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Starting a Participative Approach to Develop Local Green Infrastructure; from Boundary Concept to Collective Action

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Abstract: Flanders (Belgium) is one of the most densely populated regions in Europe. Intensive land use, widespread suburbanization, inadequate environmental qualities, and fragmentation everywhere deteriorate living conditions and put pressure on species and natural habitats. In the past, several governmental initiatives were launched to establish a coherent ecological network to improve the situation. Despite the set objectives, only a little progress was made. Therefore, to establish green infrastructure, a new approach that moves away from previous top-down and one-sided strategies is developed. Making use of Green Infrastructure as a boundary concept, interpretation was given through an open and participatory process. The core is the identification of common objectives (ecosystem services or other objectives/services), the selection of appropriate green infrastructure elements to support the services, and the co-design of a network taking the local socio-ecological realm into account. By applying the methodology in concrete urban and rural projects, we learned that establishing strong coalitions of stakeholders, obtaining and sharing reliable knowledge of the systems are key to an effective realization of green infrastructure.

Keywords: Green Infrastructure; boundary concept; collaborative planning; participative design

1. Introduction

1.1. Problem Statement

The value of nature, the variety of functions and services it delivers for society, and hence the essential contribution to human living conditions, are widely acknowledged. However, translating this premise into practice lags far behind. New initiatives in land use planning, urban development, and environmental management are striving increasingly to guarantee more optimal and sustainable spatial and environmental conditions that meet the requirements of species and habitats. However, the current use of land and natural resources still has tremendous negative consequences for nature and biodiversity [1]. As a result, most of the ecosystems in Europe are still degrading and do not deliver the optimal quality and quantity of basic services [2]. For decades, at national and international levels, targets are set and strategies are launched to improve this situation. The

protected ecological networks by the European Birds Directive (Council Directive 79/409/EEC) and European Habitats Directive (Council Directive 92/43/EEC), the integration of nature preservation goals into different policy domains, and the promotion of multifunctional land use, are typical elaborated strategies in this respect. In intensively used and densely populated regions in particular, much is expected from such approaches.

The evolution in spatial and nature policy in Flanders (a northern part of Belgium) exemplifies the typical challenges that urbanized regions are facing when trying to implement the agreed strategies. The spatial context of Flanders is characterized by a highly fragmented land use. Up until now, 32.5% of the Flemish territory is covered by dispersed built-up areas, including housing (and gardens), commercial and industrial areas, sport and recreation facilities, infrastructure [3,4]. The urban sprawl in Flanders is spawned out of a closely knitted network of historical villages and ribbon development, along a widely dispersed infrastructure network of roads, highways, railways and canals. Together with a very intensive agriculture, this urbanization resulted in a small-scaled spatial landscape mosaic, in which semi-natural sites are limited to small bits and pieces surrounded by intensively used land (Figure 1).

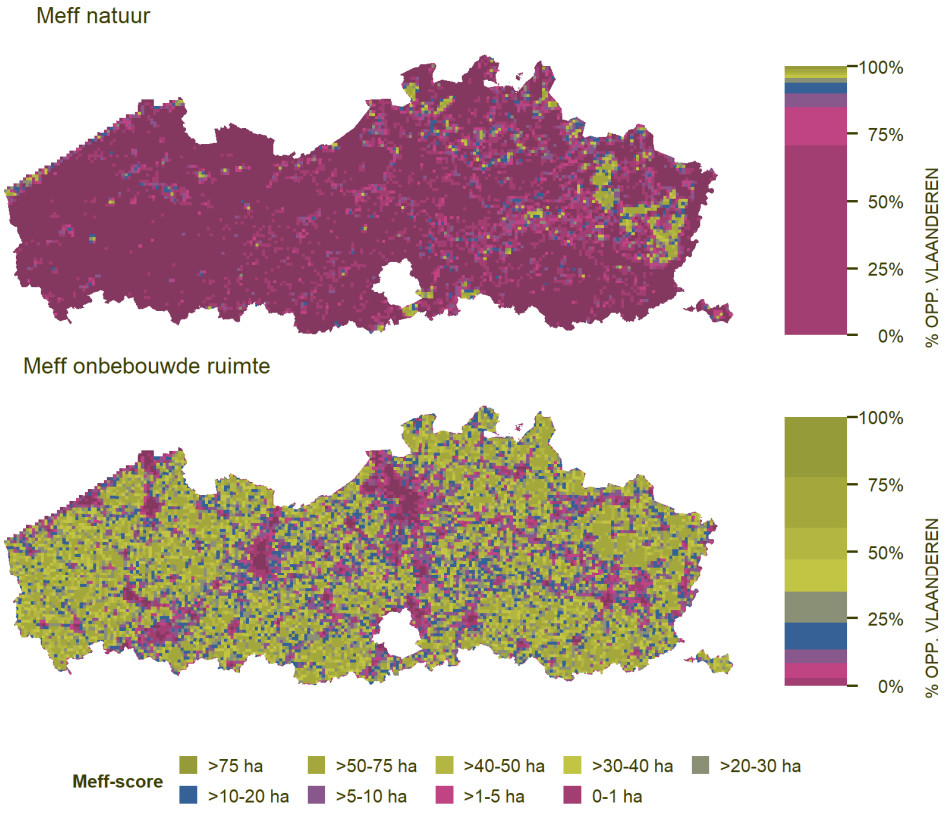

Figure 1. Fragmentation in Flanders: Available green space in Flanders (**top**) and available open space in Flanders (**bottom**). The purple color correspondents to a high fragmentation [5].

Belgium and especially its northern part, Flanders, is, together with Luxemburg, confronted with the highest fragmentation pressure in Europe. In 2011, the European Environment Agency (EEA) calculated landscape fragmentation of European countries [6]. The study shows that the western and central parts of Europe are the most fragmented regions with the Benelux countries as outliers. In Belgium, the Netherlands, and the North of France there are no areas of low fragmentation left. Additionally, large parts of Germany, Denmark, Poland, and the Czech Republic are indicated as highly fragmented. Those highly fragmented regions are mostly found along major transportation

corridors and near large urban areas. Conversely, the lowest levels of fragmentation are associated with mountain ranges or remoteness and are found in the Alps, Scandinavia, eastern European countries, Mediterranean countries (except Portugal), Ireland, and Scotland [6].

The ecological consequences of this radical spatial fragmentation are obvious [7]. The ever more shrinking habitats are exposed to increasing edge effects, a growing lack of internal environmental heterogeneity, decreasing population sizes, a higher risk of extinction, and a lower chance of colonization, which makes them highly vulnerable and less sustainable in the long run. Thus, nature conservation in general focuses on preserving larger natural areas, regarding the ecological value of small natural areas as of minor importance. However, evidence is growing that this appreciation does not hold in general. With appropriate management and spatial configuration these small habitat patches can represent a significant biodiversity [8], and can deliver a wide range of ecosystem services [9], despite high pressures from, for instance, recreation or transportation.

The potential of small habitat patches to support biodiversity and to deliver ecosystem services, adds to their importance to increase sustainability and improve living conditions in intensively used and densely populated regions. Long before it was called 'green infrastructure' (GI), policies and instruments were developed to preserve and improve the ecological value of these remaining small semi-natural habitats. For decades, integrating these habitats in a coherent network of protected sites was the guiding principle. Attempts to establish ecological networks were made in several countries [10]. Networks of small landscape elements in the wider countryside, adequately managed and guaranteed of appropriate environmental conditions, were thought to be effective for the ecosystem services they provide. Being a key concept of ecologists and conservation biologists, in the beginning, the notion of ecological networks and its reframing into the more technical 'green infrastructure', was quickly adopted by spatial and environmental planners [11]. Since the European Commission launched the Green Infrastructure Strategy [12], attention and importance further increased and European countries and regions engaged to realize effective GI networks.

Additionally, in Flanders, strengthening and completing the GI became one of the key objectives, not only for agencies, administrations, or organizations dealing with nature conservation, but also for spatial planning in general. In the current 'strategic vision' of the Spatial Policy Plan of Flanders [13], clear objectives are formulated in this respect. It is stated that, to achieve a resilient and coherent open space, a so-called dense green-blue network must be implemented. The multi-functionality of the region's open space and its green-blue network is a prerequisite. These goals and requirements regarding agriculture, nature, forest, and water must be taken into account and its composition, structure, design, and management have to support the objectives set for climate adaptation and mitigation, energy production and use, recreation, and public health.

To ensure a successful implementation of these green-blue networks, it is wise to learn from former attempts. In the past, several policy departments and interest groups have addressed GI. In 1991, the minister in charge of the Department for Environment and Nature launched the 'Green Main Structure for Flanders' ('Groene Hoofdstructuur' in Dutch) [14]. However, due to a lack of political support, and because of the strong opposition of interest groups, the plan was withdrawn before any concrete realization was started [15]. However, the idea of an ecological network was not abandoned. Detailed discussions and negotiations were conducted between different sectors and their legal bodies on the administrative level of the Council for Environmental and Nature Policy of Flanders. When this resulted in objectives and clear targets for a regional ecological network, an agreement was reached in 1997 to finally announce a new 'Flemish Ecological Network'. GI were addressed in both the new Flemish Decree on Nature Conservation and the Flemish Decree on Physical Planning and its 'Spatial Structure Plan' (=a form of strategic planning). The ambition was to designate 125.000 ha as proper 'Flemish Ecological Network' ('VEN') (= 9.3% of Flanders) and 150.000 ha (or 80.000 ha in the revised version of 2011) of 'Nature Integration Areas' ('IVON') (=11.2% resp. 6% of Flanders) [16,17]. 'VEN' areas are considered as the backbone of the 'natural structure' in Flanders where nature prevails. In IVON areas, the goal is to provide additional opportunities for biodiversity. However, other functions such as agriculture, recreation, forestry, housing, etc. may not be jeopardized.

