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Towards Adaptive Governance of Urban Nature-Based Solutions in Europe and Latin America—A Qualitative Exploratory Study

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Abstract: The concept and application of nature-based solutions (NBS) have been rapidly progressing in Europe and Latin America, reflecting a transition in the way that urban governance is perceived. There is a large call for the collaborative, polycentric, and interdisciplinary governance of NBS. However, research on options for operationalising these governance processes in different contexts is still insufficient. This study explores and analyses the operationalisation of NBS adaptive governance in Europe and Latin America. Seven cities that are part of the project EU-H2020 CONEXUS have been selected as case studies: Barcelona, Bogotá, Buenos Aires, Lisbon, Santiago de Chile, São Paulo, and Turin. This contribution aims to (i) understand how NBS governance processes are managed; (ii) identify the main positive and negative factors that influence NBS adaptive governance; and (iii) understand common factors and relationships that can hinder or drive forward adaptive governance for NBS in the investigated contexts. The results revealed common priorities indicating a shared pathway for Europe and Latin America; however, context-dependent specificities were also observed. These findings can be used to support cities in both European and American contexts in developing plans and actions for the more efficient enabling of NBS implementation and governance through adaptive governance.

Keywords: nature-based solutions; prospective analysis; urban planning; adaptive governance; climate-resilient cities; Latin America; Europe

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1. Introduction

Nature-based solutions (NBS) have recently emerged as one of the most promising approaches to challenge climate change and to counteract biodiversity loss, as well as remediate other effects of urbanisation such as air pollution, deforestation, and urban heat while aiming to improve human well-being. Defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience, and biodiversity benefits" [1], NBS are regarded as an inclusive concept for ecosystem-related approaches [2,3]. They encompass a variety of actions and solutions such as green infrastructure, urban green spaces, urban forests, sustainable drainage systems, ecosystem-based disaster risk reduction, and natural water retention measures as means to address multiple and interlinked challenges simultaneously [3]. Embedded in the provision of ecosystem services, NBS offer multiple benefits, including the enhancement of the natural environment and air quality [4–7], an improvement in life quality [8], a reduction

in urban heat [9–11], an increase in biodiversity [12–14], soil conservation [15], rainwater runoff reduction [4,16,17], an increase in property values [18–20], an improvement in mental and physical health [21–23], and other social benefits [24,25]. When applied to urban environments, NBS are increasingly being recognised as more efficient and cost-effective solutions to cross-cutting threats and improving sustainable livelihoods in comparison with more traditional urban development approaches [26].

In the last decade, interest in NBS has been rapidly growing, with a high number of studies and publications on the topic [27,28]. In fact, NBS development requires drawing on experiences from several disciplines and involves a diversity of actors due to their multifaceted, multifunctional, multibeneficial, and multidisciplinary characteristics [29]. Their development requires knowledge from comprehensive planning, design, and management approaches such as environmental planning, integrated coastal zone management, and ecosystem-based management [2]. The design of NBS also includes contributions from technical and design-oriented experts in fields such as engineering, urban planning, and landscape architecture, in addition to drawing on the local and traditional knowledge embedded in the culture of communities [30]. The concept of NBS requires cross-boundary integration and collaboration. Although these solutions are applicable globally, they need to be locally appropriate, taking into account socio-ecological systems and local socio-economic contexts, to generate ecosystem services [29,31]. These are crucial characteristics that pose difficulties for the adoption of NBS.

Struggles around NBS development in urban settings can easily be found within the literature [32–35]. Amid dense urban environments, NBS notably face high competition for physical space [36] as well as societal acceptance [37]. Inadequate financial resources and their unequal distribution further challenge NBS implementation [34]. Where public–private partnerships can be a pathway for accessing financing for NBS, equity and social justice concerns emerge [32]. Organisational and structural barriers can be found, ranging from the lack of political will and long-term commitment to the lack of supportive legal and policy frameworks [35]. The hierarchical organisational structure of the municipal departments [35] and institutional fragmentation ("sectoral silos") hamper the convergence of actors and disciplines for NBS co-development [34,35,38,39]. To overcome many of these barriers, governance is a concept frequently referred to as critical for NBS in urban planning (e.g., [40,41]). An alternative, more inclusive and collaborative governance approach for co-creating NBS in urban environments is constantly highlighted as pivotal for their successful implementation [42–44]. In particular, the concept and practice of adaptive governance are critical. As mentioned by several authors, adaptive governance is considered to be a principle (e.g., [45]), an enabler (e.g., [44]), and a model (e.g., [46]) to be used to orient NBS implementation.

However, the question of how to enable this NBS governance model has not yet been addressed in sufficient detail to inform the choice of contextually appropriate options and strategies and thereby enable effective implementation in practice. A broader body of knowledge is required concerning the specific role that governance structures can play in the stages of planning, implementation, and management of NBS, as theoretical work on the concept of adaptive governance does not provide the necessary details for its operationalisation [47]. It remains unclear how adaptive governance plays a strategic role in the process of decision making and the integration of NBS in the urban realm. This leads to the risk of NBS remaining a vague concept that lacks operational rigour [40,48].

This study aims to explore and analyse the adaptive governance of NBS in city-specific case studies within two different regional settings. First, in a wider regional context, there are European cities that already present a more mature understanding of the NBS concept [3] and where experiences with NBS have been developed. Second, there are Latin American cities where the implementation of the concept is in its inception phase and cities are still in the process of understanding and positioning the concept in the framework of urban governance. The study is based on the cases of Barcelona, Lisbon, Turin, Bogotá, Buenos Aires, São Paulo, and Santiago de Chile, which are all cities involved

in the project H2020 CONEXUS and committed to experimenting with the NBS concept and its application. The present research aspires to shed light on how the state of the NBS co-management process shared by public and private actors is currently taking place in the European and Latin American cities where the study was undertaken. This is done by analysing the factors that influence NBS adaptive governance within said cities and their differences and similarities and by identifying common aspects that can hinder or drive forward NBS in those regional contexts.

The paper is structured as follows: first, it discusses the emerging concept of adaptive governance and its potential role for NBS integration in urban planning. This is followed by the Materials and Methods section, in which the research design, its phases, and their development are reported. The findings are presented in the Results section. The results first summarise the internal and external factors influencing NBS adaptive governance that were identified in a SWOT analysis. Next, the driving and dependency relationships of identified factors uncovered by a prospective analysis are presented. The Results section forms the basis for the discussion, in which the ramifications of the NBS adaptive governance factors and influences are described for the European and Latin American cities, as well as for other contexts. The analysis proposed in this paper can be used as a basis to address specific details of NBS governance structures and to develop better informed strategies for multi-stakeholder involvement and adaptive governance in practice at city levels.

2. Adaptive Governance and Its Role in the Integration of NBS in the Planning Process

Governance systems applied to environmental and territorial issues are often designed following a top-down and a state-based approach. This can generate limits in adapting the socio-ecological complexity of urban systems to multiple temporal, spatial, and functional scales, particularly those facing rapid urban and environmental changes [49,50]. Currently, local actors worldwide call for a shift in governance models applied to urban ecosystems to substantially improve community involvement in decision-making processes [51]. The implementation of socially inclusive and collaborative NBS governance systems is oriented to match the wide range of needs emerging from urban socio-ecological systems [52–54]. Consequently, the design and implementation of NBS require an adaptive approach to meet the dynamics of the transformation of complex systems, and therefore, they also require a governance style that overcomes closed models, as these are poorly equipped to adapt to changes [55,56].

