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Chapter 5

Assessment method for prioritising transport measures and infrastructure development

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5.1 Introduction

The interplay between infrastructural development and transport policy measures requires comprehensive assessment methodologies to guide decision-making processes. Existing methodologies often fall short of encompassing the multifaceted nature of transport systems, the variety of stakeholder interests, and the broader social and environmental impacts. This chapter introduces the Assessment Method for Policy Options (AMPO), a framework designed to address this complexity by integrating cost-benefit analysis (CBA) and multi-criteria analysis (MCA) while promoting stakeholder engagement.

The background to this initiative stems from an identified gap within existing transport policy assessment frameworks. Traditional methods such as CBA, while methodologically sound, often overlook the socio-political dimensions inherent in infrastructure development and maintenance. Moreover, the dynamic nature of societal needs and environmental considerations calls for a more adaptive and inclusive approach to transport planning and assessment. In response to these challenges, the AMPO emerges as a comprehensive tool that aims not only to bridge the gap between quantitative and qualitative analysis but also to harmonise the myriad perspectives and objectives of stakeholders.

This chapter defines the structure and application of the AMPO and highlights its potential as a tool for transport policy and infrastructure planning. The sections in this chapter are methodically structured to provide insights into the AMPO. Section 5.2 describes the scope and other aspects of the AMPO and provides clarity on its application and relevance. Section 5.3 explains the ten steps of the AMPO and provides a detailed guide to its implementation. Section 5.4 presents a case study that demonstrates the practical application and effectiveness of the AMPO in a real-life scenario. Section 5.5 introduces the AMPO tool, a digital tool designed to facilitate the application of the AMPO framework. Finally, Section 5.6 provides a synthesis of the findings and provides recommendations for the future application of the AMPO to ensure its continuous development and relevance for transport policy and infrastructure development.

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5.2 Scope and other aspects

5.2.1 Scope

The AMPO has a broad coverage and is designed to address the complexities and versatility of transport systems by covering a comprehensive set of transport measures that span urban, regional, national, and international scales. This comprehensive coverage ensures that the applications of the AMPO are diverse and relevant to different types of infrastructure projects, including both passenger and freight transport. Because the AMPO can accommodate such a diverse range of transport measures, it addresses the challenges and opportunities that characterise transport policy and infrastructure planning, making it an indispensable tool in this field.

The methodological basis of the AMPO is characterised by its holistic approach to transport policy assessment. Instead of focusing on isolated aspects of transport systems, different actions and policy goals are considered, which is essential for understanding the interactions within transport systems and their related infrastructures. This holistic perspective is essential for conducting assessments that reflect the nature of transport systems, promoting informed decision-making and more effective planning.

Recognising the crucial role of stakeholders in the successful planning and implementation of transport policy measures, the AMPO emphasises inclusiveness in its design. It is accessible and relevant to a diverse group of users, including policymakers, practitioners, and regional stakeholders, and ensures that the assessment process is not only comprehensive but also collaborative. By integrating the insights, needs, and preferences of all stakeholders, the AMPO ensures a balanced and representative assessment of transport measures, contributing to sustainable results that are widely accepted and supported.

The scope of the AMPO attests to its comprehensive and adaptive nature. By covering a broad spectrum of transport measures, adopting a holistic approach to assessment, and prioritising stakeholder inclusiveness, the AMPO sets a new standard for transport planning and development. It provides a robust and multi-faceted framework that is equipped to navigate the complexity of transport systems and ensures a more comprehensive, informed, and collaborative approach to transport policy and infrastructure planning.

5.2.2 Relation with other methods

The AMPO plays an innovative role in advancing methodologies for transport policy and infrastructure planning. A comprehensive framework integrating CBAs, multi-criteria analyses (MCAs), and discussion tools, the AMPO has proven itself as a tool for evaluating transport policy measures. As a follow up on the AMPO, the Spatial Planning and Development Evaluation (SPADE) project is emerging as a next development, extending the application of AMPO principles at the European level, and to spatial development. The transition from AMPO to SPADE marks an important evolution in methodologies for transport and infrastructure assessment. SPADE not only builds on the foundation laid by the AMPO but also underpins both tools with an extensive literature analysis, reinforcing and validating its methodologies with a robust

scientific basis and ensuring that the tool is based on the latest research and best practices in the field [1,2]. But it also ensures that the tool reflects contemporary challenges and opportunities in transport planning and infrastructure development.

The AMPO's engagement with other methodologies is crucial and underlines its ability to synergise with a broad spectrum of evaluation frameworks and practices. This integration of methodologies facilitates a holistic approach to transport planning, allowing assessment of both quantitative economic impacts and qualitative stakeholder concerns. The versatility of the AMPO is further illustrated by its alignment with collaborative planning and stakeholder engagement models, which reflects a commitment to inclusive and participatory decision-making processes.

The AMPO's relationship with other (Dutch) methodologies [3–7], including those that emerged in the SPADE literature analysis, shows the potential for methodological innovation and synthesis and illustrates a comprehensive and evolving evaluative ecosystem. By integrating insights from a wide range of evaluation practices, the AMPO enhances its analytical capabilities and offers new perspectives on the environmental, social, and spatial implications of transport policy. This methodological enrichment is important for developing more sophisticated, dynamic, and responsive assessments of transport initiatives and for meeting the complex needs of contemporary transport policy and infrastructure planning.

5.2.3 Basic principles

The basic principles underlying the AMPO embody a comprehensive, inclusive, and forward-looking approach to transport policy and infrastructure planning. This section provides the basic principles that guide this methodology, focussing on assessment, stakeholder engagement, and flexibility in application.

Central to the AMPO is the principle of conducting thorough and methodologically sound evaluations of transport policies. This involves a balanced integration of cost-benefit analysis (CBA) and multi-criteria analysis (MCA), which ensures that both quantitative economic impacts and qualitative aspects, such as environmental sustainability and social equity, are comprehensively considered [8]. This approach ensures that assessments are not only methodologically robust but also reflect the multifaceted nature of transport systems and their impacts on society and the environment.