This designation was aimed to be done by 2003 according to the nature conservation decree, or by 2007 according to the physical planning procedure. After more than 20 years, and far beyond the deadlines, in 2020 74% of VEN and only 4% (or 7% for the revised version of 2011) of IVON has been designated [18]. The latter is illustrative of the difficulties in working towards the integration of objectives and multifunctional land use. The prevailing policy of the sectors that shape and manage the countryside is still predominantly based on a planning policy that merely allocates mono-functional land use zones. This outdated type of planning often results in a 'fight for hectares', whenever new zoning plans are drafted.

It is obvious that regarding the main objective of green-blue infrastructure, i.e., to implement a coherent and functional ecological network, both policy programs failed. The constraints met are various [19,20].

Social constraints relate to:

- the different perceptions of the impact of GI on management decisions and the use and value of private land,
- the contrasting interests of nature conservationists, farmers, hunters, anglers or foresters and the mutual frictions this brings about;
- the regulation of (land) use in designated areas; i.e., the issue of exclusive or joint use of designated land and the uncertainties this creates;
- the lack of a clear and effective communication strategy, especially between members and officials of the regional government on the one hand and local stakeholders or the general public on the other, which results in the failure of a fruitful participation strategy.

Political and organizational constraints relate to:

- the weak coordination capacity of different policy domains and departments, as well as the bad tuning of procedures and timing of different policy levels;
- the lack of political agreement between political parties involved in the allocation of the ecological network.

Economic constraints relate to:

- the indistinctness about the consequences of designation for economic activities and the required compensation if any;
- the uncertainty about acquisition and management costs of GI and the availability of guaranteed funds.

Resource constraints relate to:

- the incomplete knowledge about the nature targets of GI, the management practices necessary to reach these goals, and the consequences this has for formulating any alternative arrangements that may facilitate joint land use of designated land.

1.2. Looking for a New Approach towards Integration of Objectives: The Gobelin Project

The Flemish Environment Department, of which spatial planning is a part, wanted to consider an alternative approach to realize GI, being aware of the failures of the past. Rather than issuing another comprehensive blueprint plan, it was chosen to realize GI in conjunction with existing (re)development projects and work towards the integration of different objectives relating to GI and multifunctional land use. To explore the possibilities and opportunities of this approach, the 'Gobelin-project' was started. The project was commissioned by the Flemish Environment Department and conducted by the Institute for Nature and Forest Research (INBO) and the University of Antwerp (UA) from 2017 to 2019.

The poor developments regarding the ecological network in Flanders were clearly related to a defective top-down planning approach from merely one single perspective, namely the ecological view, combined with diverging discourses and objectives of different policy domains [19]. With a top-down planning approach, we mean a large-scale and government-led approach on a higher

planning level for a whole region. This top-down planning started from set objectives at the regional level (Flanders) that hardly took local demands and potentials into account. It was a unidirectional implementation and decision-making process with only few possibilities to allow adapting to local conditions. To overcome the failures of the past we chose instead to work bottom up. That means we envision a small-scale and local-led approach together with local administrations and organizations. This bottom-up approach starts from locally defined objectives and conditions which are interpreted gradually in an interactive and collaborative process and designed to meet the overall goals that are adopted at a higher level. This is in line with the conclusions of Bogaert [19] who argues that, in order to make nature policy more successful, far better coordination between policy fields, and above all coherent linkages between the various aspects of the implementation process (discourses, actors, rules, resources) are prerequisites. The same conditions apply to the successful implementation of GI.

In this paper we concentrate on the first phases of the bottom-up approach. Sharing a common understanding of the issue at stake is the first thing that needs to be done. Therefore, we study how GI, with its ambiguous definition, can be adopted as a boundary concept in collaborative planning. We explore through participatory action research (1) how a variety of local stakeholders engage and interpret GI depending on different local contexts to find a common language, and related to the search for common goals, and (2) how different objectives and interpretations regarding GI can contribute to a design process with stakeholders and how the design process then stimulates the debate towards consensus. These research questions are particularly relevant for GI policy implementation in highly fragmented and intensively used areas. Areas where multiple demands for ecosystem service provision of GI on the one hand, and land use pressure that negatively impacts GI performance on the other, increase the need to fully take into account the local context and to engage local stakeholders in the implementation process.

1.3. State of the Art

Many countries and cities such as the UK [21], Scotland [22], Helsinki-Uusimaa Region and the City of Järvenpää (Finland) [23], and Canada [24] have planning policies for implementing GI [25]. Nevertheless, planners still encounter difficulties in defining and operationalizing GI within land use policy and planning practices [23,26].

A recent review on GI in Europe shows that the number of academic papers on GI was very low before the launch of the EU Strategy in 2013, but since then increased exponentially [27]. It also states that the ambiguous definition of GI stimulated varying research topics and outputs. One of them is participation and stakeholder engagement in GI planning which is important to effectively realize GI. In this respect, ⅓ of the 194 analyzed papers mentioned the following need for further research: "implementation of GI planning, improvement and further studies on planning" [27]. None of the papers, however, adopted participatory action-research as a means to analyze a GI policy implementation process. From our experience with former planning and implementation practices, we think it is worth concentrating on this approach.

1.3.1. Boundary Concepts and a Common Language

Although there is a general interest in GI on an academic, policy, and practice level, a shared understanding is still lacking, as the concept of GI remains ambiguous. A wide variety of landscape and natural elements may be part of GI [20]; from green facades to meadows and forests. The broad definition that was given to the concept allows various interpretations depending on the sector and context in which it is developed [11,28,29]. However, according to Star and Griesemer [30], full consensus is not necessary for cooperation. They argue for the use of boundary concepts to manage both diversity of understanding and cooperation to solve problems and reach shared objectives. Boundary concepts are both "plastic enough to adapt to the needs and constraints of the several parties that employ them, yet robust enough to maintain a (common) identity" [30]. Their meaning is open to various interpretations embedded in specific and local actions, and hence meanings and values may change when actions further develop [31]. Handling GI as a boundary concept can thus make it possible to acknowledge its potential to supply a variety of social benefits without the

necessity to seek a consensus based on a single definition of GI, argues Wright [29]. However, finding a common language or shared understanding is important [32]. To make this happen, a transdisciplinary, collaborative landscape planning process based on social learning, knowledge integration, and the active involvement of local actors is most desirable, as Opdam et al. [33] have shown.

1.3.2. Multi-Stakeholder Process

The importance of local stakeholder engagement for planning a GI has been argued by many scholars [33,34]. The organization of such multi-stakeholder processes, however, are complex and time consuming [34]. A properly implemented collaborative planning process must meet several preconditions. We summarize them as follows. Collaborative planning processes are inclusive and representative, discussion-oriented and transformative [35]. Therefore, collaborative planning processes are transparent and provide equal opportunity of access and accommodate the opportunity to participate through different styles of speech in an open, legitimate, and trusting environment. They integrate local and scientific knowledge and involve stakeholders in an early stage [36]. Furthermore, they ensure that power distortions are minimized through careful listening and facilitation [35]. Organizers are expected to have an open vision and must be open to unexpected input and experienced moderators are present. [36,37] Consequently, a collaborative planning process induces shared understanding and social learning through a respect for difference and recognition of others' values and the process engenders a sense of ownership of the outcome [34,35].

1.3.3. Role of the Design(er)

Complex problems in today's society make research through design more meaningful than ever. Designers are trained to tackle ill-defined problems, to think constructively, and to focus on solutions [38]. A design stimulates imagination, invents new solutions, and formulates alternatives. In this way, boundaries of what is possible are being explored [39–42]. A designer is often seen as the planner who knows it all, however, in many situations, it is beneficial if the designer adopts a humbler attitude, for instance as an observer and collector of the ideas of the stakeholders [43]. Depending on the phase in the planning process, a designer can take up very different roles: initiator, facilitator, draftsman, supervisor, consultant, researcher, co-creator, trainer, social entrepreneur, strategist, provocateur, … [42]. The question arises as to whether they can be combined in one person. That is why designers must consider which role they will take when designing a project and which roles can be adopted by others. The role of the designer in the Gobelin-project which will be discussed hereafter, was to synthesize the knowledge, to capture new ideas and to visualize them in a synthesizing figure. The designer acted as an observer, collector of ideas, and draftsman.

2. Methodological Approach

The Gobelin-project consisted of two major phases (see Figure 2). In the first phase, the diversity of interpretations and meanings of GI by stakeholders from different sectors were revealed. This phase was intended to find a shared understanding of the boundary concept 'GI' on a generic or conceptual level. During two workshops, different aspects of GI were discussed, such as the interpretation of GI as a concept for spatial planning, the values and functions attached to it, the landscape elements that could contribute to GI, the policy and planning instruments that could contribute to the implementation of a GI network and the general conditions and constraints that facilitate or hinder its realization. The first workshop was aimed at public administrations and agencies on the regional level that directly or indirectly deal with GI networks. The workshop focused on general approaches, policy objectives on the regional level and existing strategic planning initiatives. The second workshop explored the same issues from an implementation perspective and was attended by local authorities and administrations that have experience with GI at the local level, both in urban and rural areas.

