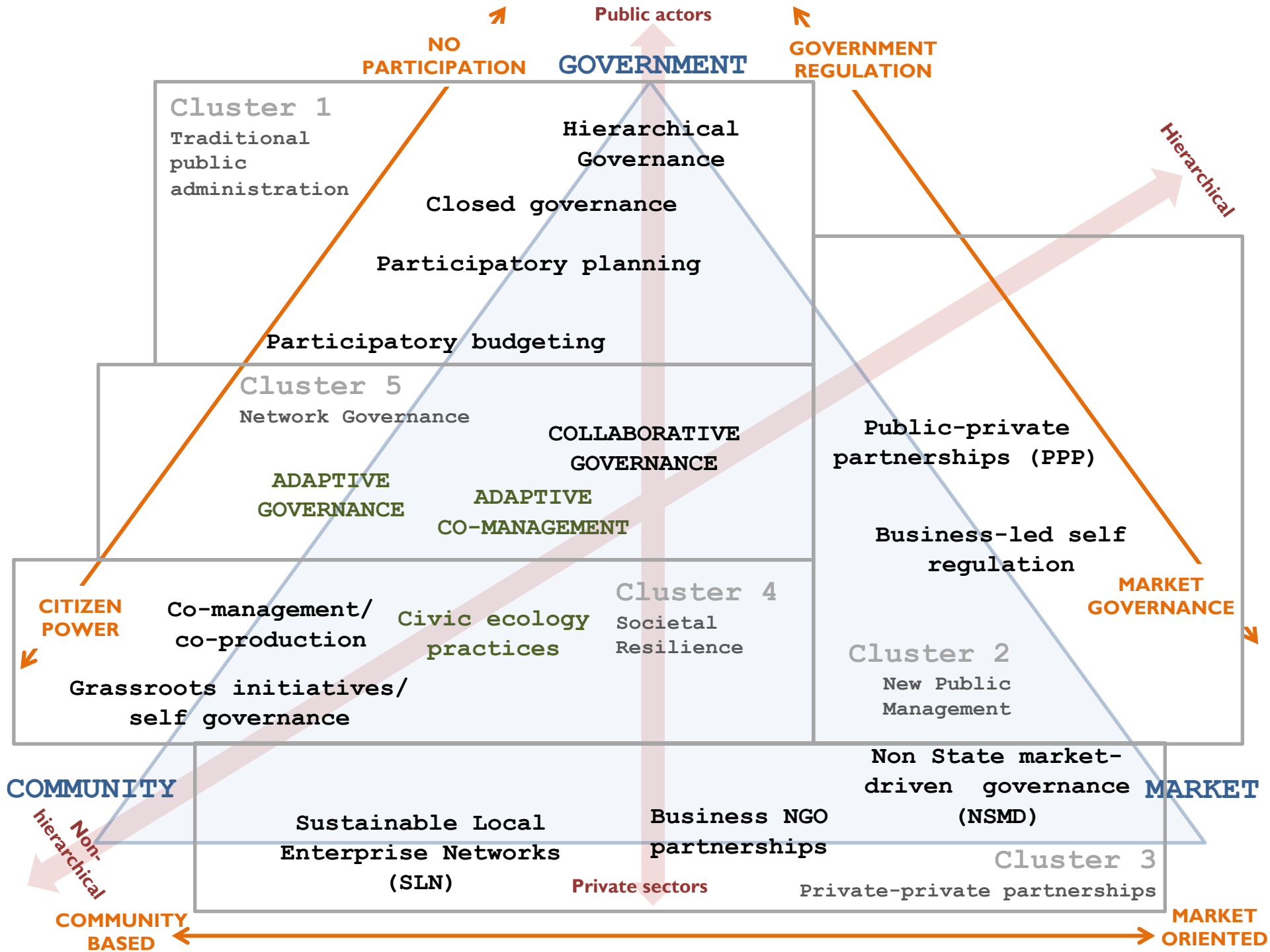
	CLUSTER2: New Public Management	
	Public–private partnership (PPP)	**Business-led self-regulation**
KEY WORDS	Marked-oriented, competitive, top-down	Business-led, decentralized
HOW EMERGES	Usually from a flexible, opportunistic approach, drawing from experiences in other cases. Not always the most evident solution, but a widely acknowledged crisis can trigger the arrangement.	When government is not perceived anymore as the only source of legitimacy and market forces are strong enough.
INVOLVED ACTORS	Government + private sector	Business sector. Efforts may be undertaken to include community
GOVERNMENT INVOLVEMENT	Can range from high to low involvement.	Announcers and commissioners
RULES	Private sector involvement does not eliminate public sector responsibilities. Continued government involvement in certain services helps ensure the efficiency of markets by reducing capital risks, increasing access to information, and reducing monopoly	Utilization of market exchanges and incentives to encourage environmental compliance. Corporate self-regulation initiatives create their own (usually voluntary) rules and procedures to guide corporate behavior.
CONTEXTUAL CONDITIONS	PPP are deeply context based.	In neo-liberal contexts
TOOLBOX	Outsourcing. Joint Venture Public-Private Partnerships	Voluntary agreements, third-party certifications, eco-labelling, corporate social responsibility
REFERENCES	[33] [49] [71]	[80], [81]
BARRIERS	BE2, BE6	
DRIVERS	DK3, DK4, DG3, DG9, DE1, DE6, DE7, DE9	
SUITABILITY FOR NBS	**Low-medium** depending the scale of the NBS project (the smaller the scale the easier to implement only market-oriented approaches). Risk aversion of the private sector often result in a **choice for proven technology** rather than for innovative solutions (such NBS).	


Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Cluster 1
Traditional public administration
Hierarchical Governance
Closed governance
Participatory planning
Participatory budgeting
Hierarchical
Public-private partnerships (PPP)
Business-led self regulation
MARKET GOVERNANCE
CITIZEN POWER
Cluster 2
New Public Management
COMMUNITY
Non-hierarchical
Sustainable Local Enterprise Networks (SLN)
Business NGO partnerships
Non State market-driven governance (NSMD)
MARKET
Cluster 3
Private-private partnerships
Private sectors
COMMUNITY BASED
MARKET ORIENTED

	CLUSTER 3: Private-private partnerships		
	Non-State Market-driven governance (NSMD)	**Business–NGO partnerships**	**SLENs (Sustainable Local Enterprise Networks)**
KEY WORDS	Market-oriented, decentralized	Hybrid governance, decentralized, non-hierarchical	Self-organizing, complex adaptive systems
HOW EMERGES	NGOs develop their sets of responsible business practices due to the difficulty to influence the government providing recognition in the marketplace to responsible companies	A reactive approach is adopted by companies in the beginning, but partnerships could evolve, where pressures from NGO lead to go from mere compliance to strategic actions	Provide an integrating opportunity for stakeholders to acknowledge a shared asset base and construct a virtuous cycle
INVOLVED ACTORS	Environmental and social stakeholders participate with business interests	Markets + NGO	NGOs + civil society members + companies.
GOVERNMENT INVOLVEMENT	Not necessarily	Medium-low	Not mandatory.
RULES	Steering by market parties, regulation on basis of supply and demand. The viability of NSMD is determined by whether it can achieve legitimacy to operate. Authority emanates from the market	Depending of the type i) threat-induced, compliance or charity-driven responses, ii) transactional partnerships for improving profitability or market share, iii) businesses move beyond bottom-line iv) other key stakeholders are involved	Require at least one for-profit business to anchor the network and ensure that it is financially sustainable.
CONTEXTUAL CONDITIONS	General dissatisfaction with old policy instruments; neoliberal institutionalism and free trade agreements and a requirement for market innovations.	Differences in organizational cultures between business and NGOs due to differing missions and accountability systems.	Depend on mobilizing all four key assets: human, social, financial and ecological (natural) capital.
TOOLBOX	Forums for exchanges of expert information, databases of experiences and best practices. Norm generation and community building	Sponsorship. Short-term problem-solving. Sustained dyadic Eco-labelling. Industry sustainability standards.	Re-conceptualization of roles.
REFERENCES	[62] [79] [80] [81] [82] [83] [84]	[86] [88]	[89] [90]
BARRIERS	BK4, BK5, BG7, BG10, BE1, BE2, BE5, BE6		
DRIVERS	DK7, DK8, DK9, DG1, DG3, DE6		
SUITABILITY FOR NBS	**Medium-high.** But currently the required conditions for the more complex models are met only in rare cases. This implies the need for a significant change in relationships between enterprise-based activities in the developing world and broader social, economic and political systems in which they are embedded.		


Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Cluster 1
Traditional public administration
Hierarchical Governance
Closed governance
Participatory planning
Participatory budgeting
Hierarchical
Public-private partnerships (PPP)
Business-led self regulation
MARKET GOVERNANCE
CITIZEN POWER
Co-management/ co-production
Civic ecology practices
Cluster 4
Societal Resilience
Grassroots initiatives/ self governance
Cluster 2
New Public Management
COMMUNITY
Non hierarchical
Non State market-driven governance (NSMD)
MARKET
Sustainable Local Enterprise Networks (SLN)
Business NGO partnerships
Cluster 3
Private-private partnerships
Private sectors
COMMUNITY BASED
MARKET ORIENTED

	CLUSTER 4: Societal Resilience		
	Co-management	**Civic ecology practices**	**Self-governance/grassroots initiatives**
KEY WORDS	Open participation, decentralized management, social learning	Small scale, local	Bottom-up, polycentric, self-organisation, self-management
HOW EMERGES	When initiated by non-government, government supports implementation. When initiated by the government stakeholders are invited	Often are initiated by lay persons, generally as a community-based response to urban decline or sudden disturbances like hurricanes and war	Decision-making about societal development is no solely in the hands of government, but companies, scientists, media, new social movements and community.
INVOLVED ACTORS	Local authorities, citizens, NGOs, researchers	Scientists and NGOs helps to ensure larger impacts and longer-term sustainability, but it is not mandatory	Local authorities, citizens, NGOs, researchers
GOVERNMENT INVOLVEMENT	Medium	Not mandatory	It could have a semi-passive role
RULES	Local authorities have to take the responsibility for the urban environment which means that there is a limit for decentralization as far as public goods and services are concerned	Local authorities have to take the responsibility for the urban environment which means that there is a limit for decentralization as far as public goods and services are concerned	Grassroots movement have their own dynamic and they are an inherently unpredictable. Institutional diversity and multi-scalarity.
CONTEXTUAL CONDITIONS	How co-operative management schemes are formulated and implemented depends on the task at hand and the responsibility shared	They reflect local environments and cultural traditions.	An active society is requirement.
TOOLBOX	Collaboration. Experimentation.		
REFERENCES	[74] [31], [94] [32] [37] [41]	[23] [95]	[65] [96] [73]
BARRIERS	BG7, BG9, BG10, BG11, BE1, BE5		
DRIVERS	DK9, DG6, DG10, DE10		
SUITABILITY FOR NBS	**High.** Management of natural resources is one field especially well fitted for these types of governance. Reflexive governance is a model that may be the one applicable for social-ecological innovations such as NBS.		