The AMPO prioritises the inclusion of a wide range of stakeholders in the planning and assessment process. This principle recognises the diverse interests and concerns of various parties involved in transport and infrastructure projects, from policymakers and practitioners to community members and environmentalists. By promoting an environment of collaborative planning and dialogue, these methodologies ensure that assessments are participatory, transparent, and responsive to stakeholder input. This inclusive approach is important for building consensus, facilitating equitable decision-making, and improving the social acceptability of transport initiatives.

Recognising the dynamic nature of transport systems and the societal needs and policy objectives, the AMPO is designed to be adaptable and responsive. This principle ensures that the methodology can be applied across a range of contexts, scales, and types of transport interventions, ensuring its relevance and effectiveness in addressing contemporary challenges. Moreover, the flexibility of the framework

supports the integration of emerging trends, technologies, and analytical tools, enabling continuous improvement and innovation in transport policy assessment.

AMPO integrates a process with a digital tool designed to facilitate collaboration between stakeholders with divergent backgrounds and interests, with an emphasis on fair participation and transparency. The process advocates collaborative planning, with stakeholders with different resources and objectives working together so that both resource-rich and resource-poor groups have an equal voice.

The core tool combines a digital workshop with an evaluation tool (see section 5.5). This combination allows for nuanced evaluation through multi-criteria and cost-benefit analyses. The digital workshop, moderated to ensure balanced participation, allows stakeholders to discuss and deliberate on policy measures using electronic support such as e-participation tools or the Delphi method. This setup ensures that every participant contributes to the discussion, bypassing the traditional dynamics of meetings where voices can dominate or silence. The innovative use of electronic means to support structured discussions and the ability to make quick, accurate assessments without extensive modelling represents a significant advance, especially for early planning and decision-making in both small- and large-scale projects. AMPO therefore not only improves stakeholder engagement, but also streamlines and speeds up the planning process and enables iterative use as more detailed information becomes available, thus anchoring decisions more firmly with stakeholders (Figure 5.1).

The AMPO's basic principles reflect a holistic and integrated approach to the assessment of transport policy and infrastructure planning. These principles – accurate assessment, stakeholder involvement, and flexibility in application – serve as the foundation for the AMPO, which is methodologically sound, inclusive, and

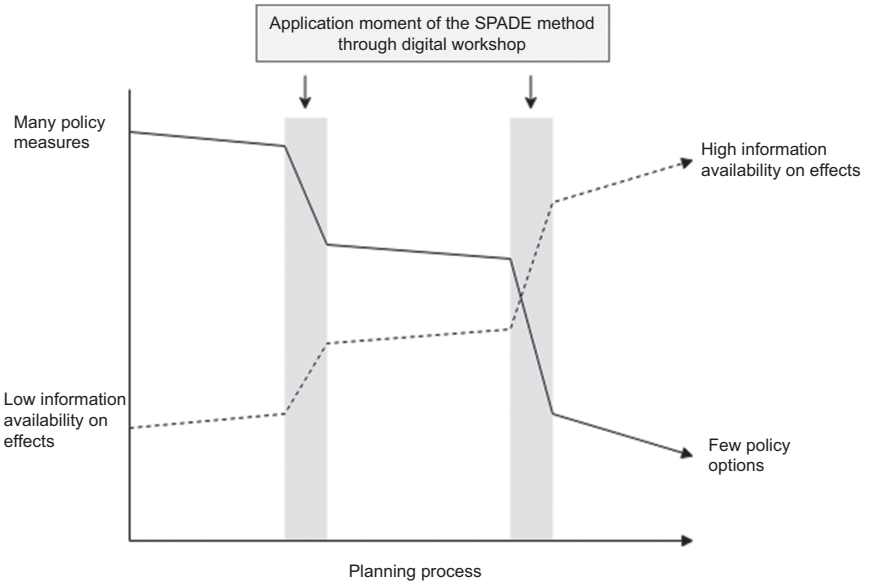

Figure 5.1 AMPO method in the entire planning process

adaptable to changing contexts and needs. By adhering to these principles, the AMPO contributes to the advancement of transport planning practices and ensures that it is equipped to navigate the complexities of modern transport systems and contribute to the sustainable development of societies.

5.3 The method in ten steps

5.3.1 Introduction

The AMPO is aimed at determining the impacts and the costs and benefits of (packages of) measures but is not intended to select these measures. Selecting measures is covered by other methods, such as the 'General Guidance for CBA' [9] or the ones mentioned in previous sections. A good CBA can obviously contribute to the realisation of a good package of measures.

To realise a good set of measures, the first step is to determine the traffic and transport problems and challenges in a region. Then, the bottlenecks and solution directions for these bottlenecks can be determined. The solutions can be tested and discussed with stakeholders and can be converted into specific measures. This set or sets of measures form the starting point for the AMPO. Stakeholders in a region often include various parties, such as local authorities, public transport companies, the regional business community and citizens. The AMPO aims at a proper assessment of the proposed measures. Involving all stakeholders in the selection and assessment process ensures that the final result will be supported.

A CBA uses a baseline scenario and project alternatives. The impact of a project is defined as the difference between the developments with the project (project alternatives) and without the project (baseline). The baseline scenario is not simply doing nothing, but the most likely development that would take place without new policies. It may consist of continuation of the existing policies but may also include other choices. In the AMPO, several measures combined in a package form a 'project alternative'. The method aims to weigh the resulting packages of measures against each other. The method also allows – in an interactive setting – to vary the composition of the package and choose the best package, based on the impacts and costs, but also based on underlying choices such as available budget, objectives and the importance that stakeholders attach to these objectives.

