



Policy implementation lessons from six road pricing cases



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ABSTRACT

The implementation of road pricing has been limited worldwide despite the notion that road pricing is generally considered to be a potentially effective measure to reduce externalities, in particular traffic congestion. By means of a content analysis of 106 scientific papers, this paper aims to identify and compare the detailed set of implementation factors for the four implemented road pricing cases of Singapore, London, Stockholm and the Norwegian cities, and the two not implemented cases of Hong Kong and Edinburgh. Policy implementation lessons are formulated to aid local and national authorities considering the implementation of road pricing. In contrast to other studies, this paper identifies a broad set of implementation factors for each empirical case (an average of 36). The cases have six generic implementation factors in common, the most prominent being political and public support. However, the generic factors only account for on average 27% of all the implementation factors listed. Consequently, authorities aiming to implement road pricing also need to take many case specific factors into account in the implementation process. Furthermore, the six cases show that policy implementation will only be successful when many factors positively contribute to the process which explains why it is such a precarious endeavour.

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1. Introduction

Since the introduction of road pricing in the literature (Knight, 1924; Pigou, 1920), it has been generally accepted among transport planners and economists that this is a potentially effective measure to reduce externalities, in particular traffic congestion (Anas and Lindsey, 2011; King et al., 2007). Many papers discuss the relation between the characteristics of road pricing schemes and the welfare effects (e.g. Arnott and Small, 1994; Eliasson et al., 2009; Hau, 1990; Li and Hensher, 2012; Santos et al., 2010; Santos and Shaffer, 2004; Small and Verhoef, 2007). Despite the available knowledge and the empirical evidence that road pricing does not always have to be a “technical, political or financial impossibility” (Ison and Rye, 2005: 464), implementation has been limited (Santos et al., 2010). The literature that discusses the challenges of policy implementation includes papers that do not focus on road pricing or choose a normative approach (e.g. King et al., 2007; May, 2013). The number of papers which discuss the implementation of road pricing is much smaller and most focus on specific implementation factors such as public acceptability and equity (e.g. Altshuler, 2010; Gaunt et al., 2007; Schuitema et al., 2010; Viegas, 2001) or discuss the implementation factors for a single case (e.g. Banister, 2004; Langmyhr and Sager, 1997; Rye et al., 2008). Few papers discuss both implemented and not implemented cases. The three papers that discuss most cases, each discussing implementation factors for five cases, are, Albalade and Bel (2009), Anas and Lindsey (2011) and Buchanan

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and Buchanan (2007). However, the first two papers only include a more detailed account of implementation factors for two cases and the third paper discusses none of the cases in detail.

To the authors' knowledge there is no paper that systematically identifies and compares detailed sets of implementation factors that have affected the policy implementation process of empirical road pricing cases. By means of a content analysis of 106 scientific papers, this paper aims to fill this gap. More specifically, implementation factors that stand out most in six road pricing cases are discussed and policy implementation lessons are formulated to aid local and national authorities considering the implementation of road pricing.

In line with Jones and Hervik (1992), we use the definition of road pricing as 'policies that impose direct charges on road use', regardless of the set of objectives or the targeted groups of road users.¹ All the factors that have affected the course of events during the policy formulation, decision-making and implementation process are considered. This process starts with the outline of a particular road pricing measure and the intention of the responsible governmental institution to implement the policy and ends with either implementation of the policy (extensions or scheme modifications are also included) or a decision to terminate the process (before real world implementation). In this paper this process is referred to as the policy implementation process. The selection of cases, explained in the next section, consists of the implemented cases Singapore, London, Stockholm and the Norwegian cities and the not implemented cases Hong Kong and Edinburgh.

The remainder of this paper is organized as follows. Section 2 discusses the methodology. Section 3 presents the results, followed by Section 4 which discusses the findings, the main conclusions and recommendations.

2. Methodology

2.1. Selection of cases and papers

Lessons regarding road pricing implementation can be learned from both implemented and not implemented cases (Van Wee, 2009). Hence, including both types of cases was our first case selection criterion. The second criterion was that the cases were well-documented with regard to policy implementation² in order to obtain a detailed picture of each case. The last criterion was that the cases had a delineated policy process covering a consecutive time period and focused on a specific road pricing measure for a defined geographical area.

Following these three criteria, our selection consisted of Singapore, London, Stockholm and the Norwegian cities as implemented road pricing cases and Hong Kong and Edinburgh as cases where the implementation of road pricing ultimately did not take place. The Area Licensing Scheme (ALS) and Electronic Road Pricing (ERP) in the Singapore case were combined because ERP was introduced to overcome several shortcomings of the ALS (Goh, 2002) and thus naturally evolved from the ALS. The most challenging case selection choice concerned road pricing in Norway. The choice was made to consider all the road pricing implementations in Norwegian cities together as one case due to the many similarities – they all concerned toll financing projects (Larsen, 1995), the projects followed the same decision-making process (Odeck and Bråthen, 2002) and the national government played an important role by providing the required approval for the initiatives and supplementing them with national grants (Ramjerdi et al., 2004). In addition, many of the reviewed papers do not distinguish between the individual road pricing projects (e.g. Osland and Leiren, 2007; Ramjerdi et al., 2004). We excluded well-known road pricing cases such as the high-occupancy toll lanes in the USA (e.g. in Orange County, San Diego, Houston, Minneapolis, Denver, Salt Lake City, Seattle and Miami), the congestion charging scheme in Milan, the tolling in Sydney, the implementation attempts in the Netherlands and New York, previous initiatives in London and Stockholm and the nationwide truck tolling schemes in Europe (e.g. Germany, Austria and Switzerland) because the number of papers discussing the implementation factors for these cases³ is limited and therefore the second selection criterion is not met.

Three databases were used to search for the papers: Scopus, ScienceDirect and Google Scholar. For each case similar search strings were used including the location of the case (e.g. London) and the label of the scheme (e.g. congestion charging). A snowball method was used to select additional papers. This resulted in a selection of 106 journal papers, conference papers and book chapters. If a conference paper or book chapter contained similar information to a journal article, only the journal article was included. The references per case are included in Appendix A, where a distinction is made between papers discussing one case (see Table A.1) and papers discussing multiple cases (Table A.2). Table 1 gives a summary of the selected cases with key references for more information on the details of the road pricing schemes and their effects.

2.2. Content analysis

The methodology of this study comprised two steps: (1) the analysis of the 106 papers to identify and rank the most important generic and case specific implementation factors per case and (2) a factor analysis to determine which cases were most alike or divergent.

¹ Parking policies and pay-as-you-drive insurance are not included.

² Papers that discuss factors that could potentially affect implementation, such as a cost-benefit analysis or effects on traffic congestion, without relating these factors to policy implementation are beyond the scope of this research.

³ For example, the number of papers discussing implementation factors for a single HOT lane case does not exceed four.

Table 1
Summary of selected cases.

	Singapore	London	Stockholm	Norway	Edinburgh	Hong Kong
Label	Area Licensing Scheme (ALS)	London congestion charging scheme (LCCS)	Stockholm congestion charge (SCC)	Urban road tolling ^a	Edinburgh's Congestion Charging Scheme (ECCS)	Electronic Road Pricing System (ERPS)
Brief description	Electronic Road Pricing (ERP) ALS is an area charge and ERP a cordon charge. Applies to restricted zone with the Central Business District as core area. ERP also includes several expressways	LCCS is an area charge in Central London (8 square miles and 22 with western extension). Camera controlled, flat charge	SCC is a cordon charge in the inner city (30 km ² with 18 control points). Variable charge	First European introduction of road pricing in Bergen. Most documented cases are Bergen, Oslo and Trondheim. All tolling systems	Cordon charge with once-a-day charge for crossing one or both cordons in an inbound direction	The first test of Electronic Road Pricing RP in a two year experiment. Use of automatic vehicle identification
Important dates	ALS: June 1975 ERP: announced in 1989, implemented in September 1998 and extended in 1999	LCCS: February 2003 Western extension: 2007–2010	Trial: decision to hold a trial in 2002, trial duration from January 3 – July 31 2006 Reintroduction charges: 2007	Bergen: 1986 Oslo: 1990 Trondheim: 1991–2005	Announced in council plan in 1999, Referendum: February 2005	Announced in March 1983, to introduce ERPS in 1987 Trial: September 1983 – June 1985
Key references	Foo (2000), Phang and Toh (2004) and Yap (2005)	Dix (2002), Banister (2003), Peirson and Vickerman (2008) and Santos et al. (2008)	Eliasson (2008), Eliasson (2009) and Börjesson et al. (2012)	Langmyhr (2001), Larsen, (1995) and Ramjerdi et al. (2004)	Gaunt et al. (2007), and Rye et al. (2008)	Pretty (1988), Borins (1988) and Hau (1990)

^a The Norwegian cities for which implementation factors were found are: Oslo, Bergen, Trondheim, Kristiansand, Stavanger, Tønsberg, Standnes and Nord-Jæren.

