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E.**

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# Accessibility Instruments In Planning Practice: Bridging The Implementation Gap

Cecília Silva<sup>1</sup>, Luca Bertolini<sup>2</sup>, Marco te Brömmelstroet<sup>2</sup>, Dimitris Milakis<sup>3</sup>, Enrica Papa<sup>4</sup>

<sup>1</sup> Faculty of Engineering of the University of Porto, Research Centre for Territory Planning and Transport (CITTA), [ccsilva@fe.up.pt](mailto:ccsilva@fe.up.pt)

<sup>2</sup> University of Amsterdam, [l.bertolini@uva.nl](mailto:l.bertolini@uva.nl), [brommelstroet@uva.nl](mailto:brommelstroet@uva.nl)

<sup>3</sup> Delft University of Technology, [d.milakis@tudelft.nl](mailto:d.milakis@tudelft.nl)

<sup>4</sup> University of Westminster, [E.Papa@westminster.ac.uk](mailto:E.Papa@westminster.ac.uk)

## Abstract

Accessibility concepts are increasingly acknowledged as fundamental to understand cities and urban regions. Accordingly, accessibility instruments have been recognised as valuable support tools for land-use and transport planning. However, despite the relatively large number of instruments available in the literature, they are not widely used in planning practice.

This paper aims to explore why accessibility instruments are not widely used in planning practice. To this end we focus our research on perceived user-friendliness and usefulness of accessibility instruments. First, we surveyed a number of instrument developers, providing an overview on the characteristics of accessibility instruments available and on developers' perceptions of their user-friendliness in planning practice. Second, we brought together developers and planning practitioners in a number of local workshops across Europe and Australia, where participants were asked to use insights provided by accessibility instruments for the development of planning strategies.

We found that most practitioners are convinced of the usefulness of accessibility instruments in planning practice, as they generate new and relevant insights for planners. Findings suggest that not only user-friendliness problems, but mainly organizational barriers and lack of institutionalization of accessibility instruments, are the main causes of the implementation gap. Thus user-friendliness improvement may provide limited contributions to the successful implementation of accessibility concepts in planning practice. In fact, there seems to be more to gain from active and continued engagement of instrument developers with planning practitioners and from the institutionalization of accessibility planning.

Keywords: Planning Support Systems, Implementation Gap, Accessibility Instruments

## 1 The Implementation Gap of Accessibility-based PSS

The integration of land use and transport planning is a key topic in urban and regional planning, and the concept of accessibility is believed to provide a central framework for this (Bertolini et al. 2005; Straatemeier and Bertolini, 2008). There is a myriad of concepts and tools to address this issue in academic research (reviews in e.g. Handy and Niemeier 1997, Bhat et al. 2000, Geurs and van Wee 2004; Geurs et al. 2015), a result of the last decades of theoretical and methodological developments

around the definition, measurement and workings of accessibility. However, the use of these concepts and tools in professional planning practice did not follow the same pace, and there is today a significant gap between the advances in scientific knowledge on accessibility and its effective application in professional planning practice (te Brömmelstroet 2010a).

The literature on Planning Support Systems (PSS) identifies the dichotomy between supply and demand of planning support instruments as the main reason for this phenomenon of underutilisation (Vonk et al. 2005; Te Brömmelstroet 2010a). On the one hand, planning practitioners (the potential users) are generally unaware of the instruments or, if familiar, are quite inexperienced in using them. The value and potential of the instruments is not recognised, resulting in low use. On the other hand, developers of planning support instruments have little awareness of the demand requirements. The effective use of PSS is currently suffering from a ‘rigour-relevance dilemma’ (Andriessen 2004, Fincham and Clark 2009, Straatemeier et al. 2010), with developers mainly concerned with scientific rigour and users mainly concerned with practical relevance, leading to diverging paths, where each group fails to see and appreciate the perspective of the other. As a result, developers produce planning tools based on abstract ideas far removed from actual practice – rather than a clear, shared understanding of the needs and demands of specific planning contexts. Planners, on the other hand, often hold unrealistic expectations of what the tool can offer, where the inevitable disappointment with the provided support leads to antagonistic attitudes towards new knowledge technologies (Meadows and Robinsons 2002; Te Brömmelstroet 2010b; Vonk et al. 2007) . Bringing these two worlds together could help bridge the implementation gap and address some of the most pressing urban mobility dilemmas.

This paper looks directly at this dichotomy from both the viewpoint of the developers of accessibility-based PSS and the viewpoint of the planning practitioners, by confronting their perspectives on *user-friendliness* and *usefulness*. *User-friendliness* refers to the (perceived) ease of use of a functionality for the intended end-user. We define user-friendliness here as “the degree to which a person believes that using a particular system would be free from effort” following Kiel et al. (1995, p. 76). An example of user-friendliness is how easy it is for you to operate your coffee machine at home. *Usefulness* of PSS is related to problems/issues addressed in the real planning practice and refers to a different question: does a PSS have an added value for the quality of the tasks that the planning practitioners have (as discussed in Pelzer, 2015). Likewise, Nielsen (1994, p. 24) defines usefulness as the ‘issue of whether the system can be used to achieve some desired goals’. In the example usefulness does not relate to operating a coffee machine, but to the quality of the coffee it produces. This dichotomy implies that a PSS can be very usable, without being useful and vice versa, pointing to the need of considering them both. Indeed, a really simple and user-friendly instrument addressing planning/policy issues outside the scope of practitioners will not be useful. Also, many relatively complex models (e.g. discrete

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choice models) are used in the transport planning practice in many countries, which probably are in many cases not user-friendly but are directly related to current policy issues/goals (Pelzer, 2015; Pelzer et al. 2016).

This paper aims to improve the understanding and contribute to bridging the implementation gap of accessibility-based PSS in European Planning Practice, by innovatively integrating assessments of *both* their user-friendliness *and* usefulness. Accessibility Instruments (AI) are defined here as tools “that aim to provide explicit knowledge on accessibility to actors in the planning domain, a tool of measure, interpretation and modelling of accessibility, developed to support planning practice (analysis, design support, evaluation, monitoring etc.)” (Papa and Angiello, 2012, 255)<sup>1</sup>. The paper elaborates on the main findings of COST Action TU1002, a research that brought together a large network of more than 100 researchers (among which AI developers) and 80 practitioners, from 22 countries, to discuss the user-friendliness and usefulness of 24 AIs which were offered by their developers as test subjects for this large scale research (see for the full background [www.accessibilityplanning.eu](http://www.accessibilityplanning.eu)). The paper’s contribution is markedly distinct from other contributions based on the COST Action (see for instance, Hull et al. 2012b; Te Brömmelstroet et al. 2014b; Papa et al. 2016), which either highlight, without connecting, specific aspects of the argument (as in Papa et al. 2016), or are geared at describing the results rather than reflecting on them (as in Hull et al. 2012b; Te Brömmelstroet et al. 2014b).

The next section describes the research approach and the data collection methods. Section 3 presents an overview of the AIs discussing their user-friendliness from the perspective of developers and the main concerns and priorities developers have when putting together these planning support tools. This debate is followed by an analysis of the perspective of planning practitioners focussed on the usefulness of AI (section 4). The last two sections confront these two perspectives of analysis synthesizing the main research findings (section 5), and the wider planning implications and research questions opened by this research (section 6).

## 2 Research Approach

### 2.1 Research Aims

Aiming to improve the understanding and contribute to bridging the implementation gap of AIs in planning practice, the research set out to look at the gap from both **the developers’ perspective** and

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<sup>1</sup> This definition, as all others from COST Action TU1002’s Glossary (<http://www.accessibilityplanning.eu/glossary/>), reflect the general position of the COST Action members, and are the result of a general debate and of detailed contribution from several of its members, later put together by Enrica Papa and Gennaro Angiello.

