



Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

BEST4ROAD

Competence Profiles and Transition Processes

Deliverable Nr 4.4

June 2017

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Project Nr. 850767

Project acronym:

BEST4ROAD

Project title:

Best Practice Guidelines for Procurement of Road Maintenance

Deliverable Nr 4.4 – Competence Profiles and Transition Processes

Due date of deliverable: 31.12.2016

Actual submission date: 30.06.2017

Start date of project: 01.06.2015

End date of project: 31.05.2017

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Version: Final

Executive summary

This work package identifies the appropriate competences which are needed to develop, implement and transition between different maintenance procurement strategies (as identified in WP2). Additionally, this work package draws out lessons learnt regarding knowledge development, capture and transfer as key activities for NRAs to develop and hone a range of maintenance procurement competences. This work package builds on a systematic analysis of primary (interviews; workshop) and secondary/tertiary datasets (reports, presentations, policy briefings) to draw out contractual, relational and technical competences for NRAs. Detailed competence profiles are developed across the different maintenance procurement strategies to further guide NRAs. Lastly, three observed transition processes between procurement strategies are described in detail to support NRAs' strategic development of procurement strategies.

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1 Introduction

The trans-national research programme “**Call 2014: Asset Management and Maintenance**” was launched by the Conference of European Directors of Roads (CEDR). CEDR is an organisation which brings together the road directors of 25 European countries. The aim of CEDR is to contribute to the development of road engineering as part of an integrated transport system under the social, economic and environmental aspects of sustainability and to promote co-operation between the National Road Administrations (NRA).

The participating NRAs in this Call are Belgium-Flanders, Finland, Germany, Ireland, Norway, the Netherlands, Sweden, United Kingdom and Austria. As in previous collaborative research programmes, the participating members have established a Programme Executive Board (PEB) made up of experts in the topics to be covered. The research budget is jointly provided by the NRAs who provide participants to the PEB as listed above.

BEST4ROAD is a two years project aiming at the development of best practice guidelines and tools for the efficient procurement of road maintenance in a changing world. Based on a comprehensive and integrative framework for maintenance procurement, the project will bring together the extensive, yet scattered procurement knowledge and experiences at National Road Authorities (NRAs) in 9 countries including the US and Australia. It will determine the lessons learnt at the NRAs and based on that will develop a number of hands-on tools and step-by-step guidance for procuring road maintenance taking current and future challenges of NRAs into account.

The benefit of the BEST4ROAD project for NRAs lies in the integration of an in-depth study and comparison of maintenance procurement practices in different countries with the development of tools and guidelines that can be easily implemented and used at NRAs. This will allow NRAs to learn from their peers and at the same time improve their maintenance procurement practices to get prepared for future challenges such as staff turnover and shrinking budgets.

The BEST4ROAD project consists of seven work packages (WP):

WP1 – Comparison of maintenance procurement practices

WP2 – Maintenance procurement strategies and maintenance efficiency

WP3 – Quick scan method for risk in maintenance procurement

WP4 – Competence profiles and transition processes

WP5 – Best practice guidelines

WP6 – Dissemination and demonstration

WP7 – Project management

The main objective of WP4 is to identify competence profiles that are needed to implement different maintenance procurement strategies and describe transition processes NRAs should follow when changing their procurement strategies.

This report presents the maintenance procurement competences that are vital for NRAs to work with internal and external stakeholders in achieving good value for money (Vfm). With wider market and policy changes, procurement competences – contractual, relational and technical – are important to ensure that the agencies can deliver their asset maintenance tasks and activities effectively and efficiently. The move towards procuring more integrated solutions (bundles of products and services) linked to quite often complex performance outcomes (i.e. trouble-free use of assets) confronts public buying organisations (i.e. the agencies) with the challenge of developing and implementing new procurement strategies and build up and hone associated skills and capabilities (hereafter referred to as competences).

2 Competences needed for the procurement of road maintenance

The three types of competences – contractual, relational and technical - need to be in place in order to equip agencies with the right skillset and knowledge to perform productive activities and daily operational routines as well as possessing a strategic ability to integrate, build and reconfigure skills and knowledge to address changes in the wider market and policy environments. A competence is the ability of an organisation to perform coordinated activities utilising resources to achieve a goal and to purposefully create, extend or modify its resource base (note: resources refer to both tangible entities such as raw materials or equipment and intangible entities such as tacit knowledge and skills which can be embodied by employees). As such, it refers to the ability to deploy resources or transfer input into desirable outputs. These competences are the result of the co-evolution of tacit knowledge accumulated through learning-by-doing and embedded in an organisation's set of routines, and explicit knowledge articulated and codified via formal processes (e.g. internal learning database).

