

What strategies for which railway stations? An experiential approach to the development of a node-place based planning support tool in Flanders

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Abstract: Node-place modeling concepts, assumptions and outcomes are rarely tested and validated in close dialogue with the intended end users of the conducted analyses and developed tools. This is surprising, since the majority of studies touch upon the interface between planning practice and planning research, and foreground, or at least hint towards, the usefulness of their empirical outcomes for (a variety of) stakeholders involved in station (area) (re)development planning processes. In order to help bridge this gap between node-place modeling research and practice, we adopted an experiential research strategy and organized a series of workshops in which we put the recently developed, node-place based, StationRadar tool to the test. More specifically, by drawing on the concepts of 'usefulness', 'usability' and 'utility' of planning support systems, we validated StationRadar in the context of three recently established 'transport regions' in Flanders: Gent, Aalst and Leuven. Data collection methods included focus groups, participatory observation and Likert-scale surveys. This paper draws together the main findings of the full experiential learning process, and illustrates to what extent and in which way StationRadar has the potential to become a useful tool to particular stakeholders actively involved in the transport region partnership.

Keywords: "node-place modeling", "planning support system", "experiential learning", "usefulness", "workshops".

1. Introduction

It is generally acknowledged that a better integration of the transport and land use policy domains is crucial to achieve more sustainable urban mobility outcomes (Meyer and Miller 2001; Marshall and Banister 2007). One of the ways in which this policy integration can be pursued is by means of 'transit oriented development' (TOD). This TOD paradigm refers to several mechanisms that can be implemented to intensify the location and mixing of housing and other activities near urban rail transport in inner cities as well as in metropolitan areas, with the overall objective of promoting transit ridership and other alternatives (walking and cycling) over the use of private cars (Cervero 2009).

A specific part of the academic literature on TOD focuses on identifying the development potential of transit station areas as an outcome of the interplay between transport and land use dimensions. The 'node-place model' (NPM) is the analytical framework that is predominantly used to map the differentiated development opportunities of station(s) areas(s) (see originally Bertolini 1996). The model is based on both the 'place value' of a station area (the area's inherent characteristics such as density and functionality) and its 'node value' (expressing the functioning of the station in terms of the various transport networks and services it is linked to) (see Bertolini 1999 and Peek et al. 2006 for more discussion). The assumption underlying most NPM studies is that a systematic inventory of both characteristics for a particular set of stations (along a corridor or within a region), provides useful knowledge that can subsequently inform evidence-based policy discussions, decision making processes and planning practices.

Based on a review¹ of academic NPM studies, we deduced the most frequently raised statements with respect to the added value of node-place model applications. According to the reviewed studies, the NPM allows 'to identify the development potential of station areas' and 'to deduce development strategies' that are 'context-sensitive'. The model furthermore allows 'to benchmark and compare stations' and draft 'more targeted' 'TOD strategies' for groups of stations. According to some studies, these features can 'trigger a

¹ We screened the Scopus, ISI Web of Science and Google Scholar databases for all contributions that directly build on and apply the node-place model to a particular case. All contributions are indicated in the reference list of this paper with a ° mark.

debate' and 'allow for discussions and negotiations' which are based on 'transparently derived evidence'. This resonates with the majority of studies indicating that their results should 'support further research', help 'shape strategic planning questions', or help 'inform policy prescription'. A limited number of studies also argue that the model can 'foster a learning process' between stakeholders. Besides the above, a large share of reviewed studies point towards the potential of the NPM for the 'evaluation of TOD policy', and/or argue that the model can 'provide insights' in order to 'better understand land use and transport dynamics'.

Given this, it is clear that the NPM literature seems to pursue a broad range of research objectives within both the basic and applied types of social science (Blaikie 2010). Although the reviewed studies are primarily of a descriptive (and, to a much lesser extent, explanatory²) nature, the majority of studies touch upon the interface between research and policy, and foreground, or at least hint towards, the usefulness of their empirical outcomes for (a variety of) stakeholders involved in station area (re)development. The latter reveals a somewhat different mission compared to the 'basic' types of research, as it is oriented towards affecting or changing the practice of planning for TOD (a research objective typical to applied research). It nonetheless seems that the change-oriented statements listed above are rarely validated in practice. In which way are node-place analyses exactly useful? For whom and to what extent? Do they indeed foster meaningful (interdisciplinary) discussions and/or social learning between stakeholders? These questions can be cast in more general terms by referring to Faludi and Waterhout's (2006, p.11) discussion of the practice of evidence-based planning: does evidence improve political decision-making about a particular planning issue? Does it generate trust in expertise and does it facilitate the transparency of outcome? How do stakeholders participate and what is the role of indicators in collecting, analyzing and presenting evidence?

In line with the work of Straatemeier (2019) and te Brömmelstroet (2010), we argue that in order to address these type of research questions ('What works?' and 'Why does it work?'), academic research needs to engage with practice and submit its findings to explicit testing in new situations in close cooperation with relevant stakeholders. To the best of our knowledge, there exist no such studies within the node-place modeling literature³, with the notable exceptions⁴ of Duffhues et al. (2014) and Kickert et al. (2014). Both papers report on the SPRINTCITY project: a computer-based serious game initiated in 2009 in the Netherlands, with the aim of helping different actors understand factors and the position of other actors in, and potential barriers to TOD. The intervention model of the game is quantified using node-place modeling principles and indicators, and the game is developed and validated through a continuous feedback loop between its players and the developers of the game, thereby repeatedly bridging the two sides of the planning practice and planning research spectrum. This research strategy strongly resonates with the 'experiential research design' methodology advocated by Straatemeier (2019, see also Straatemeier et al. 2010), which centers around the idea that planning research should go through a number of iterative action-reflection cycles in close collaboration with relevant stakeholders from planning practice, in order to deduce meaningful insights about the underlying mechanisms that determine why particular planning innovations do or do not work⁵.

² See for example Irvin-Erickson and La Vigne (2015) and Olaru et al. (2019).

³ Some of the reviewed studies nonetheless recognise the importance of 'communicative, participatory, collaborative, or deliberative planning' in the process of model development (Reusser et al. 2008 p. 201, see also Zemp et al. 2011a) or acknowledge the need for in-practice validation as an avenue for further research (Caset et al. 2018). Other studies actively involve experts in the process of model development (see Lyu et al. 2016, Singh et al. 2017, Li et al. 2019), but the role of these experts is limited to a one-off *ex ante* selection of model indicators or the assignment of indicator weights.

⁴ The work of Gilliard et al. (2018) is relevant to ours as well, albeit that the NPM is validated by urban design students, and not by actual stakeholders involved in railway station strategy making.

⁵ This line of thinking also relates to the work of te Brömmelstroet (2010), who developed a method called 'mediated planning support', in which developers of planning support tools and their end-users engage in structured and iterative dialogues. In the process, the tool is tested, discussed and evaluated in order to refine and increase its usefulness.

development opportunities by comparing particular stations with each other, and/or by comparing stations with their station typology profile.

In line with earlier work stressing the importance of spatial visualization in collaborative planning support system (PSS) processes (see Andrienko et al. 2007, Pelzer and Geertman 2014), and in order to allow for a better interpretation of the relative scores in the radar diagrams, box B provides the option to display the 'source' maps that are at the basis of the indicator calculations, along with some supplementary maps that might prove useful (e.g. administrative boundaries). Figure 1, for example, displays the land use raster data used to calculate the 'diversity' indicators and dimension.

Boxes C to E designate three other tab pages, which all serve to improve the transparency of the tool, a crucial element of a PSS as demonstrated earlier by Vonk (2006), te Brömmelstroet (2010) and Duffhues et al. (2014). To this end, a tab page is present in which the 'raw' or absolute indicator data are listed for all stations (box D), along with a page detailing the indicator metadata (box E) and a page in which the operationalization and purpose of the indicators is explained in more detail (box C).

3. Research questions, case and methodology

3.1. Research questions

The main research question of this paper is: How useful is the StationRadar tool in the context of the transport region partnership, and how can its usefulness be improved?