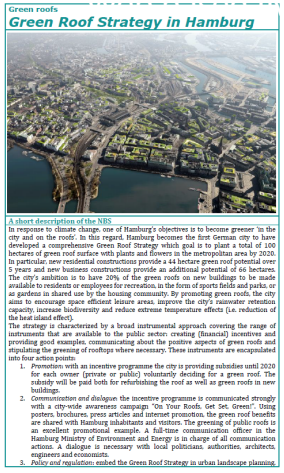

Public actors
NO PARTICIPATION
GOVERNMENT
GOVERNMENT REGULATION
Cluster 1
Traditional public administration
Hierarchical Governance
Closed governance
Participatory planning
Participatory budgeting
Hierarchical
Cluster 5
Network Governance
COLLABORATIVE GOVERNANCE
ADAPTIVE GOVERNANCE
ADAPTIVE CO-MANAGEMENT
Public-private partnerships (PPP)
Business-led self regulation
CITIZEN POWER
Co-management/ co-production
Civic ecology practices
Cluster 4
Societal Resilience
MARKET GOVERNANCE
Grassroots initiatives/ self governance
Cluster 2
New Public Management
COMMUNITY
Non State market-driven governance (NSMD)
MARKET
Non-hierarchical
Sustainable Local Enterprise Networks (SLN)
Business NGO partnerships
Cluster 3
Private-private partnerships
Private sectors
COMMUNITY BASED
MARKET ORIENTED

	CLUSTER 5: Network Governance		
	Collaborative governance	**Adaptive governance**	**Adaptive co-management**
KEY WORDS	Collaborative, multi-level, polycentric	Environmental governance, decentralized, polycentric, bottom-up	Community-based, resource management, polycentric
HOW EMERGES	Usually the model is initiated by the government trying to incorporate new resources, efficiency, knowledge and competences to solve complex problems.	May require "windows of opportunity" that appear as significant boost in capital or legitimacy	Usually triggered by a crisis.
INVOLVED ACTORS	Involves a large group of governmental and non-governmental actors that engage in competitive and/or stimulating governing activities.	Requires a structure of nested institutions and cross-scale institutional diversity connected by formal and informal networks	Diverse set of stakeholders, operating at different levels, often through networks from local users to international bodies.
GOVERNMENT INVOLVEMENT	Government retains the formal authority	Medium.	Medium.
RULES	Actors are only loosely bound to one another. The model is formally organized and meets collectively. Participants are included in decision making process. Transaction costs are high.	Largely builds on human relationships and trust.	Leadership is essential by providing innovation, building trust, making sense, managing conflict, linking actors, compiling and mobilizing broad support for change. Iterative learning and action
CONTEXTUAL CONDITIONS	Theoretically the model can be implemented at local, regional, state, national and even global levels (although at global level the decisions are voluntary)	Developed democracies and high-income countries where policy tends to leave room for and support innovation and bottom-up initiatives	Tailored to specific places and situations
TOOLBOX	Analytical-deliberative approaches. Participatory evaluation. Collaborative scenario-building exercises. Urban Transition Labs	Assessment of multiple and non-monetary benefits. Qualitative, multi-criteria, iterative and experimental approaches.	Collaboration. Experimentation. Bioregional approach to resource management
REFERENCES	[21] [54] [57] [65] [86] [93] [99] [100]	[55] [61][101] [102]	[30] [41] [91] [102] [103][104]
BARRIERS	BG2, BG7, BG9, BG10, BE1, BE2		
DRIVERS	DK1, DK2, DK3, DK4, DK5, DK9, DG1, DG7, DG8, DG9, DG10, DE1, DE2, DE3, DE4, DE5, DE6, DE7		
SUITABILITY FOR NBS	**Very High.** Collaborative governance is an approach thought for dealing with uncertainty, complexity and dynamics, therefore totally suited for NBS projects. "Transaction costs" (costs of consultations, reaching agreement, and enforcing such agreements) could be high		

NATURE 4 CITIES

Development of an Implementation Model Database

- 56 IMs organized in detailed cards
- A WordPress blog based DB for data gathering
- Web based IM DB