2.1 Contractual competences

Broadly speaking, contractual capabilities and competences are vital in order to write, negotiate, evaluate, monitor and enforce contracts. More specifically, they refer to the recognition of the contingencies associated with procuring maintenance tasks and activities and their (performance) implications for the efficiency and effectiveness of the maintenance service delivery. Contractual competences are vital in relationships between public buyers and suppliers which are quite often characterised as principal-agent relationships. In other words, these relationships are characterised when one entity (the "agent"; e.g. supplier) is able to make decisions on behalf of, or that impact, another entity: the "principal"; e.g. public buyer. In such situations, contractual (as well as relational) competences are needed to mitigate, for instance, conflicts of interests, information asymmetry or moral hazard risks (i.e. occurs when one organisation, e.g. supplier, takes more risks because another organisation, e.g. public buyer, bears the cost of those risks).

Organisations can structure contracts and protect relationships with suppliers against opportunism by relying upon legal rules, standards and remedies implied in the law. As such, contracts are important planning and incentivisation tools particularly for long-term business relationships as they form the legally enforceable instrument and control mechanisms. However, in practice it is rarely possible or desirable to draft complete contracts owing to the complex nature of the task, asymmetric information and associated costs. In such situations, organisations deploy incomplete contracts with an element of uncertainty that makes them unenforceable in their entirety. While contracts should exhibit some degree of flexibility to be better suited to deal with changes caused by environmental or endogenous contingencies, quite often organisations aim for contracts with a low degree of flexibility. It is therefore up to the contracting parties involved to decide how much of the *contract content and process specification* should be pre-determined up-front or negotiated during the contractual period - relational competences are vital in these situations to deal with changes and uncertainties. Moreover, it is vital to possess contractual competences to enforce and monitor contracts.

From the perspective of a National Road Agency, the following key competences need to be developed and deployed to become contractually competent:

- *Monitoring and surveillance skills* – ability to effectively and efficiently monitor maintenance activities and evaluate maintenance contractors based on contractual targets and measures. This includes competences to potential intervene when poor performance is detected and ensure countermeasures can

be administered.

- *Contract coordination skills* – ability to ensure that activities within a contract and across a range of contracts are effectively and efficiently coordinated to minimise service disruptions and user hindrance.
- *Understanding contract documents* – to be able to read and understand specific contract terms and clauses and their impact on the procurement cycle, maintenance activities and contractor behaviour.
- *Procurement knowledge* – full understanding of all procurement phases and procurement needs for road maintenance. This particularly includes preparation of tenders and selection of contractors.
- *Commercial knowledge* – refers to the general knowledge of maintenance as business, the individual's/team's business experience and specifically the understanding of the industry in which the organisation operates.
- *Quality management skills* – act of overseeing all maintenance activities and tasks needed to attain a desired level of excellence. This may include the determination of a quality policy, creating and implementing quality planning and assurance, and quality control and quality improvement.
- *Safety management skills* – ability to ensure that all safety risks have been identified, assessed and satisfactorily mitigated.

2.2 Relational competences

Relational competences are important to build and maintain inter-personal and inter-organisational trust and foster learning within and across organisational boundaries. They refer to the application of socially complex routines, procedures and policies in relationships to drive problem-solving and information exchange. Organisations need to invest in relationship-specific assets, exchange knowledge with each other, combine complementary and scarce resources and effectively govern relationships.

Contractual competences are complemented with relational competences to prevent conflicts and adversarial behaviour and to promote problem-solving and information exchange. Relational competences are vital to effectively and efficiently procure maintenance services and deal with wider market and policy changes. Moreover, without appropriate relational competences, organisations would not be able to co-create value with their various stakeholders (working in a close relationship) when delivering and managing these.

From the perspective of a National Road Agency, the following competences need to be developed and deployed to become relationally competent:

- *Communication skills* – ability to convey information to maintenance contractors effectively and efficiently. This may include good verbal, non-verbal and written communication skills which facilitate the sharing of relevant information between people within the NRA and across NRA and contractors for mutual benefit.
- *Negotiation skills* – ability to settle and/or bridge differences between individuals of NRAs and contractors. It is a process by which compromise or agreement is reached while avoiding argument and dispute. Negotiation skills are not only vital during contract negotiations but also to exhibit proper relationship management abilities.
- *Stakeholder management skills* – ability to effectively and efficiently identify and manage a range of key stakeholders. This includes skills such as understanding a particular stakeholder's need and desire and how it can be satisfied.

- *Understanding of roles and responsibilities* – relates to the specifics of a job role and/or task in road maintenance. This includes a clear understanding of who is responsible for which maintenance task and when.
- *Human resource management skills* – include wider competences with regards to the governance of a NRA's employees. This may include activities around creating, implementing and/or overseeing policies governing employee behaviour within a NRA and when interacting with other businesses.