In order to make sense of and operationalise the concept of 'usefulness' with respect to PSS, we draw on the conceptual framework developed by Pelzer (2017, see also Pelzer et al. 2014). Building on the work of Nielsen (1993), Pelzer (2017) argues that the usefulness of a PSS is influenced by two main explanatory variables: its 'usability' and its 'utility'. The former has often been the focus of PSS research (for example te Brömmelstroet et al. 2014; Papa et al. 2016; Champlin et al. 2018), and concerns the functionalities of the tool (such as its 'transparency', 'user friendliness', 'data quality' or 'communicative value'). 'Utility' on the other hand, concerns the question whether the functionalities of the PSS can live up to the planning task(s) at hand, and whether the PSS fits the phase of the planning process and the scale of the planning issue. Based on this conceptual framework, the main research question can be broken down into two subsidiary questions:

- In what way, and to what extent do the radar diagrams contribute to the usability of the StationRadar tool? What is the role of the maps and the other tool features?
- What is the utility of StationRadar in the context of the transport region partnership?

3.2. Empirical context: the 'transport regions' in Flanders

StationRadar is validated in the context of the recently established 'transport regions' in Flanders. The objective of these new regional partnerships (15 in total) is to stimulate cooperation between municipalities, public transport operators, the Flemish regional Government and other stakeholders around the organization and coordination of public transport in the region, and this in line with the principles of the 'basic accessibility' decree (Flemish Government 2018a). This decree, put forward by the department of Mobility and Public Works, signals a paradigm shift from a supply-driven to a demand-driven public transport system, in which the accessibility to destinations of societal importance is prioritised. A hierarchical 4-layer public transport system is envisioned, in which the railway network functions as the backbone, followed by respectively the 'core network' (a fixed network of high-capacity bus and tram lines connecting large residential areas and attraction poles), the 'supplementary network' (a feeder network of bus lines connecting smaller settlements) and 'customised transport' catering to individual and instantaneous mobility demands.

Each transport region is required to prepare an 'integrated regional mobility plan', in which a strategic vision and operational plan for the organisation of public transport in the region is formulated, and this in close dialogue with a spatial development strategy⁷. Railway stations (should) fulfil a seminal role in these plans, given that they shape what is called 'the backbone of spatial development' in recent policy papers (Flemish Government 2017; 2018b).

The organisational structure of the transport region is centered around the (political) transport region council, responsible for the decision-making processes. The council should at least have one representative of each municipality in the region, the department of Mobility and Public Works, the Agency of Roads and Traffic, the operator of the 'core' and 'supplementary' network, and the Flemish Waterways. The role of the department of Mobility and Public Works is of key importance, and additional stakeholders (such as the national railway company NMBS, the department of Environment, the Provincial Government and intercommunal organizations) can also take part in the council. The usefulness of StationRadar is verified in exactly this interdisciplinary multi-actor setting.

3.3. Methodology

In line with the work of Straatemeier et al. (2010), we adopt an experiential research design in which a number of cases are studied in series, in order to allow hypotheses to evolve from one case to the next, and to acquire a deeper understanding of the particular planning context. As stated by Straatemeier (2019, p. 59), 'this methodological philosophy leads to a research process of constantly combining and reflecting on different pieces of knowledge and evidence to try to understand what might be the underlying mechanisms that explain what is happening'. This approach directly draws on theories and methods of 'experiential learning' as articulated in the field of education by Kolb and Fry (1975). As explained by Straatemeier (2019, p. 55), central to this approach is the notion that experiential learning unfolds through 'an iterative sequence of interlinked activities, with a continuous shift between reflection and action, the one nurturing the other'. The bottom line is the contention that one can only learn the real meaning and value of knowledge by trying and probing it in action.

Straatemeier et al. (2010) applied this line of thinking to the fields of planning research and planning practice, and adapted the 'experiential learning cycle' by Kolb and Fry (1975) to fit this new context. The experiential research design should allow connection between the following interlinked activities in a direct and systematic way: 'observation and reflection' (O&R), 'concrete experience' (CE), 'testing in new situations' (TNS) and 'forming of abstract concepts' (FAC). Such a design spiral thus builds on concrete experience and aims to gradually enhance the relevance of theoretical improvements for planning practice. Figure 2 illustrates how our research strategy aims to subsequently link three of these loops, by means of a workshop in three transport regions. Section 4 will elaborate on the different phases of this experiential learning process.

3.3.1. Workshops and protocol

As we are not evaluating the usefulness of StationRadar in terms of its effect on the quality of the generated mobility plans (which would arguably require a long-term focus on one particular region), we opted to organise workshops in three *different* transport regions (see Figure 3) with largely similar groups of stakeholders. By doing so, we collect insights from a larger group of stakeholders and are able to deduce to what extent particular findings and recommendations are generalizable across workshops.

Importantly, given the short time span between the workshops (see Figure 2), we were not able to modify the tool after each workshop in line with the participant's recommendations. This has the important repercussion that what *has* evolved experientially as an input for each subsequent workshop are our

⁷ Although the department of Environment, responsible for the policy domain of spatial planning, has no decision power in the transport region and is assigned an advisory role, officials of both the department of Mobility and Public Works and of Environment emphasise that coordination with spatial planning is crucial.

Following the above considerations, we arrived at a workshop protocol consisting of the five main parts labeled A to E in Figure 3.

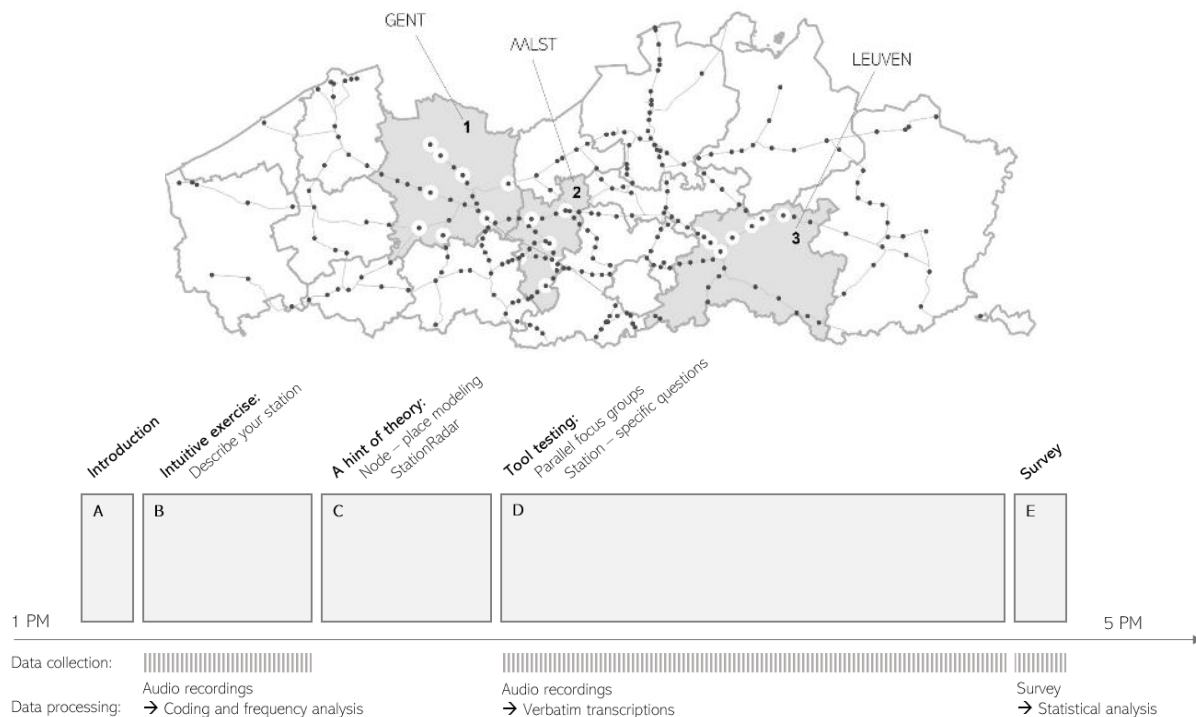


Figure 3: Workshop protocol and selected transport regions with station cases

A: Introduction. An introduction of the workshop goal and structure, a round-the-table introduction of the participants, and a clarification of how data would be collected and reported (informed consent was requested and obtained for all participants).