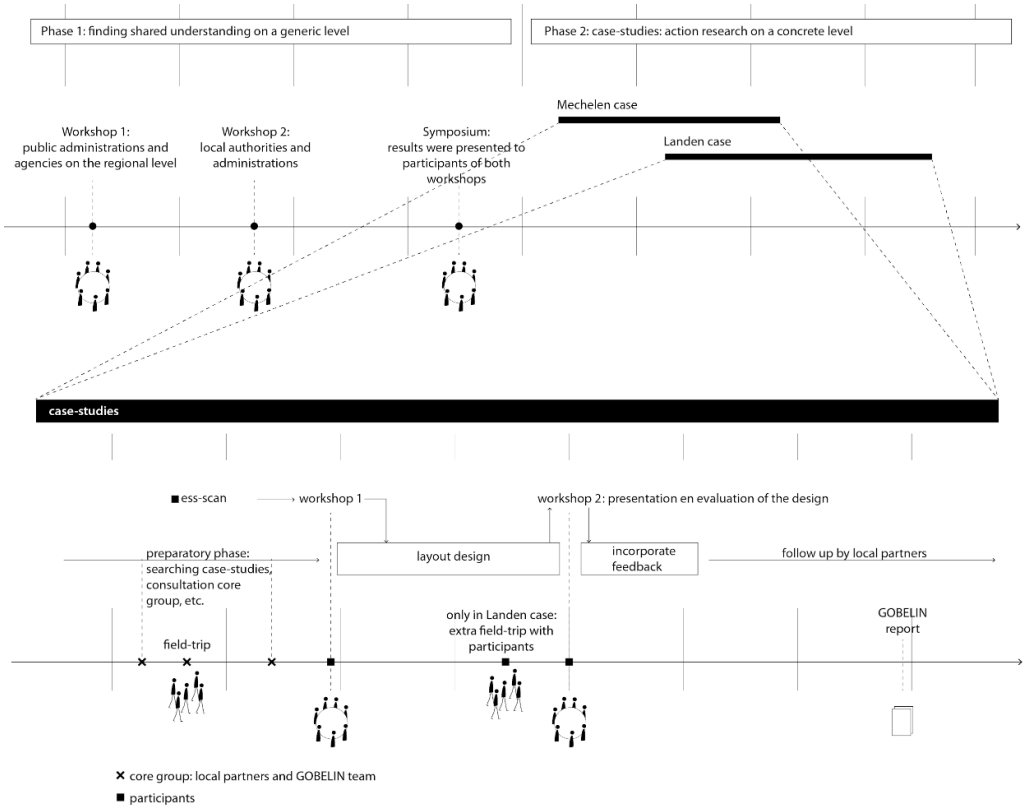

Figure 2. Graphical representation of the process approach.

In the second phase of the Gobelin-project, action research focused on the concrete implementation of GI cases. The objective was to reach a shared understanding of GI, a joint definition of common GI goals, and the initiation of a co-creation process to achieve them. This local context needed to concretize the broad definition of GI, because the physical context (landscape) and social context (stakeholders) had to be taken into account. Central to this approach was that a variety of stakeholders were actively involved in a bottom-up co-creation practice from the very beginning of the project. Through an open and participatory process, a social learning process was initiated, different views and expectations were deliberated, shared objectives explored, and implementation bottlenecks identified.

2.1. Case Selection

Based on consultation with interested local organizations working on regional development, real-life case studies were selected based on the following criteria:

1) local coordinating actors have the intention of planning a GI in their mandate area so that follow-up is assured after the Gobelin-project is finished;
2) local coordinating actors express an explicit policy interest for GI and have adequate time to invest in the project;
3) local coordinating actors are open to stakeholder participation;
4) case study areas have the potential for habitat improvement and ecosystem service delivery optimization.

In these case studies, the participative research through design method was adopted as a means for co-production. This type of research is known for stimulating discussions, exploring and imagining possible futures of specific areas, and guiding stakeholders in a complex transition process [44]. New programmatic and spatial arrangements or development strategies were assessed and optimized concerning their spatial impact or the effect they have on the formation of coalitions and

the organization of the implementation process. The approach enables researchers to detect opportunities for both GI processes and GI designs. In this approach, the designer is not the primary person responsible for the content of design proposals anymore. Instead, (s)he takes a more serving and facilitating role, stimulating sustainable design solutions from others, including laymen. In an intense period of design or planning activity, the so-called design charette, sharing and collaboration are essential, hence the designer should take a humble position at the meeting table. After capturing the results of the brainstorming, the designer can use his skills to transform the ideas into design drawings, which serve communication and discussions in the next steps of the implementation process [45]. In this paper, we discuss two case studies: Mechelen and Landen.

As the spatial planning processes in both cases will take several years, we had to restrict the action research and the co-creation in both case studies to the initial stages of the collaborative planning process. However, because the intention to realize GI was already expressed, initial plans were already approved and policy and management frameworks were defined, and the willingness to involve a variety of stakeholders was quickly assured. Therefore, key persons were easily identified and the conditions to make progress rather quickly were good. Hence, working for a couple of months with the case studies turned out to be sufficient to draw relevant conclusions.

2.1.1. Mechelen Case

This case study was selected in order to explore GI-planning in a concrete urban context. Mechelen is a city of 86,000 inhabitants along the Dijle River, halfway between Antwerp and Brussels. In recent years, several redevelopment projects of the public domain have resulted in high-quality green and blue spaces in the old city center: public parks were created by opening up enclosed areas and improving access. Additionally, several old canals and a tributary of the river Dijle were re-opened. In these public green spaces, the recreational function prevails. However, an overall vision on a multifunctional GI, with sufficient attention for habitat quality improvement and the strengthening of the connectivity between the different green spaces is still missing. Thus, the goal of this case is to identify possibilities to complete the GI in a historical city center, building on previous improvement projects and existing policy arrangements and stakeholder collaboration.

2.1.2. Landen Case

The second case study focused on GI in the contact zone between a small city and the countryside. Landen is a small city in the east of Flanders with 16,000 inhabitants, surrounded by high-density commercial orchards and very productive agricultural land. The valley of a small rivulet, the Molenbeek, borders part of Landen. In recent years, different integrated or more sectorial visions on the development of the area have been drawn up. To realize these visions, a master plan and guidelines for concrete actions and engagement of involved stakeholders are lacking. The goal of this case was to analyze to what extent GI can be the catalyst for local development plans that intend to improve spatial quality and multifunctionality of an urban fringe zone in a rural area.

2.2. Roadmap

In both case studies we followed the same roadmap (see Figure 2):

1) In the preparatory phase, consultations of the project with the local coordinating actors were held to identify additional relevant stakeholders and to analyze the relevant local policy context. Additionally, through a field visit, the researchers became familiar with the study area.
2) Successively, an online ecosystem services scan was carried out**.** This online scan was sent to the invitees of the first workshop (see step 3). The goal of the scan was to detect the desired functions (ecosystem services) for the GI in the planning area. For this individual valuation, a 7-point Likert scale was used. Participants were asked to score a list of potential functions from 'very undesirable' to 'very desirable'. The list of functions was based on policy documents, scientific overviews, and checked by the local coordinating actors [45,46]. (See Figures A1 and A2 in Appendix A)

3) During the first workshop, challenges, opportunities, and ideas were discussed**.** Representatives of different sectors, interest groups, public administrations, and local councils were invited to the workshops. First, the results of step 2 were discussed and validated. Afterward, discussions in small groups (5–8 people) detected bottlenecks, opportunities, preconditions, and concerns of the planned GI. Finally, participants were asked to Identify key institutions, organizations, and persons for project-oriented coalitions, required for the realization of the planned GI.
4) In the design phase, design drawings of possible GI solutions were made**.** Based on the information gathered during workshop 1, the field visit and document analysis, one or more design proposals were drafted for the area. The expressed desired functions, as well as the identified bottlenecks, opportunities, preconditions, and concerns were taken into account as much as possible.
5) In the second workshop, the design proposals were presented and evaluated. Several alternative design scenarios were used to trigger a debate between the participants. The participants gave feedback on the different design scenarios. Due to the rich visualizations of the design research, a fruitful discussion about possible strategic solutions was conducted in a targeted manner. In the Landen case, an 'ecosystem services proofing' of the design was carried out during this workshop. An ecosystem services proofing is an estimation of the impact of the design on the desired functions that were identified during step 2. This was done through discussions in response to the question "To what extent will the proposed design influence desired functions (identified in step 2)?" Participants were asked to agree on a score on a 7-point Likert scale. This score was compared with the scores of step 2.

During the 2nd workshop, the design scenario that best met the expectations and requirements of the stakeholders was selected. Based on the feedback of the stakeholders, improvement and detailing of the selected design were made after the workshop.

Additionally, during the 2nd workshop, potential effective alliances for the realization of an agreed scenario were discussed; the involvement of stakeholders and their responsibilities, the organization of the alliance, timing, and required resources were explored and translated into a desired organizational framework.

After each workshop, participants were asked to fill in an evaluation survey to evaluate the workshop approach and to estimate the impact of the workshops on further cooperation and implementation of GI. (See Appendix B)

3. Results

3.1. Boundary Concept and Common Language

The process made clear that interpretation of GI highly depends on the physical and social context. During the workshops in the first part of the Gobelin project, GI was discussed as a planning concept on a generic level to come to a shared understanding of GI for the whole of Flanders, including both rural and urban areas, and with all possible stakeholders involved. This means that a very concrete context was absent to guide the debate towards a well-defined definition of GI. As diverging stakeholders all looked from their perspective, the concept of GI broadened to such an extent (Figures 3 and 4) that everyone could find some kind of individual interest in it. It was argued in the workshops that the inclusiveness of the concept could hinder the willingness to collaborate in favor of shared interests. In order not to lose some of the stakeholders and to ensure the usefulness of GI as a boundary concept, participants of the workshops endorsed the necessity to attach some preconditions to GI elements regarding, for instance, the intensity of their (land) use, a specific design and management, the balancing of functions, etc.