For the first step content analysis was used to systematically reduce the amount of data into content categories using coding rules (Stemler, 2001). The rigorous use of content analysis in transport research is rare, an exception to this being Mouter et al. (2013). In this paper the selected papers were analysed for observations, strings of text that refer to factors which affected the process of policy formulation, decision-making and the implementation process of real-world road pricing schemes. A content-based clustering of these observations into implementation factors was performed to enable a count to be made of how often an implementation factor was listed by all the reviewed papers. For example, all observations concerning the role of newspapers are clustered into the implementation factor media. Factors that are present in all six cases are referred to as generic factors and case specific factors are factors which are only present in one to five cases. A factor which contributes positively overall to the policy implementation process is referred to as a success factor and one which hampers the process a failure factor. When this is not clear, the factor is simply included as an implementation factor. A factor is counted twice if it is indicated as being both a success and a failure factor at different moments or from different perspectives in the implementation process. In addition to including decisive factors, the analysis attempted to reconstruct the more or less complete sequence of interrelated causes and effects affecting policy implementation, as for example illustrated by Hamilton (2011). The reviewed papers often also include general recommendations given to aid implementation. Only recommendations specifically related to the selected cases were included.

As a second step, a factor analysis was carried out to investigate whether clusters of cases (i.e. factors) could be found among the six cases (the variables in the factors analysis). A factor analysis in which the implementation factors were clustered into sets of implementation factors was not possible because the ratio of the number of observations (i.e. is the implementation factor present in the cases) to implementation factors (the variables in the factors analysis) was not acceptable. Instead, our factor analysis investigated whether clusters of similar cases can be found. If clusters of cases showed similarities and shared certain characteristics, it could be expected that a new road pricing case with similar characteristics would have most in common with that cluster and that therefore specific lessons learnt might apply instead of generic lessons based on all six cases. We had two a priori expectations of cases which might form a cluster – Singapore and Hong Kong due to similarities in their policy implementation process and secondly a cluster of the implemented cases and a separate cluster of the not implemented cases. To cluster the cases our matrix with scores on 61 implementation factors for six cases was rotated. Hence, we analysed how alike or divergent the 6 cases were by comparing the six sets of scores on 61 implementation factors (i.e. observations) for each case. As only six of the 61 implementation factors had scores for all six cases, the majority of implementation factors had one or more missing scores. The missing scores were treated as missing values in the factor analysis, because the reviewed papers did not make the (un)importance of these implementation factors for that specific case explicit. We therefore treated the missing scores as missing rather than assuming that these factors had no importance at all for implementation. However, as a sensitivity analysis a factor analysis where the missing scores were treated as zero observations was also performed. Success factors were given a positive sign and failure factors a negative sign. An exploratory factor analysis using principal component analysis was executed. Only factors with an eigenvalue greater than one were included (Hair et al., 2010).

2.3. Intercoder reliability test

As the reliability of the coding is of vital importance for determining which conclusions can be drawn from the content analysis, we assessed the intercoder reliability. This gives a measure of the extent to which independent judges make the same coding decisions when evaluating the characteristics of messages (Lombard et al., 2002: 587). The intercoder reliability test focussed on the identification of the observations on implementation factors, labelling the identified factors as a success or failure factor, clustering similar factors and ranking the factors. General guidelines recommend recoding 10% of the complete sample (e.g. Lombard et al., 2004). To test whether it is valid to rank the most important implementation factors per case a stratified sample was selected. The case and the papers discussing this case were randomly selected. The sample consisted of eight papers on the London case (8% of all reviewed papers and 19% of the papers on London). In the intercoder reliability test the coding of the first author was compared with the coding of a second coder. The second coder was an independent researcher with experience with content analysis, active in the field of transport policy and without further involvement in this research. A coding protocol was drafted and the second coder was trained in using the coding protocol (see Mouter and Vonk Noordegraaf (2012) for more details).

The literature indicates that at least two coders should be involved (Krippendorff, 2004b). In this study the reliability was thoroughly tested. As this turned out to be time consuming and tests gave clear outcomes, there was no reason to involve an additional coder. Furthermore, as the results tended to saturate after 6 papers it was decided not to extend the sample. There are several widely used agreement indices, see for an overview Lombard et al. (2002). As there is no consensus on a “single best” index” (Lombard et al., 2002:593) the selected indices are briefly discussed. For the first part the Holsti’s coefficient (Holsti, 1969) was selected. This coefficient is simple and transparent and, as the chance that a coder selects a factor accidentally is considered negligible, using a more sophisticated coefficient was considered unnecessary. This coefficient is calculated by dividing the number of implementation factors identified by both coders with the sum of the number of implementation factors identified by coder one and the number of implementation factors identified by coder two. Hence, it accounts for situations in which the coders have identified different strings of text as implementation factors (Lombard et al., 2002). For the second and third parts the Krippendorff’s coefficient was selected because this coefficient can be used for many categories and it corrects for the fact that agreement on the labelling and clustering could result by chance

Table 2
Characteristics data set.

	Singapore	London	Stockholm	Norway	Edinburgh	Hong Kong	Average						
<i>Number of observations</i>	<i>Number of papers</i>												
1	4	5	7	4	14	7							
2–5	11	17	12	5	9	4							
6–10	6	13	2	7	5	4							
>10	1	8	6	7	6	1							
Total # papers	22	43	27	23	34	16	28						
One ^a /Multiple ^b	10	12	14	29	10	17	15	8	9	25	6	10	
Total # observations	95	298	152	204	193	84	170						
Total # of implementation factors	27	48	32	41	39	30	36						

^a One = Number of papers that discuss one case only.

^b Multiple = Number of papers that discuss this case as well as other cases.

(Krippendorff, 2011; Lombard et al., 2002). The Krippendorff's coefficient compares the observed disagreement between coders with the “disagreement that can be expected when chance prevails.” (Krippendorff, 2004a:222). More information on how to calculate this coefficient can be found in Krippendorff (2004a, 2011). The last part is assessed by comparing the two coders' rankings of the most frequently cited implementation factors. All coefficients were calculated manually. Although there is no agreement on what constitutes an acceptable level of agreement, 0.9 is generally acceptable, 0.8 in most situations and 0.7 is used in exploratory research (Neuendorf, 2002: 145 in Lombard et al., 2002).

The results reveal that the Holsti's value for the identification of observations on implementation factors was 0.61. Hence, we can conclude that the identification of implementation factors might not be complete. The main differences between the two coders were caused by incorrectly coding general recommendations and differences in the aggregation level, e.g. clustering or separately listing factors. Krippendorff's alpha for the labelling was 0.71. However, 7 out of 8 differences were caused by a simple and easily reparable error. A failure factor being formulated positively as a recommendation in the reviewed paper (or vice versa) was accidentally coded by the second coder based on the recommendation (positive formulation) instead of based on the characteristic of the factor itself (e.g., actually played a negative role in the specific case). With a correction for this specific discrepancy the Krippendorff's alpha becomes 0.94. We therefore consider the labelling of factors reliable. Third, the Krippendorff's alpha for the clustering was 0.79. The agreement between the two coders for this clustering is therefore generally acceptable. Only factors that can be assigned to adjacent implementation factors⁴ were less obvious, however, disagreements concerned the less important implementation factors. Finally, when comparing the rankings of the clusters of the most frequently cited factors amongst the two coders it was found that both coders had the same top five, although the order differed. Hence, we can conclude that it is reliable to identify the set of most listed implementation factors for a specific case, although not reliable to precisely rank the most frequently cited implementation factors for a case. Overall the intercoder reliability test shows that the labelling and clustering of implementation factors is reliable. Although it is not reliable to claim that all the implementation factors for each case are identified, the identification of the set of most listed implementation factors is considered reliable.