B: Intuitive exercise: describe your station. A round-the-table exercise in which the municipal representatives are invited to briefly describe 'their' station in terms of its 'accessibility'. We included this exercise for three reasons. First, it serves as an interactive 'ice-breaker' that introduces the station cases to those not familiar with them. Second, the intuitively sketched station profiles are later on confronted with the empirical radar diagrams, and, third, it allows us to examine the dominant wordings used to describe a station's accessibility, hence the extent to which they are captured by the indicators of the radar diagram. Interventions from us, workshop facilitators, took place whenever participants deviated from the task, or when participants were not clear enough. For example, a statement like 'the car accessibility of my station is very good' is insufficiently clear and requires more detail about (in this case) the perceived determinants of car accessibility.

C: A hint of theory. Before moving on to the tool testing in part D, it was essential for participants to become acquainted with the notion of node-place modeling. After introducing the concepts of 'node' and 'place', we explained how the radar diagrams should be interpreted, and how they are incorporated in the StationRadar tool. At the end of this part, participants were invited to explore the tool themselves.

D: Tool testing. This part is the most important and also the longest part of the workshop. It is conceived of as an actively moderated interactive discussion, organised at two or three interdisciplinary parallel worktables (see Figure 4 for an exemplary worktable setting). Each discussion is structured around a series of station-specific questions which require active tool consultation. For each station, at least 4 tailored questions were prepared, again in close dialogue with the local workshop organisers. Each question pertains to one of the fields in our radar diagram and addresses a relevant issue regarding the station's development potential. These are some archetypal questions from the first workshop:

- Is it justified to increase the density of amenities with a supra-local function in the station area?
- Is an expansion of the station's car parking capacity in line with the station's profile?
- The spatial mix of the residential, work and leisure functions is low compared to the other stations. Is it desirable to increase this mix?
- Is it desirable to relocate this station towards a larger urban core in its vicinity?
- Is it justified to increase the train service frequency in this station?

In order to address these questions, the participants were asked to consult the radar diagrams and the other functionalities provided by the tool (the maps, the tables, the metadata,...). Importantly, the questions were collectively discussed per worktable, with each of these having at least one facilitator who actively moderated the discussion and made sure that everybody was able to express their opinions. The facilitator also actively steered the discussion in order to zoom in on relevant usefulness statements and to ask for other's opinions. Hypotheses that evolved over the course of previous workshops were also introduced in the discussion. Part D always concluded with a round-the-table talk in which each participant briefly expressed their feelings with respect to both the workshop and what they had learned (if applicable). Each worktable can therefore be considered to be a focus group.

E: Survey. At the end of each workshop, participants were asked to complete a survey (which lasted approximately 15 minutes) with Likert-scale statements rated 1 to 5 (from 'strongly disagree' to 'strongly agree'). Space was provided to elaborate on particular statement scores if wanted. The survey composition is further clarified in the next section.

3.3.2. Data collection and processing

Data was collected in the B, D and E parts of each workshop (Figure 3). Both B and D were audio recorded. The accessibility descriptions of B were coded as an input for a frequency analysis in NVivo. The audio recordings of D were transcribed verbatim. The survey (E) Likert scores were processed by means of descriptive statistics in R. The survey design draws on the work of Pelzer (2017) and Champlin et al. (2018) in that it focuses on the following four dimensions: the *participants* and their *background*, the perceived *quality of the workshop process* at the individual and group level (evaluating general satisfaction, insight, communication, shared language, consensus-building and efficiency gains) the *tool usability* (evaluating transparency, credibility, output clarity, focus, level of detail, etc.) and the *tool utility* (evaluating the potential of StationRadar in the context of the transport region). Each workshop was attended and moderated by at least two people of our team, who observed, participated and actively stimulated the use of the tool throughout the workshop. Appendix II provides a summary sheet of the workshops.



Figure 4: Exemplary worktable setting

4. Findings

This section starts with a chronologic account of the insights gathered throughout the experiential learning process, from our perspective as academics. We discuss the full process as schematised in Figure 2, and mainly draw on the focus group discussions (part D) to illustrate particular findings by means of citations. Afterwards, we reflect on the results collected in parts B (section 4.2) and E (section 4.3).

4.1 The StationRadar experiential learning process

During the preparatory meetings leading to the first workshop, the local organisers expressed a clear interest in the tool. The timing to host an interdisciplinary stakeholder workshop about railway station development potential seemed quite right as the Provincial Government was preparing a new Provincial policy plan in which the principles of transit-oriented development would feature strongly. An academic, hence politically 'neutral', setting in which a sample of crucial stakeholders would be joined under the banner of this new, and quite controversial, theme of TOD, was therefore deemed highly interesting as it would allow our local organisers to 'test the waters' and explore the stance of the different stakeholders with respect to this strategic policy principle. After all, we learned from the Provincial officials how there is some resistance among certain stakeholders concerning the strategy of planning for railway station area development. One of the arguments made is that the railway system is an outdated transport system and that surely investments need to be focused on novel technologies instead. A second reason why the workshop idea was met with enthusiasm, is the abundance of data captured in StationRadar (at the time, our co-organisers were about to start a node-place modeling exercise themselves), and the inclusion of the user-based data captured in the 'people' dimensions of the radar diagram. Thirdly, our co-organisers thought that the potential of the tool to be useful within the context of the transport region was high; they hypothesised that StationRadar could introduce a '*common ground*' to support supra-local discussions about station development potential, but also expressed the concern that the radar diagrams are '*very mathematical*' which could in turn affect their usefulness.

The above observations and reflections (O&R) initiated the start of the experiential learning process. Although the abstract concepts were formed in the earlier phase of node-place modeling, we slightly readjusted the radar diagrams in line with the feedback received during these preparatory meetings (FAC). After two tool stress-tests with our university colleagues, StationRadar was ready to be tested in the new situation (TNS) of the first workshop in Gent.

At the time of the workshop, the transport region of Gent had just been established. Prior to the workshop only one informative meeting organised by the Flemish administration had taken place. As a corollary, the members of the transport region council, a large share of our group of participants, had not yet experienced any collective practice or concrete experience (CE). The concrete experience on the basis of which the tool was validated, was therefore mainly stakeholder-specific, instead of it being a collective and cohesive planning practice with well-defined roles and planning tasks.

In terms of the quality of the workshop process, main reflections following the first workshop (O&R) were that the tool and the indicators were quite difficult to grasp for those who were not acquainted with node-place model indicators or with TOD in general. As one participant stated: '*Actually we should be able to work with the tool for a longer period of time, let's say a week, in order to give more grounded feedback*'. Due to contractual agreement⁸ with the national railway company NMBS, this proposition was not feasible, but we nonetheless came to the conclusion that the workshops should dedicate more time to the 'learning

⁸ For the user-based information included in the radar diagram (see Appendix I), the raw data could not be shown in the tool. This protective data attitude mainly stems from the future liberalisation of the Belgian railway sector, which implies that several companies will be allowed to arrange domestic rail travel in Belgium, thus creating a competitive market.

by doing' bit. We therefore decided to allow more individual experimentation with the tool during part C and provide more time for the worktables in D during the next workshops.

