The potential of a life-cycle approach for improving road infrastructure planning in the Netherlands

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Samenvatting

Op het Nederlandse wegennet neemt de filedruk toe evenals de daarmee samenhangende milieuproblemen. Het aanleggen van nieuwe infrastructuur wordt noodzakelijk geacht, echter de planningsprocessen lopen vast en hebben te kampen met grote kosten- en tijdsoverschrijdingen. In dit paper worden de mogelijkheden onderzocht om deze tekortkomingen in het planproces aan te pakken door het toepassen van een zogenaamde levenscyclusbenadering. Deze benadering beoogt de verschillende fasen in het planningsproces van infrastructuurprojecten in samenhang te bezien en daar waar mogelijk te koppelen, het projectmanagement te verbeteren en de kennisuitwisseling tussen de fasen te vergroten.

Het rapport van de Commissie Elverding ingesteld door de regering om concrete voorstellen te doen om de infrastructuurplanning 'los te trekken', biedt aanknopingspunten voor een dergelijke nieuwe benadering. Belangrijk daarbij is het vinden van een betere balans tussen de verschillende fasen van het planproces door meer aandacht te schenken aan de verkenningenfase en aan monitoring en ex-post evaluatie. De koppeling tussen de latere fasen (constructie, beheer en onderhoud) en de vroege planningsfasen (waarin politieke agendavorming plaatsvindt) moet dus versterkt worden. Een manier om dit te bereiken is door marktpartijen met hun expertise op het gebied van innovatieve constructie en onderhoudsbenaderingen eerder in het planproces te betrekken. Vervlechting van planvorming- en aanbestedingsprocedures is een voorbeeld van een praktische toepassing van een benadering waarin fasen sterker aan elkaar gekoppeld worden.

Case studies laten zien dat de koppeling van twee fasen – in dit geval de planvorming en realisatie (en eventueel beheer) – een meerwaarde kan hebben; door de vroege marktbetrokkenheid kan de tijdsduur van projecten worden verkort, de controle worden verbeterd en ontstaat er meer ruimte voor innovatieve oplossingen. De ervaringen met vervlechting beslaan slechts een enkele link binnen een complete keten. Een totale levenscyclusbenadering voor weginfrastructuurplanning kan een nog grotere meerwaarde hebben al zal de exacte invulling verder moeten worden onderzocht. Om de benadering een concreter in te kunnen vullen, zullen de vragen, wensen en ideeën van de verschillende betrokken actoren (overheid, markt en belanghebbenden) in een vroeg stadium duidelijk moeten worden gemaakt. Daarnaast zal er meer inzicht moeten worden verkregen in onder andere de juridische en de financiële spanningen die integratie met zich meebrengt, en de randvoorwaarden die hieruit voortvloeien

1. Introduction

Traffic intensities are increasing every year and the road capacity cannot handle the increasing demand for travel; congestion occurs in and around bottlenecks and especially during peak hours (see, also Bovy, 2001; Bovy and Salomon, 1999). Time losses, as a consequence of congestion, have a negative economic impact. Moreover, congestion has (negative) impacts on road safety, emissions and noise (ECMT, 1999). Because of the large negative effects, fighting traffic congestion is high on the political agenda. Although traffic demand measures such as dynamic traffic management and road pricing are effective measures to do this, the current view is that demand measures alone are not sufficient. New transport infrastructure is also needed (V&W, 2005). However, the development of new infrastructure proves to be difficult because of, amongst other things, increasing scarcity of space, complex environmental issues and huge (local) public resistance. As a consequence infrastructure-planning projects have to deal with uncertainty and unpredictability. Traditional planning strategies in the Netherlands involve an extensive, phased planning process in order to 'hedge' the risks. Nonetheless, in practice, infrastructure projects deal with time and cost overruns and often the resulting quality of planning proposals is considered to be poor (Commissie Elverding, 2008). Moreover, many projects have been halted because of negative court cases.