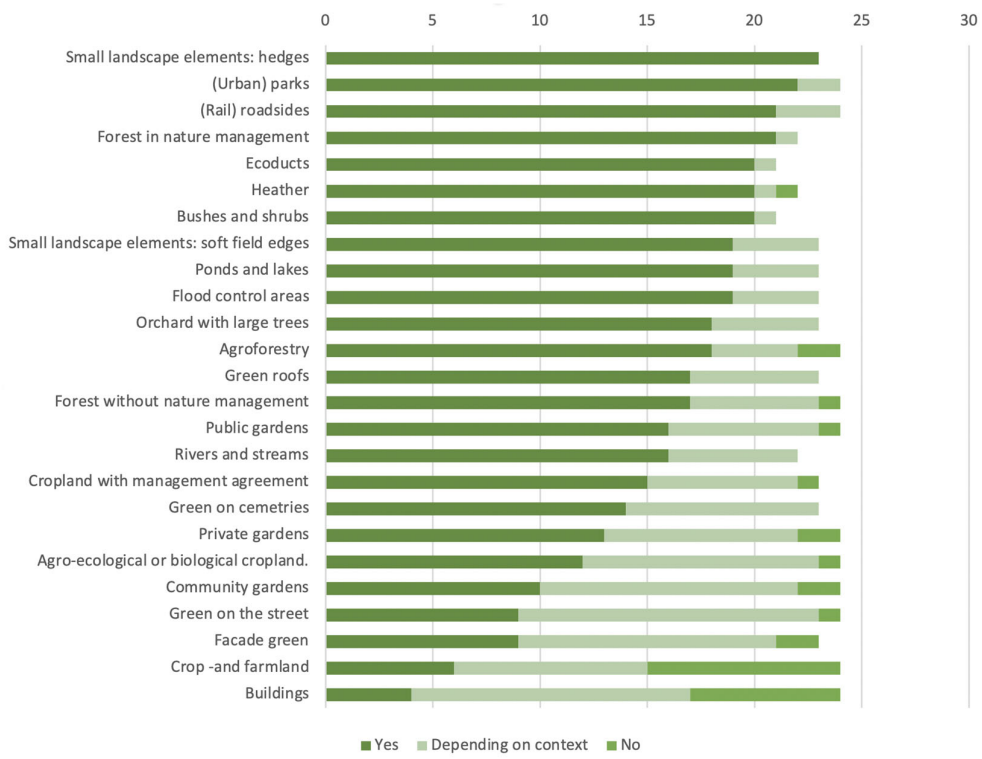

Figure 3. Landscape elements that could belong to green infrastructure (GI). In the first phase of the Gobelin projects, participants of the workshops were asked to identify which landscape elements belong to GI. This chart shows part of the results of the second workshop. For some elements, the consensus was large, while for others it was highly context-dependent issue. Even for buildings, only seven participants voted 'no'.

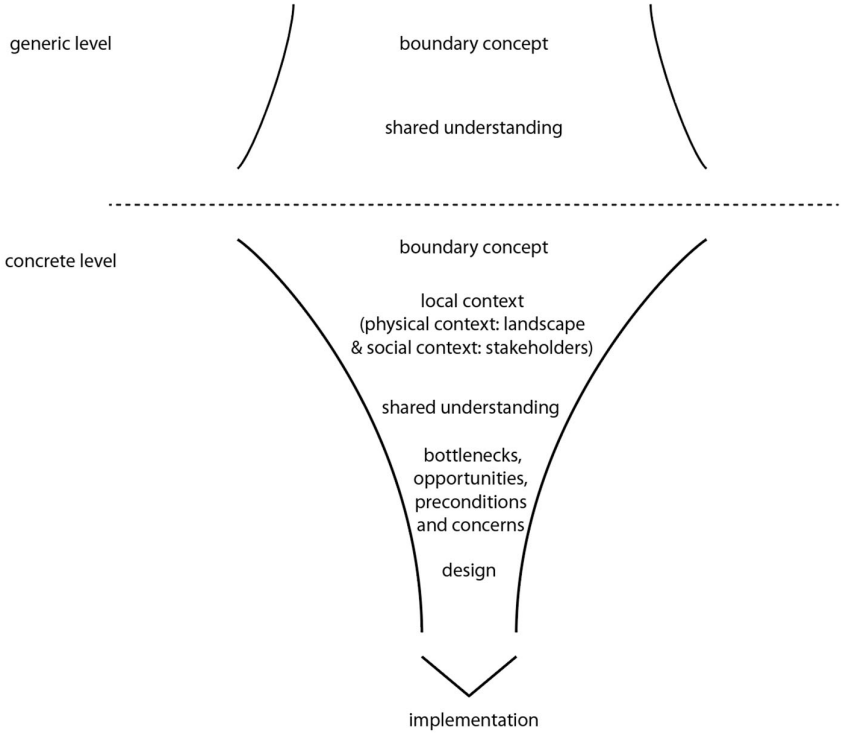

Figure 4. Evolution of the interpretation of the boundary concept GI.

The case studies showed that the local, physical, and social context is decisive for the importance attached to the different functions of GI. This means that the interpretation of GI can be narrowed down, depending on the local context (Figure 4). In two of the Gobelin cases, the concept of GI has been interpreted very differently. In the urban Mechelen case, the online scan and the policy documents showed that the desired functions of GI are mainly people-orientated: green spaces that add to the 'improvement of the quality of the neighborhood', 'play gardens', 'tempering the urban heat island effect' and 'facilitating social interaction' (Figure A1 in Appendix A). Conversely, in the rural Landen case, the focus was more on 'biodiversity and habitat development', 'water quality improvement', 'runoff control and water retention increase', but also 'recreation in an attractive landscape' was high on the priority list (Figure A2 in Appendix A). Putting forward desirable GI functions, however, did not mean that the dominant and determining land use was questioned. Moreover, all participants acknowledged the importance of taking the current users of the land, i.e., the farmers, into account. Those concerns or preconditions were determined for the design proposals for GI (Figure 4).

3.2. Multi-Stakeholder Process

The variety of stakeholders and the importance of getting to know each other through an exchange of views and information was recognized during the case studies. Participants were open to each other's arguments without too much reservation. After every workshop, most of the participants who filled in the evaluation survey (Appendix B) stated that they were granted a better understanding of other departments' expectations of a GI. Additionally, most of them acknowledged that all of the important stakeholders were present, and they estimated that the workshops would have a positive impact on future collaborations between departments.

The online ecosystem services scan turned out to be a good starting point for discussion among stakeholders. The results of the scan only gave an indication of preferences or wishes because of the limited number of respondents (n = 14 and 18). This was stated from the beginning and it reassured most participants: nobody could claim an irreversible position. Additionally, in the Landen case, few farmers filled in the online scan, so it did not represent the opinion of the agricultural sector well. Nevertheless, the results were a useful starting point for a group discussion. This all shows that the preparatory phase is very important. Pursuing firm objectives, agreeing on tangible involvement and tasks of stakeholders, and above all being clear about the course of the whole collaborative project, will help to take cooperation and co-creation forward. This may require additional information however, this can be obtained through in-depth interviews.

The value of such an open attitude was clearly recognized by all stakeholders and participants. Therefore, it is important to ensure that participants refrain from any limited strategic-sectorial thinking. Although this was sometimes difficult to achieve, a precise selection of participants can contribute considerably to this success factor. For instance, in one of the case studies, a farmer who could be directly affected by the planning proposals showed more cooperation compared to another farmer, who would not be directly affected. The latter one reasoned more from a strategic perspective and behaved more as an advocate of the whole agriculture sector. Additionally, a representative of the nature conservation sector was very cooperative during the workshops. After the Gobelin process, however, it was noted that he was more reluctant, and he changed his position to realign with the general viewpoint from his organization. This shows the difference between discussions about the objectives in a local context, for instance creating a local-tailored GI and those about more principle-based viewpoints of sectors, for instance in relation to implementing a GI network for Flanders. The first concerns mainly the organization and the use or management of the GI; the latter reflects rather the general allocation of land for GI, which induces much more strategic and defensive reasoning ('fight for hectares'). The merging of both reasonings should be avoided during the design process to ensure an open attitude towards discussions. This is especially important when the workshop builds on a long history of preceding events and historically grown sensitivities. In general, however, discussions during the workshops led to new partnerships and created a positive

atmosphere for future collaboration between different departments of the municipality and between the local authorities, intercommunal organizations, and civil associations.

Early adaptors, people who think out of the box, and people with much local physical knowledge, are important to take the process forwards. However, it takes time to have everybody aboard and to achieve shared insights and objectives. Therefore, a general comment from the participants as well as from the local partners who want to realize the GI, was that more time during and in between the workshops was needed to ensure an optimal collaborative planning and design process. Although the Gobelin project only dealt with the initial phases of the planning process, participants expressed the importance of discussing and agreeing about an action plan for further implementation as proof of commitment for the realization of the GI. The evaluation survey (Appendix B) showed that most of the participants estimate that the workshops will have a positive impact on the further implementation of a GI. The challenge of each workshop is indeed to ensure a continuous involvement of stakeholders and to consolidate the momentum created.

3.3. Design Process

The online ecosystem services scan and group discussions unveiled several desires, bottlenecks, opportunities, preconditions, concerns, and vulnerabilities for GI in the project areas. For a designer, all this knowledge is highly valuable in order to make an appropriate design. The role of the designer in the case studies was mainly to integrate the knowledge, to capture new ideas and evolving insights, and to visualize them in synthesizing drawings (Figures 5 and 6). These drawings proved to be a productive initiator for the discussions, an effective means to match the various desires of the stakeholders and a strong medium for shaping alliances. Most participants stated that the discussion about the designs had led to new ideas.