In terms of perceived tool usefulness, the main reflections were as follows. First, as hypothesised by our co-organisers, the tool was deemed most relevant for the 'supralocal stakeholders' (the mobility providers, the intercommunal organisations and the Flemish and Provincial Government). A variety of uses on this regional scale were envisioned: to *'better inform regional allocation decisions'*, *'help developing a hierarchy of nodes'*, *'help integrating the different layers and modes of public transport in the region'* and *'function as a communication tool between stakeholders'*. The added value of the tool at the local, municipal, level seemed less evident. Although many participants emphasised the necessity of empirical evidence as an input for local strategy making (the proverb *'meten is weten'*, or *'measuring is knowing'* was frequently used), the evidence conveyed by the radar diagrams was deemed insufficient at this stage, mainly in terms of relevance and level of detail. As one mobility expert stated: *'When I'm asked if we need to increase the bike parking capacity at our railway station, I will certainly not consult the tool for this specific, local, question. No, I will jump on my bike and pass by the station for a couple of months in order to see for myself'*. Most other municipal stakeholders endorsed this view, and also stated that the absolute figures provided in the table were (far) more relevant to them than the relative scores in the radar diagrams. In a similar vein, a civil servant competent for infrastructure argued that *'the influence of the largest stations on the indicator scores of smaller stations is huge and can lead to wrong conclusions. For example, at our station, the diagram indicates there is hardly any bike parking capacity while in fact that way of comparing stations is not very relevant. First of all, our station has no relationship with those large stations and, second, the real question is whether there is still room to park your bike'*. A second, related, reflection concerned the lack of interactivity of the tool and, more specifically, the fact that tool users could not plot radar diagrams as a function of their own desired station selections. This concern arose as some participants thought it made little sense to compare particular stations with other, for example larger or smaller, ones: *'It would make more sense if we could compare stations of a similar size and order'*. Additionally, the tool should allow to plot multiple diagrams next to each other, fostering the ease of visual comparison. Third, we observed and experienced how the NMBS user-based data revealed novel and meaningful insights for the majority of participants (especially to representatives of smaller municipalities who generally lack the resources to frequently update mobility plans and to organise passenger counts or conduct surveys). Unsurprisingly, as we were not allowed to make public the absolute numbers of these user-based data, this prompted some critical comments addressed at the NMBS.

With the above reflections in mind (FAC), we embarked on the second workshop in Aalst (TNS). Contrary to the previous case, the transport region of Aalst was established in 2016 as a pilot project. The concrete experience (CE) of the workshop participants was therefore more developed in terms of being a collective practice. In general, most participants found the idea behind the tool very strong, referring to the integrated approach of mobility and spatial planning and to the *'stimulans'* it could give to *'thinking more regionally'*. Similar to the previous workshop, the difference in perceived usefulness between the local and the regional governance scales was quickly raised. However, at one of the worktables an in-depth discussion arose about how the tool's usefulness could be improved for local stakeholders as well, and how this in turn could benefit the transport region's functioning. As a mobility expert explained: *'If the tool would allow for flexible radar diagram comparisons between municipalities, then it might foster inter-municipal dialogues in which certain measures taken and their effectiveness are compared and discussed. For example, if a municipality introduced toll parking at the station, it would be interesting to see, also for neighbouring municipalities, how this affects particular parts of the radar diagram. In this way, the tool could foster a bottom-up, kind of peer-review, dynamic that could reinforce the transport region'*. This statement in turn prompted questions about quality assurance: *'Of course this kind of peer-review dynamic would stand or fall with how frequently the tool would be updated, how recent the data is...'* Additionally, a series of interesting improvements in terms of diagram visualization were proposed, e.g. the suggestion to visualise the mean or median value for each indicator to immediately get a sense of the distribution of the data hence the exceptionality of your station. Another suggestion was to visualise the absolute number of an indicator

score whenever you hover your cursor over that specific piece of the diagram. Or, as one spatial planner proposed: *'It would be great if we could make selections of stations based on one particular theme, such as 'ridership'. In that way, you could easily select stations with similar ridership numbers, plot their rose diagrams and examine how and why they are performing differently'*. These usability statements reveal a similar need for interactivity as was expressed during the first workshop. Another point that had also been raised during the first workshop concerns the difference in expertise and resources between smaller and larger municipalities. As stated by an Alderwoman of Mobility and Public Works: *'The problem is that, and I mainly speak on behalf of the rural municipalities, whenever you have all that information, you need to be able to work with it. You need to have the manpower to get started with it and draw conclusions from it'*. This statement implicitly relates to the perceived complexity of the tool by many participants. As one of our co-organizing mobility experts put it: *'After today's workshop it became clear to me how the tool is of the same level as our transport models or ArcGIS. In other words, you will always need an operator, but that's ok'*.

We concluded that the second workshop led to observations and reflections (O&R) that were largely in line with those of the first workshop, and that the slightly adjusted workshop format now allowed us to sufficiently question and zoom in on the interim hypotheses. We also experienced how some stakeholders (i.e. public transport provider De Lijn and some municipalities) offered to contribute to the tool by providing additional data, which inspired us to rethink the possibilities for tool involvement.

With the above in mind, we embarked on the final workshop in Leuven (TNS). Although this transport region had just been established, a large share of participants were experienced in working together on this regional scale (CE) due to their involvement in a project called Regionet Leuven⁹. Similar to the previous workshops, a main observation was that participants requested more flexible station comparisons, and that they stressed the importance of the absolute numbers over the relative scores. Concerning the latter, comments were also made about the normalization of values between 0 (corresponding to the lowest absolute value) and 10 (the highest). As a spatial planner argued: *'It would make more sense to take proportions relative to the highest absolute value. Your point of comparison will distort the results much less, because currently two scores of let's say 546 and 550 will be rescaled to 0 and 10 which distorts proportions severely'*. Along with these suggestions, ideas for additional indicators were proposed such as a 'design for all' indicator (taking into account the accessibility of the station and bus stops for people with disabilities) and one reflecting the level of road congestion between the station under scrutiny and the most important commuter destinations. At the same time however, other participants questioned the need to further expand the amount of information included and would rather distill the most relevant indicators only. Besides these usability reflections, it became clear how, conceptually, the radar diagram requires a distinct way of thinking that seemed uncommon to many participants. A municipal mobility expert for example asked: *'But why did you opt to compare stations with each other? This diagram totally contrasts with how we are used to look at things. You look completely different at those numbers. We always start by looking at the inflow: how much and how do people get there etc. But these diagrams... It's all so relative'*.

A final observation in line with the previous workshops, was the strong interest for the NMBS user-based data. A Provincial policy officer responsible for spatial planning, for example, reflected *'how great it would be if the data about the catchment area sizes could also be visualised spatially, let's say by using rasters so there is no privacy problem. This would be incredibly valuable to better grasp a station's functioning within the transport region'*.

Following the workshops, two additional meetings with NMBS were arranged to communicate our findings and to reflect on the possibilities for disclosing (parts of) the delivered data for public use in an advanced version of StationRadar (2.0). We learned how the user-based data provided by NMBS in the context of

⁹ Regionet Leuven is a supra-local strategic project comprising the transport region of Leuven. It aims to develop a long term vision for regional development and high-quality public transport and cycling networks.

this research is only rarely extracted for analytical purposes from the 'enormous pile of data' the company owns. As one employee argued: 'the mere fact that we have dusted off and tapped into these data as part of your research is very positive'. The tool was also praised for its accessible user interface in which these and the other data were deemed easily consultable, prompting the idea for a (private) tool spin-off allowing the company to integrate and visualise much more data, such as origin-destination flows. At the moment of writing, our request in terms of the disclosure of the user-based data is under consideration, but the anticipation is that we will be allowed to not only visualise the radar diagrams, but to also display the raw data. As an employee stated, 'these data are in fact not that sensitive' and 'NMBS wants to contribute to the wave of open source applications' as much as possible. It was also stated how the company wants to collaborate more frequently with universities and research institutes, and how this research is considered a test case.

4.2 An intuitive account of a station's accessibility

The intuitive exercise in part B of the workshop (Figure 3) allowed us to examine the dominant wording that was used by the municipal representatives to describe the accessibility of 'their' station, and therefore the extent to which they are captured by the indicators of the radar diagram. We coded the accessibility statements, grouped them over all workshops (N = 22 station descriptions) and analysed how frequently they were used. Figure 5 illustrates the statement codes and their absolute frequencies.

Most frequently, stations were described in terms of the largest cities they connect to without needing to transfer (coded as 'Train TransferCentrality'), followed by the location of the station with respect to the urbanized area ('Place LocationStation'). Exemplary statements of the latter are: 'the station is located within a 5 to 10 minutes walk from the city center' or 'the station is situated at the edge of the city'. Up next are car parking capacity, car parking utilisation, train frequency per hour, the kind of environment the station is situated in ('in the middle of the fields', 'in a very residential environment', 'in an open landscape') and bike parking capacity and utilisation.