3. Results

This section starts with a brief discussion of the main characteristics of the data set. Next, the most frequently listed implementation factors that all six cases have in common are discussed, followed by the particularities of each individual case.

3.1. Characteristics data set

The main characteristics of the data set are included in Table 2. The average number of papers discussing one case is 27. The most papers discussing implementation factors were found for London (43) and the least for Hong Kong (16). The average number of observations for each case is 171. For each case, on average 36 different implementation factors (clustered observations) were listed, giving in total across all six cases 61 different implementation factors. Appendix B gives an overview of the implementation factors listed for each case and distinguishes between success factors, failure factors and implementation factors. The average number of observations of one implementation factor listed in a case is 4 although for the implementation factor most often listed 33 observations within a single case were counted. It was found that for Edinburgh and Hong Kong slightly less than half of the papers listed only one implementation factor. It seems that the not implemented cases have been less thoroughly analysed regarding implementation factors; in many papers they are often only briefly referred to. In the remainder of this paper the number of observations clustered in one implementation factor is presented as a percentage of the total number of observations for one case (with the sum of the percentages for all implementation factors

⁴ An example of adjacent implementation factors is the factor severity of the problems and the factor perceptions of the problems.

in one case adding up to 100%) because the number of papers (and with that the number observations and implementation factors that were found) varies considerably per case.

The papers differ in the number of observations on implementation factors included, both the total number and for each case (see Appendix A). The total number of observations on implementation factors in the papers varies between one and 31 observations in Albalade and Bel (2009, discussing 5 cases) and Osland and Leiren (2007, discussing 2 cases). The number of observations on a single case varies between one and 30 in Borins (1988). This variation in the number of observations on implementation factors included in the papers is obviously related to the primary objective of the paper. In the analysis a distinction was made between papers that particularly focused on implementation and papers that had other objectives but included observations on implementation factors. Furthermore, a distinction is made between papers that had collected their own empirical data from interviews or surveys on implementation factors versus papers that based their findings on implementation factors on other sources or did not make the sources explicit. It was found that 12 of the 106 papers focus on implementation and 14 of the 106 papers give some clarity on whether empirical data was used in the papers. The overlap between the papers in these categories is limited; hence the papers with a focus on implementation do not seem to use empirical data more frequently than papers with a different focus. The large majority of the papers studied are not explicit regarding the data sources used to support the observations on implementation factors. From the 14 papers that give some clarity on the data sources used, 5 papers mention the use of interviews without giving any further details (Attard and Enoch, 2011; Attard and Ison, 2010; Langmyhr, 1999; Langmyhr, 2001; Langmyhr and Sager, 1997). Marsden and May (2006), Ison and Rye (2005), Altshuler (2010) and Rye et al. (2008) make the number of interviewees and their affiliations for each case explicit and Ieromonachou et al. (2007) and Ieromonachou et al. (2006) also add the names of the interviewees and more information on the methodology. Interviews were therefore used for the case analysis, although it is not clear which observations came from the interviews. Only the papers of Isaksson and Richardson (2009) and Hamilton (2011) and Borins (1988), explicitly refer to the interviews, making it possible to determine which observations are based on the interviews and which on other sources.

3.2. Generic implementation factors

Although in total 61 different implementation factors were found, only six implementation factors were present in all six cases. These factors concern general political support, general public support, information campaign, various actor perceptions, characteristics of the transport system and marketing of the scheme. Table 3 gives an overview of these generic implementation factors. The generic factors are sorted based on the average percentage indicating how frequently this factor is mentioned in all six cases together. General political and public support are the most commonly listed generic implementation factors, accounting for 9.0% and 7.6% respectively of all the observations for those cases. Other generic factors are all mentioned less than half as frequently. Half of the generic factors are among the factors listed most frequently for that case (indicated with * in Table 3). The most important finding is that the generic factors only account for on average 27% of all the listed implementation factors. Table 3 also distinguishes between success and failure factors. Overall, the generic factors were listed as success factors in the implemented cases and as failure factors in the not implemented cases. Deviations from this overall pattern are discussed below. The reviewed papers often only mention an implementation factor without explaining precisely what it is, its importance or how it contributes to the implementation process. The discussion below focuses therefore on how frequently a factor has been listed in a specific case and more details on the factor or its role in a specific case are discussed where relevant and possible. The discussion of these factors as well as the contribution of each generic factor to the implementation processes of the six cases is structured by clustering meaningful insights and does not follow the order of Table 3.

Table 3

Overview of implementation factors present in all six cases.

	Implemented				Not implemented		Average (%)
	Singapore (%)	London (%)	Stockholm (%)	Norway (%)	Edinburgh (%)	Hong Kong (%)	
General political support	9.5 ^{*2}	4.7*	14.8*	14.7*	<u>5.6*</u>	<u>4.8*</u>	9.0
General public support	3.2	4.4*	12.8*	<u>5.9*</u>	<u>17.3*</u>	<u>2.4</u>	7.6
Information campaign	6.3*	3.0	2.0	1.5	<u>1.5</u>	<u>4.8</u>	3.2
Various actor perceptions ^a	3.2	0.7	<u>1.3</u>	<u>0.5</u>	<u>4.1*</u>	<u>7.1*</u>	2.8
Characteristics of the transport system	2.1	4.4*	3.4*	2.9	<u>0.5</u>	3.6*	2.8
Marketing the scheme	2.1	0.3	2.0	2.0	<u>1.0</u>	<u>3.6*</u>	1.8
Total% of generic factors	26.3	17.4	36.2	27.5	30.0	26.2	27.3

The scores that are underlined are failure factors, the other scores are success factors.

The scores with an * are among the factors most often listed for that case (see Table 4).

^a Various perceptions of actors (e.g. regarding exemptions, objectives, effects on local economy etc.).

As the final outcome of an implementation process relies on a political decision, it is not surprising that the first factor, general political support, is one of the four most frequently listed implementation factors in all six cases. In Singapore this factor specifically refers to the political will to implement the scheme (e.g. Santos, 2005). In London the factor concerned political will and commitment (Hensher and Puckett, 2005; Santos, 2005) which proved stronger than some political opposition. In Stockholm, a “fortuitous set of political circumstances” (Schaller, 2010: 272), including “extensive political logrolling” (Armeliuss and Hultkrantz, 2006: 163) positively contributed to policy implementation. The trial was demanded by the Green party (Eliasson, 2008) and the implementation of the charges forced another political party to break their election promise (Börjesson et al., 2012). Furthermore, the new government respected the positive referendum outcome (Osland and Leiren, 2007). In Norway road pricing was never “politically controversial” (Albalade and Bel, 2009: 969). For example, the local political parties in Bergen agreed that the implementation “should not be made into a major political issue” (Larsen, 1995: 191) and in Trondheim the implementation was the result of an uncomplicated compromise (Langmyhr, 2001). In Hong Kong the district boards did not support the scheme (Borins, 1988), leading to a lack of political support. In Edinburgh political opposition was also frequently listed despite the approval in principle of the Scottish executive (Saunders, 2005). This was caused by minimal national support (Gaunt et al., 2007) and the initiator having marginal control over the City of Edinburgh Council (Ryley, 2010). The decision to hold a referendum was even seen as an indication of the weak support in the city council (Rye et al., 2008).

The second factor, general public support, is in the Edinburgh case by far the most frequently listed factor, three times as much as the lack of political support, which held second place. For Stockholm public support is the second most frequently listed factor. In both cases the (lack of) public support was demonstrated in the referendum outcome. Although the process started in Edinburgh with public support in the stakeholder consultation process, this declined over time (Grieco and McQuaid, 2005). In the referendum 74.4% voted against the congestion charging scheme (Gaunt et al., 2007). The outcome of the referendum in Stockholm, was a majority in favour (53% yes, 47% no (Eliasson et al., 2009: 248)) of making the system permanent (Eliasson et al., 2009) leading to the reintroduction of the charges in 2007 (Eliasson, 2008). This followed a period in which “the public opinion gradually changed from support of less than 30% before the trial to just over 50% towards the end of the trial.” Public support was “nearly 70% at the end of 2007, after the reintroduction” (Eliasson, 2008: 402, 403). Although road pricing was implemented in Norwegian cities, public opposition was surprisingly listed twice as frequently as public support. In Singapore, Hong Kong and London this factor is mentioned much less frequently.