2.3 Technical competences

In order to build up relational and contractual competences, technical competences related to the various assets and maintenance services are needed in order to, for instance, write tendering documents, evaluate bids, negotiate and monitor contracts. Please see a more complete list of assets, tasks and activities in deliverable 1.1 (WP1). These competences are also vital in engaging with an agency's customers and suppliers in strategic pre-bid activities, preparing proposals or managing strategic partnerships with customers and suppliers. Moreover, technical competences also help to manage the asset life-cycle including the procurement of relevant maintenance services.

From the perspective of a National Road Agency the following competences need to be developed and deployed to become technically competent:

- *Understanding of asset condition data* – ability to extract information for performance evaluation and maintenance planning from data on asset conditions (e.g. pavement roughness).
- *Understanding of asset performance and system behaviour* - ability to assess and predict the performance of single road assets, road links and road networks for maintenance planning.
- *Understanding of maintenance techniques and technologies* – ability to evaluate maintenance technologies and techniques and technology based on their costs and benefits.
- *Understanding of durations and costs of maintenance activities* – ability to evaluate durations and costs across different maintenance activities and assets for maintenance planning.
- *Maintenance planning and programming skills* - ability to determine maintenance activities based on asset condition and performance, to develop maintenance plans for single road assets, and to establish maintenance programs for road networks.
- *Understanding of technical peculiarities of local networks* – insights into regional network characteristics which may impact maintenance tasks and activities.
- *Engineering knowledge of unique structures* – understanding of engineering objects that are unique in terms of structural and/or material characteristics.

3 Knowledge capture and transfer

Underlying the importance of knowledge capture and transfer is the view that competitive environments no longer involve stable incremental change but complex processes of discontinuous change. A key goal for firms is to shift from an essentially static approach to learning, based on information acquisition, towards a greater emphasis on information interpretation and transfer (across levels). Capturing knowledge and ensuring a transfer and exchange of knowledge across internal and external stakeholders is vital for agencies to develop the range of maintenance procurement competences identified above.

Knowledge capture and transfer needs to be a deliberate cognitive effort and investment to improve an organisation's routines and activities. Contractual, relational and technical competence development is specifically supported by experiences gained when procuring road maintenance tasks and activities. However, agencies need to ensure capturing lessons learnt in an effective way. Moreover, these lessons learnt need then to be transferred to key internal and external stakeholders to ensure that good/best practice is shared across the network of suppliers, driving improvements in terms of efficiency and effectiveness. For instance, in order to co-create value (e.g. between an agency and its suppliers), partners (including, for example, buyers and suppliers) need to pool their knowledge (e.g. with regards to specific assets, relationship management or contracts), develop a common understanding of their roles and responsibilities in order to drive value for money and engage in joint problem-solving. Market dialogues and/or alliancing as well as managing together certain risks is vital to further drive value for money considerations.

Clearly there are potential benefits in the regular use of external organisations who are likely to have different knowledge bases. The degree to which mutual organisational learning will occur in partnering situations will, however, be influenced by a number of factors. These partly relate to the objectives of each partner and partly to the type of knowledge which is potentially being transferred. These factors are in turn affected by the nature of intra- and inter-organisational communications and organisational culture. It is important to note that knowledge transfer happens between different levels – individuals, teams, departments, organisations, networks – and from within and outside the organisation. Knowledge capture and transfer routines and processes can also be specified in contracts. This may help to align the motivations of a contractor with the agencies motivations in developing good/best practice knowledge. Knowledge capture and creation can be further supported by, for instance, top management support, interdepartmental/inter-team cooperation, IT applications and by installing knowledge champions (responsible for managing and renewing particular areas of knowledge).

The transferability of knowledge between organisations and individuals is shaped by two important parameters, the degree to which it can be codified (e.g. in a contract) – structured according to a set of easily communicated identifiable rules – and its complexity. Knowledge that is readily codifiable and simple is more easily transferred than knowledge that is more embedded in the organising principles by which people work and co-operate within organisations. Successfully transferring more complex embedded forms of knowledge between or within firms is most effective in a longer-term relationship since these are more likely to promote the emergence of a shared coding scheme.

