

CLIENT LEADERSHIP IN SUSTAINABILITY: HOW THE DUTCH RAILWAY AGENCY CREATED CO2 AWARENESS IN THE INDUSTRY

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Sustainability is high on the policy agenda of the public sector in many countries. Since the Copenhagen Conference, the Netherlands has been implementing policies to support the 20/2020 carbon dioxide reduction agenda. Sustainable procurement is now obligatory for all public clients. The standard approach is to develop criteria and measures to assess the sustainability of products or offers. These are then weighted in a “most economically advantageous tender” selection procedure. In the Netherlands, a wide array of criteria guides are being developed for several product groups and practitioners criticise the bureaucracy involved. Meanwhile, ProRail (the Dutch railway agency) has followed a different approach. They have developed a CO2 performance ladder comprising six steps. Contractors can have their CO2 emission awareness and reduction policies assessed and certified. The more conscious and consistently the contractor works on CO2 reduction, the higher the contractor climbs the CO2 ladder. This will provide the contractor with clear benefits in the tendering procedure: a fictitious mark-down of up to ten per cent in the bid price (an award advantage). Although only in use since December 2009 the effects of this CO2 ladder are remarkable. This paper documents the rapid adoption of this scheme, explores the strategy and the mechanics at work, and discusses the value and impact of the scheme in a context of client leadership.

Keywords: client leadership, procurement, sustainability.

INTRODUCTION

Since the Netherlands, along with many other nations, adopted the Kyoto protocol, the Dutch government has been developing a wide range of policies to reduce carbon dioxide emissions. This trend was reinforced in 2007 by the EU ambition to cut CO2 emissions by 20 per cent by 2020. One of the programmes put in to place is compulsory sustainable public sector procurement. National and local authorities have to assess the sustainability of offers and bids, and take this element into account in the selection and contract awarding procedure. Although CO2 emissions and carbon footprint issues are central to sustainable procurement, this paper does not concentrate primarily on sustainability issues. This paper homes in on the Dutch railway agency (ProRail) and looks at its ‘client leadership’ approach to driving sustainability in the construction industry.

In 2008, the central government embarked on a nationwide programme to encapsulate "sustainability" in criteria and objective measures (www.senternovem.nl): developing

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guidelines for several dozen product groups, with over twenty guidelines for building and construction alone. ProRail meanwhile adopted a different approach in developing an instrument called the "CO2 performance ladder" (CO2PL). While the national development of guidelines was slow and sparked debate and confusion; the CO2PL was adopted remarkably quickly. Its rapid diffusion has surprised many in the industry. What is behind this success? Is it the attractiveness of the instrument? Was it the way ProRail introduced the CO2PL? Or was it a fortunate combination of characteristics and circumstances? These are the questions that have shaped this paper.

First, we will look briefly at changes in the construction industry and the role and impact of clients and client leadership. Next the CO2PL method will be explained in detail: its background and history, key features and the way the CO2PL is mobilised in the procurement process. In the subsequent section, data are presented to document the rapid adoption of the CO2PL, and these data are interpreted from a client leadership viewpoint. The discussion ties in other factors that could be seen as relevant. Finally, conclusions are drawn and a direction for further investigation and study is proposed.

PUBLIC SECTOR PROCUREMENT AND CLIENT LEADERSHIP

Over the past two decades much has been written on innovation, change and reform in the construction industry. Following the Latham (1994) and Egan (1998) reports, many reform initiatives stress the importance of national reform programmes and of governments driving change. Recently a new CIB Task Group on Construction Reform was established (TG84). Many authors underline the need for industry to orientate itself towards users, clients and clients' requirements.

