



#### Grant Agreement No.: 730468

Project acronym: Nature4Cities

**Project title**: Nature Based Solutions for re-naturing cities: knowledge diffusion and decision support platform through new collaborative models

#### **Research and Innovation Action**

**Topic**: SCC-03-2016: New governance, business, financing models and economic impact assessment tools for sustainable cities with nature-based solutions (urban re-naturing)

Starting date of project: 1<sup>st</sup> of November 2016

Duration: 48 months

# D1.2 – NBS Implementation Models Typology

Organisation name of lead contractor for this deliverable: NBK			
	Due Date	12/31/2017	
Version 6 – Rev.0	Submission Date	12/26/2017	





Authors

Dissemination Level		
PU	Public	Х
со	Confidential, only for members of the consortium (including the Commission Services)	





# **Document history**

History			
Version	Date	Author	Comment
1	09/01/2017	TEC	Table of Content
2	10/14/2017	TEC	First draft
3	11/5/2017	TEC, NBK, LIST, CAR, CER, RINA, R2M, METU, ACC, G4C, P&C, MUTK, CMM, CAN, SZEG, AH	Second draft
4	11/28/2017	TEC, NBK, LIST, CAR, CER, RINA, R2M, METU, ACC, G4C, P&C, MUTK, CMM, CAN, SZEG, AH	Third draft
6	12/12/2017	TEC	Consolidated version for review <sup>1</sup>
7	12/25/2017	TEC, NBK, LIST, CAR, CER, RINA, R2M, METU, ACC, G4C, P&C, MUTK, CMM, CAN, SZEG, AH	Final version

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### **Table of Contents**

E	Executive Summary13			
1	Inti	rodu	ction	14
	1.1	Purp	Dose	14
	1.2	Con	tribution of partners	15
	1.3	Link	with other WPs	16
	1.3	.1	Link with WP1	16
	1.3	.2	Link with WP4	17
	1.3	.3	Link with WP5	17
	1.3	.4	Link with WP6	19
	1.3	.5	Link with WP7	20
	1.3	.6	Link with WP8	20
2	Pro	ocess	s to define the typology	21
	2.1	Pior	neer experiences	22
	2.2	Part	ner cities	27
	2.2	.1	The Metropolitan City of Milan (CMM)	28
	2.2	.2	Szeged (SZEG)	28
	2.2	.3	Çankaya (CAN)	29
	2.2	.4	Alcalá de Henares (AH)	29
3	lde	ntifie	ed barriers (Process Inhibitors)	31
	3.1	Kno	wledge barriers	31
	3.2	Gov	ernance barriers	32
	3.3	Eco	nomy barriers	34
	3.4	Veri	fication with surveys, case studies and pioneer experiences	36
4	Dri	vers	of NBS implementation (Process Enablers)	38
	4.1	Kno	wledge drivers	38
	4.2	Gov	ernance drivers	39
	4.3	Eco	nomy drivers	42
	4.4	Veri	fication with surveys, case studies and pioneer experiences	44
	4.5	Con	nection between drivers and barriers	45
5	Go	verna	ance Implementation Models	49
	5.1	Clus	stering and characterizing Urban NBS Governance Structures	50
	5.1	.1	Innovation and levels of governance	50
	5.1	.2	Polycentric vs. monocentric governance	52
	5.1	.3	Initiating actor	53
	5.1	.4	Levels of participation	54
	5.1	.5	Ecological scales of governance	54
	5.1	.6	Governance concepts and steering modes for clustering	55
	5.2	Mod	lels of Governance	59





	5.2.1	CLUSTER 1: Traditional public administration	61
	5.2.2	CLUSTER 2: New Public Management	65
	5.2.3	CLUSTER 3: Private-private partnerships	69
	5.2.4	CLUSTER 4: Societal Resilience	77
	5.2.5	CLUSTER 5: Network Governance	81
6	Financ	ing mechanisms	88
	<b>6.1</b> Pu	blic	90
	6.1.1	European Structural and Investment funds: European Regiona	al and
	Develo	pment Fund (ERDF)	90
	6.1.2	European Structural and Investment funds: Cohesion Fund (CF)	91
	6.1.3	European Investment Bank Institute	92
	6.1.4	European Structural and Investment funds: European Social Fund (ESF)	93
	6.1.5	European Structural and Investment funds: European Agricultural Fe	und for
	Rural I	Development (EAFRD)	94
	6.1.6	European Funding Programmes: LIFE - Climate Action	94
	6.1.7	European Funding Programmes: Urban Innovative Actions (UIA)	94
	6.1.8	European Funding Programmes: European Territorial Cooperation	95
	6.1.9	European Funding Programmes: Horizon 2020	95
	6.1.10	Project Development Assistance (PDA)	96
	6.2 Fin	ancial Institutions Instruments	
	6.2.1	European Fund for Strategic Investments (EFSI)	96
		Network Constal Financing Facility (NOFF)	
	6.2.2	Natural Capital Financing Facility (NCFF)	97
	6.2.2 6.2.3	Non-traditional financial institutions: European Development Fi	97 <b>nancial</b>
	6.2.2 6.2.3 Institu	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI)	97 <b>nancial</b> 98
	6.2.2 6.2.3 Institu 6.2.4	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds	97   <b>nancial</b> 98 98
	6.2.2 6.2.3 Institu 6.2.4 6.2.5	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds	97   <b>nancial</b> 98 98 100
	6.2.2 6.2.3 Institur 6.2.4 6.2.5 6.3 Cit	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds	97 nancial 98 98 100 100
	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private	97 nancial 98 98 100 100 101
	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI)	97 nancial 98 98 98 100 100 101
	6.2.2 6.2.3 Institur 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans	97 nancial 98 98 100 100 101 102
	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3	Natural Capital Financial Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds	97 nancial 98 98 100 100 101 101 102 102
	6.2.2 6.2.3 Institur 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.3 6.4.4	Natural Capital Financial Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines	97 nancial 98 98 100 100 101 101 102 102
	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.3 6.4.4 6.4.5	Natural Capital Financial Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines City Planning regulations	97 nancial 98 98 100 100 101 101 102 102 102 102
	6.2.2 6.2.3 Institur 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.3 6.4.4 6.4.5 6.4.6	Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines City Planning regulations Conclusions of Financing Mechanism	97 nancial 98 98 98 98 100 100 101 101 102 102 102 103
7	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.3 6.4.4 6.4.5 6.4.6 Busine	Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines City Planning regulations Conclusions of Financing Mechanism	97 nancial 98 98 100 100 101 101 102 102 102 102 103 105
7	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.3 6.4.4 6.4.5 6.4.6 Busine 7.1 Co	Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines City Planning regulations Conclusions of Financing Mechanism ess models ntextualizing NBS concept	97 nancial 98 98 98 98 100 100 101 102 102 102 103 105
7	6.2.2 6.2.3 Institur 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.4 6.4.5 6.4.6 Busine 7.1 Co 7.2 Ide	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential loans Guarantee funds Soft loans/Dedicated Credit Lines City Planning regulations Conclusions of Financing Mechanism ess models Intextualizing NBS concept Intextualizing NBS concept	97 nancial 98 98 98 100 100 101 101 102 102 102 103 105 106
7	6.2.2 6.2.3 Institut 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.3 6.4.4 6.4.5 6.4.6 Busine 7.1 Co 7.2 Ide 7.2.1	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines City Planning regulations Conclusions of Financing Mechanism ess models Intextualizing NBS concept Intextualizing NBS concept Intextualizing NBS concept Intextualizing NBS concept	97 nancial 98 98 98 98 100 100 101 102 102 103 105 106 e106
7	6.2.2 6.2.3 Institur 6.2.4 6.2.5 6.3 Cit 6.4 Pu 6.4.1 6.4.2 6.4.3 6.4.4 6.4.5 6.4.6 Busine 7.1 Co 7.2 Ide 7.2.1 7.2.2	Natural Capital Financing Facility (NCFF) Non-traditional financial institutions: European Development Fi tion (EDFI) Municipal Green Bonds Revolving Funds izen inclusion blic-private Private Finance Initiative (PFI) Preferential Ioans Guarantee funds Soft Ioans/Dedicated Credit Lines City Planning regulations Conclusions of Financing Mechanism ess models intextualizing NBS concept entification of Business Model feasibility into NBS Business Models for Sustainability from a System Dynamics Perspective Business Models for Sustainability: Energy Efficiency in Urban Districts	97 nancial 98 98 98 100 100 101 101 102 102 103 105 106 e108





7.2.4	A literature and practical review to develop sustainable bus	ness model
archet	ypes.	
7.2.5	Business cases for sustainability: the role of business model in	novation for
corpor	ate sustainability	
7.3 Cri	tical Analysis	
7.3.1	What kind of firm is it?	
7.3.2	Where the firm is?	
7.3.3	Where does the firm want to go?	
7.3.4	What should the firm take into account to achieve its objective?	
7.3.5	Conclusions of Business Models	
8 Manag	ement strategies	
8.1 Str	ategic management	
<b>8.2</b> Ma	nagement strategies for NBS projects	
8.2.1	Barriers and drivers. IPD methodology example	
9 Implen	nentation context	
9.1 Re	gulatory contexts	137
9.1.1	The local Government Level	137
9.1.2	The Intermediate Government Level	137
9.2 So	cio-cultural context	
9.2.1	Citizen representation and participation	
9.2.2	Urban development	140
9.2.3	Neighborhood urban regeneration	141
9.2.4	Spatial planning systems	141
9.3 Eco	onomic context	141
9.3.1 N	IBS at the cities' scale	142
9.3.1	Barriers	144
9.3.3 E	nablers	145
10 Typolo	ogy of Implementation Models	146
<b>10.1</b>	Typology of Governance Models	147
10.1.1	Link with barriers and drivers	147
10.1.2	Link with NBS types	
<b>10.2</b>	Typology of financing mechanisms	149
10.2.1	Link with barriers and drivers	149
10.2.2	Link with NBS types	150
<b>10.3</b> 7	Typology of business models	151
10.3.1	Link with barriers and drivers	151
10.3.2	Link with NBS types	152
11 Conclu	usions	153
12 Refere	nces	155
13 Annex	I: Classification for T5.1	





14	Annex III: List of barriers	. 174
15	Annex IV: List of drivers	176





## List of Figures

Figure 1: IM database developed in T5.1	18
Figure 2: Link between T1.2 and T5.2	18
Figure 3: T5.4 as link between WP4 and WP5.	19
Figure 4: Methodology to define the typology of Implementation Models (IM) and related section	ons in
the deliverable	21
Figure 5: Connection between barriers and drivers	47
Figure 6: Ladder of participation [66]	54
Figure 7: Conceptions of governance and corresponding innovation (After [70] [71] [10] )	56
Figure 8: Classification of governance concepts by Van der Steen et al. [72] (translated by Y	/vette
Jeuken)	57
Figure 9: Frameworks of governance typology and steering modes (Source [63])	57
Figure 10: Four ideal-typical governance arrangements according to [57]	58
Figure 11: Framework for governance model analysis and clustering	59
Figure 12: Analysed governance models	60
Figure 13: Cluster 1 (Traditional public administration)	61
Figure 14: The hierarchical, closed and open co- and self-governance continuum ([76]as se	en in
[57]).	62
Figure 15:Cluster 2 (New Public Management)	65
Figure 16: Spectrum of PPP types [49]	66
Figure 17: Cluster 3 (Private-private partnerships)	69
Figure 18: The three phases of a NSDM governance model [81]	71
Figure 19: Business and NGOs motivations to collaborate with NGOs [86]	72
Figure 20: Types of business – NGO governance models and sustainability continuum [86]	74
Figure 21: Model of SLEN [89]	75
Figure 22: Cluster 3 (Societal Resilience)	77
Figure 23: Cluster 5 (Network Governance)	81
Figure 24: Position of collaborative governance along the continuum of government involve	ment
(Source. [86])	82
Figure 25: Positive and negative partnership outcomes by stakeholder (source: [86])	82
Figure 26: ETC investment priorities	95
Figure 27: European Fund for Strategic Investments by sector (s	ource
[http://www.eib.org/efsi/efsi_dashboard_en.jpg])	97
Figure 28: Green Bond amount from 2007 to 2017 (source: Climate Bonds Initiative, MSCI	ESG
Research, Barclays Research, Bank of America Merrill Lynch. European Investment Bank.	2017
year to date 13 March 2017, https://www.cfasociety.org)	99
Figure 29: Diverse & multiple co-benefits	105
Figure 30: The sustainable business model archetypes [115]	113
Figure 31. IPD versus traditional process: workflow [138]	133
Figure 32. IPD versus traditional process: decision making process [138]	134

Nature4Cities – D1.2 – NBS Implementation Models Typology





Figure 33: Example of ring-fenced spending - Greater London Authority 2017	144
Figure 34: Link between financing mechanisms, barriers and drivers	149





#### List of Tables

Table 1: Abbreviation and acronyms	12
Table 2: Contribution of partners	16
Table 3: Description of pioneer cases	27
Table 4: Identified knowledge barriers	32
Table 5: Identified governance barriers	34
Table 6: Identified economic barriers	36
Table 7: Verification of barriers (in green verified drivers, in red barriers that are verified that do	o not
apply)	37
Table 8: Identification of knowledge drivers	39
Table 9: Identification of governance drivers	42
Table 10: Identification of economic drivers	44
Table 11: Verification of drivers (in green verified barriers, in red drivers that are verified that do	o not
apply)	45
Table 12:Link between barriers and drivers	46
Table 13: Levels of Governance [58]	52
Table 14: Sectors and included actors	53
Table 15: Hierarchical governance	62
Table 16: Closed governance	63
Table 17: Participatory planning & budgeting	64
Table 18: Barriers, drivers and suitability for NBS of cluster 1	65
Table 19: Barriers, drivers and suitability for NBS of cluster 1	67
Table 20: Business-led self-regulation	68
Table 21: Barriers, drivers and suitability for NBS of Cluster 2	68
Table 22: Comparison of NSMD with other models [79]	70
Table 23: Business- led self-regulation versus NSDM and state-based non governance [80]	70
Table 24: Non State Market-driven governance (NSMD)	72
Table 25: Business–NGO partnerships	74
Table 26: SLENs (Sustainable Local Enterprise Networks)	76
Table 27: Barriers, drivers and suitability for NBS of Cluster 3	77
Table 28: Co-management	78
Table 29: Civic ecology practices	79
Table 30: Self-governance/grassroots initiatives	80
Table 31: Barriers, drivers and suitability for NBS of Cluster 4	80
Table 32: Collaborative governance	83
Table 33: Adaptive governance	84
Table 34: Adaptive co-management	86
Table 35: Barriers, drivers and suitability for NBS of Cluster 5	87
Table 36: Characteristics of a Sustainability Business Model [111]	112





Table 37: Substitute with renewables and natural processes	
Table 38: Create value from waste	114
Table 39: Substitute with renewables and natural processes	115
Table 40: Deliver functionality, rather than ownership	115
Table 41: Adopt a stewardship role	
Table 42: Encourage sufficiency	
Table 43: Re-purpose the business for society/environment	117
Table 44: Develop scale-up solutions	118
Table 45: Core business case drivers for the business case for sustainability [116]	119
Table 46: Interrelations between corporate sustainability strategies and business cas	e drivers [116] 120
Table 47: Interrelations between business model and business case drivers [116]	121
Table 48: Framework for business cases for sustainability and integrated business mo           [116]	del innovation
Table 49: Typologies of sustainable strategy - Established / New - Public /Private	123
Table 50: Structure of the table Interrelations between business model and busines	s case drivers
[116]	124
Table 51: The sustainable business model archetypes [115]	126
Table 52: Management strategies and explanations	129
Table 53: Barriers for NBS avoided by applying IPD methodology	
Table 54: Enablers for NBS used by applying IPD methodology	136
Table 55: Synthesis of the regulatory contexts in European countries [143]	139
Table 56: Link between governance models and barriers and drivers	147
Table 57: Link between governance models and NBS types	148
Table 58: Link between financing mechanisms and NBS types	150
Table 59: Link of business models with barriers and drivers	151
Table 60: Link of business models with NBS types	152





### Glossary

Acronym	Full name
BAF	Biotope Area Factor
ВМ	Business Model
BMfS.	Business Models for Sustainability
EC	European Commission
ІМ	Implementation Model
N4C	Nature 4 Cities
NBS	Nature Base Solutions
NSMD	Non State Market-driven governance
PDU	Program Delivery Unit
PFI	Private Finance Initiative
PPP	Public-private partnership
SBM	Sustainable Business Model
SLEN	Sustainable Local Enterprise Networks
SPV	Special Purpose Vehicle
TBL	Triple Bottom Line
WP	Work Package

Table 1: Abbreviation and acronyms





## **Executive Summary**

According to the DoA the objective of this task is the definition of a typology of Implementation Models (governance models, financing schemes and business models) according to their capacity to overcome barriers, their capacity to become drivers of NBS implementation and their capacity to be adapted to different social, economic, cultural and regulatory contexts.

The barriers, drivers and the typology of Implementation Models have been defined firstly by a review of the state of the art and secondly comparing the results with real cases. These real cases have come from the surveys and reviews carried out to urban planners and municipalities in task 8.1, the survey on pioneering NBS projects conducted in T1.3 and the partner cities from the project (Szeged, Milano Metropolitan Area, Çankaya and Alcala de Henares).

In this deliverable the different urban and environmental governance models have been mapped and characterized in order to assess their suitability for different NBS projects. Five clusters have been identified and distributed according to the involved actors (government, community and market), their position in the spectrum from high to low government involvement and their level of participation.

The study has been complemented with financing mechanisms, business models and management strategies that can facilitate the implementation of these projects. The analysis of the different regulatory, socio-cultural and economic contexts of European cities is mean to give insights regarding the applicability of the Implementation Models. Finally, a typology of Implementation Models is proposed in order to link the NBS types, barriers and drivers with the identified implementation Models. This typology would be the basis of the pre-selection model to be developed in WP5 (task 5.5).





## 1 Introduction

## 1.1 Purpose

According to the DoA the objective of this task is the definition of a typology of Implementation Models (governance models, financing schemes and business models) according to:

- their capacity to overcome identified barriers
- their capacity to become drivers of NBS implementation
- their capacity to be adapted to different social, economic, cultural and regulatory contexts

These barriers, drivers and the typology of Implementation Models have been defined by a review of the state of the art and the results from task 8.1<sup>2</sup>. Then they have been validated by the survey on pioneering NBS projects (conducted in T1.3) and the partner cities studied in the project (Szeged, Milano Metropolitan Area, Çancaya and Alcala de Henares).

NBS is a new complex concept that is not totally clear for practitioners, as seen in the interviews and surveys developed within the task 8.1 (barely 20% of the participants of the surveys accept the definition of NBS in the way the European Commission<sup>3</sup> defines it and the social perspective or the ecological balance was found in some cases not to be enough stressed by the definition). As seen during the interviews and workshops with experts and practitioners in task 8.1, the concept is frequently confused with other concepts such as biomimicry, sustainable development or green infrastructure. NATURVATION project [1] considers that this loose definition of the concept "could be a source of strength as it provides a space for a dialogue and innovation (and) opens up space for bringing the discussion further, by engaging with a wider range of voices".

The novelty of the NBS concept is both an opportunity and a challenge since "a good understanding of ecosystem processes is needed, a diversity of actors must be engaged and a broad set of societal facts/issues needs to be included and integrated" [2]. The same authors comment that "whether NBS become something that goes beyond 'just another communication tool' to promote a positive view of 'nature-based' and 'sustainable' management measures, and which avoids using old tools with diverse conceptual foundations, will depend on whether these conceptual and practical challenges can be addressed when developing projects and linking them across scales, contexts and people"

NBS concept includes the concept of integrative governance and participatory approaches to codesign, co-creation and co-management [3] and this is one of the key differences that distinguish the concept from more traditional and top-down conservation approaches [4].

<sup>&</sup>lt;sup>2</sup> D8.1-Requirements of the Nature4Cities solution

<sup>&</sup>lt;sup>3</sup> European Commission definition of NBS: "nature-based solutions to societal challenges as 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" [149]

# **HATURE 4** CITIES



In this deliverable the different urban and environmental governance models have been mapped and characterized in order to assess their suitability for different NBS projects. The study has been complemented with financing mechanisms, business models and management strategies that can facilitate the implementation of these projects. The analysis of the different regulatory, socio-cultural and economic contexts of European cities is mean to give insights regarding the applicability of the Implementation Models. Finally, a typology of Implementation Models is proposed in order to link the NBS types (developed in task 1.1<sup>4</sup>), barriers and drivers with the identified implementation Models. This typology would be the basis of the pre-selection model to be developed in WP5 (task 5.5<sup>5</sup>).

The document is structured as follows:

- **Section 1** establishes the purpose of the deliverable and the links with the whole Nature4cities project.
- Section 2 describes the methodology followed in the research
- Section 3 identifies the different barriers and process inhibitors to implement NBS projects through literature review, T8.1 outputs and contributions from pioneering experiences (T1.3) and the experience of partner cities.
- Section 4 identifies the different drivers and process enablers to implement NBS projects through literature review, T8.1 outputs and contributions from pioneering experiences (T1.3) and the experience of partner cities. This section also makes the link between barriers and drivers.
- Section 5 identifies and characterizes the different governance models
- Section 6 identifies and characterizes the different financing mechanisms
- Section 7 identifies and characterizes the different business models
- Section 8 identifies and characterizes the different management strategies
- **Section 9** analyses the different implementation contexts (regulatory, socio-cultural and economic context) of European cities
- **Section 10** proposes a typology of Implementation Models that links the NBS types developed in task 1.1, barriers and drivers with the identified implementation Models.
- In section 11 the conclusions are drawn.

## **1.2** Contribution of partners

The following table (*Table 2*) details the contribution of each partner:

PARTNER	CONTRIBUTION
NBK	Responsible for section 1.3.5. Review of the deliverable.
TEC	Responsible for the coordination of the deliverable, section 1, 2, 3, 4, 5, and 10.

<sup>&</sup>lt;sup>4</sup> Task 1.3 "Analysis of pioneering experiences and Development of a NBS projects observatory"

<sup>&</sup>lt;sup>5</sup> Task 5.5 "Development of a characterization grid for NBS Implementation Models"





LIST	Responsible for section 1.3.2. Review of the deliverable.
CAR	Contributions to section 8. Contributions from Spanish Pioneer Experiences.
CER	Contributions to section 3 and 4. Responsible for section 1.3.1. Review of the deliverable.
RINA	Contributions to section 3 and 4. Responsible for 9.1
R2M	Responsible for section 7 and 9.3
METU	Contributions to section 3 and 4. Responsible for 9.2. Contributions from Turkish Pioneer Experiences.
ACC	Responsible for section 7. Contributions to section 8. Contributions from Spanish Pioneer Experiences.
G4C	Contributions to section 8. Contributions from Pioneer Experiences.
P&C	Contributions to section 3 and 4. Contributions from Pioneer Experiences.
MUTK	Contributions from Pioneer Experiences.
СММ	Contributions from municipality experience.
CAN	Contributions from municipality experience.
SZEG	Contributions from municipality experience.
AH	Contributions from municipality experience.

Table 2: Contribution of partners

## **1.3** Link with other WPs

The connection of the work done in this deliverable with the rest of the WPs is going to be mainly through the IM database (developed in T5.1) and the preselection tool (developed in T5.5) as it can be seen in the following sections. Actually the structure of the IM database is directly related to the typologies developed in task T1.2 and presented in this report.

#### 1.3.1 Link with WP1

The Implementation Model (IM) typology (and database associated developed in WP6) is a part of Nature4Cities' NBS integrated analysis framework and knowledge base. In this context, the IM database is complementary with the 3 other databases that will be developed in WP1:

<sup>&</sup>lt;sup>6</sup> T5.1 "Mapping and characterization of NBS Implementation Models"





- **NBS database:** different kind of IM can be associated to different kinds of NBS. They are connected through factors such as the urban scales, the societal challenges targeted or the technical characteristics of the solutions implemented.
- **NBS Projects database** (base of the 'NBS Projects Observatory', and first fed with pioneer NBS cases): all existing cases present in the inventory, and those that will be added by end-users will be documented regarding the IM they are based on. This documentation will be guided by the typology so that each IM can be clearly identified. The typology of the IM proposed is meant to be as complete as possible, but cannot be exhaustive. New business models, ways of governance, etc., but also barriers and opportunities are endlessly invented. For this reason, it is important in the project to be connected with ongoing projects, and especially pioneer ones, in order to update the base of knowledge. For this reason, the structure of the database must be conceived in a way to integrate these potential new IMs.
- **Regional and local scales contextual database**: to be better understood and applied, the IM also need to be contextualized, with geographic, climatic, and other data depending on the local context, at different scales (regional and local).

#### 1.3.2 Link with WP4

The work of WP4 regarding socio-economic assessment of several NBS will continue in Task 5.4, where the influence of several types of IM on the socio-economic values will be studied. In this sense, the IM database will inform the modelling and assessment in Task 5.4 and it needs to be taken into account during the WP4 works to ensure compatibility between the tasks and the posterior aggregation of values obtained from the NBS assessment (WP4) and their IM (WP5). Additionally, understanding the IM database anticipates the collection of IM information for the NBS pioneer experiences together with the social, economic and environmental data of the NBS needed for the calibration of the models at WP4.

#### 1.3.3 Link with WP5

This deliverable has been deeply connected with the IM database (*Figure 1*) developed in parallel in task 5.1. In this task a classification has been developed in order to serve as structure for the data

## base (see Annex I: Classification for T5.1).







Figure 1: IM database developed in T5.1

The work done in this task is going to be a clear input in the development of T5.2 ("Citizens and stakeholders engagement"), T5.3 ("Societal Acceptance and Barriers to implementation of NBS") and T5.4 ("Socio-economic assessment of NBS Implementation Models") and T5.5 ("Development of a characterization grid for NBS Implementation Models"). The task 5.2 has already identified the role of the typology of IM and of the IM preselection tool as part of the citizens and stakeholder's engagement strategy that will be develop. *Figure 2* presents the first steps of this stakeholders' engagement strategy and the links with the work presented in this report.



Figure 2: Link between T1.2 and T5.2

The extent of societal acceptance and barriers to NBSs, as well as the antecedent factors influencing these, depend heavily on the type of NBS and the type of the IM. The work in Task 5.3 takes these





typologies into account and provides a comprehensive tool for measuring societal acceptance of different NBSs. The societal acceptance measurement model will be implemented and tested in Alcala de Henares, Çankaya, Milan Metropolitan Area, and Szeged. These will exemplify the utilization of the measurement tool for urban planners who would like to compare alternative NBSs as well as alternative IMs. Upon selection of an NBS and an IM, the proposed tool can be utilized and when implemented it will enable the users to identify which IM typologies are likely to work better with which NBSs. The tool will also consider societal acceptance before and after the NBS implementation. It will be a clearly useful tool for the strategy formulation stages before the NBS implementation. However, it will also enable the planners to assess and monitor the societal acceptance of an existing NBS with the chosen IM. The NBS and IM databases will play an important role in the calibration of the tool for both pre- and post-implementation periods.

As explained in section 1.3.2, Task 5.4 is going to be the link between WP4 and WP5 (see Figure 3).



Figure 3: T5.4 as link between WP4 and WP5

#### 1.3.4 Link with WP6

The Implementation Model Database that will result from WP5, using as basis the knowledge of a typology of IM defined in this task, is part of the architecture platform that is being designed in the WP6.

Specifically, the IM Database will be one of the six N4C Data Repositories deployed in the Data layer of the N4C platform. WP6 will also define the connector in charge of communicating the rest of the platform with the database and its translation to a common language to allow the components of the platform to understand the database.





#### 1.3.5 Link with WP7

The IM database that is being built in WP5 based on the typology proposed in this report, as well as the IM pre-selection tool (also to be developed in WP5) are two components of Nature4Cities platform that are going to be tested and validated with partner cities in WP7 activities. The platform demonstration activities will enable to collect feedback from end-users (partner cities) on the IM database and the IM pre-selection tool and to issue specifications for potential improvements.

#### 1.3.6 Link with WP8

From the project inception, a criticality has been identified in the process of establishing a workable typology of Nature-Based Solutions across different dimensions. This criticality is due to the involvement of different stakeholders, at different stages of NBS identification, discussion and selection process, with each user/stakeholder category having diverse aspirations and interests on the outcome. Work Package 8 has the purpose to capture and document user requirements from all involved stakeholders, such as ordinary citizens, planning professionals, civil servants involved in municipalities' urban planning, and policymakers.

Identifying and documenting the goals and needs of different users represents an important tool in reducing the risk and impact of the above criticality. A User Requirements document (D8.1) has been delivered early in the project (Month 8 of 48) to help steer and confirm the creation of the NBS taxonomy. The User Requirements document also contains extensive descriptions of real-life enablers and barriers collected during field work and user interviews at several demo sites, whereby success stories and users' concerns are analysed in order to abstract workable categories.

Furthermore, the User Requirements document lays the foundation for the development of Use Cases i.e. high-level descriptions of how the NBS platform software should perform, what capabilities are expected to accomplish certain tasks, goals, outcomes etc.

The Use Case Definition document (D8.2) has been released in advance of this typology (M12) so that positive confirmation can be assessed between the NBS taxonomy and its real-world usage through the Nature4CitiesNBS platform.





## 2 Process to define the typology

The methodology to define the Implementation Models (IM) Typology has followed 4 steps (*Figure 4*):

- Step1: Identification and definition of barriers and drivers
- **Step2:** Identification and characterization of governance models, financing schemes, business models and management strategies
- **Step3:** Definition of regulatory, socio-cultural and economic context that allows the urban characterization regarding the IM
- **Step4:** Definition of a typology of IM that links the barriers, drivers, implementation context, NBS types (defined in T1.1) with the different IM.



Figure 4: Methodology to define the typology of Implementation Models (IM) and related sections in the deliverable

For each step the following method has been followed:

• First a literature survey has been carried out. A snowball approach has been followed. In a first step some primary documents have been identified [5][6][7] taking into account the research outputs that have been generated for similar research project such as NATURVATION, EKLIPSE and GREENSURGE [1] [8] [9]. These documents guided the posterior literature review to specific fields and issues.





- The literature review has been complemented by the results of T8.1<sup>7</sup>. In this task several interviews, on-line surveys and workshops were conducted targeting experts, urban planners and municipality workers in order to "gain an understanding of citizens, experts and municipalities practices, routines and difficulties and how they interact with Nature-based Solutions in their daily lives and operating processes".
- Finally, the results have been verified comparing with the survey carried out in T1.3<sup>8</sup> regarding NBS Pioneer Experiences across Europe and the experiences of the partners cities in the project.

## 2.1 Pioneer experiences

As explained before, the literature review has been verified and checked through real cases. The survey regarding pioneer experiences that has been carried out within the project has been used for this purpose. In this survey pioneer experiences regarding NBS implementation from 8 countries (Germany, Austria, Switzerland, Spain, Turkey, France, Hungary and Italy) have been analysed from different perspectives, including their IM. The following table describe briefly these cases (see Table 1).