The mere existence of a partnering relationship is not in itself sufficient – firms need to be able to recognise the value of knowledge and apply it strategically. In particular, the quality of information transfer may lead to new or more broadly based organisational learning. This suggests that the internal and external communication structures of an organisation will be an important influence. The presence of “champions” – central figures helping to nurture and implement the partnering process – may well be crucial in promoting and distributing an “organisational memory” of the lessons learned from partnering experiences. In larger organisations one of the challenges in information transfer is to develop awareness of where information could actively serve different functional units. Knowledge capturing and transfer

and thus competence levels are influenced by various factors such as:

- *Experience*: this is simply measured in months in an employee category. Planned enhancements will modify this to include range of projects undertaken.
- *Quality of experience*: the 'experience months' can be adjusted by a factor depending on proportion 'good learning projects'.
- *Meeting days*: the time spent, under the direction of a senior partner or director, in formal project 'knowledge sharing'.
- *Recruit 'quality' factor*: The raw competency of a novice consultant/employee.
- *Pace of change*: This variable drives the redundancy of competency level and depends on the pace of development within the evaluated industry.

4 Competence profiles for identified procurement strategies

This section outlines the key competences – contractual, relational and technical – needed across the three procurement strategies identified and described in more detail in WP2. The competence profiles outlined in Table 1 are supported by primary data collection (e.g. interviews, Delft workshop) and secondary/tertiary data collection (e.g. government reports, agency reports, practitioner and academic papers) and analysis (a more detailed table can be found in Appendix A). While the set of contractual, relational and technical competences described in more detail in section 2 are important, each procurement strategy positions a different emphasis across these competences. In other words, depending on the NRAs' adopted procurement strategy, certain competences need more emphasis and hence development than others. The detailed competences across the different procurement strategies are detailed in Table 1. Table 1 first draws attention to the key competences needed across the three procurement strategies, before presenting the required competences by ranking them in order of importance (i.e. from 1 – being the most important one and the last one, being the least important one).

Tables 1 Procurement strategies and competences

Procurement Strategy	Strategy B	Strategy C	Strategy D
Brief description	<p><i>Single maintenance tasks</i> are bought from separate contractors.</p> <p><i>All asset management tasks and single maintenance tasks are done in-house.</i></p>	<p><i>Single and integrated maintenance tasks</i> are bought from separate contractors.</p> <p><i>All asset management tasks</i> are done in-house.</p>	<p><i>Single asset management tasks and all maintenance tasks (single or integrated)</i> are bought from separate contractors.</p> <p><i>Single asset management tasks</i> are done in-house.</p>
Contractual competences	<p>Medium; contract negotiation, monitoring and surveillance competences; importance of contract coordination skills; quality and safety management skills needed; deep understanding of procurement knowledge</p>	<p>Medium to high; contract negotiation, monitoring and surveillance competences needed, contract coordination skills, writing clear contract negotiations</p>	<p>High; extensive contract negotiation, monitoring and surveillance competences; writing clear contract specifications across maintenance activities/task and assets; good understanding of procurement and commercial knowledge</p>
	<p>Ranking:</p> <ul style="list-style-type: none"> • <i>Contract coordination skills (1)</i> • <i>Monitoring and surveillance skills (2)</i> • <i>Quality management skills (3)</i> • <i>Safety management skills (4)</i> • <i>Understanding contract documents (5)</i> • <i>Procurement knowledge (6)</i> • <i>Commercial knowledge (7)</i> 	<p>Ranking:</p> <ul style="list-style-type: none"> • <i>Monitoring and surveillance skills (1)</i> • <i>Procurement knowledge (2)</i> • <i>Understanding contract documents (3)</i> • <i>Safety management skills (4)</i> • <i>Quality management skills (5)</i> • <i>Contract coordination skills (6)</i> • <i>Commercial knowledge (7)</i> 	<p>Ranking:</p> <ul style="list-style-type: none"> • <i>Procurement knowledge (1)</i> • <i>Understanding contract documents (2)</i> • <i>Commercial knowledge (3)</i> • <i>Monitoring and surveillance skills (4)</i> • <i>Quality management skills (5)</i> • <i>Safety management skills (6)</i> • <i>Contract coordination skills (7)</i>