When dealing with uncertainty, the reflex of hedging against risks is not always the best approach. It tries to limit risks as a consequence of, for instance, technical, juridical or political uncertainties by gathering as much information as possible and taking remedial measures for the containment of risks. Another principle, flexing, on the other hand, tries to master risks by using a process approach applying early warning and adaptive strategies. If problems then do occur, reparation is possible. The focus is on adaptive management (Holling, 1978). Trusting too much on hedging in unpredictable situations may lead to devastating results as planners are too focused on one type of solution and are insufficiently prepared for unexpected situations. In complex planning situations, a mix of both hedging and flexing may be a better strategy since both principles are closely connected and complementary (Collingridge, 1983). In order to deal with the complexity issues in planning, mentioned before, Arts (2007) proposes to be more flexible with respect to involving other *actors* into the planning process (e.g., collaborative planning; open, participative planning; strategic partnership approaches), to be more inclusive in relation to the *space* surrounding infrastructure (area-oriented infrastructure planning) and, finally, to adopt a more flexible planning with respect to *time*. Regarding the latter, a life-cycle approach is expected to stimulate the use of knowledge and operational expertise attained in the different stages of the planning process by the various actors involved (e.g., government, market parties, other private stakeholders, environmental organisations) and integrates them into a learning cycle in order to improve the exchange of ideas and expertise (Morrison-Saunders & Arts, 2004). Doing so, surplus value and cost savings can be achieved (Laverman, 2007). So, conceptually, life-cycle integration may improve infrastructure planning in the sense that better use is made of the knowledge and operational expertise of the actors involved through enabling a learning process in which the relevant actors play their specific role. This knowledge could then be used to improve the project management in infrastructure planning. Until now, full life-cycle integration has not been applied in the transport infrastructure planning practice. However, recently, some experience has been gained in the Netherlands from projects that apply early contractor involvement in which the tender

procedure and the infrastructure planning procedure are carried out simultaneously (i.e., 'parallelization' and 'interweaving'). Such an early involvement can be regarded as a specific form of life-cycle approach. Other operationalizations, however, are possible as well.

In this paper we aim to explore the potential of a life-cycle approach to relief (some of the) the current problems in the Dutch road infrastructure planning. To do so, we start in section 2 with a description of the current road/transport infrastructure planning in the Netherlands. Subsequently, section 3 focuses on a further analysis of the problems in the Dutch transport infrastructure planning and on potential directions for improvement by explicitly making use of and review an important recently published governmental advisory report by the Committee Elverding. In the light of this report and our review, section 4 illuminates the characteristics of a (full) life-cycle approach. Subsequently, in section 5 we shortly present evaluation results of some first practical applications of an early market involvement (i.e. 'parallelization' and 'interweaving') in Dutch road infrastructure planning. Finally, the conclusions and future research directions follow in section 6.

2. Transport infrastructure planning in the Netherlands

A well-functioning transportation system plays an essential role in open economies around the world. This may even be more the case for a country such as the Netherlands whose economic well being to a large extent depends on a fluent distribution of goods to and from its two important international mainports, i.e. the harbour of Rotterdam and the Schiphol airport in Amsterdam. As a consequence, transport and mobility play an important role in Dutch policy making which is also reflected by various policy reports that have been written and the extensive array of planning instruments that have been created over time.

In the Netherlands, national policy reports guide the transport related developments for pre-determined time horizons. Since the 1960s five of such policy reports have been developed. These plans differ substantially with respect to their focus on either supply or demand related measures to improve mobility (see, e.g., Bouwman and Linden, 2004). In the most recent policy plan, i.e. the National Mobility Plan ('Nota Mobiliteit'; V&W, 2005) supply-side measures play an important role (e.g., planning new peak lanes, extension of roads by extra lanes, or new roads). However, at the same time it also pays attention to demand measures, such as road pricing. It aims to facilitate the traffic demand, but not always and in a unlimited way; in addition to accessibility, for instance, objectives such as traffic safety and liveability now also have to be attained and take an important place in Dutch transport policy. Mobility is thus seen as a necessary condition for economic and social development, albeit within environmental boundaries (V&W, 2006). This stresses the strong relationship between transportation and spatial planning policies. To regulate the budgets there is a programming and budgeting system under which the Long-Range Program Infrastructure & Transport ('MIT'; V&W, 2007) is updated every year. The MIT provides an overview of current infrastructure projects and involves three stages of decision-making: the explorative study stage ('reconnaissance studies'), the project study and the actual realisation stage. In order to be realised, every infrastructure project has to run through each of these subsequent stages (V&W, 2004). Recently the MIT has been replaced by the MIRT – the Long-Range Program

Infrastructure, *Space* & Transport – as part of the Cabinet policy to integrate spatial and infrastructure investments in a better way. The MIRT-programming is still under development, and up to now the MIT-programming regulations still apply.

The goal of the reconnaissance phase is to provide the minister of Transport with the information to make a sound decision. It starts with an intake decision; this is a declaration by the minister that a certain traffic-related problem may exist. After this intake decision, an explorative study starts, in which the problem is worked out into more detail, the relevant directions for solutions are investigated, the necessity to make infrastructural solutions is made clear, and in which an indication is given of the finances that are involved. Afterwards, the minister can order to start a project study. In the project study phase the formal decision-making takes place. Usually, route determination and Environmental Impact Assessment (EIA) procedures – resulting in an Environmental Impact Statement (EIS) - are required. Both are fully integrated, as required by the Infrastructure Planning Act ('Tracéwet'). The project study phase is characterized by several rounds of clarifying the proposed project, each of them concluded by a round of consultation, advice and public review. After the last consultation round, the ministers of Transport and of Environment[1] make the final Route Decision. Next, the permits necessary to carry out the project can be granted by the authorities involved. In the final stage, the realisation phase, the procurement procedure is started, after which the bidding market party that has won – the contractor – can sign the contract with the government and the construction of the road can be started. After the construction has finished, EIA follow up monitoring and ex-post evaluations can be performed.