GERMANY	
ECO District Vauban – Freiburg	This project is a very good example for a dense green city and a perfect conversion of old military bases. The complete project was from the beginning a Partitive process to enable the inclusion of the residents wishes and suggestions to the planning process. All buildings are built to a low-energy consumption standard. Many buildings have solar collectors or photovoltaic cells and produce more energy than needed. Vauban is the first housing community worldwide with a complete positive energy balance. In the whole district the number of cars is reduced by 50%. The coverage and great usage of plants make Vauban to look like a big garden with houses. This image helps to convey the importance of green city structures and illustrates the ecofriendliness of Vauban.
Facade Greening Adlershof – Berlin	The building of the Institute of Physics of the Humboldt university in Berlin is the result of combining decentralised rainwater management, building greening and elements for cooling and ventilation. All necessary factors, like water and energy consumption, temperature, radiation, etc., are monitored, evaluated, optimised and documented to gain information about basic conditions for the long term implementation and further development of innovative and economic technologies. This project gives needed information about benefits of façade greening. The results and experiences of the concept model were integrated into the "Rainwater Management Concepts – Greening building, cooling buildings – Planning, Construction, Operation and Maintenance Guidelines" developed by the Senate for Urban development of the City Berlin.
White Paper Weißbuch Stadtgrün	The White Paper proposes recommendations for action and concrete measures for the next few years through which it will, within its areas of competence, support municipalities and other actors in strengthening urban green infrastructures. The government will thus make a key contribution to

<sup>&</sup>lt;sup>7</sup> D8.1 Requirements of the Nature4Cities solution

<sup>&</sup>lt;sup>8</sup> T1.3 Analysis of pioneering experiences and Development of a NBS projects observatory





	improving quality of life, environmental justice and climate resilience within cities. The White Paper defines ten fields of action for protecting and enhancing urban green and open space as a longer-term initiative for high quality urban spaces.
AUSTRIA	
BIOTOPE CITY – Vienna	The project BIOTOPE CITY is a combination of buildings and green spaces based on the principles of a dense urban neighbourhood with nature in a close juxtaposition. The project is developed on the background of current and future consequences of environmental changes to strengthen biodiversity in cities and minimize the ecological impact of urban building. To reach the best result in combining these two planning Ideas the planning process was a big partitive planning process with the residents. Only planning close to people can provide a functional conglomeration like the biotope city.
Living Wall MA48 – Vienna	The administration department of waste management (MA48) in Vienna developed a pioneer program for greening buildings to investigate the effects on heat flow in winter and the influence on the heat transfer losses and heat demand of the building. The facades were to create ecological niches for insects and birds and positively affect the surrounding indoor and outdoor climates, too. With this easy to be seen living wall, the department reached a greater public interest and awareness for green facades and managed to improve the quality of the urban space in this area. Because of the very complex implementation process of vertical green and the need of successful interdisciplinary cooperation between several stakeholders, followed among others because of this successful pioneer projects, a project was launched by the City of Vienna in 2016, to work on defining legal requirements and framework conditions and implementation instruments.
Urban Heat Islands Strategy Plan – Vienna	The aim of this is the identification of measures and adaptations to reduce the negative aspects of urban warming. The intention is to develop a strategic plan for the City of Vienna to implement urban and open space planning measures and urban ecology measures to reduce the negative aspects of urban warming.
SWITZERLAND	
MFO-Park – Zurich	The MFO park is a public park in the Oerlikon quarter of Zurich which was developed in the framework of urban development phase for <zentrum zürich-nord="">. Initially this one was a pilot project, but after 10 years of successful implementation/usage of the NBS with lots of experiences and several awards its graduated to a pioneer project. The park is characterised by its steel-framed construction combined with climbing plants. These steel frames are covered with up to 1200 different climbing plants and 100 different species. This project defines the contemporary park in a complete new way. Thanks to the international recognition also a quite higher consciousness for facade greening is built.</zentrum>
SPAIN	
LEAFSKIN®	LEAFSKIN® is a green shady structure with several benefits designed by SINGULAR GREEN. This green infrastructure consists in a vertical garden with a pitch between 30° and 90°, it is destined for the planting and growth of plants, including irrigation and water collection system. Their benefits include:





	<ul> <li>Temperature reduction: Increasing the area of green space in urban areas, reduce local temperatures in summer.</li> </ul>
	<ul> <li>Leafskin acts as a filter for contaminants: This green infrastructure will be able to catch and process pollutants.</li> </ul>
	Green space can buffering noise: It is a noise shielding.
	<ul> <li>Increasing commercial activity: The installation of shadow elements and special vegetable features are able to increase the influx of visitors in shopping streets.</li> </ul>
	Increasing green area per habitant: WHO advises 16.7m2/capita.
	Increased real estate values.
TURKEY	
Climate Friendly Çankaya Parks with Natural Plants	Çankaya Municipality and the Association of Landscape Research Associations will use the natural plants Çankaya parks in Ankara. Within the scope of the project "Climate Friendly Çankaya Parks with Natural Plants" supported by United Nations Development Program (UNDP-GEF) Small Grant Program Turkey (SGP), 5 species of drought-resistant bushes, which form the natural vegetation of Ankara, will be grown with this project, Çankaya Municipality will transfer the natural vegetation to the city center.
Ankara Integrated Solid Waste Management System	"Ankara Integrated Solid Waste Management System" consists of several simultaneously conducted activities, such as sorting of waste, power generation through bio-methanization process, disposal of hazardous and medical wastes, design and operation of sanitary landfills and rehabilitation of old landfills. The objective in the project is to minimize the amount of waste to be landfilled, and the ultimate goal is to eliminate the need for landfills. Negative effects of "Mamak Dumping Area" eliminated by the rehabilitation works and implementation of waste treatment technologies landfill transformed into areas growing vegetables and fruits.
Çankaya Municipality Rain Harvesting and Water Storage	To ensure the familiarity and sustainability of managers, designers, experts and practitioners working in the municipality about rain harvesting and water storage methods Çankaya Municipality made action in collaboration with EU and non-governmental organizations. In the scope of the





	project, best practices of water retention methods located in Europe will be analyzed and implemented in urban parks in Çankaya.			
Çankaya Municipality Rain Harvesting	Since the natural resources are not infinite, the placing and spreading of the greatest solution to the diminishing natural resources, can be avoided by natural solutions, especially in urban areas. It is aimed to create awareness in many parks by explaining some of the applications to the citizens in the borders of Çankaya.			
FRANCE				
Restoration of ground wild bee populations (Lille)	Devices as shelter and hosting capacity for ground solitary bees (pollinators)			
Taking into account soils in urban planning	Design and use of an index of soil use versatility combining 5 soil functions and 9 potential uses (Uqualisol ZU research project)"			
School of the Saida / Olivier de Serres (Paris)	A wide greening design with a specific participative, consultation and pedagogical approach with children.			
The sylviculture city (Lorient)	Structuring a local wood network from producers to users: hedges wood production as a synergy solution between clean energy production, ecosystem services and maintenance of local hedges, valorization of local actors.			
The riverside gardens (Nantes)	Artificial equipment to host fauna and flora. nesting boxes for bats, ducks and coots egg-laying baskets, insects hotels, passerines nestboxes, artificial fish spawning beds, or even artificial ponds, green rafts.			
Creation of an artificial wetland habitat downstream a water plant for the treatment of emerging pollutants (Dragonfly Zone - project ZHART)	Stormwater management in a new district design (Bezannes): from a traditionnal solution of civil engineering to a multifunctional and integrated scenario			
HUNGARY				
ECO –park development, Balatonfűzfő, at the lakeshore of Balaton	This project started in 2014 and the first section finished in 2016. The main goal of the project was the development of an ecological park at the lake Balaton. The area was problematic, because of sludge-soil. The plans of the municipality and the local civic organization were to develop a pleasant, ecological park filled with different kind of leisure activities from the neglected gulf. The financing model was based on Public-private partnership, but was also funded by the EU. Now there is a special playground, a new phase of the Balaton bike ring road, and some catering facilities for bikers and tourists too. The second phase of the project will start on according to plans in 2018, the landscape architectural plans are ready.			
Promenade along Danube – Budapest	This is a particularly public initiative program by designed and implemented by VALYO (organization for the City and River). VALYO is an organization dealing with the issues and relations of city and the river (Danube), their aim is to engage as many stakeholders in their projects as possible. The initial questions are: What does the Danube mean in life of the citizens? How are			





	we contacted with the river in our everyday life? The Promenade covers a bunch different kind of alternative events, focusing on art, mobility and active woodworking. They are united by the core objective to bring Danube nearer to the citizens' hearts.				
Urban regeneration in Ferencváros, Budapest	The target area of urban regeneration actions in Ferencváros is located in the heart of Budapest. This pioneer project was realized before urban planners would have recognized the importance of urban green spaces. At the same time this project brought measurable market benefits (appreciation of occupied property), also helped to create a neighborhood community. The project was a successful tool in mitigating the negative effects of urban heat island, and summer air temperatures significantly decreased.				
Community Garden, Nagykovácsi	This is a new initiative in a wealthy suburban village near Budapest. The project is rather interesting from the community building point of view. The settlement is characterized by wealthy households, the proprietors of which work in the city and they haven't got enough time to take care of their own garden, thus they hire gardeners to take care of their relatively spacious gardens. Despite of that they live in a small village, their lifestyle is more urban and they have little connection to each other – even to their next-door neighbours. Observing the situation, some local people decided to create a community garden in the village, where people can work together, and they have the possibility to acquire gardening skills, thus they can take care of the plants while they build a community too. The project proved to be successful and flourishes at present time.				
Urban Public Space Refurbishment, Szeged	Szeged is a mid-size historic city in the south of Hungary, the temperature is usually higher than in other similar-sized cities in the country. The goal of this project was to reduce the effects of the urban heat island in a very busy street with a lot of cars and shops. The idea was to increase the green area, planting trees, creating a more pleasant space for the pedestrians. The project has a significant effect which stimulated the economy as well.				
Bird Friendly School garden in an Elementary School, Szeged	<ul> <li>The school is surrounded by roads bearing heavy traffic, with significant amount of air pollution and noise. The quality of soil is of extremely poor quality, and the vegetation of the garden is poor in species. Activities:</li> <li>habitat development, with a three metres wide shrub and herbaceous plant line along the fence (diverse species collection);</li> <li>soil amelioration with compost and structure improvement;</li> <li>reaping the lawn in tracks in summer;</li> </ul>				
	<ul> <li>iviediterranean nerb garden on the root,</li> <li>placement of bird protection devices (e.g. bird feeders, nest boxes);</li> <li>natural science awareness raising actions</li> </ul>				
ITALY					
LET'S CROP THE DIVERSITY – Rome	"Let's Crop the Diversity" (LCD) aims to redevelop urban spaces through the co-production of solutions based on nature (SBN) to promote resilience and environmental quality of the geographical areas of intervention. The goal of this project is developing an Urban Agricultural System that, tanks to the use of SBN, allowing to regenerate abandoned, unused and/or under- used spaces in densely urbanized areas. LCD intends to face this challenge in a social, innovative,				





	multi-disciplinary and trans-disciplinary way, involving local stakeholders in order to develop a model based on the participation of citizens. LCD provides a set of activities related to the innovation of agricultural practices, information campaigns and involvement of citizens and marginalized social classes, and training courses aimed at local stakeholders.
INPS, Green Facade Pilot Project – Genoa	A vertical greening system installed on the facade of an office building built early in the last century and renovated in the 1980's, owned by INPS (National Institute of Social Insurance) and located in the city center of the Genoa neighborhood of Sestri Ponente, an area characterized by a relatively high population density. INPS Green Facade is a pilot project coordinated by the University of Genoa (DAD) which aims to quantify the positive effects of the green envelopes in densely built urban environment. Monitoring activities are focused on the evaluation of the environmental benefits, both economic and social, in particular in densely urbanised areas, with special attention to the Mediterranean area.
<ul> <li>Vertical Forest is a model for a sustainable residential building, a project for n reforestation contributing to the regeneration of the environment and urban biodiversity implication of expanding the city upon the territory. It is a model of vertical densification within the city that operates in relation to policies for reforestation and naturalization of and metropolitan borders. The first example of the Vertical Forest consisting of two towers of 110 and 76 m height was realized in the Centre of Milan, on the edge of the façade). The creation of a number of Vertical Forests in the city can set up a environmental corridors which will give life to the main parks in the city, bringing togethe space of avenues and gardens and interweaving various spaces of spontaneous growth.</li> </ul>	
Flood retention basins of Lura river – Milan	Milan's metropolitan region is affected by severe flooding during heavy rain events because of the high sealing rate of urban areas and increasing effects of climate change. Among several measures planned by the regional government there is a wide retention area that has been planned as flood control device, which also creates high quality natural areas and reconnects slow-mobility routes and recreational spaces inside the Lura Valley park. The project consists of the implementation of two rolling basins connected by an open air ditch and a pond filled with ground water. The basins will be temporarely flooded by Lura river during intense rainy periods through natural inlet from the river bed, whilst the pond will recharge constantly the ditch to maintain wetland vegetation all over the year to guarantee its phytodepuration functions. The balance of ground movements within the project is null as the volumes excavated are reused to create mounds and dikes. Wide areas of the river banks and plains have been upgraded through afforestation with native species.

Table 3: Description of pioneer cases

## 2.2 Partner cities

The verification from pioneer experiences has been complemented with the experience from the partner cities of the project: Çankaya, in Turkey, Milan, in Italy, Alcala de Henares in Spain and Szeged in Hungary. Those cities are located in 4 different countries and 3 different climate zones.

# **HATURE 4** CITIES



The cities are from different sizes, Çankaya and Milan are over 1 million of habitants. Çankaya is the central population district of Ankara, capital city of Turkey and 2nd most dynamic cities. Milan is also one of main cities in Europe for its economic activity. Alcala de Henares and Szeged are approximately the same size (around 200.000 habitants). While Szeged is a major city in Hungary, Alcala is very connected to the capital of Spain Madrid and is part of the suburb of Madrid.

#### 2.2.1 The Metropolitan City of Milan (CMM)

The Metropolitan city of Milan is a public administrative authority between the level of the Region and that of the Municipalities. It replaced the Province of Milan in 2015 and includes the city of Milan and other 133 municipalities.

CMM has chosen the topic "quarry" as case study for N4C. CMM has concrete competences in this topic and in the near future is going to start the participation process to design a new quarry plan for the next 10 years. The "Quarries Plan" is a territorial planning tool. It will govern the major transformations in urban and suburban areas also through re-naturalization processes. The Quarry Plan defines the location of quarries, the extraction volumes, the environmental recovery mode and the final fruition of the area. All stakeholders (municipalities, quarry enterprises) are already involved and signed an agreement with CMM. The type of Nature-Based Solutions to be implemented are as follow:

- morphological arrangement of the slopes of embankments produced by the extractive area for the future public use
- laying turf
- vegetation reconstruction of marsh and riparian environment
- vegetation reconstruction of woods (forest), hedges and rows
- reconstruction of agricultural areas
- realization of foot and cycle paths for the fruition of citizens

The cost of the approved environment recovery project is 352.666,08 euros (not counting the interventions already implemented).

#### 2.2.2 Szeged (SZEG)

Szeged has to develop an integral approach for future planning in order to avoid urban heat island, floods, biodiversity loss and acoustics issues. Szeged has a history of struggles with water flooding from the Tisza River which divides Szeged in two. There are major floods every few years and sometimes they even threaten the city itself. During the great flood in 1879, most of Szeged was destroyed but afterwards a new modern city was rebuild-taking the structure of Paris with its broad avenues and open spaces as an example. The EU is the main source of funding for Szeged's urban development and restructuring (for the period 2007-2013, Szeged was the most successful in Hungary in getting funding from the EU).

In 2006, the flooding signalled the starting point to build a mobile diking system (which can be built up in only 24 hours). An improved diking system has in fact been a precondition from the side of the





EU to be eligible for further funding. The Tisza River itself has been covered to a large extent and the river is dredged regularly as well to prevent flooding. The riverbanks also serve cultural functions, as several events are held there, e.g. the parade, the dance festival, the paprika festival.

Next to flooding, there also is an issue with draught. Contrary to what some believe, the low groundwater levels are not a direct consequence of the covering of the Tisza with concrete. The water level started to drop in the seventies. Because the higher levels of groundwater were contaminated (industrial pollution and sewerage system), the water was pumped from deeper, creating some sort of tube, and then the top level sunk down into that. Now the city works to restore it to the proper conditions. Additional caused need to be viewed at a larger scale, from a more ecosystemic level.

Nowadays the Tisza River bank is an example of a non-NBS solution par excellence: many concrete and high dikes are to protect the city from flooding. These concrete spaces alternate with green parts on the other side of the river. Many people visit the riverbanks regularly to do sports, meet others, walk their dog, swim, visit cultural events etc.

The rehabilitation and re-naturing of the Tisza bank in Szeged is a developed concept that has been integrated in the municipalities' urban development plans. The re-naturing of the Tisza bank is an urban challenge of big importance as this action could ensure the connection between the river and the city. The reconstruction of the downtown section of the river has already started and it is still one of the strategic objectives of Szeged for the 2014-2020 period. Complex flood risk management is required.

#### 2.2.3 Çankaya (CAN)

Çankaya (Ankara) is already taking steps towards NBS to tackle some of the major issues being faced by the city. It is already implementing NBS actions as one of their fundamental visions is to create and use environment friendly systems to inherit a good future to the next generations. However, these actions lack a holistic and systematic framework and assessment methodology.

#### 2.2.4 Alcalá de Henares (AH)

Alcalá de Henares faces serious heat island issues in the city center which impacts not only in inhabitant's comfort and wellbeing but also in the touristic economic potential of the area. The AH pilot case is driven through a so-called edible forest (forest garden) creation, with the aim of increasing biodiversity in the Isla del Colegio park on one hand, and offering a multifunctionality space on the other. This approach ensures not only recreational activities and the performance of a buffering role against the pressure on the gallery forest, but also the recovery of the protected banks of the river Henares. The alinement of the project with the objectives of N4C, is the foundation of a collaborative action between citizens and the municipality.

An edible forest is an orchard carefully designed to obtain food while retaining the benefits of a natural system. The food obtained is not only for humans, but also for those animals that find shelter in this forest, which at the same time are fed and participate in the seeds dissemination or pollination of the forest itself. In addition, the symbiosis between roots and microbial life will be considered in its design, taking into account also the municipal mycological interest.





After the successful cultivation of all the space provided by the City Council for the implementation of urban vegetable gardens, and once they are settled and functioning, the City Council plans to expand the project for the recovery of the Island of the School. This latter has been very degraded by the action of humans, mainly by the intensive agriculture, that has reduced the extension of the gallery forest associated to the river Henares practically until its disappearance. The next planned phase consists in reinterpreting the recovery of this agricultural island with NBS.





## 3 Identified barriers (Process Inhibitors)

The following sections describe the identified barriers in the literature regarding knowledge, governance and economics domains (see *Table 4*, *Table 5* and *Table 6*). A code is assigned to each barrier and the literature sources are mentioned ("Main" for the primary sources regarding the

barriers and "Sec" for more specific sources). A simplified list of barriers can be found in **Annex** 

## **III: List of barriers**

## 3.1 Knowledge barriers

Some of the most important processes of social-ecological change like NBS "are embedded in very complex systems of which our understanding is still incomplete and in part clouded by profound uncertainties" [10]. They need interdisciplinary work across scientific domains (e.g. between ecological sciences and engineering or ecological and social sciences) and are likely to increase the demands for input and flexibility from different disciplines [2].

Three main barriers have been identified: uncertainty, accessibility to information and technical inadequacy. As it can be seen in *Table 4*, the novelty of the approach makes evident a need for further research and knowledge and evidence generation.

DOMAIN	CATEGORY		DESCRIPTION	Literature source			
		CATEGORY SUBCATEGORY		Main	Sec	CODE	
			Operational unknown	Due to the newness of the approach there is a lack of protocols for design, implementation and maintenance for NBS projects.			BK1
Knowledge	Uncertainty	Performance unknown	Lack of evidence regarding the quantitative benefits of NBS, especially from policy makers and citizens' perspective. Research focused on the design and early-stage implementation which does not monitor the long-term impacts of human-environment relationships would make difficult to understand issues or unexpected benefits during the service life of the solutions. Designers may encounter difficulties in implementing NBS solutions when compared to traditional solutions. This might reduce the confidence of the client in NBS performance compared to traditional solutions; since the designers are more familiar with them from a	[5]	[11] [12] [13]	BK2	





			technical point of view and with respect to legal compliance. There are some unknowns regarding plant materials production processes, especially in short-life projects.		
	Accessibility	Information overload	Municipalities are already overloaded with knowledge improving papers and platforms that end up making new concepts and approaches as NBS more difficult to reach.		ВКЗ
	to information	Incomprehensibl e or unusable presentation of results	Presentation of scientific results in formats that are incomprehensible or not accessible to urban planners (such as publication in non- open-access journals) hinders the knowledge transfer between science, policy and planning.	[14]	BK4
	Technical inadequacy	Lack of ready-to- apply scientific results, concepts and technologies	The lack of ready-to-use technologies and ready-to-apply scientific results and concepts makes the adoption of NBS more difficult even if a certain policy receptiveness exists. A simple and overarching theoretical framework to facilitate the application and communication of NBS is lacking. People in charge of design, implementation regulation and permit granting of NBS, such as engineers, contractors and regulators would need specialized training. Lack of national standards and codes for the design phase	[14] [15] [16] [17]	BK5

Table 4: Identified knowledge barriers

## 3.2 Governance barriers

Social engagement of citizens and local stakeholders is vital to the successful transformation of cities. Lack of information at the level of both decision makers and practitioners may hinder the implementation of NBS. Information asymmetry as in the landlord/tenant problem also affects spread and adoption of NBS. A large number of measures may require the coordination of different actors from different sectors/functions, resulting in a divergence of interests.

Integrated solutions, such as NBS, require covering urban planning, buildings licensing, infrastructures, water and waste management. However, these domains are often classified under different departments, all having their own targets and budgetary constraints. In addition, politicians tend to think and act on the short term, whilst transformation towards a sustainable city may take





decades. Moreover, actions against climate change do not result in direct benefits for the implementer, therefore the mitigation of climate change by NBS are not taken into account.

As it can be seen in Table 3, the literature shows four main barriers in the governance domain: the disconnection between short-term actions and long term goals, institutional barriers, complexity of governance structure, participation and awareness.

DOMAI	CATEGORY	SUBCATEGORY	DESCRIPTION	Literature		CODE			
N	OATEGORI	CODUATEOONT	DEGORITHON	Main	Sec	CODE			
Governance	Disconnection	Short-term action and decision- making cycles	The usual short-term action and decision-making cycles within municipalities not always match with the long-term requirements of the whole life cycle of NBS projects (planning, implementation, maintenance processes, but also sustainable financing)	[5]			BG1		
	between short-term actions and long term goals	Establishment of long term responsibilities	Responsibilities for the maintenance of the project could remain unspecified at the design stage so that actors who will be implied in the maintenance are not implied in the decision and design. This can lead to difficulties in maintenance of NBS not previously foreseen.			BG2			
				Gentri	Gentrification	The willingness of improve life and urban quality with NBS projects in a short term could lead to risk of gentrification in a long term.			BG3
		Institutional barriers	Lack of coordination between city departments	A lack of coordination between traditional structures of city departments makes knowledge to be trapped in " <i>sectorial silos</i> " which could hamper the implementation of NBS, which usually requires transdisciplinary coordination	[5] [6]	[15] [17] [18]	BG4		
		Lack of flexibility of decision making structures	The decision making structure of municipalities where the different departments have clearly defined responsibilities could not be suitable for			BG5			





		multilevel, multiscale and multi-thematic projects as NBS.			
	Bureaucracy and unsupportive legal frameworks	Lack of knowledge due to the novelty of NBS as concept. Excessive legal rigidity, bureaucracy and lack of specific regulation (e.g. difficult agreements in multi-property dwellings).		[14]	BG6
	Goal misalignment	Different goals of stakeholders within partnership arrangements could hinder collaboration.			BG7
Complexity of governance	Apathy	A high number of stakeholders could generate inertia and apathy.			BG8
structure	Role ambiguityA high number of involved stakeholders can cancel out some process enablers related with collaboration through unclear stakeholder relationships and lack of clarity in responsibilities within the arrangements.[6]		[6]		BG9
Participation and	Perception	PerceptionThe perception of the society of nature as source of problems and nuisances and the fear due to uncertainty can hinder the participation of the citizens in 			BG10
awaitiitss	Lack of participation	Top down processes with no real citizen participation makes the NBS more difficult to accept by the citizens.			BG11

Table 5: Identified governance barriers
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## 3.3 Economy barriers

Market conditions in many cases do not favour the best solution from an environmental point of view. Often the perception of cost-effectiveness works against the NBS. Several reasons can affect the cost-effectiveness perception of measures to be implemented: technology maturity (subsidies to support technology maturing periods have shown lack of success), market uptake (some new products may be economically competitive only if sold with significant scale).





In this regard, the literature shows four main economic barriers: perception of the benefits, budget constraints and risk perception (see Table 4).

				Lite	0005	
DOMAIN	CATEGORY	SUBCATEGORY	DESCRIPTION	sc Main	Sec	CODE
Economy	Perception of the benefits	Under appreciation of non-economic benefits	Benefits of NBS are perceived as mostly public and 'soft' and not directly related with economic growth-oriented issues as creating jobs and attracting investments. Economic resources remain for the development of solutions the economic impact of which is not directly targeted such as NBS.	Main		BE1
		Short term vision	Lack of insight that investment now will prevent costs later. Economic benefits are long term (lack life cycle costing analysis or holistic vision of cost and benefits). Investment to be made versus long term benefits not representing a strong motivation.	[5]		BE3
		Vandalism	Robbery or destructive actions, especially during early stages, could prevent the viability of NBS.			BE4
	Budget constraints	NBS not a priority	City budgets for green development and the maintenance of green spaces often face severe budget constraints, while staff and related expertise is decreasing.		[14] [19] [20] [21]	BE5
		Lack of funding knowledge	Financing mechanisms (such as EU- funding instruments) are available for cities, but they are complicated to apply for (requiring additional			BE6





		administrative staff and time resources) and, more importantly, require cofinancing, which many cities cannot afford.		
Risk perception		Lack of incentives and motivation to attract private investment		BE7

Table 6: Identified economic barriers

## **3.4** Verification with surveys, case studies and pioneer experiences

The barriers identified in the literature review have been complemented with the surveys of T8.1, case studies from partner cities and pioneer experiences investigated under task 1.3.

	Interviews <sup>9</sup> Partner cities					Pioneering Experiences								
CODE	Planners	Mun.	CM Milano	Szeged	Çankaya	Alcala	Spain	France	Austria	Germany	Switzerland	Italy	Turkey	Hungary
BK1														
BK2														
BK3														
BK4														
BK5														
BG1														
BG2														
BG3														
BG4														
BG5														
BG6														
BG7														
BG8														
BG9														
BG10														
BG11														
BE1														

<sup>&</sup>lt;sup>9</sup> Interviews and surveys carried out in T8.1. to urban planners (Planners) and municipality workers (Mun.)




BE2							
BE3							
BE4							
BE5							
BE6							
BE7							

Table 7: Verification of barriers (in green verified drivers, in red barriers that are verified that do not apply)

As it can be seen in Table 7 the verification of the barriers with real cases is quite uneven. Interviews, surveys and the cities of CMM and SZEG showed a medium-high level of recognition of the proposed barriers, in German speaking countries instead the level is very low. The key parameter seems to be the previous experience in NBS projects. When this experience is not predominant (as in the interviews and surveys <sup>10</sup>) the barriers are more recognised. The Knowledge and economic barriers are the ones that are most recognized although only one of the identified barriers is recognized in almost all the cases (BK1: Operational unknown).

<sup>&</sup>lt;sup>10</sup> See D8.1 ("Requirements of the Nature4Cities solution")





## 4 Drivers of NBS implementation (Process Enablers)

The following sections describe the identified drivers in the literature regarding knowledge, governance and economics domains. A code is assigned to each driver and the literature sources are mentioned ("Main" for the primary sources regarding the barriers and "Sec" for more specified

sources). A simplified list of drivers can be found in **Annex IV: List of drivers** 

## **4.1** Knowledge drivers

One of the clear drivers is valorising and exploiting the existing expert knowledge of all the stakeholders about NBS in cities and generating the knowledge that is still missing. This requires a transdisciplinary research approach that links practitioners, policy-makers and scientists from different disciplines, and which engages with citizens and other users and producers of knowledge. [2]

As it can be seen in Table 6, the literature shows four main drivers: generation of evidence, collaboration, information accessibility and awareness.

	CATEGODY	SUBCATEGODY		Litera	ture	CODE
	CATEGORT	SUBCATEGORT	DESCRIPTION	Main	Sec	CODE
	Generation of evidence	Lesson learnt through implemented projects	Successfully implemented projects generate useful evidence regarding the benefits that can be used by other projects. Lessons learned from less successful projects are proved to be instrumental for an effective integration of NBS in urban planning.			DK1
		Research on benefits	Generation of quantified information and knowledge regarding benefits (direct and indirect)	[5]		DK2
		Research on cost effectiveness	Research on cost effectiveness of implementing NBS might help to justify new investments and to promote long-term funding or public-private arrangements.	[8] [22] [23]		DK3
Knowledge	Collaboration	Networks	Demonstration projects on NBS create collaborative networks and communities of practice that cross institutional boundaries and can function as drivers for legitimizing new planning practices and approaches. When new stakeholders engage with networks that have already acquired experiences, new knowledge can be integrated and put in practice		[24] [25]	DK4





	Co-creation	Solutions to be developed could be based in collaboration between designers, citizens and companies in the early stages in order to find out the most balanced solution between feasible technical solution and analysis of budget implications		DK5
Information accessibility and sharing	Knowledge platforms	Knowledge platforms focused on cities, accessible and open, can be used for knowledge gathering, aggregation and cocreation. Develop online NBS impact calculation tools.	[8] [26] [27] [28] [29] [30]	DK6
	NBS ambassadors	NBS ambassadors can promote NBS by making NBS benefits and risks communicable to citizens and politicians. Strategically selected NBS could work as flagship projects to city servants, local entrepreneurs, investors, and other actors increasing awareness about the benefits of NBS.		DK7
Awareness	Climate Change	Climate change is perceived as a new criterion for decision making. It can be a driver for changing the whole vision of urban planning, raising awareness, fostering new projects and visions as NBS and changing priorities.		DK8
	Ecological memory	Processes that enrich and regenerate 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.	[31]	DK9

Table 8: Identification of knowledge drivers

## 4.2 Governance drivers

The literature shows that the establishment and utilization of collaborative governance approaches (in which the government collaborate with citizens, businesses, and civil society) can connect demands for action with responsible actors or partnerships for action and jointly ensure good governance practices adhering to transparency, legitimacy, and openness [2].

As it can be seen in Table 7, four main drivers are identified in the governance domain: the improvement of process efficiencies, self- governance, co-creation and participation.

Nature4Cities – D1.2 – NBS Implementation Models Typology 39/178





	CATEGORY	SUBCATEGORY	DESCRIPTION	Litera	ture	
	CATEGORI	JODCATEGORT	DESCRIPTION	Main	Sec	CODE
		<b>Collaboration</b> The combination of the different strengths coming from different sectorial affiliations of a diverse stakeholders' partnerships lead to improved efficiencies				DG1
Governance	Process efficiencies	Coordination role		[34]	DG2	
		Action-thinking approach Action-thinking approach (ad hoc or problem-based governance) could help to focus on a better use of existing finance instruments and to coordinate biodiversity and climate change efforts in implementing strategies on NBS.	[5] [6] [8] [32] [33]		DG3	
		Capacity building	Capacity building can balance the uncertainty that comes from the newness of the NBS approach.			DG4
		Emerging partnerships	Innovative NBS projects can learn modes of self-governance from emerging partnerships between civil societies in cities		[35]	DG5
	Self- governance	Grassroots innovations and transition initiatives	Grassroots innovations and transition initiatives as collaborative networks of citizens play a significant role in advocating and practicing NBS in cities as re-establishing green urban commons providing on-the- ground evidence of the multiple benefits of NBS.		[36] [37]	DG6





Co-creation	Reflexive/adaptive governance	As adaptive management is an approach thought to include flexible ways to maximize learning opportunities and the experimentation and careful monitoring is in the core of the concept it is especially suited to overcome barriers related with uncertainty, complexity and system dynamics. Multiple actors possessing different types and degrees of knowledge could engage in a reflective way to update their planning, governance, knowledge production practice over time to continuously address arising risks and uncertainties. More reflexive approaches to urban and environmental governance bring together other drivers as networks and NBS ambassadors. The adaptive approach allows the process of self- learning regarding how to implement NBS (reflecting on failures and contradictions in planning and implementation processes).	[5] [7] [33] [38]	DG7
and participation	Involvement of urban government	The involvement of local governments is crucial for opening space for innovative approaches and solutions like NBS through a rapid transfer from concepts to action. A urban government can facilitate collaborative arrangements without losing its government role. Its new dual role (steering and orienting when partnerships exhibit capacity for delivering and regulating and directing when strategic planning is required)	[19] [39] [40] [33]	DG8
	Cross sectorial spaces and partnerships	Enabling cross-sectorial partnerships for NBS design implementation and maintenance. Creating different institutional spaces for cross-sectorial dialogue and interactions of different stakeholders for strengthening/fostering adaptive co-management and knowledge sharing about urban ecosystems.	[15] [23] [41] [42] [43] [44] [45]	DG9
	Co-production	Design knowledge co-production processes to bring openness, transparency in governance processes, and legitimacy of knowledge from	[41] [45] [46]	DG1 0





		citizens/civil society, practitioners and policy stakeholders		
	Tools to build a common vision	Stakeholders from different natures and backgrounds (politicians of different persuasion, planners in various tiers of government, fragmented local communities, small or large developers and local, remote, or online financiers) are unlikely to share a common vision. Tools to formulate common goals could include local surveys, Delphi approaches, focus groups or other negotiated solutions to untamed political problems. One way to reach the goal might be to include NBS in local planning and zoning regulations. Regulatory approaches to flood and erosion impacts, for example, generally fall in to one of three categories: zoning codes, building codes, and storm water management ordinances.	[47]	DG1 1

Table 9: Identification of governance drivers

## 4.3 Economy drivers

The literature review shows that there main economic drivers are: de-risking, government support, creation of conditions for new business models and finance schemes, cooperative competition, mid-long term financing, real estate and self-financing and self-management strategies.