In our neo-liberal market economies, governments, international federations and institutes provide rules and regulations for market structure and market conduct. They aim to secure an open market, fair competition, anti-discrimination and so on (see also OECD and EU policies). Furthermore, in our western economies, public sector procurement amounts to a substantial part of GDP. Public clients are in general recurrent clients that can exert significant buying power. In some sectors, such as infrastructure and schools, public entities are dominant in terms of market volume. This strong market position can be utilised to 'guide' an industry in a desired direction. Latham's "constructing the team" (1994) recommends a government to commit itself to being a best-practice client. The Egan report (1998) hints at client leadership but does not use the precise term. In *Modernising Construction*, the National Audit Office (NAO 2001) relates public procurement to dynamics in the industry and the procurement conduct of public agencies. In *accelerating change* (DTI 2002) the term client leadership was explicitly used. Manley (2006) used the term client leadership in looking at Australian clients.

In the context of clients driving change, reference is made to Von Hippel's concept of "lead user" (von Hippel 1986). Although this concept has some similarities, the pragmatic connotations differ significantly from the general sense of client leadership. The first – lead user - refers to the category of users that first encounter or develop new needs or requirements that then become relevant for other users in due time; the latter – client leadership – refers to a deliberate action to guide development of and within the supply chain in a preferred direction. Some authors prefer the term client-led strategies (Briscoe *et al.*, 2004; Agapiou *et al.*, 2003).

Client leadership is often related to the idea that public agencies can use their buying power to enhance innovation and reform. Dalpé (1994) reviewed several strategies for converting public procurement into instruments of technology policy. Edler and Goerghiou (2007) saw a new significance in these procurement strategies and placed them in the context of EU market regulation and innovation policies. In their critical review of construction reform initiatives, Fernie *et al.*, (2006) stress the impact and dominance of the client, be it for better or for worse. Ivory (2005) argues that client leadership may have corrosive effects on innovation. He sees potential negative consequences if clients use their power to merely pursue a reduction in project time, risks and costs. That type of leadership would be counterproductive to innovation and industry vitality, and might even induce fraud and malpractice (Dorée 2004; OECD 2008). This insight can be traced further back to Bowley (1966) and Emerson (1962). Although it is still debated whether the impact is positive or negative, it is generally accepted that the client and the procurement practice shape the market environment for an industry (Dorée *et al.*, 2003). Edler *et al.*, (2007) argue for coordinated innovation policies, regulatory frameworks, procurement strategies and support for private demand. In this, governments have to negotiate through the competition policy dilemma (Audretsch *et al.*, 2001) and strike a balance between two innovation rationales: the classic market economic reasoning where innovation is pushed by competition, leading to the rationale that the more competition the better; and the rationale in which innovation needs coordination, cooperation and brokerage to overcome market and investment failures (Martin *et al.*, 2000). A client leadership that uses demanding demands to promote innovation and change might exclude firms from a market and could then be perceived as violating international trade rules (Edler *et al.*, 2007). Better use of procurement can be an effective strategy, in particular when government is a large consumer (OECD 2010, referring to Mowery *et al.*, 2009). To be effective, demand side innovation policies (demanding procurement) need to be aligned with supply side innovation policies (R&D agendas and subsidies) (Edler *et al.*, 2007; OECD 2010).

Given the above arguments, we can make an initial attempt to frame client leadership as purposely exerting market power through innovation-enhancing procurement in synchronisation with contemporaneous supply-side innovation policies. Furthermore, market share is key in creating client leadership potential. Ideally, client leadership also encompasses the setting and maintaining of standards and innovation targets, support to the supply chain through education and R&D subsidies, and provide support and encouragement to other clients.

THE CO2 PERFORMANCE LADDER

The idea for the CO2PL originated from a round-table session of clients and industry. Several companies had developed social responsibility and sustainability policies and felt that this effort was not being properly rewarded in tendering procedures. In fact, they even argued that their investments in these societal issues put them at a competitive disadvantage in public sector procurement relative to less responsible contractors. ProRail took this as a challenge: how could ProRail reward the climate responsive front-runners and inspire the laggards to catch up?