It can be concluded that the regulations for road infrastructure development are very strict because of the potentially huge impact of transport infrastructure on environmental, health, safety and property interests. The regulations, and especially the Route Decision (for which an EIS has to be prepared), regulate the location, the land-use, the emissions permitted, the design as well as the (outlines of) operation and maintenance of roads.

3. Analysis of the issues in current planning practice

In response to delays in planning and decision-making on infrastructure projects, described in section 1, the minister of Transport and the minister of Environment together appointed an external Committee on the 'faster decision-making of infrastructure projects' ('Commissie Elverding'). The report by this committee (Elverding, 2008) indicates that projects, for which a final decision has been made, take some nine to ten years from the first start in the reconnaissance phase to the final construction. Moreover, many projects proposed within the Long-Range Program Infrastructure & Transport (MIT) have not yet been approved and have actually stagnated. If these projects are also taken into account, the duration of the planning process is even higher: on average approximately fifteen years, while planning processes of more than twenty years are no exception. Many formal time limits are not met in practice. Even over time, little or no improvement can be seen (Elverding, 2008). Most time seems to be spent on will-shaping, the principle 'go/no-go decision' (Arts 2007). Nevertheless, it is not only a

[1] Hereafter the Minister of Transport, Water Management & Public Works ('V&W') will be called Minister of Transport and the Minister of Housing, Physical Planning & Environment ('VROM') the Minister of Environment.

problem that is specifically linked to the Netherlands. In other countries the planning of transport infrastructure also takes much time, in the order of ten to twenty years (see e.g. TK, 2004; Flyvbjerg et al., 2003; WRR, 1994).

The Committee Elverding listed the causes of the delays for each of the planning phases in a MIT-project. The corresponding consequences for the different phases of the present road infrastructure planning process are depicted in figure 1, in which the height of the boxes represents the effort that, generally speaking, is put into each of the phases. Currently, the reconnaissance phase for many projects is often lacking, and when it is carried out it is rather unstructured and undirected. A great number of alternatives go through an unclear decision-making process, which results in a project-study decision. The phase can be characterized by a low degree of participation, especially compared with the project study phase, in which the many alternatives that result from the reconnaissance phase are examined more closely. Within the project-study phase much detailed information is usually gathered in order check whether the various alternatives fit within the strict (environmental) regulations – especially air quality, noise and nature issues are of vital importance to the plan - and within the decision-making process. However, involved stakeholders, who oppose to a project, can easily find facts in the great amount of information that contain errors, and thus provide ground to appeal against such a project proposal, which they utilize. As a consequence, these appeals can well cause major delays or even (temporary) cancellations of total projects. The judicial risks, together with the ever-changing political preferences and commitment create an unstable context in the project study phase, and cause this phase of the project to be time and cost intensive. Once the construction phase has been started, the planning process seems to 'calm down'. After completion of the construction there is hardly any specific attention for the project anymore: the monitoring of the effects of the project is insufficient or missing.

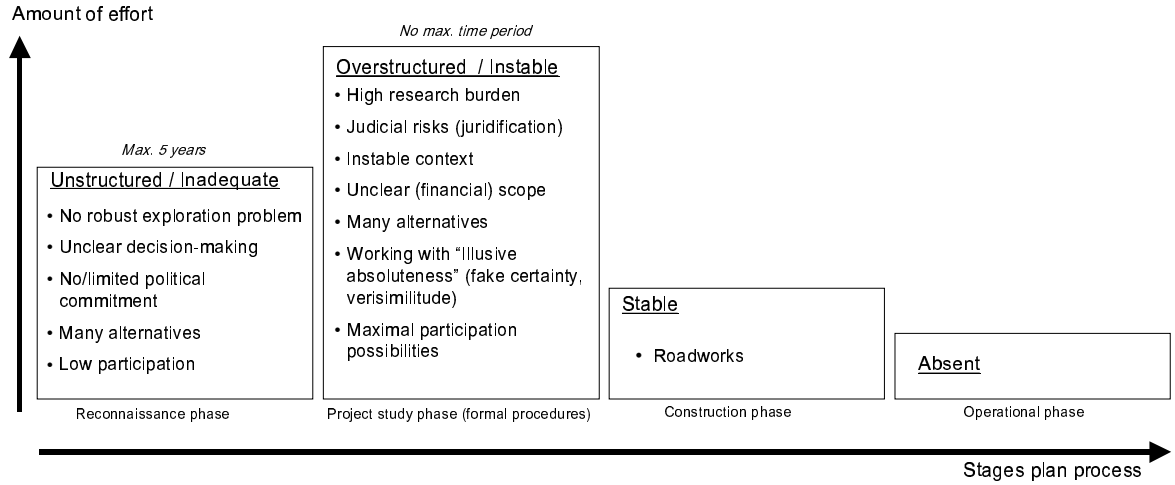

Figure 1: Present situation in road construction projects (after Danhof, 2008)