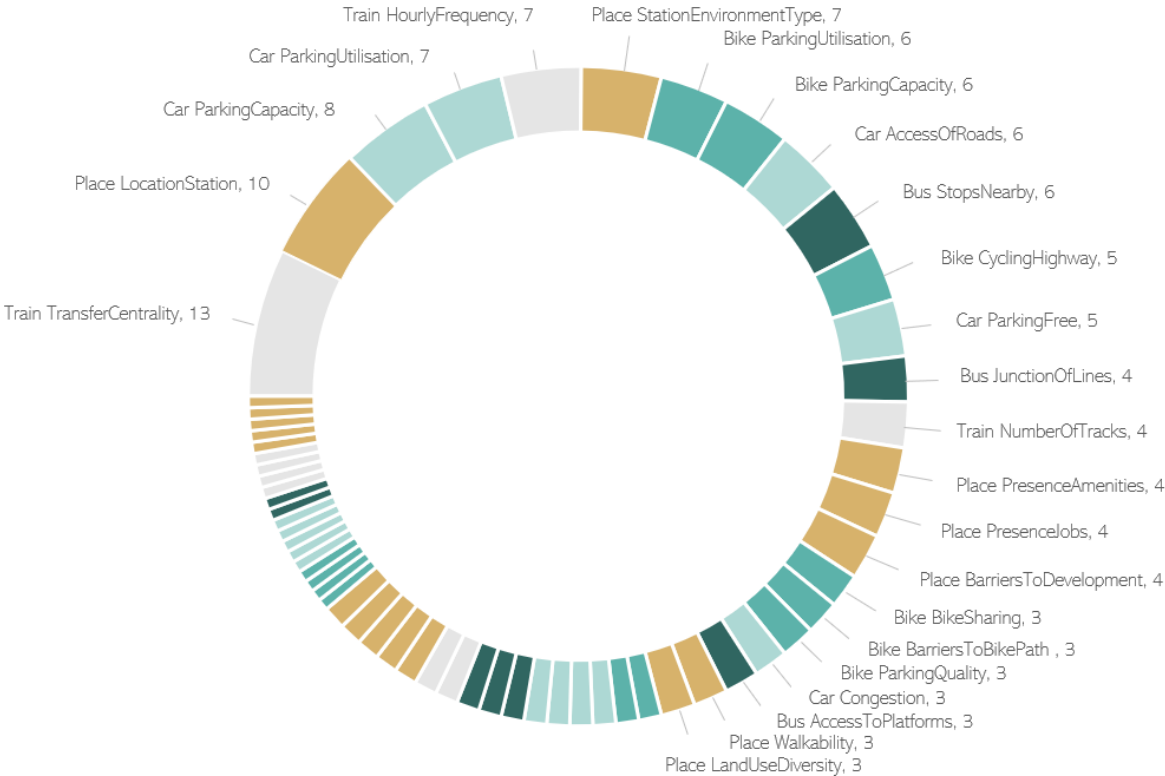


Figure 5: Frequency of accessibility statements

Some general conclusions that can be drawn from this are that, first, most of the statements centered around the station feeder modes (car, bike and public transport), with the car featuring most prominently. Second, although place characteristics were frequently discussed, the standard TOD dimensions of 'density', 'diversity' and 'design' (see Cervero and Kockelman 1997) were hardly mentioned or referred to. For example, statements about land use diversity and design of the built environment (walkability) were both mentioned in only 3 out of 22 cases. This could be due to the underrepresentation of spatial planners and urbanists in two of the three workshops. Third, we concluded that some of the frequently mentioned characteristics were not incorporated in StationRadar, i.e. parking utilisation data, parking quality data, road congestion data, and more 'soft' user-based data about the accessibility of the platforms and safety at and around the station. Following the focus groups, we concluded that some of these characteristics (especially parking utilisation data and road congestion data) are deemed crucial, therefore these should be incorporated in StationRadar 2.0.

4.3 Survey results

The post-workshop survey focused on four dimensions: the background characteristics of the participants, the quality of the process (individual and group), the tool usability and the tool utility. The latter three dimensions will be discussed below, by means of visualizations of the most relevant five-point Likert scale statements and their ratings across the workshops. When relevant, written survey statement replies are also cited, along with the results of one-way analyses of variance (ANOVA). These are used to determine whether there are any statistically significant differences between the means of particular statement scores for different groups of participants (we tested for age and sex categories, but also for 'organisation' and 'background', see Appendix II). In total, 43 surveys were completed.

4.3.1 Quality of process

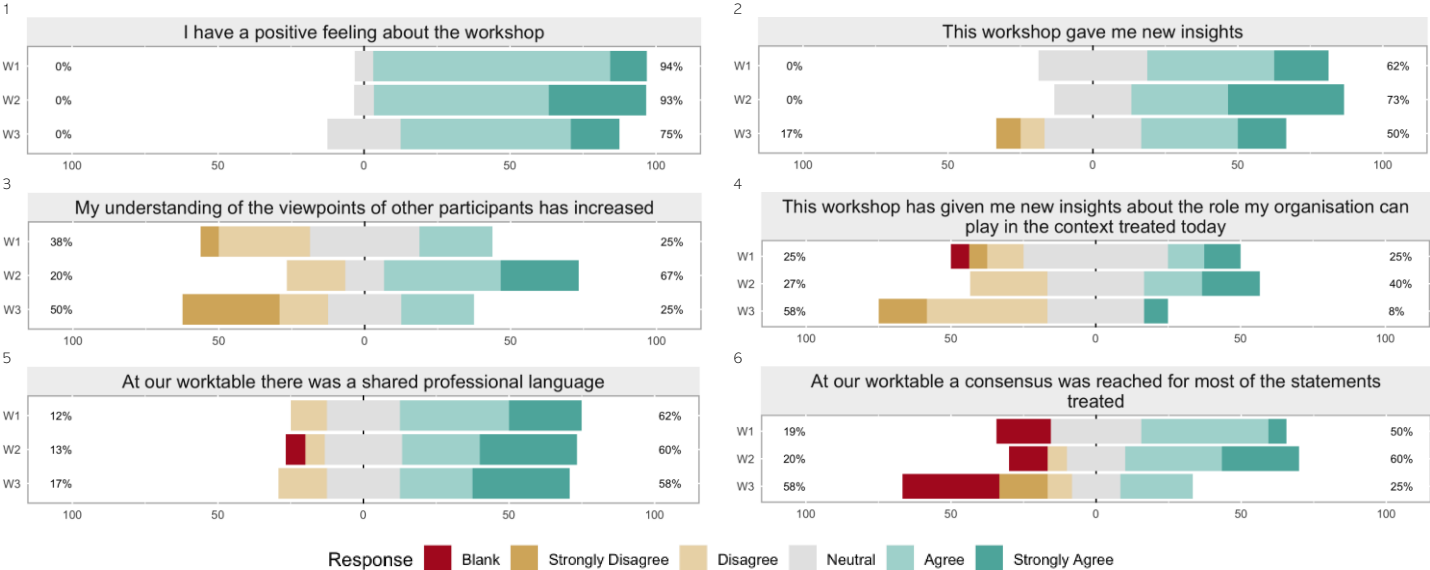


Figure 6: Quality of process - Likert scale statements

We evaluated the perceived quality of the workshop process at the individual and group level based on 11 statements (some of them included in Figure 6). At the individual level, the majority of participants expressed positive feelings about the workshop and stated to have required new insights, such as: 'the tool gives a clear insight into the factors that influence the node and place values of a station' or 'this multidisciplinary approach was new to me'. Results are more diverging for statements 3 and 4 (Figure 6). As for 3, a large share of the participants stated that the viewpoints of other participants were already sufficiently clear, while others argued that the tool enabled them to better understand the logic of NMBS, or that it helped 'to see things through the lens of other stakeholders'. As for 4, a majority of participants

(strongly) disagreed with the statement or rated it with a 'neutral', which may in part be explained by the recent character of the transport region concept. As two participants stated: *'the division of roles for mobility planning in the region is still very unclear'* and *'there is no coordination of roles yet within the transport region'*. These opinions echo our earlier statement about how the 'concrete experience' within the transport region planning practice had not yet matured at the time of the workshops, which has important repercussions for the inferences made (see section 5).