	PROCESS ENABLERS										
	CATEGORY SUBCATEGORY DESCRIPTION										
Ŋ		Sharing risks		[48]	DE1						
Econorr	De-risking	Public de-risking strategies	Due to the newness of the concept NBS is now in a beginning phase in the field of urban regeneration. This phase requires a great government support, due to methodologies and ways are not yet completely defined. De-risking signals to increase credibility, well-designed	[5] [6]		DE2					





		projects and structured community engagement for planning robustness		
	Provisioning of incentives to attract private investment	The provisioning of incentives and/ or the removal of administrative barriers allows the creation of partnerships between government and businesses where citizen associations can participate also. The		DE3
Government support	Removal of administrative barriers	generated in those partnerships can create new opportunities for an efficient uptake of NBS. Encourage methods to transfer the benefits of common goods provided by NBS to the initiators of NBS (e.g. tax reductions or subsidies). Public subsidies and tax cuts can stimulate private investments and make NBS more attractive	[33]	DE4
	Public-private partnerships	The inclusion of companies and private sector in the implementation and management of NBS projects can help to overcome budget constraints and limitation of resources.	[49]	DE5
Create condit business mod schemes	ions for new els and finance	Divesting from dominant solutions (e.g., investments in optimizing efficiency of grey infrastructure) as the one and only focus, can leverage private and public funding in strengthening NBS and can create conditions for new business and finance models (e.g. production of the plants that used for NBS in order to use natural vegetation can create new business opportunities)		DE6
Cooperative c	ompetition	A fair competition between private stakeholders, specially between companies, that does not hinder the collaboration, makes some processes more efficient and successful.		DE7
Mid-Long term	ı financing	Allocation of a sufficient budget for implementing and maintaining NBS projects can give sustainability in tight financial periods. Widely using natural vegetation helps to decrease the costs associated with vegetation care.	[17] [21]	DE8





Real estate	Increased commercial and domestic property prices and attraction of businesses	[50] [51] [52]	DE9
Self-financing and self- management	Self-financing and self-management projects can be sustainable and resilient and are less dependent of external changes.		DE1 0

Table 10: Identification of economic drivers

## 4.4 Verification with surveys, case studies and pioneer experiences

The drivers identified in the literature survey have been checked with the surveys of T8.1, case studies from partner cities and pioneer experiences investigated under task 1.3.

	Inter	views	Case studies				Pioneering Experiences							
CODE	Planners	Mun.	CM Milano	Szeged	Çankaya	Alcala	Spain	France	Austria	Germany	Switzerland	Italy	Turkey	Hungary
DK1														
DK2														
DK3														
DK4														
DK5														
DK6														
DK7														
DK8														
DK9														
DG1														
DG2														
DG3														
DG4														
DG5					x									

<sup>&</sup>lt;sup>11</sup> Interviews and surveys carried out in T8.1. to urban planners (Planners) and municipality workers (Mun.)





DG6							
DG7							
DG8							
DG9							
DG10							
DG11							
DE1							
DE2							
DE3							
DE4							
DE5							
DE6							
DE7							
DE8							
DE9							
DE10							

Table 11: Verification of drivers (in green verified barriers, in red drivers that are verified that do not apply)

As it has been seen previously with the barriers, here also the key parameter is the degree of experience in NBS projects. The contexts with more experience in NBS (such as Çankaya and German speaking countries) are more inclined to see the possible drivers comparing with cases less experienced (as the urban planners and municipalities interviewed). Similarly, to the barriers, the knowledge domain is the one more highlighted.

## 4.5 Connection between drivers and barriers

In the following table and figure the links between drivers and barrier are listed (see *Table 12*) and graphically displayed (see *Figure 2*).

DOMAIN	CATEGORY	CODE	SUBCATEGORY	ASSOCIATED DRIVERS
	Uncertainty	BK1	Operational unknown	DK1, DK4, DK7, DG7
Knowledge		BK2	Performance unknown	DK1, DK2, DK3, DE1, DE2, DG7
-		BK3	Information overload	DK6, DK7





	Accessibility to information BK4 Incomprehensible or of re		Incomprehensible or unusable presentation of results	DG4, DG9, DK6, DK7
	Technical inadequacy	BK5	Lack of ready-to-apply scientific results, concepts and technologies	DK3, DK7, DG9, DG10
	Disconnection	BG1	Short-term action and decision-making cycles within city administrations	DK8, DG1, DG2, DG7, DG9, DG11
	term actions and long term goals	BG2	Establishment of long term responsibilities	DG1, DG2
		BG3	Gentrification	DK5, DG2, DG5, DG6, DG7, DG10
		BG4	Lack of coordination between traditional structures of city departments	DG2, DG7 <b>,</b> DG9
Governance	Institutional barriers	BG5	Lack of flexibility of decision making structures	DG2, DG7, DE10
		BG6	Bureaucracy and unsupportive legal frameworks	DG7, DE4, DE10
	Complexity of governance structure	BG7	Goal misalignment	DG2, DG1, DG3
		BG8	Apathy	DK5, DG1, DG5, DG9, DE10
		BG9	Role ambiguity	DG2, DG9
	Participation and awareness	BG10	Perception	DK5, DG6, DG10
		BG11	Lack of participation	DG6, DG10
	Perception of	BE1	Under appreciation of non-economic benefits	DK1, DEK2, DK3, DG9, DG10, DE9, DE10
		BE2	Uncertain economic feasibility	DK3, DE1, DE2, DE3, DE6, DE8, DE9, DE10
		BE3	Short term vision	DK8, DG11, DE8
Economy		BE4	Vandalism	DK5, DG6, DE10
	Budget	BE5	NBS not a priority	DEK2, DK7, DK8, DG8, DG11, DE10
	constraints	BE6	Lack of funding knowledge	DK6, DG1, DG4
	Risk perception	BE7		DK3, DE1, DE2, DE5, DE7

Table 12:Link between barriers and drivers





			DIZA	DK	4	Looson looret through projects	
	Uncertainty	Operational unknown	BK1		() ()		- Compation of ordered
	2	Performance unknown	BK2		2		Generation of evidence
Mac	Accesibility to	Information overload	BK3		.э И	Networks	
<sup>o</sup> g	information	Incomprehensible presentation of results	BK4		35	Co-creation	Collaboration
	Technical		DIVE	DK	6	Knowledge platforms	Information accessibility
	inadequacy	Lack of ready-to-apply scientific results	BKS	DK7	7	NBS ambassadors	
	Disconnection	Short-term decision-making cycles	BG1	DK	.8	Climate Change	Awareness
	between short-term	Long term responsibilities	BG2	DKS	.9	Ecological memory	
	term goals	Gentrification	BG3	DG1	i1	Collaboration	
		Gentification	003	DG2	2	Coordination	
		Lack of coordination	BG4	DG	3	Action- thinking approach	<ul> <li>Process efficiencies</li> </ul>
000	Institutional barriers	Lack of flexibility of decision making	BG5	DG4	64	Capacity building	-
100		Unsupportive legal frameworks	BG6	DG	5	Emerging partnerships	Salf governance
		Cool mission ment	DO7	DGe	6	Grassroots and transition initiatives	Sell governance
Ċ	Complexity of	Goal misalignment	BG/	. DG7	67	Reflexive/adaptive governance	
	governance	Apathy	BG8	DGE	8	Involvement of urban government	
	structure	Role ambiguity	BG9	DG	9	Cross sectorial spaces and partnerships	Co-creation and participation
	Dentisianation and	Perception	BG10	DG1	10	Co-production	_
	Participation and awareness			DG1	11	Tools to build a common vision	
7	uwareness	Lack of participation	BG11	DE1	1	Sharing risks	De sieking
		Appreciation of non-economic benefits	BE1	DE2	2	Public de-risking strategies	De-risking
	Perception of the	Perception of the Uncertain economic feasibility BE2	DE3	3	Provisioning of incentives to private investment	Government support	
	benefits	Short term vision	BE3	DE4	4	Removal of administrative barriers	
8				DES	5	Public-private partners	hips
Ş		Vandalism	BE4	DEG	6	Conditions for new business models an	nd finance schemes
ŭ	í Rudgat sanstrainte	NBS not a priority	BE5	DE7	7	Cooperative competiti	on
	Budget constraints	Lack of funding knowledge	BE6	DEE	8	Mid-Long term financi	ng
	Risk perception		BE7	DES	.9	Real estate	
	i don perception		DEI	DE1	10	Self-financing and self-mana	agement

Figure 5: Connection between barriers and drivers





Some conclusion can be highlighted:

- As it can be seen, the links between barriers and drivers are often cross-domain. The degree of this transversality varies from domain to domain: governance barriers and drivers are very related but economy and knowledge domains are more interrelated.
- There is a clear 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.
- Governance barriers are mainly addressed by governance drivers. The exception are knowledge and economic derivatives of open governance as co-creation strategies and self-financing.
- Some governance drivers, such as "coordination" (DG2), "co-production" (DG10), "cross sectorial spaces and partnerships" (DG9) and "reflexive/adaptive governance" (DG7) are drivers that address significant number of cross-domain barriers. These drivers are features of open governance models that will be explained later in Chapter 5.

# **HATURE 4** CITIES



## **5** Governance Implementation Models

A 'nature-based' perspective has to adopt a 'society-based' perspective also in order to incorporate the notion that human beings have shaped the landscape [53]. Ernstson et al. develop a summary of the challenges that governance and management of urban ecosystem face currently [54]:

- Urban landscapes are characterized by "heterogeneity, highly contested land use, rapid social changes, limited capacity for ecological renewal, and a high concentration of administrative units."
- Literature in urban ecology has been mainly focused on exploring how the heterogeneity of land-use patterns affect ecosystem function neglecting actual management
- Few studies have focused on groups of humans that intentionally interact with urban ecosystems and how such actors could be organized in governance in order to maintain ecosystem services in larger urban landscapes.

Governance models based on traditional simplified strategies as imposed markets or one-level, centralized "*command and control*" strategies deployed in order to optimise the processes and eliminate redundancies have been tried and have failed addressing complex problems [55]. Sometimes, complexity, redundancy, uncertainty, multi-layered arrangements and decentralisation are technical and social requirements in order to address multifaceted projects like the implementation of NBS (especially when medium-big scales are addressed).

The involvement of different groups can bring three types of benefits to the process of planning and delivering improvements in environmental management [56]:

- **Substantive benefits**, as stakeholders' different and complementary perspectives, conditions and knowledge can improve planning
- **Instrumental benefits**, as the process becomes better understood and therefore more accepted and better supported by stakeholders
- Normative benefits, as a deeper stakeholder involvement increases the legitimacy of the process

These benefits can be included in the process of designing NBS, but require stakeholders to be involved and empowered through the whole process in a proper way. Critical decisions about NBS projects (design, costs, location, scale or levels of management intensity) involve a wide range of stakeholders who surely have different ideas and backgrounds. Therefore the involvement of the diversity of actors in the decision making processes regarding the role, scope and appropriateness of NBS interventions will require governance models that can enable NBS with an inclusive, long-term and balanced approach [2].

Innovative models of urban and environmental governance and new approaches to traditional ones have to be mapped and characterised in order to facilitate the implementation of NBS and the engagement of different stakeholders.

Governance could be an ambiguous concept and there is not an agreed and clearly defined governance theory [57]. In this deliverable we will use the term "governance" to refer to collective





action arrangements designed to achieve the implementation of NBS projects, and government to refer to the formal organisations of the "public sector" as in [58].

When generating governance arrangements, environmental concerns are not usually the most important issues comparing with others as economies of scale, division of skills across organizations, costs of coordination, culture and political identity issues [59]. Commonly, NBS projects require types of governance that are at the intersection between **urban governance** and **environmental governance**. The concept of urban governance is complex and has numerous definitions in the literature. Moretto describes the two-fold nature of urban governance: the "formal, institutional, theoretical, and normative aspect, broadly analysed and debated by the international community, and unfailingly included in donors' development agendas" and the "more informal, local, community-based characteristic, which describes how governance works in practice, beyond top–down and external development policies and strategies" [60]. Environmental governance can be defined as the "system of institutions, including rules, laws, regulations, policies, and social norms, and organizations involved in governing environmental resource use and/or protection" [61]. A literature review regarding environmental governance can be found in the work of Lemos and Agrawal [62]

# **5.1** Clustering and characterizing Urban NBS Governance Structures

The different urban and environmental governance models that can be found in literature cannot be packed in clearly delimited boxes. Urban and environmental governance is a map of spectrums where the different models coexist in different degrees regarding some key axes. As Hall pointed out talking about the development of a typology of governance for tourism policy analysis [63] "the development of an appropriate typology of governance is therefore not (the compilation of) all possible dimensions noted in the policy and planning literature that characterise decision-making processes, outputs and outcomes. Instead, the criterion for the frameworks of governance should be systematically based on defining what dimensions are included and which are left out". Following this advice, the following section will describe the dimensions that have been taken into account in order to define our typology of governance in the next section.

## 5.1.1 Innovation and levels of governance

The implementation of successful and complex NBS projects requires of a great deal of innovation and the mobilisation of energies and resources available in the different sectors of the society. Healey analysed the relationship between innovation and the forms and practices of governance at urban context [58]. She developed an analytical scheme with a three-level approach to the interacting dimensions of urban governance that links episodes, processes and cultures of governance.

The objective of this analytical framework is to evaluate actual governance situations and identify the dynamics that should be present in any governance mode that aims to facilitate innovative and transformative processes. This scheme explores the particular "balance" in any new governance initiative between "constraining and enabling forces" and the potential for the innovations in specific episodes "to spread to the wider governance context" (see Table 13).





	LEV	/ELS OF GOVERNANCE	DIMENSIONS	QUALITIES OF CREATIVE MODES OF URBAN GOVERNANCE
		Highly visible and experienced directly in the	Actors – roles, strategies and interests	Diverse actors
1	Specific governance		<b>Arenas</b> – institutional sites	Open, accessible and safe arenas
	episodes	timescale of daily encounter and action.	Settings and interactive practices – communicative repertoires	Ambiences are welcoming, respectful, knowledgeable and stimulating; with generative and insurgent potential
		Where strategic projects for governance	Networks and coalitions	Networks and coalitions are diverse and mutually aware, loosely-coupled and flexible
2	Governance processes that set rules of the game	purposes are created and managed. Explicit struggles occur over access to the power to frame formal rules and resource flows, and over the ideologies and policy principles	Stakeholder selection processes	Stakeholder selection processes are open, transparent, safe and flexible
		which inform this framing work. Constrained not only by the particular capacities and interests of the actors involved (level 1), but also by more deeply embedded cultural assumptions (level 2). Could be a significant obstacle to the spread of social learning from specific episodes and to the development of a response to the pressures for greater relevance and legitimacy arising from changes at the socio- cultural level.	Discourses – framing issues, problems, solutions, etc.	Open-minded, inclusive, informative and inventive discourses
			<b>Practices</b> – routines and repertoires for acting	Facilitative and experimental practices, supporting self- regulating processes
			Specification of laws, formal competences and resource fl ow principles	Laws, formal competences and resource flow principles value local initiative and encourage experimentation
3	Governance cultures	Cultural assumptions (governance culture) provide the implicit norms and values, which legitimate (or not) what individual actors do	Range of accepted modes of governance	Diversity is valued; attention focused on real-world societal concerns; emphasis on performance not conformance





	and the way governance processes operate in any context	Range of embedded cultural values	Identity and open negotiation of values and ethics beyond utilitarianism and consumerism; open-minded tolerance and sensitivity encouraged
		Formal and informal structures for policing discourses and practices	Self-regulative and distributive; supportive and constraining

Table	13:	Levels	of	Governance	e [	581
i abio	10.	201010	01	001011101	-ι	001

This analytical approach can be used in any given urban arrangement for NBS implementation to identify the current level of governance, the dimensions to be analysed and the already existing qualities of creative modes of urban governance.

#### 5.1.2 Polycentric vs. monocentric governance

One of the most important current trends in environmental governance is the shift from centralized control to the incorporation of lower-level administrative units and social groups into more democratic decision making processes through co-management, community-based natural resource management, and environmental policy decentralizations [62].

Skelcher defines the polycentric systems as the systems where "political authority is dispersed to separately constituted bodies with overlapping jurisdictions that do not stand in hierarchical relationship to each other" [64]. The same authors suggest that governance never was completely monocentric. Huitema et al. highlight that "the "old fashioned" mutual exclusivity between jurisdictions operating at the same level and the rational hierarchical ordering of jurisdictions at different spatial levels has been abandoned" [65].

Polycentric systems have advantages and disadvantages [65][62] to be take into account in governance models for NBS implementation. Some of the advantages are as follows:

- They are resilient due to the redundancy: if a unit fails, others can adopt their functions.
- They could be more efficient due to the competition among units (competitive cooperation).
- They make decision making closer to those affected, promoting higher participation and accountability.
- They make easier and more probable learning processes within units and the incorporation of more precise time- and place-specific knowledge about natural resources and local problems.
- The large number of units enables the experimentation with new approaches.





• Issues with different geographical scopes can be managed at different scales.

As disadvantages it can be listed:

- When the basic units in the system are too small economies of scale may be lost
- Collective decision making could be difficult
- Redundancy may generate resilience but also unnecessary duplication of efforts
- When the responsibilities are very dispersed the democratic accountability can be more difficult.

#### 5.1.3 Initiating actor

One classical way to characterize the governance structures is according to the main actors promoting the governance structures. Traditionally governance has been carried out by public actors with government status. However, non-governmental or private actors can also be involved in governing public goods as green infrastructures [57]. This issue will be considered more in detail in task T5.2<sup>12</sup>.

The typology of actors that are considered in this deliverable are classified in three main sectors: government, community and market. The initiative will come from one of these sectors and this will be one of the key parameters that will determine the nature and rules of the arrangement. The following table shows the actors that are included in each sector (see Table 14):

SECTOR	ACTORS
	Regional / national government
Governments	Local government/municipality
	Semi-government organizations / institutions
	NGO's / CSO's / interest groups
Community	CBO's / neighborhood communities
	Citizens
	Research institutions
Market	Private sector
	Social enterprises / social entrepreneurs

Table 14: Sectors and included actors

<sup>&</sup>lt;sup>12</sup> Task 5.2: Citizens and stakeholder's engagement





#### 5.1.4 Levels of participation

Arnstein in 1969 described a ladder of participation writing about citizen's involvement in planning processes in the United States. The ladder has eight steps that range from non-participation to citizen power.



Figure 6: Ladder of participation [66]

The first two steps (*Manipulation* and *Therapy*) are not really participatory approaches. Their goal is to manage to achieve public support for already made decisions through public relations. The next step is what Arnstein called "Tokenism" and comprises *Informing, Consultation* and *Placation*. These steps are one level higher in the legitimation scale, although the power is still retained by the government (by means as one-direction information flow and ritualized and not decisive participation). In the last step, *Delegated power* and *Citizen Control*, public has the power to assure the accountability or even to plan and manage without intermediaries.

The intensity of participation can be also be classified according to the range of parties included in the decision making process, the intensity and direction of information flows and the level of influence in the decisions to be made [67].

#### 5.1.5 Ecological scales of governance

Environmental problems are spatially, socio-politically, and temporally multi-scalar, adding complexity to their governance [62]. According to Ernstson et al. one of the central challenges for sustaining ecosystem services lies in addressing scale mismatches between ecological processes on one hand, and social processes of governance on the other. In their work they try to explicitly combine analyses of social network structure with analyses of ecological scales [54].

Based on the results of several case studies in Stockholm the authors suggest three scales of ecological processes relevant to governance that joint the socio-political scales with the spatial scales. These scales are the following:





- Local scale green area where much of the current management takes place
- City scale green networks although less recognized in planning, link hierarchically between the other two scales
- Regional scale green infrastructure

The temporal multiscalarity of environmental problems could be a barrier for NBS implementation as seen in the previous chapters. In this regard, literature highlights two main barriers: contempocentrism (*"the tendency to disregard the welfare of future generations"*) and uncertainty *"regarding cause and effect relationships involving long-term environmental changes"* that could lead to *"do nothing until we know more"* attitude [62].

#### 5.1.6 Governance concepts and steering modes for clustering

Nature-based oriented urban planning and urban regeneration deal with a complex reality that requires the integration of multiple points of view. Both horizontal, which brings together different policies and sectorial departments, and vertical coordination, which brings together different levels of government, are critical for integrated planning. The governance framework and its capacity to tie different areas and levels of government, has been identified as a critical factor for the success of integrated interventions such as NBS [68].

Glavovic, mainly based on the work of Hartley, differentiates three broad conceptions of governance that theoretically have evolved sequentially but in practice co-exist, overlap and compete [69]. These conceptions are: "Traditional public administration", "New Public Management" and "Networked Governance".

	Traditional public administration	New Public Management	Networked governance
Context	Homogeneous and stable	Competitive, self-interested individuals	Diverse and in flux
Needs/problems	Complicated; defined by professionals	Wants expressed through markets	Complex, volatile and prone to risk
Modalities of governance	Hierarchies; public servants	Markets; purchasers and providers; clients and contractors	Networks and partnerships; civic leadership
Strategy	State- and producer-oriented	Market- and consumer- oriented	Shaped by civil society
Key concepts	Public goods	Public choice	Public value
Key goals	Maintain stability	Efficient service delivery	Resilient and sustainable socio- ecological system





Uncertainty	Reduce uncertainty, then take action	Discount future and rely on market forces to guide service provision	Embrace uncertainty: retain flexibility to adapt
Innovation	Some large-scale national and universal innovations	Innovations in organisational form more than content	Innovation at all levels
Improvement	Large step-change improvements initially, but less capability for continuous improvement	Improvements in managerial processes and systems; customer focus produces quality improvements in some services	Aiming for both transformational and continuous improvement in front-line services
Role of policy- makers	Commanders	Announcers/commissioners	Leaders and interpreters
Role of public managers	Clerks and martyrs	Efficiency and market maximisers	Explorers
Role of the public	Clients	Customers	Co-producers

Figure 7: Conceptions of governance and corresponding innovation (After [70] [71] [10] ).

Van der Steen et al. classified these three types according to their position in the results/conditions and government/society axes (see *Figure 8*). In this classification a fourth governance concept is added: Societal Resilience.







Figure 8: Classification of governance concepts by Van der Steen et al. [72] (translated by Yvette Jeuken)

We will use these four concepts to make the clustering of the types of governance models (see *Figure 12*): government –led traditional governance models (Cluster 1), market oriented governance models (Cluster 2), community based governance models (Cluster 4) and collaborative governance models (Cluster 5).

Two additional key dimensions are the degree of involvement of public actors (government) vs. private sectors (communities and markets) [73] together with the hierarchical/non-hierarchical distinction. Using this two axes Hall [63] classifies four frameworks of governance regarding their steering modes (see *Figure 9*).



Figure 9: Frameworks of governance typology and steering modes (Source [63])

Nature4Cities – D1.2 – NBS Implementation Models Typology 57/178





This classification provides the fifth cluster: private-private partnership that considers all governance models between community and market sectors.

Another classification regarding ideal governance arrangements that complements the previous ones is the one proposed by Arnouts et al. applied to nature policy in a Dutch region [57]. The authors made a distinction between hierarchical, closed, open and self-governance and analysed the actors involved, the rules and the interaction rules as it can be seen in *Figure 10*.

	Hierarchical	Closed co-	Open co-	Self
Actors	Mainly governmental actors	Select mixed group of actors	Large mixed group of actors	Mainly non- governmental actors
Power	With government	Pooled	Diffused	With non- government
Rules	Governmental coercion	Restricted cooperation	Flexible collaboration	Non- governmenta forerunning

Figure 10: Four ideal-typical governance arrangements according to [57]

Based on the previous references and in the triangle connecting government, market, and community also used by Lemos and Agrawal [62], a framework for governance model analysis and clustering has been developed (see *Figure 11*). Using this framework in the next section (see Section 5.2) the different governance models will be analysed and characterised.



# **HATURE 4** CITIES



Figure 11: Framework for governance model analysis and clustering

## **5.2** Models of Governance

Many problems and urban challenges addressed by NBS (climate change, loss of biodiversity, resource scarcity...)<sup>13</sup>, are too broad and too complex to be solved by the government alone. Therefore the cooperation between the government and parties from civil society (ranging from individual citizens and civil society organisations to businesses and small social enterprises) is increasingly a technical requirement [73]. It is necessary, then, to move the focus from individual actors to network structures, to be able to inform about practices that support the emergence of purposeful network structures for ecosystem governance [54].

The objective of this section is to identify and conceptualise different models of cooperation arrangements among the different actors that can lead to the implementation of NBS projects. The identified models are not static or definitive. They can coexist in the same initiatives or change during the different stages of the projects. For example, an initiative can start spontaneously and later be absorbed in formal policies or a government initiated neighbourhood planning process can evolve into a self-organising management body as seen in [74]

The Figure 12 shows the different analysed governance models clustered in 5 clusters and distributed according to the involved actors (government, community and market), their position in the spectrum from high to low government involvement and their level of participation. The analysed governance models are the followings:

- CLUSTER 1: Traditional public administration
  - Hierarchical governance
  - Closed governance
  - Participatory planning & budgeting
- CLUSTER 2: New Public Management
  - Public-private partnership (PPP)
  - Business-led self-governance
- CLUSTER 3: Private-private partnerships
  - Non State Market-driven governance (NSMD)
  - Business–NGO partnerships
  - Sustainable Local Enterprise Networks (SLEN)
- CLUSTER 4: Societal Resilience

<sup>&</sup>lt;sup>13</sup> See deliverable D2.1 ("System of integrated multi-scale and multi-thematic performance indicators for the assessment of urban challenges and NBS") for a detailed list of the urban challenges to be addressed by the N4C project.





- Co-management
- Civic ecology practices
- Self-governance/grassroots initiatives

#### • CLUSTER 5: Network Governance

- Collaborative governance
- Adaptive governance
- Adaptive co-management
- Scale-crossing brokers



Figure 12: Analysed governance models

In the following sections, the different models are analysed from different perspectives: how they emerge, involved actors, the degree of government involvement, rules, contextual conditions and tools that can be used. These analyses are structured in the tables that come in each section. Each cluster is also studied regarding the barriers that can help to overcome, drivers that can be triggered and finally their suitability for NBS projects (including the barriers that the own IM generate).





#### 5.2.1 CLUSTER 1: Traditional public administration



Figure 13: Cluster 1 (Traditional public administration)

The first cluster ("*Traditional public administration*") comprises "*Hierarchical governance*", "Closed governance" and "*Participatory planning & budgeting*". As seen in Section 5.1.6, they are government- and producer-oriented governance models. With different levels of low-moderate participation (from non-participation to tokenism in Arnstein ladder), the community role is mainly to be a client while the role of the government is to be the commander. The needs and problems are defined by professionals and since a key goal is to maintain stability they are uncertainty averse.

#### 5.2.1.1 <u>Hierarchical governance</u>

In an ideal-typical hierarchical governance arrangement, the government is superimposed above non-governmental actors and all the policies are top-down.

KEY WORDS	Centralized, government led, top-down, hierarchical
HOW EMERGES	Default governance regime. State bureaucratic authority appeared to many policy makers and academic observers as the appropriate means to address the externalities associated with the use of environmental resources.
INVOLVED ACTORS	Government. Citizens and community are always at the receiving end.
GOVERNMENT INVOLVEMENT	Leading role





RULES	<ul> <li>Instrumental vision on policy</li> <li>Administrations hierarchically controlled by electorally accountable governments</li> <li>The interaction rules give government a leading role, whereas non-governmental actors follow</li> <li>Coercion by the government is the predominant interaction type</li> </ul>	
CONTEXTUAL CONDITIONS	Often fails to provide effective solutions for highly contextualized situations	
TOOLBOX	Top-down directives or command-and-control policies.	
REFERENCES	[57] [75]	

Table 15: Hierarchical governance

## 5.2.1.2 Closed governance

In a closed governance model the government has the leading role and a few selected nongovernmental actors are engaged in small and no-flexible coalitions. Therefore, closed governance is characterised by a "*restricted, structured and fixed form of governmental/non-governmental cogoverning*" [57]. It can be considered as a step further from the hierarchical governance in the open governance direction but still with a top-down and hierarchical approach (see *Figure 14*).



Figure 14: The hierarchical, closed and open co- and self-governance continuum ([76]as seen in [57]).

KEY WORDS	Hierarchical, closed participation, top-down
HOW EMERGES	A select group of participant is chosen by the government that also defines the problem
INVOLVED ACTORS	One strong coalition in which the involved governmental actors are organised and complemented with a few non-governmental selected actors. Access is restricted to those that forms the main coalition.
GOVERNMENT INVOLVEMENT	Leading role
RULES	- The government has the power because it controls the resources that can be mobilised





	<ul> <li>The non-governmental actors are able to influence as long as the government allows it</li> </ul>	
	<ul> <li>Access to governing processes is restricted to governmental actors and to those that government chooses to involve</li> </ul>	
	- The government and non-governmental actors cooperate but in a very restricted way	
	<ul> <li>Government assigns certain tasks to the involved nongovernmental actors and then monitors them.</li> </ul>	
	<ul> <li>If the elite actors are provided with a privileged space for participation, they will have no incentive to exert their veto power or obstruct the decision-making process.</li> </ul>	
CONTEXTUAL CONDITIONS	In cases of environmental issues with potentially catastrophic impacts (e.g., global climate change), the predominance of "less than democratic" expert politics could be justified in the name of the urgency and severity of the problem.	
TOOLBOX	Top-down directives or command-and-control policies.	
REFERENCES	[57] [62] [76]	

#### Table 16: Closed governance

#### 5.2.1.3 Participatory planning & budgeting

The consultation of citizens regarding planning documents is a legal requirement in the majority of European cities. If the participation is carried out only for legal reasons, it is probable that consultation will not be specifically about green infrastructures and urban NBS since they may play only a marginal role within the strategic planning documents. Moreover when consultation efforts concerning the strategic planning documents are motivated by higher level regulations, these efforts are often just seen as *"ritualistic nature and superficial, reaching only a limited number of people"* [74]. One step further is strategic involvement in decision-making. As explained by the same authors *"the higher level government does not only rely on the knowledge and competence of other actors through a consultation process but delegates some of its decision making power to nongovernmental stakeholders".* 

KEY WORDS	Hierarchical, open participation	
HOW EMERGES	Isually required by law. EU structural and cohesion funds create a requirement or transparency encouraging government to engage relevant stakeholders in lanning	
INVOLVED ACTORS	Government, citizens, NGOs	
GOVERNMENT INVOLVEMENT	Very high	





	- Hierarchically organized participation.	
RULES	<ul> <li>There is a need to formalise the rules of the game and provide well established supporting tools (like websites, guidelines) in order to rebalance the information asymmetry.</li> </ul>	
	- The stage when the stake holders are involved depends of the level of collaboration. Too early involvement or too late could be problematic	
CONTEXTUAL CONDITIONS	Some countries have adopted national level policies and instruments to promote different forms of public consultations at the local levels providing guidelines and tools.	
	- Neighbourhood planning	
	- Participatory budgeting	
TOOLBOX	- E-tools for citizen involvement and empowerment	
	- Workshops, professional moderation of debates	
	- Interactive mapping	
REFERENCES	[23] [74] [77] [78]	

Table 17: Participatory planning & budgeting

## 5.2.1.4 Barriers, drivers and suitability for NBS of Cluster 1

In the following table it is shown the barriers and the drivers associated to this cluster and its suitability for NBS.