5.3.2 The ten steps

5.3.2.1 Step 1 – stakeholder engagement

The beginning of the AMPO depends on the critical first step of stakeholder engagement. This stage prioritises identifying and engaging a broad spectrum of stakeholders so that the assessment process is based on inclusiveness and diversity from the outset. It includes a process to identify all entities that could be affected by or have an interest in the transport policies, ranging from government agencies and the private sector to community groups and the general public. This inclusive approach not only enriches the assessment with a multitude of perspectives, but also lays the foundation for a transparent, trust-building process that recognises and addresses the concerns and expectations of all stakeholders.

Engaging stakeholders is an effort that goes beyond initial identification. Ongoing contact and dialogue are needed to maintain engagement and trust throughout the assessment and implementation phase. Challenges such as reconciling divergent interests and countering engagement fatigue are addressed with strategies such as facilitated discussions and regular updates to keep stakeholders engaged and informed. By ensuring that the different views and interests of stakeholders are integrated into the planning and decision-making process, this step lays a solid foundation for the next stages of the AMPO. This leads to the development of transport policies that are not only more sustainable and equitable, but also enjoy a higher degree of social acceptance and support.

5.3.2.2 Step 2 – determining the interaction between measures

The second step examines the extent to which policy measures influence each other. Practice shows that measures can reinforce or weaken each other. Measures that reinforce each other are preferable to those that weaken each other. Therefore, the interaction of measures should first be identified so that it can be taken into account in the next steps. For example, a measure that introduces a green wave on a route and another measure that expands capacity on the same route both have a positive effect on travel time. Travel time will decrease. Especially, if it is a busy route, the interaction between the two measures will be high.

In this step, all proposed measures are compared. It involves the full list of measures, without having already been combined into packages. The interaction between measures is determined by stakeholders by assigning scores for example from −3 to +3, where the score '=3' represents a strong negative correlation and '+3' a strong positive correlation. Table 5.1 shows an example. The scores are subjective, but if all stakeholders complete the form, a relatively clear, 'inter-subjective' picture should emerge. The result of this step is taken into account in step 6 and is reflected in the following steps.

5.3.2.3 Step 3 – assessment of costs and benefits

For each measure within a policy package, it is essential to determine both costs and benefits. This stage often requires considerable effort, as extensive information has to be collected or calculated. A standardised assessment requires monetising the benefits where possible, depending on the quantifiability of the effects of the measures. Quantification becomes feasible when impacts on primary indicators such as distance, time and transport costs can be identified, along with derived indicators such as speed, time loss or emissions. For monetisation, a time factor is usually used; in freight transport this can be applied in a similar way, or alternatively using fixed and variable costs (e.g. salaries and fuel), supplemented by additional transport costs such as tolls or parking fees. To monetise safety and environmental impacts, conversion factors for emissions and traffic-related deaths and injuries are used. If monetising environmental or safety variables is deemed inappropriate, they should instead be quantified, a process described in the next step.

Table 5.1 Example of interaction matrix

	Bundle goods	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**	**Sum**
Bundle goods		2	0	1	1	0	0	4
Eco-transport	3		1	–1	0	0	0	3
Green wave	0	1		0	0	0	0	1
Information	1	–1	0		0	0	0	0
Measure X	0	0	0	0		–1	0	–3
Measure Y	0	0	0	0	0		0	0
Measure Z	0	0	0	0	0	0		0
Sum	4	2	1	0	1	–3	0	5
Relative score	10	8	7	3	2	1	3	

Determining the costs associated with the measures is equally crucial and includes all expenditures, including future maintenance. A certain time horizon and discount rate must also be applied to ensure the accuracy of the assessment. The culmination of this step is a comprehensive overview of the costs and benefits of each measure, as illustrated in Table 5.2. Early on in the policy process this step can be skipped and replaced entirely by a multi-criteria analysis as detailed information that serves as input for a cost-benefit analysis probably is not available.

5.3.2.4 Step 4 – investigation of other quantifiable impacts

If monetisation of the impacts on aspects such as safety and environment is not desirable or possible, it can be chosen to quantify these effects. For safety, the number of accidents, deaths and injuries are quantified. For the environmental impacts all types of emissions and noise can be quantified. For safety and the environment, the partial effects of each measure are put together in absolute terms. Table 5.3 shows an example where Measure X reduces the number of accidents by 30, the number of casualties by 14 and the number of deaths by 3. For the measures it is clear what the absolute effects are and how they relate to each other. Based on the sum of the absolute effects the measures can be ranked on safety and environment. Apart from summing them also other operators can be used to determine a score for safety.

5.3.2.5 Step 5 – determine qualitative impacts

While assessing impacts on accessibility, safety and the environment often yields quantitative results, qualitative impacts require a separate analysis, complementing steps 3 and 4. Instead of monetary values or absolute numbers, these impacts are assessed using a scoring system, for example ranging from '−5' to '+5'. In this ranking, '0' stands for 'no effect', '+5' for a 'significant positive effect' and '−5' for a 'significant negative effect'. This stage is inherently more subjective and can lead to discussions about the magnitude or direction of an effect. Asking for the scores of different stakeholders helps build a collective, intersubjective consensus. Discrepancies in scores may prompt a review to understand divergent perceptions.

The scoring process involves stakeholders completing a questionnaire to evaluate impacts, ensuring that each perspective is captured. The scores collected from all stakeholders are then aggregated to calculate an average impact for each measure. This approach culminates in a comprehensive summary of the average estimated impact for each measure, which provides a balanced view of the qualitative impacts. An illustration of this process can be found in Table 5.4, where the aggregated results clearly reflect the perceived impact of each measure, facilitating informed comparison and discussion among stakeholders.