The Committee Elverding gives important recommendations to improve the planning process. It advises a more balanced approach in terms of attention for, and effort put into the different phases of infrastructure projects. More effort is needed in the early phases: a broad, open reconnaissance stage in which various potential solutions in the area are studied and discussed together with other (local) stakeholders. According to Elverding, the early involvement of interested parties should not be limited to the

'infrastructure-line' planning itself. Rather infrastructure developments should be linked to spatial potentials/benefits in order to achieve synergy effects. For more complex projects in which both infrastructure and spatial solutions are studied (an area-oriented study) this could get the form of a 'structure vision' under the Spatial Planning Act together with a Strategic Environmental Assessment. For more simple projects in which the scope is limited to intensifying the use of existing road capacity only, such a reconnaissance study is form-free, flexible. The reconnaissance study should result in a preference decision with a clear political commitment of the various authorities involved. This decision should clearly mark the end of the reconnaissance phase and should set the scope and provide the direction for the subsequent plan and decision-making stages.

The next stage, the project study, should be more compact and pragmatic. Starting points – relating to input data, policy issues, financial budget, etc. – are fixed. Only the preferred alternative, which contains different variants for the lay-out and (mitigating) measures, is elaborated. These variants are subject to a project-level Environmental Impact Assessment that is prepared for the Draft Route Decision. There is no Route Plan anymore. Because the ex ante assessment of traffic and environmental impacts is always associated with uncertainty, the final Route Decision plan may contain some flexible measures to remedy unwanted, negative impacts. The Committee wants to prevent detailed assessments of environmental impacts and measures by complex prediction models, the outcomes of which in such an early phase are often surrounded by huge uncertainty, and therefore low practical relevance. Instead more standardized rules of thumb have to be introduced, which still enable decision-making based on quantitative data. Such rules may quickly and roughly give insight into the effects on the economy, on nature and on spatial issues. They should be transparent and decrease the chances of errors in the input of the data. To enable adequate remedial action if actual environmental impacts (in the real world) exceed the assumed/estimated impacts in the Route Decision, the realization and especially the operational stages of infrastructure projects should be better linked to the previous phases by improving the monitoring function. The monitoring of whether certain (environmental) standards are exceeded due to an infrastructure project should be carried out in a real-world situation (i.e., after the construction phase). This is different from the current approach in which the potential for exceeding standards and the needed mitigating measures already have to be assessed in the project study phase.

Finally, the committee also stresses that the process of preparing an infrastructure project cannot last forever. Therefore, the reconnaissance phase has to be finished within 2 years. Otherwise it will be dropped out of the MIT-program. As the new project study stage will be simplified, it should be finished within 2 years. If not, its scope becomes 'unfrozen' and discussion over the project's starting points may rise again. The various proposed shifts of attention within, as well as between the different planning phases, together with Elverding's other recommendations, are summarized in figure 2. The height of the different boxes and the direction of the printed arrows illustrate the proposed change in effort, which should be put into each of the phases.