At the group level, participants stated that the social dynamic at the worktables was constructive, that time was used efficiently, and that there was a shared professional language (statement 5). Drawing on our experience as focus group moderators, we can corroborate the latter as we felt that most participants indeed used and mastered the node-place jargon towards the end of the workshop. Statement 6 in turn has a high proportion of blanks, which might be explained by the fact that some of the station-specific questions or statements were not addressed because the discussion deviated from this task.

4.3.2 Usability

The survey included 22 usability statements, 14 of which specifically focused on the radar diagrams (Figure 7), and the remaining ones on the StationRadar tool (Figure 8). As statement 7 illustrates, the majority of participants finds these type of visualizations useful, provided that some of the limitations detailed above are tackled. Similarly, most people do not perceive the radar diagrams as being too abstract, *'as long as you fully realise what you are comparing and what the scores really mean'*. Or, as one participant noted: *'For me it's all about the scale of abstraction. It's fine to compare between stations on a regional scale, but on the level of let's say 1 station, a radar diagram is removed too far from reality and in this case, I am more in favour of the combination of multiple tools to approach reality'*. Or: *'In order to make sense of this complex matter, I don't think you can proceed differently than through an abstraction of reality'*. Interestingly, the ANOVA test for statement 7 in terms of the participants organisation is statistically significant (between groups, $p = .048$), indicating how all stakeholders operating on a supra-local scale value the radar diagrams more strongly than the municipal representatives (this is especially the case for mobility provider De Lijn, the intercommunal organisations and both the Flemish and Provincial Governments). These results closely echo the focus group findings discussed above.

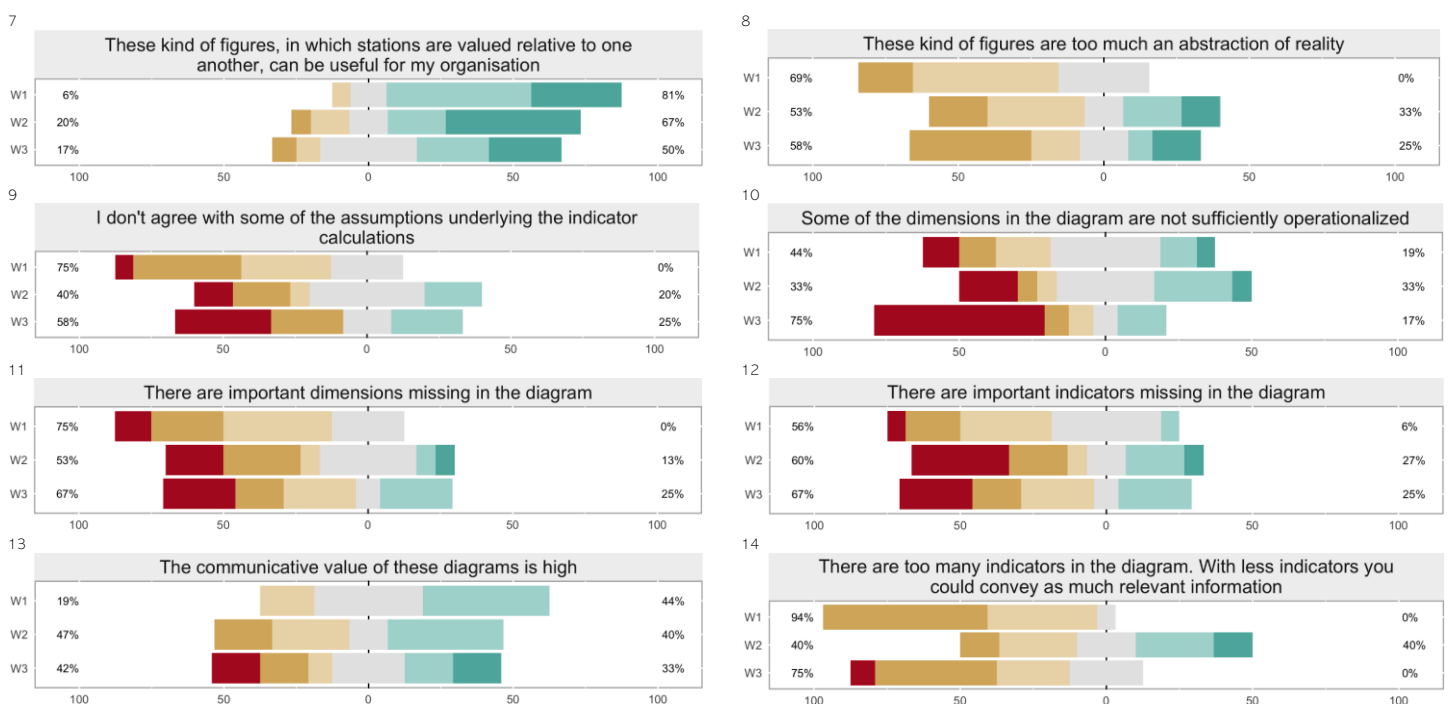


Figure 7: Radar diagram usability - Likert scale statements

As for statements 9 to 12, the results indicate how the workshop set-up did not provide enough time for most people to be able to respond to these statements in a properly informed way – this was also explicitly stated by most participants. Suggestions for extra dimensions and indicators were nonetheless made, and are mostly in line with the ones raised during the focus groups. With respect to the communicative value of the diagrams (statement 13), opinions are divided. Those that do not agree mostly refer to the extensive knowledge required to interpret the diagrams, and therefore argue that it is *'definitely not a quick visualization tool'*. In a similar vein, some also state the communicative value is only tangible for *'professionals'*. Besides that, many participants noted that the communication potential of the generalised diagrams is certainly higher than the detailed diagrams. The latter contention somewhat contradicts with the ratings for statement 14, as it seems that the majority of participants is clearly of the opinion that there are not too many indicators in the diagram.

Another usability question was to ask the respondents to rate each dimension in terms of their importance on a scale from 0 to 5. The results (see Appendix III) indicate how, in general, the left and middle sides of the diagram (corresponding to the node, train, effort and user intensity dimensions) are deemed most important, while the right side (place and motivations) receives lower scores. The catchment area dimensions in particular are deemed very important, along with the accessibility of the station by bike and public transport. The motivations of the station users and the place characteristics (especially diversity and design) are deemed less important. However, this general image changes when results are disaggregated according to the participants backgrounds (mobility or spatial planning). Interestingly, spatial planners tend to value the importance of the place dimensions (density, diversity and design) more strongly than their counterparts, and the accessibility by car is also deemed less important. When running a series of one-way ANOVA tests to discern whether these differences in mean values are statistically different between both groups, only the *'design'* dimension returns a significant result ($p = .045$).