**the planning practitioners' perspective.** These perspectives were then confronted in search of a wider understanding of the gap and for recommendations for new AIs.

For the **developers' perspective** we looked at the perception of **user-friendliness** of AIs by their developers', and at concerns and priorities developers have when putting together these planning support tools. Perceptions and priorities were collected among the developers of AIs taking part in the research by resorting to the *Accessibility Instrument Survey* (AIS) which is discussed in detail below. A total of 24 AI developers' were surveyed.

For the **practitioners' perspective** we looked at the experience of **usefulness** of the same AIs by planning practitioners. Their perceptions were collected after they experienced a particular AI in a near-to real life planning exercise. A *Post-Workshop Survey* (PWS) was one of the main tools for collecting planning practitioners' perception of usefulness – also to be discussed in detail below. A total of 16 local workshops were developed during this research, of which 13 successfully collected planning practitioners' perception on usefulness from 80 practitioners with different backgrounds.

## 2.2 Sample

Table 1 presents the AIs considered for the results presented in this paper. The AIs selected for the proposed analysis are original instruments, in some cases used in planning practice by private consultancies or local authorities, and all open to improvement or even still in a development phase. The interest in possible improvement or adaption was a main concern in the research being fundamental in opening the debate between developers and planning practitioners around the implementation gap. Of the 24 AIs involved in the research only 20 were considered in the analysis of the results of the AIS<sup>2</sup>. Of these 13 were used in local workshops and collected evaluations on usefulness through the PWS.

Table 1 presents the 20 AIs considered in the analysis of the AIS and the name of the city of the local workshop, when applicable. Half of these had previously been used in planning practice while the other half had only been used for research and/or was still under development. Figure 1 summarizes the main data collection phases as well as the main outputs in each phase. In Hull et al. (2012b) a comprehensive and detailed description of each instrument is provided, including a discussion on the use of accessibility instruments in planning practice, and the presence of national guidelines on accessibility measure.

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<sup>2</sup> Of the four excluded, two didn't fill in the survey, another misunderstood the evaluation scales and another was at a too early stage of development at the time of the survey.

### 2.3 Research design

The research design combines elements of a classical multiple case study, whereby each accessibility instrument is used and analysed within one local planning setting, with an experiential case study logic (Straatemeier et al., 2010). In an experiential case study design, the researcher does not only observe, but also actively intervenes in planning practice. Fuelled by theoretical understandings on how practice can be improved, the researcher develops an intervention, applies it in a case, reflects on its effectiveness and (if needed) improves both the theoretical understanding and the intervention itself. In an ideal situation an intervention is tested in real-life practices, but because of the distinct focus on reflection by both researcher and participants some distance is necessary. Nevertheless we sought to replicate real-life planning as close as possible. The workshop protocol (defined below in section 2.4) had a four-step structure that mirrored the procedure during a typical planning exercise (for more details Te Brömmelstroet et al., 2014b; 2016).

### 2.4 Data Gathering

Data collection for the analysis of the developers' perspective on user-friendliness was based essentially on the *Accessibility Instrument Survey (AIS)*, focussed on collecting technical characteristics of AIs involved in the research and perceptions on user-friendliness of researcher who had developed the instruments. The survey was divided into 4 groups of questions. The first group aimed to identify a number of baseline issues for the development of the AI, namely, the existence of political requirements for accessibility planning, the geographical scale and the status of development of the instrument. The second group of questions aimed to identify the main planning goals considered in the development of the instrument. The third group of questions aimed to summarize the main operational characteristics of the AIs surveyed, including accessibility measure types, the components considered, the level of disaggregation, and the transport modes and spatial opportunities considered. The last group of questions collect information on potential users for the AIs, the performance and requirements of AIs on specific issues that influence user-friendliness, and developers' opinions on institutional barriers blocking the use of their AIs in practice.

Table 1 – AI analysed (Source: Adapted from te Brömmelstroet et al., forthcoming)<sup>3</sup>

AI – Acronym	Local Worksop City
AI1* Accessibility Tool for Road and Public Transport Travel Time Analysis - ATRaPT (Larsson and Elldér, 2013)	Västra Götaland (SW) (Larsson et al., 2014)
AI2* Space Syntax: Spatial Integration Accessibility and Angular Segment Analysis by Metric Distance - ASAMeD (Charalambous and Mavridou, 2012)	Limassol (CY) (Charalambous et al., 2014)
AI3 From Accessibility to the Land Development Potential - ATI (Kovač et al., 2012)	Ljubljana (SI) (Kovač M, 2014)

<sup>3</sup> The references presented in this table refer to short reports presenting the AI or the local workshop in which the AI was used, available in, Hull et al. (2012b) and Te Brömmelstroet et al. (2014b).

AI4	Erreichbarkeitsatlas der Europäischen Metropolregion München - EMM (Keller and Wulfhorst, 2012)	Munich (DE) (Büttner et al., 2014)
AI5	Geographic / Demographic Accessibility of Transport Infrastructure - GDATI (Zakowska et al., 2012)	Kracow (PL) (Zakowska et al., 2014)
AI6*	Gravity Based Accessibility Measures for Integrated Transport-Land Use Planning - GraBAM (Papa and Coppola, 2012)	Rome (IT) (Coppola et al., 2014)
AI7	Heuristic three-level Instrument combining urban Morphology, Mobility, Service Environments and Location Information - HIMMELI (Iltanen, 2012)	Helsinki (FI) (Iltanen et al., 2014)
AI8*	Isochrone Maps to Facilities - IMaFa (Arce-Ruiz et al. 2012)	Madrid (ES) (Calderón et al., 2014)
AI9	Interactive Visualization Tool - INViTo (Pensa, 2012)	Turin (IT) (Masala et al., 2014)
AI10*	Joint-Accessibility Design - JAD (Straatemeier, 2012)	Breda (NL) Bos and Straatemeier, 2014)
AI11	Structural Accessibility Layer - SAL (Silva, 2012)	Lisbon (PT) (Patatas et al., 2014)
AI12*	Spatial Network Analysis for Multimodal Urban Transport Systems - SNAMUTS (Curtis et al., 2012)	Sidney (AU) (Curtis et al., 2014)
AI13*	Measures of Street Connectivity: Spatialist Lines - MoSC (Trova, 2012)	Volos (GR) (Trova et al., 2014)
AI14*	Method for Arriving at Maximum Recommendable Size of Shopping Centres - MaReSi SC (Tennøy, 2012)	-
AI15*	Place Syntax Tool - PST (Stähle, 2012)	-
AI16*	German Guidelines for Integrated Network Design-Binding Accessibility Standards - RIN (Gerlach, 2012)	-
AI17	Spatial Network Analysis of Public Transport Accessibility - SNAPTA (Hull and Karou, 2012)	-
AI18	Social Spatial Changes because of New Transport Infrastructure - SoSINeTi (Hoemke, 2012)	-
AI19	Retail Cluster Accessibility - TRACE (Verhetsel et al, 2012)	-
AI20	Celular Automata Modelling for Accessibility Appraisal in Spatial Plans - UrbCA (Pinto and Santos, 2012)	-

