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Planning for a green city: The Green Factor tool

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ABSTRACT

In recent years, new planning tools have emerged to aid planners to achieve multiple goals to sustainability. The Green Factor tool has been adopted by some cities to increase the share and effectiveness of green areas. This short communication asks how useful the Green Factor tool is and how it fits with the existing planning procedures regarding green areas through a qualitative case study in the city of Helsinki. The results show that while the tool functions well, improvements could be made in relation to monitoring, for example. Also, an ambitious target set in the tool could encourage or force developers to aim higher with the planning of green areas and construction, but existing regulations challenge its use.

1. Introduction

Urban green areas, which are integral to human health, represent a complex and necessary feature of the urban landscape (Momm-Schult et al., 2013; Schäffer and Swilling, 2013; Tzoulas et al., 2007). Green areas provide ecosystem services, either through local climate regulation (Jim and Chen, 2008), carbon sequestration (Strohbach and Haase, 2012) or reduction of stormwater runoff (Ellis, 2013), amongst other things. There is an increasing pressure for the urban planning sector to be able to account for all these ecosystem services.

There has been an emergence of new planning and modelling tools that are both process and substance-oriented (Ben-Zadok, 2010) for a growing number of concerns facing urban planners (Smith, 2015; Devuyst and Hens, 2001; Gil and Duarte, 2013), and the planning of green infrastructure and green areas, in particular (Thorén, 2000). The Green Factor tool, which appears under varying names, has emerged in many cities around the world to assess the sustainability of landscape designs and construction based on the proportion of green areas and built-up areas. It has been used for example in Seattle, WA (Seattle Department of Construction and Inspections 2017), Berlin, Germany (Senate Department for the Environment, Transport and Climate Protection, 2017), Helsinki, Finland (City of Helsinki, 2017) and Southampton, UK (Southampton City Council, 2017).

At the heart of it, the Green Factor tool offers a numeric value for the ratio between the built area and green areas within a selected area. The aim of a Green Factor analysis is to improve the ecological sustainability of the built environment by increasing the total green area (Stenning, 2008), while granting freedom and choice in the selection of green elements and their location within the area. The tool allows city officials to estimate the impact of various individual green structures in relation to the sustainability goals they have set for the city (or for smaller areas within the city), by giving each element a multiplier that feeds into the calculation of the Green Factor. The tool can also aid the comparison of different kinds of plans and to check whether the official requirements for green spaces are fulfilled. Practical experiences of the development and application of the Green Factor are sparse (Stenning, 2008).

Many of these new planning tools have been developed through research projects, and their analysis has primarily focused on presenting the tool, rather than evaluating its use or usability (Vartholomaios et al., 2013). If the usefulness of these new planning tools is not assessed, it is possible that more will be developed that are never fully applied in practice. Therefore, it is pertinent to investigate their use and usefulness. This short communication presents a qualitative case study in the city of Helsinki, Finland, to ask how the Green Factor tool is being used and how the existing planning context affects its use.

2. Background

New planning tools address overall sustainability (Ameen et al., 2015), different types of urban energy planning (Zanon and Verones, 2013; Huang et al., 2015), urban heat island (Lambert-Habib et al., 2013), green-blue adaptation (Voskamp and Van den Ven, 2015), economic valuation of green infrastructure investments (Vandermeulen et al., 2011) and landscape conservation (Pirnat and Hladnik, 2016). There are also now several studies comparing the tools (e.g. Haapio, 2012; Sharifi and Murayama, 2013). For example, Ameen et al. (2015) compare tools that assess overall urban sustainability and Lindholst et al. (2016) discuss tools created for mapping recreational and social

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values of green spaces. However, less attention has been paid to the use of these tools in actual planning cases and there is a lack of cases assessing their use in cities. Based on a review of this existing literature, I propose that the challenges associated with their use can be categorised in two; *exogenous* and *endogenous* factors (e.g. Sharifi and Murayama, 2013; Garde, 2009).