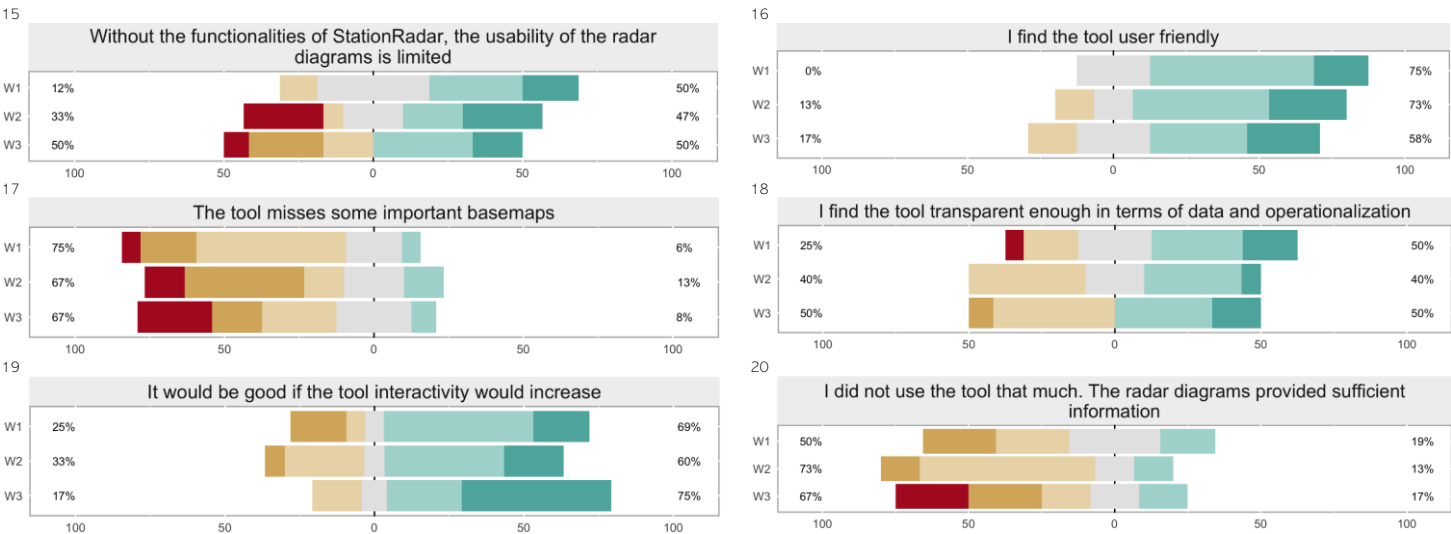


Figure 8: StationRadar usability - Likert scale statements

When moving to an assessment of StationRadar’s usefulness (Figure 8), the following observations can be made. First, most participants consider the embeddedness of the radar diagrams in the tool crucial (as revealed by statements 15 and 20). Second, the majority finds the tool user friendly and does not think important cartographic material is missing. As for the latter, some interesting suggestions were however made, such as: *'it would be interesting to add a layer visualising the expected demographic growth in the region, and a layer that informs which type of people are living in the station area (age, income, ...)*. Statement 18 in turn reveals how opinions diverge on the perceived transparency of the tool and the statement 19 ratings echo the above mentioned critiques in terms of tool interactivity (mainly in terms of the ability to make flexible station comparisons).

4.3.3 Utility

In terms of utility, the survey included 5 statements. The first examined to what extent these kind of empirical analyses are deemed relevant within the transport region. Judging from Figure 9, the vast majority of participants in all three workshops clearly (and strongly) agree with statement 21, provided that the usability limitations of the radar diagrams are tackled. The number of 'neutral' and 'blank' replies are very small, reflecting a quasi consensus. Statement 24 nonetheless reveals how a significant share of participants consider the tool to be most meaningful in terms of social interaction: communication, discussion and collaboration. Opinions nonetheless diverge. One participant stated that *'this is indeed a very important added value'*; two others noted that *'both aspects are relevant'*, while somebody else considered social interaction as *'a nice side-effect of the tool'*, and another participant hypothesised that *'the tool will not bring stakeholders around the table'*. The latter could be related to the perceived complexity of the tool by a (smaller) part of the participants, as indicated by statement 22, although the majority disagrees that this complexity could hinder its usefulness within the transport region. Written feedback mainly focuses on the usability limitations raised above. Tool utility is moreover determined by the priority given to railway station (area) development in the transport region, and the extent to which this is expected as part of the regional mobility plan (statement 23). In this respect, most participants argue that *'TOD is very important'* and refer both to the decree on basic accessibility (see section 3.2) and Flanders' new spatial policy plan in which the railway network is considered the backbone for future spatial development (Flemish Government 2017; 2018b). Others stress that the 'node value' is just one aspect, and that the 'place value' of other non-railway station locations is equally important, or argue that *'there are large areas within the transport region without railway stations or railway line. Important bus stops could or should be added to the tool'*. Another participant argued that *'the main question is how to reduce car traffic in favour of train traffic and other public transport. Therefore, mainly biking and walking from and towards the railway stations needs to be prioritised'*. A final utility statement (25) concerns the stakeholders involved in the planning task. The majority of participants argued all relevant stakeholders were present at the workshop. Those who disagreed were participants from workshop 2 where NMBS was not represented, and participants from workshop 3 where De Lijn was not represented. Other absent stakeholders registered in the surveys are *'Infrabel'¹⁰*, *'policy representatives'*, *'other spatial stakeholders'* and *'representatives of large companies'*.

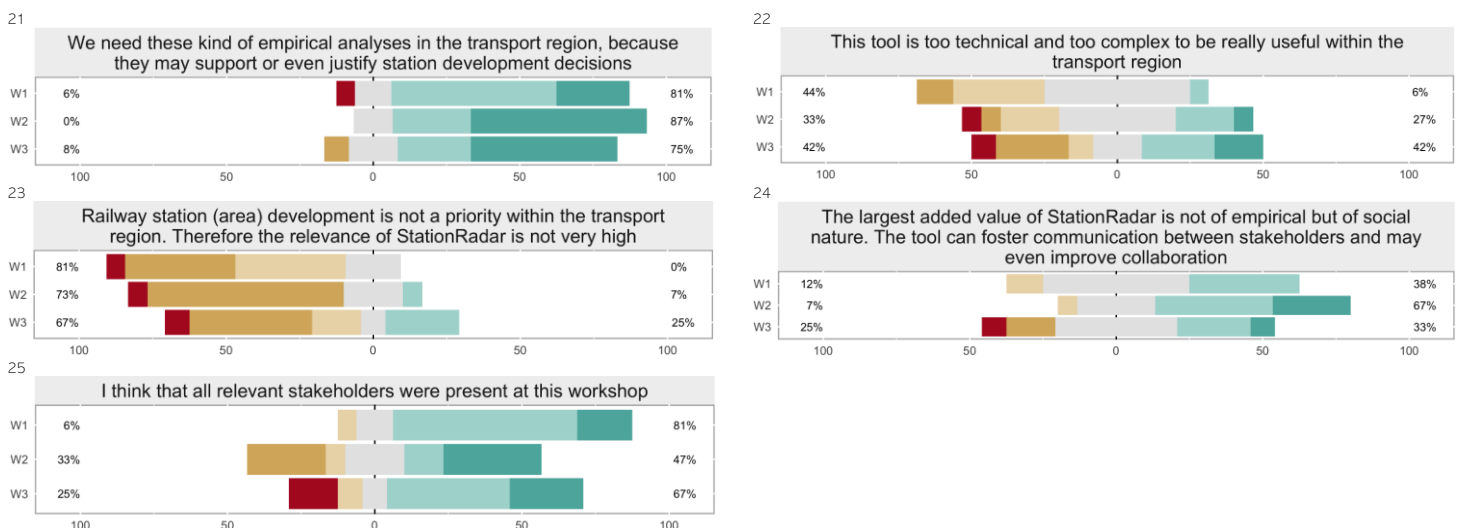


Figure 9: Utility - Likert scale statements

¹⁰ Infrabel is the infrastructure manager of the railways in Belgium.

5. Discussion and concluding remarks

This paper reported on an experiential approach to the development of a node-place based planning support tool in the context of the transport region partnership in Flanders. At the root of this research project was the observation that NPM concepts, assumptions and outcomes are rarely tested and validated in close dialogue with the intended end users of the conducted analyses and developed tools. This is surprising, since the majority of studies touch upon the interface between planning practice and planning research, and foreground, or at least hint towards, the usefulness of their empirical outcomes for (a variety of) stakeholders involved in station (area) development. In order to help bridge this gap between NPM research and practice, we adopted an experiential research strategy and organized a series of workshops in which we put the recently developed, node-place based, StationRadar tool to the test.

During the course of the process, usability and utility hypotheses were continuously revisited and fine-tuned, as an input for each successive workshop. The tool itself was not modified based on the comments received. This has an important limitation in that the feedback is based on assumptions, and is therefore not grounded in actual 'before and after' experimentation. On the other hand, as the workshop protocol was uniform in all cases, this approach allowed us to aggregate across workshops, yielding a sample size of 45 respondents which was large enough to enable statistical analyses. Moreover, given that the feedback received is mostly consistent across workshops, the majority of conclusions drawn are straightforward and consensual.