Providing information about the scheme and marketing of the scheme are the third and fourth related implementation factors present in all six cases. These factors were most listed in the cases Singapore, Hong Kong and Stockholm. In Singapore these factors involved a massive public relations exercise (Tan and Subramaniam, 2006) and the fact that the scheme was marketed as part of an overall transport strategy (Foo, 2000; Yap, 2005). In Stockholm, the successful information campaign (Eliasson, 2008; Hamilton, 2011) and the scheme being branded as an environmental charge, were frequently listed (Börjesson et al., 2012; Eliasson, 2010; Eliasson and Jonsson, 2011). On the other hand, in the Hong Kong case the “lack of advertising campaigns and literature” (Attard and Ison, 2010: 18) and a government which did not effectively sell the scheme (Hau, 1990) were frequently mentioned. In Norway and London these two factors were also present but less frequently listed than in the other cases (Attard and Enoch, 2011; Santos, 2004). These failure factors were less frequently listed in the Edinburgh case, probably overshadowed by the factor communication. The communication was considered unsuccessful (Lapsley and Giordano, 2010; Rye et al., 2008) because the public had limited understanding of the scheme (Albalade and Bel, 2009; Gaunt et al., 2007; Saunders and McLeod, 2005). The scheme was perceived as being not well developed, complex and, therefore, difficult to explain to the public (Gaunt et al., 2006). Furthermore, the scheme’s benefits were not sufficiently promoted (Rye et al., 2008).

The fifth common factor is the characteristics of the transport system. In all six cases this played a modest role. It refers to how susceptible the context is for the implementation of road pricing. Singapore, London and Stockholm have an existing well-functioning public transport system (Anas and Lindsey, 2011; Yap, 2005). Furthermore, in Stockholm the “initial high public transport share contributed to the acceptance of the road charging package” (Kottenhoff and Brundell Freij, 2009: 304). Although not made explicit, this could indirectly have positively contributed to policy implementation. In London where public transport accommodates “some 85 percent of travellers entering central London” (Anas and Lindsey, 2011: 83) this unique circumstance is considered to have contributed to the policy implementation (Nash, 2007). Similarly, the low car use in Singapore made implementation easier (Morrison, 1986). These modal splits result in a relatively small group of ‘losers’ (Lee, 2008) being outnumbered by the winners (Metz, 2008). Even in the not implemented case of Hong Kong, the high usage of public transport is listed as a success factor, called “the ideal climate for the successful implementation” by Hau (1997: 9). Conversely, in Edinburgh it was the high car-dependency that was mentioned for negatively contributing to implementation (Kottenhoff and Brundell Freij, 2009). The outlier with respect to how this factor contributed to implementation, is the case of the Norwegian cities, where it refers to the scarcity of public budgets, making road pricing an interesting option (Bråthen and Odeck, 2009).

The sixth factor, various actor perceptions, actually comprises a cluster of both success and failure factors. As this is a heterogeneous cluster, the composition of the clusters differs per case and the individual perceptions contributed differently to the various cases, the cases have less commonalities regarding actor perceptions than initially thought and are, where relevant, discussed in the next section. Common perceptions are actor perceptions of the problem, the perceived effectiveness and views on the technical feasibility. In addition, all six cases mentioned a variety of other actor perceptions. Examples include fears for future trade in the city centre (Tretvik, 2007), resistance to charging what used to be free (McQuaid and Grieco, 2005) and lack of agreement on the objectives (Rye et al., 2008).

Table 4

The most listed factors per case.

	%
<i>Singapore</i>	
Experience ^a	16.8
Transport policy and supporting measures	11.6
General political support*	9.5
Information campaign*	6.3
Culture of decision-making	4.2
Few decision-making layers	4.2
General public support*	3.2
Geographical layout	3.2
Overall policy design ^b	3.2
Participatory process	3.2
Power ^c	3.2
Privacy concerns	3.2
Project management	3.2
Technical feasibility	3.2
Various actor perceptions* ^d	3.2
Various design factors ^e	3.2
<i>Stockholm</i>	
General political support*	14.8
General public support*	12.8
Implementation strategy ^f	9.4
Legislation	<u>6.0</u>
Overall policy design ^b	6.0
Political process	<u>4.1</u>
Studies and research	4.1
Characteristics of the transport system*	3.4
Media	3.4
Perceptions on effectiveness	3.4
Political support of the central government	3.4
Timing	3.4
Use of revenues	3.4
<i>Edinburgh</i>	
General public support*	<u>17.3</u>
Implementation strategy ^f	<u>6.6</u>
General political support*	<u>5.6</u>
Media	<u>5.1</u>
Communication	<u>4.7</u>
Support of regional politicians	<u>4.7</u>
Legislation	<u>4.1</u>
Various actor perceptions* ^d	<u>4.1</u>
Transport policy and supporting measures	<u>3.6</u>
Trust ^g	<u>3.6</u>
<i>London</i>	
Transport policy and supporting measures	7.4
Political support of the mayor	6.0
Participatory process	5.0
General political support*	4.7
Political champion (in this case the mayor)	4.7
Power ^c (in this case of the mayor)	4.7
Characteristics of the transport system*	4.4
General public support*	4.4
Studies and research	4.4
Legislation	3.7
Media	3.7
Scope and exemptions	3.7
<i>Norway</i>	
General political support*	14.7
Experience ^a	6.9
General public support*	5.9
Partial funding of the central government	5.9
Support of the road authority	5.9
Use of revenues	5.4
Overall policy design ^b	4.9
Level and structure of charge	3.4
Various design factors ^e	3.4
Characteristics of the transport system*	2.9

(continued on next page)

Table 4 (continued)

	%
Perceptions of the problems	2.9
<i>Hong Kong</i>	
Privacy concerns	<u>15.5</u>
Various actor perceptions* ^d	<u>7.1</u>
General political support*	<u>4.8</u>
Information campaign*	<u>4.8</u>
Non-business interest groups	<u>4.8</u>
Perceptions of cost and benefits	<u>4.8</u>
Technical feasibility ^h	<u>4.8</u>
Technology ^h	4.8
Trust ^g	<u>4.8</u>
Characteristics of the transport system*	3.6
Marketing the scheme*	<u>3.6</u>
Perceptions of the problems	<u>3.6</u>
Timing	<u>3.6</u>

The scores that are underlined are failure factors, the other scores are success factors.

The scores with an * are generic implementation factors.

^a The use of experience of other road pricing implementation processes in the implementation process.

^b The starting points for making the policy design and the general requirements that the policy should fulfil (e.g. flexible, easy to understand).

^c The capability of an actor (e.g. the government) to have a significant influence on the decision-making process or determine this process.

^d Various perceptions of actors (e.g. regarding exemptions, objectives, effects on local economy etc.).

^e Various general characteristics of the policy design (e.g. user friendliness, implementation for a limited time period).

^f The strategy used by the organisation responsible for managing the policy implementation process.

^g The trust other actors have in the organisation responsible for policy implementation.

^h Technology refers to the design choice for a specific technology, the technical feasibility refers to how this choice is perceived by the involved actors.

3.3. Case specific implementation factors

Table 4 gives an overview of the most frequently listed factors per case, including both generic and case specific factors. For each case at least the ten most listed factors are included. If the next factors were exactly as frequently listed as the tenth factor, these factors are also included. Appendix B gives an overview of the implementation factors listed for each case. Similar to the discussion in the previous section, this section discusses only the most remarkable insights on the case specific factors in detail. The three implementation factors most often listed for each case account on average for 30% of all the implementation factors listed in the cases. This indicates that the set of implementation factors is relatively broad.