To promote CO2 emissions mitigation, ProRail developed a tool to stimulate suppliers to “produce in a climate conscious manner”. Suppliers get a rating related to how conscious, ambitious, transparent and cooperative they are regarding their CO2 emissions. ProRail then gives this rating a weight during the tender evaluation

procedure: the higher the rating the greater the likelihood of winning the tender with a given bid. ProRail thus gives the more CO₂-conscious suppliers a competitive advantage over less conscious suppliers.

The core incentive mechanism

The rating system is depicted as a ladder of six steps rising from Level 0 (low or unrated) to Level 5 (highest). The higher the CO₂PL rating, the greater the advantage during bid evaluation. In the bid evaluation procedure, ProRail will reduce the bid prices of the contractors by a percentage based on their CO₂PL rating. These fictitious markdowns are successively 0, 1, 2, 4, 7 and 10 per cent for the six CO₂PL levels. For example, consider a situation where two contractors A and B compete for a tender and A puts in a bid of €100,000 and B put is a bid of €95,000. Contractor A has a CO₂PL Level 4 certificate and contractor B a Level 2 one. In comparing them, ProRail mentally reduces A's bid by 7% to €93,000, and B's bid by 2% to €93,100. ProRail will then award the job to A at the €100,000 bid price.

By default a supplier is categorised at Level 0. Levels 1, 2 and 3 are achieved through internal efforts and ambitions of suppliers regarding direct and indirect CO₂ emissions. Level 4 requires insight into CO₂ emissions in the supply chain; preferably working on collaborative schemes to reduce upstream and downstream emissions. A firm can reach Level 5 by actively cooperating with government organisations (GOs) and NGOs on climate change issues.

In certification, suppliers are evaluated on four separate elements with each assessed in terms of the above levels. The four elements in the CO₂PL and their weighting factor are as follows:

3. The firm's insight into its carbon footprint (40%);
4. The CO₂ reduction (recorded and ambitions) (30%);
5. Transparency (communication on CO₂ performance and ambition) (20%)
6. Participation in initiatives related to CO₂ reduction such as supply chain collaboration, and with climate agencies and research centres (10%).

In general a supplier is rated at a certain CO₂PL level when it fulfils the minimum requirements of each element on that level. Some corrections may apply depending on the spread of the weighted scores. Consortia are rated at the level of the lowest achieving participating firm.

Support structure

The idea and the core incentive mechanism of the CO₂PL are rather straightforward. Putting it into practice however requires far more than just the idea and the incentive. The public sector procurement process is highly regulated, institutionally complex and prone to disputes and legal action. The procurement directives require objective criteria and the antitrust agency requires fair competition and a level playing field. Industrial and professional associations urge clear and simple evaluation schemes. To become successful, the CO₂PL needed to be practical, inspirational and robust.

The support structure for the CO₂PL consists of a guidebook (84 pages), a glossary of terms, calculation models, references to applicable standards, regulations, a technical committee, a disputes board, assessment schemes, conversion factors and a certification procedure. A supplier is required to assess its CO₂ performance based on the CO₂PL guidelines. This self-assessment has then to be submitted to an accredited Conformity Assessment Body (CAB) which checks the documents, audits the

company and provides the appropriate CO2PL certificate. In a tender submission, the company includes a copy of its certificate.

ADOPTION OF THE CO2PL

The CO2PL was well received and the rate of take-up took ProRail by surprise. The first tendering procedures in which supplier submitted CO2PL certificates were in December 2009, with six out of the fifteen projects tendered in that month seeing their use. At the end of 2009, only twelve contractors had such certificates but a year later the number issued had passed one hundred, of which about one-third were in response to resubmissions for upgrading. The tables and graphs below illustrate the speed of adoption. As of March 2011 a total of 138 certificates had been issued of which 50 were upgrades. That is, 88 certificates were authorized and active.

Most of the 88 valid certificates were for Level 3 or above (Level 1: 0% | L2: 10% | L3: 46% | L4: 19% | L5: 25%). Three-quarters of the firms applying for their first certificate assessed themselves as Level 3. Only one in ten new applicants were aiming at Level 4 or 5 with their first submission. Fifteen firms had upgraded twice: three to reach level 4 and the other twelve to Level 5.