5.3.2.6 Step 6 – determine the priority order of impacts

From steps 3 to 5, the ranking of measures for individual impacts can be determined. For each measure, for each aspect (accessibility, environment, safety,

Table 5.2 Example of matrix with monetised impacts

	Bundle goods	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**
Costs	*1.000*	*500*	*200*	*200*	*300*	*250*	*0*
Benefits in travel costs (k€)	2.000	0	1.000	500	25	15	10
Benefits in emissions (k€)	15	20	25	2	3	2	1
Benefits in safety (k€)	0	1.300	900	0	300	0	0
Balance of costs and benefits	1.015	820	1.725	302	28	−233	11
Relative score accessibility	10	1	5	3	1	1	1
Relative score environment	6	8	10	1	2	1	1
Relative score safety	1	10	7	1	3	1	1
Relative score balance	7	6	10	3	2	1	2

Table 5.3 Example of matrix with quantified impacts

	Bundle goods	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**
Reduction emissions (tonnes)	234	345	445	25	30	15	10
Reduction accidents		−20	30		30		
Reduction casualties		−10	16		14		
Reduction deaths		−1	2		3		
Score on environment	234	345	445	25	30	15	10
Score on safety	0	−31	48	0	47	0	0
Relative score environment	6	8	10	1	1	1	1
Relative score safety	5	1	10	5	10	5	5

Table 5.4 Example of matrix with qualitative impacts

	Bundle goods	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**
Comfort	1		2		2	2	
Image		3	3	2	1	1	1
Barriers							
Landscape quality	−3				−2		
Score on perception	−2	3	5	2	1	3	1
Relative score perception	1	7	10	6	5	7	5

quality aspects and interaction) and impact (e.g. costs, number of accidents, emissions, comfort, reliability), it is possible to examine how the scores of the measures compare with other measures. Within the aspects, the scores are added together so that each aspect shows one score. The choice for rankings now is that they scale proportionally and so are continuous ranges of 1–10. But other choices for ranking are possible and the choice of proportional scale is something to test in a case study. Table 5.5 gives an example of the effects that can be monetised.

The measures all have some impact on the previously mentioned aspects of accessibility, safety, environment, quality aspects, and interaction. Some comments on these:

For accessibility, this involves an impact on the key variables distance, volume and capacity, travel time, travel cost and revenue. More than these variables are not needed to determine the impact on accessibility, as almost all other indicators can be derived from them. These impacts can be monetised.

Environmental impacts involve effects on emissions and noise. These too can be monetised, but this is not necessary. A quantification of the volume of emissions (such as NOx and CO_2) may be sufficient.

For safety, we look at the impact of measures on the number of accidents, deaths and injuries. In principle, these effects can be monetised, but not necessarily. There may be ethical reasons that prevent it. If that is the case, it is enough to quantify the number of accidents, injuries and deaths.

Qualitative aspects lead to effects that cannot be quantified, such as emotion, comfort, image or landscape quality. Sometimes the number of relevant aspects can be large.

The importance of interaction between measures (mutual reinforcement and weakening of measures) is also included in the assessment of the effects of measures. Mutual reinforcement earns extra points.

Table 5.5 Example of matrix comparing monetised impacts

	Bundle goods	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**
Costs per measure	1.000	500	200	200	300	250	0
Changes in travel costs (k€)	2.000	0	1.000	500	25	15	10
Changes in emissions (k€)	15	20	25	2	3	2	1
Changes in accidents (k€)		200	300		100		
Changes in casualties (k€)		1.000	2.000				
Changes in deaths (k€)		100	200		200		
Balance	1.015	820	3.325	302	28	−233	11
Relative score balance	7	6	10	3	2	1	2

5.3.2.7 Step 7 – determine the weights for the different aspects

Within a region or sector, different objectives and stakeholder interests may result in certain aspects – such as accessibility, safety, environment, qualitative factors or interactions – being given higher priority than others. This variability is addressed in this step, where it becomes possible to assign specific weights to these different aspects, facilitating the formulation of a balanced set of measures. This process not only helps to gain a full understanding of how each aspect affects the overall outcome, but also ensures that the package with measures matches regional or sectoral priorities and needs. Weights can be assigned on a scale of 1 to 100, with the total sum of the weights across all aspects equal to 100.

In some cases, stakeholders may hesitate to assign weights, fearing that this could politicise the assessment process. In such cases, this step is omitted so that the assessment can be carried out without this prioritisation layer. It must be clear that this method allows for a tailored approach to prioritising measures and reflects the unique context and objectives of each region or sector.

5.3.2.8 Step 8 – perform a multi-criteria analysis

Once the weights are determined, a multi-criteria analysis (MCA) can be carried out, taking all aspects into account. This exercise reveals which measure is the best, based on a weighted average across all aspects, and which gives the least result. In Table 5.6, the safety and environmental aspects have not been monetised, but their relative scores have been used. This shows, in this example, that before weighting, green wave is the best, but after weighting, bundling of goods is slightly better.

If the aspects accessibility, safety and environment are monetised, we can use the relative scores by balance (see Table 5.5). The outcome is shown in Table 5.7. In this case, the green wave is the best measure because of its lower cost and better safety score.

5.3.2.9 Step 9 – perform a sensitivity analysis

With the available budget and cost per measure, the sensitivity of several different packages of measures can be determined. This is done using the results of steps 3 and 6. The cost of a measure can be extracted from step 3 and the average ranking across all aspects and effects from step 6 can be used. Different composite measure packages are possible within the available budget. Normally the budget is exhausted, but of course there is a possibility that the budget is exceeded or under-utilised. There is also the possibility that the optimal measure package in terms of benefits requires additional funding compared to the original budget. In that case, the discussion will focus on where additional financial sources can be found.