Procurement Strategy	Strategy B	Strategy C	Strategy D
Relational competences	<p>Medium; communication and relationship management competences needed to coordinate multiple firms; drive certain supplier behaviour to avoid principal-agent problem (e.g. shirking, opportunistic behaviour)</p> <p>Ranking:</p> <ul style="list-style-type: none"> • <i>Communication skills (1)</i> • <i>Stakeholder management skills (2)</i> • <i>Negotiation skills (3)</i> • <i>Human resource management skills (4)</i> • <i>Understanding of roles and responsibilities (5)</i> 	<p>Medium; communication and relationship management competences needed; managing (potentially close) relationships; drive supplier behaviour; stakeholder management skills</p> <p>Ranking:</p> <ul style="list-style-type: none"> • <i>Communication skills (1)</i> • <i>Negotiation skills (2)</i> • <i>Understanding of roles and responsibilities (3)</i> • <i>Stakeholder management skills (4)</i> • <i>Human resource management skills (5)</i> 	<p>High; deep communication and relationship management competences needed; clear understanding of roles and responsibilities; strong communication and negotiation skills; strong abilities to drive supplier behaviour</p> <p>Ranking:</p> <ul style="list-style-type: none"> • <i>Negotiation skills (1)</i> • <i>Stakeholder management skills (2)</i> • <i>Understanding of roles and responsibilities (3)</i> • <i>Communication skills (4)</i> • <i>Human resource management skills (5)</i>
Technical competences	<p>High; technical competences needed to evaluate work and costs; understanding technical peculiarities of network (incl. weather conditions); deep maintenance planning and programming; deep understanding of maintenance techniques and technologies</p> <p>Ranking:</p> <ul style="list-style-type: none"> • <i>Understanding of durations and costs of maintenance activities (1)</i> • <i>Maintenance planning and programming skills (2)</i> • <i>Understanding of asset condition data</i> 	<p>Medium; understanding of asset condition data, duration and costs of maintenance activities, ability to evaluate work and costs; understanding technical peculiarities of network</p> <p>Ranking:</p> <ul style="list-style-type: none"> • <i>Maintenance planning and programming skills (1)</i> • <i>Understanding of asset condition data (2)</i> • <i>Understanding of asset performance and system behaviour</i> 	<p>Medium; understanding of asset performance and system behaviour; more expert knowledge able to abstract “functional requirements” instead of thinking in terms of technical specifications</p> <p>Ranking:</p> <ul style="list-style-type: none"> • <i>Maintenance planning and programming skills (1)</i> • <i>Understanding of asset performance and system behaviour (2)</i> • <i>Understanding of asset condition data</i>

Procurement Strategy	Strategy B	Strategy C	Strategy D
	<p>(3)</p> <ul style="list-style-type: none"> • <i>Understanding of asset performance and system behaviour (4)</i> • <i>Engineering knowledge of unique structures (5)</i> • <i>Understanding of technical peculiarities of local networks (6)</i> • <i>Understanding of maintenance techniques and technologies (7)</i> 	<p><i>system behaviour (3)</i></p> <ul style="list-style-type: none"> • <i>Understanding of durations and costs of maintenance activities (4)</i> • <i>Understanding of technical peculiarities of local networks (5)</i> • <i>Understanding of maintenance techniques and technologies (6)</i> • <i>Engineering knowledge of unique structures (7)</i> 	<p>(3)</p> <ul style="list-style-type: none"> • <i>Understanding of durations and costs of maintenance activities (4)</i> • <i>Understanding of technical peculiarities of local networks (5)</i> • <i>Understanding of maintenance techniques and technologies (6)</i> • <i>Engineering knowledge of unique structures (7)</i>

5 Transition processes for changing procurement strategies

National Road Agencies have to especially pay attention to the transition from one procurement strategy to another. The following paragraphs describe key considerations with regards to competences when transitioning from: (i) Strategy B to Strategy C; (ii) Strategy C to Strategy D; and (iii) Strategy D to Strategy C.

Based on our extensive research, we found multiple rationales for these changes, but most often these transitions were driven by national policy from government, a strong belief to achieve cost savings and supported by opinion leaders (internal and/or external to the NRA). Transition processes are often slow changes happening over several years to develop and hone relevant competences, change internal NRA structures and conduct a detailed market consultation to ensure that the wider market „is ready for the transition“ too.

Overall, we observed that all three types of competences – contractual, relational and technical – are needed for the transition process, but that certain competences are more salient for certain transition processes. For instance, for some transitions NRAs need to be able to move from more prescriptive effort-based contracts to performance-based contracts. With regards to knowledge management issues experienced during and after transition processes, various challenges were identified. For example, aiming at reducing resistance of the organisation and the technical personnel (which quite often was significantly reduced in number and status) is vital for NRAs to avoid knowledge and competence loss (e.g. by technical experts leaving the NRA).

Please find below a more detailed description of the identified transitions based on our research (for a detailed description of each strategy please refer to WP2).

5.1 From Strategy B to Strategy C

A transition from procurement strategy B to C includes a move from procuring single maintenance tasks from multiple contractors to procuring integrated maintenance tasks from a single contractor. While strategy C is characterised by NRAs outsourcing single maintenance tasks to suppliers, NRAs retain all asset management tasks in-house for both strategies. Performance specifications move from being task related to asset related and performance monitoring is less frequent after the transition. The transition is also accompanied by a change in payment mechanisms from unit price to lump-sum and contracts with longer contract durations. NRAs need to not only evaluate tenders based on price but also further quality criteria when transitioning from procurement strategy B to C. The transition is characterised by an increasing need to develop deeper contractual competences such as monitoring and surveillance and contract negotiation. Communication and relationship management skills are also vital for this transition to be successful as potentially closer relationships need to be managed and to drive certain supplier behaviours. With this transition, technical skills are important to understand, for instance, asset condition data, duration and cost of maintenance activities.