In terms of *endogenous* factors, i.e. issues related to the tool itself, concerns centre around the tool being easy to use so that it is applicable to planning – whether this would be through voluntary means or through planning regulation. Second, the plans produced using the tools need to be applicable in practice, in terms of budgetary concerns, too (Sharifi and Murayama, 2013). In tools where a scoring system is used, the scoring tasks and evaluation can be a subjective exercise where minimum levels and other thresholds might not be based on scientific data (Haapio, 2012). It has also been noted that there can be a trade-off between the transparency of the assessment and the coverage of the assessment (Ameen et al., 2015). The issue of generalizability of the tool is also noted in the literature (Thorén, 2000). While there is a need to develop a tool that can be widely used, it ought to incorporate local differences and special conditions. Questions have also been raised about who can participate in the use of the tools and whose views are taken into consideration in the use of the tool (Bugs et al., 2010; Baycan-Levent and Nijkamp, 2009). Garde (2009) also points out that there is no real consensus on what the form of a sustainable residential area takes. Hence, even if tools are used, there are no guarantees that they will contribute to the overall sustainability of an area. Several factors contribute to sustainability, such as greening, density, sustainable transport and mixed land use, but the optimal mix of these continues to be discussed (Jabareen, 2006).

Exogenous factors, i.e. the institutional environment, include that the use of these tools may aid the permit process of the developments, should fulfilling the goals of a tool count as adequate proof of a project's environmental impact, for example (Sharifi and Murayama, 2013). Haapio and Lahti (2012) too note that the usefulness of the tools for public officials comes from being able to numerically evaluate the environmental impact of a project. However, because many of the tools are market-led, their use can create a situation where those engaged in project choose projects or components of projects that are easy to score but do not perhaps give the best overall outcome to the whole project (Ameen et al., 2015). A further problem with the tools is that their use is voluntary, and this may lead to them being used only when convenient to the developer (Sharifi and Murayama, 2013). It is also possible that the tools are used for marketing purposes only, should the project fulfil the criteria of the tool without additional effort (Garde, 2009). In addition to this, the tools could be used as a criterion in planning competitions (Haapio and Lahti, 2012) or as a requirement in issuing building permits (Garde, 2009).

3. Case study and methodology

In the case of Helsinki, the Green Factor was developed as part of a European Union funded project, in collaboration with the city and a private consultancy. The Helsinki Green Factor tool offers a numeric value for the share between the built area and green areas (Inkiläinen et al., 2014). It is based on an element scoring approach which includes first the establishment of a list of green factor elements commonly used in urban planning that are incorporated into the tool (See Fig. 1).

These are then given different weights that are used in calculating the Green Factor. Each element is evaluated based on their importance with regards to four factors: ecology, functionality, landscape, and maintenance. Based on this, a land use classification was developed to identify a target minimum score for each land use class (residential, services, commercial and industrial/logistics), while considering regional and lot-specific attributes (EPECC, 2013). A MS Excel-based tool was developed that was further tested in two pilot projects in the Helsinki region (see Fig. 2).

This study employs a case study approach, which enables of a detailed investigation of a specific phenomenon (Yin, 2013), and the city of Helsinki Green Factor tool was chosen as a case because of its continuous growth, as well as its aspiration to be sustainable (City of Helsinki, 2002). For the purposes of this study, qualitative interviews were conducted. This is a research method for a structured discussion based on themes (Berg, 2009). They were conducted in February and March 2014 with informants (n = 10) who were engaged in the processes of landscape and urban planning and planning regulation in the city of Helsinki. Interviews were recorded, transcribed and later thematically analysed through different themes, see Table 1. The thematic codes were derived from the questions and organised accordingly.

The results of these interviews were further verified in June 2014 through an e-mail survey consisting of 5 sets of open questions, slightly different from the initial interview questions. These were sent to 20 representatives of companies operating in the pilot areas of the Helsinki Green Factor and to 9 landscape designers working on construction projects within these areas. A very low numbers (three, out of which one was received as an interview) resulted. Although some new information was received through the survey, the answers obtained were in line with the views obtained in the interviews, and thus the material was seen to be saturated (Creswell, 2014).