How do all these certificates play out in the market place? Between December 2009 and March 2011, ProRail put 551 projects out to tender with a total value of €840 million. Bidders could make use of CO2PL certificate on 424 of these. In our analysis, we use a sample of 164 of the 424 projects. The sampling was based on data accessibility (i.e. those where documents were digitally filed). Table 1 shows the types of work, the number of projects, the cumulative contract sum, the average CO2PL level of all the bids and the average CO2PL level of the winning bids.

Table 1: Use of CO2PL certificates by type of work

task /work type	No. of projects	Sum contracts (€ million)	Average submitted cert level	Average winner's cert level
railway works *	63	114.4	4.71	4.68
infrastructure works *	14	33.8	3.80	3.86
buildings *	5	7.5	3.32	2.60
sound barriers *	9	7.2	3.76	3.22
engineering *	42	5.6	3.00	2.29
earth works *	11	5.0	2.85	1.64
cables *	5	4.9	3.90	4.00
conservation/protection	9	3.6	0.56	0.00
maintenance	2	0.3	2.50	2.50
landscaping	2	0.3	2.50	3.00
HVAC	1	0.3	4.75	5.00
steel construction	1	0.1	0.00	0.00
Total	164	183.0	3.64	3.30

In our further analysis, we concentrate on the work types with the largest overall budgets (marked * in the table above). Further, the whole period is divided into five periods of three months (I to V in the tables below). Unfortunately, data from the initial projects were not available digitally, so Period I starts in February 2010, two months after the initial introduction. Table 2 shows the number of projects in the sample sorted by work type in each three-month period. Table 3 illustrates the roll-out of the CO2PL scheme in two ways. The average level of the submitted certificates per project is shown in columns {A}, while columns {B} show the average percentage of

bidders per project that used a certificate in their bid. Both show an increase in use of the CO2PL over time by firms tendering for ProRail projects.

Table 2: Projects by work type in each three-month period.

Work type	I	II	III	IV	V	total
railway works	11	12	13	14	13	63
infrastructure works	0	5	1	4	4	14
buildings	0	1	2	2	0	5
sound barriers	1	2	3	3	0	9
engineering	5	6	6	19	6	42
earth works	3	1	2	4	1	11
cables	1	2	0	0	2	5
Total	21	29	27	46	26	149

Table 3: Increase in level and use of the CO2PL by period

work type	{A} average level of certificates used					{B} percentage of bidders that used certificates				
	I	II	III	IV	V	I	II	III	IV	V
railway works	4.0	4.8	4.8	4.9	4.9	93	100	100	100	100
infrastructure	-	3.2	4.3	4.7	3.5	-	74	100	96	75
buildings	-	3.3	1.8	4.9	-	-	75	50	90	-
sound barriers	3.0	3.2	3.9	4.2	-	50	71	84	79	-
engineering	2.8	2.4	3.1	2.9	3.8	43	39	88	62	77
earth works	1.8	4.0	3.5	2.7	4.3	28	33	33	56	100
cables	3.0	3.8	-	-	4.5	25	100	-	-	100
Total	3.3	3.7	3.9	3.8	4.3	67	78	87	78	91

The tables show a steady increase of CO2PL adoption with both the percentage of bidders submitting certificates and their average level increasing over time. A more detailed analysis of the projects and certificates database shows:

The firms that frequently work for ProRail were the first to adopt CO2PL certificates;

Although there was no obligation for firms to use the CO2PL, the incentives were apparently sufficient for them to embrace the scheme. For the ProRail projects that rewarded CO2PL certificate holders during the tendering process, three-quarters were awarded to a CO2PL certificate holder (covering 92% of the work tendered);

All but 1 of the 22 Level 5 certified firms are contractors and so it would seem that the scheme has had a massive impact on infrastructure contractors. Within these 22 all the larger contractors that pursued railway work had reached Level 5. The larger engineering consultancy firms were mainly certified at Level 3, with only one engineering firm achieving Level 5;

For some segments, the CO2PL procedure has ceased to offer a competitive advantage because all the firms who compete are on Level 5. In some market segments, such as conservation and protection, CO2PL certification is very low.