\* AIs that had been used in planning practice prior to the AIS

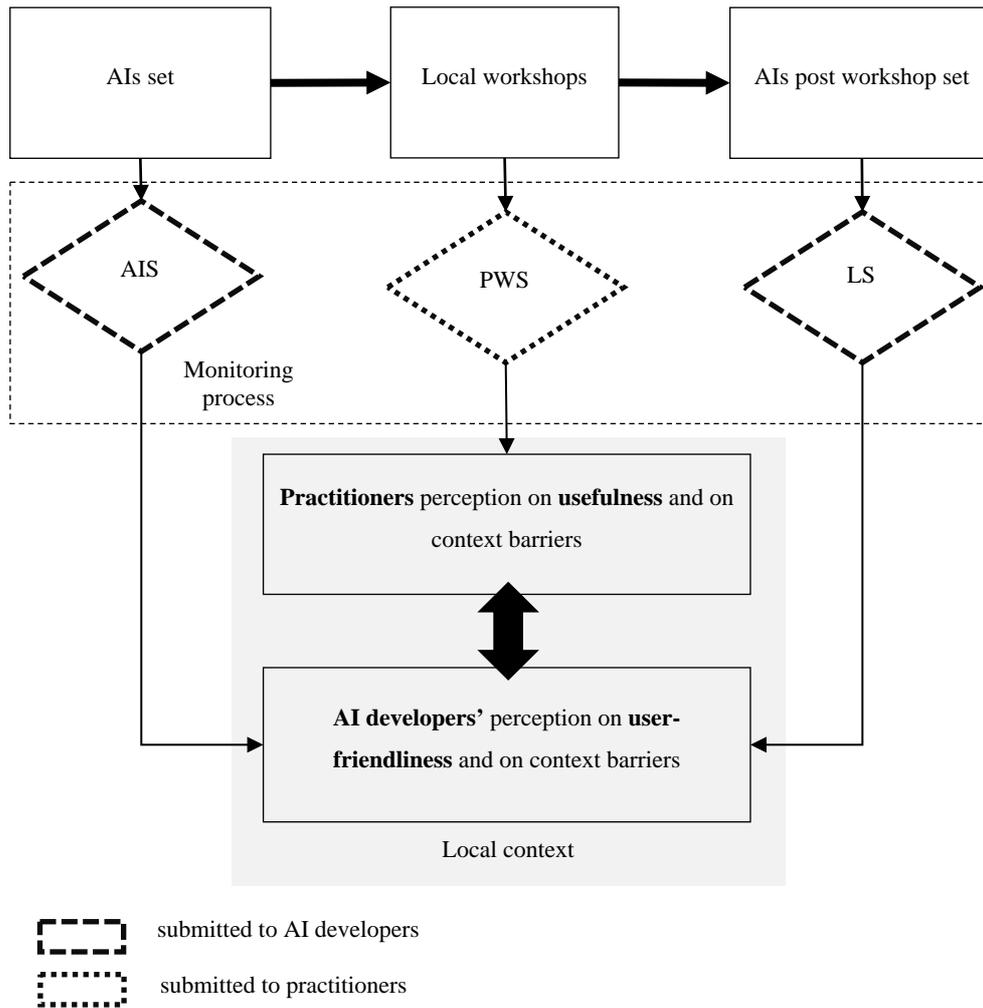


Figure 1 – Data collection phases and outputs

The research on the experience of usefulness by planning practitioners encompassed the development of a series of *local workshops* across European and Australian cities. The rationale behind the workshops was based on the development of an ‘experiential learning cycle’ (Kolb and Fry, 1975; Straatemeier et al, 2010), arguing that assessing usefulness requires hands-on experience. Thus, each workshop involved local practitioners in near-to real life experiments in which practitioners were asked to formulate planning problems and resort to information provided by AI to explore planning solutions and even have an active role in adapting the AIs to the planning goal. This exercise was performed prior to the assessment of perceptions of usefulness. To cope with the number of workshops, performed in different countries and cities, by different researchers, a *workshop protocol* was developed. This protocol defined guidelines for the use of AIs by practitioners and for the evaluation procedures. A four-step workshop template was applied, inspired by Straatemeier and Bertolini (2008). The 1<sup>st</sup> step involved formulation of economic, social and spatial planning goals and

the definition of accessibility criteria by the local practitioners mediated by the local unit of the research team. In the 2<sup>nd</sup> step of the workshops, local practitioners were asked to collectively map, measure, interpret and analyse current accessibility conditions, resorting to information provided by the AI under evaluation in that workshop. The 3<sup>rd</sup> step involved the development of intervention strategies by local practitioners based on the information and analysis developed in the 2<sup>nd</sup> step and responding to the priorities and concerns defined in the 1<sup>st</sup> step. In the last step, the research team provided mappings of the expected effects on accessibility of the strategies defined in the 3<sup>rd</sup> step fuelling the debate among practitioners about potential impact of planning strategies defined and thus leading to learning effects. Formal data collection was also structured by the workshop protocol, which defined 4 collection instruments (see Figure 2).

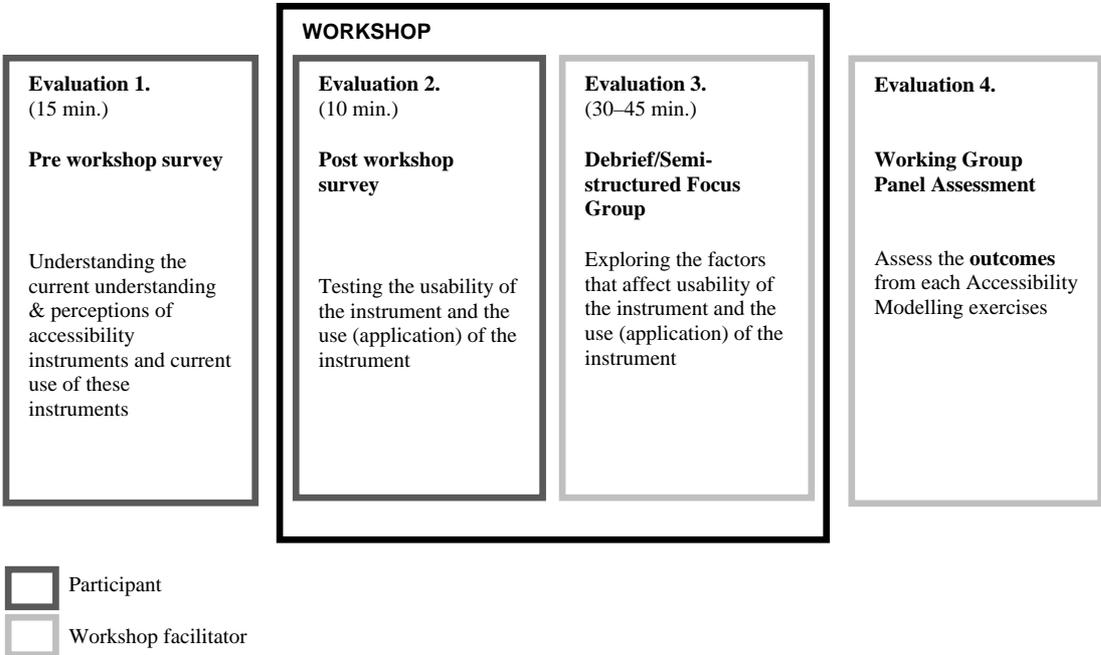


Figure 2 – Data collection instruments for local workshops (Source: te Brömmelstroet et al., 2014a)

The main feedback collection instrument was the *Post Workshop Survey (PWS)* asking for an extensive review of the usefulness of the AIs used in the workshop together with questions on the usefulness and added value of the workshops itself and on barriers blocking the implementation of AI. In more detail, the survey explored, among other things, the added value of AIs with regard to enthusiasm, insight, development of a shared professional language, communication, efficiency, cohesion, prospects for planning practice (analysis and strategy development). With regard to barriers the survey concentrated on technical and resource barriers and on political barriers. In addition to the PWS another survey was conducted prior to the workshops aiming to understand the prior understanding and use of accessibility concept in the local planning practice.