The design process gave a better insight into possible synergies and constraints. The first drafted plans were very ambitious. After the discussion in the second workshop, they became more realistic and in line with the potential, indicated by the stakeholders. During this discussion, priorities of – sometimes conflicting—desires became very clear. For instance, during the first workshop in the Mechelen case, the possibility to reduce car traffic in the city center was discussed, which would create space for more greenery and cycling and walking paths. The discussion about the preliminary design in the second workshop, however, showed that the removal of parking spaces (in the short term) seemed politically very delicate. Additionally, in the Landen case, the first workshop showed a desire to combine functions such as agriculture, nature, recreation, controlling soil erosion, etc. The discussion about the proposed design of agroforestry, which combined all these functions, however, showed that a distinct land use demarcation was more preferred (Figures 5 and 6). This type of discussions not only shed light on the potentials to reorganize land use and management and the desired ecosystem services, but it also led to a better understanding of (spatial) relationships and the possible land use of the wider area. In both case studies, it became thus clear that some of the conflicts, such as parking requirements in Mechelen and water quality improvement of the Molenbeek river in Landen, needed a solution on a higher level.

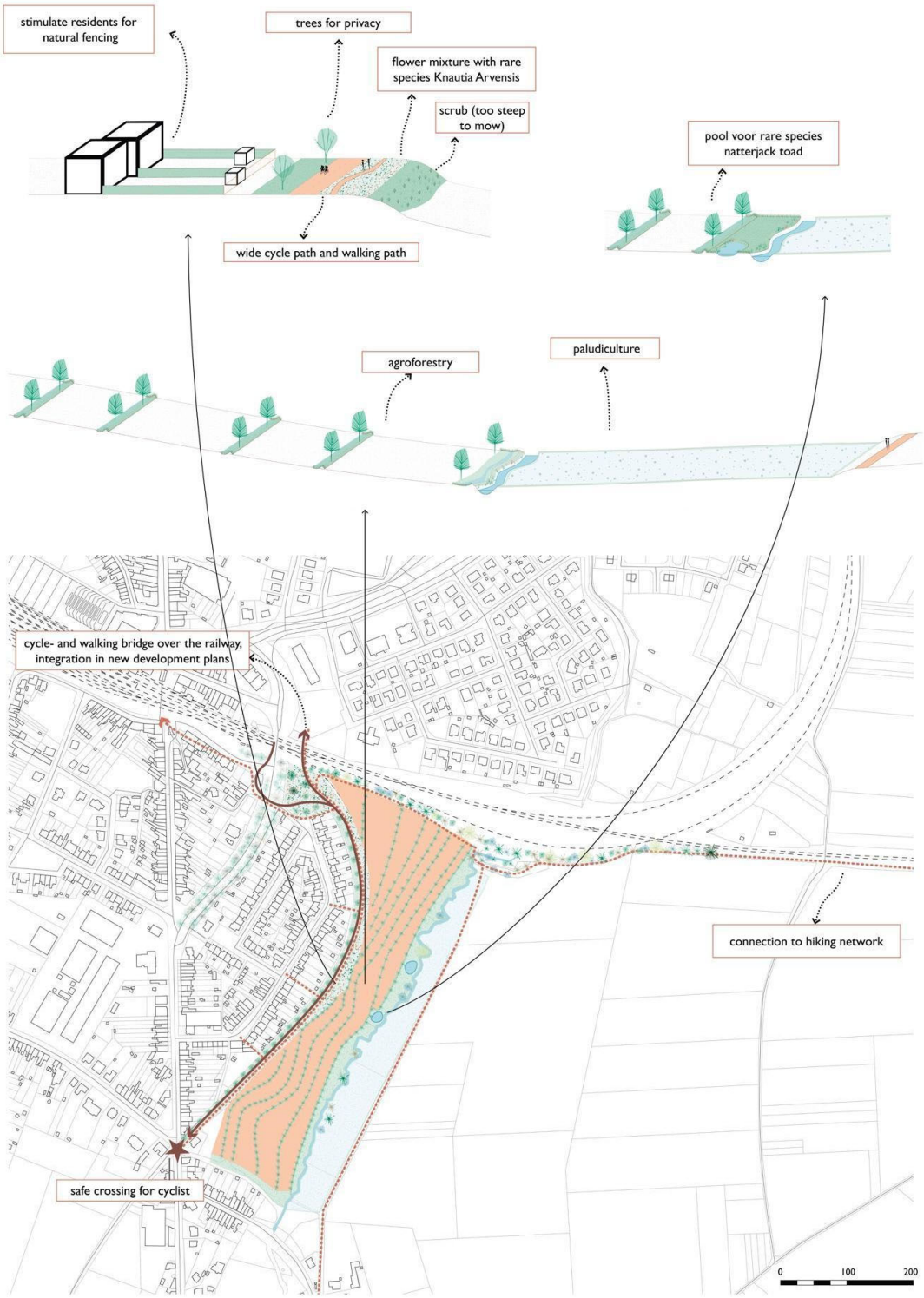

Figure 5. Example of a synthesizing figure of one of the first design scenarios in Landen. The most desired functions identified in the first workshop were biodiversity, space for water and water quality, a forest, and hiking connections with the city center. It was important, however, that agriculture remained possible. This scenario combined agriculture and the forest (agroforestry). Another scenario juxtaposed the new forest with the existing farmland.

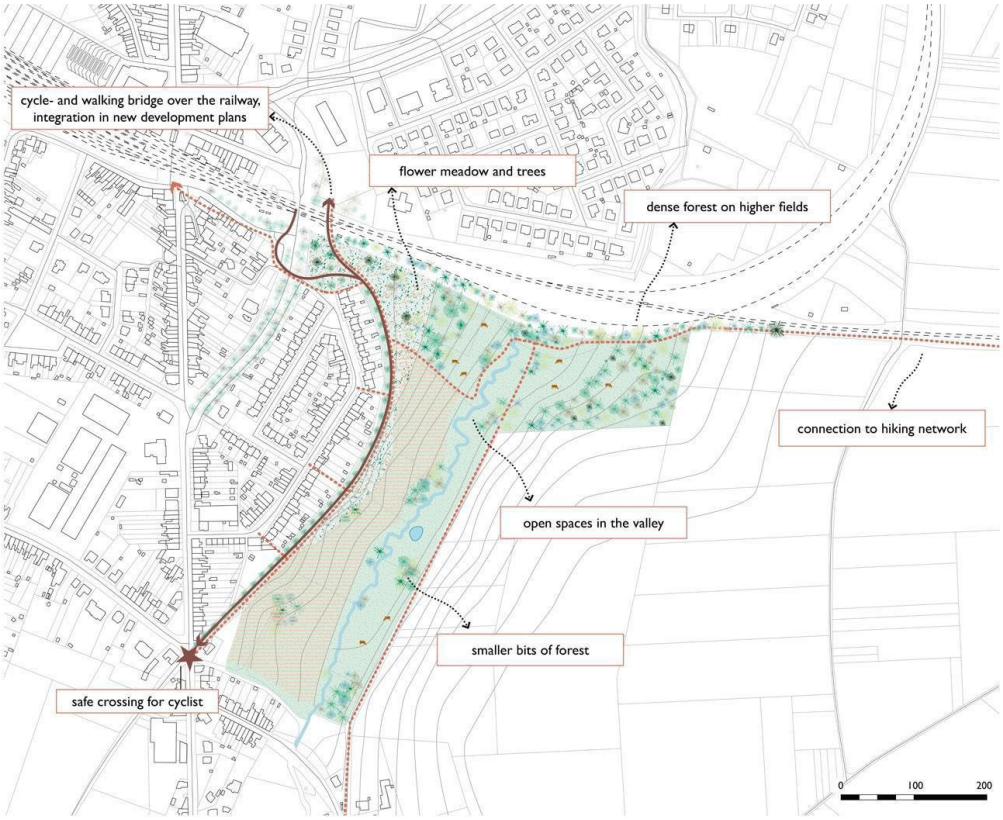

Figure 6. Example of a synthesizing figure of the final design in Landen. This design took shape during the second workshop. A pasture for large grazers with smaller bits of forest near the river leads to a dense forest near the railway. The farmland (on the left) remains untouched.

4. Discussion

This research considered the added value of addressing GI as a boundary concept in a participatory planning and design approach for the implementation of GI. To do so, participatory action research was applied, an interesting method to conduct research 'from within' practice traditions [47]. In doing so, it creates conditions for practitioners to participate and develop the format of action and interaction of the practice. Nevertheless, it is a challenging and time-consuming method [48], our research project could only give a first impetus for this new approach towards the integration of objectives. Although participants estimate that the Gobelin workshops will have a positive impact on the implementation of GI, only time can tell how effective this approach turns out to be. Action research is thus a transformative research method. We hope the Gobelin process has planted a seed and implementation of GI will be achieved soon.

Using GI as a boundary concept in participatory planning and design definitely has benefits. Being an ill-defined policy objective that is specified with an unlimited list of tangible habitats, land cover types, and functions, the concept has the potential to offer something for very diverse contexts and all involved stakeholders. As the debate may move away from consensus on a strict definition, conflicts should be avoided at the start of the process. This was achieved by diverting the focus from a strict definition towards the opportunities of GI and its elements, as well as to the functions that a GI can deliver, without avoiding the concerns of some stakeholders. Especially on a generic level, when a specific local context is not at stake, stakeholders added GI elements and functions that might be part of GI. On a local level, GI can take various forms, depending on the physical, social and institutional context and the many functions and ecosystem services that GI is required to provide.