In terms of usability, we can conclude that StationRadar has the potential to become a functional and helpful tool for different stakeholders in the region, provided that some important limitations are tackled. Regarding interactivity¹¹, users need to be allowed to manually select the stations they want to compare with each other, and the diagrams should be plotted on the screen simultaneously. Additionally, interesting ideas were raised to experiment with visualizations of indicator-specific station comparisons. In terms of transparency, it is absolutely crucial to disclose all raw data underpinning the relative scores in the radar diagrams, and in terms of user friendliness, the relative scores need to be weighted in a more intuitive way, i.e. proportional to the highest score in the distribution. Opinions about the perceived communicative value of the diagrams currently diverge, but will arguably converge once the above recommendations are tackled. A final usability remark deals with the level of detail provided by the tool. Compared to earlier NPM research, the radar diagrams can be considered very detailed as more dimensions were added and all underlying indicators can be displayed. Judging from the survey results, the majority of participants (strongly) appreciated this level of detail. Unfortunately, the workshop set-up did not allow for a more thorough examination of the indicators and their operationalization. A future validation of the indicators as part of StationRadar 2.0 (by means of surveys or another multi-actor workshop) is therefore a sensible next step.

The above observations and reflections have a broader significance for the NPM literature, as the practice of developing visual renderings of station-specific performance levels seems to become more prevalent (see Balz and Schrijnen 2009, Singh et al. 2017, Vale et al. 2018, Caset et al. 2018, Groenendijk et al. 2018, Nigro et al. 2019). Although each planning context is unique and each NPM analysis originates from a particular problem statement, it may well be the case that certain usability traits in terms of node-place modeling are transferable across cases.

In terms of utility, we believe our findings are less straightforward and consensual in this stage of the research, and will require further examination. Although there seemed to be a clear consensus about the need for suchlike empirical evidence in the transport region, and the importance of putting TOD on the regional agenda, there is still much uncertainty about the exact role that StationRadar could fulfill in this

¹¹ One way in which we will tackle these interactivity recommendations is by scaling the landing page of the project to a Vue.js and D3.js based web app, which will allow for more flexibility and interactivity. We will however also keep the Shiny app for the detailed maps. Recently, we witnessed the creation of similar webtools such as the Urban Mobility Index (<https://urbanmobilityindex.here.com/>) which use JavaScript, react.js/vue.js together with beautiful user interfaces to present often complex data in a simple and reactive way.

multi-actor setting. Due to the recent character of the transport region partnership and the timing of the workshops at the very start of this planning process, the planning practice to which StationRadar was subjected can be considered 'premature'. Among some of the participants, there was much uncertainty about the subjects that will be prioritised in the region, how (frequently) the meetings will be organised, what is expected from them and what exactly is expected in light of the regional mobility plan. This uncertainty obviously hinders an adequate assessment of StationRadar's utility in the region. A future research step will therefore deal with the organisation of additional interviews with representatives from the different supra-local partners, in which we will aim to deepen our understanding of the 'fit' between the tool and the concrete regional planning task(s) at hand.

From a valorisation point of view, the most noteworthy contribution of this research project arguably consists of the actor-mobilising and data-disclosing potential of the tool. We experienced how different stakeholders spontaneously contacted us with the intention to contribute by delivering data. Besides that, NMBS will (very likely) approve of the public communication and dissemination of their recent user-based data for all railway stations in Flanders and Brussels. As such, we hope to somehow fuel the momentum initiated by the transport regions to put sustainable mobility, quite literally, on the map.

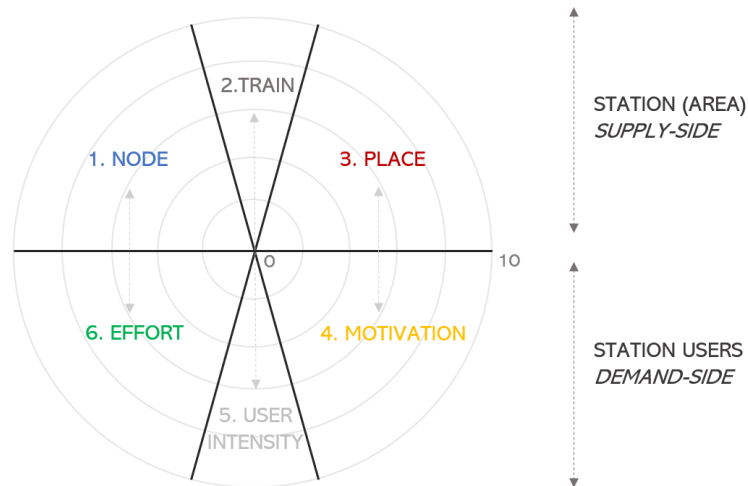
Acknowledgements

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Appendix I – Radar diagram: explanation

The radar diagram is composed of six fields and will be briefly explained here. A detailed account of all indicators and their operationalization will be provided in Caset et al. (under review).

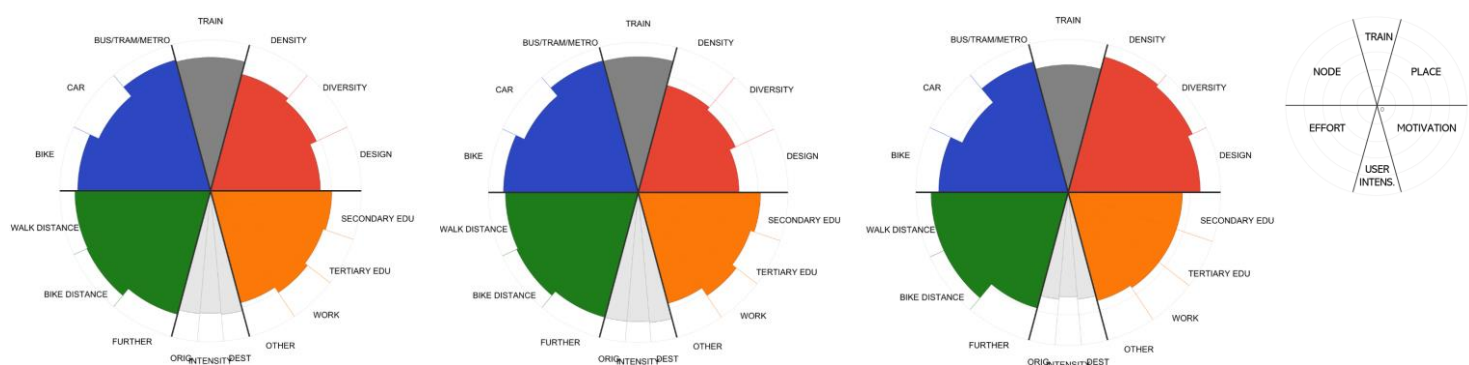
Instead of aggregating all transport modes in the 'node value' of the station (as is usually done in NPM studies), we opted to separate the train accessibility in the field 'train', and the feeder mode accessibility (by car, bike and public transport) in the field called 'node'. The 'place' field captures the standard TOD dimensions of 'density', 'diversity' and 'design', based on a walkable network buffer of 1200 m (15 minutes of walking). The lower half of the diagram presents a demand-side perspective by visualizing data about the users of the station. The 'effort' field captures how far people live from their station of origin, and arguably relates to the effort it takes for people to reach the station. 'Ridership' in turn reflects the frequency of passengers boarding on a regular working day and the extent to which the station functions as an origin or as a destination station. Lastly, 'motivation' informs about the extent to which particular groups use the station (secondary education, tertiary education, work, and other).



Appendix II – Summary sheet workshops

	WORKSHOP GENT 17-01-2019	WORKSHOP AALST 25-01-2019	WORKSHOP LEUVEN 21-02-2019
Participants	16	15	14
Organisation			
Municipality	7	10	6
Intercommunal org.	2	1	1
Flemish Government	2	2	3
Provincial Government	3	0	3
NMBS (railway company)	1	0	1
De Lijn (bus company)	1	2	0
Background			
Mobility	10	10	7
Spatial planning	4	3	7
Other	2	2	0
Age category			
<30	4	3	2
31 - 45	6	5	5
46 - 60	5	6	7
> 60	0	1	0
Sex			
Men	11	9	8
Women	5	6	6
Other	0	0	0
Worktables	3	2	2
Facilitators	4	2	2
Station cases	8	6	8
	Eeklo Waarschoot Evergem Beervelde Deinze Eke-Nazareth Landegem Melle	Wichelen Dendermonde Aalst Burst Denderleeuw Ninove	Haacht Wespelaar-Tildonk Hambos Wijgmaal Wezemaal Aarschot Langdorp Testelt

Appendix III – Rated importance of dimensions (mean values)



a) All (N = 43)

b) Mobility (N = 27)

c) Spatial planning (N = 14)

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