5.3.2.10 Step 10 – discuss the results and determine the measures

The last step in the process is a discussion among stakeholders about the composite packages from step 9 and the weights from step 7. In the beginning, basically every

Table 5.6 Example of the rankings without and with weighing (without monetisation)

	Bundle goods	Eco-transport	Green wave	Information	Measure X	Measure Y	Measure Z
Accessibility	10.0	1.0	5.5	3.2	1.1	1.0	1.0
Safety	4.5	1.0	10.0	4.5	9.9	4.5	4.5
Environment	5.6	7.9	10.0	1.3	1.4	1.1	1.0
Perception	1.0	7.4	10.0	6.1	4.9	7.4	4.9
Interaction	10.0	7.5	6.7	3.5	1.8	1.0	3.5
Total score	**31.2**	**24.9**	**42.2**	**18.7**	**19.0**	**15.1**	**14.8**

	Weight	Bundle goods	Eco-transport	Green wave	Information	Measure X	Measure Y	Measure Z
Accessibility	50	5.0	0.5	2.7	1.6	0.5	0.5	0.5
Safety	15	0.7	0.2	1.5	0.7	1.5	0.7	0.7
Environment	15	0.8	1.2	1.5	0.2	0.2	0.2	0.2
Perception	10	0.1	0.7	1.0	0.6	0.5	0.7	0.5
Interaction	10	1.0	0.8	0.7	0.3	0.2	0.1	0.3
Total score		**7.6**	**3.3**	**7.4**	**3.4**	**2.9**	**2.2**	**2.2**

Table 5.7 Example of the rankings without and with weighing (with monetisation)

	Bundle goods	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**
Balance	6.7	5.8	10.0	3.5	2.2	1.0	2.1
Perception	1.0	7.4	10.0	6.1	4.9	7.4	4.9
Interaction	10.0	7.5	6.7	3.5	1.8	1.0	3.5
Total score	**17.7**	**20.8**	**26.7**	**13.1**	**8.9**	**9.4**	**10.4**

	Weight	**Bundle goods**	**Eco-transport**	**Green wave**	**Information**	**Measure X**	**Measure Y**	**Measure Z**
Balance	80	5.4	4.7	8.0	2.8	1.8	0.8	1.7
Perception	10	0.1	0.7	1.0	0.6	0.5	0.7	0.5
Interaction	10	1.0	0.8	0.7	0.3	0.2	0.1	0.3
Total score		**6.5**	**6.2**	**9.7**	**3.7**	**2.4**	**1.6**	**2.5**

aspect gets the same weight. In practice, however, it will turn out that stakeholders attach more value to certain aspects. In step 7, the weights can be adjusted, and it is therefore possible that some measures get a different ranking if the valuation of individual aspects changes. Optionally, a second iteration can be done from step 6 to step 9 to change the composition of the packages based on the changed weights.

The composite packages show, given the cost and available budget, which measures can be taken together in one package. Discussion among stakeholders should lead to agreement on which package of measures is best and should be chosen.

5.4 Case study A15 'River land'

5.4.1 Description of the case

The project 'A15 River land' was carried out with the objective to make an analysis of the current and future problems on the A15 motorway from Rotterdam to Germany (more specifically between Gorinchem and Valburg), as well as the underlying road network in this region. But also, to provide a broad package of policy measures to overcome these problems.

Different policy measures have been drafted within this project. A selection of these policy measures has served as input for the case study. The AMPO could not be used to a full extent as for most policy measures the costs and benefits of implementation were unknown. Therefore, only an MCA could be used. Input for the MCA was collected by means of a workshop with different stakeholders, consisting of road authorities in the region, Rijkswaterstaat (motorway operator) and logistic organisations.

5.4.2 Measures and interactions

Some 22 measures were considered. Table 5.8 provides an overview of the measures and their assumed interaction scores.

5.4.3 Costs and benefits

The costs are usually given in Euros, but at this stage of the project, most cost data were not available. By means of a discussion and rating tool, the costs were scored, ranging from 'very low' to 'very high'. After that, relative scores were calculated (a high relative score means low costs). Table 5.10 shows the costs. As can be seen, the costs for extra capacity on the motorway were assessed as very high. All other costs were lower and due to the large difference in costs, all other measures do not score very different on this aspect.

5.4.4 Unquantifiable impacts

As benefits could not be expressed in quantitative or monetary terms, all benefits were assessed by the stakeholders in a qualitative way. Table 5.9 shows the scores on accessibility, but also on safety, environment and other qualitative aspects. As can be seen the extra capacity on the A15 scores highest on accessibility, while

Table 5.8 Measures and interaction for the case A15 'River land'

No.	Measure	Total score	Relative score
1	Accessibility Kerkdriel-North	0	1
2	Better access logistic hotspot Medel	4	4
3	Promotion of the usage of e-bikes	4	4
4	High-speed bicycle path between Geldermalsen and Tiel	2	3
5	Bundling freight	4	5
6	Rescheduling freight transport	2	3
7	Improvement traffic flow N322/N323	1	2
8	Increase capacity of the N323 (Kesteren – Rhenen)	1	2
9	Extra lane on the A15 motorway	6	4
10	Peak-hour lane A15 between Tiel and motorway junction Deil	5	8
11	Automated driving	1	2
12	Mobility management Medel	4	5
13	Traffic safety N320 (Culemborg – Kesteren)	2	3
14	Safety on intersection Maas-Waal road	1	2
15	Remove billboards A15	0	2
16	Awareness driving behaviour	5	8
17	Better design of curves in the A15	1	2
18	Ramp metering on-ramps to the A15	8	10
19	Usage of the A15 in off-peak hours	3	5
20	Control traffic on the A15 using real-time data	3	7
21	Longer acceleration lanes on slip roads to the A15	4	6
22	Motorway traffic management system on the A15 (queue tail warning)	5	7

measures for the bike score the highest on environment. For quality, automated driving scores the highest, probably due to the comfort involved.

Summing the scores (unweighted) shows that Motorway traffic management scores best with 35.2 points. Bundling freight flows scores second best with 34.2 points, followed by Controlling A15 traffic using real-time data and longer acceleration lanes. So, the best measures are related with the motorway. If we involve costs, we get Table 5.10. Because the costs of an extra lane on the A15 is very high compared to the other measures, the costs don't differentiate the measures further. That is a critical point to consider: if the costs of certain measures have a different magnitude, then scaling them from 1 to 10 decreases the difference between measures and the real difference is not reflected in the scores.

5.4.5 Multi-criteria analysis

The weights for the different measures have been determined by the stakeholders, with and without costs. They are shown in Table 5.11.