Finally, the research also included a *Learning Survey* (LS) evaluating the learning process of AI developers' during this research. Amongst other things this survey aimed to reveal the potential changes in understanding and attitudes of AI developers and in the characteristics of the AIs following the local workshop experience. In addition, the survey aimed to re-evaluate implementation barriers after the testing of their AI with local planning practitioners. A total of 18 AIs participated in the LS after having participated in the AIS and in a local workshop.

For more detail on the research approach in particular on the AIS, on the workshop protocol and its data collection and on the LS see, Hull, et al. (2012b), te Brömmelstroet et al. (2014b) and Silva et al. (forthcoming).

### **3 The perceptions of AIs developers**

#### *3.1 Concerns and Priorities of AI developers*

The analysis of the 20 AIs revealed a very interesting heterogeneity with regard to 4 main issues: geographical scale, planning goals, transport modes, trip purpose.

Altogether, this collection of AIs provides support for all geographical scales (from the street to the supranational level) and for very distinct planning goals (from Land Use and/or Transport oriented to Equity, Social Cohesion and Economic Development). It is possible to find support for accessibility measurement of all the main different transport modes, even including comparative measures and aggregate measures, and for the most relevant trip purposes (work, school, leisure, shopping and healthcare). For a more detailed analysis see, for instance, Hull et al. (2012a), Papa et al. (2016), Bertolini et al. (forthcoming).

However, regardless of the good coverage of all these issues by the sample it is also evident that specific characteristics are more frequently available than others. For instance, although it is possible to find AIs for virtually any geographical scale, there is a clear prevalence of the municipal and supra-municipal scale. This suggests that, AI developers are mainly concerned with accessibility (or the lack thereof), or feel accessibility measurement is mostly relevant at this particular geographical scale. Similarly, regarding planning goals, orientation towards Land Use and /or Transport planning is clearly dominant. This is no surprise since it directly relates to the conceptual underpinnings of the concept of accessibility. However, although research suggest accessibility as an integrating concept of these fields (see, for instance, Bertolini et al., 2005; Halden et al., 2000; and Straatemeier, 2006), this potential is not particularly visible here with developers generally concerned with one or the other of these fields.

With regard to transport mode, although coverage is not as imbalanced as in previous issues we can still find a higher amount of instruments measuring accessibility by car and/or public transport. Interesting enough, several instruments allow accessibility assessment for different transport modes among which are instruments specifically designed for the comparison of accessibility levels (ex. SAL). However, measures considering multimodality and interchange are largely absent from current AIs. Considering the importance of both non-motorized modes and of multimodal transport in the context of more sustainable travel behaviour, these seem important issues to be addressed by future research. With regard to trip purpose, no evident preferences are found. Nevertheless, it is worthwhile pointing out that many instruments still look at activities aggregately (making no distinction between them) or, alternatively, are designed for only one specific purpose. Thus, these issues seem to be still undervalued by AI developers’.

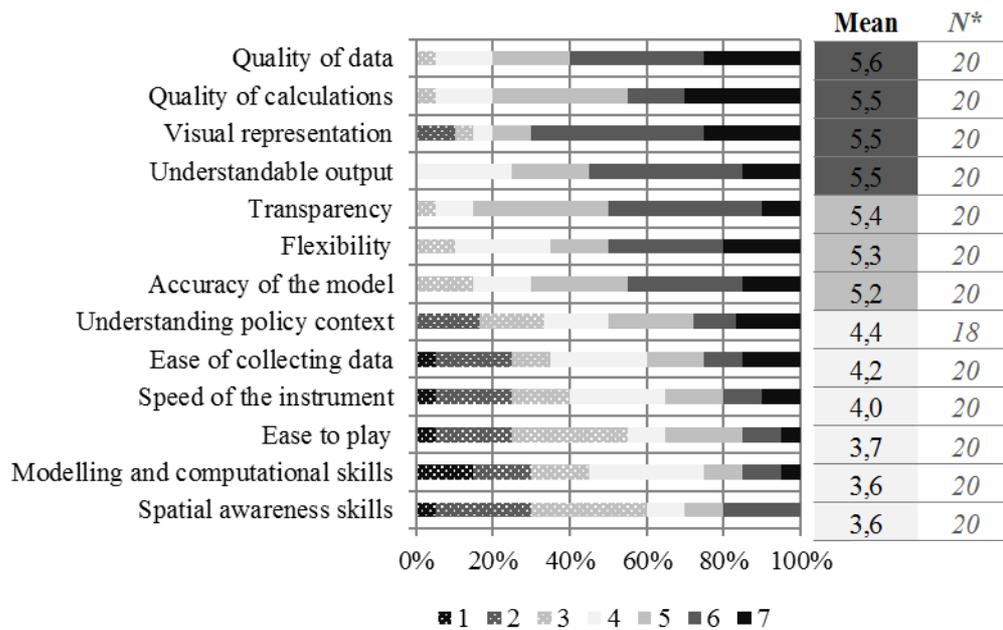
### *3.2 AIs User-friendliness<sup>4</sup>*

The AIS evaluated user-friendliness, among other things, based on developers’ perception of performance and requirements of their instruments on specific issues believed to have a direct influence on user-friendliness, as found in the literature (Vonk et al. 2005; Te Brömmelstroet 2010a). The 13 issues under evaluation by the survey included aspects, such as, quality of calculations, accuracy, transparency, speed, ease of use, flexibility and knowledge, skills and resources required, amongst others. Developers’ perception on the performance and requirements of their AIs was evaluated on a scale from 1 (worse performance or being most demanding to implement) to 7 (best performance or being less demanding to implement). Results are summarized in Figure 3, with issues ordered by decreasing perception of user-friendliness.

Developers of PSS are generally believed to be very enthusiastic about the user-friendliness of their tools. Indeed, nothing less is expected of the developer of a tool specifically built to support planning practice. This survey revealed that this sample of accessibility instruments developers is in fact less enthusiastic about the (perceived) ease of use of their own instruments as could be expected. Some are more enthusiastic than others, but in general there are very few self-reported top scores (all issues present less than 30% of developers scoring them as top performing, at the same time that the highest average score is 5.5 in 7).

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<sup>4</sup> The results discussed in this section have been previously presented in Hull et al. (2012a), Papa et al. (2015) and Bertolini et al. (forthcoming). This section summarises analysis published in the referred publications highlighting the main findings for the purpose of the general reflexion on the role of user-friendliness and usefulness on the implementation gap.



N\* - Number of responses considered

Figure 3 – Developers’ perception of AIs user-friendliness (performance and requirements)

If we look at the distribution of scores for each issue under evaluation we can see that quality of data, quality of calculations, understandable outputs, visual representation and transparency are among the issues which most developers (around 80%) rate as well performing, with a score of 5 or higher. Of these, quality of calculations shows the highest number of very highly confident developers (rating their instrument with score 7). Accuracy of the model and flexibility is also generally positively perceived by developers, with around 70% considering their tool as performing well, with a score of 5 or higher. On the other hand, speed, ease of collecting data and ‘ease to play with’ are among the worst performing issues with many developers having low perception of their instruments. With regard to requirements, the figure shows many developers find their instruments most demanding of modelling and computational skills, and of spatial awareness skills. Of these, modelling and computational skills stand out as the requirement found to be very demanding (score 1) by almost 20% of the instruments. No substantial differences were found between AIs which had been used in planning practice prior to this research and those which had not (Figure 4). Survey results suggest that developers of AIs used in planning practice prior to the survey are more confident than their counterparts in the accuracy of the model and in the lower requirements for understanding of the local context. On the other hand, developers of AIs that have not yet been used in planning practice are more confident on their flexibility than their counterparts. Regardless, these results are not enough to define distinct patterns between groups.