Adaptive governance refers to the evolution of institutions for the management of shared assets, particularly common resources, and other forms of natural capital, which improve the efficacy of social arrangements [57]. Adaptive governance is structured through collective actions oriented to facilitate experimentation, learning, cooperation, and power sharing around governance processes, which are combined to improve the governance structure's capacity for adaptation [58–60]. Adaptive governance can be understood as the evolution of the rules and norms that promote the need to satisfy underlying human needs and people's preferences, on which the institutions' governance arrangements rely on for their operation and legitimacy. Therefore, it is important to understand the objectives and the social, economic, and environmental context [57].

The concept of adaptive governance presents an argument for a potential co-management process of NBS that is shared by public and private actors, enabling a system of multiple and decentralised centres of power. Proponents of adaptive governance argue that in this way, jurisdictions overlap and limit hierarchical relationships, thereby fostering collective decision-making processes and power-sharing arrangements [54,58,61]. Adaptive governance allows for the active involvement of diverse actors in NBS development, valorising the complexity of the interactions between social and ecological systems. Adaptive governance emphasises the adaptability of the joint agency and management processes between the public and the private sector. This comes in response to societal challenges emerging from the changing urban environment and the necessary acquisition of new knowledge to orient it [54,62,63]. Collective action is possible through the confluence of

public and private actors who make decisions following the government and define the functions and trajectory of a particular NBS within an adaptive and collaborative learning environment [54,58,61,64].

However, NBS adaptive governance systems face contextual and internal challenges. Contextual challenges refer to the timing of policy measures, the level of (de)centralisation, and the autonomy of decision making. Internal challenges are linked to the multi-actor composition of NBS governance systems, whose trajectory and legitimacy are threatened by complex socio-political structures that represent a diversity of interests, roles, and forms of power. Consequently, NBS adaptive governance demands an additional capacity to effectively address not only issues of power balance, legitimacy, and equity, but also to secure transparency and effective public participation in the decision-making process [54,61,65–68].

Additionally, adaptive governance and co-management processes engaging private sector stakeholders and their co-investments can lead to a weakening, or even a failure, of the process itself [65]. Depending on the context, this can happen whenever conflicts of interest provoke actors in powerful positions to disengage with justice concerns [69]. In fact, the private sector actors seldom hold the common good and the interest of the urban community as their core mission, but rather their interests are profit-driven [65]. In essence, the coherence and convergence of private/public interests must be seriously checked and robustly monitored whenever stakeholders (e.g., enterprises, corporations, and/or private firms) are engaged in the governance process [65,69]. There is substantial evidence that has been collected in recent decades of how influential private sector actors have blocked overarching public interests [70]. In practice, the dynamics between private and public actors will depend on the balance of mutual powers, the arrangement of laws and regulations and their control, transparency, and accountability during decision-making, and the extent to which the personal interest of elected policy representatives is linked to private interests [65,70,71]. These are key aspects in reaching a fair and equitable power-sharing condition within the processes. Private sector interests can also drive illicit behaviours, such as bribery and corruption, regardless of whether "co-management" practices are formalised or not.

An operating adaptive NBS governance structure involves a set of nested processes, including collaboration and learning, which are regulated by formal and informal organisations to orient and improve social–ecological relationships concerning natural resources and ecosystem management in the urban realm [60,62,72,73]. Collaboration refers to a multilevel network of actors that harness collective action to manage the governance structure and reach shared NBS objectives. Learning refers to developing the capacity of involved actors to learn from their experiences and create new knowledge to develop the governance structure, co-manage the NBS, and improve the decision-making process [58,61,64,74]. Power sharing comes from the sense that the system should be steeped in democratic ideals such as inclusion and broad representation of a wide array of interests, and that it operates and distributes power based on norms and ideals of inclusiveness [75]. It does not address any specific typology of actors in particular, but it focuses on democratic sharing of power and the promotion of polycentricity. Experimentation, learning, cooperation, and power-sharing are combined to reach a governance structure capable of self-adapting to changing contexts [58–60].

Adaptive governance systems should therefore be flexible, community-based, and tailored to specific places and situations enabling them to answer societal challenges addressed by NBS in the urban context. Flexible institutional arrangements and ecological knowledge (combining scientific, traditional, and local knowledge) are tested and revised in such governance systems in a dynamic, continuous, and self-organised process of learning by doing. The adaptive governance model is based on frameworks and structures open to the unexpected and oriented to a problem-solving approach through negotiation [76]. In this way, information is shared horizontally and vertically in the presence of coordinated institutions, allowing for well-informed and coordinated responses at the

appropriate scale [58–60]. Furthermore, community-based adaptive governance guarantees the balance of the relationship between governments and local communities, whereas the governance models based on partnerships between local authorities and powerful private actors or dominant civil society associations are more vulnerable to manipulation and lobbying [77–79]. A high commitment from those involved is needed in order to avoid a distorting influence that can arise from private actors whenever they hold a privileged position in the decision-making process. This can be facilitated by adopting governance and planning strategies (e.g., green hubs, green barters, or organisation-initiated grassroots campaigns), such as those described in Pauleit et al. [56], to clearly address the role of community-based systems.

3. Materials and Methods

To explore how to move forward with NBS adaptive governance in cities of Europe and Latin America, this study aimed to identify influential negative and positive governance factors of NBS adaptive governance and analyse their relationship. The research was envisioned to follow a comparative city-specific case study methodology utilising the seven cities of the H2020 project CONEXUS. The case studies encompass three cities in Europe (Barcelona, Lisbon, and Turin) and four in Latin America (Bogotá, Buenos Aires, São Paulo and Santiago) to bring together evidence from two different regional contexts. A mix of methods was used to understand the differences and similarities emerging from both contexts.

First, qualitative mixed data were collected. Primary data were gathered through sequenced surveys and expert interviews in each city studied. Secondly, a situational (SWOT) analysis of the primary data was conducted to identify the internal and external factors that could influence the potential NBS adaptive governance in the selected case studies. Next, a prospective analysis evaluating the relative importance and interdependencies among the formerly identified factors was conducted. The results were compared during each analysis phase to shed light on the factors emerging and on their importance for moving forward with adaptive governance. According to this process, possible pathways to advance NBS adaptive governance can be identified, as shown in the discussion.

3.1. Data Collection

Primary data were collected through an iterative sequence of surveys and semi-structured expert interviews conducted with key stakeholders of each city. Two groups of actors were involved. On the one hand, we interviewed actors responsible for top-down urban planning processes, including public administrators, heads of urban planning, and heads of departmental units (urban planning, environmental, project management and other departments), as well as technical professionals, such as the city employees responsible for the implementation and construction of NBS projects. On the other hand, we also surveyed actors that participate in bottom-up NBS projects, research, and advocacy, including local community members, activists, community leaders, academics, and environmental NGOs leaders, among others. Local CONEXUS partners within the case studies were used for actor identification, and the selection was based on (1) previous experience with NBS development or similar activities (i.e., urban forest, urban agriculture, and green infrastructure) within their city; (2) knowledge of local governance processes; and (3) availability to take part in the study.