Applying the weights without costs leads to the situation in which the extra capacity of the motorway becomes most attractive. The peak hour lane has the highest score and also the extra lane scores high, because both score well on accessibility,

Table 5.9 Scores for all aspects without costs

No.	Measure	Costs	Accessibility	Environment	Safety	Quality	Interaction	Total Score
1	Accessibility Kerkdriel-North		7.4	4.5	5.0	1.9	1.0	19.8
2	Better access logistic hotspot Medel		7.4	6.0	5.0	1.0	4.4	23.8
3	Promotion of the usage of e-bikes		3.6	10.0	1.0	6.8	4,4	25.8
4	High-speed bicycle path Geldermalsen – Tiel		4.2	10.0	4.0	9.2	3.3	30.7
5	Bundling freight		5.8	9.5	6.0	7.6	5.3	34.2
6	Rescheduling freight transport		3.6	7.0	4.5	1.9	3.3	20.3
7	Improvement traffic flow N322/N323		7.9	5.5	4.5	4.7	1.6	24.2
8	Increase capacity N323 (Kesteren – Rhenen)		8.4	2.0	3.5	2.8	1.6	18.3
9	Extra lane on the A15 motorway		10.0	1.0	5.5	5.1	3.8	25.4
10	Peak-hour lane A15 between Tiel and Deil		10.0	3.0	4.0	6.0	7.8	30.8
11	Automated driving		3.9	2.5	6.5	10.0	2.1	25.0
12	Mobility management Medel		4.7	8.5	4.0	5.1	4.9	27.2
13	Traffic safety N320 (Culemborg – Kesteren)		1.0	5,.5	9.5	5.6	2.7	24.3
14	Safety on intersection Maas-Waal road		1.0	5.5	10.0	5.6	2.1	24.2
15	Remove billboards A15		2.1	5.5	6.5	4.7	1.6	20.4
16	Awareness driving behaviour		2.1	7.2	7.5	2.7	8.3	27.8
17	Better design of curves in the A15		2.6	5.5	7.5	1.9	2.1	19.6
18	Ramp metering on-ramps to the A15		5.2	6.6	6.9	1.9	10.0	30.6
19	Usage of the A15 in off-peak hours		4.7	8.0	6.0	4.4	4.9	28.0
20	Control traffic on the A15 using real-time data		5.8	7.5	6.0	6.8	6.6	32.7
21	Longer acceleration lanes A15		5.8	6.6	7.5	6.8	5.5	32.2
22	Motorway traffic management system A15		5.8	7.5	8.5	6.8	6.6	35.2

Table 5.10 Scores for all aspects with costs

No.	Measure	Costs	Accessibility	Environment	Safety	Quality	Interaction	Total Score
1	Accessibility Kerkdriel-North	9.5	7.4	4.5	5.0	1.9	1.0	29.3
2	Better access logistic hotspot Medel	10.0	7.4	6.0	5.0	1.0	4.4	33.8
3	Promotion of the usage of e-bikes	10.0	3.6	10.0	1.0	6.8	4,4	35.8
4	High-speed bicycle path Geldermalsen – Tiel	10.0	4.2	10.0	4.0	9.2	3.3	40.7
5	Bundling freight	10.0	5.8	9.5	6.0	7.6	5.3	42.2
6	Rescheduling freight transport	10.0	3.6	7.0	4.5	1.9	3.3	30.3
7	Improvement traffic flow N322/N323	10.0	7.9	5.5	4.5	4.7	1.6	34.2
8	Increase capacity N323 (Kesteren – Rhenen)	9.9	8.4	2.0	3.5	2.8	1.6	28.2
9	Extra lane on the A15 motorway	1.0	10.0	1.0	5.5	5.1	3.8	26.4
10	Peak-hour lane A15 between Tiel and Deil	6.0	10.0	3.0	4.0	6.0	7.8	36.8
11	Automated driving	9.8	3.9	2.5	6.5	10.0	2.1	34.9
12	Mobility management Medel	10.0	4.7	8.5	4.0	5.1	4.9	37.2
13	Traffic safety N320 (Culemborg – Kesteren)	9.9	1.0	5,.5	9.5	5.6	2.7	34.2
14	Safety on intersection Maas-Waal road	10.0	1.0	5.5	10.0	5.6	2.1	34.2
15	Remove billboards A15	10.0	2.1	5.5	6.5	4.7	1.6	30.4
16	Awareness driving behaviour	10.0	2.1	7.2	7.5	2.7	8.3	37.8
17	Better design of curves in the A15	10.0	2.6	5.5	7.5	1.9	2.1	29.6
18	Ramp metering on-ramps to the A15	10.0	5.2	6.6	6.9	1.9	10.0	40.6
19	Usage of the A15 in off-peak hours	10.0	4.7	8.0	6.0	4.4	4.9	38.0
20	Control traffic on the A15 using real-time data	10.0	5.8	7.5	6.0	6.8	6.6	42.7
21	Longer acceleration lanes A15	10.0	5.8	6.6	7.5	6.8	5.5	42.2
22	Motorway traffic management system A15	9.9	5.8	7.5	8.5	6.8	6.6	45.1

Table 5.11 Two different set of weights

	Weight		Weight
		Costs	44
Accessibility	47	Accessibility	27
Safety	18	Safety	10
Environment	20	Environment	11
Qualitative aspects	6	Qualitative aspects	5
Interaction	6	Interaction	4
Total	**100**	**Total**	**100**

which has a high weight. Measures which score low on accessibility (for example, Promotion of e-bike) have a low total score. All scores are shown in Table 5.12.

When the costs are taken into account, measures to add extra capacity to the motorway drop in the list and now the motorway traffic management scores best. The relative low weight of accessibility and the high weight for the costs are the reasons for this. The relative scores for all measures are given in Table 5.13. It shows that taking into account the costs at this stage of the project has significant implications for the ranking of the measures.