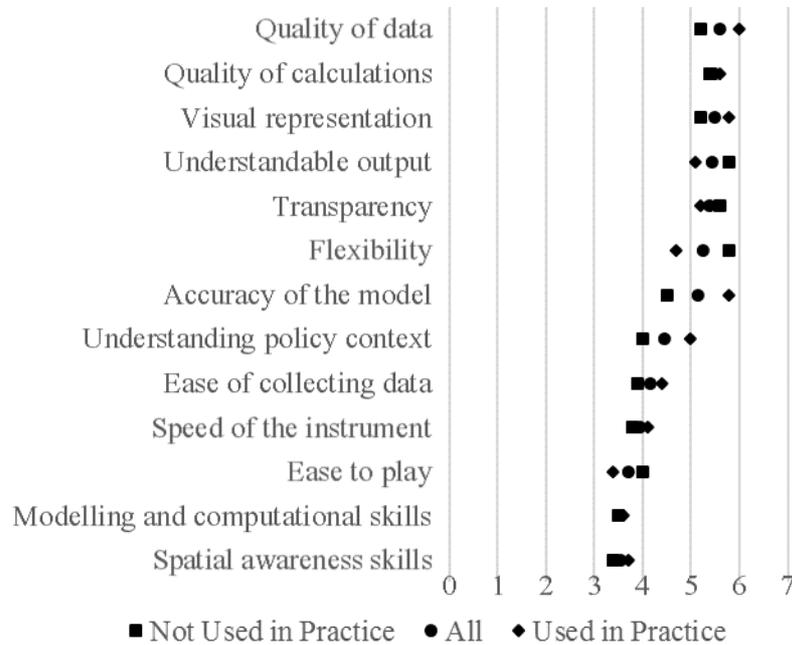


Figure 4 - Developers' perception (mean values) of AI user-friendliness (performance and requirements) for AIs not previously used in practice, previously used in practice and all AIs

#### 4 The experiences of Planning Practitioners<sup>5</sup>

A total of 80 people participated in our workshops (on average 6 people per workshop). Most of them were male (69%), young (31–45 years old, 46%) and middle-aged (46–60 years old, 44%). The professional background of the participants was quite diverse, including transport planners (43%), urban planners (26%), architects (8%), urban and transport planners (6%) and regional planners (4%) amongst others (lawyers, surveying engineers, housing developers; 14%).

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<sup>5</sup> The results discussed in this section have been previously presented in Milakis, 2014. This section summarises and adapts analysis on usefulness of AI published in the referred publication, highlighting the main findings for the purpose of the general reflexion on the role of user-friendliness and usefulness on the implementation gap.

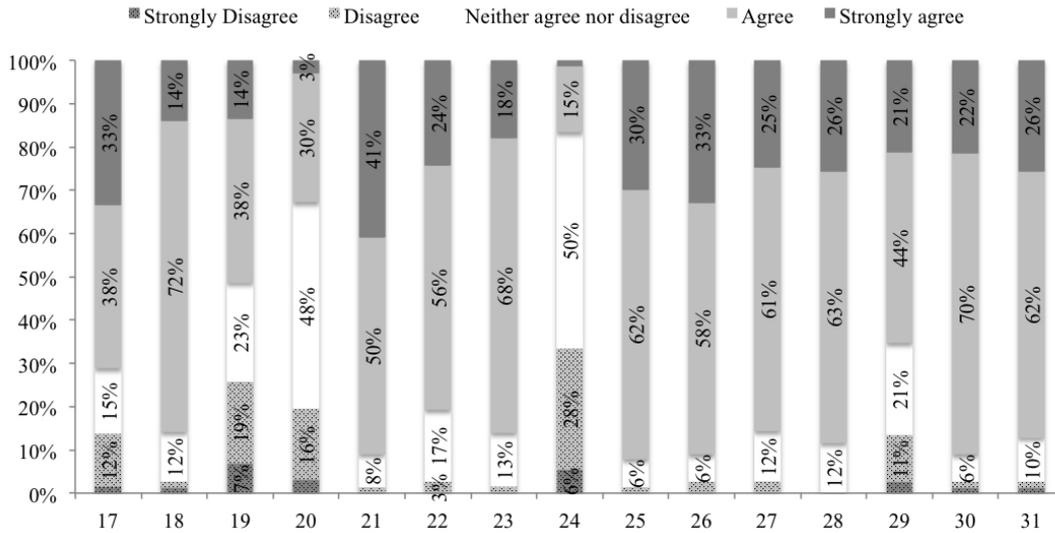


Figure 5 - Experienced usefulness of the instruments aggregated for all 13 participating cities (5-point Likert scale) (Source: Milakis, 2014)

Legend (Questions):	
17.	My organization has the required computational skills to use the instrument “x”
18.	The concepts/calculations/assumptions used in instrument ‘x’ could be useful in real world planning decisions
19.	Instrument ‘x’ would likely be selected for use in planning decisions as the organization is familiar with accessibility instrument
20.	The results from instrument ‘x’ are strongly related with the political commitment of my org.
21.	Accessibility instruments are relevant to my profession
22.	Instrument ‘x’ offers new insights to planning problems
23.	The organization serves the needs of multiple communities, and instrument ‘x’ outputs would be useful to inform the debate
24.	The precision of instrument ‘x’ would not increase its cost
25.	Instrument ‘x’ would be useful at generating and identifying problems in the urban structure
26.	Instrument ‘x’ would be useful at selecting strategy/options for the urban structure
27.	Instrument x’ would be useful during implementation of an urban structure solution
28.	Instrument ‘x’ would be useful for analysis of urban structure problems
29.	Access. Inst. outputs should be part of a learning process and not provide answers
30.	Access. Inst. outputs should be used to communicate urban structure concepts and ideas
31.	Access. Inst. outputs should be used to look for alternative scenarios to a planning solution

Analysis of the PWS results (Figure 5) revealed that workshop participants expressed very positive experiences regarding the usefulness of the instruments in real-life planning practice (q. 18: 86% agreed or strongly agreed). They also found the instruments relevant to their profession (q. 21: 91% agreed or strongly agreed). Eighty per cent of the participants responded that the instruments offered them new insights into planning problems (q. 22), although this percentage dropped significantly (to 48%) when the participants were asked about the insights that the instruments offered into the land use–transportation relationship (q. 35). The instruments were experienced as useful for generating and

identifying problems in the urban structure (q. 25: 92%), analysing problems (q. 28: 89%), selecting strategies (q. 26: 91%) and finally implementing solutions (q. 27: 86%).