An example for this transition is the outsourcing of winter maintenance tasks from in-house to integrated 3rd party contracts in all Scandinavian countries. The main driver for this transition has been the further reduction of the number of state employees and to achieve further cost savings. In the past, all investigated Scandinavian countries had strong central administration, knowledge existed both at a country's central organisation, in regions and was embodied in the operational workforce. After staff reductions and high degrees of outsourcing were realised, also asset management activities delivered by the NRA in the past are now provided by external consultants (e.g. to manage winter maintenance contracts, including for instance, QA, contract development, planning and programming tasks). In this regard, the NRAs moved further to strategy D.

5.2 From Strategy C to Strategy D

A transition from procurement strategy C to D includes a move from procuring only maintenance tasks from contractors to procuring maintenance tasks combined with asset management tasks from contractors. After the transition, NRAs retain single asset management tasks in-house. Performance specifications move from being asset related to service related and performance monitoring is indirect and frequent rather than direct and infrequent. The transition is also accompanied by a change in payment mechanisms to cost plus fee and long-term contract durations. Tenders are evaluated based on quality, cost and wider value for money criteria. The transition is characterised by an increasing need to develop even deeper contractual competences such as procurement knowledge and commercial knowledge. Very strong communication and relationship management skills are also vital for this transition to be successful as closer and longer relationships with key stakeholders need to be managed and certain supplier behaviour needs to be induced over a long contract period. With this transition, technical skills are important to understand, for instance, asset condition data, duration and cost of maintenance activities.

An example for this transition is the implementation of the Integrated Service Arrangements (ISA) in Australia. ISA is a relationship-based contract that includes the co-location of systems and people from public and private sector, a non-adversarial, collaborative decision-making approach, an open-book approach, development and retaining of core knowledge and skills, and the support for investment in innovation. Under this contract public and private parties are working as team to deliver not only all maintenance work (including capital work) but also all operation asset management tasks. Relational competences became very essential under the ISA but this contract also indicates the importance of contractual competences. The developed key performance indicators particularly used at the beginning of the contract were not sufficiently challenging to drive contractor performance and reward performance improvement. In terms of technical competences, the transition towards ISA was particularly meant to bring back knowledge on condition and performance of the network that was lost with the previous contract generation.

5.3 From Strategy D to Strategy C

A transition from procurement strategy D to C includes a move back from procuring all maintenance tasks and single asset management tasks to only procuring single and integrated maintenance tasks from contractors. After the transition, NRAs retain all asset management tasks in-house. Performance specifications move from being service related to asset related and performance monitoring is direct and infrequent rather than indirect and frequent. The transition is also accompanied by a change in payment mechanisms to lump-sum and shorter contract durations. Tenders are evaluated based on required quality and price criteria. The transition is characterised by core contractual competences such as monitoring and surveillance, contract coordination and extensive contract negotiation skills. Communication and relationship management skills are still important for this transition to be successful, but NRAs will have to manage slightly shorter (and potentially more) relationships with key stakeholders. With this transition, a deeper understanding of core technical skills becomes more important to understand, for instance, asset condition data, duration and cost of maintenance activities.

This transition is often accompanied by a need to (re-) develop strong technical knowledge in-house. Some investigated NRAs mentioned that knowledge development is becoming more risk-driven and focuses on functions at strategic levels and their performance within networks. Missing knowledge at more operational levels are often not obvious at first sight as a number of NRAs often deploy externally hired technical knowledge. Our research showed that certain transition processes may lead to decreased in-house knowledge. Different NRAs pointed out some positive effects of this development („We used to develop a lot of new knowledge, maybe too much.“), however the transition between procurement strategies (and inherent changes in competences and knowledge levels) has been often described as being to abrupt

and „hollowed out“ (loss of staff, competences and knowledge) NRAs too quickly. NRAs felt that they „do not need to know all the exact technical details“, but that NRAs would need to be able to intelligently engage with contractors (e.g. understand and evaluate proposed new solutions for maintenance activities). Resources which are freed up by not focusing on building up in-house knowledge could then be focused on other activities. However, quite often have transitions been accompanied by a (high) degree of staff loss and resources are lost rather than being redeployed in other areas.

