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Summary of performed revisions:

- Improvements on the Executive Summary in order to remove some trivial methodological details and make more clear the dissemination potential of the results obtained;
- Modifications to the Conclusions to better explain how the team can create a decision support system to guide urban stakeholders by integrating the results of the present deliverable into the Nature4Cities Handbook.

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Glossary

ABM	Agent-based model
BM	Business Model
BMC	Business Model Canvas
ES	Ecosystem Service(s)
FM	Financial Model
GM	Governance Model
IM	Implementation Model
IM-DB	Implementation Models Database
NBS	nature-based solution(s)
PM	Participatory Model
PPP	Public-Private Partnership
QoL	Quality of Life
UPI	Urban Performance Indicator

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Executive Summary

Nature-based solutions (NBS) are proven ways out to tackle multiple socio-economic and environmental benefits for urban societies. Identifying practical means to exploit the effectiveness of NBS is thus becoming urgent to allow public and private actors deploying NBS and solicit integrated initiatives in different urban contexts. The use of NBS Implementation Models (IMs) is proposed in Nature4Cities as a valuable anticipatory strategy for urban planners and NBS practitioners to establishing an effective deployment of NBS. However, an IM for NBS depends upon the complex interaction of ecological, technological, socio-economic, cultural, and regulatory criteria, rules and factors occurring in urban contexts, which do not necessarily make the deployed solution(s) optimal in addressing one or more urban challenges. In order to overcome barriers and to become drivers of NBS implementation, the relationship between different models of NBS governance, financing and business mechanisms and their impact on urban spheres must be better understood.

Within the framework of Work Package 5 (“New governance, business and financing models for NBS-oriented urban planning”) in Nature4Cities, Task 5.4 aimed to investigate the impact of three typologies of IMs determined in Task 1.2: governance models (GMs), i.e. collective action arrangements driven by formal organizations of the public sector and designed to achieve the implementation of NBS projects; financial models (FM), i.e. conventional and non-conventional funding methods that can be exploited to pay for NBS implementation; and business models (BM), i.e. archetypes of viability of deploying NBS, with main focus on sustainability models that target all possible economic, social and environmental aspects underpinning the implementation of NBS. The objective of Task 5.4 was twofold: (1) to characterize the socio-economic impact of NBS projects taking into account the choice of specific IMs and their relationships with different impact spheres for the urban communities (made by citizens, enterprises and public organizations), namely social, economic, cultural, institutional and environmental spheres; and (2) to prospect adjustments to the definition and types of stakeholders belonging to those communities and previously studied through the use of agent-based models (ABMs) of Task 3.2.

A methodological approach constituted by seven steps was established: step 1 (identification of stakeholder types and associated IMs and impact drivers capitalizing on the knowledge generated in the previous Tasks 1.2, 5.1, 5.2 and 5.3); step 2 (review of the literature specifically addressed to determine the links - either qualitative or quantitative - between IMs and impact drivers); step 3 (selection of key elements associated with the definition of stakeholders, IMs and related impact spheres, using for the latter the library of urban performance indicators developed in Task 2.1); step 4 (characterization of stakeholders and IMs through a participatory process involving NBS expert partners of Nature4Cities); step 5 (definition of a qualitative Likert-type scale based scoring approach for defining the link and its relevance between selected IMs and impact indicators, using a participatory approach combined with scientific evidences from the investigation of the literature); step 6 (creation of a table of correspondence arrays specific for each selected NBS and impact indicator, based on the score-based valuation scale defined in the previous step); step 7 (definition

of new agents and requirements for improving three types ABMs with scoring outputs from the impact characterization of step 6).