Workshops were conducted in the cities studied with the later application of an iterative sequence of standardised surveys and feedback following the Delphi method [80–82]. The Delphi method is a methodological tool for gathering the insights of experts and forming a group consensus. It involves a facilitator to recruit the experts (the workshops), the compilation of the surveys, the comparison of the responses, and a convergence of the responses across survey rounds [83]. Surveys were delivered and collected via email. The Delphi method was performed in two rounds. After each survey round concluded, inputs and perceptions were summarised and handed back to the participants by email

for acknowledgement. After the final round, a feedback report describing the results was sent to participants in each city. Although local demographic, cultural and socio-economic determinants were reflected, the number of stakeholders was limited. The conditions of the COVID-19 pandemic conditions determined the need for finding different alternatives to obtain the desired materials and reach participants. This methodology was combined with semi-structured expert interviews to compensate for impediments caused by COVID-19. The interviews were conducted online with experts from the same group of participants as utilised in the Delphi method. A total of 44 survey participants took part in the Delphi method and 33 participated in the expert interviews for the seven case studies (Table 1). All data were collected in the participants' native language between April and October 2021.

Table 1. Number of participants in the data collection per method and region.

	Europe	Latin America
Delphi Method	18	24
Expert Interviews	9	34
Total	27	58

3.2. Data Analysis and Interpretation

The content of the interviews and surveys was analysed following the SWOT analysis method. Data collected were transcribed and coded based on the four categories of the method: strengths and weaknesses, with respect to positive and negative internal factors of the governance process of NBS; and opportunities and threats, with respect to positive and negative external factors of the process (Figure 1). The European and Latin American cities were treated as two separate groups, and a SWOT analysis was conducted using the data collected in the European and Latin American contexts to identify the main factors within each context. To maintain comparison rigour, an equal number of factors for both contexts were extracted from the analysis. Results were later presented and discussed with the interview participants for validation.

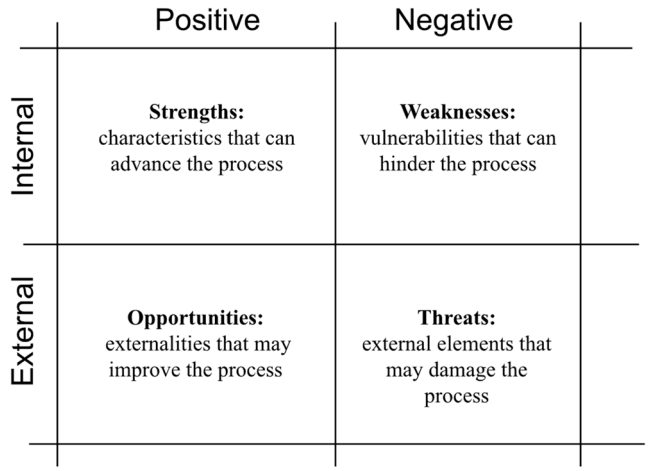

Figure 1. SWOT methodology.

A prospective analysis was then performed following the MicMac (matrix-based multiplication applied to a classification) method, which is also known as cross-impact matrix multiplication [84]. The MicMac method, developed by Godet [85–87], allows for the identification and classification of relationships between the main factors affecting the evolution of a social system. It is used to analyse more in depth the impact of each factor, identifying those that have a dependency on others or those that are driving factors. The method firstly identifies pairwise relationships among the factors to develop a double-entry matrix. Relationships were evaluated based on the information collected

through the interviews and workshops, assigning a different level of influence between each pair of factors that range from 0 to 3 (Table 2). Interviews and survey participants were consulted online to validate the results. The double-entry matrix can be found within the Supplementary Materials.

Table 2. Levels of influence used in the pairwise relationships.

Level of Influence
0—No direct influence
1—Low direct influence
2—Medium direct influence
3—High direct influence

The matrix was assessed first by using direct classification and then through indirect classification by increasing the power of the matrix to identify each factor's level of power and dependence on the governance systems. This process was automated using the MicMac software available online. According to the relationships identified, the factors were then categorised into four categories: volatile, driving, autonomous, and dependent. The four categories are based on the power of each factor to drive or influence other factors to change, and their dependency on other factors. The four categories are classified as follows:

I. Volatile factors, which display strong driving power and very strong dependence;
II. Driving factors, which have very strong driving power and very weak dependence;
III. Autonomous factors, which present very weak driving power and weak dependence;
IV. Dependent factors, which display very low driving power but high dependence.

The procedure was performed separately for each group of cities and the results were compared. Results obtained are presented in terms of developing the central component of the prospective method, called the cross-impact analysis (MicMac), which is represented by a graph based on the relationships identified (driving x dependence power). Notably, the combination of those two analysis methods allows not only for the identification of influencing factors of NBS adaptive governance, but it also provides i) clarification of which are internal and external factors of the local governance system; ii) identification of factors with a negative or positive influence; and iii) contrast between the factors that have a higher influence within the system and are capable of enabling meaningful change. A full picture of the combination of methods used and their steps can be seen in Figure 2.

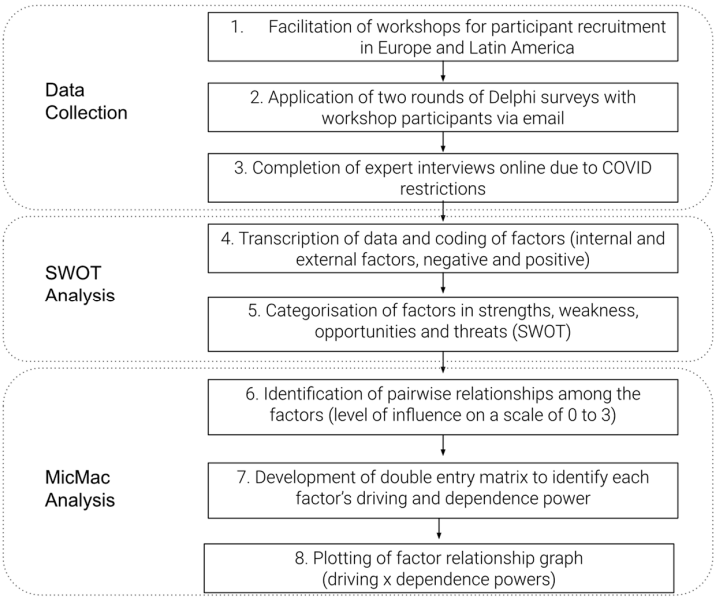

Figure 2. Summary of research methods and steps.

4. Results

The results of the analysis are presented in this section, beginning first with the results of the SWOT analysis that shows the main factors identified in both the European and Latin American cities (Section 4.1) internally (Section 4.1.1) and externally (Section 4.1.2), followed by the results of the prospective analysis in both contexts (Section 4.2) subdivided into four categories (volatile—Section 4.2.1, driving—Section 4.2.2, autonomous—Section 4.2.3, and dependent—Section 4.2.4). The two analyses are presented in a comparative way, contrasting the findings of the European and Latin American case studies in each subsection.

4.1. SWOT Analysis: Main Factors That Influence Urban NBS Adaptive Governance in Europe and Latin America

The analysis led to the identification of 16 factors for each group of cities, with regard to the governance systems in place, that could influence NBS adaptive governance (see Appendix A for a detailed description of each factor). Factors were summarised and grouped within the SWOT analysis categorisation (Figures 3 and 4). The findings were then submitted to the participants for their validation. The converging or coinciding factors across European and Latin American contexts suggest that the cities shared common issues. Nevertheless, divergences also emerged, clearly indicating that some factors were specific to the European and Latin American contexts, respectively. A summary of the analysis can be found in Figures 3 and 4.