3.3.1. Singapore

The most cited factor in the Singapore case is experience. The only other case where this factor is prominent is the Norwegian cities. Experience in Singapore basically refers to the complexity and inconvenience of ALS (Santos, 2005) which led to the introduction of ERP to overcome operational difficulties (Goh, 2002). Furthermore, the ALS was considered not to fit with the high-tech image of Singapore (Santos et al., 2004). The next most cited factor in the Singapore case is that the scheme was part of an integrated transport policy (Santos et al., 2004). Hence, ERP was implemented together with improving public transport, leading to an increase in public acceptance (Santos, 2005), and with tax reductions to ease implementation (Enoch, 2003; Phang and Toh, 2004; Tan and Subramaniam, 2006). Finally, there are three related institutional factors that are frequently mentioned in the Singapore case: the culture of decision-making, power and few decision-making layers. First, Foo (1997:163) characterizes the decision-making culture as “Singaporeans are generally literate, well-informed and law-abiding citizens who are normally cooperative and supportive of government policies. There is ample public respect for the country’s laws and statutes.” (Foo, 1997:163; Foo, 2000). Next, the government is powerful (Phang and Toh, 2004). Third, having a one level government is efficient because of the absence of coordination across different layers of government (Albalade and Bel, 2009; Foo, 1997). Finally, “painstaking” project management during nine years resulted in a smooth implementation process, including feasible technology (e.g. installing the On Board Unit) (Menon and Chin, 1998:179).

3.3.2. London

Transport policy and supporting measures was the most frequently listed implementation factor. The London Congestion Charging Scheme was part of an integrated and coherent transport strategy (Richards, 2008; Santos, 2005). The additional investments in an already well-functioning public transport system and traffic management are also considered to have positively contributed to the implementation (Dix, 2002; Livingstone, 2004). Yet, it was mayor Livingstone and the exceptional

role he played in the implementation of congestion charging that is most distinctive of the London case. Frequently listed factors were the power of the mayor, the political support of the mayor and the mayor as political champion. The mayor was able to play a large role because of the institutional setting in which “the mayor of London had sufficient powers to forge ahead with road pricing without the need to build a political coalition.” (Anas and Lindsey, 2011: 83). This “unilateral authority to implement this promise proved critical” (Altshuler, 2010: 167). This power was provided to the mayor by enabling legislation from the central government (Banister, 2003). This legislation is also separately listed as a success factor. Next, the mayor supported congestion charging, often referred to in more specific terms as his commitment, strong will, determination, charisma, vision and leadership (Banister, 2003, 2004; Lee, 2008; Santos et al., 2008). In fact, his role reaches far beyond supporter as the mayor is frequently qualified as project champion with adjectives as ‘bold’ and ‘strong’ to further reinforce this qualification (Marsden and May, 2006; Peirson and Vickerman, 2008).

The general political support, and to a lesser extent public support were also frequently indicated as success factors. However, the lack of public support was also mentioned, mainly in relation to the western extension of the scheme, leading eventually to its removal (Baigabulova, 2010; Santos and Fraser, 2006). Characteristic of the London case is the participatory process implying “continuous and extensive public consultation” (Banister, 2003: 253). Responsiveness refers to the fact that the views of stakeholders were taken into account (Santos, 2004) and led to modifications in the scheme (Livingstone, 2004). “A range of exemptions would appear to have smoothed the introduction of congestion charging in Central London.” (Ison and Rye, 2005: 458).

However, despite support from some key players, strong opposition remained (Ieromonachou et al., 2007). Most present in this perspective is the role of the media, in contrast to the previously discussed factors, the only failure factor in this case. The implementation in London faced a sceptical, hostile press (Altshuler, 2010; Ryley and Gjersoe, 2006) leading to predominantly negative newspaper coverage (Livingstone, 2004; Peirson and Vickerman, 2008). Yet, as implementation was accomplished, this failure factor was apparently not decisive. Finally, similar to Stockholm, having sufficient and comprehensive research available (Baigabulova, 2010) and having monitoring in place (Buckingham et al., 2010) are also listed as implementation factors.

3.3.3. Stockholm

After the generic factors of political and public support, the most cited implementation factor is the implementation strategy, in this case primarily referring to holding a trial followed by a referendum. This made the scheme perceptible to the public (Oehry, 2010), was key for the public support (Albalade and Bel, 2009; Gudmundsson et al., 2009) and led to a majority voting in favour of the scheme (Poole, 2011). Yet, upfront this outcome was by no means certain. This decision was “initially forced through by opponents” (Eliasson and Jonsson, 2011: 637) and was intended to reduce political risks (Buchanan and Buchanan, 2007). Furthermore, surviving “a heated and complicated political and legal process” (Börjesson et al., 2012: 1; Eliasson, 2008; Isaksson and Richardson, 2009) was also a factor that defines this case as legislation and the political process are frequently listed as failure factors. The initially hostile media, first cited as a failure factor, became more positive during the trial (Börjesson et al., 2012; Eliasson and Jonsson, 2011). The factor policy design was most prominent in the Stockholm case. Overall, Hamilton (2011) concludes that there was a successful scheme design (Hamilton, 2011). Perhaps this is caused by the also frequently listed factor available expertise (Osland and Leiren, 2007) and the extensive and scientific evaluation (Eliasson, 2008).

3.3.4. Norway

After the generic factor political support, the second most cited factor is, similar to Singapore, the case specific factor experience. Norway has more than 100 years of experience with toll financing (Bråthen and Odeck, 2009). The implementation of the toll cordon in Bergen in 1986 made the public more familiar with road pricing which helped public acceptance (Larsen, 1995). This implementation inspired other cities (e.g. Trondheim and Oslo) to build on this experience (Ieromonachou et al., 2006; Waersted, 2005).

As explained in the previous section, all the Norwegian cases received additional funding from central government (Larsen, 1995; Ramjerdi et al., 2004; Waersted, 1992). Another important factor in the Norwegian case is the support of the road authority, which in many cities acted as a promoter by providing leadership (Osland and Leiren, 2007), manpower and know-how for implementation (Langmyhr, 1999; Langmyhr, 2001). The role of this actor is unique to the Norwegian case.

Finally, the use of revenues is, compared to other cases, frequently mentioned in this case. Langmyhr (2001: 67) argues that “the purpose of raising funds for infrastructure investments and environmental improvements is more acceptable to the general public than tolls aimed at managing demand.” Also in other cities the importance of earmarking the revenues for infrastructure investment (Waersted, 2005) in public transport is stressed (Bekken and Norheim, 2007). Also for several cities factors were listed related to the level of complexity of the overall policy design (e.g. Foo, 1997; Langmyhr and Sager, 1997; Osland and Leiren, 2007; Waersted, 1992).

3.3.5. Edinburgh

The Edinburgh and the Stockholm case have the same three most cited implementation factors – political and public support and the implementation strategy of holding a referendum. However, the Edinburgh proposal was rejected in a public referendum. The reasons for the referendum are completely different from Stockholm. For Edinburgh holding a referendum was neither mandatory nor demanded (Lapsley and Giordano, 2010). “While the decision to persist with congestion charging

may, in the circumstances, be considered brave, the decision to hold a referendum was not.” (Gaunt et al., 2007:100). The referendum was planned without a trial in which road users could have the opportunity to experience the scheme (Anas and Lindsey, 2011), it was controversial because not all those who wanted to vote got the opportunity (Gaunt et al., 2006; Rye et al., 2008) and it consumed the resources of an already small implementation team with a limited budget (Rye et al., 2008; Saunders, 2005). Being the first to interpret the legislation also added time, expense and complexity to the process (Gaunt et al., 2006).

Striking in the Edinburgh case is the opposition from two actors that played a less important role in other cases. First of all, there was opposition from regional politicians in neighbouring authorities in reaction to exemptions for Edinburgh residents which were considered unfair (Ryley and Gjersoe, 2006). Secondly, the role of the media was important, specifically the newspapers, which had been “highly politicized and increasingly negative over the time period leading up to the referendum” (Ryley and Gjersoe, 2006: 66).

3.3.6. Hong Kong

Striking about the Hong Kong case, compared to the other cases, is the large variety and higher frequencies of occurrence of actor perceptions, in this case all comprising concerns. Concerns about the invasion of the road user’s privacy was the most cited. This “highly controversial” factor (Fong, 1985:38) comprises 16% of all the factors listed for this case. The other factors are mentioned half as much or even less. Although privacy is also mentioned in the Singapore and London case (3% and 1%), this factor is typical for the Hong Kong case. Not only the public and motorists but also the councillor, district board members and computer society shared this concern (Borins, 1988; Ison and Rye, 2005). This can partly be explained by the timing, shortly after the decision to hand Hong Kong over to China. “Naturally, the invasion of privacy and fear of a “big brother” government were foremost in people’s minds.” (Hau, 1990:210).