	BG2: Establishment of long-term responsibilities
	BG3: Gentrification
BARRIERS	BG7: Goal misalignment
it can help overcome	BG9: Role ambiguity
	BE1: Under-appreciation of non-economic benefits
	BE3: Short term vision
	DG2: Coordination role
	DG8: Involvement of urban government
DRIVERS it can trigger	DE4: Removal of administrative barriers
	DE8: Mid-Long term financing
	DE9: Real estate





	Low. Often falls short in efforts to coordinate governance across large-scale ecosystems that cross multiple jurisdictional boundaries.
SUITABILITY FOR NBS	Innovation is limited to some large-scale national and universal innovations being not enough for local innovation required but the majority of NBS projects.
	Large step-change improvements could be possible initially, but less capability for continuous improvement required by NBS projects.

Table 18: Barriers, drivers and suitability for NBS of cluster 1

## 5.2.2 CLUSTER 2: New Public Management



Figure 15:Cluster 2 (New Public Management)

The idea beyond the involvement of market actors in environmental collaboration is to overcome the inefficiencies of government action by injecting competitive pressures through market actors that are seen as capable of achieve bigger profitability in the utilization of environmental resources [62]. In a competitive context, the self-interested individuals express their desires through markets as consumers.

The different models for this kind of arrangements could be placed in a spectrum that goes from an almost fully public sector governance to an almost private sector governance. The following sections describe two representative models of this cluster: the public-private partnerships (PPP) and the business led self-regulation.





#### 5.2.2.1 <u>Public–private partnership (PPP)</u>

In the last decades many cities have moved away from public sector dominance in a variety of key sectors (provision of water, waste, and energy services). One of the ways of this shift has been the privatisation, "whereby the government cedes total ownership and control of the service and its underlying assets to a private organisation, either through outright sale or through long-term concession (...) the government typically maintains responsibility for the public welfare through regulatory commissions or other statutory powers of surveillance and sanction". One of the limitations of this kind of arrangement is the scale (small projects are unable to attract this type of private sector investment) but specially that the lack of government direct involvement hinders the guarantee of public services (such as public accountability, protection of all sectors of society or delivery of social and environmental and economic benefits) [49].

The term "public-private partnership" describes a spectrum of possible relationships between public and private actors for the co-operative provision of infrastructure services with different degrees of private participation (see *Figure 16*).



Figure 16: Spectrum of PPP types [49]

KEY WORDS	Marked-oriented, competitive, top-down	
HOW EMERGES	The most successful PP arrangements come from a flexible, opportunistic approach, drawing from experiences in other cases. In the beginning is not always the most evident solution. A widely acknowledged crisis can trigger the arrangement.	
INVOLVED ACTORS	Government + private sector	
GOVERNMENT INVOLVEMENT	Can range from high to low involvement.	





RULES	<ul> <li>Under the joint venture PPP scenario, private sector involvement alters, but by no means eliminates public sector responsibilities.</li> <li>Continued government involvement in certain services helps ensure the efficiency of economic markets by reducing capital risks, increasing access to information, and reducing monopoly power.</li> </ul>		
CONTEXTUAL CONDITIONS	PPP are deeply context based.		
TOOLBOX	Outsourcing. Joint Venture Public-Private Partnerships		
REFERENCES	[33] [49] [71]		

Table 19: Barriers, drivers and suitability for NBS of cluster 1

#### 5.2.2.2 Business-led self-regulation

Market governance has been defined as "the notion that private economic actors and institutions gain authority in governing areas which were conventionally ruled by states" [79]. Specifically, marketised environmental governance is a mode of neoliberal governance. From a political economy perspective, some authors consider business sector as "an intrinsic part of the fabric of environmental governance, as rule-maker, and often rule-enforcer" since businesses can construct and enforce their own systems of environmental governance through standard-setting [80] or third-party certification [81]. The strength of the instruments used within this approach is based in the utilization of market exchanges and incentives to encourage environmental compliance [79]. Some of these tools could be energy taxes, tradable permits, voluntary agreements, ecolabelling, and certification adoption [62]

KEY WORDS	Business-led, decentralized	
HOW EMERGES	When government is not perceived anymore as the only source of legitimacy and market forces are strong enough.	
INVOLVED ACTORS	Business sector. Efforts may be undertaken to include the broader community, but authority over what to do, and how to do it, rests with the companies.	
GOVERNMENT INVOLVEMENT	Announcers and commissioners	
RULES	<ul> <li>Utilization of market exchanges and incentives to encourage environmental compliance.</li> <li>Do not attempt to institutionalize governing apparatuses nor create an adaptive arena in which stakeholders and organized interests deliberate to create policy.</li> </ul>	





	- Corporate self-regulation initiatives create their own (usually voluntary or discretionary) rules and procedures to guide corporate behavior.		
CONTEXTUAL CONDITIONS	In neo-liberal contexts		
TOOLBOX	Voluntary agreements, third-party certifications, eco-labelling, corporate social responsibility		
REFERENCES	[80,81]		

Table 20: Business-led self-regulation

#### 5.2.2.3 Barriers, drivers and suitability for NBS of Cluster 2

In the following table it is shown the barriers and the drivers associated to this cluster and its suitability for NBS.

BARRIERS	BE2: Uncertain economic feasibility	
it can help overcome	BE6: Lack of funding knowledge	
	DK3: research on cost-effectiveness	
	DK4: Networks	
	DG3: Action-thinking approach	
DRIVERS	DG9: Cross-sectorial spaces and partnerships	
it can trigger	DE1: Sharing risks	
	DE6: Create conditions for new business models and finance schemes	
	DE7: Cooperative competition	
	DE9: Real estate	
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). Innovations comes in organisational form more than content.	
	Improvements mainly in managerial processes and systems but customer focus produces quality improvements in some services	

Table 21: Barriers, drivers and suitability for NBS of Cluster 2





#### Public actors GOVERNMENT NO PARTICIPATION REGULATION GOVERNMENT Non State marketdriven governance Business NGO (NSMD) MARKET Sustainable Local CITIZEN GOVERNANCE partnerships Enterprise Networks POWER Cluster COMMUNITY MARKET (SLN) Private-private partnerships NGOs COMMUNITY MARKET ORIENTED BASED Private sectors

#### 5.2.3 CLUSTER 3: Private-private partnerships

Figure 17: Cluster 3 (Private-private partnerships)

The third cluster is when the governance arrangements are between private actors in a nonhierarchical mode. In this cluster three governance modes are analysed in the following section: *Non State Market-driven governance (NSMD), Business-NGO partnerships* and *sustainable local Enterprise Networks (SLN).* 

#### 5.2.3.1 Non State Market-driven governance (NSMD)

The objective of NSMD governance systems is "to reverse global liberalism's impact on policy and regulatory development by targeting large multinational companies with market incentives (price premiums, market access, 'social licences' to operate) or disincentives (boycott campaigns, shaming), which in turn should put pressure along the market's supply chain to encourage compliance to a governing system's rules and procedures" [80]. Berstein and Cashore identify six features of NSMD governance that distinguish it from other types of governance as traditional governance or public–private partnerships[80]:

- Absence of state authority
- Institutionalized governance mechanisms
- Market-based authority
- Policy arena is the social domain
- Stakeholders and broader civil society part of authority granting process
- Enforcement mechanisms and mandatory requirements

Nature4Cities – D1.2 – NBS Implementation Models Typology





The following two tables compare NSMD with other governance models: with traditional government and PPP regarding the sources of authority (see Table 22) and with business- led self-regulation and state-based non governance regarding rules and scope (see Table 23).

Comparison of NSMD Sources of Authority

Features	NSMD Governance	Shared Private/Public Governance	Traditional Government
Location of authority	Market transactions	Government gives ultimate authority (explicit or implicit)	Government
Source of authority	Evaluations by external audiences, including those it seeks to regulate	Government's monopoly on legitimate use of force, social contract	Government's monopoly on legitimate use of force, social contract
Role of government	Acts as one interest group, land-owner (indirect potential facilitator or debilitator)	Shares policy- making authority	Has policy- making authority

#### Table 22: Comparison of NSMD with other models [79]

	NSMD governance	Self regulation	State-based non-governance
Who participates in rule making	Environmental and social interests/stakeholders participate with business interests	Business-led	NA
Rules – substantive	Non-discretionary	Discretionary-flexible	Complete discretion (Voluntary or Required reporting)
Rules – procedural	To facilitate implementation of substantive rules	End in itself (belief that procedural rules by themselves will result in decreased environmental impact)	To create learning environment
Policy scope	Broad (may includes rules on secondary consequences of activities such as labour, indigenous rights, wide-ranging environmental impacts, etc.)	Narrower (management rules and continual improvement in practices)	Narrow (reporting of pollution)

Table 23: Business- led self-regulation versus NSDM and state-based non governance [80]

The same authors distinguish three different phases on a NSDM governance: initiation phase, widespread support and political legitimacy phase (see *Figure 18*).







Figure 18: The three phases of a NSDM governance model [81]

KEY WORDS	Market-oriented, decentralized					
HOW EMERGES	NGOs develop their own sets of socially and environmentally responsible business practices due to the difficulty to influence the government. The idea is to reward companies providing recognition in the marketplace of their responsible business practices, with a corresponding promise of either market access and/or a price premium.					
INVOLVED ACTORS	Environmental and social stakeholders participate with business interests					
GOVERNMENT INVOLVEMENT	Do not necessarily have to be involved. When governments play important roles they remain non-authoritative.					
RULES	<ul> <li>Steering by market parties, regulation on basis of supply and demand.</li> <li>The viability of NSMD is determined by whether it can achieve legitimacy to operate</li> <li>Due to the absence of sovereign state authority governing systems are created: institutions designed to create and implement policy where actors and organizations participate in adaptive policy-making</li> <li>Authority emanates from the market</li> </ul>					





CONTEXTUAL CONDITIONS	A general dissatisfaction with old policy instruments; neoliberal institutionalism and free trade agreements and a requirement for market innovations. Learning processes must be established that include forums for exchanges of expert information, the building of databases of experiences and the				
	development of best practices. Second, systems must be designed to create a learning environment in which stakeholders can "build community" that taps into shared understandings of legitimacy among participants.				
TOOLBOX	Norm generation and community building				
REFERENCES	[62] [79] [80] [81] [82] [83] [84]				

Table 24: Non State Market-driven governance (NSMD)

#### 5.2.3.2 Business–NGO partnerships

"Businesses are viewed as purely self-serving, pursuing profit in ways that are inherently destructive to human culture, well-being, and the environment," whereas NGOs are viewed as "altruistic, charged with identifying and solving the world's problems, and acting as public watchdogs to raise the element of business."

u	ne	alarm	about	ine	eviis	01	business	[85].	AS	п	can	be	seen	IN
NGOS			Building repu and branding Maximizing s and garnerin	itation, im: ) phere of ir g wider su	age mpact ipport	Acquiring complementary capabilities, such as technical and managerial skills		Gaining access to networks and to business and political leaders Reducing costs			s Influer enviro busin and s	Influencing social and environmental change in businesses, industries and society Building public awareness of issues		
			Becoming a more prominent actor					Securing	funding	Buildi aware Makir				
			Responding for account	g to dema ability	Inds			and volunteers			by so	by solving problems		

\*Black text signifies primarily proactive motivations, whereas bolded text signifies primarily reactive motivations.

Figure *19*, the motivations from companies and NGOs to collaborate together are very diverse and can range in both cases from the search of legitimacy, the need of competencies in complex problems, the search of resources or society oriented motivations.




MOTIVATIONS	LEGITIMACY-ORIENTED	COMPETENCY-ORIENTED	RESOURCE-ORIENTED	SOCIETY-ORIENTED
Business	Building reputation, image and branding	Gaining expertise	Gaining access to networks	influencing policy development
	Concerna and a strend at	Leveraging heterogeneous	Capacity building	
	Building the social licence to	knowledge	Contraction and	Responding to
	operate	Identifying issues and trends	products and markets	stakeholder and shareholder activism
	Avoiding confrontation		producto and marketo	regarding local and
		Growing awareness of	Securing monetary funds	problems
	Attracting & retaining	complex social problems	Diek ebaring	
	employees		r nan andre ig	
	Saving face			
NGOs	Building reputation, image and branding	Acquiring complementary capabilities, such as technical and managerial skills	Gaining access to networks and to business and political leaders	Influencing social and environmental change in businesses industries
	Maximizing sphere of impact	and managenar shiris	political isaders	and society
	and garnering wider support		Reducing costs	
			~	Building public
	Becoming a more prominent		Securing monetary funding	awareness of issues
	00001		Gaining goods, services	Making the world better
	Responding to demands for accountability		and volunteers	by solving problems

\*Black text signifies primarily proactive motivations, whereas bolded text signifies primarily reactive motivations.

Figure 19: Business and NGOs motivations to collaborate with NGOs [86]

In any case, the collaboration between business and NGOs can vary from "*conventional forms of philanthropy*" to "*more substantive forms of multi-stakeholder engagement*" [87]. Gray et al. developed a classification of these models arranging the different types in two axes: scope of the partnership (stakeholders and sectors involved) and scale (from local to global); and the degree of shared ownership and responsibility. The authors also use a gradation to reflect the different levels of complexity. In an incremental way they consider: reactive, transactional, integrative and transformational (see *Figure 20*) [86]. The same authors describe shortly each type:

- **Philanthropy or sponsorship** (usually formed by a single business with a single NGO) occurs when the business offers a direct financial contribution to an NGO.
- **Environmental impact assessment**, when a business considers other stakeholders' input (e.g. regarding on its plans for a new facility or site). The degree of NGO involvement varies, from one-time input to substantial input in the whole cycle of the project.
- Short-term problem-solving/ dyadic partnership, the former when business consult NGOs for one single issue and the later when a more sustained dyadic partnership is developed
- **Ecolabelling** occurs when several firms within an industry adopt standards for labelling certain products as sustainable
- Industry sustainability standards, when industries and NGOs are engaged to develop voluntary sustainability standards
- Base-of-the-Pyramid strategies, when businesses work closely with income-poor





communities around the globe to develop new locally embedded sustainable business opportunities.



KEY WORDS	Hybrid governance, decentralized, non-hierarchical	
HOW EMERGES	The reactive approach usually is adopted by companies that are new to this kind of partnerships. Then partnerships could evolve by a "'reactive-turned-proactive' strategy, where pressures from NGO activists lead the company to go from resistance and mere compliance to strategic actions	
INVOLVED ACTORS	Markets + NGO	
GOVERNMENT INVOLVEMENT	Medium-low	
	<ul> <li>Philanthropy or sponsorship/Environmental impact assessment/Short- term problem-solving: threat-induced, compliance or charity-driven responses.</li> </ul>	
RULES	<ul> <li>Sustained dyadic partnership/changes in supply chain/Eco-labelling: transactional partnerships where the primary motive for business is improving profitability or market share</li> </ul>	
	<ul> <li>Industry sustainability standards: businesses move beyond bottom- line considerations to consider how to balance those considerations with social and ecological concerns</li> </ul>	





	<ul> <li>Base-of-the-Pyramid strategies: other key stakeholders are involved in sustained interactions designed to agree on and enact</li> <li>This partnership is often difficult for businesses so NGOs often serve as liaisons between businesses and communities</li> </ul>	
CONTEXTUAL CONDITIONS	Differences in organizational cultures between business and NGOs stem largely from their differing missions and accountability systems.	
TOOLBOX	<ul> <li>Tools to construct shared visions</li> <li>Consensus-based decision making</li> <li>Accountability criteria for assessing progress against joint goals</li> </ul>	
REFERENCES	[86] [88]	

Table 25: Business–NGO partnerships

### 5.2.3.3 SLENs (Sustainable Local Enterprise Networks)

Wheeler et al. describe the SLEN model as "relatively dense networks of for profit businesses, communities, not-for-profit organizations and other actors that work synergistically to create value in social, ecological and economic terms (and) depend on simultaneous synergistic support for mobilizing four key assets: human capital, social capital, financial capital and ecological (natural) capital" [89].



Figure 21: Model of SLEN [89]





KEY WORDS	Self-organizing, complex adaptive systems	
HOW EMERGES	SLE Networks provide an integrating opportunity for businesses, communities, individuals, governments, development agencies and civil society actors to acknowledge a shared asset base and construct a virtuous cycle of asset growth and sustainable outcomes.	
INVOLVED ACTORS	NGOs + civil society members + companies. Businesses with an overt sustainable development mission are frequently an integral part of SLE Networks and they can be small or medium sized or, in some cases, may be multinational enterprises. Co-ops or profitable social enterprises spun off from NGOs can also perform the role of generating the economic value that ensures the financial sustainability of the SLE Network.	
GOVERNMENT INVOLVEMENT	Not mandatory.	
	- Successful SLE Networks require at least one for-profit business to anchor the network and ensure that it is financially sustainable.	
RULES	<ul> <li>The four capitals are synergistic and are not traded-off. The outcomes are reinvested in the network, creating a self-reinforcing virtuous cycle and are often further enhanced with additional external exogenous investments in human, social, financial and ecological capital.</li> </ul>	
	<ul> <li>It is not necessary for all participants in the SLE Network to agree on the primary purpose of the network.</li> </ul>	
CONTEXTUAL CONDITIONS	Effective SLE Networks depend on mobilizing all four key assets: human capital, social capital, financial capital and ecological (natural) capital. The interconnectedness of these four capital assets requires a 'systems view' of assets, resources, and the flows between them and an understanding of how network phenomena and complex, adaptive systems work in social, ecological and economic terms.	
	Re-conceptualization of roles as:	
	1) Network Builders	
TOOLBOX	2) Capacity Builders	
	3) SLE Network Incubators	
	4) Innovators, Leaders and Disseminators of Good Practice and Lessons Learned	
REFERENCES	[89] [90]	

Table 26: SLENs (Sustainable Local Enterprise Networks)





### 5.2.3.4 Barriers, drivers and suitability for NBS of Cluster 3

In the following table it is shown the barriers and the drivers associated to this cluster and its suitability for NBS.

	BK4: Incomprehensible or unusable presentation of results		
	BK5: Lack of ready-to-apply scientific results, concepts and technologies		
	BG7: Goal misalignment		
BARRIERS	BG10: Perception		
it can help overcome	BE1: Under-appreciation of non-economic benefits		
	BE2: Uncertain economic feasibility		
	BE5: NBS not a priority		
	BE6: Lack of funding knowledge		
	DK7: NBS ambassadors		
	DK8: Climate change		
DRIVERS	DK9: Ecological memory		
it can trigger	DG1: Collaboration		
	DG3: Action-thinking approach		
	DE6: Create conditions for new business models and finance schemes		
SUITABILITY FOR NBS	Medium-high. But currently the required conditions for the more complex models (specially SLEN and NSDM) 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. In general, power asymmetry could be a problem.		

Table 27: Barriers, drivers and suitability for NBS of Cluster 3





### 5.2.4 CLUSTER 4: Societal Resilience



Figure 22: Cluster 3 (Societal Resilience)

In this cluster, there are situated the governance models in the higher steps of the participation ladder when communities have the power for plan and manage without (almost) intermediaries.

### 5.2.4.1 <u>Co-management</u>

Co-management seeks to bring together resource users in shared stakeholder management regimes. Such arrangements theoretically provide potentiality to "*democratise decision making, foster conflict-resolution, and encourage stakeholder participation*" [37] [91] [92] and has been defined as "*a situation in which two or more social actors negotiate, define, and guarantee amongst themselves a fair sharing of the management functions, entitlements, and responsibilities for a given territory or set of natural resources.*" [93]

The initiating actor could be the government as well as non-governmental actors. According to Colding et al. [31] some examples of collectively managed green spaces are the following :

- Public-access community gardens or PAC-gardens (public ownership and open access but active participation is absent or very low) [37]
- Community gardening, which depends upon collaborative efforts of a diverse set of individuals and/or interest groups to succeed.
- Allotment gardening. An allotment garden contains multiple garden plots of equal size, often on municipally owned land, constituting well-managed flower-, bush-, and tree rich sites that provide lot holders with vegetables, fruits and ornamental flowers.





KEY WORDS	Non- hierarchical, open participation, decentralized management, social learning	
HOW EMERGES	When it is initiated by non-government actors the government usually supports the implementation. Bottom-up initiatives mainly concern areas of public green spaces where the local inhabitants or other stakeholders (such as researchers or artist groups) intend to implement their own ideas, often heavily relying on public resources (e.g. sites, infrastructure). When initiated by the government non- governmental stakeholders are invited to share rights for democratic reasons (empowering people, integrating marginalised groups) or in need of more cost efficient ways of management and maintenance.	
INVOLVED ACTORS	Local authorities, citizens, NGOs, researchers	
GOVERNMENT INVOLVEMENT	Medium	
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	
CONTEXTUAL CONDITIONS	How co-operative management schemes are formulated and implemented depends on the task at hand (e.g. planning, financing, implementing, managing, maintaining, providing services to the public) and the responsibility shared (e.g. keeping the green space safe and orderly, providing self-finance, keeping it public).	
TOOLBOX		
REFERENCES	[74] [31,94] [32] [37] [41]	

#### Table 28: Co-management

### 5.2.4.2 <u>Civic ecology practices</u>

Civic ecology practices are characterized for being local, hands-on environmental stewardship actions taken to *"enhance the green infrastructure and community well-being of urban and other human-dominated systems"* [95]. They include community gardening, shellfish reintroductions, tree planting, invasive species removal, and native habitat restoration [23].

KEY WORDS	Small scale, local	
HOW EMERGES	Often are initiated by lay persons, generally as a community-based response to urban decline or sudden disturbances like hurricanes and war	
INVOLVED ACTORS	The involvement of scientists and NGOs helps to ensure larger impacts and longer-term sustainability but it is not mandatory. Sometimes adversarial relations with government and business.	





GOVERNMENT INVOLVEMENT	Not mandatory	
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	
CONTEXTUAL CONDITIONS	They reflect local environments and cultural traditions.	
TOOLBOX		
REFERENCES	[23] [95]	

Table 29: Civic ecology practices

### 5.2.4.3 <u>Self-governance/grassroots initiatives</u>

Citizens are increasingly present in the public domain with an increasingly more significant role in civil and government affairs; these groups represent a growing class of bottom-up, grassroots-movement citizens and organizations with names like 'the participation society,' 'the energetic society,' and 'do-it-yourself democracy,' [73]. A current trend in urban research is that effectivity of urban areas has to come also for self-organisation and self-governance [96] since "*local communities all face their own problems, and that their skills and local knowledge place them in the best position to address these problems*" [65]

KEY WORDS	Bottom-up, polycentric, self-organisation, self-management		
HOW EMERGES	Decision-making about societal development is no longer solely in the hands of government, but actors such as companies, scientists, the media, new social movements and the community.		
INVOLVED ACTORS	Local authorities, citizens, NGOs, researchers		
GOVERNMENT INVOLVEMENT	Traditionally, the nature of self-government is the absence of government, although some research trends explore practical ways to embed bottom-up initiatives within existing government structures. The government could have a semi-passive role that provides support, being flexible, having an eye for the local context and by stepping back in certain areas at the right time.		
RULES	<ul> <li>Grassroots movement have their own dynamic and they are an inherently unpredictable.</li> <li>Institutional diversity and multi-scalarity.</li> </ul>		
CONTEXTUAL CONDITIONS	An active society is requirement.		
TOOLBOX			





#### REFERENCES

[65] [96] [73]

Table 30: Self-governance/grassroots initiatives

### 5.2.4.4 Barriers, drivers and suitability for NBS of Cluster 4

In the following table it is shown the barriers and the drivers associated to this cluster and its suitability for NBS.

	BG7: Goal misalignment		
	GB9: Role ambiguity		
BARRIERS	BG10: Perception		
it can help overcome	BG11: Lack of participation		
	BE1: Under-appreciation of non-economic benefits		
	BE5: NBS not a priority		
	DK9: Ecological memory		
DRIVERS	DG6: Grassroots initiatives and transition activities		
it can trigger	DG10: Co-production		
	DE10: Self-financing and self-management		
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.		

Table 31: Barriers, drivers and suitability for NBS of Cluster 4





### 5.2.5 CLUSTER 5: Network Governance



Figure 23: Cluster 5 (Network Governance)

Beyond the idea of the addition of community and local voices to environmental governance lays the hope to solve complex environmental problems providing the benefit of time- and place-specific information and allowing a more equitable allocation of benefits from environmental assets [62].

### 5.2.5.1 <u>Collaborative governance</u>

Due to complexity of the current problems that are faced by the different levels of governments, the decline in government efficacy and the scarcity of resources that forces them to "do more with less" a new form of governance have emerged called "collaborative governance" or "network governance" [86]. The literature defines collaborative governance as "*the coordination of interdependent actors from public, private and societal sectors for the purposes of developing and implementing public policy*" [97]. The model falls in the middle of the spectrum that comprises the different degrees of government involvement [98]







Figure 24: Position of collaborative governance along the continuum of government involvement (Source. [86])

The key factor of this model is the inclusion of non-governmental stakeholders in the decision making processes, including the tacit knowledge that these stakeholders can incorporate to the understanding of complex urban issues as NBS projects. Ansell and Gash establish six criteria that define the collaborative governance [99]:

- 1. The model is initiated by the government side
- 2. They are included non-government stakeholders
- 3. Participants are included in decision making process and not merely "consulted"
- 4. The model is formally organized and meets collectively.
- 5. The aim of the decision making process is to seek the consensus (although not always is achieved)
- 6. The focus of the collaboration is public management issues

	BUSINESS	NGOs	GOVERNMENT	COMMUNITY	ENVIRONMENT
Positive	Improve CSR reputation; ensure licence to operate	Greater focus on	Improved project designs	Greater voice in policymaking	Environmental advocacy
	Supply chain improvements	accountability	acceptance of plans	Improved quality of life	Deal with complexity
	Innovative products	Enhanced reputation	More efficient resource usage	Gain models that can be used for other	Institutionalized attention to problem
	New markets	The second se	Strengthen data management	projects	11 2017 - 11 - 11 - 11 - 11 - 11 - 11 - 11 -
	Attractiveness to employees	Achieve needed funding	Meet sustainability targets	Integrated service delivery	Environmental conditions improved
	Gain critical competencies		Garner greater public accountability	Retain control of lives	
	Integrate sustainability in core business practices		Insight into economic and demographic trends	Gain culturally suitable products and outputs	
	De facto rules for regulating Industries		Improve interagency coordination	Build networks for self- reliance	
Negative	Perceptions of greenwashing	Suffer tainted reputation	Need to deal with conflict	Inequitable outcomes	Continued degradation
		Cooptation	Less thorough study of research	Need to balance subgroup vs. greater public interest	Replacement of
			Reduced funds	papio interdor	produced products

Figure 25: Positive and negative partnership outcomes by stakeholder (source: [86])

KEY WORDS	Collaborative, multi-level, polycentric
HOW EMERGES	Usually the model is initiated by the government side trying to incorporate new resources, efficiency, knowledge and competences to solve complex problems.
INVOLVED ACTORS	Involves a large group of governmental and non-governmental actors that engage in competitive and/or stimulating governing activities.





GOVERNMENT INVOLVEMENT	Medium. Government retains the formal authority for any decisions made (anyway non-government actors are expected to assume serious deliberative roles and often play a key role in implementing any decision taken)
RULES	<ul> <li>The actors are only loosely bound to one another, either organised in several relatively small coalitions that exist beside each other or operating on a more individualistic basis.</li> </ul>
	- The model is formally organized and meets collectively.
	<ul> <li>Participants are included in decision making process and not merely "consulted". The aim of the decision making process is to seek the consensus (although not always is achieved).</li> </ul>
	<ul> <li>"Transaction costs" (costs of consultations, reaching agreement, and enforcing such agreements) are high</li> </ul>
	- The focus of the collaboration is public management issues.
	<ul> <li>For business sector positive outcomes increase when the collaboration is widely publicized within the firm and both top management and employees are engaged.</li> </ul>
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)
	- Analytical-deliberative approaches
TOOLBOX	<ul> <li>Introduction of ranges of desired or accepted variability in the formulation of NBS goals</li> </ul>
	<ul> <li>Selection of a set of easily measurable criteria for the ecological, social and economic effectiveness of the interventions (especially for NBS that are applied at large scales)</li> </ul>
	<ul> <li>Participatory evaluation in order to respect the legitimacy of different views on quality (Delphi, group-model building and other expert or stakeholder opinion solicitation and deliberation methods)</li> </ul>
	<ul> <li>Collaborative scenario-building exercises (construction of maps and narratives aiming to generate a holistic landscape view among actors to help coordinate collective action)</li> </ul>
	- Urban Transition Labs
REFERENCES	[2] [54] [57] [65] [86] [93] [99] [100]

Table 32: Collaborative governance

### 5.2.5.2 Adaptive governance

As Schultz et al. described, Adaptive governance "rests on the assumption that landscapes and seascapes need to be understood and governed as complex social–ecological systems rather than





as ecosystems alone (...) In comparison with other efforts aimed at conservation and sustainable use of natural capital, adaptive governance developed capacity to manage multiple ecosystem services and respond to ecosystem-wide changes and enabled collaboration across diverse interests, sectors, and institutional arrangements" Adaptive governance refers to flexible and learning-based collaborations and decision-making processes involving both state and non-state actors, often at multiple levels, with the aim to adaptively negotiate and coordinate management of social– ecological systems and ecosystem services across landscapes and seascape [101].

KEY WORDS	Environmental governance, decentralized, polycentric, bottom-up
HOW EMERGES	Usually triggered by a crisis. May require "windows of opportunity" that appear as significant boost in capital or legitimacy (e.g., a shift in policy, a disruptive political election, a significant increase in funding or autonomy, a biophysical perturbation such as a natural disaster, or the recognition of a previously informal network as a formal governance organization)
INVOLVED ACTORS	Theoretically, an adaptive governance system requires a structure of nested institutions (complex, redundant, and layered) and institutional diversity (a mixture of market, state, and community organizations) at the local, regional, and state levels, connected by formal and informal social networks
GOVERNMENT INVOLVEMENT	Medium.
RULES	Largely builds on human relationships and trust.
CONTEXTUAL CONDITIONS	Normally "developed in democracies and high-income countries involved and in situations where policy tends to leave room for and support innovation and bottom-up initiatives for ecosystem management.
TOOLBOX	<ul> <li>Assessment of multiple and non-monetary benefits from nature</li> <li>Qualitative, multi-criteria, iterative and experimental approaches (better than exact calculus and utility maximization)</li> <li>Practices of natural capital management such as protected areas, environmental subsidies, quotas, or regulations</li> </ul>
REFERENCES	[55] [61][101] [102]

Table 33: Adaptive governance

### 5.2.5.3 Adaptive co-management

Richter et al. described adaptive co-management as "a cyclic process of learning about system states and dynamics and adjusting management action according to observable behavioural changes". Adaptive co-management will be in the participatory end of the gradient formed by the different models generated by this approach. [30]. Folke et al. describe adaptive co-management systems as "flexible community-based systems of resource management tailored to specific places





and situations, and they are supported by and work with various organizations at different levels. The flexible structure allows for learning and ways to respond to and shape change (...) it combines the dynamic learning characteristic of adaptive management with the linkage characteristic of cooperative management and also with collaborative management" generally involves polycentric institutional arrangements as nested quasi-autonomous decision-making units operating at multiple scales [102]

Adaptive management highlights the need of structured experimentation in combination with flexibility as ways to achieve learning. Co-management emphasizes the sharing of rights, responsibilities, and power between different levels and sectors of government and civil society. Therefore adaptive co-management, is a combination of the learning dimension of adaptive management and the linkage dimension of co-management [65]

KEY WORDS	Community-based, resource management, polycentric
HOW EMERGES	Usually triggered by a crisis.
INVOLVED ACTORS	Diverse set of stakeholders, operating at different levels, often through networks from local users to municipalities, to regional and national organizations, and also to international bodies. The sharing of management power and responsibility may involve multiple institutional linkages among user groups or communities, government agencies, and nongovernmental organizations (NGOs).
GOVERNMENT INVOLVEMENT	Medium.
RULES	<ul> <li>Leadership is essential in shaping change and reorganization by providing innovation in order to achieve the flexibility needed to deal with ecosystem dynamics. Leaders can provide key functions for adaptive governance, such as building trust, making sense, managing conflict, linking actors, initiating partnership among actor groups, compiling and generating knowledge, and mobilizing broad support for change. Key individuals also develop and communicate visions of ecosystem management that frame self-organizing processes</li> <li>Social capital and trust</li> <li>Governance system must continuously learn and generate experience about ecosystem dynamics</li> <li>Iterative learning and action</li> </ul>
CONTEXTUAL CONDITIONS	Tailored to specific places and situations
TOOLBOX	Collaboration Experimentation Bioregional approach to resource management





#### REFERENCES

[30] [41] [91] [102] [103][104]

Table 34: Adaptive co-management

### 5.2.5.4 Barriers, drivers and suitability for NBS of Cluster 5

In the following table it is shown the barriers and the drivers associated to this cluster and its suitability for NBS.