5.4.6 Conclusions from the case

During the meeting with the stakeholders the discussions were determined by the costs of the measures and the scale that was used (5-step scale) and finally who will pay for the measures. The discussion partially influenced the scoring procedure as well as making choices between measures. The assessment method has been developed to weigh the different measures equally. Therefore, a focus should be put on the impacts, then ranking the measures based upon their scores and finally look at the scores based upon their (financial) feasibility, support and available information. Scoring the measures may lead to quick wins of some measures which can be realised on short term. For other more expensive measures the costs need to be determined first. This asks for more information. The amount of investment needs further insight in the financial feasibility of the policy measures before they can be implemented. Finally, this case shows that it is difficult to take into account transport measures that differ much, such as a parking facility for bikes and extra capacity on a motorway. We conclude that the transport measures should have some relation to each other concerning size and costs.

5.5 AMPO tool

The AMPO, described in this chapter, has been translated into a web-based tool. This tool makes gives the user an interface to the steps involved and makes it easy to involve stakeholders into the process and to do the calculations and sensitivity analysis.

The measures and aspects can be defined freely and for the aspects it can be chosen to make them quantitative or qualitative, using a scale. Also, the levels for the scales can be chosen, e.g. from −3 to +3, or from 1 to 10.

Table 5.12 Results of MCA, without costs

No.	Measure	Costs	Accessibility	Environment	Safety	Quality	Interaction	Total Score
1	Accessibility Kerkdriel-North		3.5	0.9	0.9	0.2	0.1	5.5
2	Better access logistic hotspot Medel		3.5	1.2	0.9	0.1	0.3	5.9
3	Promotion of the usage of e-bikes		1.7	2.0	0.2	0.6	0.3	4.7
4	High-speed bicycle path Geldermalsen – Tiel		2.0	2.0	0.7	0.8	0.2	5.7
5	Bundling freight		2.7	1.9	1.1	0.7	0.2	6.6
6	Rescheduling freight transport		1.7	1.4	0.8	0.2	0.2	4.3
7	Improvement traffic flow N322/N323		3.7	1.1	0.8	0.4	0.1	6.1
8	Increase capacity N323 (Kesteren – Rhenen)		3.9	0.4	0.6	0.3	0.1	5.3
9	Extra lane on the A15 motorway		3.7	0.2	1.0	0.5	0.2	6.6
10	Peak-hour lane A15 between Tiel and Deil		4.7	0.6	0.7	0.5	0.5	7.0
11	Automated driving		1.8	1.5	1.2	0.9	0.5	5.9
12	Mobility management Medel		2.2	1.7	0.7	0.5	0.3	5.4
13	Traffic safety N320 (Culemborg – Kesteren)		0.5	1.1	1.7	0.5	0.2	3.9
14	Safety on intersection Maas-Waal road		0.5	1.1	1.8	0.5	0.1	4.0
15	Remove billboards A15		1.0	1.1	1.2	0.4	0.1	3.8
16	Awareness driving behaviour		1.0	1.4	1.4	0.2	0.5	4.5
17	Better design of curves in the A15		1.2	1.1	1.4	0.2	0.1	4.0
18	Ramp metering on-ramps to the A15		2.4	1.3	1.2	0.2	0.6	5.8
19	Usage of the A15 in off-peak hours		2.2	1.6	1.1	0.4	0.3	5.6
20	Control traffic on the A15 using real-time data		2.7	1.5	1.1	0.6	0.4	6.3
21	Longer acceleration lanes A15		2.7	1.3	1.4	0.6	0.3	6.3
22	Motorway traffic management system A15		2.7	1.5	1.5	0.6	0.4	6.8

Table 5.13 Results of MCA, with costs

No.	Measure	Costs	Accessibility	Environment	Safety	Quality	Interaction	Total Score
1	Accessibility Kerkdriel-North	4.2	2.0	0.5	0.5	0.1	0.0	7.3
2	Better access logistic hotspot Medel	4.4	2.0	0.7	0.5	0.1	0.2	7.8
3	Promotion of the usage of e-bikes	4.4	1.0	1.1	0.1	0.3	0.2	7.0
4	High-speed bicycle path Geldermalsen – Tiel	4.4	1.1	1.1	0.4	0.4	0.1	7.5
5	Bundling freight	4.4	1.6	1.0	0.6	0.3	0.1	8.0
6	Rescheduling freight transport	4.4	1.0	0.8	0.5	0.1	0.1	6.8
7	Improvement traffic flow N322/N323	4.4	2.1	0.6	0.5	0.2	0.1	7.8
8	Increase capacity N323 (Kesteren – Rhenen)	4.4	2.3	0.2	0.4	0.1	0.1	7.4
9	Extra lane on the A15 motorway	0.4	2.7	0.1	0.6	0.2	0.2	4.2
10	Peak-hour lane A15 between Tiel and Deil	2.6	2.7	0.3	0.4	0.2	0.3	6.6
11	Automated driving	4.3	1.1	0.8	0.7	0.4	0.3	7.6
12	Mobility management Medel	4.4	1.3	0.9	0.4	0.2	0.2	7.4
13	Traffic safety N320 (Culemborg – Kesteren)	4.4	0.3	0.6	1.0	0.2	0.1	6.5
14	Safety on intersection Maas-Waal road	4.4	0.3	0.6	1.0	0.2	0.1	6.6
15	Remove billboards A15	4.4	0.6	0.6	0.7	0.2	0.1	6.5
16	Awareness driving behaviour	4.4	0.6	0.8	0.8	0.1	0.3	6.9
17	Better design of curves in the A15	4.4	0.7	0.6	0.8	0.1	0.1	6.6
18	Ramp metering on-ramps to the A15	4.4	1.4	0.7	0.7	0.1	0.4	7.7
19	Usage of the A15 in off-peak hours	4.4	1.3	0.9	0.6	0.2	0.2	7.5
20	Control traffic on the A15 using real-time data	4.4	1.6	0.8	0.6	0.3	0.3	7.9
21	Longer acceleration lanes A15	4.4	1.6	0.7	0.8	0.3	0.2	7.9
22	Motorway traffic management system A15	4.4	1.6	0.8	0.9	0.3	0.3	8.1

After the definitions, a scoring form is compiled, and this can be sent to the stakeholders for the scoring process. The stakeholders can fill in the form and send it back to the tool. The forms are managed, and results are calculated (see Figure 5.2)

The outcome, which includes average scores, but also standard deviations, can be input for a discussion with the stakeholders. Why does a certain measures scores higher than another on this aspect? Why is the standard deviation for that score so high? That means that people have valued that aspect very differently for a certain measure and that could be used for a good discussion and eventually could lead to a better understanding of the viewpoints and interests of stakeholders.