A concern that often recurs, both in the first phase of the Gobelin project and in literature, is that broadly defined 'green' infrastructure does not assure a functional ecological network and the infrastructure will support viable communities or species populations [49]. Several reasons may be at the root of this concern, such as a lack of coordination between different projects towards a functional network or ecological connectivity, a lack of knowledge for local GI design or local development for biodiversity, or a lack of local political support for GI development in favor of biodiversity.

Reducing fragmentation and improving connectivity for species indeed requires coherence between different local projects which may be provided by a blueprint from a higher planning level. However, a dominant approach on a higher planning level for GI has failed in the past. So it seems this kind of strategic planning is widely accepted for grey infrastructures such as highways or sewerage, but not for GI, nature, or ecosystem services.

To design functional ecological networks, scientifically underpinned guidelines are a necessity. A thorough knowledge and understanding of the occurrence and state of species and populations is a prerequisite to deciding on the need for and if so, type, location, and regime of GI on a regional level. Concerning the local GI, however, in all the Gobelin case-studies, one or more participants had a lot of local knowledge and a good understanding of the physical landscape and its biodiversity. Those participants gave the local interpretation of GI a precise ecological perspective and proved to have a good understanding of the possible ecological improvements. Moreover, in both cases, the possibilities to increase local biodiversity or to strengthen the ecological network were identified by the online ecosystem services scan as one of the top three functions of GI. The high appreciation for those functions was quite uniform among participants in both cases (low standard deviation of scores). This shows that almost all participants agreed on the importance of biodiversity and ecology of a local GI. This could contribute to the local political support.

The participative approach combined with research by design has proven to be a successful methodology to involve a variety of stakeholders from the start of the planning process, to reduce the risk of an impasse because of conflicting interests that usually only becomes clear later in the process. This approach proved to be successful, especially in the concrete local case studies. It is clear that this process created a strong momentum in both cases. Time will tell if this impulse can be consolidated. Reasonably, it will be important to maintain some key characteristics of the boundary concept during the co-creation process: broadly interpretable and context dependable.

Research by design was in our research project an interesting method to adopt on the local scale. The designer acted as an observer, collector of ideas, and draftsman. Therefore, skills that translate ideas from different angles into spatial images, show implications of dimensions and acreages, and subject integrated designs to a reality test are essential. The designs were very helpful to navigate the discussions towards different possibilities, solutions, and impacts that a GI can establish. To guide the debate properly, it was important to find a balance in the degree of detail of the designs. Drawings with too much detail can distract the focus of the discussion to small details that do not yet matter. On the other hand, drawings can also remain too vague to lead to a concrete action plan. The latter is something characteristic for strategic planning on a higher level; many green arrows were put on maps to indicate a desired connection between green areas. It is questionable that this has led to implementation.

In the Gobelin case-studies, stakeholders were identified in consultation with the local partners. In a multi-stakeholder process, an important question is which stakeholders should be involved [34]. The literature presents different identification techniques, e.g., snowballing [36]. Those techniques, however, may be time-consuming and complex. In the Gobelin case-studies, we acknowledge the difficulties of completing a methodological stakeholder identification, considering the time and resources available. In the evaluation survey (Appendix B) most participants stated that the relevant stakeholders were present. Two of them noticed that residents and representatives of minorities were missing. This choice to include only stakeholders in the Gobelin cases, and not the public, was stated from the beginning.

Gathering local knowledge of the social, physical, and political local context proved to be crucial. In-depth interviews with key persons may improve insight into the social networks, the distribution of power, the arrangements regarding decision making, the local groups that influence decisions, and the preceding events regarding the project [50]. Revealing these aspects in an early stage is crucial to bring together a balanced group of representatives of all stakeholders concerned and to avoid the distorting dominance of a single actor. Transparency about assumptions and choices made is a prerequisite to have open discussions and an atmosphere that allows a collaborative design process.

Whether this approach can be extrapolated to similar programs in other countries, is unclear. Many countries indeed have a strategic planning program for implementing GI, e.g., UK, Scotland, Finland, and Canada. However, the nature of spatial planning systems and public participation varies depending on historical, cultural, and governance issues in different countries. Adopting GI as a boundary concept can be an interesting track to explore in countries where the process of implementing GI is stuck due to too strict and one-sided definitions.

5. Conclusions

We conclude that working with GI as a boundary concept in a bottom-up multi-stakeholder collaboration and co-creation, using participatory action research with research by design, is likely to yield results on the local level. Although the research project concerned only the preliminary phase, we think this approach can be fruitful on a local level. However, to realize overarching networks on a broader landscape scale that deliver the desired ecosystem services or sustain viable communities and populations, mere coupling of separate local GI projects will not guarantee a functional network or ecological connectivity. A more orchestrated approach with a definition of shared objectives, together with the shared acknowledgement that GI is the main spatial framework for future development, is, then, a necessity. Further research should demonstrate how cooperation and co-creation can help to bring the implementation of GI one step further. In addition, further research should elaborate on similar programs in other international contexts to identify the success factors and preconditions of adopting GI as a boundary concept in GI.

Whether this approach is advantageous on a higher planning level is unclear. Many policy objectives remain vague because this vagueness can facilitate a consensus. However, some boundary concepts such as GI—and actually also ecosystem services—need to be described with proper conditions and qualifiers to achieve the set objectives. Only then will it become clear what is meant with a particular GI or ecosystem service and hence with the benefits, functions, or qualities they may deliver.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

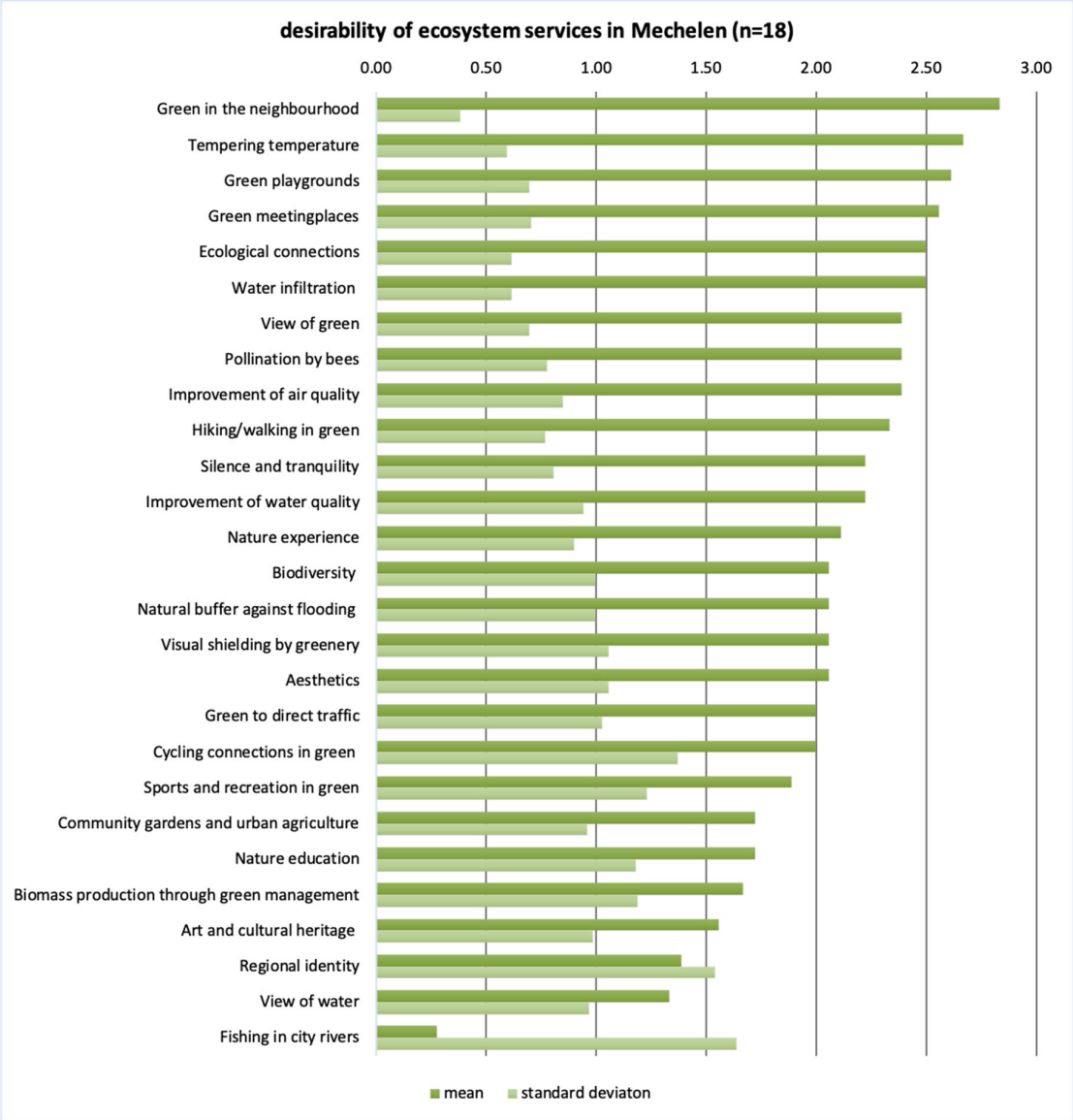

Figure A1. Desirability of Ecosystem Services in Mechelen.