4. Results

In terms of the *endogenous* factors, many respondents considered the tool be useful in that it gave them a numeric value to work with when it came to the planning of green areas. This was considered important to help persuade other stakeholders of the importance of green areas in general and the necessity to implement them in that particular location. A higher score would imply better quality and the ability to back one's claims with numbers appeared to carry more weight. While the tool was useful in the planning phase, it does not in its current form offer the ability to monitor implementation or progress, nor evaluate the success of the green area and this was considered a drawback.

In using the tool, the interviewed city planners noted that the tool was easy to use, and its logic was easy to comprehend in the MS Excel format. If the use of the tool was compulsory in the planning process, the city planners felt that it could be used to secure a certain level of green infrastructure in an urban environment. In addition, the interviewees thought that the tool allowed for the user to consider the role of smaller urban areas in terms of wider sustainability of the city and to estimate the impact of various individual green structures to the sustainability by giving each element a multiplier. The private sector actors that responded to the questionnaire had not had much experience with the tool so far, but considered it an interesting starting point and possibly a way to establish a common baseline for new developments.

When it came to the *exogenous* factors, the respondents were able to identify a number of constraints in the use of the tool. These issues were mainly raised by the city planners who are familiar with the existing regulations, and less so by the private actors. First, the existing regulations from several sectors were considered a challenge that would limit what can be done in a particular area, even if the tool would suggest it. This indicates a conflict between some of the functions that a green area ought to include and what an optimal score based on the Green Factor tool is. Now, the tool is not officially part of this process, due to its voluntary nature, and therefore it is unclear how it ought to be considered in the planning process.

For example, there are numerous rules and regulations that already guide construction in Helsinki. The Land Use and Building Act steers the planning of green areas around buildings with the use of detailed local plan. It sets the guidelines for the green area's relation to its surroundings and the details related to the efficiency of construction and outdoor space necessary for buildings, including parking spaces (Sopanen et al., 2007). In addition to the Land Use and Building Act, the management of water services also set the regulations for the

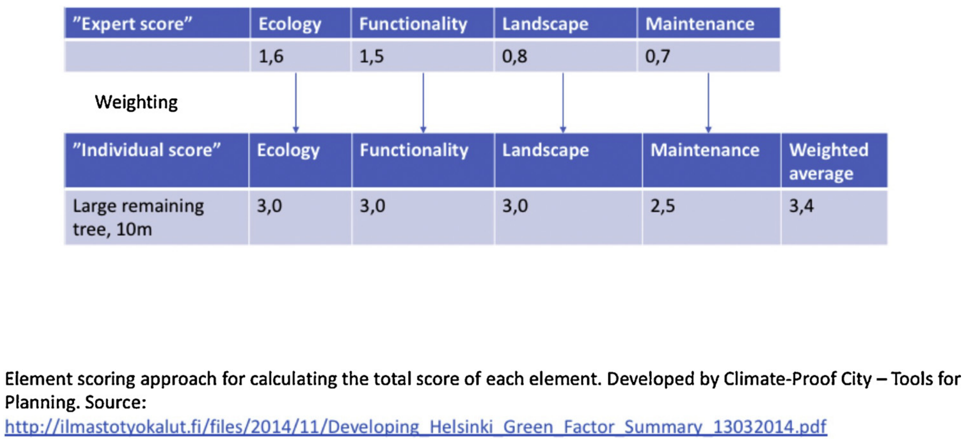


Fig. 1. Element scoring approach.

management of surface runoff water and the regulations on emergency exits and service access roads are set by the Rescue Act (Helsingin kaupungin pelastuslaitos, 2013).