Green roofs

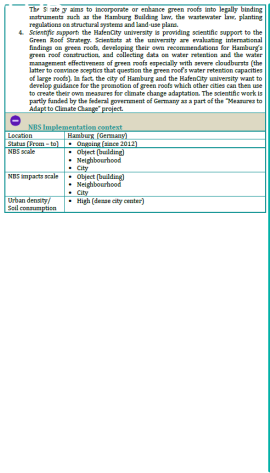
Green Roof Strategy in Hamburg

A short description of the NBS

In response to climate change, one of Hamburg's objectives is to become greener 'in the city and on the roofs'. In this regard, Hamburg becomes the first German city to have developed a comprehensive Green Roof Strategy which goal is to plant a total of 100 hectares of green roof surface with plants and flowers in the metropolitan area by 2020. In particular, new residential constructions provide a 4-4 hectare green roof potential over 5 years and new business constructions provide an additional potential of 66 hectares. The city's ambition is to have 20% of the green roofs on new buildings to be made available to residents or employees for recreation, in the form of sports fields and parks, or as gardens in shared use by the housing community. By promoting green roofs, the city aims to encourage space efficient leisure areas, improve the city's rainwater retention capacity, increase biodiversity and reduce extreme temperature effects (i.e. reduction of the heat island effect).

The strategy is characterized by a broad instrumental approach covering the range of instruments that are available to the public sector: creating (financial) incentives and providing good examples, communicating about the positive aspects of green roofs and stipulating the greening of rooftops where necessary. These instruments are encapsulated into four action points:

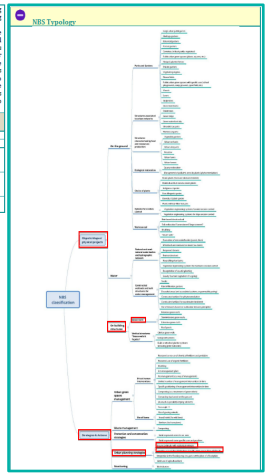
1. *Promotion* with an incentive programme the city is providing subsidies until 2020 for each owner (private or public) voluntarily deciding for a green roof. The subsidy will be paid both for refurbishing the roof as well as green roofs in new buildings.
2. *Communication and dialogue*: the incentive programme is communicated strongly with a city-wide awareness campaign "On Your Roofs. Get Set, Green!". Using posters, brochures, press articles and internet promotion, the green roof benefits are shared with Hamburg inhabitants and visitors. The greening of public roofs is an excellent promotional example. A full-time communication officer in the Hamburg Ministry of Environment and Energy is in charge of all communication actions. A dialogue is necessary with local politicians, authorities, architects, engineers and economists.
3. *Policy and regulation*: embed the Green Roof Strategy in urban landscape planning.

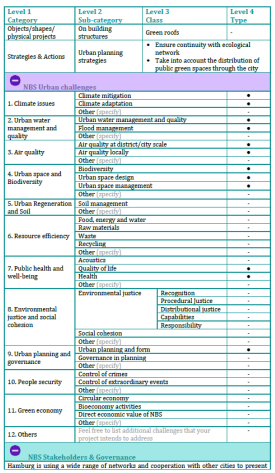

The S ate y aims to incorporate or enhance green roofs into legally binding instruments such as the Hamburg Building law, the wastewater law, planting regulations on structural systems and land-use plans.

4. *Scientific support*: the HafenCity university is providing scientific support to the Green Roof Strategy. Scientists at the university are evaluating international findings on green roofs, developing their own recommendations for Hamburg's green roof construction, and collecting data on water retention and the water management effectiveness of green roofs especially with severe cloudbursts (the latter to convince sceptics that question the green roof's water retention capacities of large roofs). In fact, the city of Hamburg and the HafenCity university want to develop guidance for the promotion of green roofs which other cities can then use to create their own measures for climate change adaptation. The scientific work is partly funded by the federal government of Germany as a part of the "Measures to Adapt to Climate Change" project.