BARRIERS	BG2: Establishment of long term responsibilities
it can help overcome	BG7: Goal misalignment
	GB9: Role ambiguity
	BG10: Perception
	BE1: Under-appreciation of non-economic benefits
	BE2: Uncertain economic feasibility
DRIVERS	DK1: Lesson learnt through implemented projects
it can trigger	DK2: Research on benefits
	DK3: Research on cost effectiveness
	DK4: Networks
	DK5: Co-creation
	DK9: Ecological memory
	DG1: Collaboration
	DG7: Reflexive/adaptive governance
	DG8: Involvement of urban government
	DG9: Cross sectorial spaces and partnerships
	DG10: Co-production
	DE1: Sharing risks
	DE2: Public de-risking strategies
	DE3: Provisioning of incentives to attract private investment
	DE4: Removal of administrative barriers
	DE5: Public-private partnerships
	DE6: Create conditions for new business models and finance schemes
	DE7: Cooperative competition





SUITABILITY FOR NBS	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

Table 35: Barriers, drivers and suitability for NBS of Cluster 5





## 6 Financing mechanisms

This chapter outlines both conventional and non-conventional funding methods to pay for NBS implementation, and enumerates both public and private funding opportunities at various levels, from local to national and supra-national, initiated and led by diverse stakeholders.

Public funding sources such as taxation, fees, grants etc. are identified, as well as public and private loans, other debt instruments such as bonds, and forms of public-private partnership.

Depending on size and scope NBS may be funded through diverse actors, from informal, grassroots, citizen-led fundraising up to structured multi-national cooperation plans managed by Development Financial Institutions. However, no NBS plan can be implemented unless a clear "how-to-pay" strategy has been identified, irrespective of the scale.

Moreover, another aspect must be underlined: the global benefits of NBS application are evident while the cost is always addressed to specific subjects. At the moment, the "will to pay" considered at a wide and diffuse scale (with the structural involvement of private capitals), is not enough developed.

Considering the financing mechanism, the different typologies of NBS that can be defined are related to the scale of application and to the main actors who operate to improve them.

These typologies must be interrelated to the subjects who can access the financing methodology. About this last point, it is possible to classify:

- 1. International level (mainly referable to EU), that can involve both private and public subjects;
- 2. National level;
- 3. Regional level;
- 4. Metropolitan/Provincial level;
- 5. Municipality level.
- 6. Formal or informal urban communities.

About points 3., 4. and 5., it is possible to consider also consortiums made of Regions, or Provinces or Municipalities.

As it is developed in the following paragraphs, the level of the financing bureau is not connected to the level of the beneficiary (i.e. EU founds may be addressed both to national or municipality levels, and to public, private or public-private subjects).

So the financing mechanism is not strictly able to define the scale of NBS application. Of course, big scale NBS such as "green infrastructures" or "ecological networks" have at least a Regional scale, but they also need to be improved at the local scale. On the contrary, NBS connected to interventions on single buildings or groups of buildings (i.e. green roofs and green facades) have a correct financing scale at the Municipality level.





It is therefore beneficial to list funding methods and their applicability to different types of NBS projects.

- Public
  - European Regional and Development Fund (ERDF)
  - Cohesion Fund (CF)
  - o European Investment Bank Institute
  - European Social Fund (ESF)
  - European Agricultural Fund for Rural Development (EAFRD)
  - LIFE Climate Action
  - Urban Innovative Actions (UIA)
  - European Territorial Cooperation
  - o Horizon 2020
  - Project Development Assistance (PDA)
- Financial Institutions Instruments
  - European Fund for Strategic Investments (EFSI)
  - Natural Capital Financing Facility (NCFF)
  - European Development Financial Institution (EDFI)
  - Municipal Green Bonds
  - Revolving Funds
- Citizen inclusive financing instruments
- Public-private
  - Private Finance Initiative (PFI)
  - o Preferential loans
  - o Guarantee funds
  - o Soft loans/Dedicated Credit Lines





# 6.1.1 European Structural and Investment funds: European Regional and Development Fund (ERDF)<sup>14</sup>

The ERDF aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. The ERDF focuses its investments on several key priority areas, such as Innovation and research, support for small and medium-sized enterprises (SMEs), low-carbon economy, climate change adaptation and risk management.

The ERDF also gives particular attention to specific territorial characteristics and this action is designed to reduce economic, environmental and social problems in urban areas, with a special focus on sustainable urban development, environmental protection and resource efficiency.

Viability for NBS is good, as well as cooperation of multiple funding mechanism, public-privatepartnership and blended finance.

### 6.1.1.1 <u>The London Green Fund</u>

The London Green Fund (LGF) is a £120 million fund set up to invest in schemes that cut London's carbon emission. The fund was launched in October 2009 by the Mayor of London and the European Commissioner for Regional Policy - the first JESSICA Holding fund in the UK.

It is made up of £60 million from the London ERDF Programme, £32 million from the Greater London Authority (GLA), £18 million from the London Waste and Recycling Board (LWARB), and £10 million from private funding at project level. The European Investment Bank manages the LGF on behalf of the GLA and LWARB.

The LGF provides funding for three UDFs that invest directly in waste, energy efficiency, decentralised energy and social housing projects. They are 'revolving' investment funds, where the money invested in one project is returned and then reinvested in other projects. As of 31st December 2015, the Fund had committed all the funds allocated and invested in 18 projects valued over £500 million<sup>15</sup>.

### 6.1.1.2 Low-Carbon Life in Finland

The ERDF has contributed approx. €300,000 towards a citizens-led initiative aiming at exploring, defining and designing six low-carbon services and consumer-driven projects in the Finnish Municipality of li<sup>16</sup>.

<sup>&</sup>lt;sup>14</sup> <u>http://ec.europa.eu/regional\_policy/en/funding/erdf/</u>

<sup>&</sup>lt;sup>15</sup> <u>https://www.london.gov.uk/what-we-do/funding/european-regional-development-fund/london-green-fund</u>

<sup>&</sup>lt;sup>16</sup> <u>http://www.greenpolis.fi/en/projektit/innohiili-innovative-low-carbon-public-services/</u>

# **HATURE 4** CITIES



### 6.1.1.3 GRaBS - Improved urban planning helps adaptation to climate change

The GRaBS project is enabling urban designers, architects and planners across Europe to create or remodel outdoor spaces and buildings to ensure they are resilient to climate change and extreme weather. The GRaBS project – Green and Blue Space Adaptation for Urban Areas and Eco-towns – sets out to provide the tools and knowledge to ensure that urban development across Europe, both existing and new, is suitably adapted to the impacts of climate change.

Its key objective is to improve capacity and skills in the use of 'green' and 'blue' infrastructure.

The project "GRaBS: Green and Blue Space Adaptation for Urban Areas and Eco-towns" had a total eligible budget of €3.183,000, with the EU's European Regional Development Fund contributing €2.430,000 for the 2007 to 2013 programming period <sup>17</sup>.

### 6.1.2 European Structural and Investment funds: Cohesion Fund (CF)<sup>18</sup>

The European Cohesion Fund is aimed at Member States whose Gross National Income (GNI) per inhabitant is less than 90 % of the EU average. It aims to reduce economic and social disparities and to promote sustainable development. The fund may support NBS-Relevant activities on projects related to energy or transport, as long as they clearly benefit the environment in terms of energy efficiency, use of renewable energy, developing rail transport, supporting intra-modality and strengthening public transport.

### 6.1.2.1 Improved Wastewater Treatment in the Poreč Region, Croatia

The European Cohesion Fund has financed an upgrade in the water and sludge treatment facilities in the region of Poreč in Croatia. Total expected financing is around €28 million for the period 2014-2020.<sup>19</sup>

### 6.1.2.2 <u>New sewage system in Slovakia to reduce pollution and improve quality</u> of life

Upgrades to three waste-water treatment plants, construction of a new sewage system and installation of 47 pumping stations are being carried out in order to improve waste-water collection and treatment in Slovakia's Trenčín and Nitra regions. The work, which is supported by European Union funding, should ensure that sewage systems in the area comply with EU requirements for urban waste-water treatment. The total investment for the project is €81.673,753, with the EU's Cohesion Fund contributing €47.019,184 through the "Quality of Environment" Operational Programme for the 2014-2020 programming period<sup>20</sup>.

<sup>&</sup>lt;sup>17</sup> <u>http://ec.europa.eu/regional\_policy/en/projects/italy/improved-urban-planning-helps-adaptation-to-climate-change</u>

<sup>&</sup>lt;sup>18</sup> <u>http://ec.europa.eu/regional\_policy/en/funding/cohesion-fund/</u>

<sup>&</sup>lt;sup>19</sup> <u>http://odvodnjaporec.hr/</u>

<sup>&</sup>lt;sup>20</sup> <u>http://ec.europa.eu/regional\_policy/en/projects/slovakia/new-sewage-system-in-slovakia-to-reduce-pollution-and-improve-quality-of-life</u>





### 6.1.2.3 <u>Water supply and waste water treatment systems modernised in north-</u> east Romania

The second phase of a project to extend and modernize water supply and waste water treatment systems in Botoşani County, in Romania's North-East region is underway with support from EU funding. The improvements will ensure the continuous provision of clean drinking water, and the reduction of public health risks and environmental pollution in an area with a population of about 186,80 inhabitants.Total investment for the project "Extension and modernization of water supply and waste water treatment systems in Botoşani County - Phase II" is  $\xi$ 71,403.888, with the EU's Cohesion Fund contributing  $\xi$ 47,039.354 through the "Large Infrastructure" Operational Programme for the 2014-2020 programming period<sup>21</sup>.

### 6.1.2.4 <u>Cleaner waste water collection and treatment in Bucharest-Ilfov</u>

Extension of the waste water treatment plant at Glina in the Bucharest-Ilfov area of Romania's Macroregion three is underway with EU support. The second phase of renovations to the main sewerage collection system running beneath the course of the Dâmboviţa river is also being carried out as part of the project. The total investment for the project "Finalisation of Glina Waste Water Treatment Plant, rehabilitation of the main sewer collectors and of Damboviţa sewer collector canal (CASETA) - Stage II" is €390,404.609, with the EU's Cohesion Fund contributing €196,459.342 through the "Large Infrastructure" Operational Programme for the 2014-2020 programming period<sup>22</sup>.

### 6.1.3 European Investment Bank Institute<sup>23</sup>

The EIB Institute was set up within the EIB Group (European Investment Bank and European Investment Fund) to promote and support social, cultural, and academic initiatives with European stakeholders and the public at large. It is a key pillar of the EIB Group's community and citizenship engagement.

### 6.1.3.1 <u>A blueprint for turning a city green<sup>24</sup></u>

Essen was a byword for industrial pollution, but in 2017 it has been named European Green Capital. From its past as a capital of pollution in the heart of the Ruhr industrial region, Essen has changed. In 2017 it was named nominated European Green Capital by the European Commission. The projectisprojects is building more than 400km of new underground sewers and is re-naturalizing 350km of river banks and landscapes. The EIB provided an initial loan in 2011 for €450million, then added a further EUR 450 million covering the period 2014 to 2016. The Bank is working on a third deal for EUR 450 million more. In addition, the loans are for 45 years and have a fixed interest rate,

<sup>&</sup>lt;sup>21</sup> <u>http://ec.europa.eu/regional\_policy/en/projects/romania/water-supply-and-waste-water-treatment-systems-modernised-in-north-east-romania</u>

<sup>&</sup>lt;sup>22</sup> <u>http://ec.europa.eu/regional\_policy/en/projects/romania/cleaner-waste-water-collection-and-treatment-in-bucharest-ilfov</u>

<sup>&</sup>lt;sup>23</sup> <u>https://institute.eib.org/</u>

<sup>&</sup>lt;sup>24</sup> <u>http://www.eib.org/infocentre/blog/all/a-blueprint-for-turning-a-city-green.htm</u>





despite the long maturity. Also, a€340 million loan from the Bank signed in April 2016 will be used to purchase 82 new double-deck electric trains with better energy efficiency, greater capacity and improved passenger comfort.

### 6.1.3.2 <u>Investing in forestry: for the cash flow, but also the violins and the</u> poetry

European Investment Bank has recently invested approximately €30 million with Dasos Capital Oy, an experienced forest investment manager to consolidate a portfolio of around 12,000 hectares of productive forest area in Ireland and ensure its sustainable management. The investment has been included in the Investment Plan for Europe portfolio, partially guaranteed by the European Commission, intending to trigger €315 billion in additional investment in Europe over three years.

With the increased investment, Ireland, currently the country with the lowest forest area of all the countries in the EU, expects to be able to increase that 11% a bit closer to the EU average of 42%<sup>25</sup>.

# 6.1.4 European Structural and Investment funds: European Social Fund (ESF)<sup>26</sup>

The ESF is Europe's main tool for promoting employment and social inclusion; it invests in people, with a focus on improving employment and education opportunities across the European Union. It also aims to improve the situation of the most vulnerable people at risk of poverty. For the 2014-2020 period, the ESF will focus on four of the cohesion policy's thematic objectives: promoting employment and supporting labour mobility; promoting social inclusion and combating poverty; investing in education, skills and lifelong learning; enhancing institutional capacity and an efficient public administration. Focus area are sustainability, quality and mobility of labour, social inclusion, combating poverty and discrimination, education and institutional capacity.

### 6.1.4.1 <u>Gateway per SusCon - Green builders for greener buildings</u>

SusCon has designed new education curricula that integrate learning across disciplines and take sustainability as a core competence. SusCon construction-industry courses take central themes such as energy efficiency, zero-carbon supply, sustainable materials, and biodiversity integration. With national accreditation and strong support from employers, SusCon surpassed its targets after only one year: for example, 417 SMEs signed up to the project against 280 targeted; 441 unemployed participants completed training while 400 were aimed for; and the numbers of students registering and completing courses exceeded expectations.

ESF contribution was approx. £1.000,000 on a total budget of about £2.000,000.<u>http://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=298</u>

<sup>&</sup>lt;sup>25</sup> <u>http://www.eib.org/infocentre/blog/all/investing-in-forestry.htm</u>

<sup>&</sup>lt;sup>26</sup> <u>http://ec.europa.eu/regional\_policy/en/funding/social-fund/</u>

## **HATURE 4** CITIES



# 6.1.5 European Structural and Investment funds: European Agricultural Fund for Rural Development (EAFRD)<sup>27</sup>

The EU's rural development policy helps the rural areas of the EU to meet the wide range of economic, environmental and social challenges of the 21st century. It shares a number of objectives with other European Structural and Investment Funds (ESIF). It complements the system of direct payments to farmers and measures to manage agricultural markets (the so-called "first pillar"). Member States and regions draw up their rural development programmes based on the needs of their territories and addressing at least four of the following six common EU priorities:

- fostering knowledge transfer and innovation in agriculture, forestry and rural areas;
- enhancing the viability and competitiveness of all types of agriculture, and promoting innovative farm technologies and sustainable forest management;
- promoting food chain organisation, animal welfare and risk management in agriculture;
- restoring, preserving and enhancing ecosystems related to agriculture and forestry;
- promoting resource efficiency and supporting the shift toward a low-carbon and climateresilient economy in the agriculture, food and forestry sectors;
- promoting social inclusion, poverty reduction and economic development in rural areas.

### 6.1.6 European Funding Programmes: LIFE - Climate Action<sup>28</sup>

LIFE Climate Action will support projects in the development of innovative ways to respond to the challenges of climate change in Europe and to foster a low-carbon, climate resilient economy. Three priority areas have been identified, such as climate change mitigation through greenhouse gas (GHG) emissions reduction, climate adaptation through higher resiliency, and climate change governance and information, by increasing awareness and encouraging cooperation and information dissemination on climate change mitigation.

### 6.1.7 European Funding Programmes: Urban Innovative Actions (UIA)<sup>29</sup>

Urban Innovative Actions (UIA) is an Initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenge.

Urban Innovative Actions offers urban authorities with the possibility to take a risk and experiment the most innovative and creative solutions. The main objective of UIA is to provide urban areas throughout Europe with resources to test innovative solutions to the main urban challenges, and see how these work in practice and respond to the complexity of real life.

<sup>&</sup>lt;sup>27</sup> <u>https://ec.europa.eu/agriculture/rural-development-2014-2020\_en</u>

http://ec.europa.eu/esf/home.jsp

<sup>&</sup>lt;sup>28</sup> <u>https://ec.europa.eu/clima/policies/budget/life\_en</u>

<sup>&</sup>lt;sup>29</sup> <u>http://www.uia-initiative.eu/</u>





### 6.1.8 European Funding Programmes: European Territorial Cooperation<sup>30</sup>

European Territorial Cooperation (ETC), better known as Interreg, now in this fifth period, provides a framework for the implementation of joint actions and policy exchanges between national, regional and local actors from different Member States. The overarching objective of European Territorial Cooperation (ETC) is to promote a cohesive, harmonious economic, social and territorial development of the Union as a whole. In 2015, Interreg has become the key instrument of the European Union to support cooperation between partners across borders; it aims is to tackle common challenges together and find shared solutions - whether in the field of health, research and education, transport or sustainable energy.

In accordance with the new design of the European Cohesion Policy 2014-2020 and the targets set out in Europe 2020, Interreg has significantly been reshaped to achieve greater impact and an even more effective use of the investments. Key elements of the 2014-2020 reform are concentration, simplification and results orientation.

The fifth period of Interreg is based on 11 investment priorities laid down in the ERDF Regulation contributing to the delivery of the Europe 2020 strategy for smart, sustainable and inclusive growth.



Figure 26: ETC investment priorities<sup>31</sup>

### 6.1.9 European Funding Programmes: Horizon 2020<sup>32</sup>

Horizon 2020 is the biggest EU Research and Innovation programme ever, with nearly €80 billion of funding available over 7 years (2014 to 2020). It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

Horizon 2020 is an initiative aimed at securing Europe's global competitiveness.

By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure

<sup>&</sup>lt;sup>30</sup> <u>http://ec.europa.eu/regional\_policy/en/policy/cooperation/european-territorial/</u>

<sup>&</sup>lt;sup>31</sup> http://ec.europa.eu/regional\_policy/en/policy/cooperation/european-territorial/

<sup>&</sup>lt;sup>32</sup> <u>https://ec.europa.eu/programmes/horizon2020/</u>





Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

Horizon 2020 is open to everyone, with a simple structure that reduces red tape and time so participants can focus on what is really important. This approach makes sure new projects get off the ground quickly – and achieve results faster.

Main focus areas are: public/private building stocks; retail Energy Market Infrastructure, including smart grids; mobility charging points, public lighting, district heating networks, distributed renewables and demand response infrastructure; commercial and logistic properties and sites.

Moreover, H2020 calls focusing on NBS have posed a very specific challenge, i.e. provide a broad and robust evidence base that NBS work as cost-effective climate-resilience and water-resilience solutions.

### 6.1.10 **Project Development Assistance (PDA)**<sup>33</sup>

The European Commission has set up a series of facilities funding Project Development Assistance (PDA) to support ambitious public authorities - regions, cities, municipalities or groupings of those - and public bodies in developing bankable sustainable energy projects. The PDA facilities aim to bridge the gap between sustainable energy plans and real investment through supporting all activities necessary to prepare and mobilise investment into sustainable energy projects. These activities can include feasibility studies, stakeholder and community mobilisation, financial engineering, business plans, technical specifications and procurement procedures. Main focus areas are: SME support, Environment, energy and maritime.

## 6.2 Financial Institutions Instruments

### 6.2.1 European Fund for Strategic Investments (EFSI)<sup>34</sup>

The European Fund for Strategic Investments (EFSI) is an initiative to help overcome the current investment gap in the EU. Jointly launched by the EIB Group and the European Commission, it aims to mobilise private investment in projects which are strategically important for the EU. It helps to finance strategic investments in key areas such as infrastructure, research and innovation, education, renewable energy and energy efficiency as well as risk finance for small and medium-sized enterprises (SMEs). EFSI is managed by the European Investment Bank (EIB). The European Fund for Strategic Investments is delivering concrete results, encouraging a sustainable increase in the low investment levels in Europe after the financial crisis.

<sup>&</sup>lt;sup>33</sup> <u>https://ec.europa.eu/easme/en/project-development-assistance-pda</u>

<sup>&</sup>lt;sup>34</sup> <u>http://ec.europa.eu/growth/industry/innovation/funding/efsi\_it</u> <u>http://www.eib.org/efsi/index.htm</u>







Figure 27: European Fund for Strategic Investments by sector (source [http://www.eib.org/efsi/efsi\_dashboard\_en.jpg])

### 6.2.2 Natural Capital Financing Facility (NCFF)<sup>35</sup>

Under the Natural Capital Financing Facility (NCFF), the European Investment Bank (EIB) provide loans and investments in funds to support projects which promote the preservation of natural capital, including adaptation to climate change, in the Member States. The total budget for the Investment Facility amounts to € 100 – 125 million for 2014-2017. Halting the loss of biodiversity and adapting to climate change requires increasing investment in natural capital that complements the more traditional grant-based funding. The main aim of the NCFF is to demonstrate that natural capital projects can generate revenues or save costs, whilst delivering on biodiversity and climate adaptation objectives. The NCFF is to establish a pipeline of replicable, bankable operations that will serve as a "proof of concept" and that will demonstrate to potential investors the attractiveness of such operations. The NCFF will support projects working on the following themes:

- Payments for Ecosystem Services: projects involving payments for the flows of benefits resulting from natural capital.
- Green Infrastructure: projects generating revenues or saving costs based on the provision of goods and services such as water management, air quality, forestry, recreation, pollination and increased resilience to the consequences of climate change. Examples are green roofs, green walls, ecosystem-based rainwater collection / water reuse systems, flood protection and erosion control.
- Innovative pro-biodiversity and adaptation investments: projects involving the supply of goods and services, mostly by SMEs, which aim to protect biodiversity or increase the resilience of communities and other business sectors. Innovation may relate to new approaches to ecological restoration and/or conservation or innovative business

<sup>&</sup>lt;sup>35</sup> <u>http://ec.europa.eu/environment/life/funding/financial\_instruments/ncff.htm</u>





models such as harnessing ethical investments and adding value to goods and services through certification and standards schemes.

• Biodiversity offsets: are conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects.

# 6.2.3 Non-traditional financial institutions: European Development Financial Institution (EDFI)<sup>36</sup>

A DFI is an alternative financial institution active in developing countries and conventionally backed by sovereign states of developed economies. Its role is to provide access to higher risk loans, especially for large scale infrastructure projects. Notable examples of DFIs and multi-lateral development banks, who are active in green funding, are the World Bank, the European Investment Bank and the European Bank for Construction and Development.

Development Finance Institutions (DFIs) are specialised development banks that are usually majority owned by national governments. DFIs can be bilateral, serving to implement their government's foreign development and cooperation policy, or multilateral, acting as private sector arms of International Finance Institutions (IFIs) established by more than one country.

DFIs invest in private sector projects in low and middle-income countries to promote job creation and sustainable economic growth.

They apply stringent investment criteria aimed at safeguarding financial sustainability, transparency, and environmental and social accountability.

DFIs source their capital from national or international development funds or benefit from government guarantees, which ensures their credit-worthiness. The financial support they bring to relatively high-risk projects helps mobilising the involvement of private capital, bringing in such diverse actors as commercial banks, investment funds or private businesses and companies.

### 6.2.4 Municipal Green Bonds <sup>37</sup>

Municipal Bonds (not necessarily green) are a traditional and time-tested channel for municipalities to finance long-term infrastructure projects, both in the design/build stages and in the operational phases. The issuing of green municipal bonds is a more recent development to finance climate adaptation and mitigation measures, energy efficiency and green infrastructure.

The first climate-specific bond issue on record has been the Climate Awareness Bond (European Investment Bank, 2007), and the market has grown to approx. US\$37 billion annually, in the space of ten years [73].

By combining the characteristics of green projects with the attractiveness of the traditional instrument of municipal bonds (long term, patient capital, trusted issuer etc.) the investors are offered the same

<sup>36</sup> <u>https://www.edfi.eu/</u>

<sup>&</sup>lt;sup>37</sup> <u>https://muninetguide.com/green-bonds/</u>





financial terms as conventional muni bonds, with the added benefit of greenness, as the issuer actively tracks and reports the use of proceeds to comply with the environmental, climate change, green etc. requirements.

The figure below is representing the amount of the Green Bond from 2007-2017 (data are in billions of dollars - Bmo Global Asset Management.



Figure 28: Green Bond amount from 2007 to 2017 (source: Climate Bonds Initiative, MSCI ESG Research, Barclays Research, Bank of America Merrill Lynch. European Investment Bank. 2017 year to date 13 March 2017, https://www.cfasociety.org)

Furthermore, according to a Dec-2016 report published by the Climate Policy Initiative, the single key constraint to green bonds remains credit-worthiness of the issuing city, especially in the case of issuers from developing countries. The report cites the US\$137 million Green Muni Bond from the city of Johannesburg as *the only* bond currently issued by city in a developing nation.

The credit-worthiness of the issuer may be improved through the conventional methods of *structuring*, guarantees and *cornerstone* buyers.

Bond Structuring. The issuer has a wide array of options to attract green capital by addressing issues such as sizing, maturity, debt service and redemption provision.

Guarantees. Conventional interest and debt repayment guarantees by a third party can be used to remove the risk of issuer insolvency.

A cornerstone buyer such as a Development Financial Institution (DFI), development bank or multilateral bank can reduce the risk to investors by acquiring part of the debt as well as providing loan guarantee instruments

Important is the *Climate Bond Initiative* is an international non-profit organization whose mission is to mobilize the bond market to tackle climate change. According to CBI estimates, the potential for green bonds exceeds US\$100 trillion.





### 6.2.5 Revolving Funds

By definition, a revolving fund is a fund or account that remains available to finance project(s) or operation(s), irrespective of fiscal year endings or closing dates. It is understood that the financing organization periodically replenishes the fund by repaying the money used into the account.

For example, a government (at local-, federal- or state-level) may finance the cost of goods and services via a revolving fund, under the assumption that the fund will be replenished by charging the fund's beneficiaries for such goods and services.

An example is "Clean Water State Revolving Fund (CWSRF)", United States. The fund is a partnership between the US Environmental Agency (EPA) and individual states. Recipients are eligible for loans to construct municipal wastewater treatment facilities, to enable pollution control measures and undertake green infrastructure projects.

The fund issues special low-interest loans with the overarching objectives of protecting public health, safeguard valuable water resources and comply with environmental standards.

Loan payments from the beneficiaries are used to replenish the fund's resources.

### 6.3 Citizen inclusion

With reference to the previous list introduced at the beginning of the chapter, the 6<sup>th</sup> category involves citizen that may also be gathered in formal or informal groups.

The role of citizens as owners of land, or of real estate properties, are better described in 6.4 Chapter in particular in City Planning Regulation paragraph.

Citizen considered as individuals who participate to the NBS development, are the one who accept the "will to pay" to have better urban and territorial conditions. This "will to pay" might also be intended as a sort of investment comparing the direct expense in NBS and the consequent improvement of health that could derive that means minor sanitarian expenses. Of course, the direct correlation between these two economic elements should need specific and deep analysis.

It is possible to distinguish two basic typologies of citizen inclusion as follows:

Cooperatives	Defined as "autonomous associations of people [] united to meet common needs and aspirations" they are frequently not-for-profit organizations and may state a specific intervention or action as its mission. May draw upon own funding, third party charitable funding or be granted public funding, usually on an ad-hoc basis.
Crowdfunding	Crowdfunding consists in the aggregation of investors who have no direct link to the project being funded and who must trust the website offering the scheme and the projects' promoters. It generally refers to open calls to the public to raise funds for a specific project.





Sustainable saving account	Deposits on sustainable savings accounts are used to finance energy efficiency and renewable energy sources projects. The citizens, as depositors, become financers and contribute to the achieving energy efficiency goals.
Volunteering	Generally defined as actions intended to promote human quality of life, volunteering may contribute to the promotion of NBS actions both in a structured and freeform, grassroots way. Like cooperatives, may draw upon charitable funding or receive public grants, but only if the volunteering association has some legal status, i.e. statute of incorporation, registration for fiscal purposes etc.
Crowdsourcing experimentation programme for sustainable solutions	This type of programme is based on the concept of crowdsourcing innovative sustainable solutions and financing pilot projects to test their feasibility. Collecting ideas for sustainable solutions directly from local residents and involving them in their implementation has provided acceptance from the local communities for advancing resource efficiency and sustainable development, acceptance that is otherwise in some cases a considerable barrier for such projects.

### 6.4 Public-private

### 6.4.1 Private Finance Initiative (PFI)

PFI is a specific type of Public-Private Partnership whereby two (in rare cases more than two) parties, public and private, enter a typically long-term financial agreement in order to deliver public infrastructure. PFI contracts are commonly funded via bonds issue or senior debt. Therefore, it uses private sector investment in order to deliver public sector infrastructure and/or services according to a specification defined by the public sector.

It is a sub-set of a broader procurement approach termed Public Private Partnership (PPP), with the main defining characteristic being the use of project finance (using private sector debt and equity, underwritten by the public) in order to deliver the public services. Beyond developing the infrastructure and providing finance, private sector companies operate the public facilities, sometimes using former public-sector staff who have had their employment contracts transferred to the private sector through the TUPE process which applies to all staff in a company whose ownership changes. PFI is a special case of public procurement.

A public body signs a contract with a private sector consortium conventionally called a Special Purpose Vehicle or SPV, in that it has been incorporated with the specific purpose of delivering the goods and services under procurement. While traditionally used as a financial instrument for the procurement of traditional infrastructure, PFI lending has seen significant growth in "green" energy projects, especially near shore and offshore wind [74].





### 6.4.2 Preferential loans

The term *Preferential Loan* is used in this instance to mean a government-led initiative whereby capital is advanced at below market rates (similar to soft loans) in order to promote investment in under-developed areas

Preferential loans (usually linked with revolving funds) and credit risk guarantees are considered to be the most frequently used financing tools in policies to stimulate private investment within the European Union.

### 6.4.3 Guarantee funds

While preferential loans are characterized by having their interest rate subsidized by governments, guarantee funds share the credit risk of investments with the investors. Guarantee funds are used to underwrite the losses to the lender should the borrowers miss a payment or default.

If the loan goes into default the debt recovery process will start. If the loan is irrecoverable this can be recouped from the guarantee fund (up to the maximum amount in the guarantee fund). Guarantee mechanisms aim at engaging financial institutions by supporting and sharing the credit risk.

Guarantee funds may be used as a temporary public-sector intervention in order to demonstrate to the financiers that loans are being repaid successfully, thus on the long run gaining their trust.

### 6.4.4 Soft loans/Dedicated Credit Lines

Dedicated credit lines (or soft loans) are a mechanism where public funding decreases the cost of energy efficiency building renovation loans and provides concessions on terms, such as repayment periods. The impact and relative success of dedicated credit lines can also be attributed to their retail distribution through networks of private banks. Many public international financing institutions and national governments are experimenting loan programmes to kick-start the market and fill the debt gap where local and traditional banking sector actors are not active.

In the PE LEAFSKIN® case public and private funding are considered because the municipality of Valladolid considered subsidies to encourage NBS and this NBS allows to place advertising on the bottom of the infrastructure as an additional financial support.

### 6.4.5 City Planning regulations

To enhance public/private cooperation for NBS, there are some implementation models that can be related to city planning activities ad rules. One possibility consists in defining ecological parameters strictly connected with NBS applications and then to define incentive schemes or subsides rules to reach defined targets. One example of ecological parameter that can enter in City Planning regulations is the Biotope Area Factor (BAF, deepened and used in Berlin since the end of the XX century), as it has been applied in the 2017 City Plan of the Municipality of Segrate (Milan, Italy).

For the existing city, the application of specific methodologies such as BAF needs to be guided by the public administration and must be put in action by the private subjects. In order to have the wish to really apply an environmental improvement of the performance of the existing city, it is necessary





to define specific incentive schemes, so to make the private act to enhance the collective environment having a personal advantage.

Therefore, some BAF targets have been defined based on the density and the covered ratio (following the Berlin experience): every transformation of the existing city must reach the BAF targets; if a private stakeholder is able to reach better performances, the half of the percentage of increasing of performance is converted in volumetric bonus. In this way, the virtuous behaviours are not only possible but also subsidized with volume rights.