	Beneficial	Harmful
Internal Factors	- Emergence of **NBS knowledge**: among the confluence of NBS actors. - Initial **inter-institutional coordination**: convergence of actors in and within institutions to implement NBS.	- Emergence of **NBS knowledge**: among the confluence of NBS actors. - Initial **inter-institutional** coordination: convergence of actors in and within institutions to implement NBS. - Limited integration of the NBS concept and their socio-ecological principles in **public policies**. - Limited **environmental education.** - Need to deepen citizens' **participation** and agency. - High implementation **costs** and lack of regulatory frameworks for investments. - Scarcely available **technology** for NBS dissemination and implementation.
External Factors	- Lack of **continuity**: stable plans and programmes to maintain NBS. - **RDI** to concretize impacts, connection with development and innovation dynamics in design, responses and financing. - **Global agendas** addressing the effects of climate variability on the urban environment signal the need for the identification and implementation of NBS. - **Demand**: population's pressure towards public institutions to obtain resources and support to solve socio-environmental issues.	- Low **credibility** in the public sector: growing distrust due to problems of corruption and clientelism. - Disconnection with local **heritage** linked to NBS implementation. - Low **equity**: unequal access to natural resources and environmental services between individuals or groups. - Rapid **growth and urban development**: unplanned socio-spatial growth and management of the city. - Conflicting **political agendas** (municipal, regional and national); instability of government and plans; - Lack of **continuity**: stable plans and programmes to maintain NBS.

Figure 3. SWOT categorisation of influencing factors for NBS adaptive governance in Latin America, with abbreviated category headings highlighted.

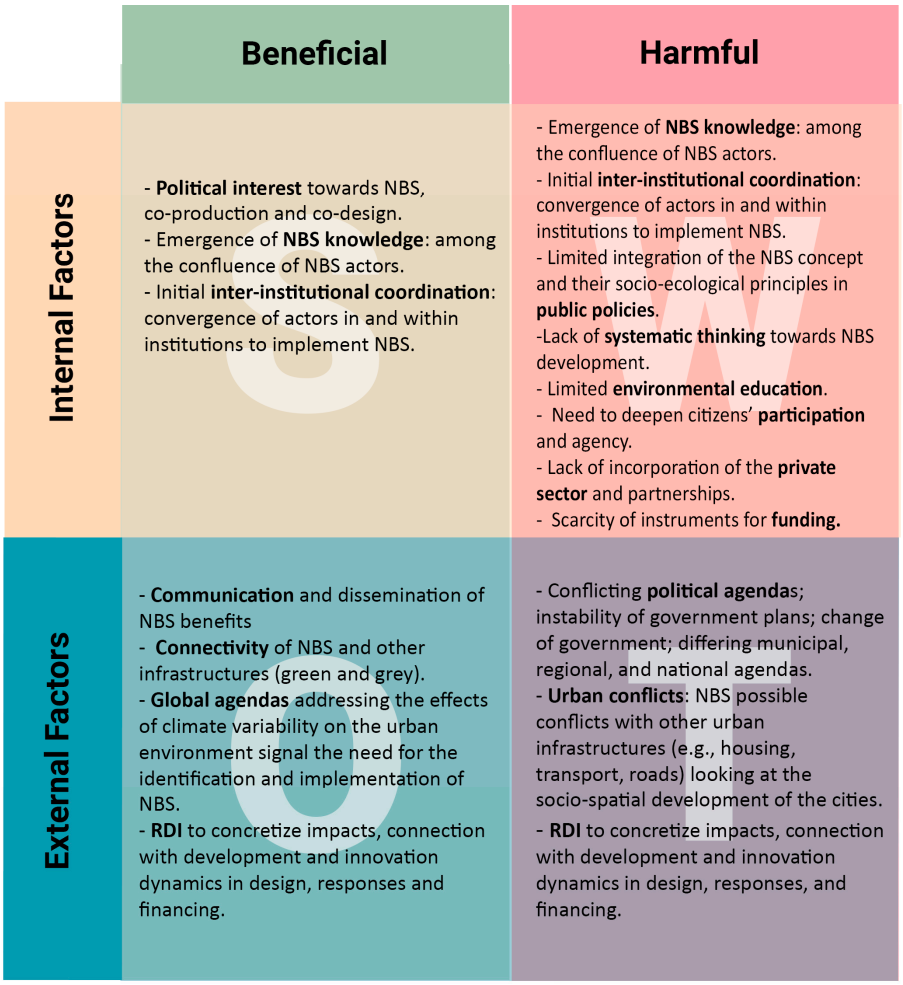

Figure 4. SWOT categorisation of influencing factors for NBS adaptive governance in the EU, with abbreviated category headings highlighted.

4.1.1. Strengths and Weaknesses: Positive and Negative Internal Factors of Urban NBS Adaptive Governance

First, the internal factors that positively influence NBS adaptive governance were noted. In Latin America (Figure 3), the most important strengths that emerged were increasing knowledge about NBS, their multifunctionality, and their capacity to respond to problems of a socio-ecological nature, which was coupled with initial cooperation among sectors working towards NBS development. Indications emerged in both contexts of growing cooperation among internal municipal departments and between different sectors of society, such as between the public sector and academia and between the public sector and local citizens. In the European case studies (Figure 4), the highlighted factors were in regard to, in particular, the increasing political interest of the local authorities alongside citizens' demands for NBS and their co-production.

On the side of negative internal factors that might constitute barriers to adopting NBS in the cities or impede their effective management, two central elements in all case studies were identified: limited existing knowledge of NBS and limited environmental education. These factors were reported to be found both in public institutions and within social organisations and communities. In the European cities (Figure 4), a further expression of this regarded the presence of the "not in my backyard" (NIMBY) phenomenon, in which residents desired the development of NBS but not the drawbacks that come when implementing them (i.e., loss of parking spaces, or organic litter on their streets and homes). Another important common factor that was highlighted by the participants as a

major weakness in both regional contexts is the lack of availability of financial resources, which is crucial for financing new NBS and promoting basic research in the field. In the Latin American cases, NBS were perceived to have high costs for development, and it was determined that there is a need for more mechanisms and services for technology transfer, innovation with a solid scientific basis, and exploration of markets and financing mechanisms. Difficulties arising from the limited inter-institutional coordination among public institutions were still perceived as persistent in Europe (Figure 4). Although interest and initial indications of cross-sectoral collaboration were reported, the lack of in-depth cooperation remains, preventing the creation of networks and collective decision-making, and favouring what has been called "planning in silos". Inter-institutional coordination beyond the environmental and planning departments was disclosed to be difficult in both contexts and was perceived as a gap within the NBS governance process. In turn, the same coordination difficulties were reported to be replicated among different sectors, in particular within the private sector and social organisations. Experts disclosed the need for deepening citizen participation in the decision-making process and the difficulty of implementing this amid inadequate regulatory procedures, resource constraints, and planning and policy without sensitisation and systematisation (integration of NBS).