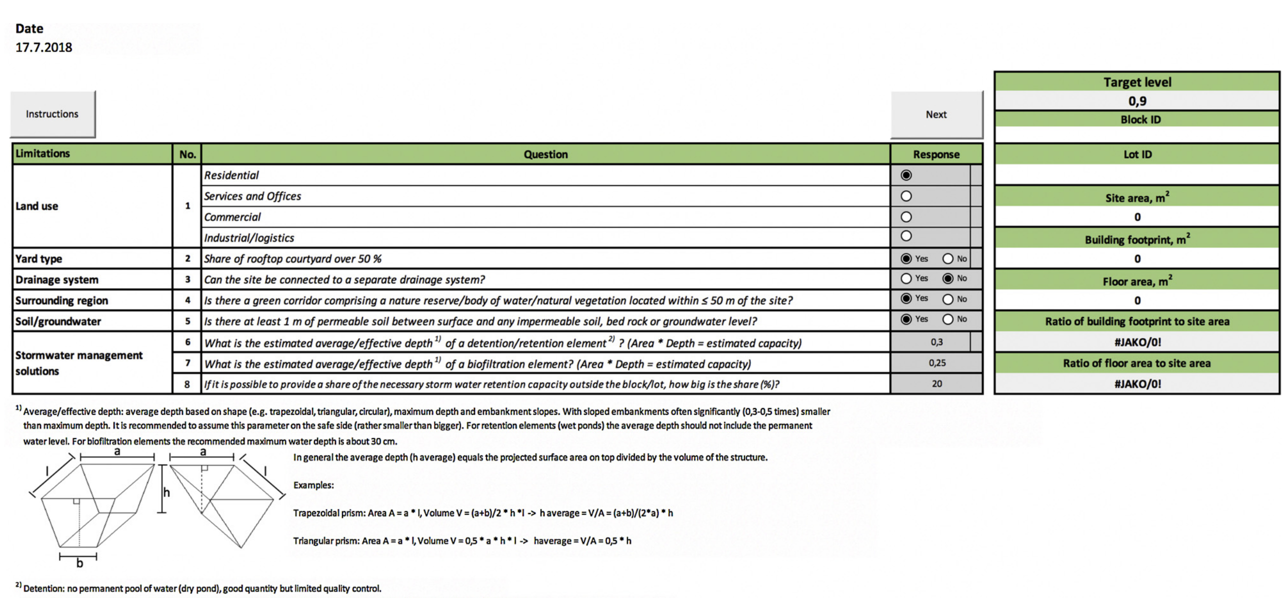
In some cases, the planners noted that conflicts had arisen between these. The respondents also noted that the tightening of regulations related safety (e.g. in case of a fire) has increased the space needed for emergency measures near residential buildings. All buildings higher than three stories must have a second exit, which in effect translates to an access to balconies by a hydraulic platform (Helsingin kaupungin pelastuslaitos, 2013), which limits what can be done with different green elements. Another major challenge is the provision of adequate parking, which should be provided with every 100–145 m^2 of floor space in dwellings (Kaupunkisuunnittelulautakunta, 2012). Thus, all these regulations need to be adhered to before addressing the planning of green areas in terms of ecology, functionality or sustainability.

5. Conclusion

There are several challenges related to the use of new tools, mainly existing legislation and other competing issues. While the Green Factor tool offers support to the planning of green areas, there are concerns related to its application. The value of the Green Factor or any other tool lies in their nature of being both definite in general aims, while allowing for flexibility in meeting them. The ability to adjust a tool to the context within which it is applied will likely increase its uptake.

While the will of the city in terms of functions or qualities of green areas can be realised and supported by using the tool, it is up to the designers and developers to find cost effective ways of meeting these targets. One of the biggest challenges in using a tool such as the Green Factor is establishing a common baseline for its use (Sharifi and Murayama, 2013). If the Green Factor is to overcome these difficulties, the target score should be set high enough to effectively force the developers to include novel green elements in their selection, as has also been noted by others (Haapio, 2012). As of yet, there is no clear criteria of success for the use of the tool, mainly because there have been no follow-up studies to assess whether the use of the Green Factor tool has led to more sustainable, greener cities.

The role of existing regulation and guidelines becomes an issue of contention when new planning tools are introduced. Their implementation can be weak and lead to relatively few changes (Momm-Schult et al., 2013) unless the use of the tool becomes legally binding. In the meanwhile, the voluntary nature of these tools is directly related to their users, and literature has shown that wider participation tends to increase the acceptability of the outcomes of the process (Bugs et al., 2010). Here, there was interest within city planners but less so in terms of the private sector developers. One opportunity to incentivise their