Contractual and relational competences at NRAs are vital to support contractors to drive innovation. Also, when there is limited technical know-how the principal (NRAs) will struggle to drive innovations. Sometimes contracts are not specified well enough (to allow for innovation) and in these instances contractors may use these contractual shortcomings to their own advantage, e.g. supplying a cheaper material than NRAs expected but did not specify. Differences in knowledge levels between NRAs (the principal) and their contractors (the agent) quite often lead to (task, process, relational) conflicts and lengthy/costly (re-) negotiations/discussions. To counteract these issues, NRAs may consider implementing innovative monitoring systems which require knowledge on how to interpret the data and translate it at operational and strategic levels.

Overall, our research points towards some key observations to mitigate and/or counterbalance some negative effects inherent in these transition processes. It is important to consider valuing other factors apart from cost/price to ensure that transitions are successful, requiring foremost a detailed knowledge and strong competences (contractual, relational and technical). The entire innovation process is based on the evaluation, appreciation and acceptance of new techniques, hence further emphasising the need for different types of competences and knowledge retention is crucial. Sharing knowledge between different NRA units/regions is vital to create „pockets of knowledge“. For instance, making certain people responsible for a particular type of knowledge and have them operate in different municipalities will help to spread lessons learnt and offer evaluations in different regional settings. Integrating external parties (e.g. contractors) will further help to not only develop but also share knowledge. Lastly, NRAs need to establish a clear strategic vision about issues such as: what is their role in the market, what level of knowledge is needed, and how can partners jointly (NRAs and external partners) develop shared knowledge to drive performance of maintenance activities.

6 Conclusions

Maintenance procurement competences are vital for National Road Agencies (NRAs) to work with internal and external stakeholders in achieving good value for money (Vfm). With wider market and policy changes, procurement competences are important to ensure that the Agencies can deliver their asset maintenance tasks and activities effectively and efficiently. The move towards procuring more integrated solutions (bundles of products and services) linked to quite often complex performance outcomes (i.e. trouble-free use of assets) confronts public buying organisations (i.e. the Agencies) with the challenge of developing and implementing new procurement strategies and build up and hone associated skills and capabilities.

This work package identified the appropriate competences which are needed to develop and implement different maintenance procurement strategies (as identified in WP2). Contractual competences are vital in order to write, negotiate, evaluate, monitor and enforce contracts. More specifically, they refer to the recognition of the contingencies associated with procuring maintenance tasks and activities and their (performance) implications for the efficiency and effectiveness of the maintenance service delivery. Relational competences are important to build and maintain inter-personal and inter-organisational trust and foster learning within and across organisational boundaries. They refer to the application of socially complex routines, procedures and policies in relationships to drive problem-solving and information exchange. Organisations need to invest in relationship-specific assets, exchange knowledge with each other, combine complementary and scarce resources and effectively govern relationships. In order to build up relational and contractual competences, technical competences related to the various assets and maintenance services are needed in order to, for instance, write tendering documents, evaluate bids, negotiate and monitor contracts. These competences are also vital in engaging with an agency's customers and suppliers in strategic pre-bid activities, preparing proposals or managing strategic partnerships with customers and suppliers. Moreover, technical competences also help to manage the asset life-cycle including the procurement of relevant maintenance services.

The work package also drew out lessons learnt regarding knowledge development, capture and transfer as key activities for NRAs to develop and hone a range of maintenance procurement competences. Underlying the importance of knowledge development is the view that competitive environments no longer involve stable incremental change but complex processes of discontinuous change. A key goal for organisations is to shift from an essentially static approach to learning, based on information acquisition, towards a greater emphasis on information interpretation and transfer (across levels). Capturing knowledge and ensuring a transfer and exchange of knowledge across internal and external stakeholders is vital for agencies to develop the range of maintenance procurement competences identified above. Lastly, core contractual, relational and technical competences are discussed across the three procurement strategies (which are identified and described in more detail in WP2). The research found that while the set of contractual, relational and technical competences are important, each procurement strategy positions a different emphasis across these competences. In other words, depending on the NRAs' adopted procurement strategy, certain competences need more emphasis and hence development than others. This report concludes with a description of transition processes between procurement strategies (and their implications with regards to different competence profiles) relevant for NRAs to realise innovation and high performance when procuring maintenance activities.

Appendix

This appendix includes a detailed table showing key contractual, relational and technical competences needed across key procurement strategy dimensions.