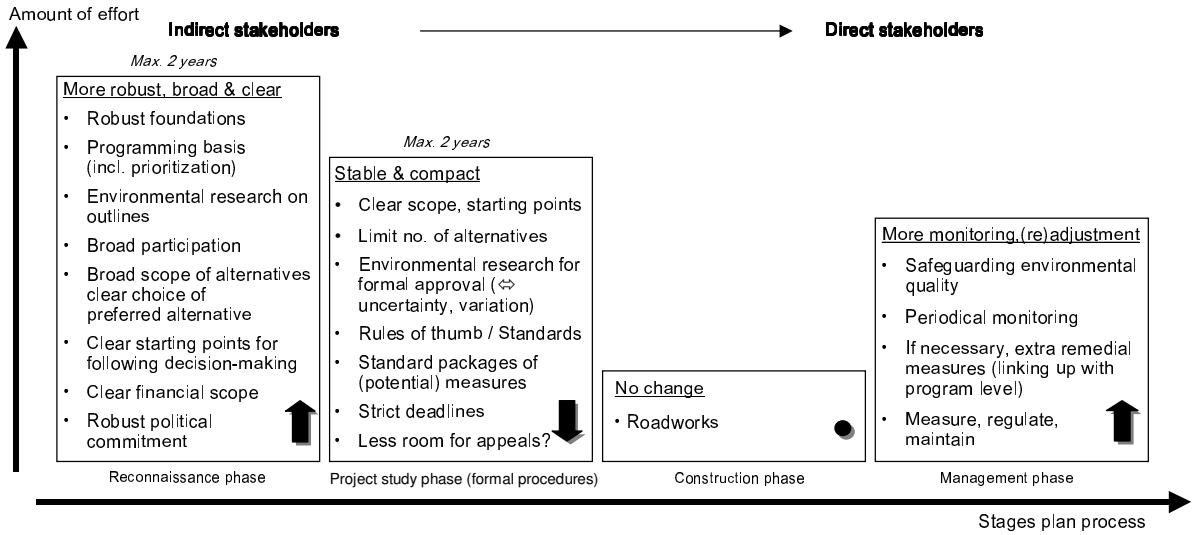

Figure 2 Preferred situation in road construction projects (after Danhof, 2008)

Some critical remarks with respect to the Committee's findings can be made as well. Little attention is given to the relationship between the MIT stages and the whole policy and planning life cycle in which it is embedded. This relates to the strategic stages of policy and programming as well as to the linkages at the end to the operational stages. For instance, the political value attached to a project in the programming phase may be a major factor in the speed of the planning process. Another issue discussed by Ten Heuvelhof (2008) may arise with the advice to postpone the analysis of possibly needed remedial measures to the post-construction phase. This causes the accompanying uncertainty over the costs to be transferred to a later phase and could negatively influence the willingness of parties to participate in the project funding. Also the role of the market parties in the planning process, and especially in its earlier phases remains rather vague. Ten Heuvelhof argues, for instance, that the negotiation process in the reconnaissance phase, which according to the committee has to gain importance, may toughen since stakeholders will take a (firm) stand in an earlier phase in the planning process. It remains to be seen whether the proposed strict deadlines will help to come to a concrete committed preference decision. Also, the committee does not relate explicitly the proposed changes (e.g. the area-oriented approach) to the surplus value that market parties could bring to the projects and to the initiatives that need to be undertaken to stimulate the early market involvement (e.g., market scans and consultations, competitive dialogues and interweaving procedures (see Van Valkenburg et al. 2008). Another point of attention is the financing of infrastructure projects. The Committee Elverding concludes that the government should take more of a mediating role, which suggests that other ways of funding the infrastructure projects might be possible. However, this has not been worked out into detail. A different advisory committee, i.e. "Private financing of infrastructure" ("Commissie Ruding"), did investigate possibilities for private funding of infrastructure projects (Ruding, 2008). However, this committee unfortunately did not relate this to the infrastructure planning process.

4. A life cycle approach for Dutch infrastructure planning

As indicated in the previous section, balancing and linking the planning phases in a better way, and exchanging knowledge and expertise could be ways to improve infrastructure planning. In addition to the advice of the Committee Elverding, several initiatives have

been started to improve this exchange in practice, most notably in the field of early market involvement in infrastructure planning. There is not yet an overarching theoretical framework. However, a life-cycle approach could function as one.

Basically, a life-cycle approach to infrastructure planning could be seen as consisting of two directions of integration of the planning cycle, i.e. a forward and a backward integration. The first entails integration by involving plan-makers (e.g., governmental actors) into a process of 'forward integration' (see, for example, Morrison-Saunders and Arts, 2004) or project management (see figure 3). Forward integration is a natural and common activity in the current (infrastructure) planning practice. Plans and projects are formulated with incorporated elements that ensure that the plan(-makers) have influence in a project, for example through coordination, monitoring and testing of the conformity to plans. This type of integration has received much attention of the planning theory community: the (strategic) relation between policy and project development has been researched intensively (see, e.g. Arts 1998, Teisman 2001, Van Duinen 2004, Zonneveld and Verwest 2005). It especially involves linking the policy-making to the plan-making (developing concrete plans and programs from policy). Traditionally, less attention has been given to issues as the follow-up and implementation of projects – the 'implementation gap', see Dunsire (1978) – such as linking the project planning to the construction (putting the plans into practice, e.g. through tender procedures), and linking the construction to the operation (ensure that the construction finishes on time to be able to start the exploitation) – see, e.g., Cherp et al. (2008), Arts et al. (2008) and Morrison-Saunders and Arts (2004).