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Instructions

Next

Limitations	No.	Question	Response
Land use	1	*Residential*	◉
		Services and Offices	○
		Commercial	○
		Industrial/logistics	○
Yard type	2	*Share of rooftop courtyard over 50 %*	◉ Yes ○ No
Drainage system	3	*Can the site be connected to a separate drainage system?*	○ Yes ◉ No
Surrounding region	4	*Is there a green corridor comprising a nature reserve/body of water/natural vegetation located within ≤ 50 m of the site?*	◉ Yes ○ No
Soil/groundwater	5	*Is there at least 1 m of permeable soil between surface and any impermeable soil, bed rock or groundwater level?*	◉ Yes ○ No
Stormwater management solutions	6	*What is the estimated average/effective depth [1)] of a detention/retention element [2)] ? (Area * Depth = estimated capacity)*	0,3
	7	*What is the estimated average/effective depth [1)] of a biofiltration element? (Area * Depth = estimated capacity)*	0,25
	8	*If it is possible to provide a share of the necessary storm water retention capacity outside the block/lot, how big is the share (%)?*	20

Target level
0,9
Block ID
Lot ID
Site area, m^2
0
Building footprint, m^2
0
Floor area, m^2
0
Ratio of building footprint to site area
#JAKO/0!
Ratio of floor area to site area
#JAKO/0!

[1)] Average/effective depth: average depth based on shape (e.g. trapezoidal, triangular, circular), maximum depth and embankment slopes. With sloped embankments often significantly (0,3-0,5 times) smaller than maximum depth. It is recommended to assume this parameter on the safe side (rather smaller than bigger). For retention elements (wet ponds) the average depth should not include the permanent water level. For biofiltration elements the recommended maximum water depth is about 30 cm.

In general the average depth (h average) equals the projected surface area on top divided by the volume of the structure.

Examples:

Trapezoidal prism: Area A = a * l, Volume V = (a+b)/2 * h * l -> h average = V/A = (a+b)/(2*a) * h

Triangular prism: Area A = a * l, Volume V = 0,5 * a * h * l -> haverage = V/A = 0,5 * h

[2)] Detention: no permanent pool of water (dry pond), good quantity but limited quality control.
Retention: holds permanent pool of water (wet pond), permanent water level reduces detention space but increases quality control.

Fig. 2. Helsinki Green Factor tool (Source: iWater project).

Table 1
Research methodology.

Research questions	Themes	Interview questions
Endogenous What are the pros and cons of the green factor tool in the planning process?	Usefulness of the tool	Is the green factor a useful tool for planning green areas? Can its use bring new benefits in addition to the existing tools?
	Use of the tool in planning process	In what kinds of situations or phases of planning do you see the tool being used? Do you see any risks or difficulties associated with the use of the tool?
Exogenous How does the green factor analysis fit with the existing planning procedures?	Current situation of green area planning	How do you see the current state of planning of green areas in the city? How would you describe the quality of the current green areas?
	Challenges associated with green area planning	Given the limited space of green areas in general, is it possible to fit more green structures in? Are there any limits to the functionality of yards beyond which new gains can be achieved? What are the current challenges of planning and constructing?

use is to include added benefits to those who score higher than the minimum required score, as in other cases (Garde, 2009). Also, if the tool is a valued brand in the eyes of the public, it can also become attractive to those companies that are currently not using it (Sharifi and Murayama, 2013).

The Green Factor tool could also be used to broaden out the scope or the functionality of green spaces for a specific ecosystem service. In these cases, ecosystem services could be identified and valued according to their overall benefit, be they supporting, provisioning, regulating or cultural. For example, built environments can provide regulative services by enabling water management, mitigation of greenhouse gas emissions, and air and water purification. Cultural services can include landscape values and environmental art, while supporting services include the maintenance for photosynthesis (e.g. Bergström et al., 2011).

More broadly, the challenges of developing sustainable cities are in understanding and managing complex systems, while paying enough attention to details (da Silva et al., 2010). The findings here echo others in that there is a need for more empirical studies (Bahadur and Thornton, 2015) that could focus on understanding how to engage the private sector in the use of the tool already in the early phases of the planning process. With regards to lessons learnt from this study, there are a number of issues that should be kept in mind. First, it is necessary to carry out a pre-assessment on how the Green Factor tool relates to existing regulations. Second, there is a need to design follow up on implementation and evaluate the use of the tool after its use in projects.

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