According to this methodological approach, the deliverable outlines the impact across twenty categories of urban performance indicators associated with twelve typologies of IMs (among traditional and innovative GMs, FMs and BMs of NBS). Results show that GMs have typically highest relationships with cultural and social impact spheres, certainly higher than the relationships between these two impact spheres and the other FMs and BMs. Not surprisingly, FMs and BMs are mostly associated with impacts on the economic sphere. Whereas the environmental and institutional impact spheres are mostly dependent on the role of GMs and FMs, with BMs not even showing an explicit relationship with institutional impact drivers. More specifically, the impact associated with GMs is mainly dependent upon the challenges of *climate adaptation*, *air quality at district/city scale* and *air quality locally*, *raw materials* and *circularity*, which affect the dimension of environmental sustainability at the urban scale, the provision of ecosystem services for people and their well-being. Moreover, relevant links with social and cultural impacts are observed that rely in particular with *environmental justice*, *health and quality of life*, *control of crime* and *control of extraordinary events*. Such relationships make the GMs particularly influenced by those impact drivers, which are related to people's behaviour of life and their influence and integration with the place they are living in. Instead, FMs show to have a stronger link with resource related impacts, mainly represented by indicators belonging to the economic impact dimension, rather than other impact spheres. In particular, highest relational scores are recorded for impact drivers related to *energy provision*, *water* and the overall *economic value of NBS*, implying that substantial investments might be expected in the future in order to overcome the challenge of securing resources to cities. Finally, the set of BMs analysed in Task 5.4 show to have "no link" with a relatively large number of impact drivers, mostly because of the scarce information available to conduct a robust scoring exercise. However, social and technological BMs are found to be typically linked with the economic impact sphere through the indicators of *water* and *economic value of NBS*, as well as with the environmental impact indicators of *raw material* and *circularity* and the social impact driver represented by the *urban space management*. The introduction of these findings within the investigated ABMs has confirmed the effectiveness of this modelling system as a predictive tool to ensure that innovative and participatory IMs have a positive impact on the implementation of NBS for selected stakeholders. ABMs can help gaining insights on the citizen's behavioural impacts associated with the introduction of new NBS in the urban environment, and through those on the social and economic lives of citizens. However, results from the implementation of new data/information into the ABMs shall be considered with care, as they do not necessarily represent the full coverage of stakeholders' needs, criteria and knowledge to supporting a positive (beneficial) IM, or *viceversa* depending on the rules.

Nature4Cities experts participating to the score-based impact evaluation in Task 5.4 have eventually considered three clusters of innovative governance models associated with "new public management", "societal resilience" and "network governance" highly related to multiple impact indicators across all the five analyzed spheres (social, environmental, cultural, institutional and economic). This suggests that those IMs are worth to be prioritized over the other IMs if the goal of

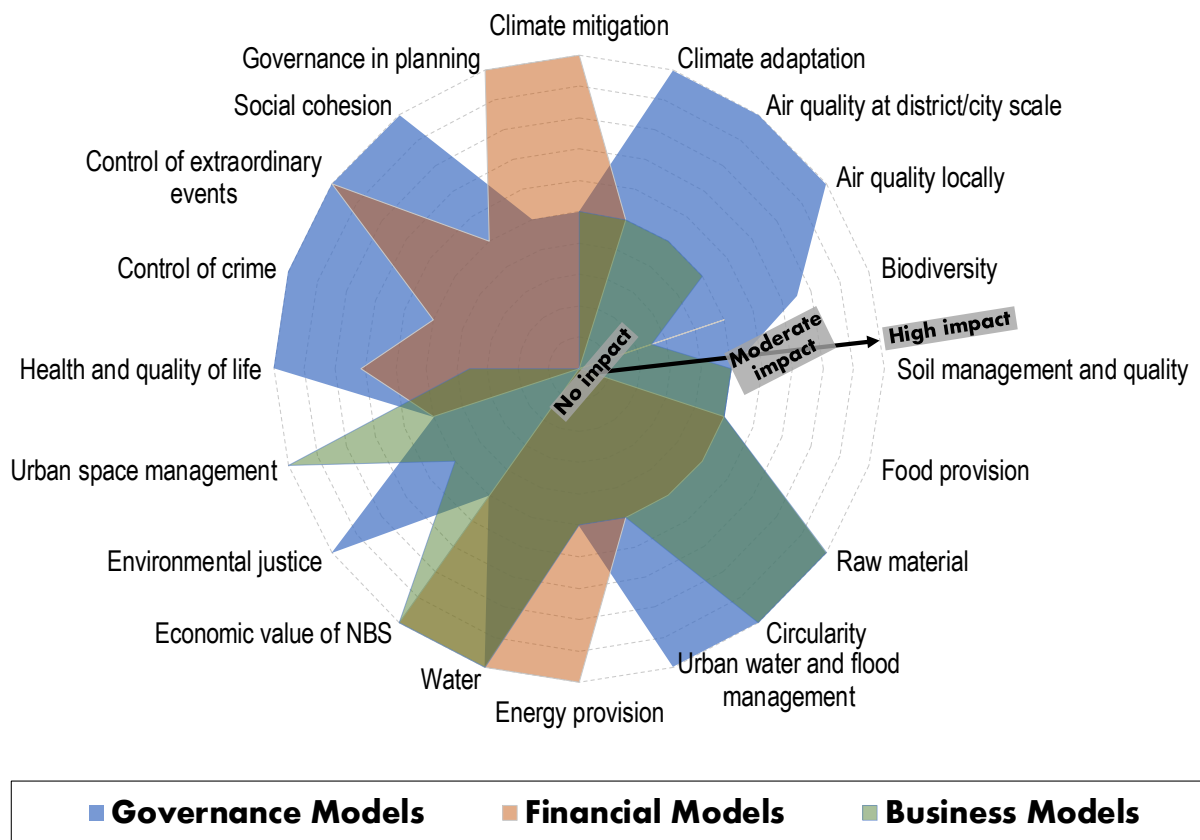
the NBS project is to provide multiple benefits for the urban stakeholders. Otherwise, priorities of investigation (of cost-effectiveness, feasibility, social acceptance, etc.) can be given to the models that have been judged to target one or a lesser number of impact spheres, but with more effectiveness or specificity, such as the traditional financial and business models (typically more oriented to address economic and environmental urban challenges).