However, many authors acknowledge that the planning process in practice does not only comprise a top-down process in which 'higher', strategic levels set the stage for subsequent plan and project development but also comprises bottom-up movement in which concrete project implementation and operation influences strategic planning levels (see for a discussion Arts et al. 2008). Little attention is given how to deal with such backward relations in the planning process in a structured manner. Therefore, a life-cycle approach also contains backward integration. Apart from 'thinking through' what the consequences of decisions will be for subsequent 'forward' stages, which in essence underlies the concept of (environmental) impact assessment, backward integration could be achieved by earlier involvement of parties that play an important role in the different planning stages. Examples of such parties are other authorities, residents, interest groups but also market parties. Especially market parties are very relevant for enhancing backward integration. Currently, the role of market parties is usually limited to consultancy during the project-plan preparation stages (engineering, designing, impact assessment studies). After the formal consent decision market parties are involved in the construction (contracting of building activities) and the operational stages (contracting out of maintenance). Usually different market parties are involved in each of the various stages, i.e. engineering consultants, construction companies, (sub)contractors. The backward integration is aimed at learning and at exchanging knowledge by earlier contractor involvement (see figure 3). It involves linking the operation to the construction (e.g. by providing knowledge to build easily maintainable roads), linking the construction and operation to the project plan-making (e.g. enabling innovative building techniques or providing a reality check on data by using the expertise of market parties

in the plan-making; see Nijsten et al., 2008), and linking project plan-making to policy-making (e.g. by using knowledge from 'practice' to formulating effective policy).

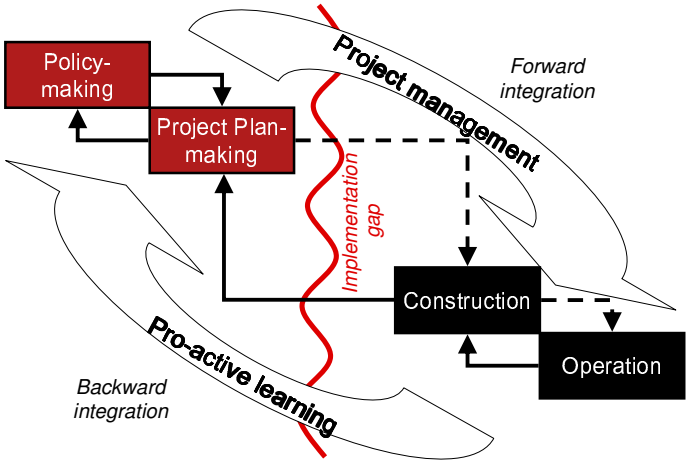

Figure 3: Life-cycle integration in road infrastructure planning

Contrary to forward integration, the application of backward integration is not yet common practice in infrastructure planning. However, given the current non-optimal planning process and in the light of the recommendations of the Elverding Committee, a backward integration of, for instance, innovative and knowledgeable market parties may (to a certain extent) help to relief the current problems in the Dutch transport infrastructure planning. In principle, the involvement of different actors in an integrated planning process is not something new in planning theory, which is also indicated by the popularity of, for example, collaborative planning approaches (Healey, 1997). However, the life-cycle approach differs from these more 'traditional' collaborative approaches in the sense that not all stakeholders will be involved in the same way in a life-cycle approach. Only potential shareholders who have developmental, transformative power, or as Teisman (2000) puts it, 'the purposeful actors' are integrated more actively into the earlier phases of the planning process. These actors have the power to help realizing the project, by providing money, knowledge, expertise or simply manpower. By doing this, endless rounds of negotiation with all involved stakeholders, which can be regarded as a negative side effect of the collaborative planning approach, are to be avoided. Third parties, residents, environmental organisations and other stakeholders hold their legal rights and security because of public law and procedures. This focus on purposeful actors also fits well with the advice of the Elverding Committee which points at the selective involvement of parties in decision-making.

A related potentially important merit of life-cycle integration is that it can help to create more competition in infrastructure provision by transferring the developmental role of government (partly) towards market parties. However, for a successful involvement of market parties into the planning process, the current inflexible, hedged planning approach should be softened by introducing more flexibility and adaptability in such a manner that the market parties can make optimal use of their knowledge. Only then the possibilities for actor interaction across the phases will increase and room for innovative ideas will be created. As a consequence surplus value and cost savings may be achieved (Laverman, 2007). The involvement of transformative (market) parties could also help to come to a more business-like approach to infrastructure planning, enhancing project

control over the stages of project preparation, construction and/or operation. Market parties may show government parties (at all levels) that the application of successful management techniques from the private sector may reduce costs and time. Subsequently, such techniques may then also be adopted by public institutions, which is in line with the 'new public management' concept (see, for instance, Common 1998, in England and Ward, 2007). By involving transformative actors into the process, also the view of end-users can be included in a better way into plan-making. The included market parties have a good 'feeling' for the needs of society – the 'market'.