NBS Implementation context

Location	Hamburg (Germany)
Status (From – to)	• Ongoing (since 2012)
NBS scale	• Object (building) • Neighbourhood • City
NBS impacts scale	• Object (building) • Neighbourhood • City
Urban density/ Soil consumption	• High (dense city center)


NBS Typology



Level 1 Category	Level 2 Sub-category	Level 3 Class	Level 4 Type
Objects/shapes/ physical projects	On building structures	Green roofs	-
Strategies & Actions	Urban planning strategies	• Ensure continuity with ecological network • Take into account the distribution of public green spaces through the city	

NBS Urban challenges

1. Climate issues	Climate mitigation	•
	Climate adaptation	•
	Other (specify)	-
2. Urban water management and quality	Urban water management and quality	•
	Flood management	•
	Other (specify)	-
3. Air quality	Air quality at district/city scale	•
	Air quality locally	•
	Other (specify)	-
4. Urban space and Biodiversity	Biodiversity	•
	Urban space design	•
	Urban space management	•
	Other (specify)	-
5. Urban Regeneration and Soil	Soil management	-
	Other (specify)	-
6. Resource efficiency	Food, energy and water	-
	Raw materials	-
	Waste	-
	Recycling	-
	Other (specify)	-
7. Public health and well-being	Acoustics	-
	Quality of life	•
	Health	•
	Other (specify)	-
8. Environmental justice and social cohesion	Environmental justice: Recognition	-
	Environmental justice: Procedural justice	-
	Environmental justice: Distributional justice	-
	Environmental justice: Capabilities	-
	Environmental justice: Responsibility	-
	Social cohesion	-
	Other (specify)	-
9. Urban planning and governance	Urban planning and form	•
	Governance in planning	-
	Other (specify)	-
10. People security	Control of crimes	-
	Control of extraordinary events	-
	Other (specify)	-
11. Green economy	Circular economy	-
	Bioeconomy activities	-
	Direct economic value of NBS	-
	Other (specify)	-
12. Others	Feel free to list additional challenges that your project intends to address	-

NBS Stakeholders & Governance

Hamburg is using a wide range of networks and cooperation with other cities to present itself as a climate action centre at regional, national, European and international level. When developing the incentive programme for green roofs, Hamburg involved other cities in a search for good practice and soliciting for feedback on draft versions of the incentive programme. Based on this interaction with other cities Hamburg decided to have their financial incentive program based on surface and thickness of the green roofs instead of water retention capacity as is the case in most other programs in other cities. This decision led to constructors not only focusing on water retention but also considering other benefits that green roofs may have such as in the context of biodiversity and space utilisation.

Within the city a stakeholder group is established including housing estate companies, constructors, landscape architects and urban planners. Parallel to the dialogue with other cities this group is involved in defining the incentive programme. The group remained active since and during the bi-annual meetings; the Green Roof Strategy is evaluated by the working group.

Finally, Hamburg seeks to raise awareness among the general population about all aspects of climate change and protection. It is systematically building up and expanding the range of easy-access information for the general public.

Initial actors (Leaders)	Governments • Local government/municipality (Hamburg municipality)
Involved actors	Governments • Local government/municipality (Hamburg municipality) • Semi-government organisations / Institutions (HafenCity University, Hamburg Port Authority, Hamburg Wasser) Market • Private sector (landscape architects and urban planners)
Ecological scale	• Local scale green area • City scale green networks
Governance model	CLUSTER 5: Network Governance • Collaborative governance

NBS Financial aspects

Green roofs are an investment with clear future returns: a green roof can create a more pleasant building climate and help to save on heating or cooling costs; it insulates in winter and cools in summer resulting in energy savings varying from 2-44% depending on roof insulation measure separate from the green roof; it also protects the roof water proofing from weathering effects so that green roofs last up to twice as long as conventional flat roofs; plants and substrate on green roofs retain a large amount of rain water, which results in additional savings of 50% on rain water fees for the owner in Hamburg.

Hamburg's Ministry for Environment and Energy invests. €500.000 of its own resources for the implementation of the overall Green Roof Strategy, including efforts in all four areas of activity: promotion/support, dialogue and communication, scientific support, and policy/regulation. It also includes a full-time employee based at the Ministry. In addition, Hamburg's Ministry for Environment and Energy and the Harbour City University receive €300.000 in federal grants on expenditure basis from the German Ministry of the Environment under a funding programme supporting local activities for the adaptation to climate change. This federal grant on an expenditure basis is used to pay a full time communications officer and a part-time HafenCity researcher for 2-3 years.