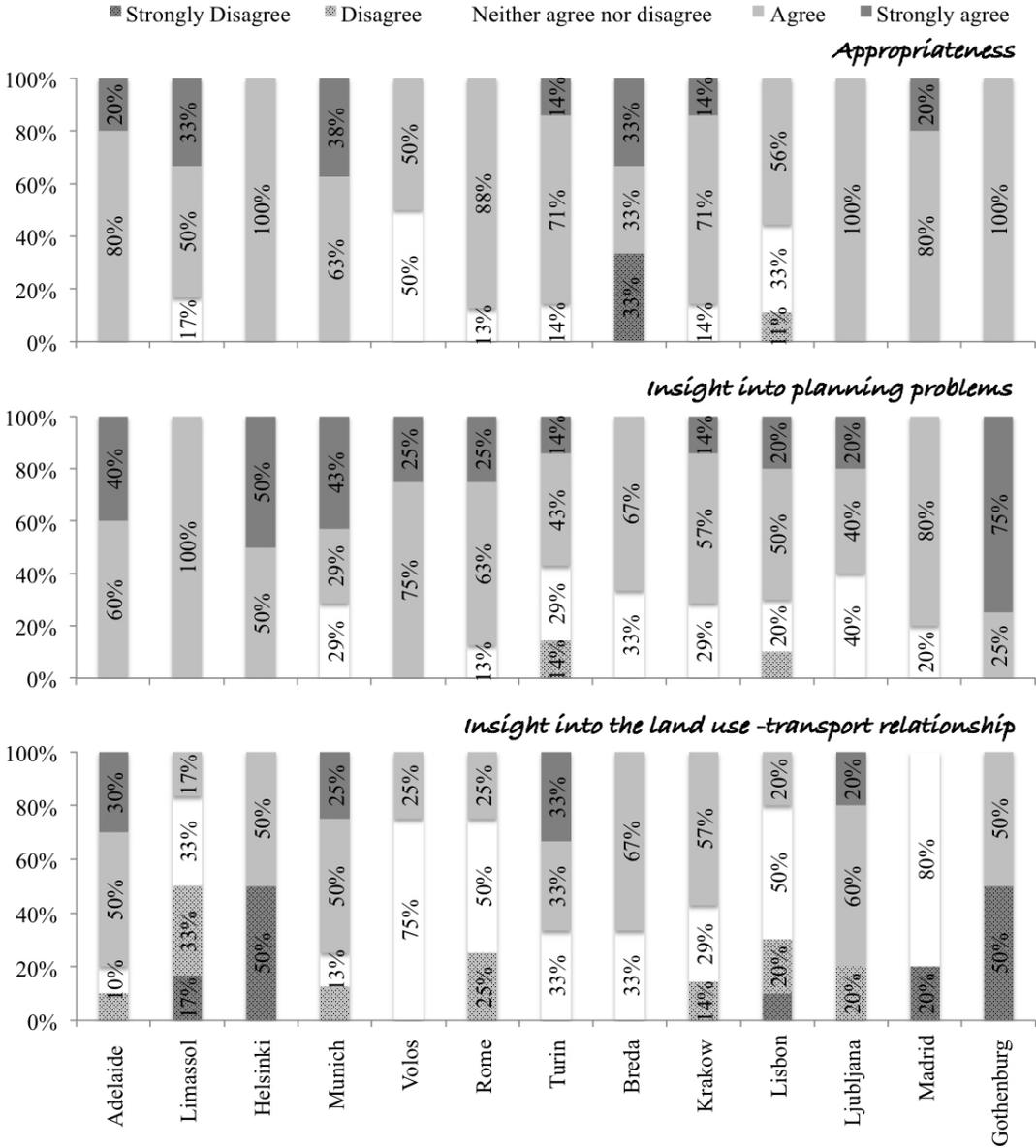


Figure 6 - Experienced usefulness of the instruments according to city (Source: Milakis, 2014)

Of the more aggregate analysis made around seven statements (Milakis, 2014) we present here three which were selected to further investigate the experienced usefulness per city (see Figure 6): appropriateness, insight into planning problems and insight into the land use and transport relationship. Participants in Adelaide, Limassol, Munich, Madrid and Helsinki were the most positive regarding the appropriateness of the instrument for the analysis of urban structure problems and support of planning decisions. Moreover, the instruments in the Adelaide, Helsinki, Munich and Gothenburg workshops were found to be insightful for planning problems, while in cities like Turin,

Lisbon, Ljubljana, Krakow and Breda the participants were less positive and more neutral about this factor. The instruments in all cities seem to be less successful in giving insight into the land use–transportation relationship. Specifically, in Krakow, Lisbon and Ljubljana the previously neutral assessment about the general insight into problems, turned into a negative perception regarding the insights provided into the land use–transportation relationship. However, the most negative perception of this factor was recorded in Helsinki, Gothenburg, Madrid and Limassol (50%, 50%, 20% and 17% strongly disagreed respectively).

The final set of results presents the variations of the experienced usefulness according to the profession of the participants (Figure 7)<sup>6</sup>. Urban planners are less sure about the usefulness of the instruments in real-life planning problems and about the insights into planning problems. Moreover, urban planners are more negative than transport planners about the insights that AI gave them into the land use and transport relationship during the sessions (16% disagreed or strongly disagreed).

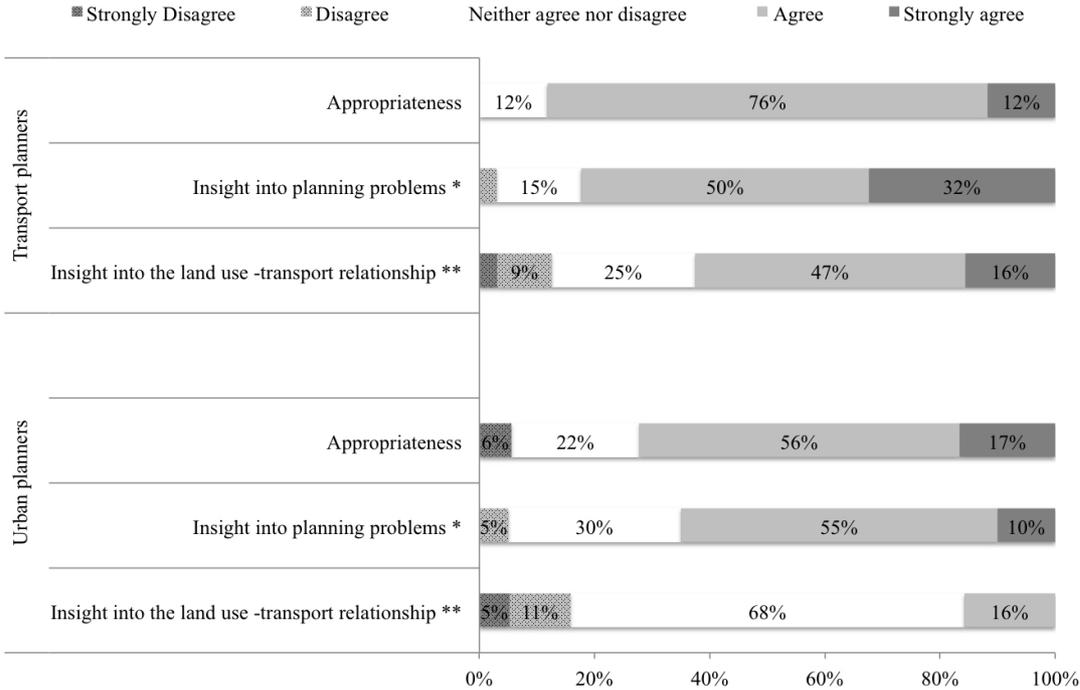


Figure 7 - Experienced usefulness of the instruments according to profession (Top: Transport planners, bottom: urban planners). Statistically significant differences are shown as \*p<0.05, \*\*p<0.1 (Mann-Whitney U test) (Source: Milakis, 2014)

<sup>6</sup> For detail on the analysis of other reference groups, such as, comparisons between public sector and private sector employees, between gender and between age of participants, see Milakis (2014).