Next, the “traffic conditions were not seen to be sufficiently bad” (Pretty, 1988:319). For example, the automobile association found that the congestion problem was exaggerated by the government (Borins, 1988:40). Moreover, timing was mentioned referring to the reduced need for road pricing after the introduction of several other measures and in the face of an economic decline (Hau, 1990; Ison and Rye, 2005). Other actor perceptions include the public and the automobile association which perceived the scheme as a tax increase (Borins, 1988; Khan, 2001). In addition, there was also criticism of the resource allocation (Fong, 1985), doubts about equity (Hau, 1990; Ison and Rye, 2005; Pretty, 1988) and concerns about the technical feasibility (Borins, 1988). Last, there was a range of other concerns, e.g., regarding the funding, the study results (Borins, 1988) and the export of employment to the United Kingdom (Hau, 1990). Despite concerns about technical feasibility, there are several references to the technical pilot as a success factor (e.g. Pretty, 1988). All these concerns might be linked to “the government who did not succeed in effectively selling ERP to the public” (Hau, 1990: 211) and the timing, as the problem was perceived to be in decline.

3.4. Factor analysis

Rather than performing a factor analysis on implementation factors (see Section 2.2), the factor analysis was performed to analyse whether clusters of similar cases could be found. If clusters could be found with distinct characteristics, it is possible more specific lessons could be formulated than the generic lessons based on all the cases. The results of the factor analysis included in Table 5 show that we found that the cluster of the Singapore, Stockholm and Norway cases loads high on factor 1, the cluster consisting of the London and Stockholm cases loads high on factor 2, and the cluster of the London and Hong Kong cases load high on factor 3. From the factor analysis it becomes clear that Edinburgh is the most deviant case. The three factors together account for 96% of the variance. Hence, we can conclude that there are similarities between cases. However, the clusters found are not the expected clusters of the Singapore and Hong Kong case nor the clusters of implemented cases or not implemented cases. The first policy implication of our findings is that it is not possible to a priori determine with which cluster of cases a potential new case would have most similarities in terms of which implementation factors are likely to play

Table 5
Factor loadings (Varimax rotated), values higher than 0.5 in bold, software: IBM SPSS 20 for Windows.

Cases	Factor ^a 1	Factor 2	Factor 3
London	.482	.606	.573
Singapore	.918	.283	–.231
Stockholm	.510	.800	.171
Norway	.971	–.133	.086
Edinburgh	.197	–.973	.065
Hong Kong	–.128	.004	.988
Eigenvalues	2.913	1.652	1.220
Percentage variance	48.5	27.5	20.3

^a Note that this factor represents a cluster of variables (i.e. cases) and does not refer to a specific implementation factor.

a minor or large role in such a case. Second, it is not possible to learn specific policy implementation lessons based on similarities in the implemented versus the not implemented cases.

In trying to explain why these three factors were found in the factor analysis, we analysed the underlying items (e.g. implementation factors) which scored high on each factor. As factor scores are only given for the six generic implementation factors (the specific implementation factors have missing values), it is not known how specific implementation factors have contributed to the clustering. The most important generic implementation factor for the cluster of Singapore, Stockholm and Norway is political support, for the cluster of London and Stockholm public support and for the cluster of London and Hong Kong the characteristics of the transport system. However, only the contribution made by these factors is known and this is insufficient to derive new policy lessons from. From the sensitivity analysis, i.e. a factor analysis where unlisted factors are treated as zero observations instead of missing values (see Section 2.2), three factors were also found. However, there are fewer cases that load on two factors (Stockholm does not load on factor 1 and London does not load on factor 2 anymore). Furthermore, a broader cluster of underlying implementation factors scores high on the factors even though the explained variance is lower. The sensitivity analysis therefore does not give additional insights. If the (un)importance of each implementation factors had been made explicit, it is possible that larger clusters of underlying items would have scored higher on the cluster. Overall this factor analysis shows that several cases have similarities with other cases except for Edinburgh. However no specific policy implementation lessons can be drawn from this factor analysis.

4. Discussion and conclusions

4.1. Policy considerations

Our results suggest that a broad set of factors defines road pricing implementation processes. Of the 61 implementation factors found in this research, on average 36 implementation factors played a role in the six road pricing cases studied. The three implementation factors most often listed for each case account on average for 30% of all the implementation factors listed in the cases. Thus, policy makers need to take into account a broad set of factors when managing a policy implementation process for road pricing. This makes the implementation process a rather precarious endeavour.

There are six generic implementation factors that are recurrent in each case. Not surprisingly political and public support are implementation factors in each case. These factors are success factors in the implemented cases and failure factors in the not implemented cases. For Singapore and Hong Kong public support is much less frequently mentioned than in the other cases. This makes sense as the political system and the role of public opinion in the policy process is different in these countries. Unexpectedly public support was also less mentioned in the London case. Perhaps the dominance of the political circumstances may have made public support relatively less important. Results reveal that the support and power of the mayor played a major role. It is also highly likely that, seeing that the mayor made the implementation of the scheme an election promise, the public knew what they voted for and in this way implicitly expressed their support. Other important implementation factors that all the analysed cases share, are the relevance of an information campaign, marketing of the scheme and the characteristics of the transport system.

The most prominent case specific implementation factors are the role of specific actors such as the mayor in London and the road authorities in Norway. Furthermore, the supporting governmental funding was a specific factor in Norway. The concerns about privacy and the scheme being perceived as a tax increase were prominent specific concerns for the Hong Kong case.

In our analysis the generic factors account on average for only 27% of all the listed implementation factors. In addition, the factor analysis showed that although several cases have similarities there are large differences as well, with the Edinburgh case as the most deviant case. Hence, also many case specific factors need to be taken into account in a policy implementation process. In our view, the fact that besides generic factors case specific factors are also frequently listed puts general policy recommendations into perspective. Many papers aid policy makers with generic recommendations for policy implementations based on implementation factors found in road pricing cases (e.g. Albalade and Bel, 2009; Ison and Rye, 2003; King et al., 2007). Our analysis shows, however, that the importance of case specific factors cannot be underestimated.

It is interesting to note that the factor experience was only listed in the Singapore and Norway case as an implementation factor and not in the more recently implemented schemes in London and Stockholm. In the Singapore and Norway cases they could draw on the experiences in their own country. Policy learning from the same country appears to be more valuable therefore in implementation than from other countries. Theories on cross cultural policy transplantation describe many challenges to policy learning across multiple countries (De Jong et al., 2002).

When drawing potential policy lessons from the implemented compared with the not implemented cases, our results reveal that there are not many typical factors that only occur in implemented cases or only in the not implemented cases. Yet, the two not implemented cases have some commonalities. The factor various actor concerns is in the top of the most listed factors for both not implemented cases Hong Kong and Edinburgh whereas in the implemented cases this factor is much less frequently mentioned. In fact, as explained in this paper, a remarkably wide variety of concerns played a role in the Hong Kong case. Furthermore, the lack of trust is a factor that only occurred in the not implemented cases. Finally, the factors marketing in Hong Kong and communication in Edinburgh were failure factors and played, compared to the implemented cases, a much more prominent role. It seems that the important role of communication, marketing and information in a road pricing implementation process cannot be underestimated.

Table A.1
Number of observations in reviewed papers discussing one case.