The Green Roof Strategy's incentive programme has € 3 million at its disposal until the end of 2019. This amount includes the total remuneration to be provided under the financial incentive programme implemented via Hamburg's investment and development bank (IFB), which handles all applications and transactions for the Green Roof incentive programme. Of the total € 3 million, € 2 million are sourced from the 'implementation and service' budget line of the Ministry responsible for city development and environment; the other € 1 million stems from the innovation fund of the Senate Office. The general approach taken is that financial incentives are available to those that voluntarily decide for a green roof before 2020. After that date Hamburg plans to have green roofs are compulsory by law. In particular, until 2020 building owners can receive subsidies to cover up to 35-60% of construction costs for the greening of their roofs.

The multi-functionality of green roofs is reflected in the subsidy system supporting the Green Roof Strategy. A basic subsidy creates incentives to build a basic green roof while additional funding encourages more specialised, sustainable measures. Optional additional subsidies are then provided for: constructing high quality rooftops (root penetration protection and improving load bearing capacity for existing roofs), sustainable urban develop (lower city roofs, a green roof in combination with solar energy generation, and/or space utilisation area) and an extra flood prevention by reducing rainwater discharge (improving run-off delay). Private owners with a 20-100sqm green roof who live themselves in the building receive a 40% subsidy on the total construction cost, including materials and contractor, and even up to 60% on material cost if the constructors are trained (professionals) either in architecture, roofing, landscaping or gardening that ensuring high quality in construction. For all other owners with a >20sqm green roof - commercial, private, public - an owner receives a basic financial incentive ranging from € 14/sqm meters (on 8cm substrate soil thickness) to € 56/sqm (on 30cm substrate soil thickness) net vegetation area (maximum can be achieved via additional subsidy of € 1/sqm of net vegetation area per additional centimetre substrate soil thickness (starting layer thickness)).

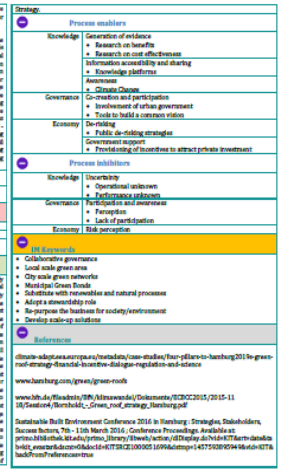
Global (estimated) cost of the project	• 1366-5566
Financing mechanism	CLUSTER 2: Financial Institutions • Municipal Green Bonds

NBS Business Models Archetype

Technological	• Substitute with renewables and natural processes
Social	• Adopt a stewardship role
Organisational	• Re-purpose the business for society/environment • Develop scale-up solutions

NBS success and limiting factors

The Green Roof Strategy fits within Hamburg's aim to be a growing, yet climate-friendly and resilient, compact city. For this purpose green rooftops provide a financially beneficial and multifunctional solution. In addition to reducing of climate change threats, they highly improve green quality space in the city. Investing in green roofs for adaptation to increase stormwater management and flooding risk is financially beneficial and minimizing the cost of upgrading the current sewage system. The German Federal Ministry for the Environment, Nature, Building and Reactor Safety supports Hamburg's Green Roof Strategy as a pilot project within their programme "Measures for adaptation to climate change", providing financial support, networking and transfer of knowledge. Promotion and communication of the Green Roof Strategy are a top priority and several hurdles still have to be taken. For example, it has been questioned whether green roofs indeed provide the needed water retention capacities especially with a heavy storm water event. The concern is that support for this only stems from small scale experimental settings and that real and large roofs would not provide adequate retention service. To solve the matter HafenCity University is currently researching this question. Further, when initiating the Green Roof Strategy it was challenged whether Hamburg was having sufficient flat roofs to be able to succeed with the strategy. GIS-based research solved this question, showing that over 40% of the cities roofs are flat and suitable for greening. Another particular challenge requiring strong communication efforts on the positive benefits of green roofs has been the appearance of specific animals on the green roofs. On one of the industry flat roofs a sea gull colony of ~5000 individuals has found a new home, putting off other businesses to also install green roofs. Similarly, green roofs attract insects which may result in people deciding to not choose for a green roof. Communication and research for Hamburg therefore have shown to be a crucial component for succeeding with the Green Roof Strategy.