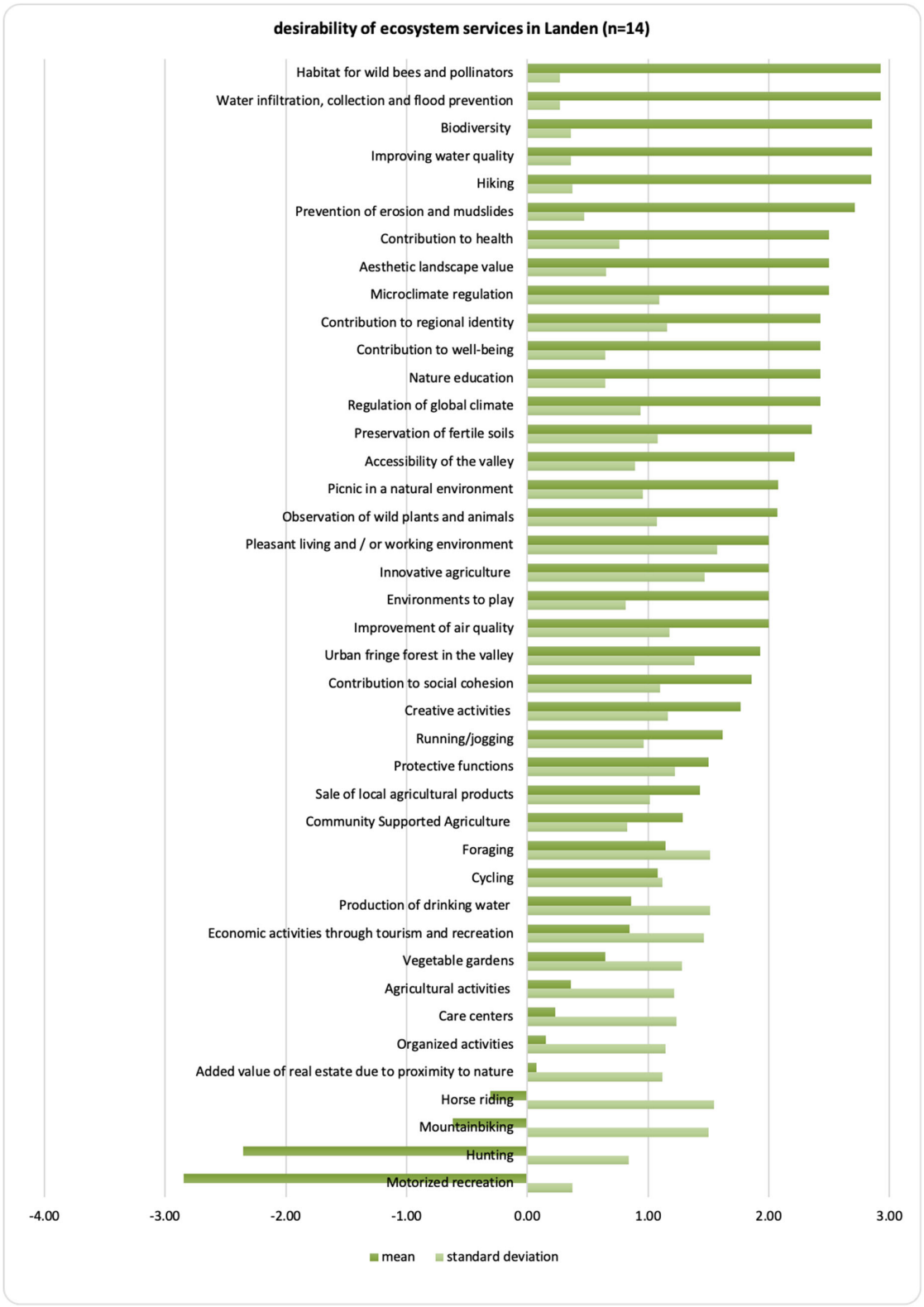

Figure A2. Desirability of Ecosystem Services in Landen.

Appendix B

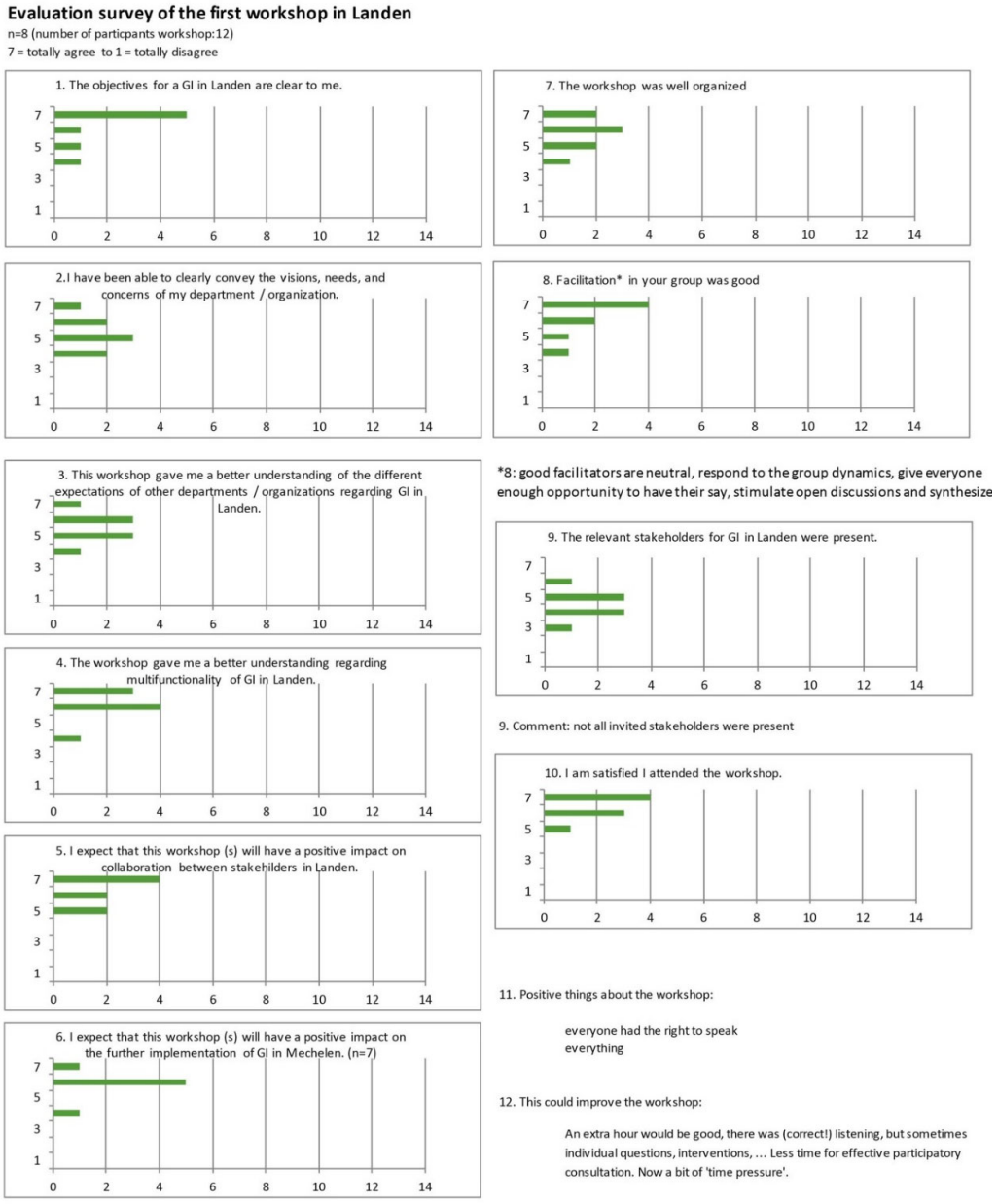

Figure A3. Evaluation survey of the first workshop in Landen.