4.1.2. Opportunities and Threats: Positive and Negative External Factors of Urban NBS Adaptive Governance

With respect to external factors that might support a wider adoption of NBS in urban settings, the participants from the two contexts noted a growing public interest in increasing their levels of health and well-being based on a clearer and more structural reconnection with nature. A major increase in this factor was perceived after the COVID-19 pandemic. This opportunity was accompanied by the growing influence of global agendas on improving ecosystem health and controlling planetary boundaries. Global agendas addressing cross-cutting issues such as climate change, sustainable development goals, food security, and energy security, among others, were mentioned as playing an important role as drivers for urban NBS and considered as normative frameworks able to orient emergent adaptive governance structures. A direct effect of those agendas was expressed to be significantly perceived in the local institutional mandates and interests of the cities. In the European cities studied, where international mandates play a large role due to European Union regulatory frameworks, this aspect was highly reported. The evidence from the Latin American cities indicated a similar trajectory, but at a slower pace. Research, development, and innovation (RDI) was a critically important factor perceived by the experts, both in Europe and Latin America. From the perspective of the experts participating in this study, an important argument exists for improving RDI since the current increase in NBS research is a key opportunity to further advance NBS adaptive governance. Latin American experts also highlighted that although there is a lack of continuity of plans and programmes to maintain NBS, an opportunity can also be perceived to properly integrate NBS into the local plans and systematically reflect on their continuation and development. The European experts further reported initial communication and dissemination of information regarding NBS as an opportunity. This factor was combined with the opportunity to connect NBS with other infrastructures such as bike lanes, drainage systems, and leisure urban spaces.

Looking at the potentially negative external factors, the limited availability of relevant technology for NBS development in Latin American cities was perceived as a significant barrier (Figure 3). This factor was identified as being connected with the need for coupling incoming scientific knowledge with the generation of appropriate legislation, as these cities currently face privatisation processes in the regional context, hindering the creation of easily accessible programmes for NBS knowledge transfer. In the European case studies (Figure 4), further research to concretise impacts and innovation dynamics in design responses and financing was noted, particularly for research on the valuation of NBS benefits. Additional external factors with potentially negative effects on NBS adaptive governance include difficulties in finding a balance between the planning process for the development of cities

in constant growth, and the public demands to increase the reconnection with nature. For the European cities (Figure 4), the biggest issue was reported to be the conflict between the cities' high population density and the already-built urban environment. In Latin American cities (Figure 3), different factors such as poverty and inequality were indicated as largely contributing to these difficulties. A need for a systematic approach based on the co-design and implementation of shared rules of the game (formal and informal) was highlighted. In the context of Latin American cities, it was found that the political agendas face ever deeper difficulties. There were strong perceptions of the possibility of appropriation of the NBS benefits for political clientelism, which would also generate a weakening of the concept within the region and undermine the credibility of public institutions. Along this line, in the European cities, a major threat identified was the competing political agendas between neighbouring cities and local authorities, between government levels, and shifts in agendas linked to changes in political leadership, which can break the continuity of NBS adaptive governance development on a temporal, spatial, or jurisdictional scale or on all scales simultaneously.

4.2. Prospective Analysis: Driving Power and Dependence of Influencing Factors of NBS Adaptive Governance

The prospective analysis classified the factors identified in the SWOT analysis into four different categories based on their driving power and interdependence. The analysis was conducted separately for each regional context. The results are graphically represented in Figures 5 and 6, with each quadrant respectively representing a category: volatile, driving, autonomous, and dependent factors.

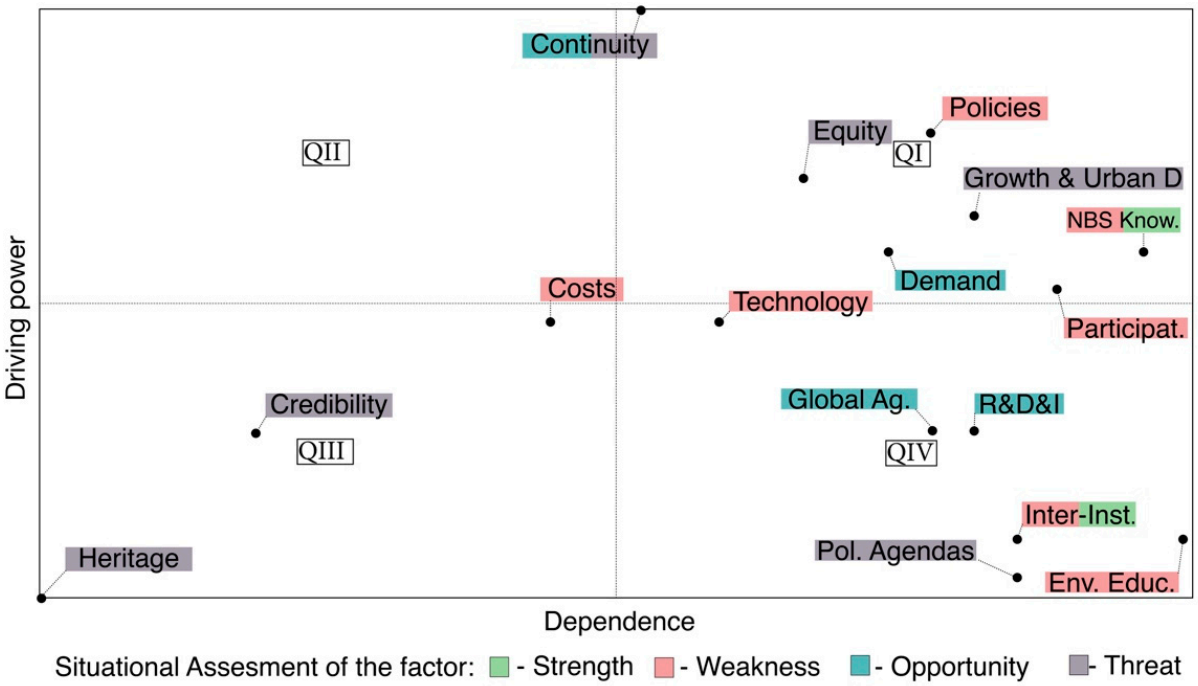

Figure 5. Relationship between direct and indirect influence among the Latin American factors.

4.2.1. Quadrant I: Volatile Factors

Quadrant I shows the volatile factors, which are the most influential and dependent factors. Volatile factors are those factors with a high level of driving power that can change or influence change in other factors, while also displaying a high level of dependence on other factors themselves. They are factors that can drive meaningful changes to a system but are also highly unstable. Any action taken on these factors will most likely affect other factors and create a feedback loop. In the Latin American cities (Figure 5, Quadrant I), the lack of equity, rapid urban growth, and development of the cities emerged as unstable

threats to NBS adaptive governance that should be accounted for. Meanwhile, limited public policies and limited citizen participation were found to be negative internal factors that the cities should work on. Public demand arose as a volatile opportunity for those cities to further promote NBS adaptive governance. NBS knowledge, perceived both as a weakness and an opportunity in the SWOT analysis, and public policies as internal negative factors were the common ground present in this quadrant, being a similarity between Latin American and European cities. In the European case studies, the other volatile factors (Figure 6, Quadrant I) found were mainly negative factors that can act as barriers for NBS adaptive governance: the need to further enhance the systematic thinking of the cities, their current urban conflicts, and inter-institutional coordination. The only external positive factors classified as volatile in the European cities were global agendas. RDI was identified as being an opportunity but also a threat, and thus further research on NBS impacts, valuation, and innovation dynamics is needed.