## 5 Confronting Developers' and Planning Practitioners' perspectives<sup>7</sup>

From the general literature on user-friendliness of PSS (e.g. Meadows and Robinson, Te Brömmelstroet 2010a, Vonk 2006, Pelzer 2015) it could be expected that developers of AIs perceive their own instruments as highly usable (while assuming their usefulness) while potential users experience low usefulness of existing AIs (while not particularly interested in user-friendliness). It could thus be hypothesised that the low level of use of AIs in planning practice can be explained by the gap between highly perceived user-friendliness by instrument developers and low experienced usefulness by planning participants. This hypothesis was here explored through a comparison of user-friendliness perception of developers and usefulness perception of planning practitioners, for the 13 AI involved in both, the AIS and the local workshops. However, the expected discrepancy did not clearly come out in the sample. There seems to be considerable doubt about the actual user-friendliness of the instruments amongst the developers themselves (see Figure 3). On the other hand, we find that most planning participants are actually quite positive about the usefulness of the instruments for supporting them in their day-to-day work (see Figure 5). A more detailed comparison of developers' user-friendliness perception and planning practitioners' usefulness perception (see Te Brömmelstroet et al., forthcoming) has revealed that, if anything, there seems to be a diverging pattern: the instruments that are considered usable by their developers score lower on perceived usefulness while those that are considered less usable score higher. Prior use of a given AI in planning practice does not seem to play a significant role here as well. Figure 8 presents all 13 AIs evaluated for user-friendliness and usefulness ordered by a generalised ranking for both these analysis from best (rank 1) to worst (rank 13).

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<sup>7</sup> The results discussed in this section have been previously presented in Te Brömmelstroet (forthcoming). This section reproduces and adapts analysis published in the referred publication.

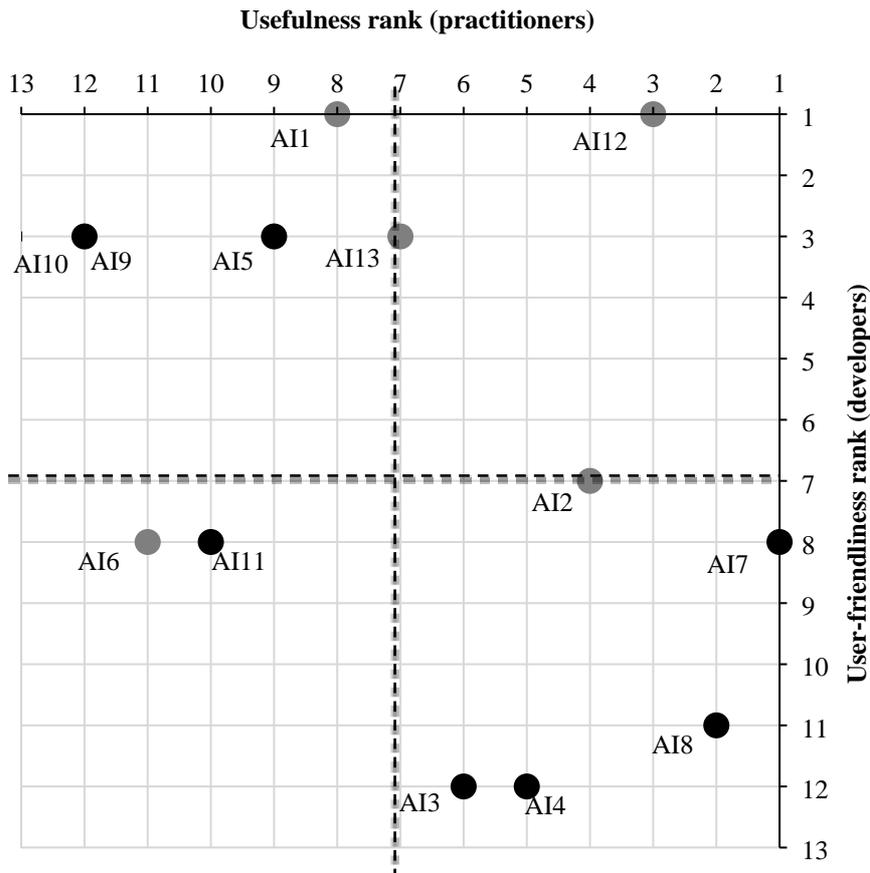


Figure 8 - Comparison of 'User-friendliness rank' with 'Usefulness rank' (Source: Te Brömmelstroet et al., forthcoming); light grey markers represent AIs which have been used in practice before the research

Observations and discussion during the Action seem to point to the fact that a well-considered workshop protocol might form a crucial explanation for this apparent contradiction. When practitioners experience high potential usefulness, they might be more willing to accept that an AI has low direct user-friendliness; i.e. if the coffee is so good, you do not mind somebody else (a barista) working the machine for you. AI developers that are aware of such user-friendliness limitations might put in more effort to chauffeur to AI and structure the meeting. In this way, they do not have to bother with the specific skills that are needed for hands-on operation and instead can focus on the important content. This is mirrored in recent debates around Planning Support Systems that start to emphasize the importance (and general neglect) of the process of facilitating the exchange of knowledge between planning practitioners and the instruments (Pelzer and Te Brömmelstroet, 2014).

An alternative hypothesis is raised by additional information from the AIS and the PWS. In fact, both, AI developers and planning practitioners recognise a variety of institutional barriers as reasons for low use. For example, Figure 9 shows that developers consider separation of urban and transport institutions (20%) and political commitment of organizations (13%) among the most important barriers. On the other hand Figure 10 shows that practitioners perceive conflicts in policies and lack of

incentives for cooperation between agencies on accessibility issues as two of the most important issues that can explain low use of accessibility instruments in planning practice (45% and 40% agree or strongly agree respectively). The culture of the organization is considered as an additional barrier (23% agree or strongly agree). Interestingly, the organised workshops and the experiences that the participants had might be a part of the solution. In the post-workshop survey more than 70% of the participants stated that they would use insight created by the session in their daily practice. In addition, more than 50% stated it was likely that they would select the AI used in the workshop for other planning decisions.

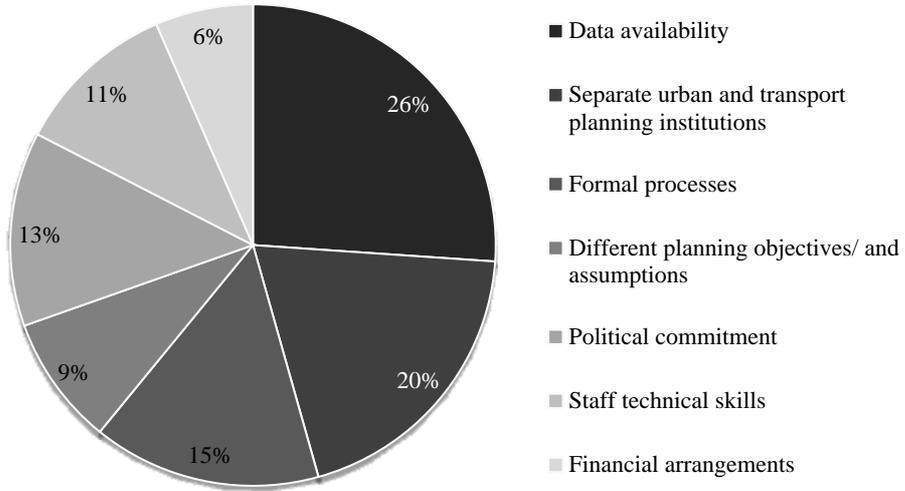


Figure 9 - Developers' perception of barriers blocking the use of AIs (N=21) (Source: Papa et al, 2016).