Table 2 Procurement strategies and competences (in detail)

Procurement Strategy	Strategy B	Strategy C	Strategy D
Brief description	<i>Single maintenance tasks (e.g. winter maintenance, pavement renewal) are bought from separate contractors</i>	<i>Integrated maintenance tasks are bought from a single contractor</i>	<i>Single asset management tasks and all maintenance tasks are bought from separate contractors</i>
Outsourced activities	<p><u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed; quality and safety management skills needed</p> <p><u>Relational competences:</u> Medium; communication and relationship management competences needed to coordination multiple firms</p> <p><u>Technical competences:</u> High; technical competences needed to evaluate work and costs; understanding technical peculiarities of network</p>	<p><u>Contractual competences:</u> Medium; e.g. contract negotiation, monitoring and surveillance competences needed</p> <p><u>Relational competences:</u> Medium; communication and relationship management competences needed; managing one (close) relationship</p> <p><u>Technical competences:</u> Low; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>	<p><u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed</p> <p><u>Relational competences:</u> High; communication and relationship management competences needed; clear understanding of roles and responsibilities</p> <p><u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>
In-house activities	<u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed	<u>Contractual competences:</u> Medium; e.g. contract negotiation, monitoring and surveillance competences needed	<u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed <u>Relational competences:</u> Medium;

Procurement Strategy	Strategy B	Strategy C	Strategy D
	<p><u>Relational competences:</u> Low to medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> High; technical competences needed to evaluate work and costs; understanding technical peculiarities of network; maintenance planning and programming</p>	<p><u>Relational competences:</u> Medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>	<p>communication and relationship management competences needed</p> <p><u>Technical competences:</u> Low to medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>
Performance specification	<p><u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; writing precise contracts; contract coordination skills needed</p> <p><u>Relational competences:</u> Low to medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> High; technical competences needed to evaluate work and costs; understanding technical peculiarities of network and maintenance techniques/technology; engineering knowledge for particular/unique structures</p>	<p><u>Contractual competences:</u> Medium to high; e.g. contract negotiation, monitoring and surveillance competences needed</p> <p><u>Relational competences:</u> Medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>	<p><u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed</p> <p><u>Relational competences:</u> Medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> Low-medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities); understanding of asset performance and system behaviour</p>

Procurement Strategy	Strategy B	Strategy C	Strategy D
Performance monitoring	<p><u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed</p> <p><u>Relational competences:</u> Low to medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> High; technical competences needed to evaluate work and costs; understanding technical peculiarities of network (including weather conditions)</p>	<p><u>Contractual competences:</u> Medium to high; e.g. contract negotiation, monitoring and surveillance competences needed</p> <p><u>Relational competences:</u> Medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>	<p><u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed</p> <p><u>Relational competences:</u> Medium; communication and relationship management competences needed</p> <p><u>Technical competences:</u> Low; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)</p>
Payment mechanisms	<p><u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed</p> <p><u>Relational competences:</u> None to low; drive certain supplier behaviour</p>	<p><u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed</p> <p><u>Relational competences:</u> None to low; drive certain supplier behaviour</p>	<p><u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed</p> <p><u>Relational competences:</u> High; communication and relationship management competences needed; clear understanding of roles and</p>

Procurement Strategy	Strategy B	Strategy C	Strategy D
	<u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)	<u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)	responsibilities <u>Technical competences:</u> High; technical competences needed to evaluate work and costs; understanding technical peculiarities of network; understanding of asset performance and system behaviour
Contract duration	<u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed	<u>Contractual competences:</u> Medium to high; e.g. contract negotiation, monitoring and surveillance competences needed; understanding of contractual incentives	<u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed; writing clear contract specifications (yet allow some contract flexibility)
	<u>Relational competences:</u> Low; limited communication and relationship management competences; drive certain supplier behaviour to avoid principle-agency problems (e.g. shirking, opportunistic behaviour)	<u>Relational competences:</u> Medium; communication and relationship management competences needed; drive certain supplier behaviour to avoid principle-agency problems (e.g. shirking, opportunistic behaviour)	<u>Relational competences:</u> High; communication, relationship and stakeholder management competences needed; clear understanding of roles and responsibilities
	<u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)	<u>Technical competences:</u> Low; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities)	<u>Technical competences:</u> Medium; some technical competences (e.g. understanding of asset condition data; duration and costs of maintenance activities; collecting and analysing data)

Procurement Strategy	Strategy B	Strategy C	Strategy D
Tender evaluation	<p><u>Contractual competences:</u> Low to medium; e.g. some contract negotiation and monitoring competences; contract coordination skills needed</p> <p><u>Relational competences:</u> None</p> <p><u>Technical competences:</u> Low to medium; some technical competences</p>	<p><u>Contractual competences:</u> Medium to high; e.g. contract negotiation, monitoring and surveillance competences needed; writing clear contract specifications (including contract incentives)</p> <p><u>Relational competences:</u> None</p> <p><u>Technical competences:</u> Medium; some technical competences</p>	<p><u>Contractual competences:</u> High; extensive contract negotiation, monitoring and surveillance competences needed; contract coordination skills needed; writing clear contract specifications (including contract incentives)</p> <p><u>Relational competences:</u> None</p> <p><u>Technical competences:</u> Medium; some technical competences</p>