	A	B	C	D
<i>Singapore</i>				
Chin	2005	8	N	N
Chin	2009	2	N	N
Christainsen	2006	3	N	N
Enoch	2003	1	N	N
May	2004	1	N	N
Menon and Chin	1998	8	N	N
Morrison	1986	4	N	N
Santos et al.	2004	6	N	N
Tan and Subramaniam	2006	5	N	N
Yap	2005	11	N	N
<i>London</i>				
Banister	2003	22	N	N
Banister	2004	7	Y	N
Buckingham et al.	2010	9	N	N
Dix	2002	12	N	N
Goodwin	2004	3	N	N
Ieromonachou et al.	2006	8	N	N
Litman	2005	7	N	N
Livingstone	2004	24	Y	N
Peters and Gordon	2009	2	N	N
Richards	2008	5	N	N
Santos	2004	4	N	N
Santos and Schaffer	2004	7	N	N
Van Wee	2009	1	N	N
Viegas	2001	2	N	N
<i>Stockholm</i>				
Armeliuss and Hultkrantz	2006	3	N	N
Börjesson et al.	2012	13	N	N
Eliasson	2008	15	N	N
Eliasson and Jonsson	2011	12	N	N
Eliasson et al.	2009	3	N	N
Gudmundsson et al.	2009	3	N	N
Hamilton	2011	23	N	Y
Jansson	2008	1	N	N
Munnich	2008	2	N	N
Oehry	2010	1	N	N
<i>Norway</i>				
Bekken en Norheim	2007	7	N	N
Bråthen and Odeck	2009	7	N	N
Hårsman	2001	4	N	N
Ieromonachou et al.	2006	13	N	Y
Langmyhr	1999	25	Y	Y
Langmyhr	2001	25	Y	Y
Langmyhr and Sager	1997	23	Y	Y
Larsen	1995	10	N	N
Larsen and Ostmoe	2001	7	N	N
Meland et al.	2010	2	N	N
Odeck and Bråthen	2002	4	N	N
Ramjerdi et al.	2004	7	N	N
Tretvik	2007	6	N	N
Waersted	1992	11	N	N
Waersted	2005	17	N	N
<i>Edinburgh</i>				
Gaunt et al.	2006	23	N	N
Gaunt et al.	2007	9	N	N
Gorman et al.	2008	5	N	N
Lapsley and Giordano	2010	10	N	N
McQuaid and Grieco	2005	8	N	N
Rye et al.	2008	24	Y	Y
Saunders and McLeod	2005	6	N	N
Saunders	2005	16	Y	N
Saunders and Lewin	2005	12	Y	N
<i>Hong Kong</i>				
Arnott and Small	1994	1	N	N
Borins	1988	30	Y	Y

Table A.1 (continued)

	A	B	C	D
Dawson and Catling	1986	3	N	N
Fong	1985	5	N	N
Hau	1990	10	N	N
Pretty	1988	8	N	N

A: Year.

B: Number of observations.

C: Focus of paper on implementation (Yes/No).

D: Empirical data collected (Yes/No).

E: Total number of cases included in the paper.

We think our conclusions and recommendations are valid for urban road pricing schemes. Possibly they are also relevant for other road pricing schemes but that needs to be validated. Our study makes clear that when studying other road pricing cases there can be large differences between cases in the importance of implementation factors and the manifestation of individual factors. For example, power can play a role. In London it was embodied by the mayor (Altschuler, 2010) and in Singapore by the government (Phang and Toh, 2004). Perhaps, as recommended from the adaptive policy making perspective, adequate monitoring of the implementation process could provide helpful pointers in managing the uncertainty (Marchau et al., 2010) regarding the importance of an implementation factor and its specific manifestation in the implementation process.

Summarizing, the main policy implementation lessons are:

- Road pricing policy implementation requires managing a broad set of implementation factors.
- Political and public support were frequent implementation factors present in all six road pricing cases and could therefore play a role in other road pricing cases as well. The most prominent case specific implementation factor is the role of specific actors.
- Neglecting communication, marketing and information seems to hamper road pricing implementation processes.
- The results are expected to be relevant for other road pricing cases although the implementation factors found in this study are not a priori transferable to new cases. Other implementation factors than the 61 factors found in this study could play a role. The relative importance of factors may be different in other cases. The implementation factors found in this study may have different manifestations in other cases (see Section 4.1). The importance of case specific factors cannot be underestimated.

4.2. Methodological considerations

A contribution of our methodology (selecting six cases, a review of an elaborate set of scientific papers per case and content analysis) is that it resulted in a rich set of implementation factors. For example, on average six implementation factors per case were included in the reviewed papers. Compared to for example Anas and Lindsey (2011) who list nine implementation factors for London and ten for Stockholm, we were able to list respectively 48 and 32 implementation factors. Furthermore, the fact that our research reviewed 106 scientific papers which include implementation factors for the six selected cases supports a more thorough and detailed analysis of the implementation processes than has previously been done. There are some papers that list the most important implementation factors for each case although they do not claim to be complete. Our account of implementation factors is based on a much wider selection of sources than the reviewed papers and we therefore conclude that we have identified an elaborate set of the most important implementation factors for road pricing, at least for the six cases we studied.

One remark on the methodology is that in this paper we have used frequency of occurrence as an indicator of importance. We assume that the reviewed papers only list the implementation factors that had a considerable impact on the course of events in the case concerned. The factors that we listed most for a case are either the distinct implementation factors, such as the role of the mayor in London, or the decisive factors. This latter claim is supported by the fact that several reviewed papers make the importance of particularly the most listed factors of a case explicit. For example, (Ison and Rye, 2005: 463) call the absence of public opposition “most important” and communication “a key lesson” for future implementations. However, we are unable to make a ranking of the most important implementation factors based on the indication of importance of the factors in the reviewed papers as most reviewed papers do not make this explicit for the majority of the implementation factors. Furthermore, from the intercoder reliability test it also became clear that ranking the implementation factors is not very reliable. Hence, this paper gives an overall account of which implementation factors played a role in each case and which set of factors were most relevant. Yet, it does not indicate the precise ranking within the set of important factors. In future research a ranking could for example be made by interviewing the actors involved in order to explicitly evaluate the importance of each factor and to combine these evaluations. More generally, to obtain an even more detailed and complete picture for each case, we recommend examining non-academic literature as well.

Another comment is that the majority of the reviewed papers do not make explicit which evidence is used in the discussion of implementation factors; only 13% collected their own empirical data on implementation factors. Even in papers that

Table A.2

Number of observations in reviewed papers discussing multiple cases.

	A	Singapore B	London B	Stockholm B	Norway B	Edinburgh B	Hong Kong B	Total B	C	D	E
Albalade and Bel	2009	3	11	3	3	11		31	Y	N	5
Anas and Lindsey	2011	2	9	10		3	1	25	N	N	5
Buchanan and Buchanan	2007	3	1	1	1	1		7	N	N	5
Altshuler	2010		9	4		1		14	N	Y	3
Hårsman and Quigley	2010			4	1	1		6	N	N	3
Isaksson and Richardson	2009		3	16		1		20	N	Y	3
Kottenhoff and Freij	2009		2	5		1		8	N	N	3
Lemoine	2009		2	2	2			6	N	N	3
Metz	2008		4	3		1		8	N	N	3
Ryley	2010		3	1		2		6	N	N	3
Schaller	2010		2	1		1		4	N	N	3
Armstrong-Wright	1986	1					2	3	N	N	2
Attard and Enoch	2011		9			5		14	N	Y	2
Attard and Ison	2010		1				1	2	Y	Y	2
Baigabulova	2010		18	1				19	N	N	2
Eliasson	2010			1		1		2	N	N	2
Foo	2000	7					1	8	N	N	2
Foo	1997	7			1			8	N	N	2
Goh	2002	4					1	5	N	N	2
Grieco and McQuaid	2005		1			3		4	N	N	2
Hau	1997				1		6	7	N	N	2
Hensher and Li	2013			5		2		7	N	N	2
Hensher and Puckett	2005		1			1		2	N	N	2
Ieromonachou and Warren	2008		4			8		12	N	N	2
Ieromonachou et al.	2007		10		7			17	N	Y	2
Ison and Rye	2005		10				9	19	Y	Y	2
Khan	2001	3					4	7	N	N	2
Laird et al.	2007		3			23		26	N	N	2
Leape	2006		8			1		9	N	N	2
Lee	2008	1	20					21	N	N	2
Marsden and May	2006		4			2		6	N	Y	2
Nash	2007		7			1		8	N	N	2
Osland and Leiren	2007			11	20			31	N	N	2
Peirson and Vickerman	2008		12			1		13	N	N	2
Phang and Toh	2004	5					1	6	N	N	2
Phang and Toh	1997	2					1	3	N	N	2
Poole	2011		2	2				4	N	N	2
Ryley and Gjersoe	2006		2			5		7	N	N	2
Santos	2005	8	5					13	N	N	2
Santos and Fraser	2006		7			2		9	N	N	2
Santos et al.	2008		15			1		16	N	N	2
Schuitema et al.	2010			6		1		7	N	N	2