Strategy:

Process enablers

Knowledge	Generation of evidence • Research on benefits • Research on cost-effectiveness Information accessibility and sharing • Knowledge platforms Assessment • Climate Change
Governance	Co-creation and participation • Involvement of urban government • Tools to build a common vision
Economy	De-risking • Public de-risking strategies Government support • Provisioning of incentives to attract private investment

Process inhibitors

Knowledge	Uncertainty • Operational unknown • Performance unknown
Governance	Participation and awareness • Perception • Lack of participation
Economy	Risk perception

Keywords

- Collaborative governance
- Local scale green area
- City scale green networks
- Municipal Green Bonds
- Substitute with renewables and natural processes
- Adopt a stewardship role
- Re-purpose the business for society/environment
- Develop scale-up solutions

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Short description + picture

Implementation context (location, scale, urban density)

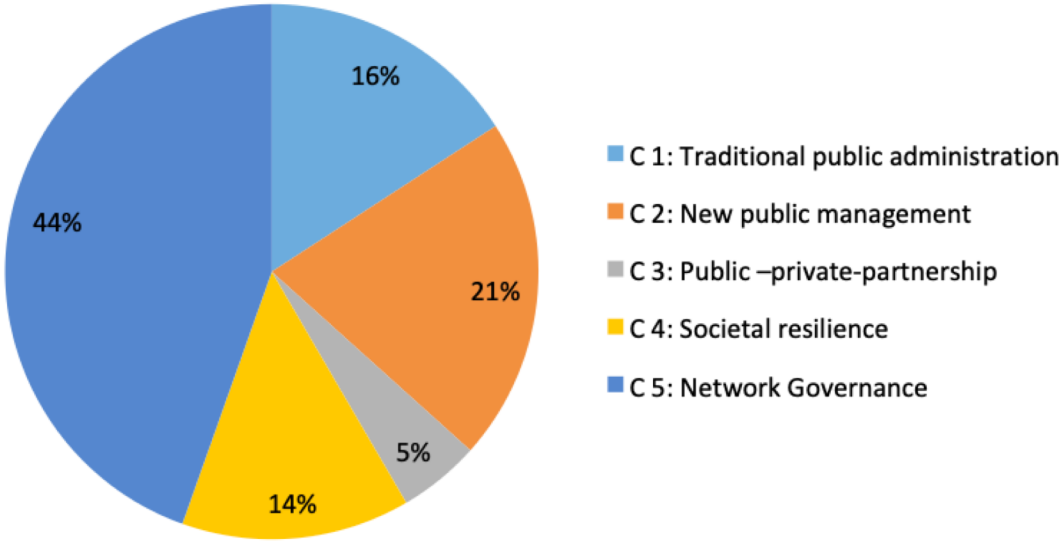
NBS typology

Urban challenges Stakeholders & Governance model

Financial aspects

Business model Enablers & Inhibitors

Keywords References



- ✓ Governance models→ The results that emerged from the IM database
  - ✓ more usual governance models are the ones from the Cluster 5 – "Network governance" (around 43% of the cases)
  - ✓ The second is the Cluster 2- "New public management" (21%) and the third is the Cluster 1- "Traditional public administration" (16%) with a theoretical suitability level of "low" or "medium low"
  - ✓ **Correlation between the suitability of the governance models and their incidence is not so evident**
  - ✓ The frequency of these types of governance → more related with the **traditional inertia of government structures** than with the suitability of them.

Thank you for your attention!

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