Maybe the most surprising certificate holder is Douwe Egberts BV (Level 2) that supplies coffee machines and coffee;

Forty-five per cent of CO2PL certificate holders were not awarded ProRail projects between December 2009 and February 2011. Some will be suppliers (like Douwe Egberts) and therefore unlikely to be bidding for projects, but most are firms that seldom work for ProRail. Many simply see the CO2PL as a good instrument for

highlighting their sustainability profile. Such firms have also inspired other clients to include the CO2PL scheme in their procurement processes;

The profile of the CO2PL scheme was raised when Level 5 firms approached NGOs about cooperation. The NGOs were startled by the initiatives taken by these firms and saw a broader range of opportunities.

In March 2011, ProRail handed over the authority and management of the CO2PL scheme to a special foundation (www.skao.nl) with a high profile board of trustees. This SKAO foundation will make the CO2PL scheme available to other industries, and also provides education, training and documentation to facilitate CO2PL adoption.

CLIENT LEADERSHIP REVISITED

The impact of the CO2PL scheme on ProRail's contracting is clear. The firms that repeatedly work for ProRail have adopted the scheme and organised their sustainable policy to align with the scheme's elements. These firms now know their carbon footprint and they are ambitious to improve and have policies to achieve this. All the firms operating on Levels 4 and 5 reach out to the supply chain and to GOs and NGOs to seek cooperation in reducing CO2 emissions. The clarity of the scheme has also attracted firms that do not see ProRail as a client. These firms see CO2PL certification as a way to structure and demonstrate their CO2 reduction credentials. The GOs and NGOs see the CO2PL scheme as a blueprint that can be rolled out in other contexts.

In developing the CO2PL scheme, ProRail has made a real impact on industry but can this be classified as client leadership? Client leadership was defined as purposely exerting market power through innovation that enhances procurement in synchronisation with contemporaneous supply-side innovation policies. Market share is key in client leadership potential. Ideally, client leadership also encompasses the setting and maintaining of standards and innovation targets, support of the supply chain with education and R&D subsidies and providing, by example, support to other clients. In these terms:

The CO2PL undertaking was in line with sentiments in the industry. There were ambitions and motivations to reduce CO2 emissions, but there was little trust in the 'sustainable procurement' tools that were being developed on the national scale as these were expected to be too complex and ambiguous. There was a general urge to do something, but it had to be practical and pragmatic. ProRail took the lead in developing such an instrument.

Developing and applying such a scheme is not without risks. Legal ambiguities, opposition and potential claims are inconvenient, time consuming and can damage one's reputation. A scheme requires proper and robust embedding in the legal and institutional context, and some boldness to accept the risks. There was no formal or legal necessity to develop such a scheme. The scheme was developed from ProRail's own ambitions in combination with requests from industry to incorporate sustainability in tender evaluation. ProRail could have played it safe and sat back, but they did not.

Developing the CO2PL required investment and persistence. A certification structure had to be built. Certification bodies had to be contacted and connected. Methods, rules, standards and procedures had to be developed. Guidebooks had to be written. ProRail used its own market leverage to drive the roll-out of the CO2PL. It also had to confront sceptics within ProRail itself ("we will end up paying more").

The impact of the CO2PL goes beyond the project interests of ProRail. It reaches out to the supply chain and affects the cultures of the firms that apply for CO2PL certification. Specifically, the CO2PL elements of transparency and cooperation create externalities that build new and more stable relationships in the industry. The adoption of the CO2PL by a high profile foundation, supported by NGOs dedicated to climate change issues, illustrates the strength of the scheme.