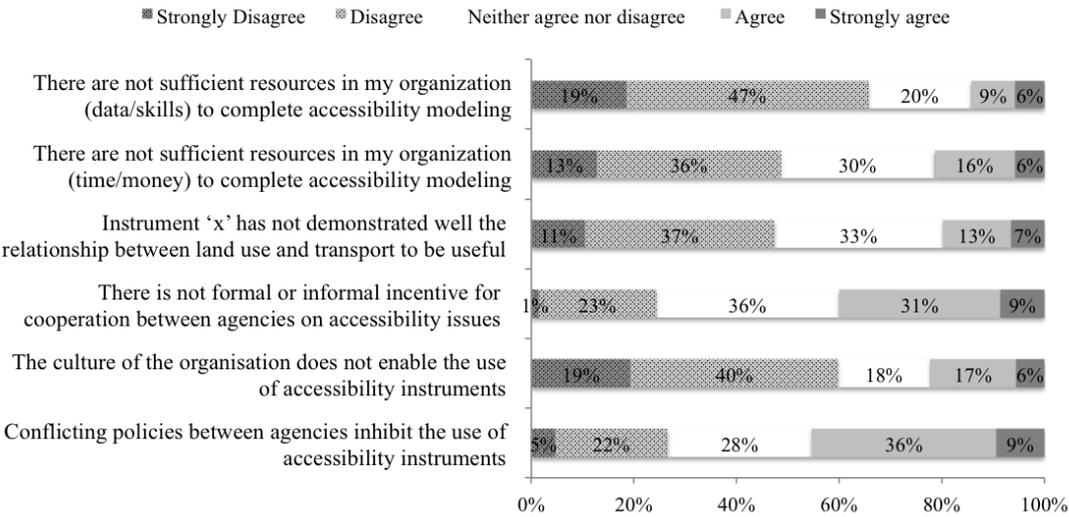


Figure 10 – Planning Practitioners’ perception of barriers blocking the use of AIs (N=80) (Source: Milakis, 2014).

It is important to point out that after the local workshops AI developers were convinced that the lack of institutional requirements for accessibility analysis were among the most important implementation barriers (Papa and Coppola, forthcoming), as revealed by the LS (Learning Survey). Technical barriers, on the other hand, do not seem to be as important as organizational and political barriers. When comparing the results of the LS and the AIS it is worth mentioning that ‘data availability’, rated as most problematic in the AIS, was rated in 13th place (out of 22 issues analysed) after the local workshops through the LS. This suggests that AI developers seem to be more concerned with institutional and governance barriers than with data requirements (and thus user-friendliness) after engaging with practitioners.

The LS also revealed that 9 out of 18 AI developers’ changed their AI during the research, following their experience in the local workshops. According to the analysis developed by Papa and Coppola (forthcoming), changes were more frequent among more complex AI (such as time-space and utility-based measures). In fact, none of the contour based AIs made changes. The survey revealed that these changes mainly aimed to improve flexibility and communicability of the AI and not precision and accuracy as could be expected from the debate among developers/researchers. Of the issues analysed in the AIS, visual representation, transparency, ease to play with, ease of collecting data and flexibility were amongst the most frequently changed by AI developers after the local workshops.

The range of the instruments affected to some extent these outputs. Indeed the involvement of instruments still under development or open to improvements increased the probability of changes to AIs during the research to increase their flexibility and usage.

## **6 Main Findings**

This research looked in detail at the dichotomy between supply and demand of accessibility instruments (AIs). To do so, we looked both at the developers’ perception of *user-friendliness* of AIs for planning practice and at the practitioners’ experience of *usefulness* of AIs for planning practice. Contrarily to what could have been expected, developers were not found to be as positive about the user-friendliness of their AIs, while planning practitioners actually revealed quite positive evaluations on the usefulness of AIs in planning practice. While being aware of the limited generalizability from this very specific sample, these findings support exploring rival explanations for the AI implementation gap. One such explanation as suggested by both developers and practitioners are the persistence of organizational barriers. According to practitioners participating in the workshops, major barriers are the still marginal and at best ambivalent position of accessibility in the policy agenda (by and large, the focus is still on facilitating mobility) and the lack of institutionalization of AIs

(accessibility analysis is not a formal requirement, nor are there accepted procedures to perform it). These two matters seem at the heart of the implementation gap, and it is difficult to see how the gap can be bridged without them being addressed.

The research showed that AIs can generate new and relevant insights for urban and transport planners. However, this promise is only truly valuable if the insights derived from the workshops are followed by consequent decisions and actions. AIs becoming an integrated part of common practice requires change on both the demand and supply side. AI developers should *keep engaging* with planners and the organizations they work in and practitioners need to engage more in the AI developing or improving phase. We have seen that the way in which the workshops in this study were organised holds the potential to support such interaction. However, just a couple of workshops will not do, at least for the time being. Planners and organizations need to continue being *willing and able* to keep engaged, for which institutionalization of accessibility planning would be an important contribution.

The research also pointed at a number of necessary improvements in the AIs as such. When relevant, new AIs should provide some of the now lacking information (e.g. with respect to non-motorized modes, multi- and inter-modality, or specific destinations). More knowledge is also needed on individual perceptions of accessibility and accessibility thresholds, and on accessibility options other than those shown by actual behaviour. Next to improving the contents, providing real-time interaction capabilities (by speeding up calculations and allowing participants to sketch and analyse) and strengthening the communicative value (by better visualization and spatialisation) seem also key areas of enhancement. Furthermore, new AIs should be more explicit about the policy goals they imply, and be open to adapt the characteristics of the instrument to match different views about these goals.

It is important to point out that, in addition to the findings produced by this research, the Action of which this research was part already had a tangible contribution in closing the implementation gap through the development of a number of local workshops. On the one hand, these workshops have brought researchers out of their office and out in contact with practice. Much due to the workshop protocol which provided researchers with a setting for learning and experiencing/experimenting with practitioners revealing new forms of engagement which were, until then, unknown by many of the researchers involved. On the other hand, the workshops also were a unique opportunity to bring awareness on accessibility planning and instruments to practitioners, across several European and Australian Cities.

## 7 Discussion: Wider Research Questions Opened <sup>8</sup>

Confirming the logic that research makes us confused, but on a higher level, this research has also opened new questions. Some of these directly define the follow-up steps, others identify new debates on what are and should be the main research questions. One key question for follow-up is related to the rigour relevance dilemma mentioned in the introduction. This research has been based on the assumption that the attention of PSS developers has to be shifted from how to improve scientific rigour to how to improve practical relevance. The work reported here did not provide reasons to question this assumption, on the contrary. For instance, the recommendation for more real-time calculations and more visualization and spatialization of results seem to require *less* rigour while striving for increasing simplification. This, however, contradicts current trends for increased detail and complexity of PSS following technological improvements with regard to computational power and data gathering (see e.g. Geertman et al. 2013). Until now, PSS developers have been facing the question of how to improve the rigour of their tool while keeping it usable. Now we might need to redefine the challenge to how simple can we make the instruments without renouncing too much to the opposite requirement that the information produced should be as true as possible to the complexity of reality.

The research also raised some fundamental questions. An implicit assumption of accessibility planning is that accessibility has positive value, and that it should be increased. However, is that always the case? Or are there limits? How much accessibility is *enough*? Should we, could we identify ‘critical accessibility thresholds’ (not too little, not too much)? And if so, should they be the same across transport modes, spatial structures, urbanization levels, user groups, etc.? New questions have arisen around, for instance, local versus regional accessibility, the benefits of high accessibility with low mobility, amongst others. Some evidence of innovative research following these new premises are for instance Milakis et al. (2015a) and Milakis et al. (2015b).

Finally, how do accessibility planning and AIs relate to a possible more fundamental shift in planning issues? Most crucially: are we going to see a shift in focus from quantitative goals (e.g. fostering growth) to qualitative (e.g. fostering quality of life, or fostering identity)? Which planning support tools and procedures would be required by such different issues? What would be the role of AIs and planning, if any?

## 8 Acknowledgements

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<sup>8</sup> This section summarizes and adapts discussion published in Bertolini and Silva (forthcoming) highlighting the fundamental research questions opened.

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