It is not always the case anymore that ready-made projects are put on to the market for bidding, while only focusing on price. Instead, more and more the government formulates open and functional questions, which have to be elaborated by (market) contractors and are awarded on criteria of quality. This is made possible by recent procurement regulations that allow for the 'economically most favourable bid'. The implementation of this strategy has led to a large-scale application of Design and Construct (DC) contracts for construction, 'Performance' contracts for maintenance, and Design, Build, Finance, Maintenance (DBFM) contracts for large scale projects. However, such DB(FM) contracts only have real added value if contractors are sufficiently free in their design and choice of methods of construction (Pakkala et al., 2007). This freedom can be given if the participants are integrated early in the planning process (Van Valkenburg et al., 2008).

So, conceptually, life-cycle integration may improve the infrastructure planning in the sense that better use is made of the knowledge and operational expertise of the involved actors by means of a learning cycle. Although the question remains how to bring the life-cycle approach effectively and in a coherent and integral way into practice, current initiatives in early contractor involvement (like the market consultations, market scans and competitive dialogues) show that the need for an approach that aims at the integration of planning stages is recognized. Two interesting approaches for integrating market parties earlier into the infrastructure planning process are 'parallelization' and 'interweaving', which are both ways to combine the tender procedure with the route determination/EIA procedure. In the case of parallelization, the tender procedure starts before the planning consent decision and, therefore, runs parallel to the route determination/EIA procedure. There is, however, little exchange of information between the procedures. With respect to interweaving, on the other hand, the tender procedure starts before the planning consent decision, and is 'interwoven' with the route determination/EIA-procedure; both the tender and route determination procedure are coordinated and information is exchanged explicitly (Van Valkenburg et al., 2008). Compared to parallelization, interweaving is thus a more integrated process. It provides more room for innovation by (competing) market parties and enhances the quality of the Route Decision. However, even interweaving is an example of only partial life-cycle integration, i.e. the integration of the construction and plan-making phase (see also figure 3). It does not (yet) aim at the integration of all stages of the planning process (including the strategic stages). Nevertheless, since full life-cycle integration has not yet been applied in practice, it is interesting to gain greater insight into the consequences (e.g. with respect to time, cost overruns and quality of project plans) of such a partially integrated planning processes. Insights, for instance, can be used to assess whether the theoretically assumed advantages of life-cycle integration indeed occur in practice.

Moreover, it may give some first insights and directions of how to proceed in order to come to a more fully integrated life-cycle approach, if we at least assume that interweaving or parallelization have positive effects. Some practical experiences and concrete case study results are, therefore, described in the next section.

5. Towards a life-cycle approach: parallelization and interweaving

Traditionally, the Dutch tender for the (re)construction of large infrastructure projects only starts after the route determination/EIA-procedure has been successfully completed with a Route Decision that gives planning consent. This legally binding Route Decision determines the final location or route, the detailed design of the road in terms of height and width and the permitted emissions. After the Route Decision, only limited decision-making takes place. The route determination/EIA-procedure is an extensive procedure in which a broad assessment of the environmental and other impacts is made, with intensive consultation of regional and local authorities, and other parties. Because of the direct environmental consequences, during the construction only marginal deviations from the Route Decision are allowed. The consequence is that, with the current approach in which planning and procurement are linked in series, the contractors have very little room for flexibility to deviate from the solution as laid down in the Route Decision. As a result, innovative ideas from the contractors may have become impossible to implement.

Some years ago the Dutch government started experimenting with early market involvement. Most of the projects are still in the middle of the planning process, which makes a final evaluation of the consequences and merits of parallelization and interweaving a tricky task. Even more so the few running projects differ substantially with respect to type, scale, context, etc. This makes it hard to 'filter-out' generic findings with regard to the effects of an early market involvement. We assessed five early market involvement projects especially for their time consequences (for a more elaborate review of the results, see, Van Valkenburg et al., 2008). The projects that were examined are A4 Steenbergen, Passage A2 Maastricht, N31 Zürich – Harlingen, Westrandweg, and the capacity expansion of the Second Coentunnel. The cases differed amongst other things with respect to timing (i.e., at what point in the process were contractors involved), spatial scope (i.e., a focus on line-infrastructure or an area-integrated scope), and with respect to role of the contractors in the planning process (i.e., either an reactive role of testing proposed plans or a more active participation in developing plans and proposals). In all cases important time gains were achieved even though the preparation of an early contractor involvement approach required a considerable effort. Even in the case of a fairly late involvement of contractors into the project study phase, still considerable time gains (of e.g. 11 months) have been achieved. Although an early involvement provides contractors with the best opportunities to bring in their solutions, the market parties remain tied to the traditional sequence of procedures, which take much time. Although both the parallelization and the interweaving approach resulted in time gains and project control, the case studies also made clear that for achieving innovation, just parallelization alone is not enough. Parallelization may provide some potential for enhancing project control (time, cost, quality issues) over the projects life-cycle, by giving market parties the possibility to evaluate the (governmental) project plans. However, an interweaving approach provides more room for enhancing project control, as the Route Decision can be based on a committed bid by the market party that provides the best price/quality ratio. Moreover, to achieve innovation it is essential that contractors are involved at an

early stage in a competitive planning procedure, which offers them possibilities to develop project proposals including aspects regarding technical design and environmental mitigation measures.