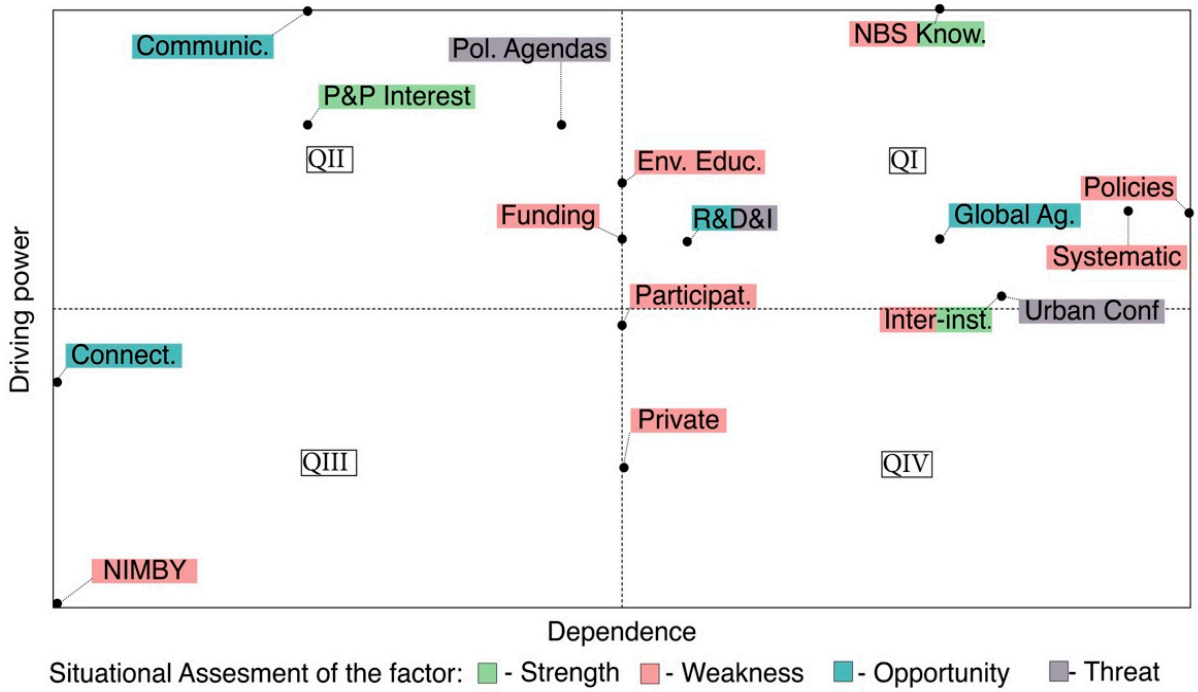

Figure 6. Relationship between direct and indirect influence among the European factors.

4.2.2. Quadrant II: Driving Factors

The factors found in Quadrant II are the driving factors: the most influential and independent factors of the system (Figures 5 and 6, Quadrant II). They are mobile factors that have a strong driving power and are able to highly affect the other factors without being influenced themselves. They have the power to provoke meaningful change, but also could cause the future collapse of the system. For the European cities studied, the results suggest that the main factors to be considered to drive forward NBS adaptive governance are the improvement of communication, the opportunity for political and public interest in NBS, and the need to strengthen NBS in political agendas across borders and levels. In this context, environmental education and instruments for funding were found to be on the borderline of being a volatile or a driving factor, as they are factors with a high influence over other factors but have an unclear dependence. In the Latin American cities, no such factors were found. However, given the uncertainty about NBS in the region reported in the interviews, it is worth noting the neighbouring factors with a low dependence but high driving power. For this reason, the lack of continuity of the planning process for the NBS agency, originally identified as a volatile factor, can be treated as a driving factor in Latin American cities' NBS adaptive governance. The high implementation costs of NBS projects,

an original autonomous factor, also emerged as a highly influential barrier that should be kept in mind.

4.2.3. Quadrant III: Autonomous Factors

The least influential and least dependent factors are found in Quadrant III: the autonomous factors. These are factors with weak driving power and dependency that are rather disconnected from the other factors of the system. They do not largely influence the system in the short term but are important to be considered in the long term if the driving and volatile factors are transformed. In the Latin American cities (Figure 5, Quadrant III), this quadrant only indicated factors found in the SWOT analysis that negatively influence NBS adaptive governance: costs, low credibility in the public sector, and the limited consideration of local heritage. For the European cities (Figure 6, Quadrant III) the NIMBY phenomenon was found as a weakness that needs to be worked on in the long term, whereas the desire for connectivity to create synergies between NBS and other infrastructures is an opportunity to generate long-lasting changes.

4.2.4. Quadrant IV: Dependent Factors

Lastly, Quadrant IV displays the most dependent and least influential factors, the dependent factors. The dependent factors are levers of the volatile and driving factors that should be considered to drive actions. They constitute a set of factors that, due to their location, pose an important level of transversality that can permeate the actions of other factors. The advancement of RDI, as well as global agendas, emerges as a dependent opportunity for the Latin American cities to advance NBS adaptive governance (Figure 5, Quadrant IV). On the other hand, changes in political agendas and governments appear as a threat and are combined with the need for further technological advancement for NBS, low inter-institutional coordination, and limited environmental education. For the European cities (Figure 6, Quadrant IV), citizen participation and agency as well as the incorporation of the private sector were two weaknesses that emerged that urgently need to be improved.

5. Discussion

Developing an adaptive governance approach can be considered an effective means of reducing vulnerability, fostering resilience, and improving the sustainability of NBS [88,89]. From a governance perspective, arrangements for integrating NBS in the urban landscape can support or constrain both cities and the governance system itself in their capacity to adapt to their changing environment. The perspective of adaptation and adaptive capacity in NBS requires specific features to be established and managed, such as mechanisms for cooperation, experimentation, and public participation [54,90–93]. The findings from this study are in line with the literature bringing essential topics of NBS adaptive governance to the surface.

Factors that can foster NBS adaptive governance identified in European and Latin American cities displayed many differences but also presented shared elements. Eight factors were common between the two contexts investigated. This indicates that certain similar pathways can be foreseen besides the need for NBS adaptive governance to be place-based and suited to the setting where it is applied. The common factors are related to global agendas, public policies, political agendas, inter-institutional coordination, NBS knowledge, RDI, environmental education, and citizen participation and agency. These factors concern three main issues commonly discussed in the field of governance: (a) the legal and institutional framework; (b) learning and experimentation; and (c) cooperation and co-management. The following subsection is structured according to these three issues.

5.1. Common Pathways

5.1.1. Legal and Institutional Framework Related Factors

The emergence of global agendas, public policies, and political agendas in the investigated cities highlights the key role of policymakers and public institutions' actions, goals, and policies towards enabling adaptive governance on a local, national, and global level (e.g., [38,94,95]). Legal frameworks and informal institutions can be considered as formal and informal rules of the game, which provide a direction for actions fostering the implementation of NBS. To achieve NBS adaptive governance, they should be identified and must function efficiently. However, the results show that existing formal regulations are dispersed along diverse multi-level legal frameworks related to land use and environmental management [96]. Public policies are perceived as a weakness, which is a negative internal factor that needs to be improved in both regions. Findings are consistent with Dorst et al. [33] who found insufficient NBS policy development, implementation, and enforcement as one of the seven barriers for NBS integration in urban development due to limited organizational capacity within local authorities. However, public policies are, at the same time shown to be a crucial driver and enabler within the implementation dynamics [44,97] since they constitute a propulsive force for NBS adaptive governance even if they are volatile. The complexity of NBS demands clear procedures and new institutions tailored to select the solutions required for each urban centre and to guarantee their continuity.