Finally, the tool provides a priority order for the measures. This does not mean that one a certain measure is better than the other, but simply that this measure has the best overall score (see Figure 5.3).

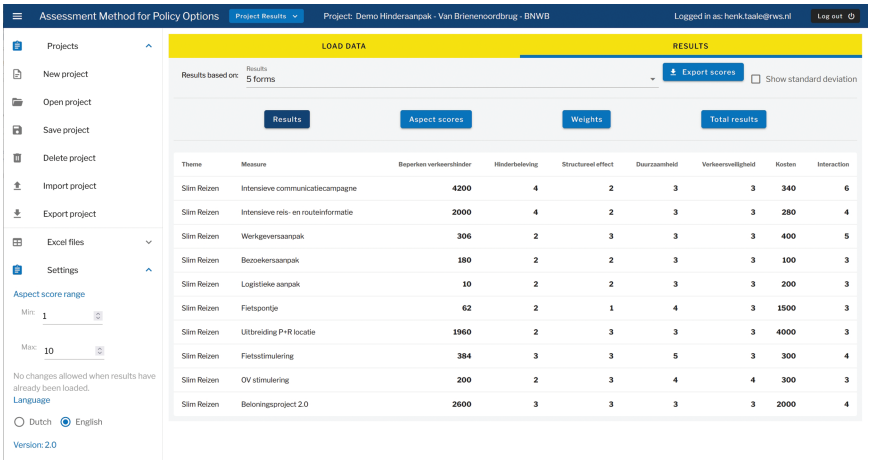

Figure 5.2 AMPO tool – results

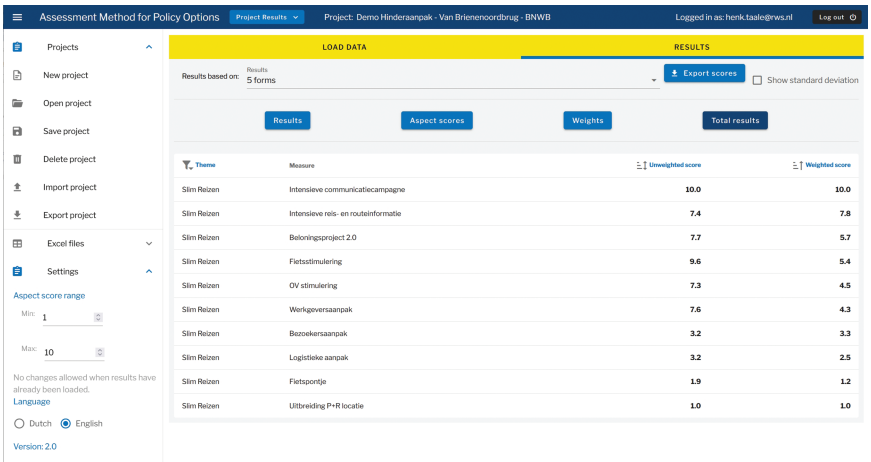

Figure 5.3 AMPO tool – final score

5.6 Conclusions

Based on the use cases we have done so far, we can conclude that the assessment method can be applied for the selection of different packages of policy measures, both similar and divergent measures, such as infrastructural projects and traffic management projects. The AMPO has added value in an early stage of policy-making. It provides a feeling of the relative impacts of the policy measures. In a later stage the AMPO can also be applied when more detailed cost–benefit information becomes available.

When real costs are not available, discussions may arise on the question 'Who will pay?' and this may disturb the assignment of scores or the choice between measures. Policy measures with high benefits may be rejected in an early stage due to high costs, even though it is not yet clear what the available budget is. Therefore, we feel it would be better to put benefits in front of the process instead of costs: a Benefit–Cost analysis in other words.

The case of A15 River land shows that the policy measures should not diverge too much if only an MCA is carried out. The differences between small and large policy measures, such as parking bikes versus development of a motorway, may hamper a good evaluation of the projects. The projects should be more or less in line with each other. A possible solution is to do the assessment in two steps: one assessment for a package of smaller measures and an assessment for a package of big measures.

Currently, the allocation of budgets for infrastructure and other policy measures has become more dynamic than in the past, largely owing to the opportunities for co-financing from public and private organisations. This flexibility allows for the consideration of more costly measures that are financially viable due to their significant benefits. The prospect of co-financing not only makes measures more attainable but also enhances public support for them, leveraging shared financial responsibility to broaden the base of endorsement.

The AMPO maintains an expansive view, encouraging the exploration of innovative solutions for policy packages. This holistic approach fosters creativity and avoids the limitations of a cost-centric analysis by means of a social cost-benefit analysis. By including benefits such as accessibility, safety, environment, and qualitative improvements a more balanced evaluation emerges, guiding the selection process to consider the overall value of measures. This strategy suggests that the emphasis should be on assessing the benefits, deferring cost considerations to later discussions. This is instrumental in the assessment, where the costs are reintegrated into the dialogue alongside financing strategies, ensuring a comprehensive review of each package's feasibility.

Adopting this approach illuminates the most impactful measures, beyond their cost, facilitating informed decisions about which initiatives are practical. It also aids in strategically phasing policy measures, distinguishing between immediate gains and more complex, long-term projects. This transparent methodology not only clarifies the potential return on investment for each measure but also aligns the

selection process with broader strategic objectives, ensuring that chosen initiatives are both impactful and financially sustainable.

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