In conclusion, some first practical experiences with parallelization and interweaving indicate that an early market involvement may well result in time gains regarding the total infrastructure planning process and may also lead to a better project control with respect to time, cost and (technical) quality aspects. Moreover, there are some signs that a more integrated process, such as interweaving, leads to more innovativeness, which may benefit the overall quality of the planning process and potentially also the resulting quality of the (to be) constructed infrastructure.

6. Conclusions

Infrastructure projects worldwide deal with time and cost overruns and often the resulting quality of planning proposals is considered to be poor. Moreover, many projects have been halted because of negative court cases. This is also the case in the Netherlands. These problems are caused amongst other things by the increasing scarcity of space, the complex environmental issues, and the huge (local) public resistance against new infrastructure (e.g., NIMBY effects). The traditional planning strategies, which involve an extensive, phased planning process in order to 'hedge' the risks, clearly do not work efficiently within this complex reality. More flexible planning approaches that pro-actively take into account opinions and (innovative) ideas of different relevant actors that incorporate spatial opportunities and constraints, and are more flexible with regard to time, may be better able to cope with the complex reality. This may result into a faster infrastructure planning process and into more innovative and higher quality end products. In this paper, we looked for more flexible approach with regard to time. More specifically, our objective was to explore the potential of a life-cycle approach to relief (some of the) the current problems in the Dutch road infrastructure planning.

Basically, the infrastructure planning in the Netherlands can be subdivided into four phases of the MIT-process: the reconnaissance phase, the project study phase, the realisation phase, and the operation phase. Traditionally, the government and other public institutions focus their attention to the first two phases: they focus on plan-making, often without paying much attention to the actual realisation and operation phase, as recently shown in the report of the Elverding Committee. In contrast, contractors/market parties are the ones that build and maintain the infrastructure, but are hardly involved in the planning process itself. Life-cycle integration aims on the one hand at involving public institutions also into the construction and operational phase (i.e., forward integration). This has already proven to lead to better plan making. On the other hand, contractors/market parties and other private actors may participate more actively in the plan making phases: the backward integration. The 'market' may show government parties (at all levels) that the application of successful management techniques from the private sector may reduce costs and time. Moreover, by involving important private actors into the process, also the view of end-users can be included in a better way into plan-making. This may lead to higher quality end results.

Although, conceptually promising, a full backward integration, linking all the different planning stages, has not yet been applied in practice. However, practical experience has

been gained with some more limited forms of early market involvement, in which the tender procedure is combined with the route determination/EIA procedure, i.e. the integration of the construction and plan-making phase (e.g., interweaving). Within these projects considerable time gains were achieved as well as increased quality control. Market scans and market consultations could be useful instruments in the early phases to make the added value of interweaving clear and increase its effectiveness. These results are promising and may opt for taking further steps towards of a full backward integration, that additionally links the operational phase to the construction phase (e.g., using the knowledge about maintenance to develop better maintainable roads), both these phases to the project plan-making, and that links the project plan-making to the policy-making (e.g. using the knowledge from 'practice' to formulate effective policy).

Although the life-cycle approach, especially the backward integration, seems to be promising for relieving some of the shortcomings in Dutch road infrastructure planning, still issues remain open and ask for further research. In lack of practical evidence about the effects of a full life cycle integration, it remains impossible to say whether a full integration will lead to more savings and to higher quality products compared to less fully integrated approaches, such as those described in section 5 (e.g., interweaving). A more complete integration, of course, has the advantage that the expertise of different (market) parties can be used in all phases from agenda setting via planning all the way to the operational phase. However, this may also complicate the earlier phases, since they get more 'crowded' with potentially conflicting ideas and interests, which may slow down the process. In addition, to come to a well-working full life-cycle approach, also legal aspects have to be worked out into more detail, for instance with regard to division of responsibilities (and risks) in the different stages. Furthermore, it has to be studied whether and under which conditions different (market) parties want to take part, and how much freedom governments should give them. Further research, therefore, should focus both on legal/judicial aspects as well as on gaining insight into the demands, wishes and ideas of different involved actors (market parties, public institutions, etc.). Such insights may lead to the development of practical forms of life-cycle integration that are supported by important parties involved in the planning process. Pilot studies should then assess if and to what extent such 'new' approaches improve the current infrastructure planning.

7. References

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