An outlier in this group is the factor of political agendas, identified by the prospective analysis as an autonomous factor in Europe that has a very high potential to affect all other factors, and therefore significantly boost or hinder NBS adaptive governance. A similar finding of Sarabi et al., [95] that shows that political support is essential for NBS development and political barriers "are identified as the underlying critical factors affecting all the other barriers" (p. 8). The factor of political agendas functioning as a threat can open the way for fractious NBS implementation and governance putting it at risk to be delayed at the outset [28]. Global policies, on the other hand, may not only be supported by NBS, as indicated by Timboe and Pharr [98], when identifying potential areas for NBS to contribute to the global goals and thereby enhance societal and ecological resilience, but also emerged in the results as a significant opportunity both for Latin American and European cities. They come with a stronger potential to influence other factors towards enabling adaptive governance, possibly due to the socio-political and economic context provided by the European Union. It is essential to address these factors on a global level to provide an empowering and supportive political environment.

5.1.2. Learning and Experimentation Related Factors

The eight common factors also present characteristics of experimentation and learning. They demonstrate the need for leading experiments to probe and identify the fit between different NBS and their capacity to solve complex social-ecological problems as reported by Kingsley et al. [99] and Cárdenas et al. [88]. Working in this direction can contribute to achieving NBS adaptive governance in Europe and Latin America, as well as further facilitate environmental and NBS learning among stakeholders and local decision-makers. It is a challenging process that demands long-term collective action among multiple stakeholders [2]. The prospective analysis revealed that both in Europe and Latin American cities NBS knowledge is a volatile factor that can drive forward and lead other dependent and driving factors in the short and long term. NBS knowledge was perceived both as an opportunity, due to its growing status, and also as a weakness, given the limited know-how available. A factor that persists, as the lack of knowledge and information regarding the creation, implementation, and management of NBS, in particular by the general public, is well-known within the literature, as Sarabi et al. [34] discuss in their results. The lack of comprehensive information and knowledge of NBS deepens the level of uncertainty and potential conflicts among stakeholders [34,89,100], and it is crucial for determining the attainment of NBS adaptive governance.

RDI, an unstable factor for the two regions with a higher driving power in the European cities than in the Latin American cities, highlights the need for more action research initiatives based on participatory processes [88], such as Living Labs, which are noted in the literature as a possible way to encourage a sense of belonging, support the transformation of mental models, and enhance polycentricity in the long term [35,42,97,101]. The state of the art in this field remains largely academic [96] affecting the level of acceptance and inclusion in public and private agendas [102,103]. Enhancing levels of knowledge through experimentation, environmental education, and training programmes and targeting citizens and experts at different institutional scales can help reduce levels of uncertainty and improve citizens' and other local actors' support [104,105]. For instance, Cárdenas et al. [88] mention that learning and experimentation instruments such as citizen science can reach immediately local and larger communities expanding participation for NBS. Case study experiences reported by Arlati et al. [106] in Hamburg, Germany, demonstrate that experimental research-based interventions can further lead to insights for shifting governance settings.

A highly significant similarity between the European and Latin American cities that can be taken from these results is a shared understanding of NBS governance, leading towards an adaptive governance for NBS. This refers to a multi-level and multi-actor social structure that can plan and manage NBS from a participatory perspective in which public and private institutions are integrated and collaborate.

5.1.3. Cooperation and Co-Management Related Factors

The common factors generally refer to cross-sectoral work (both across governments, governments sectors, and sectors of society), and multi-actor participation. The first, found to be both an opportunity and a weakness with high dependence for both groups of cities analysed, reveals a continued urgency in overcoming the "sectoral silos" to break the consolidation of fragmented visions, legal frameworks, unilateral perspectives, and mental models derived in the strengthening of command-and-control policies, as mentioned by Frantzeskaki et al. [107]. "Planning in silos" is a structural characteristic in many governmental organisations [33]. It stands as a barrier to facilitating the collaboration and the construction of networks of stakeholders [96,108] and the successful uptake and implementation of NBS [34,35,38,39]. Interinstitutional coordination in this field is central since diverse public institutions, working at different levels and with different missional agendas, need to create consensus, clarify their roles, and define mechanisms for sharing investments and collective monitoring with private actors. As noted by Kabisch et al. [3], mainstreaming NBS to the interinstitutional level is key "to ensure the sustainable implementation of on-the-ground measures, and challenge current practice and procedures at multiple levels of governance" (p. 269). Bridging knowledge among public institutions (vertical and horizontal) still poses an important challenge in the practice and governance of NBS [109] that requires urgent attention.

Citizen participation constitutes a highly dependent weakness and is a reminder of the necessity to involve local citizens, civil society organisations, and NGOs to guarantee sufficient levels of equity, stewardship, and place-based orientation in the process of NBS co-design and implementation [44,99,110]. Conventional participatory approaches to NBS development remain the norm, while the complexity of the problems NBS addresses demands the need for deeper levels of participation and more inclusive and accessible modalities [110]. A shared understanding of NBS and their functions among multiple actors is a key element of its development [111] and facilitates the emergence and consolidation of co-management [112]. The use of place-based approaches as a bridging mechanism can facilitate the engagement of different actors by improving a shared understanding of NBS, collaboration, and common language among actors [89,107].

Similarities in relation to cooperation and co-management can also be perceived within the slightly diverging factors between European and Latin American cities. In line with Toxopeus and Polzin [32], who found a lack of public financing and societal drawbacks of private investment for NBS in the urban context, NBS funding and costs were found to

be influential factors for achieving adaptive governance. Weak spots cause bureaucratic challenges for investments such as conflicting tax and grant schemes, delays in planning, and risk aversion, as the multiple benefits of NBS are still challenging to value and quantify in the long term [3,95,104]. Economic instruments and inadequate financial resources still represent a gap in the field, and more effective methods to make NBS cost-effective need to be found [34,113]. Moreover, further experimentation and public-private partnerships need to be activated. Lastly, the demand from the population found in Latin America and the growing political and public interest found in the European cities demonstrate the growing momentum for enhancing cooperation and co-management in NBS. Vertical and horizontal integration among public, private, and civic institutions can enhance adaptive governance by involving local perspectives, and new economic mechanisms, and by increasing the legitimacy of the solutions implemented [32].

5.2. Singular Pathways

Differences among the regions start to increase along with the negative externalities of urban conflicts in the European cities and in tandem with the growth and urban development in Latin America, reflecting the different rates and processes of urbanisation in the two contexts. European cities display more consolidated urbanisation, whereas Latin American cities have rapid, compact, and ongoing young urban growth [114,115]. Both factors are unstable and are highly influential threats to NBS adaptive governance as they bring pre-existing urban conflicts and dynamics into play. Within the Latin American case studies, the issue of equity emerges as an unstable and highly influential threat, echoing the high socio-economic and environmental inequality of the continent [116]. Specific predominant societal challenges cannot be ignored, and the consideration and adaptation of place-specific characteristics, such as equity, are essential during NBS implementation [44]. In European cities, systematic thinking was highlighted as a weakness, emphasising the need for more holistic and integrated thinking for NBS. Technology was further identified as a weakness of Latin American cities and is highly dependent on other factors, in particular RDI and environmental education. The continuity of stable support plans and programmes to maintain and disseminate NBS and their expected services and functions also come up as a high priority in Latin America.