Another application is the possibility to change the urban functions (i.e. from a less valuable, such as industrial, to a more valuable one, such as residential) maintaining the same density and total built surface parameters with the request to improve BAF values. Another possible application, not inserted in the Segrate City Plan, is related to the direct subsidy consisting in construction taxes reduction when the ecological performance, measured with BAF parameter, reaches a higher value than the defied target. This last aspect is strictly connected to the economical balance that a Municipality is able to provide. Another simpler parameter is the definition of a certain quantity of minimum green surface for each intervention, and guarantee a volumetric incentive scheme when the minimum level is surpassed

### 6.4.6 Conclusions of Financing Mechanism

This chapter has examined conventional funding methods such as public grants and private capital, as well as hybrid models such as preferential loans, ad-hoc debt financing such as green bonds and finally non-conventional methods such as crowdsourcing and charitable giving and/or volunteering.

The suitability of each funding mechanism to NBS implementation has been found to be a matter of scale, as measured across the different dimensions of funders, beneficiaries and NBS actions.

Trying to synthesize some basic concepts, the aspects regarding the NBS scale, the differentiation of actors involved in relation to the government structure and related budget, the specific fiscal system and benefit structures that have been selected could be divided with the following structure:

- Different scales of funding providers (the actors who furnish the economic support);
- Different scales of beneficiaries (the actors who implement the NBS);
- Different NBS scales (specific NBS actions and techniques).

The different typologies of NBS are related to the scale of application, from the large scale urban green corridors (or green infrastructures) to the small scale of private green spaces and single buildings solutions (green roofs, green facades, permeable surfaces).

The economic context in which NBS may have more possibilities of application depends firstly on to the scale of considered NBS; moreover, the typology and hierarchical level of the involved actors, who operate to improve them, define the accessibility to specific funds (i.e. EU funds and EU research projects such as Horizon 2020). It is possible that there is convergence among models in relation with their size.

An interesting study that could be carried out in the following steps of the research, is the interrelations among the economic scale, urban planning strategies and the intervention on the NBS.





In closing we note that when examining such different scales, there emerges at least anecdotal evidence<sup>38</sup> that while the direction of capital is typically *top-down*, with infrastructure funding being controlled and distributed through varying layers of government, the direction of action is typically *bottom-up*, with grassroots initiatives and low-stakeholder count NBS projects taking the lead. This singularity, acknowledged and documented in [105], aligns closely with barriers to adoption detailed in Section 3. Where the proposed action is bottom-up, limited in scale, and typically involving only the lowermost tier of government (neighborhood, borough, town), there exist significant knowledge barriers preventing stakeholders to take full benefit of the more structured and complex funding options, or to engage in debt funding such as municipal bonds.

Contrast this with conventional infrastructure spending (i.e. construction of a length of road, for instance), where the same government layer controlling the capital typically also sets policy and oversees execution of works, possessing all the necessary technical and financial capabilities to appropriate and manage the funds.

This generalized lack of knowledge and capabilities also represents the major barrier to private capital funding, especially for PFI-type projects, which are risk-averse by definition and rely on complex evaluation methods. The inability of proponent stakeholders to address funders' concerns thus limits PFI financing to projects where a clear revenue stream can be identified.

There is therefore ample opportunity to *upskill* the grassroots initiators of NBS projects, as well as the lower tier(s) of government. *NBS Ambassadors* should play an important role as mediators, bridge-builders, technology transfer agents and so on. The above-mentioned "Innohiili" project constitutes a strong example of grassroots-led initiative where a limited number of "experts" have kickstarted a widespread adoption of low-carbon services as a response to climate change.

<sup>&</sup>lt;sup>38</sup> The *Nature4Cities* NBS Implementation Models Database <u>www.nature4cities.wordpress.com</u>





## 7 Business models

The aim of this chapter will be to identify, through the analyses of literature, the characteristics that could help to design a business model or its archetype that could be used by Nature Based Solutions (NBS). Although there is a lot of bibliography that relates sustainability to Business Models, it has not been easy to identify specific information of NBS concept within Business Models literature. One of the reason could lay on the fact that despite of emerging some years ago, the NBS concept has not been sufficiently developed yet.

Hence, the approach selected to address the mentioned objective has been based on exploring the Business Models for Sustainability (BMfS) literature, what seems to be the most aligned concept with NBS concept and moreover, both of them have similar particularities.

## 7.1 Contextualizing NBS concept

According to the European Commission, NBS are "living solutions, inspired and supported by nature, which provide environmental, social and economic benefits, and they help build resilience. Such solutions bring more nature into cities, landscapes and seascapes, through local, resource-efficient and systemic interventions"<sup>39</sup>. Therefore, the possible spectrum of NBS's co-benefits is large and they cover a wide range of topics and technologies, as it was mentioned by the EC<sup>40</sup> (Figure 29).



Figure 29: Diverse & multiple co-benefits<sup>41</sup>

As far as business model concept is concerned, we selected from literature the following description according to the context of this chapter: "the conceptual structure supporting the viability of a

<sup>&</sup>lt;sup>39</sup> Freitas, http://www.alter-net.info/outputs/conf-2017/presentations/tiago-freitas/view

<sup>&</sup>lt;sup>40</sup>Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities'

<sup>&</sup>lt;sup>41</sup> De Boissezon, http://www.alter-net.info/outputs/conf-2015/presentations





business, including its purposes, its goals and its ongoing plans for achieving them, and it is a specification describing how an organization fulfils its purposes".<sup>42</sup>

Finally, the meaning of archetype is "a typical example of something, or the original model of something from which others are copied" <sup>43</sup> or, it is "something that is considered to be a perfect or typical example of particular kind of person or thing because it has all the most important characteristics"<sup>44</sup>

Having clarified those concepts, the aim will be to identify the typical example of conceptual structure that allows supporting the viability of living solutions inspired and supported by nature, which provides environmental, social and economic benefits that help building resilience. All this includes its purposes, its goals, and its ongoing plans in order to achieve them.

## 7.2 Identification of Business Model feasibility into NBS

Within the field of business model for sustainability, there is not a consensus yet about what a sustainable business model might be, however, the literature in this field has evolved in the last years, showing different alternatives to approach it, thus, through the process of analyses of different papers, we propose identifying those appropriate tools for the construction of one Business Model archetype that could fit to NBS.

# 7.2.1 Business Models for Sustainability from a System Dynamics Perspective.

The work of Abdelkafi & Täuscher shows a model that allows getting value to the customers, to the environment, and also value captured by the firm [106]. To obtain these values, these authors propose the creation of feedback loops between environment, customer and firm through the application of System Dynamics.

The process to develop this model was through the analyses of partial models in order to integrate of all of them. In this sense, the model developed has the following features:

- It supports decision makers in understanding how the business model can affect the natural environment
- The model reveals the direct and mostly indirect impact of the natural environment of the firm
- The system dynamics model illustrates the different types of stocks and flows that relate the main stakeholders of a BMfS.
- The model represents important feedback loops by explaining from a stakeholder perspective the rationale of a BMfS.

<sup>&</sup>lt;sup>42</sup> http://whatis.techtarget.com/definition/business-model

<sup>&</sup>lt;sup>43</sup> https://dictionary.cambridge.org/dictionary/english/archetype

<sup>&</sup>lt;sup>44</sup> https://www.collinsdictionary.com/dictionary/english/archetype





### 7.2.1.1 Feedback Loops, Delays and knowledge.

Among the main characteristics of System Dynamics, the identification of feedback loops is quite relevant. There are two types of feedback loops:

- Reinforcing (positive). The system is bound to move in one direction, either growth or decline [106]
- Balancing (negative). This has a balancing effect and counteracts growth or decline leading the system to threshold values [107]

In their study, these authors identify the feedback loops generated through the generation of value to the customers, environment and captured by the firm. Without some of them, it is not possible to make that the model works. This approach is different from the traditional Business Model, which is focused mainly on economic benefits, leaving aside social and environmental issues.

The system dynamics analysis allows identifying delays between the actions and results. The delays that Abdelkafi & Täuscher (2016) identify are the following: between the intention to go towards sustainability and get it, and it could make the managers, with short-term vision/targets, less likely to develop BMfS successfully; a new business that grows with the sustainability beliefs since its inception is more likely to overcome these delays.

Other feedback loop they represent is related to the knowledge. A proactive manager will be worried about acquiring the knowledge that allows him to identify the relationships between its business and the ecological capital. This knowledge will become in beliefs that will allow him to develop the behaviour to adapt or develop new BMfS, but it will take time (delays).

Finally, what triggers the development of a BMfS it is either the knowledge (education) of the decision maker, or the requirements of the customers. This also could be the difference between a proactive and a reactive firm to the environmental issues related to its business.

The paper analyses a case of a *bettervest* as a real example where the timing of implementation, the generation of value and the feedback loops are shown. "*Bettervest is a crowd funding platform, on which people can invest small amounts of money in energy efficiency projects initiated by companies, local authorities, and so on. Investors can contribute 50 to 12.500 Euros to the project and earn money by getting a percentage of the energy cost savings that result from project implementation.*" [106]

It shows how the feedback loops generate value to environment, customer and firm: first, the environment, through the reduction of the amount of GHG emission; second, the customer by the energy savings (less energy consumption = more profits); and finally, the firm which has a fee benefit for each success project.

This case also explains the delays that the owner of the company had to overcome for creating value to environment, customer and firm. The delays were about the lack of funding, in spite of the founder of the firm had the BMfS at least five years before.
# **HATURE 4** CITIES



This case helps to identify and understand with a real example, how the knowledge, the feedback loops and the delays are critical issues that must be addressed and managed, but also highlight, to the NBS, the importance of could quantify the benefits to each part of the TBL.

# 7.2.2 Business Models for Sustainability: Energy Efficiency in Urban Districts.

In their study, Gauthier & Gilomen [108] make a deep analysis of two real cases of energy efficiency in urban districts, and examine all the process through the evaluation of each of the stakeholders that took part in the project, taking as reference the BM elements (Value proposition, the Supply chain, the Customer interface, and the Financial model) described by Boons and Lüdeke-Freund [109]. This analyses allows identifying how some firms have modified their ways to work, depending on the level of penetration in BMfS. This paper also introduces the "collective dimension of sustainable solutions, mainly remarking the role of the agency" [108].

There are three features of this document, that will useful concerning the development of NBS business model. The first one is the level of change in the BM elements, and could be used to identify where the firm is with regard to its sustainable target and their competitors. The second one is the links between customer interface, supply chain, value proposition and financial model. They are very useful in the design of any Business Plan. The last one is the Collective Dimension of Sustainability-Focused Projects which explains some of the changes in the work relation to stakeholders, including all the competitors.

## 7.2.2.1 Level of change in Business Model elements

The proposed classification divided the firms taking into account how many BM elements they had. Thus, they had to change or to transform or to adapt themselves to a more sustainable approach.

- No Changes in BM Elements: The firms that have been classified in this part did not change theirs way of work although they took part in the implementation of solutions.
- Marginal Changes in BM Elements: The firms classified here, although they had deployed some solution changing the value proposition, they did not change in their operational/structure. However, they could get some benefits for subjects as well as reputation and image.
- Substantial Changes in BM elements: These firms have made changes that allow to capture value in a different way. Possibly, these firms have done some modifications in theirs original BM although with the same structure. They have understood that the collaborative work is an essential element to be closer of BMfS. In any case, they also have captured value in different (non-financial) ways, reputation, image, and knowledge.
- Radical Changes in BM elements: In this case, the firms have done a deeply change in their ways of work, addressing them to a new BM models which could mean: new kind of products (even changing its archetype of BM, i.e. selling services instead of products), new ways to connect with their partners (collaborative work), and of course, new ways to generate value and obtaining both tangible and intangible benefits.

# **HATURE 4** CITIES



## 7.2.2.2 <u>Links</u>

Related to the links between customer interface, supply chain, value proposition and financial model, this paper establishes two main relations:

- First, the link of the Customer Interface and the Supply Chain with the Value Proposition Element to Increase Sustainability. There are two ways to do this link: the first one, a "context imposed" that could be associated to reactive firms, and the second one, a "self-determined" that could be associated to proactive firms in their relation to sustainability.
- Second, the link of the Customer Interface and the Supply Chain with the Financial Model Element to Increase Sustainability. It is possible to identify three levels of this link. First, firms that do not do this link is due to the fact that there is not a clear economic benefit in short term. Second, firms that do it thinking in a long term, but getting intangible benefits in a short term. And third, the perspective of public and not-for-profit organizations which could have more motivations than economic, for instance, voters, reputation, etc. "In real-life cases, there may be more drivers of BM transformations than simple financial profits" [106]

## 7.2.2.3 Collective Dimension of Sustainability-Focused Projects

The analyses of the two demo cases allow the identification of the trigger of collective decisionmaking structures which seems to be a more important condition for the emergence of BMfS than the actual nature of the project. This trigger is the level of flexibility of the governance to allow a collaborative work that, as was proved in one the cases analysed, allows to get efficiency in the team and generates a stronger commitment to seek open-ended mutual benefits as well as the building of radical sustainable solutions [106].

## 7.2.3 Conceptualizing a "Sustainability Business Model"

The work of Stubbs and Cocklin [110] deals with the search of a sustainability business model through the analyses of two companies in case studies which considered leaders in operationalizing sustainability. The article highlights the issue that the classic conception of a company (maximize profits for shareholders) could be a hamper for getting into a Sustainable Business Model, and leaving the sustainability in the background. In another way, they use the ecological modernization (EM) perspective of sustainability as one of the drivers they identified. In here, the authors defined the concept as an alternative to the classic conception of business, which can be leveraged through environmental policies, innovation, and new technologies.

Through the analyses of both companies, Stubbs and Cocklin [111] were able to identify the outstanding characteristics that could support a Sustainable Business Model, which in turn, could be applicable to NBS. In addition, they identify the "candidate" characteristics of a Sustainable Business Model which give to NBS a guide of attributes related to TBL<sup>45</sup>, including a multidimensional chapter.

<sup>&</sup>lt;sup>45</sup> In 1994 John Elkington coined the term The Triple Bottom Line (TBL), which target is to measure the economic, social and environmental performance of the firm.





#### 7.2.3.1 Characteristics that could support a Sustainable Business Model

The characteristics that could support a sustainable Business Model are the following:

- Redefining the Purpose of Business: The sustainability as a core of business strategy, which means that not only economic profits have to be taken into account.
- Reporting Financial, Environmental, and Social Outcomes: Triple bottom line reporting is not a sufficient indicator for sustainability, On the other hand, the value of the TBL has to be the same for all the parts (market analysts, customers, firms, regulatory bodies, stakeholders, etc.), and the Market analysts typically placed little value on it.
- Stakeholder View of the Firm: The education and communication between stakeholders in sustainability issues are a necessity, and these will generate co-operation between them and will remove pressure on the short term.
- The Role of Leadership: The leaders have to address the change.
- Nature and Environmental Sustainability: It is so relevant to consider the nature as a stakeholder, but it is necessary to change the behaviour, to develop new technologies, and to work in a collaborative way.
- Modifying the Taxation System: The structure of the tax system is a barrier to sustainability.
- Retaining and Reinvesting Local Capital: "keeping capital local" is a necessary condition for a sustainable society [112] [113].
- An Sustainable Business Model Encompasses the Systems Perspective as well as the Firm-Level perspective: Organizations can make significant progress towards achieving sustainability through their own internal capabilities, but ultimately organizations can only be sustainable when the whole system of which they take part is sustainable [114].

## 7.2.3.2 <u>"Candidate" characteristics of a Sustainable Business Model</u>

The next chart shows the characteristics that according to Stubbs and Cocklin [111] could define a Sustainable Business Model. The chart has two dimensions: one shows the economic, environmental, social and holistic characteristics; and the other explains the structural and cultural attributes. The information on it could be very useful to track the configuration of a NBS Business Model, taking into account that the range of option to a NBS covers a similar range of characteristics showed, and it must maintain a balance between the components of the TBL.

Economic	Environmental	Social	Multidimensional or
Characteristics	Characteristics	Characteristics	Characteristics





	External bodies that track performance of companies use a triple bottom line approach.	Threefold strategy: offsets (do no harm but make amends if you do), sustainable (do no harm), restorative (leave the world better than you found it).	Stakeholder engagement skills: understanding stakeholders' needs and expectations (being relevant to stakeholders).	Systems approach: • cooperative business strategy and planning. • collaborative model including supply chain, competitors, government agencies, communities.
Structural	Lobby industry and government for changes to taxation system and legislation to support sustainability.	Closed-loop systems: responsible for product throughout its lifecycle.	Educate stakeholders; "relentless" communication.	TBL approach to measure organizational performance.
attributes	Keep capital local: local shareholders and investment in local sustainability initiatives.	Implement a services model.	Implement stakeholder consultation program.	Institutionalise sustainability in the business: "relentless" communication, stakeholder education, leadership, champions, and align internal performance measures.
		Industrial ecosystems and stakeholder networks.	Get "buy-in" from internal and external stakeholders.	Demand-driven model, not supply-driven model (driven by what people need, not driven by companies trying to get people to buy more).
Cultural attributes	Profit is a means not an ends.	Treat nature as a stakeholder.	Stakeholder approach (managing the organization for the benefit of all stakeholders and not prioritizing shareholders' expectations above other stakeholders).	Medium to long-term focus.
	Business makes a profit to do something more.			
	"Higher purpose" to business than making money.			





Shareholders invest for social & environmental impact reasons as well as for financial reasons.	Alignment of stakeholder expectations.	Reduction in consumption.
Shareholders temper expectations for short- term financial returns.	Sharing of resources (people, profits, and time) among stakeholders to achieve sustainable outcomes.	
	Relationship building (trust, two-way loyalty, honesty, integrity, and fairness, equity).	

 Table 36: Characteristics of a Sustainability Business Model [111]

# 7.2.4 A literature and practical review to develop sustainable business model archetypes.

The aim of the work of Bocken et al. [115] is to identify sustainable business models by proposing archetypes that could be used as reference models. The research starts with a deeply assessment about the current situation of sustainability concept from business point of view. They identify that developing a business model as usual is not a good option for a sustainable future, so it is necessary rethinking perceptions of value and shift all the business conceptions, giving value to the natural assets. Through the research, the authors identified the lack of information that allows carrying out a comparative between different approaches of sustainable business models and the lack of archetypes.

The main characteristic of this paper is the wide range of information analysed (the authors have compiled the most relevant bibliographical and real cases information by using the most confident data bases). Also it is important to mention the way in which the information was analysed since it gives confidence in the results and allows the use of the archetypes identified as a guide to NBS Model business.

Previous the explanation of the archetypes, it is necessary to clarify what the authors (Bocken et al.) consider as main elements in a business model: the value proposition, the value creation and delivery, and the value capture. They also remark about business innovation the next two highlights:

- The level of ambition of business model innovations needs to be high and focused on maximizing societal and environmental benefits, rather than economic gains only.
- Business model innovations for sustainability may not be economically viable at the beginning, but it may become so in the future due to the regulatory or other changes implemented.





#### 7.2.4.2 Archetypes

The archetypes were classified, in a first step, in groups which describe the main type of business model innovation (Technological, Social, and Organizational) and then, inside of these levels it can be identified the corresponding types of archetypes, as it is shown in the next chart.

The explanations of each one of the archetypes help to identify where the NBS business model is or must be, but more than this, these explanations could help to identify where the firm are today and if its BM is what the manager thought from the beginning. The classification will be a tool very convenient to the Nature Based Solutions Business Model definition.

Groupings	Technological		Social		Organisational			
Archetypes	Maximise material and energy efficiency	Create value from waste	Substitute with renewables and natural processes	Deliver functionality rather than ownership	Adopt a stewardship role	Encourage sufficiency	Repurpose for society/ environment	Develop scale up solutions
	Low carbon manufacturing/	Circular economy,	Move from non- renewable to	Product-oriented PSS -	Biodiversity protection	Consumer Education	Not for profit Hybrid	Collaborative approaches
	Lean	Cradle-2-Cradle	Solar and wind- power based	irces extended	Consumer care - promote	(models); communication and awareness	businesses, Social enterprise	production,
	manufacturing Additive	Industrial		Solar and wind- power based Use	Use oriented consumer health and well-being	consumer health and well-being	Demand	(for profit)
oles	manufacturing	Reuse, recycle,	energy innovations	lease, shared	Ethical trade (fair trade)	(including cap &	ownership: cooperative, mutual, (farmers) collectives	Entrepreneur support models Licensing,
xamp	De- materialisation	re-manufacture	Zero emissions	Result-oriented	Choice editing by	trade)		
ш	(of products/ packaging)	s/ Take back management	Blue Economy	Private Finance	retailers	Product		Open innovation
	Increased	Use excess	Biomimicry	Initiative (PFI)	Radical transparency	longevity	Social and (platform biodiversity regeneration initiatives ('net positive') "Patient / s	(platforms)
	functionality (to reduce total number of products	ality (to capacity The I	The Natural Step	Design, Build, Finance, Operate	, Build, about Operate environmental/	Premium branding/limited		Crowd sourcing/ funding
		(shared ownership and	Slow manufacturing	(DBFO)	societal impacts	availability		"Patient / slow
required)		collaborative consumption)	Green chemistry	Management	stewardship	Frugal business	Base of pyramid solutions	capital" collaborations
		Extended		Services (CMS)		Responsible	Localisation	
		producer responsibility				distribution/ promotion	Home based, flexible working	

Figure 30: The sustainable business model archetypes [115]

The next tables are self-explanatory for each of the archetypes, the information to build these tables has been extracted from "A literature and practice review to develop sustainable business model archetypes" [115]

#### TECHNOLOGICAL





Maximise material and energy efficiency		Do more with fewer resources, generating less waste, emissions and pollution. This archetype contributes towards system-wide reduction of resource consumption.	
	Value Proposition	Products and services that use fewer resources (less pollution and emissions	
BM Elements	Value Creation	Product and manufacturing process innovation - value network reconfiguration - reduce supply chain emission	
	Value Capture	Reduce of cost and waste - Competitive pricing advantage - minimised environmental footprint.	
Examples		Lean Manufacturing - De materialization - low carbon manufacturing	

Table 37: Substitute with renewables and natural processes

TECHNOLOGICAL			
Create value from waste		The concept of 'waste' is eliminated by turning waste streams into useful and valuable input.	
BM Elements	Value Proposition	Eliminate the waste concept	
	Value Creation	Close Material loops - eliminate life cycle waste	
	Value Capture	Turn waste into value - reduce footprint - Economic and environmental cost are reduce	
Examples		Industrial symbiosis - Cradle 2 cradle - closed loop Business Model	

Table 38: Create value from waste

#### TECHNOLOGICAL





Substitute with renewables and natural processes		This archetype seeks to reduce environmental impact of industry by substitution with renewable resources and natural processes.
BM Elements	Value Proposition	Increase business resilience by reducing material constraints
	Value Creation	Innovation in products and production process design - introducing renewable resources - mimicking natural systems - new value network - new partnership to deliver holistic nature inspired solutions.
	Value Capture	revenue associated with new products and services - reducing emissions and the use of non-renewable resources
Examples		Substitution with renewable resources - The Natural Step - local renewable energy solutions - environmentally benign materials and production processes

#### Table 39: Substitute with renewables and natural processes

Social			
Deliver functionality, rather than ownership		Delivering functionality on a pay-per-use basis, rather than selling ownership of a product. This archetype has the potential to change consumption patterns.	
BM Elements	Value Proposition	Provide services instead of own physical products - shift form manufacturing to use of product - reducing production.	
	Value Creation	durability, reparability and up gradability - direct consumer contact and education - supply chains become more integrated	
	Value Capture	consumer pay for services - change in the ownership concept - access to expensive products - market potential of new products	
Examples		Product-orientated PSS (maintenance)- Use orientated PSS (rental) result orientated PSS (pay per use)	

Table 40: Deliver functionality, rather than ownership

Social





Adopt a stewardship role		This archetype seeks to maximize the positive societal and environmental impacts of the firm on society. Through their business models, firms actively seek to contribute to sustaining and developing the well-being of their value networks.
BM Elements	Value Proposition	Product and services intended to engage with stakeholders - ensure long-term health and wellbeing
	Value Creation	Production systems and suppliers selected to deliver environmental and social benefits - alternative suppliers.
	Value Capture	Brand value and potential for premium pricing - wellbeing and health = long term benefits - healthy workers =less sick days = more productive
Examples		Biodiversity Protection - Consumer care - ethical trade - radical transparency about environmental/societal impacts

#### Table 41: Adopt a stewardship role

Social			
Encourage sufficiency		Tackling sustainability from the perspective of sustainable consumption. On a systems level, this could reduce overconsumption, and hence material and energy throughputs.	
BM Elements	Value Proposition	Solutions to reduce the demand-side consumption (durable modular). the focus of such innovation is on the consumer relationship and influencing consumption behaviour.	
	Value Creation	Less is consumed and wasting - product redesign for durability - shift in promotion and sales - supplier selection based on durability - discourage overselling.	
	Value Capture	Profitability (premium pricing) - customer loyalty - increases market share - educated society	
Examples		ESCOS -Slow fashion - Product longevity - Market places for second hand goods - Frugal business models	

Table 42: Encourage sufficiency





Organisational			
Re-purpose the business for society/environment		Prioritizing delivery of social and environmental benefits rather than economic profit. This archetype focuses on the changing fiduciary duty and structure of a firm for social and environmental.	
BM Elements	Value Proposition	Prioritising delivery of social and environmental benefits rather than economic profit - close integration between the firm, local communities and other stakeholders	
	Value Creation	Creating social benefits (secure - livelihoods) environmental (regenerating flora and fauna) - Participatory business approach (NGO`s) - Embracing employee ownership.	
	Value Capture	Health and education at a low environmental cost	
Examples		Social enterprises (for profit) - Non for Profit - Social and biodiversity regeneration initiatives - localisation - Hybrid business model - cooperative, mutual (farmers) collectives.	

Table 43: Re-purpose the business for society/environment

	Organisational			
Develop scale-up solutions		Delivering sustainable solutions at a large scale to maximize benefits for society and the environment. This archetype is introduced to consider the scale-up and widespread presence of business models for sustainability.		
	Value Proposition	Scaling sustainability solutions to maximise benefits for society and the environment.		
BM Elements	Value Creation	Ensuring a sustainable business model solution can achieve scale by employing the right channel, and partnering with others, new and potential unusual partners (e.g. government for infrastructure change) and business relationships are required to scale the business.		





Value Capture	Ensuring a variable or fixed fee is paid for scaling up a solutions / venture and that other mutual benefits between partners are achieved through scaling up.	
Examples	Licensing - franchising - collaborative models (Crowd sourcing/funding - collaborative approach) Incubators and Entrepreneur support models.	

Table 44: Develop scale-up solutions

# 7.2.5 Business cases for sustainability: the role of business model innovation for corporate sustainability.

Schaltegger et al. propose that "a business case for sustainability can be created by addressing business case drivers. Furthermore, it argues that to strategically create business cases for sustainability on a continuous basis, it requires an innovative business model which supports the management of voluntary social and environmental activities in addressing the business case drivers in a systematic manner" [116].

To get the target of this paper, the authors used different tools, which can be used by NBS in the path to develop an archetype of Business Model adapted to its targets. The first tool is the identification of core drivers of business cases for sustainability. The second is the definition of different kinds of corporate strategies, according to its predisposition to sustainability. The third is the identification (according to relevant literature, mainly Ballon in [117]) of a general business model concept where four central pillars have been identified, 1) Value proposition. 2) Customer relationship. 3) Business infrastructure. 4) Financial aspects). The fourth and according to Mitchell and Coles 2003 [118] is the identification of the degrees of business model innovation that finally could design an integrated framework of sustainability strategy, business case drivers and business model innovation.

#### 7.2.5.1 Drivers of business cases for sustainability

Through different authors such as Christmann [119], Epstein and Roy [120], Schaltegger and Wagner [121,122], [121], Porter and van der Linde [123,124], Jones and Rubin [125], van Marrewijk [126] Ehnert [127], Revell et al.[128], Cohen and Winn [129] and Pujari [130] Schalteger et al. identified the drivers that are shown on the next chart:





Core business case drivers	Exemplary authors
Costs and cost reduction	e.g., Christmann (2000), Epstein and Roy (1996)
Risk and risk reduction	e.g., Schaltegger and Wagner (2006)
Sales and profit margin	e.g., Porter and van der Linde (1995a, 1995b)
Reputation and brand value	e.g., Jones and Rubin (1999), van Marrewijk (2003)
Attractiveness as employer	e.g., Ehnert (2009), Revell et al. (2010)
Innovative capabilities	e.g., Cohen and Winn (2007), Pujari (2006), Schaltegger and Wagner (2011)

Table 45: Core business case drivers for the business case for sustainability [116]

#### 7.2.5.1 <u>Typologies of sustainable strategy</u>

Schaltegger et al. [116] have defined the typologies of the firms in order to classify the level of penetration in sustainability, so they take into account that BMfS must be more than products (solutions), this classification is relevant to identify whether the firm/organization is in the right path according to its sustainable strategy.

- Defensive (limited integration): Defensive strategic behaviour is often a reaction on (perceived) cost-constraints. Managers deal with sustainability issues in a narrow, reactive manner. The main motivation behind defensive strategies is to comply with the legislation.
- Accommodative (integration): This strategy reflects a cautious modification of internal processes and the modest consideration of environmental or social objectives such as environmental protection, eco-efficiency or occupational health and safety.
- Proactive (full integration): Proactive strategies integrate environmental or social objectives as part of the core business logic in order to contribute to sustainable development of the economy and society.

The next chart explains the relation between the core drivers of business and corporate sustainability strategy. The use of this information to BMfS has two main goals: first, the identification of current strategy, and second, the identification of what the firm must do in order to become what it wants.





		Corporate sustainability strateg	3,
Core drivers of business cases for sustainability	Defensive	Accommodative	Proactive
Costs and cost reduction	Mainly cost and efficiency-oriented compliance activities (often 'low hanging fruit' only)	Cost and efficiency-oriented activities actively pursued and linked to sustainability issues when possible	Cost and efficiency-oriented activities actively created to achieve sustainability goals; cost concept includes external social costs
Risk and risk reduction	Sustainability issues seen as sources of risk; activities aim at risk reduction (in contrast to precaution)	Sustainability and risk management seen as complementary and opportunity-creating concepts	Sources of high risks are largely removed
Sales and profit margin	Products or product communication are adapted to reduce risks of sales decrease; cause-related marketing to 'attach' a green image to unchanged products	Sustainability-oriented customer segments are partly acknowledged and served with specific products (besides existing conventional product lines)	Market-oriented strategies to gain competitive advantage by making sustainability-oriented products and services become the core of the company's portfolio
Reputation and brand value	Reputational activities, rather reactive and mainly oriented towards risk reduction	Sustainability activities have limited potential to contribute to reputation and brand due to mainly internal focus	Sustainability is actively communicated and is a major driver of reputation and brand value; the company engages in boundary-spanning and stakeholder integration
Attractiveness as employer	Increased salaries to retain and attract personnel	Sustainability engagement (and related communication) partially increases attractiveness to some groups of employees and talents	Continuous education, innovative positions, social attention (e.g., towards families) increase attractiveness to highly skilled workforce and new talents due to high sustainability reputation
Innovative capabilities	Innovations to obscure non-performance with regard to sustainability (e.g., 'greenwashed' products)	Process, product, and organisational innovations limited by boundaries of existing business logic	Sustainability-oriented process, product, and organisational innovations transform business logic; sustainability problems and stakeholders are considered a key source of innovation

Table 46: Interrelations between corporate sustainability strategies and business case drivers [116]

The chart below easily allows the identification where the firm is in each of the core drivers in relation to the generic business model pillars allowing a diagnostic that could facilitate the design of the route towards sustainability either through changes in the current Business Model or through the implementation of a new Business Model for sustainability. This is possible by doing emphasis in the NBS characteristic.