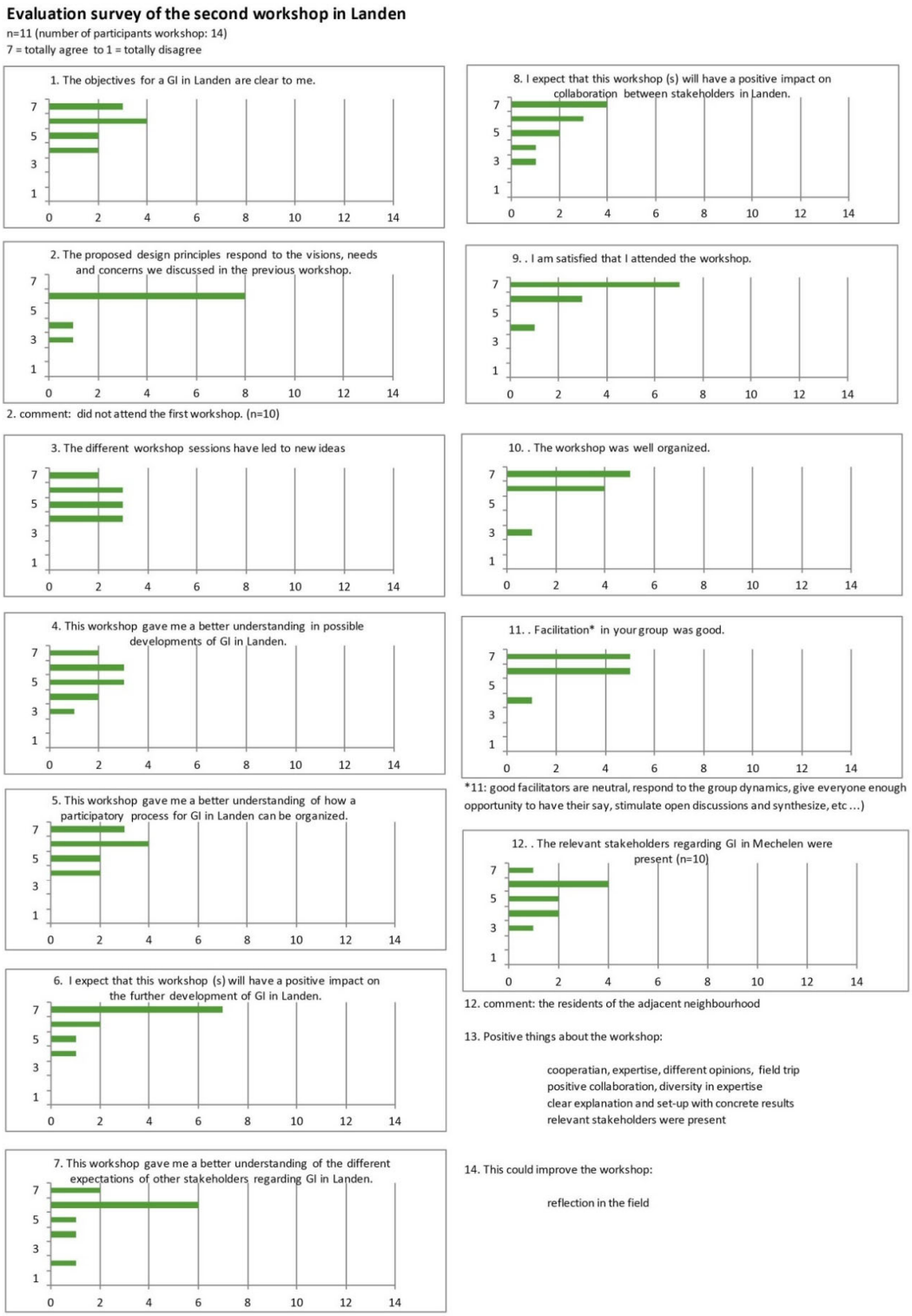

Figure A4. Evaluation survey of the second workshop in Landen.

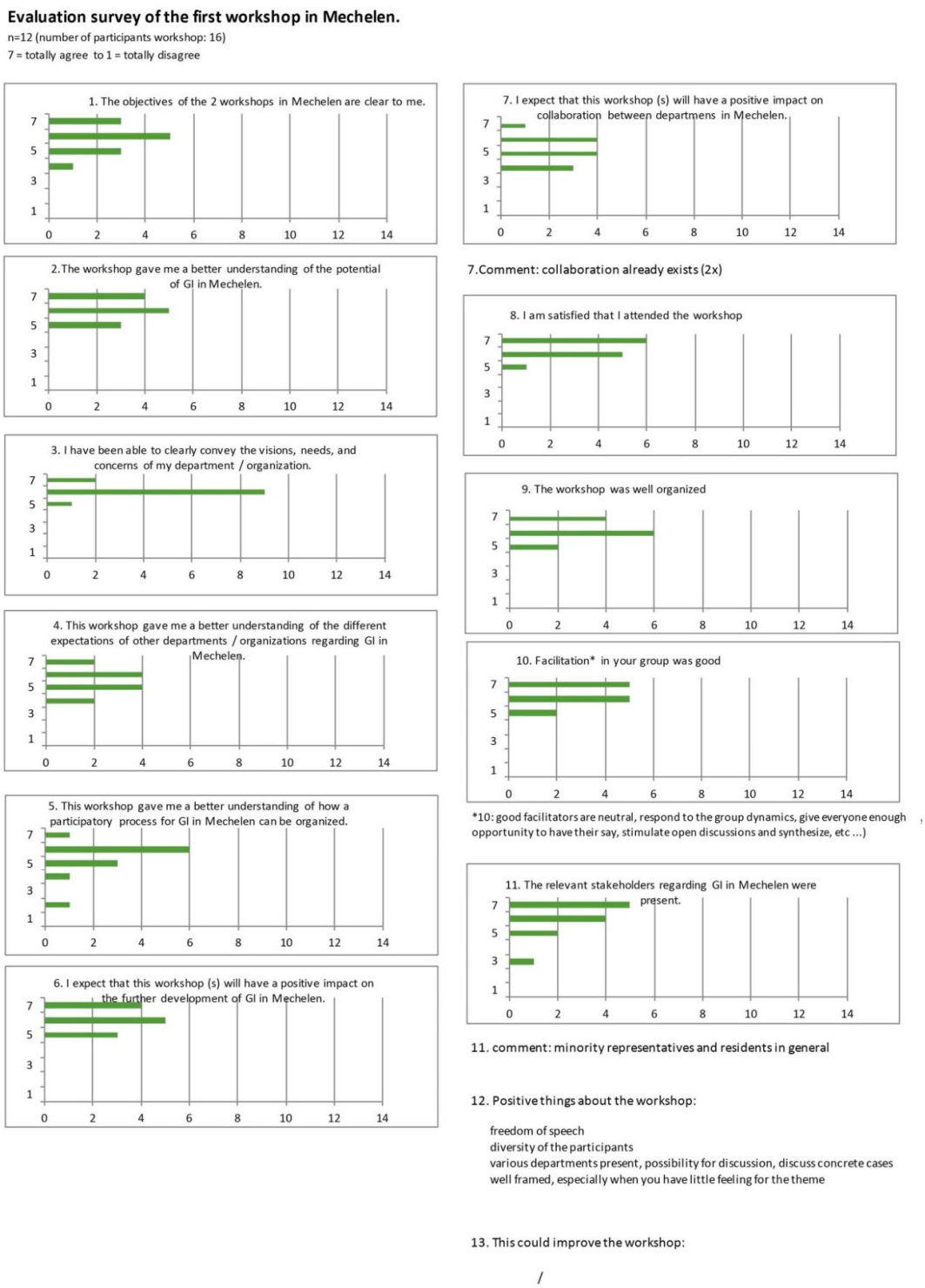

Figure A5. Evaluation survey of the first workshop in Mechelen.

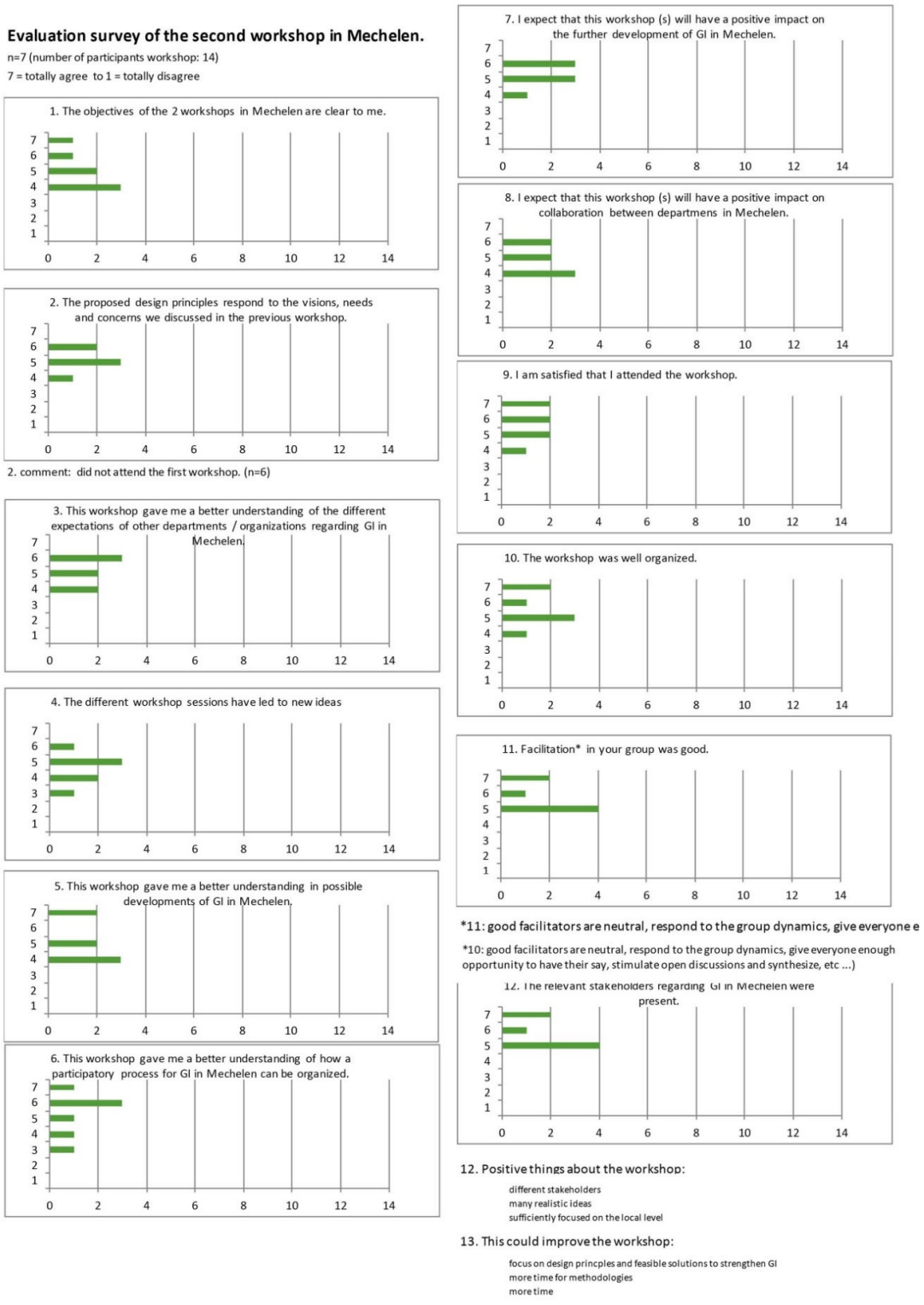

Figure A6. Evaluation survey of the second workshop in Mechelen.

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