For the European cities, communication and dissemination of NBS benefits emerge as an initial powerful driving factor for NBS adaptive governance, as the lack of communication and awareness damage the process, by possibly influencing the reported NIMBY phenomenon, for instance. Similar findings have also been reported by Dorst et al. [33] in the Netherlands, where citizens wished for NBS benefits but not their disbenefits, and by Vojvodíková et al. [111], in the Silesian Metropolis in Poland, where residents noted the importance of the urban wilderness of NBS but did not wish for it in their neighbourhood due to the possible attraction of "troubled citizens". The latter study further displayed the need to communicate with local communities during NBS design to avoid a sense of danger and enhance acceptance [111]. The gap in the integration of the private sector continues to be an obstacle for the region, as found by the same authors [29] when uncovering structural conditions hindering NBS. Lastly, in the Latin American cities, the analysis revealed the lack of recognition of the various forms of tangible and intangible, public and private heritage linked to NBS, as well as the lack of trust in the public sector within the region. Although NBS legislation has not yet been consolidated in Latin American countries, initiatives linked with green infrastructure (e.g., the wetland policy in Bogotá and forest conservation in São Paulo) can enhance mainstreaming NBS by directly involving nature–society relationships [117,118].

6. Conclusions

The implementation of NBS in urban settings is urgently needed to address the complex and cross-cutting issues that cities experience all around the world. NBS can substantially contribute to climate change adaptation and mitigation, protect human health

and well-being, preserve air and water quality, increase liveability, and support biodiversity in urban environments and beyond. To strengthen and improve NBS implementation, the need for a new governance approach becomes clearer. Adaptive governance has been increasingly suggested as a way forward to unlock the full potential of NBS. However, effective and contextually appropriate approaches to NBS adaptive governance are still under construction. The present study employed a SWOT analysis and a prospective analysis based on sequenced surveys and expert interviews in European and Latin American cities to identify external and internal positive and negative factors of NBS adaptive governance. These findings should be considered for tracing potential pathways to enable NBS adaptive governance in European and Latin American cities. The results show that the two regions share significant common factors and priorities, while also displaying differences. This underlines that, although implemented in different contexts, NBS adaptive governance can be conceptualised on a global level, while still ensuring room for each region's peculiarities. To achieve this, a collaborative environment, composed of collective decision-making, co-management, and polycentricity, is required. The most central challenge that emerges from this study for the enabling of NBS adaptive governance in Latin American and European cities consists of (a) the need for cities to adapt the formal and informal governance systems (public policies, political agendas, and inter-institutional coordination); (b) the call for creating opportunities for more informative and educational tools (on NBS, the environment, and RDI); (c) the basic importance of financial support (budgetary and investments) dedicated to facilitating transformative experimentation processes towards adaptive governance; (d) the key role of a robust community engagement platform across sectors and interests, (e) the need for clear and comprehensive dissemination (including contextually appropriate and audience-specific terminology and forms of communication), and (f) the adoption of a multiscale spatial and temporal approach to address the multiple levels at which NBS are about to be introduced. In other words, the cities from the two contexts will face old and new challenges in addition to many barriers when aiming to implement adaptive governance for the benefit of reconnecting urban society with nature.

Limitations of the present research include the high dependence on experts' opinions and the consequently limited number of factors considered. Furthermore, in both regional contexts, it is still not possible to find concrete evidence of the impacts of adaptive governance on the levels of efficiency and sustainability of NBS, in comparison with the traditional or monocentric forms of government. A better understanding of the influence of the governance structure on the trajectory and outcomes of NBS implementation is necessary. This can substantially help to connect the governance structure with the specific functions and orientation of NBS to untie the socio-environmental problems that often affect their design and implementation.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su15054479/s1, File S1: Qualification of the levels of influence used in the pairwise relationships in Europe. File S2: Qualification of the levels of influence used in the pairwise relationships in Latin America.

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Data Availability Statement: The data resulting from the analysis presented in this study are available at CORDIS: https://cordis.europa.eu/project/id/867564/results---T2.2 Report (accessed on 22 January 2023). The data resulting from the interviews and workshops are strictly confidential and are not publicly available.

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Appendix A

Table A1. Factors for NBS adaptive governance, identified through SWOT analysis.

EU	LA
1. Political agendas: political party agendas; instability of government plans; change of government; differing municipal, regional and national agendas.	1. Political agendas: political party agendas; instability of government plans; change of government; differing municipal, regional and national agendas.
2. Public policies: limited integration of the NBS concept and of socio-ecological principles and criteria for their design and implementation.	2. Public policies: limited integration of the NBS concept and of socio-ecological principles and criteria for their design and implementation.
3. Inter-institutional coordination: confluence of resources and actors in institutions to implement NBS.	3. Inter-institutional coordination: confluence of resources and actors in institutions to implement NBS (e.g., housing and environmental management policies).
4. Relation to global agendas: global agendas addressing the effects of climate variability on the urban environment signalise the need for the identification and implementation of NBS.	4. Relation to global agendas: global agendas addressing the effects of climate variability on the urban environment signalise the need for the identification and implementation of NBS.
5. NBS knowledge: facilitate the confluence of actors (people, public administration, academia, and private sector) and their knowledge.	5. NBS Knowledge: facilitate the confluence of actors (people, public administration, academia and private sector) and their knowledge.
6. Environmental education: increased knowledge about NBS and their effects on socio-ecological dynamics and urban ecology.	6. Environmental education: increased knowledge about NBS and their effects on socio-ecological dynamics and urban ecology.
7. RDI (research, development, and innovation): research to concretise impacts, connection with development and innovation dynamics in design, responses and financing.	7. RDI (research, development, and innovation): research to concretise impacts, connection with development and innovation dynamics in design, responses and financing.
8. Citizens participation and agency: deepen citizens' participation and empowerment.	8. Citizens participation and agency: deepen citizens' participation and empowerment.
9. Political and public interest: interest of the local population and authorities on reconnecting with nature.	9. Demand: population's pressure towards public institutions to obtain resources and support to solve socio-environmental issues.
10. Instruments for funding: regulatory frameworks for investments to understand and enable fiscal and financial incentives and private funding.	10. Costs: implementation costs and regulatory frameworks for investments. Fiscal and financial incentives can subsidise implementation and operating costs.
11. Urban conflict & development approach: NBS possible conflicts with urban infrastructures (e.g., housing, transport, roads) looking at the socio-spatial development of the cities.	11. Growth and urban development: consider the socio-spatial growth of the city and its management.
12. Systematic thinking toward development: approach to NBS through three perspectives (social, environmental, and economic).	12. Equity: unequal access to natural resources and environmental services between individuals or groups constitute a major issue of inequity causing a perception of conflict between NBS and social issues.
13. NIMBY: trade-offs between NBS implementation and urban lifestyle can hinder NBS development.	13. Heritage: various forms of tangible and intangible, public and private heritage linked to NBS implementation.
14. Incorporation of the private sector: understand how to engage the private sector, assessing available funds and partnerships.	14. Technology: permeates all scales and dimensions of NBS. Its availability and accessibility are fundamental for NBS dissemination and implementation.

Table A1. *Cont.*

EU	LA
15. Connectivity: create synergies between NBS, other green infrastructures and traditional grey infrastructures of the cities.	15. Continuity: stable support plans and programmes to maintain NBS and ensure continuity of expected services and functions.
16. Communication: dissemination of NBS benefits to enable the local population to fulfil a crucial role in decisions affecting their environment.	16. Credibility in the public sector: growing distrust caused by problems of corruption and clientelism.

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