		Generic busines	s model pillars		
Core drivers of business cases for sustainability	Value proposition (VP)	Customer relationships (CR)	Business infrastructure (BI)	Financial aspects (FA)	
Costs and cost reduction	Products and services with lower energy or maintenance costs for customers	Cost-efficient contracting relationships, closed-loop service systems	Costs of new products and services can be lowered through partnerships	Balancing cost reductions for customers and cost structures of new products and services to increase profitability	
Risk and risk reduction	Lowering societal risks through products and services can create value to certain customer segments	Service-relationships reducing sustainability risks for customers result in higher customer loyalty	Resources, activities, and partnerships set-up in order to minimise internal and external risks	Improved risk and credit rating resulting from lowered sustainability risks	
Sales and profit margin	Environmentally and socially superior products and services require modified or new VPs to turn into sales and profits	Higher customer retention and customer value as a result of sustainability-oriented, service-intense relationships	New products and services may require strategic partnerships (e.g., coopetition) to overcome market barriers	New products and services and/or new customer relationships contribute to diversified revenue streams	
Reputation and brand value	Sustainability as distinctive element of good corporate reputation	Sustainability as marketing feature of the brand increasing customer loyalty	Strategic partnerships with sustainability leaders can increase reputation and brand value	Sustainability performance leading to a good rating and the consideration in sustainability indices and funds	
Attractiveness as employer	A companies' offerings and VPs allowing for personal identification to attract employees	Better customer service as a result of higher employee motivation	Attractiveness as principal can enhance the quality of activities, resources, and partnerships	Reduced costs for HR acquisition, less fluctuation costs and lower compensation costs	
Innovative capabilities	Unfolding the full sustainability-potential of innovations enables modified or new VPs	Innovative products and services creating solutions to sustainability problems, improving customer retention	To allow for innovations to unfold may require new activities, resources, and partnerships	Higher innovation potential and expectations for profitable innovations leading to an increase of shareholder value	

Table 47: Interrelations between business model and business case drivers [116]

Finally, the next chart draws the effects that could be of the implementation, or not, of a strategy that the firm addresses toward sustainable models, relating the strategy to the right way of implementing that allows aligning the strategy itself and the Business Model.

The chart also shows the degree of business model innovation, which looks to have a direct relation with the strategy of the firm. These degrees are explained bellow.

"Business model adjustment refers to changes of only one business model element, excluding the value proposition. Business model adoption refers to changes that mainly focus on matching competitors' value propositions. Business model improvement takes place when substantial parts of the business model elements are changed. Business model redesign exists in a focused sense when an improvement leads to a completely new value proposition" [116].





Sustainability strategies	Degree of business model innovation	Effects of addressed drivers of business cases for sustainability	Contribution to business cases
Defensive	Business model adjustment*	Mainly cost and efficiency-oriented measures aim for low-hanging fruit and thus only require moderate (if any) business model changes. Accordingly, only a minor number of	Ν
	Business model adoption*	business elements (excluding the value proposition) are affected. Sustainability issues are primarily perceived as <i>risks</i> leading to protective behaviour, while <i>reputational activities</i> are of a rather cosmetic nature.	
Accommodative	Business model improvement	Cost and efficiency-oriented measures are pursued actively and partly linked to sustainability issues. Together with sustainability-oriented risk management this can require very basic changes like renewing production processes, changing value network partners, or approaching new market segments. A general orientation towards external addressees in terms of reputation, brand, and attractiveness to employees can require basic changes in customer relationships and business processes.	sustainability
Proactive	Business model redesign (in a focused sense)	As proactive strategies feature radical changes to the core business logic of a company, a major number of business model elements will be affected. Sales and profits are improved by environmentally and socially outstanding products and services, leading to not yet available value propositions. Cost and efficiency-oriented measures are applied to support the new products and services and to gain competitive advantage through sustainability performance, which in turn pays in terms of risk management, reputation and corporate brand value. As innovative drivers unfold their full potential the company becomes increasingly attractive to high-skilled employees.	Business cases for

Note: \*Mitchell and Coles (2003, p.17), on which this classification is based, themselves reduce the lowest two degrees of business model innovation to one category.

Table 48: Framework for business cases for sustainability and integrated business model innovation [116]

# 7.3 Critical Analysis

As already mentioned, the NBS concept is relatively new, and because of this there is not – at the moment- a specific Business Model Archetype that fits totally into NBS. However, taking into account that one of the targets of NBSs is related to the restoration of ecosystems and sustainable urbanization, it has been proposed the links between business models and sustainability through literature exploration. According to this, the previous section has shown a summary of the literature related to Business Model for Sustainability.

One of the findings of the review has been that there is not a consensus about a definition of Business Model for Sustainability. Therefore, it has been decided to explore available tools in the literature that would allow the development of a process to develop NBS Business Models according to the N4C project's objectives.

Taking into account the characteristics of NBS related to scale, stakeholders involved in the process and typology of solution used, it is important to highlight that there is not unique Business Model structure or archetype that could be useable for all solutions. Therefore, it has been proposed to address the design of a Business Model for NBSs throughout the process of answering the following questions:

- What kind of firm is it?
- Where the firm is?
- Where does the firm want to go?
- · What should the firm take into account to achieve its objective?





## 7.3.1 What kind of firm is it?

The first question tries to identify whether the firm is private, not profit, public institutions, other. This is important because depending on the nature of the customer (public / private) will change the sense of the perceived value and the way to set up the business. For example, for a public institution, the value to adopt any kind of NBS could be related to votes or reputation, instead of get an economic benefit.

Another answer to this first question is whether the firm is a new venture or an established company. This is relevant because of the necessity of issues such as: the culture of the company, the knowledge of the team about sustainability and NBS, the beliefs of the manager that will allow him (or not) to address the firm to the target, the commitments previously acquired, etc. These answers will determine the form of designing the path to take. In any case, it is easier to define and introduce a strategy in a new venture.

The third answer is to identify the typologies of sustainable strategy or the level of change of a Business Model, which will allow knowing in a first round whether the firm is willing to make changes in its Business Model structure and classifying it with a strategy: defensive, accommodative or proactive.

	Public /Private /Other	Public	
		Private	Sense of the perceived value and the way to set up the business
		Not for profit	
	Established / New	Established company	Culture/ Knowledge/
What kind of		New Venture	Beliefs/Commitments
firm is it?	Typologies of sustainable strategy	Defensive	Reaction on cost-constraints. Managers deal with sustainability issues in a rather narrow, reactive manner.
		Accommodative	Cautious modification of internal processes / modest consideration of environmental or social objectives
		Proactive	Integrate environmental or social objectives as part of the core business logic

Table 49: Typologies of sustainable strategy - Established / New - Public /Private

# **HATURE 4** CITIES



## 7.3.2 Where the firm is?

The answer to this question requires a self-analysis. It means the use of tools that helps to identify whether the firm is really where it thinks. In any case, the response to this could be the classification of the firm at different levels, depending on the driver and its relation to a Corporate Sustainability Strategy and the driver to a generic Business Model Pillar. The tools to do this identification will be the chart from the section 7.2.5: Interrelations between corporate sustainability strategies and business case drivers and the structure of the chart Interrelations between business model and business case drivers [116].

While the first question aims to identify the strategy of the firm, in this second question it is necessary to identify the relation of the strategy with the drivers, which will require a more detailed analysis.

A self-analysis to identify what the company does, relating drivers and Business Model Pillars, is presented in the following table, going in a deeply analysis of the Business Model of the company.

Interrelations between business model and business case drivers		Drivers of business cases for sustainability					
		Costs and cost reduction	Risk and risk reduction	Sales and profit margin	Reputation and brand value	Attractiveness as employer	Innovative capabilities
	Value						
	proposition						
Gonoric	Customer						
Business	relationships						
Model Billars	Business						
Model Fillars	infrastructure						
	Financial aspects						

Table 50: Structure of the table Interrelations between business model and business case drivers [116]

## 7.3.3 Where does the firm want to go?

This question will help the firm to identify the path to get a NBS business plan, in any case, it has to be replied by each company or organization. An appropriate tool for such objective is the chart of used by Bocken al. [115], which includes a wide range of Archetypes of Business Models for Sustainability that could be applied to the NBSs' business models.

## 7.3.4 What should the firm take into account to achieve its objective?

To do this, it will be necessary to bear in mind the next considerations which have been drawn from the analyses of the all literature reviewed, but mainly from the *Conceptualizing a "Sustainability Business Model"* from Stubbs and Cocklin [111], *Business Models for Sustainability from a System Dynamics Perspective from Abdelkafi, and Täuscher,* [106] and *Business Models for Sustainability: Energy Efficiency in Urban Districts* from Gauthier and Gilomen [131]:

- Include the nature as a relevant part of the strategy.
- The decision maker has to have the beliefs that allow him to address the business towards sustainability.
- Education and training to all the value chain, is an imperative to get success.
- The search for the value has to be of the customer, the environment and the firm.





- The long term will be a characteristic of the Business Models for NBS developing the skills, designing and implementing the NBS Business Plan and looking for sponsors that getting the target.
- Tax and regulation have to change for boost the implementation of NBS.
- The focus on the strategy must be enough wide to integrate Economic, Social and Environmental characteristics, keeping a good balance among them. This is important due to a TBL approach.
- The approach will not be only in the economic part.
- The looking for of closed-loop that takes into account the Life Cycle analysis.
- Collaboration between all the stakeholders is a condition in this kind of business models. (Collective dimension, cooperation, coopetition, collaborative model, etc.)

## 7.3.5 Conclusions of Business Models.

As main conclusion of the literature reviewed of Business Models for Sustainability, is that, there is not only one option to get a NBS Business archetype. This is due to the heterogeneity of the possible Nature Based Solution to be implemented. On the one hand, it is not the same design for a Business Model or a new venture than for a firm with a current Business Model implemented. On the other hand, a public body doesn't capture value in the same way as a private company does, (which mean that the approach will be different), etc. In any case, there are enough tools that allow giving an answer to each of the cases as the analysis in the previous sections shows.

However, taking into account that it will be necessary to have a business model typology flexible enough to fit with different alternatives of NBS, it is considered that the model proposed by Bocken et al. [115] is the better alternative. It includes the categorization of eight business model archetypes divided in three groups (see next figure) that embrace a wide range of options.

GROUPINGS	ARCHETYPES	
	Maximize material productivity and energy efficiency	
Technological	Create value from waste	
	Substitute with renewables and natural processes	
	Deliver functionality, rather than ownership	
Social	Adopt a stewardship role	
	Encourage sufficiency	
Organizational	Re-purpose the business for society/environment	
	Develop scale-up solutions	





Table 51: The sustainable business model archetypes [115]

Finally, the three business model elements that had been defined to identify each of the Business Models Archetypes (value proposition, value capture and value creation and delivery) will address the targets that any NBSs' business model should cover:

- To create competitive advantage through superior customer value and contributes to a sustainable development of the company and society [132].
- To improve the quality of human life [133].
- To build on the triple bottom line approach to define the firm's purpose and measure performance [111].
- To align the interests of all stakeholder groups, and explicitly consider the environment and society as key stakeholders [115].





# 8 Management strategies

A new management strategy to promote the installation and maintenance of NBS is essential. This should provide a good optimization of the selection, installation and maintenance of NBS. It seems clear that to ensure the success of the NBS, a strategy that only promotes its installation is not enough. It is necessary to design a good management strategy that serves to promote its installation, makes its maintenance sustainable and even to create an adequate framework for the development of NBS business in the city.

There will be companies with demonstrated experience in different sectors like construction or gardening that must adapt them to the new requirements of a global economy in the climate change adaptation. In this chapter, first, the general basics of strategic management will be described. Before different kinds of management strategies will be introduced.

# **8.1** Strategic management

The strategic management deals with the planning and implementation of strategies in companies [134]. From the economic point of view, strategies are the starting point and midpoint of strategic management. The general understanding of it includes the following characteristics according to Hungenberg [135]:

- Strategic management decisions affect the basic direction of company development. An Integrated City Strategic Plan is a Key element for the city and NBS should have specific areas
- A strategic plan describes a target state and outlines a method of how to reach it. The plan will describe the ways a company can achieve its goals and work towards a desired state. In the NBS case, City Strategic Plans should define city challenges and the use of NBS to face them. An integrated Plan should include different sub-plans on green space management, water management, mobility, etc.
- The purpose and objective of a strategic plan is to ensure the long-term success of a company, which also keeps the company competitive. Strategic planning generally involves the process of developing a strategy. To achieve the long-term objectives of the city, a strategic plan is necessary. Its implementation and execution will make the city maintain the levels of satisfaction of its citizens in the values it considers appropriate.
- Strategic decisions seek to secure future success by co-determining the internal and external alignment.
- Strategic decisions help to create success potential.
- Strategic decisions must be made from a cross-cutting perspective. An integrated strategy covers all of the areas of the municipality and includes different aspects affecting the city, people, mobility, green spaces, etc.
- The direction of a company can only be affected if an action plan is done using organizational units.





With N4C project, the planning and implementation of strategies in companies that following these characteristics is related to NBS.

An innovation strategy is a part of the strategic management. It is the cornerstone of what makes businesses successful. Strategic innovations, such as the development of a new business model or the implementation of an innovative management method, offer the opportunity to stay sustainable competitive.

Good project management ensures that the goals of projects closely align with the strategic goals of the business. A project can never be successful until and unless it manages to align with its strategic objectives. The achievement of the final objective of a project on schedule and on budget is a key challenge for many companies. Without a project management threatens, the risk of unclearly objectives, unrealistic planning, budget over drafting, poor quality deliverables, a late delivery etc.

# **8.2** Management strategies for NBS projects

With N4C project, the planning and implementation of strategies in municipalities and companies that following these characteristics will be related to NBS.

From NBS point of view, it is necessary to know the impact of the actions / interventions in a management context. There are methodologies that calculate this impact, because each NBS generate several impacts at different scales. It could be important to include into NBS maintenance plans some indicators to evaluate the impact and the performance of each NBS. There are some methodologies that can be used as it is shown in deliverable from T2.1<sup>46</sup>. As a general example of methodology that is yet available, EKLIPSE project has published an impact evaluation framework to support planning and evaluation of nature-based solutions projects [8].

Another management strategy to consider is the working relationship between companies and public management. The NBS actions/interventions needs a direct implication by both. The challenges and limitations regarding public management, already mentioned, should be taken into account. Most of NBS are living elements that should be careful of them. On the other hand, long-term planning is important for most public infrastructure. The length of a development cycle can be very short, perhaps lasting as little as 30 years for some buildings from starting to build to eventual demolition, but trees can live much longer [136].

The table below shows an overview about four different types of management strategies and includes short explanations that were analysed for the energy sector through the authors of the report CITYNVEST [137]. This report is prepared by Sofia Energy Centre within the framework of Horizon2020 CITYnvest project. Although it deals with the field of energy, it can be transferred also to NBS solutions and some comments have been included in this respect.

<sup>&</sup>lt;sup>46</sup> N4C\_D2.1 System of integrated multiscale and multithematic performance indicators for the assessment of urban challenges and NBS.





Management strategies	Description	Comments to NBS
Program Delivery Unit	The Program Delivery Unit (PDU) is the organization that is specifically set-up to execute or facilitate the program or project. It is often a separate legal entity, but can also be a department or project team within an existing organization	In NBS case, municipalities or companies could adapt this model when the process/project/implementation is relatively resources and operational tools intensive and leads to more long completion times
Aggregation	The projects of multiple beneficiaries are bundled into a single larger project. Aggregation is done to create economies of scale both operationally and financially. companies could carry out the works at lower prices and with a simplified procedure.	This method could be interesting in the case of several public tenders in order to implement different NBS. If only one project/public tender process is opened, the same company or group of
Project finance	A financial way to relate success projects with revenues/grant could be the use of a Project Finance. Project Finance (PF) is the creation of a new company or a Special Purpose Vehicle (SPV). This financial tool is used to fund big projects with high financial needs. Companies and partners are part of equity of the SPV. Rest of the liabilities would be the new debt acquired by the SPV.	
Integrated Project Delivery	Integrated Project Delivery (IPD) is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all of design, fabrication, and construction[138].	

Tabla E2.	Management strategies and synlandians
I able SZ.	

Implementing a scheme and coordinating projects can be executed by a Program Delivery Unit (PDU). According to CITYNVEST [137] PDU is the organization that is specifically set-up to execute or facilitate projectors the development of project programs. It is often a separate legal entity, but can also be a department or a project team within an existing organization. According to CITYNVEST PDU can deliver different types of services to the beneficiaries depending:

• In the **Facilitation model** the PDU facilitates the projects by assisting the beneficiaries during the reparation, the tendering process and the follow-up of the projects. In this model, PDU does not take on the technical and performance risks of the project; those remain on the beneficiary's shoulders. An example for a facilitation model is the Berlin Energy Saving Partnership. It was initiated for improving energy efficiency in public buildings in Berlin. The





partnership was formed by the Federal state of Berlin and the Berlin Energy Agency (BEA). The role of the PDU takes BEA and acts as a. project marketer, aggregator, facilitator and also as a financial advisor for the beneficiaries of the program. An existing NBS example is Gomeznarro park: storm water retention in Madrid<sup>47</sup>.

- In the Integration model on the other hand the PDU acts as an intermediary. This means that the PDU acts between the beneficiary and the contractors or subcontractors. ESCOLIMBURG2020<sup>48</sup> is an example for an integrated model from Belgium. This program is successfully helping to reduce emissions by municipal buildings with smart investments and actions. INFRAX, a provincial energy grid, has acted as a PDU in 46 projects. The partnership is completed with the provincial consultancy institute, entity that is specialized in sustainable buildings, the municipality and eventually other partners. The aim of this partnership is to accelerate the energy renovation of municipal buildings. This model could serve as an example for NBS promotion as green roofs and green walls for building renovation (with isolating purposes). It is defined as a variation of the two previous introduced models Facilitation model & Integration model where the projects and/or the beneficiaries can be bundled/pooled and/or aggregated in one or more larger project units
- **Bundling/pooling** means that the beneficiary or the PDU bundles/pools the projects in one or more single projects to increase the size of the projects in order to make these feasible and/or to create economies of scale both operationally and financially [137]
- **Aggregation** means that the PDU bundles the projects of multiple beneficiaries into a single larger project. Aggregation is done to create economies of scale both operationally and financially. The aggregation service can include bundling/pooling of projects. This approach requires that the PDU is entitled to act on behalf of the beneficiaries[137]. An existing NBS example is Sustainable Stormwater Management project in Malmö<sup>49</sup>

Every project implementation usually requires a financial basis, especially for the implementation of big projects. A financing model to relate projects with revenues/grant could be the use of a Project Finance. Project Finance is the opposite of the classic corporate-credit-rating-based-financing. It is the establishment of a new company or a Special Purpose Vehicle (SPV). A SPV is a legal entity established for a clearly defined purpose. SPV is a subsidiary of a company that attempts to isolate risk from the main organization (parent company). The purpose of it is to allow the parent company to make highly leveraged or speculative investments without endangering the entire company. If the SPV goes bankrupt, it will not burden the parent company. Companies and partners are part of the equity of the SPV. This form of financing is used to fund big projects with high financial needs. After reaching the purpose, the SPV can be dissolved.

On the other hand, we have seen that using, for instance, a green infrastructure approach, can save money (e.g. heating costs or public health) and even increase value (e.g. sales and rental value of

<sup>&</sup>lt;sup>47</sup> NBS-IM DATABASE - https://nature4cities.wordpress.com/2017/12/04/gomeznarro-park-storm-water-retention-madrid-2014/

<sup>&</sup>lt;sup>48</sup> www.escolimburg2020.be

<sup>&</sup>lt;sup>49</sup> NBS-IM DATABASE - https://nature4cities.wordpress.com/2017/04/10/sustainable-stormwater-management-in-malmo/





buildings), but a question is who makes those savings or gains these benefits (and who bears the costs). There are clearly two types of beneficiary: individuals and commercial organisations (Private), and Society (Public) [139]. Many of the ecosystem services that are delivered through a green infrastructure approach (e.g. moderating local climate, reducing pollution, conserving pollinators) are not kind of values that would motivate a business and can be classed as primarily Public benefits. Other services are clearly of direct Private benefit: such as a reduction in heating or air-conditioning costs, faster sales/take-up of commercial premises and one can see how, provided the return was clear, Private interests would find them attractive

Policy, regulations, incentives and taxes all have a part to play in encouraging the take-up of green infrastructures and especially the greening of sealed surfaces [136].

Integrated Project Delivery (IPD) [138] is a management method in which integrated projects are uniquely distinguished by highly effective collaboration among the owner, the prime designer, and the prime constructor, commencing at early design and continuing through to project handover according to AIA's definition. IPD is based in several principles that will be described below.

1. Mutual Respect and Trust

In an integrated project, owner, designer, consultants, constructor, subcontractors and suppliers understand the value of collaboration and are committed to working in close collaboration in the best interests of the project.

2. Mutual Benefit and Reward

All participants or team members benefit from IPD. Due to the need of early involvement by more parties required by the integrated process, IPD compensation structures recognize and reward early involvement. Compensation is based on the value added by an organization and it rewards "what's best for project" behaviour, such as by providing incentives tied to achieving project goals. Integrated projects use innovative business models to support collaboration and efficiency.

3. Collaborative Innovation and Decision Making

Ideas are freely exchanged among all participants and are judged on their merits, not on the author's role or status. Key decisions are evaluated by the project team and made unanimously.

4. Early Involvement of Key Participants

In an integrated project, the key participants are involved from the first moment. Decision making is improved by the influx of knowledge and expertise of all key participants. Their combined knowledge and expertise is most powerful during the initial stages of the project where decisions have the greatest effect.

5. Early Goal Definition

Project goals are developed early, agreed upon and respected by all participants. Insight from each participant is valued in a culture that promotes and drives innovation and outstanding performance, holding project outcomes at the centre within a framework of individual participant objectives and values.





#### 6. Intensified Planning

The IPD approach recognizes that increased effort in planning results in increased efficiency and savings during execution.

#### 7. Open Communication

In IPD's focus responsibilities are clearly defined in a no-blame culture leading to identification and resolution of problems, disputes are recognized as they occur and promptly resolved. Team performance is based on open, direct, and honest communication among all participants.

#### 8. Appropriate Technology

Integrated projects often rely on innovative technologies which ought to be specified at project initiation to maximize functionality, generality and interoperability. Open and interoperable data exchanges are essential to support IPD.

#### 9. Organization and Leadership

The project team is an organization where leadership is taken by the team member most capable with regard to specific work and services. Often, design professionals and contractors lead in areas of their traditional competence with support from the entire team, however specific roles are necessarily determined on a project-by-project basis. Roles are clearly defined, without creating artificial barriers that chill open communication and risk taking.

In **Erreur ! Source du renvoi introuvable.**, a comparative can be seen between traditional design process and IPD process. The main difference is that major part of the work is moved to pre-design and design phase while in the traditional process major part of the work was concentrated in implementation phase.







Figure 31. IPD versus traditional process: workflow [138]

Due to this change on the workflow, possible clashes, mistakes or interferences are identified and solved during the design process. The consequence of this is that implementation phase is much more agile, not having to re-design parts in parallel to implementation works due to problems detected on site. This produces savings in time, in money, in work and avoid re-doing work. This is especially interesting in the case of public tenders that are more rigid and possible modifications provokes many problems.

In addition, the early integration of technical inputs of the different guilds (constructor, installers, providers, etc) will highly enrich the design and give to it a higher level of completion even before starting the detailed design phase. This will be shaped in less effort and difficulty when realizing the implementation documentation.

Somehow, this process of moving forward several activities has consequences also in decisionmaking process. Decisions related to how is something done or who is doing something were traditionally postponed to implementation phase among other thing because in some cases it was not known until then all the stakeholders that would be implied in the process. When following IPD process, as all the stakeholders are known and implied from the beginning, tasks can be distributed among entities implied and have all the processes to be followed defined from the very beginning of the project. This can be seen in Figure *32. IPD versus traditional process: decision making process* Figure *32.* 







Figure 32. IPD versus traditional process: decision making process [138]

All the traditional biding methods are applicable but not all of them will offer the same opportunities for IPD. Design Bid Build is a very rigid system and does not offer opportunities for IPD. Multi-prime has some flexibility in order to relatively adapt to IPD. Design Build offers enough flexibility to adapt in good measure to IPD. Construction Manager at Risk is the best suited for IPD. IPD is on itself the name of another bidding method but not currently extended. In this method, all the stakeholders are involved from the initial phase and share risks and rewards.

As seen in the previous text, IPD is a very interesting management methodology for NBS as it allows close collaboration between stakeholders, implication of different stakeholders from the beginning, early definition of the objectives and actions to be taken and sharing of risks and grants.

Projects, in which different stakeholders are implied, should take into account the implications of the close collaboration between architects or urban plans developers with environmental engineers or biologists, for example. This helps the definition of the interventions as architects or urban planners will give a technical input when defining the restrictions of building process or of planning norms while biologist or environmental engineers will give technical inputs on which types of plants should be chosen or about operational issues that should be taken into account in order to enable the good performance of the natural processes implemented.

Obviously, the knowledge of the stakeholders is complementary and it needs to be crosschecked in order to do a better technical definition of the interventions taking into account all the variables that are affecting the process and the results.





#### 8.2.1 Barriers and drivers. IPD methodology example.

This management methodology is very suitable for NBS as it allows avoiding several barriers as uncertainty or technical inadequacy due to the early technical definition of the interventions and the possibility to have feedback from all the implied stakeholders in the early stages avoiding like this unexpected errors during execution phase. This fact also helps to avoid budget constraints and uncertain economic feasibility as the budget can be readjusted in the early stages and probably, as unexpected issues during execution phase will be minimized, budget variations will be minimized. Disconnection between short-term actions and long-term goals will also be avoided due to the intensified planning applied in this methodology. The complexity of the governance structure caused by implying all the stakeholders from the early stages is also solved by applying open communication and a proper organization and leadership.

Barriers for NBS avoided by applying IPD methodology			
	Barrier	Way of avoiding it with IPD	
e	Uncertainty	Early technical definition and early feedback of all the	
wledg	Technical inadequacy		
Kno	Unexpected errors during execution phase		
my	Budget constraints	Budget readjusted in the early stages a	
Econo	Uncertain economic feasibility	phase with the consequent minimization of budget variations	
Governance	Disconnection between short term actions and long-term goals	Intensified planning	
	Complexity of governance structures	Open communication and proper organization and leadership	

#### Table 53: Barriers for NBS avoided by applying IPD methodology

In the same way that barriers can be overcome, there are enablers that are favoured by applying IPD management methodology. Co-creation and collaboration as well as information accessibility and sharing are favoured by the collaborative way of working enabled by the implication of all the stakeholders since the early phases and the clear organization of the work as well as the open communication principle also favour the coordination. This way of working lead to a co-creation and co-production between the stakeholders because the results are the result of a conjoint work. Regarding economical, sharing risks between the stakeholders with IPD methodology. Self-financing and self-management are also principles of the methodology because the group of stakeholders





stablishes its own management structure and in major times there is no public financing though it could be included in the structure.

	Enablers for NBS used by applying IPD methodology			
	Enabler	Way of using it with IPD		
Knowledge	Co-creation	Early implication of the stakeholders and clear organization of the work		
	Information accessibility and sharing	Open communication		
Economy	Sharing risks	Principle of the partnership established between stakeholders with IPD		
	Self-financing and self- management	Proper management structure and major times proper financial management		
Governance	Collaboration	Early implication of the stakeholders and clear organization of the work		
	Coordination	Open communication and proper organization and leadership		
	Co-creation and co-production	Conjoint work of the stakeholders		

Table 54: Enablers for NBS used by applying IPD methodology

Participatory and planning governance aims to improve the citizens' perception on urban nature. Concurrently, the implement of management strategies with NBS the potential for economic opportunities and green jobs will notably increase. New NBS business are going to open. All NBS could contribute to the generation of employment and economic power in a direct or indirect way.





# 9 Implementation context

The selection of a specific IMs for a NBS project is going to be as influenced by the technical and financial characteristics of NBS type as by the context where is going to be implemented. In the following sections issues regarding regulatory, socio-cultural and economic contexts are analysed in order to see their influence for NBS implementation.

# 9.1 Regulatory contexts

The European Union motto "United in diversity" could not better reflect the wide range of municipalities, counties, provinces, regions, etc. and the different ways in which they run and develop their communities and territories.

Each country is characterized by three levels of tiers:

- national;
- regional;
- local.

The characterization of administrative-government systems between member states have been performed through the analysis of the local level (i.e. municipalities) and the regional level (i.e. the intermediate organization of the government between the local and the national level), according to the outcomes of the Study "Urban Development Programmes in the Context of Public Administration and Urban Policy" from Tosics and Dukes [140]. One of the main findings of the study is that the central influence over Urban Development Programmes depends more on the urban policy framework of the central government than on the model of public administration of a country. Indeed, countries with strong national (regional) urban policies, sufficient decentralisation of public administration to the municipal level and use of governance methods at the local level open up possibilities for successful UDPs. For these reasons, the national administrative level was not considered, but attention was focused on lower government levels.

## 9.1.1 The local Government Level

As introduced by Page and Goldsmith, a first distinction can be made between integrated and nonintegrated administrations [141]. This differentiation is closely connected with the competence given to local governments. In the Northern countries local governments are large and have general functional competence while in the Southern countries local governments are small with either general or limited competences.

In the case of local municipalities, there is a trade-off between size and power, as for general competence a given minimum size is required. The power of local governments is sometimes mixed up with the position of the mayor: elected or appointed.

## 9.1.2 The Intermediate Government Level

The following typologies are based on the outcomes of Tosics et al. [140], integrated with the 3.2 study within the ESPON programme [142] and the EU project entitled "GREEN SURGE" [74]:

Nature4Cities – D1.2 – NBS Implementation Models Typology 138/178





- Federal state, i.e. for example Austria, Belgium, Germany, Switzerland;
- Regionalised unitary countries, i.e for example Italy, Spain;
- Decentralised unitary countries with strong local and regional levels, i.e for example France, United Kingdom, Poland;
- *Centralised unitary countries with strong integrated local levels*, i.e. for example Finland, Norway, Denmark, the Netherlands, Sweden, Estonia, Latvia, Lithuania, Slovenia;
- *Centralized unitary countries with strong but non-integrated local levels*, i.e. for example Portugal, Bulgaria, Czech Rep., Hungary, Romania, Slovakia, Cyprus, Malta;
- *Classic unitary countries*, i.e. for example Greece, Ireland, Luxembourg.

In the integrated type, the size of local governmental units is a larger, as it is determined by the supposed optimal size for the effective provision of public services (e.g. Scandinavian or Anglo-Saxon systems).

In the non-integrated administrative systems, preference is given to local autonomy over the aspect service provision. Local government are typically small (most settlements might have their own municipality), and integrative institutions are set up to ensure the coordination required for public services.

Unitary countries have been examined considering the following aspects:

- number of intermediary levels;
- strength of the intermediate levels (general/limited competence, elected/appointed governmental);
- extent of government units integration.

The classification is thus correlated to the power of local and regional levels of government.

More than a third of European countries have more than one regional government level. Usually one of the levels has power and responsibilities stronger than the others and the different functions are split between them in order to avoid conflicts.

A synthesis of the regulatory contexts in European countries is shown in the following table.

Political system (Intermediate levels of government systems based on Tosics/Dukes 2005, with alterations based on ESPON <sub>3</sub> )	Classic Unitary Countries
	Centralised Unitary Countries with strong but non- integrated local authority level
	Centralised Unitary Countries with strong integrated local authority level
	Decentralised unitary Countries with strong local and regional level
	Regionalised Unitary Countries





	Federal States
Tiers of government	National
	Regional (number of provinces, counties, etc.)
	Local (number of municipalities)
	Elected/strong functional competence
Analysis of middle tier	Elected/weak functional competence
(regional level)	Appointed/strong functional competence
	Appointed/weak functional competence
Analysis of local	Large/strong functional competence
level	Small/strong functional competence
(size versus competence)	Large/small functional competence
	Small/small functional competence

Table 55: Synthesis of the regulatory contexts in European countries [143]

# 9.2 Socio-cultural context

Social context refers to social setting in which people live, interact and develop. It may also be referred as environment surrounded by people, their culture and their social institutions. Social, economic and environmental benefits of an NBS is an important issue and the positive impact of an NBS on social life is an expected outcome of it. In this section, the social and cultural context of NBS is explained with a special focus on implementations related citizen representation and participation, urban development, urban regeneration, and spatial planning.