Overall the CO2PL is perceived as a success – in adoption rate, impact and prestige. Given the approach ProRail took in the development and introduction of the CO2PL, this would seem exemplary of client leadership.

DISCUSSION AND OBSERVATIONS

The quantitative description and analysis of the development and adoption of the CO2PL has been based on the changes in the certification register over time, ProRail's project database and bid evaluation matrices of 164 projects. These data show the rapid adoption of the CO2PL but provide little insight into the incentives driving this adoption. Which factors and mechanisms were decisive in the CO2PL's success? To obtain an in-depth understanding of the impact and the dynamics within firms, an MSc thesis project focused on the CO2PL certification process at a medium size contractor (Veneberg 2010). This contractor does not do work for ProRail but, nevertheless, saw CO2PL Level 5 certification as desirable. The MSc student assisted in submitting an initial request for Level 4 certification and then an upgrade application for Level 5 and documented the processes. This was valuable in gaining insight into the effect of the CO2PL scheme on the contractor's strategy, organisation and working processes. Further, some interviews helped to understand how the CO2PL was conceived within ProRail.

If the CO2PL success is to be replicated by other clients and in other fields it is crucial to understand what factors are relevant and significant for the successful development and adoption of the CO2PL scheme. Although not yet exhaustively tested, some initial indications were seen in our investigations.

Connectedness and synchronicity: the scheme was developed in close cooperation with industry and addressed an active concern (how to evaluate and award sustainability in tendering processes). Here, the CO2PL and certification process provides a framework to align and structure sentiments and processes already present within the firms.

Procedural clarity and investment in support structure: in innovation and organisational change, ambiguities and uncertainties lead to investment failure and reluctance to act. The attention given to the institutional framework, rules and guidelines, in combination with the involvement of certification agencies, reduced ambiguity and created clarity.

Simple and transparent: the choice for firm certification and virtual discounts in bid evaluations separated the complexities of sustainability assessment from the tendering procedure. The consequences of the various levels for bid evaluation were transparent. The CO2PL added little complication to the bid evaluation procedure and added little risk of ambiguity and claims.

Weight of the incentives: the CO2PL gives certificate holders up to a ten per cent virtual discount in bid evaluation. The level of these virtual discount 'tariffs' is crucial. The firms weigh these tariffs against the margins they expect on a project and

against the spread they expect in competing bids. The tariffs have to make a difference in the process.

Positive enhancement of reputation: the CO2PL certificates are a tangible manifestation of a firm's ambitions and dedication regarding CO2 emission reduction. As such, firms use the certificates in their PR and external communication. The success of the CO2PL in a wider context positively reinforces the value of the CO2PL certificates.

Championship: ideas and vision are important in starting innovation and change and, while necessary, are not sufficient. Changing industrial practices and routines requires effort, persistence and endurance. ProRail's client leadership was preceded by championship (a concept introduced by Donald Schön (1963)) and it seems unlikely that the CO2PL scheme would have become what is today without this fuelling and managing the process within ProRail.

CONCLUDING REMARKS

The quantitative data show the rapid adoption of the 'CO2 performance ladder' scheme. It is widely perceived as a meaningful and successful intervention in procurement and tendering practices.

Although the scheme could also have been evaluated from the perspective of its impact on sustainability and CO2 emission reduction, this paper has focused on the CO2PL as an example of successful client leadership. The paper uses collected data to make the case that the CO2PL scheme (a) is an exemplar and (b) contains valuable lessons about change in the construction industry through client leadership.

Although the factors driving the success in development and adoption of the CO2PL need further investigation and validation, our research provides strong pointers and presents relevant insights for academics and practitioners. It shows the strength of certification in conjunction with incentive mechanisms. It further shows the importance of institutional embedding and giving attention to the support structure. Above all, it shows the potential impact of client leadership.