Despite the extensive coverage of findings, both in terms of impact indicators and analysed IMs, the proposed methodology is not free of limitations and results still incorporate some uncertainty. For example, contextual analysis in the framework of GMs assessment should be included, allowing to obtain a clear distinction between historically developed political-institutional cultures and project-based governance strategies. Moreover, a quantitative assessment should be put forward to better substantiate the actual trade-offs and synergies underpinning the implementation models and their relationships with the different impact spheres.

Concerning the overall implications for the Nature4Cities project, it is worth mentioning that both methodology and most relevant results of the Task 5.4 will be incorporated within the Nature4Cities Platform as part of the NBS Handbook currently under development within WP9. The Handbook, which will be available for download on the Nature4Cities Platform, collects the results from all the tasks of WP5 in order to offer general guidelines for practitioners to select IMs according to their socio-economic expectations, through an integrated approach and a set of tools for the implementation of NBS projects framed in the Step by Step guide developed in the Task 5.2. More specifically, the user will be able to navigate through the different IMs and compare the performance of one or another hypothetic model by looking at the set of impact scores associated with the urban performance indicators estimated in this study. In this regard, the methodological approach developed in the Task 5.4 may be used as a diagnostic instrument to understand the potential impact of three types of NBS IMs (based on governance, financial and market mechanisms) aiming to provide benefits and generate positive impacts to the society. Task 5.4 further aligns with other Nature4Cities activities devoted to the assessment of socio-economic aspects, since it analyses indicators compatible and mutually matching with those from Task 4.2 and Task 4.3, i.e. the methodologies developed in these three tasks allow to calculate/evaluate complementary indicators such as quantitative “ecosystem service” and “quality of life” indicators from, respectively, Task 4.2 and Task 4.3, and qualitative “key performance indicators” of environmental, social, cultural, institutional and economic type from Task 5.4. The approach proposed in Task 5.4 can also help, in the long-term and with the introduction of a series of improvements, to build a decision support system to guide urban stakeholders towards the choice of NBS that might be most (i) cost-effective (from a business and financial modelling perspective, looking at the environmental and economic costs and benefits of NBS) and/or (ii) socially inclusive and acceptable, adaptable to local cultures and diversities, and institutionally manageable (from a governance modelling perspective). At this stage, however, the diagnostic tool proposed in Task 5.4 is not able to allow practitioners inferring whether one type of implementation model is more or less successful in delivering impacts on single-issues or multiple dimensions simultaneously, since a ranking between indicators has not been performed.

WP5/Task 5.4 of Nature4Cities

Socio-economic Assessment of NBS Implementation Models



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