## 9.2.1 Citizen representation and participation

Considering that a NBS has to be developed as a comprehensive approach, the contribution of nature-based solutions to a socially inclusive urban development becomes one key point of the implementation. Participative approach might be considered as a requirement for socially inclusive development. As in the results of the task 8.1 stated<sup>50</sup>, based on the surveys, participative approach is a clear requirement by citizens, experts and municipalities. Participation (and/or representation) is a way making sure that the varying wants and needs of the population are considered [5]. It is not "very easy to access and to implement in all consulted municipalities" (D8.1). Reducing complexity

<sup>&</sup>lt;sup>50</sup> D8.1: Requirements of the Nature4Cities solution (p.152)





by participation and representations as requirement of the urban planning seems to be emerged as another key issue in the surveys. The participation and representation can make the NBS implementation easy and smooth. In the Turkish case, for instance, it can be said that if the NBS projects are implemented by municipalities or government support increases the possibility of the social acceptance of the NBS since the elected mayor represents the society and their commitment to the implementation increases the credibility of the NBS. On the other hand, in Milano, the council's master plan influences the most of the decision. In Alcalá de Henares, national and regional regulation in urban planning and environment and municipal ordinances mostly influence the implementation of NBS. "In United Kingdom, the Local- and Neighbourhood plans are subject to consultation with the community and are adopted by full council of the elected member, who are the democratically elected representatives of the people."<sup>51</sup>

Society's contribution to the implementation of an NBS can be significant if the NBS in a specific region can provide some knowledge about the sustainability practices. Unfortunately, local or national level referenda are not always applicable; however, this does not necessarily imply failure or unacceptance of NBS. Indeed, perceptions about excess benefits to the regional and national level may overcome the desire of the citizen's participation to the decision making process.

## 9.2.2 Urban development

NBS are also deployed to emphasize the social, economic and environmental benefits in urban development. As stated in Vucici ,et al. [144] "The general disproportion of urban development and the socio-economical crisis in Serbia, followed by a number of acute and chronic stressors, as well as years of accumulated trauma, prevented the parallel physical, mental and social adaptation of society as a whole. These trends certainly affected the quality of mental health and well-being, particularly on the vulnerable urban population, increasing the absolute number of people with depression, stress and psychosomatic disorders." The result in the above study indicates that the NBS can significantly improve the mental health and well-being of the urban population. An improvement on mental health and well-being lead the population to keep their original place. For the NBSs in Turkey, it is quite common to see that keeping the original population in place is substantially important. As the benefits of the place increase, people more engage to the original place and prefer stay in there. NBS the risk of staying in a place increases.

NBSs may show the characteristics of integrated urban renewal since they may develop technology, employment and adds values to the country's economy. That would be a benefit to the population. As the implementations are not targeting large areas or masses, it is not very common to observe that NBS has extensive physical interventions thus, for instance in Çankaya, the population is not directly affected by NBS, especially in the short run.

<sup>&</sup>lt;sup>51</sup> D8.1: Requirements of the Nature4Cities solution (p. 143)





#### 9.2.3 Neighborhood urban regeneration

NBSs "are deployed to advance urban renewal processes and the regeneration of neglected and degraded areas to enhance the livability of a city" [145]D. E. Massimo et al. in [146] states that "*urban regeneration emerged during the last decades as suitable model for an integrated sustainable urban development*". The regeneration policies should be supported by local authorities and obviously this policy is a subject for social acceptance issue related to the NBS. Once the risk and benefits of the NBS are determined the excess benefits led local stakeholders to implement urban regenerating polices.

The most widely observable NBS types can be gentle urban renewal since they do not focus on direct transformation of the cities or regions. Those implementations are generally aimed through subtle changes in urban daily lives which keep the original population in place without demolishing established structures. However, the integrated urban renewal can still be observed since some NBSs provide regional and even national benefits to society in general and extensive physical interventions are not widely observable.

#### 9.2.4 Spatial planning systems

Mark Et al. states that "*Nature-based solutions have emerged as a concept to operationalize an ecosystem services approach within spatial planning policies and practices to fully integrate the ecological dimension alongside traditional planning concerns.*" [147] The comprehensive integrated approach when NBS has both regional and country level impacts in German, land use management in UK, and urbanism tradition in Mediterranean model when the NBS focuses on the local needs are some examples for the spatial planning policy implementations. As stated in Besze and Lukovics [148] after Hungary joined the European Union, spatial planning policies became important and intensively implanted as a requirement of eligibility for EU financial support. However, in Turkey, there is no such generally applied spatial planning systems in terms for NBS, since, unlike regional economic planning of French model, in Turkey there is no central approach. In Turkish case, the projects or implementations are initially targeted changes in local places. Therefore, the spatial planning inside of those projects can affect only determined districts in generally cities, since the applications are performed by mainly municipalities or local institutions which can be supported by main government.

## 9.3 Economic context

Following a general description of the main elements that emerge from the previous chapters (2, 3, 4, 6), in the present chapter it is presented a specific application at the urban scale about the economic aspects regarding NBS implementation models. Governance, Financing, Business and Management (Chapter 2 step 4 of Implementation Models) are elements that must have a complex relation with Chapter's 3 main themes: Knowledge, Governance and Economy.

The different defined approaches, categories and characteristics related to NBS, involve diverse the actors (institutional and private); they also have a strict connection with the government structure and related budget; they depend on the specific fiscal system and benefit structures. All these main aspects must be taken into account to define the economic context in which NBS are implemented.





In particular, the economic context in which NBS may have more possibilities of application depend firstly one the scale of considered NBS. From the big scale represented by the European Ecological Network to the very small scale represented by interventions on singular private buildings, different actors are involved. This is an aspect that is related to the Chapter's 3 theme Knowledge.

About the Governance models, a general top-down hierarchical scheme, starts from the EU scale, passes through national scale, regional scale, metropolitan scale, municipality scale and carries to individuals or formal or informal groups of citizens. In fact, there is a strong pressure towards fiscal decentralization, i.e. general assumption that transfer of powers should be accompanied by transfer of economic independence.

As it is well known, the principle of subsidiarity and the passage from a rigid government system to a governance one, that underlines the bottom-up process, re-distributed the political and economic roles and responsibilities. In this sense, the scale of application of NBS and the scale of economic support are not similar but they have a merging that creates more possibilities of implementation.

Shifts in governance over time leading to shifts in economics and relative balance of power. There is a strong pressure towards fiscal decentralization, i.e. general assumption that transfer of powers should be accompanied by transfer of economic independence. Nature Based Solutions and Green Infrastructure are usually implemented at lowest tier. Taxable income (individuals) or profit/capital (corporations) may be benefit-based i.e. according to the benefit the taxpayer receives (i.e. council tax excised by local municipality may contain elements of sanitation, effluent treatment, waste management etc.)

## 9.3.1 NBS at the cities' scale

At the urban scale, some typologies of NBS may be defined considering different sources of financial procurement:

- a) public green spaces (parts of the local ecological network i.e. core areas or corridors);
- b) private green spaces;

c) diffuse natural urban quality in private spaces (definable in example with parameters such as the Biotope efficiency of urban area that involve green roofs, green facades, permeable surfaces, etc.).

According to the EU Directives about Ecological Networks (from Directive 92/43/CEE "Habitat" on), the public subject is the one who has to build, own and manage the green spaces that generate the local ecological network, so the possibility to have founding depends on the public budgets or on the accessibility to Regional or European funds.

About the public green spaces, the local budget defines the economic boundaries of Municipalities' actions. Considering that the city scale actions (small scale and mid-tier) are usually managed by Municipalities, it is important to underline that they have the political and economic control of the investments at the local scale, while wider scale intervention involve a sort of inter-institutional agreement.





Normally, the local budget is built on the balance composed by several income voices (in which taxation is the most relevant) and the expenses voices (see in example the ring-fenced spending of Greater London Authority 2017, Figure 33).

Green spaces and ecological network may assume different weights in terms of public investment depending on specific political decisions and on the economic availability. The political decision about public services is fundamental, and it addresses the whole behavior of the Municipality. The recent definition of "ecological services", that connects the NBS to "urban commons", such NBS assume the same role of public services, so they can become a part of the budget as well as schools, hospitals, public transportation and so on. As is has been underlined in previous chapters, the time of public expense is immediate, the rent related to NBS investments follows nature timing, so the political sphere must be able to have long term program. Investments in other public services sectors (i.e. in public buildings or in classical public works such as roads, cycle lanes) may have a faster visible effect, and the political decisions might be infected by this issues: because of the low common perception of the benefits that NBS procure, the public investment may be oriented to more tangible elements.

About the public property of green spaces, the possibility to acquire more quantity of spaces to increase public NBS (the procedures depend on specific national and regional regulations) can be improved designing City Planning Strategies: instruments such as urban planning standardization and TDR (Transfer of Development Rights) involve the private subjects attributing private building rights having in exchange the transfer of area property from private to public. These are procedures that do not involve public economic expenses but that concern an assessment between the value of the transferred area (i.e. ecological value of a green land) and the environmental impact of the new buildings (using instruments such as Strategic Environmental Assessment or Impact Assessment).






Figure 33: Example of ring-fenced spending - Greater London Authority 2017

#### 9.3.1 Barriers

Historically taxation has been levied mostly at the highest tier, i.e. central level. Thus, lower tiers of government i.e. city councils and lower, have had to depend on higher tiers for funds. This barrier has been gradually overcome by the overall trend of decentralization of power. However, decentralization of power has not always resulted in decentralization of funding or fiscal autonomy.

The perception of NBS as public value, and the subsequent political approaches to the theme is one of the highest barriers. The economic difficulty of (different scales) public bureaus may affect the global public investments and, unless NBS are basic and primary goals of a political program, it is difficult to forecast big investments that have e different rent timing in comparison with the administrative political mandate.

Public action must be helped by private one and an efficient public-private economic relation is fundamental. In urban and regional planning, the public-private effective cooperation has been developed, but the low public relevance of NBS may be a barrier to define practical actions.





#### 9.3.3 Enablers

The ability to levy taxes at the local level represents the main enabler, as transfer of funding between tiers is usually ring-fenced, i.e. funds are earmarked in advance for specific measures.

Decentralization may be also an enabler because it encourages the action at the very local scale and at the Municipality level. The more the scale is limited, and the more the involved subjects are few, the more the practical actions have effectiveness.

Moreover, the coordinated action among different local actors may have relevant results.

The quality of urban spaces and environments is strictly connected to real estate value; in recent times the global perception of the urban quality as related to NBS is growing and it facilitates the strategies application: specific investments on communication surely improve this aspect.

The ecological issues are more and more present in political programs, so related public investments in NBS are easily accepted by the population.





# **10** Typology of Implementation Models

The final selection of the implementation model for a specific NBS project is going to be influenced mainly by the NBS type itself (technical and financial characteristics) and by the context (including barriers and drivers). This relationship will be deeply analysed in T 5.5<sup>52</sup> but in this section an initial link between the analysed IM models, barriers, drivers and NBS types is addressed. The following tables show these links using a code colour that shows the degree of connection that ranges from a strong link to a conflicting one.

<sup>&</sup>lt;sup>52</sup> Task 5.5: Development of a characterization grid for NBS Implementation Models





## **10.1** Typology of Governance Models

#### 10.1.1 Link with barriers and drivers

																					PR	OCES	SS IN	HIBI'	TORS	AND	ENA	BLER	S																			
											BAR	RIERS	5																					C	DRIVE	RS												
			KNOW	/LEDG	E				(	GOVER	RNAN	CE						ECON	юму	,					KNO	WLED	GE							GOVE	RNAN	CE							E	CONOI	MY			
	TYPOLOGY OF IMPLEMENTATION MODELS	BK1	BK2 BK2	BK4	BK5	BG1	BG2	BG3	BG4	BG5 PC6	050	BG8	BG9	BG10	BG11	BE1	BE2	BE3 BE4	BE5	BE6	BE7	DK1	DK2	DK3	DK4	DK5	DK6	DK7	DK9	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG10	DG11	DE1	DE2	DE3	DE4	DES	DE6	DE/ DFR	DE9	DE10
	CLUSTER 1: Traditional public administration																																															$\Box$
	Hierarchical governance																																															
	Closed governance																																															
	Participatory planning & budgeting																																															
	CLUSTER 2: New Public Management																																															
	Public-private partnership (PPP)																																															
ELS	Business-led self-regulation																																															
00	CLUSTER 3: Private-private partnerships																																															
Σ u	Non State Market-driven governance (NSMD)																																															
NC	Business–NGO partnerships																																															
<b>NA</b>	Sustainable Local Enterprise Networks (SLEN)																																															
VEF	CLUSTER 4: Societal Resilience																																															
69	Co-management																																															
	Civic ecology practices																																															
	Self-governance/grassroots initiatives																																															
	CLUSTER 5: Network Governance																																															
	Collaborative governance																																															
	Adaptive governance																																															
	Adaptive co-management																																															
			st	trong	ly lin	ked		mod	erate	ely lir	nked		mo	odera	ately	confl	icting	3	st	rong	ly cor	nflict	ing																									

Table 56: Link between governance models and barriers and drivers





### 10.1.2 Link with NBS types

										NBS types							
							I. Objects								II. Actions	& strategies	
				I.1/ On th	e ground				1.2/ \	Water	1.3/ C sti	On building ructures	II.1/ Gre mana	en spaces gement	II.2/ Waste management	II.3/ Protection strategies	II.4/ Urban planning strategies
	TYPOLOGY OF IMPLEMENTATION MODELS	Parks and gardens	Structures associated to urban networks	Food and resources production	Choice of plants	Works on soil	Ecological restoration	Erosion control	Water bodies & hydrographic network	Wetlands & built structures for water management	Green roofs	Green walls & facades	Human interventions	Use of fauna			
	CLUSTER 1: Traditional public administration																
	Hierarchical governance																
	Closed governance																
	Participatory planning & budgeting																
	CLUSTER 2: New Public Management																
	Public-private partnership (PPP)																
ELS	Business-led self-regulation																
O	CLUSTER 3: Private-private partnerships																
≥ ⊔	Non State Market-driven governance (NSMD)																
NO N	Business–NGO partnerships																
AN <sup>S</sup>	Sustainable Local Enterprise Networks (SLEN)																
< EF	CLUSTER 4: Societal Resilience																
09	Co-management																
	Civic ecology practices																
	Self-governance/grassroots initiatives																
	CLUSTER 5: Network Governance																
	Collaborative governance																
	Adaptive governance																
	Adaptive co-management																

strongly linked

moderately linked

moderately conflicting

strongly conflicting

Table 57: Link between governance models and NBS types





## 10.2 Typology of financing mechanisms

#### 10.2.1 Link with barriers and drivers

																						PRC	DCES	S INH	HIBIT	ORS	AND	ENA	BLER	S																				
											BA	RRIE	RS																							DRIV	ERS													
					~-													_																	~ ~															
			KNO	WLED	GE					GO	VERNA	NCE						E	CONC	JIVIY						KNOV	VLEDO	βÈ							GOVE	ERNAI	NCE							'	:CONG	OIVIY				
	TYPOLOGY OF IMPLEMENTATION MODELS	BK1	BK2	BK3	BK4	BK5	BG1 BG2	200	BG4	BG5	BG6	BG7	BG8	BG9 PC10	BG10 BG11	BE1	BE2	BE3	BE4	BE5	BE6	BE7	DK1	DK2	DK3	DK4	DK5	DK6	DK7	פאת	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG10	DG11	DE1	DE2	DE3	DE4	DES	DE6	DE7	DE8	DE9	DE10
	CLUSTER 1: PUBLIC FINANCING																																																	
	ERDF																																																	
	Cohesion Fund																																																	
	European Investment Bank																																																	
	European Social Fund																																																	
	EAFRD																																																	
	LIFE - Climate Action																																																	
	Urban Innovative Actions																																																	
	European Territorial Cooperation																																																	
	Horizon 2020																																																	
S	Project Development Assistance																																																	
ISN	CLUSTER 2: FINANCIAL INSTITUTIONS																																																	
AN	European Fund for Strategic Investments EFSI																																																	
Ŀ	Natural Capital Financing Facility NCFF																																																	
Β	European Development Financial Institution																																																	
5NG	Municipal Green Bonds																																																	
NCI	Revolving Funds																																																	
NA	CLUSTER 3: CITIZEN INCLUSION																																																	
Ξ	Cooperatives																																																	
	Crowdfunding																																																	
	Sustainable Savings Account																																																	
	Volunteering																																																	
	Crowdsourcing (sustainable)																																																	
	CLUSTER 4: PUBLIC-PRIVATE																																																	
	Private Finance Initiative PFI																																																	
	Preferential Loans																																																	
	Guarantee Funds																																																	
	Soft Loans/Dedicated Credit Lines																																																	
	City Planning Regulations																																																	
				stron	gly l	inke	d	m	oder	ately	linke	ed	n	node	erate	ly co	nflic	ting		stro	ongly	con	flicti	ng																				_		_				_

Figure 34: Link between financing mechanisms, barriers and drivers





#### 10.2.2 Link with NBS types

										NBS types							
												II. Actions	& strategies				
				I.1/ On th	e ground				1.2/ \	Water	1.3/ 0 str	n building ructures	II.1/ Gre mana	en spaces gement	II.2/ Waste management	II.3/ Protection strategies	II.4/ Urban planning strategies
	TYPOLOGY OF IMPLEMENTATION MODELS	Parks and gardens	Structures associated to urban networks	Food and resources production	Choice of plants	Works on soil	Ecological restoration	Erosion control	Water bodies & hydrographic network	Wetlands & built structures for water management	Green roofs	Green walls & facades	Human interventions	Use of fauna			
	CLUSTER 1: PUBLIC FINANCING																
	ERDF																
	Cohesion Fund																
	European Investment Bank																
	European Social Fund																
	EAFRD																
	LIFE - Climate Action																
	Urban Innovative Actions																
	European Territorial Cooperation																
	Horizon 2020																
S	Project Development Assistance																
ISM	CLUSTER 2: FINANCIAL INSTITUTIONS																
AN	European Fund for Strategic Investments EFSI																
E.	Natural Capital Financing Facility NCFF																
Ξ	European Development Financial Institution																
5NG	Municipal Green Bonds																
NCI	Revolving Funds																
NA	CLUSTER 3: CITIZEN INCLUSION																
Ξ	Cooperatives																
	Crowdfunding																
	Sustainable Savings Account																
	Volunteering																
	Crowdsourcing (sustainable)																
	CLUSTER 4: PUBLIC-PRIVATE																
	Private Finance Initiative PFI																
	Preferential Loans																
	Guarantee Funds																
	Soft Loans/Dedicated Credit Lines																
	City Planning Regulations																

strongly linked

moderately linked Table 58: Link between financing mechanisms and NBS types strongly conflicting

moderately conflicting





## **10.3** Typology of business models

### 10.3.1 Link with barriers and drivers

																				I	PRO	CESS	INHI	BITO	RS AN	ID EN	ABLE	RS																			
										В	ARRIE	RS																					DI	RIVER	S												
			KNOV	VLEDG	E				G	OVERN	NANCE						ECO	ONO	МҮ					KN	NOWLI	DGE							GOVER	NANCE	E							ECC	DNON	ΛY			
	TYPOLOGY OF IMPLEMENTATION MODELS	BK1	BK2	BK3 BK4	BK5	BG1	BG2	BG3	BG4 RG5	BG6	BG7	BG8	BG9	BG10 BG11	BE1	BE2	BE3	BE4	BE5	BE6	BE7	DK1	DK2	DK3 DK4	DK5	DK6	DK7	DK8	DG1	DG2	DG3	DG4	DG5	DG7	DG8	DG9	DG10	DG11	DE1	DE2	DE3	DE4 DE5	DE6	DE7	DE8	DE9	DE10
	Technological																																				$\square$									$\square$	
	Maximize material productivity and energy efficiency																																				$\Box$										
S	Create value from waste																																														<b>—</b>
DEL	Substitute with renewables and natural processes																																														<b>—</b>
101	Social																																														1
SS N	Deliver functionality, rather than ownership																																														
NE	Adopt a stewardship role																																				$\square$									$\square$	
ISU	Encourage sufficiency																																													$\square$	1
B	Organizational																																														Γ
	Re-purpose the business for society/environment																																				$\square$									$\square$	
	Develop scale-up solutions																																														

Table 59: Link of business models with barriers and drivers





### 10.3.2 Link with NBS types

										NBS types							
							I. Objects								II. Actions	& strategies	
				I.1/ On th	ne ground				1.2/ \	Water	1.3/ ( st	On building ructures	II.1/ Gre mana	een spaces Igement	II.2/ Waste management	II.3/ Protection strategies	II.4/ Urban planning strategies
	TYPOLOGY OF IMPLEMENTATION MODELS	Parks and gardens	Structures associated to urban networks	Food and resources production	Choice of plants	Works on soil	Ecological restoration	Erosion control	Water bodies & hydrographic network	Wetlands & built structures for water management	Green roofs	Green walls & facades	Human interventions	Use of fauna			
	Technological																
	Maximize material productivity and energy efficiency																
S	Create value from waste																
DEL	Substitute with renewables and natural processes																
Q	Social																
SS	Deliver functionality, rather than ownership																
Ŭ	Adopt a stewardship role																
ISU	Encourage sufficiency																
8	Organizational																
	Re-purpose the business for society/environment																
	Develop scale-up solutions																
			strongly link	ed		modera	ately linked		moderately	conflicting		strongly	conflict	ing			

Table 60: Link of business models with NBS types





## **11 Conclusions**

This deliverable aimed to analyse the issues regarding the implementation of NBS projects through a literature review that has been contrasted with real cases. After this analysis some conclusions can be drawn:

- 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. As a new concept generates uncertainty, lack of technical preparedness and operational unknown. But also allows innovative approaches, new ways to address (and consider) old problems and more inclusive practices.
- The degree of experience in NBS projects makes the difference in the moment of recognizing the possible drivers and barriers of its implementation. This can be seen as an optimistic conclusion as the more we know the easier we see the implementation of NBS.
- The implementation barriers and drivers can be classified in three domains: knowledge, governance and economic domain. The links between implementation barriers and drivers are often cross-domain. The degree of this transversality varies from domain to domain: governance barriers and drivers are very related but economy and knowledge domains are more interrelated. There is a clear 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. Drivers related with network governance models (such as coordination, co-production, cross-sectorial cooperation and reflexive/adaptive governance) are drivers that address significant number of cross-domain barriers showing the suitability of these kind of governance models for NBS projects.
- A significant number of NBS projects require types of governance that are at the intersection between urban governance and environmental governance. Urban and environmental governance is a map of spectrums where the different models coexist in different degrees regarding some key axes such as level of innovation, polycentric vs. monocentric, involved sectors, level of participation and scale. The models are not static or definitive as they can coexist in the same initiatives or change during the different stages of the projects.
- For the conceptualization of the different models of cooperation arrangements among the different actors that can lead to the implementation of NBS projects they have been clustered in 5 clusters and distributed according to the involved actors (government, community and market), their position in the spectrum from high to low government involvement and their level of participation. The different models are analyzed from different perspectives: how they emerge, involved actors, the degree of government involvement, rules, contextual conditions and tools that can be used. These analyses are structured in the tables that come in each section. Each cluster is also studied regarding the barriers that can help to overcome, drivers that can be triggered and finally their suitability for NBS projects (including the barriers that the own IM generate).
- Collaborative, multisector, polycentric and adaptive governance models have been considered to be the more suitable governance models for NBS projects, especially when urban scales are considered.

Nature4Cities – D1.2 – NBS Implementation Models Typology





- The suitability of each funding mechanism to NBS implementation has been found to be a matter of scale, as measured across the different dimensions of funders, beneficiaries and NBS actions. The economic context in which NBS may have more possibilities of application depends firstly on to this scale of considered NBS; although the typology and hierarchical level of the involved actors, who operate to improve them, define the accessibility to specific funds.
- While the direction of capital is typically top-down, with infrastructure funding being controlled and distributed through varying layers of government, the direction of action is typically bottom-up, with grassroots initiatives and low-stakeholder count NBS projects taking the lead.
- The lack of knowledge and capabilities also represents in the economic domain a major barrier to private capital funding. Projects initiated by private sector are especially risk-averse by definition and rely on complex evaluation methods. The inability of proponent stakeholders to address funders' concerns thus limits private financing to projects where a clear revenue stream has to be identified.
- There is therefore ample opportunity to upskill the grassroots initiators of NBS projects, as well as the lower tier(s) of government. NBS Ambassadors should play an important role as mediators, bridge-builders, technology transfer agents and so on.
- As main conclusion of the literature review of Business Models for Sustainability, it can be said that there is not only one option to get a NBS Business type. This is due to the heterogeneity of the possible NBS to be implemented. The model proposed by Bocken et al. [117] has been considered to be the better alternative.
- The final selection of the implementation model for a specific NBS project is going to be influenced mainly by the NBS type itself (technical and financial characteristics) and by the context (including barriers and drivers). This relationship will be deeply analysed in the project later but an initial link between the analysed IM models, barriers, drivers and NBS types have been addressed in this report.

Finally, we would like to highlight some future work that would be interesting to address in later developments of the project:

- The implementation models should be studied more in depth from the scales of time perspective, analysing the differences between the different stages of the life cycle of the project: design, implementation and maintenance in order to operationalise more precisely the IM.
- The procurement barriers and/or drivers should be addressed and explicit attention could be given to the issue of Transaction Costs.
- In PPP's the analysis should be broadened including PPP's as contracts for implementation.



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# 13 Annex I: Classification for T5.1

		Governance Models	
1	IM TYPE	Business Models	
		Financing Schemes	
		Goal	Goal of the IM
			Regional / national government
			Local government/municipality
			Semi-government organizations / institutions
2	Objectives	Deneficiaries	NGO's / CSO's / interest groups
		Beneficiaries	CBO's / neighbourhood communities
			Private sector
			Social enterprises / social entrepreneurs
			Citizens
2	Barriers &	Barriers	Associated barrier code
ა	enablers	Enablers	Associated enabler code
		Related with a NBS?	
		Type of NBS	
		Country	
		City	
4	Implementation	Timeline of the intervention	Start date
	context		End date
		Planning	IM as response to a specific city-level plan
			Classic Unitary Country
		Political system	Centralised Unitary Country with strong but non- integrated local authority level





	Centralised Unitary Country with strong integrated local authority level
	Decentralised unitary
	Country with strong local and regional level
	Regionalised Unitary Countries
	Federal States
	National
Tiers of government	Regional (number of provinces, counties, etc.)
	Local (number of municipalities)
	Large/strong competence
Analysis of local level (size	Small/strong competence
versus competence)	Large/small competence
	Small/small competence
	Elected/strong competence
Apply significant middle tion	Elected/weak competence
Analysis of middle tier	Appointed/strong competence
	Appointed/weak competence
Composition of	Local taxation
municipalities' total revenue	Government grants
	Elected mayor/no elected mayor
Citizen representation and participation	National referenda (binding or not)
	Local referenda (binding or not)
	Extensive Physical Interventions
Urban development	Efforts to keep the original population in place
	Integrated Urban Renewal





		Extensive physical interventions (rough urban renewal)
	Neighbourhood urban regeneration	Efforts to keep the original population in place (gentle urban renewal)
	-	Integrated urban renewal (combination of physical, economic and social interventions)
		Regional economic planning (French model) – central
	Spatial planning systems	Comprehensive integrated approach (German model) – multilevel
		Land use management (British model) – primarily local
		Urbanism tradition (Mediterranean model) – local
	Type of governance	Self-governance/grassroots initiatives
		Civil society and/or private sector' governance (with government participation)
		co-production / co-creation
		government-led with civil society and/or private sector
		government-led
	Initiating actor	Regional / national government
		Local government/municipality
Governance		Semi-government organizations / institutions
		NGO's / CSO's / interest groups
		CBO's / neighbourhood communities
		Private sector
		Social enterprises / social entrepreneurs
		Citizens
		Research institutions
	Involved stakeholders	EU bodies





		Regional / national government
		Local government/municipality
		Semi-government organizations / institutions
		NGO's / CSO's / interest groups
		CBO's / neighbourhood communities
		Private sector
		Social enterprises / social entrepreneurs
		Citizens
		Research institutions
		Private foundations
		others
	LEVELS of governance	Specific governance episodes
		Governance processes that set rules of the game
		Governance cultures
	Ecological SCALES of governance	Regional scale green infrastructure
		City scale green networks
		Local scale green area
	Steering mode	Hierarchical
		Non-hierarchical
	Public	EU
		National
Financing schemes		Regional
		Local
		others





	Citizen inclusive	cooperatives
		crowfunding
		sustainable saving account
		community financing
		Crowdsourcing experimentation programme for sustainable solutions
		others
	Private	Private investors
		Funds provided by non-governmental organization
		Private foundation
	Public-private	Preferential loans
		guarantee funds
		revolving funds
		Soft loans/Dedicated Credit Lines
		Green bonds
		Tax exemption
		Others
	Non-financial contribution	volunteering
		provision of land
		provision of goods
		others
Business	Technological Business Model Archetype	Maximise material productivity and energy efficiency
models		Create value from 'waste
		Substitute with renewables and natural processes

Nature4Cities – D1.2 – NBS Implementation Models Typology 173/178





	Social Business Model Archetype	Deliver functionality, rather than ownership
		Adopt a stewardship role
		Encourage sufficiency
	Organisational business model Archetype	Re-purpose the business for society/environment
		Develop scale-up solutions
Poplicability	NBS type applicability	
Replicability	Requirements	





# 14 Annex III: List of barriers

CODE	DOMAIN	CATEGORY	SUBCATEGORY
BK1	Knowledge	Uncertainty	Operational unknown
BK2	Knowledge	Uncertainty	Performance unknown
BK3	Knowledge	Accessibility to information	Information overload
BK4	Knowledge	Accessibility to information	Incomprehensible or unusable presentation of results
BK5	Knowledge	Technical inadequacy	Lack of ready-to-apply scientific results, concepts and technologies
BG1	Governance	Disconnection between short-term actions and long term goals	Short-term action and decision-making cycles within city administrations
BG2	Governance	Disconnection between short-term actions and long term goals	Establishment of long term responsibilities
BG3	Governance	Disconnection between short-term actions and long term goals	Gentrification
BG4	Governance	Institutional barriers	Lack of coordination between traditional structures of city departments
BG5	Governance	Institutional barriers	Lack of flexibility of decision making structures
BG6	Governance	Institutional barriers	Bureaucracy and unsupportive legal frameworks
BG7	Governance	Complexity of governance structure	Goal misalignment
BG8	Governance	Complexity of governance structure	Apathy
BG9	Governance	Complexity of governance structure	Role ambiguity
BG10	Governance	Participation and awareness	Perception
BG11	Governance	Participation and awareness	Lack of participation
BE1	Economy	Perception of the benefits	Under appreciation of non-economic benefits
BE2	Economy	Perception of the benefits	Uncertain economic feasibility
BE3	Economy	Perception of the benefits	Short term vision
BE4	Economy	Perception of the benefits	Vandalism
BE5	Economy	Budget constraints	NBS not a priority





BE6	Economy	Budget constraints	Lack of funding knowledge
BE7	Economy	Risk perception	Risk perception





# 15 Annex IV: List of drivers

CODE	DOMAIN	CATEGORY	SUBCATEGORY
DK1	Knowledge	Generation of evidence	Lesson learnt through implemented projects
DK2	Knowledge	Generation of evidence	Research on benefits
DK3	Knowledge	Generation of evidence	Research on cost effectiveness
DK4	Knowledge	Collaboration	Networks
DK5	Knowledge	Collaboration	Co-creation
DK6	Knowledge	Information accessibility and sharing	Knowledge platforms
DK7	Knowledge	Awareness	NBS ambassadors
DK8	Knowledge	Awareness	Climate Change
DK9	Knowledge	Awareness	Ecological memory
DG1	Governance	Process efficiencies	Collaboration
DG2	Governance	Process efficiencies	Coordination role
DG3	Governance	Process efficiencies	Action- thinking approach
DG4	Governance	Process efficiencies	Capacity building
DG5	Governance	Self-governance	Emerging partnerships
DG6	Governance	Self-governance	Grassroots innovations and transition initiatives
DG7	Governance	Co-creation and participation	Reflexive/adaptive governance
DG8	Governance	Co-creation and participation	Involvement of urban government
DG9	Governance	Co-creation and participation	Cross sectorial spaces and partnerships
DG10	Governance	Co-creation and participation	Co-production
DG11	Governance	Co-creation and participation	Tools to build a common vision
DE1	Economy	De-risking	Sharing risks
DE2	Economy	De-risking	Public de-risking strategies
DE3	Economy	Government support	Provisioning of incentives to attract private investment





DE4	Economy	Government support	Removal of administrative barriers
DE5	Economy	Government support	Public-private partnerships
DE6	Economy	Create conditions for new business models and finance schemes	Create conditions for new business models and finance schemes
DE7	Economy	Cooperative competition	Cooperative competition
DE8	Economy	Mid-Long term financing	Mid-Long term financing
DE9	Economy	Real estate	Real estate
DE10	Economy	Self-financing and self-management	Self-financing and self-management