REFERENCES

- Agapiou, A. and Dainty, A.R.J. (2003), "Client-led approaches to increasing participation of women, ethnic minorities and disabled people in the construction workforce: A framework for change", *Journal of Construction Procurement*, **9**(2), 4-16.
- Ahn, S. (2002), *Competition, innovation and Productivity Growth: A Review of Theory and Evidence*, OECD Economic Department Working Papers No:317. Paris, France.
- Audretsch, D.B., Baumol, W.J. and Burke, A.E. (2001), "Competition policy and dynamic markets", *International Journal of Industrial Organisation*, **19**, 613-634.
- Bowley, M. (1966), *The British building industry, four studies in response and resistance to change*, Cambridge University Press, Cambridge UK.
- Briscoe, G.H., Dainty, A.R.J., Millett, S.J. and Neale, R.H. (2004), "Client-led strategies for construction supply chain improvement", *Construction Management and Economics*, **22**(2), 193-201.
- Dalpé, R. (1994), "Effects of Government Procurement on Industrial Innovation", *Technology In Society*, **16**(1) 65-83.

- Dorée, A., Holmen, E. and Caerteling, J. (2003), "Co-operation and competition in the construction industry of the Netherlands", in Greenwood, D.J. (Ed.), *19th ARCOM Conference*, 3-5 September 2003, University of Brighton, **2**, 817-26.
- Dorée, A. (2004), "Collusion in the Dutch construction industry: an industrial organization perspective", *Building Research and Information*, **32**(2), 146-156.
- DTI (2002), *Rethinking Construction: Accelerating Change*, Strategic Forum for Construction, London, UK.
- Edler, J. and Goerghiou, L. (2007), "Public procurement and innovation—Resurrecting the demand side", *Research Policy*, **36**, 949–963.
- Egan, J. (1998) *Rethinking construction: the report of the Construction Task Force to the Deputy Prime Minister, John Prescott, on the scope for improving the quality and efficiency of UK construction*, Department of the Environment, Transport and the Regions Construction Task Force, London, UK.
- Emmerson, H. (1962), *A survey of the problems before the construction industry*, Ministry of works, HSMO, London, UK.
- Fernie, S., Leiringer, R. and Thorpe, T. (2006), "Change in construction: a critical perspective", *Building Research and Information*, **34**(2), 91-103.
- Von Hippel, E. (1988), *The Sources of Innovation*, MIT Press, Cambridge, UK.
- Ivory, C. (2005), "The cult of customer responsiveness: is design innovation the price of a client-focused construction industry?", *Construction Management & Economics*, **23**, 861–70.
- Latham, M. (1994) *Constructing the team: final report of the government/industry review of procurement and contractual arrangements in the UK construction industry*, HMSO, London, UK.
- Ling, F.Y.Y., Hartmann, A., Kumaraswamy, M., and Dulaimi, M. (2007), "Influences on Innovation Benefits during Implementation: Client's Perspective", *Journal of Construction Engineering and Management*, **133**(4), 306-15.
- Manley, K. (2006), "The innovation competence of repeat public sector clients in the Australian construction industry", *Construction Management and Economics*, **24**, 1295 - 1304.
- Martin, S. and Scott, J.T. (2000), "The nature of innovation market failure and the design of public support for private innovation", *Research Policy*, **29**, 437–47.
- Mowery, D., Nelson, R. and Martin, B. (2009), *Technology Policy and Global Warming: Why New Policy Models are Needed*, NESTA Provocation 10, October, London, UK.
- NAO (2001), *Modernising Construction*", National Audit Office, London, UK.
- OECD (2010), *The OECD innovation strategy; getting a head start on tomorrow*, OECD.
- OECD (2008), *Policy round tables construction industry*, DAF/COMP(2008)36, OECD.
- Schön, D. (1963), "Champions for Radical New Inventions", *Harvard Business Review*, **41**(2), 77-86.
- Veneberg, J. (2010), *Scoren op duurzaamheid*, MSc Thesis, Construction Management & Engineering, Universiteit Twente, Enschede, The Netherlands.