Appendix B. Overview of implementation factors in the six cases

	Singapore				London				Stockholm				Norway				Edinburgh				Hong Kong				#	Av.
	S	F	I	T	S	F	I	T	S	F	I	T	S	F	I	T	S	F	I	T	S	F	I	T		
General political support	8.4	1.1	0.0	9.5	3.7	1.0	0.0	4.7	11.4	3.4	0.0	14.8	9.8	4.9	0.0	14.7	1.5	4.1	0.0	5.6	0.0	4.8	0.0	4.8	6	9.0
General public support	3.2	0.0	0.0	3.2	3.0	1.0	0.3	4.4	9.4	2.7	0.7	12.8	2.0	3.9	0.0	5.9	1.5	15.8	0.0	17.3	0.0	2.4	0.0	2.4	6	7.6
Information campaign	6.3	0.0	0.0	6.3	3.0	0.0	0.0	3.0	2.0	0.0	0.0	2.0	1.0	0.0	0.5	1.5	0.0	1.0	0.5	1.5	0.0	4.8	0.0	4.8	6	3.2
Various actor perceptions	2.1	0.0	1.1	3.2	0.7	0.0	0.0	0.7	0.0	1.3	0.0	1.3	0.0	0.5	0.0	0.5	0.0	4.1	0.0	4.1	0.0	7.1	0.0	7.1	6	2.8
Characteristics of the transport system	2.1	0.0	0.0	2.1	4.4	0.0	0.0	4.4	3.4	0.0	0.0	3.4	2.0	1.0	0.0	2.9	0.0	0.5	0.0	0.5	3.6	0.0	0.0	3.6	6	2.8
Marketing the scheme	2.1	0.0	0.0	2.1	0.3	0.0	0.0	0.3	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	1.0	0.0	1.0	0.0	3.6	0.0	3.6	6	1.8
Transport policy and supporting measures	11.6	0.0	0.0	11.6	7.0	0.0	0.3	7.4	0.7	0.0	0.0	0.7					0.0	3.6	0.0	3.6	0.0	1.2	0.0	1.2	5	4.9
Implementation strategy					1.0	0.0	0.0	1.0	8.1	1.3	0.0	9.4	2.0	0.0	0.0	2.0	0.0	6.1	0.5	6.6	0.0	1.2	0.0	1.2	5	4.0
Overall policy design	3.2	0.0	0.0	3.2	1.0	0.0	0.0	1.0	5.4	0.7	0.0	6.0	3.4	1.0	0.5	4.9	0.0	3.1	0.0	3.1					5	3.6
Legislation	1.1	0.0	0.0	1.1	3.7	0.0	0.0	3.7	0.0	6.0	0.0	6.0	0.0	0.5	0.0	0.5	0.0	4.1	0.0	4.1					5	3.1
Use of revenues	2.1	0.0	0.0	2.1	2.7	0.0	0.0	2.7	2.7	0.0	0.7	3.4	4.9	0.5	0.0	5.4	0.0	1.0	0.0	1.0					5	2.9
Perceptions of the problems					3.0	0.0	0.0	3.0	0.7	0.0	0.0	0.7	2.0	1.0	0.0	2.9	0.0	2.6	0.0	2.6	0.0	3.6	0.0	3.6	5	2.6
Project management	3.2	0.0	0.0	3.2	2.3	0.0	0.0	2.3	2.0	0.0	0.0	2.0	2.0	0.5	0.0	2.5	0.0	1.5	0.5	2.0					5	2.4
Participatory process	3.2	0.0	0.0	3.2	4.7	0.3	0.0	5.0	0.7	0.0	0.0	0.7	1.0	0.5	0.0	1.5	0.5	0.5	0.0	1.0					5	2.3
Technical feasibility	3.2	0.0	0.0	3.2					1.3	0.0	0.0	1.3	0.0	1.5	0.0	1.5	0.0	0.5	0.0	0.5	1.2	3.6	0.0	4.8	5	2.2
Timing					1.7	0.0	0.0	1.7	2.0	1.3	0.0	3.4	0.0	1.5	0.0	1.5	0.0	1.0	0.0	1.0	0.0	3.6	0.0	3.6	5	2.2
Political support of regional politicians					0.0	1.0	0.0	1.0	0.0	0.7	0.0	0.7	0.0	0.5	0.0	0.5	0.0	4.6	0.0	4.6	0.0	2.4	0.0	2.4	5	1.8
Various design factors	3.2	0.0	0.0	3.2	1.3	0.0	0.0	1.3	0.7	0.0	0.0	0.7	2.5	1.0	0.0	3.4	0.0	0.5	0.0	0.5					5	1.8
Perceptions on effectiveness					1.3	0.0	0.3	1.7	3.4	0.0	0.0	3.4	0.5	0.0	0.0	0.5	0.0	2.0	0.0	2.0	0.0	1.2	0.0	1.2	5	1.8
Geographical layout	3.2	0.0	0.0	3.2	0.7	0.0	0.0	0.7	1.3	0.0	0.0	1.3	1.5	0.0	0.0	1.5				1.2	0.0	0.0	1.2	5	1.6	
Various management issues	1.1	0.0	0.0	1.1	0.7	0.3	0.0	1.0	1.3	0.7	0.0	2.0	1.5	0.0	0.0	1.5	0.0	1.0	0.0	1.0					5	1.3
Media					0.0	3.0	0.7	3.7	2.7	0.7	0.0	3.4	0.5	1.0	0.0	1.5	0.0	5.1	0.0	5.1					4	3.4
Political champion					4.7	0.0	0.0	4.7					1.5	0.0	0.0	1.5	1.0	2.0	0.0	3.1	0.0	2.4	0.0	2.4	4	2.9
Non-business interest groups					1.7	1.0	0.7	3.4					0.5	1.0	1.0	2.5	0.0	1.0	0.0	1.0	0.0	4.8	0.0	4.8	4	2.9
Technology	2.1	0.0	0.0	2.1	2.0	0.3	0.0	2.3					0.0	2.0	0.0	2.0				4.8	0.0	0.0	4.8	4	2.8	
Scope and exemptions					3.4	0.3	0.0	3.7	0.0	0.7	0.0	0.7	0.5	0.5	1.0	2.0	0.0	2.6	0.0	2.6					4	2.2
Communication					0.7	0.0	0.0	0.7	1.3	0.0	0.7	2.0					0.0	4.6	0.0	4.6	0.0	1.2	0.0	1.2	4	2.1
Power	3.2	0.0	0.0	3.2	4.7	0.0	0.0	4.7	0.0	0.7	0.0	0.7	0.5	0.0	0.0	0.5				1.2	0.0	0.0	1.2	4	2.0	
Political process					0.7	0.0	0.0	0.7	1.3	2.7	0.0	4.0	0.5	0.5	0.5	1.5	0.5	0.5	0.0	1.0					4	1.8
Objectives	1.1	0.0	0.0	1.1	2.0	0.0	0.0	2.0	1.3	0.0	0.0	1.3	2.5	0.0	0.0	2.5									4	1.7
Equity					0.0	0.3	0.0	0.3					0.0	1.5	0.0	1.5	0.0	2.6	0.0	2.6	0.0	2.4	0.0	2.4	4	1.7
Level and structure of charge	0.0	1.1	0.0	1.1	0.3	0.0	0.0	0.3					3.4	0.0	0.0	3.4	1.0	0.0	0.0	1.0					4	1.5
Experience	16.8	0.0	0.0	16.8									6.9	0.0	0.0	6.9	0.5	0.5	0.0	1.0					3	8.2
Privacy concerns	3.2	0.0	0.0	3.2	0.3	0.3	0.3	1.0													0.0	14.3	1.2	15.5	3	6.5
Studies and research	1.1	0.0	0.0	1.1	4.0	0.0	0.3	4.4	4.0	0.0	0.0	4.0													3	3.1
Trust													1.0	0.0	0.0	1.0	0.0	3.6	0.0	3.6	0.0	4.8	0.0	4.8	3	3.1
Many decision-making layers	4.2	0.0	0.0	4.2									0.0	1.0	0.0	1.0	0.0	1.5	0.0	1.5					3	2.2
Culture of decision-making	4.2	0.0	0.0	4.2													0.0	0.5	0.0	0.5	0.0	1.2	0.0	1.2	3	2.0

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(continued on next page)

Appendix B (continued)

	Singapore				London				Stockholm				Norway				Edinburgh				Hong Kong				#	Av.
	S	F	I	T	S	F	I	T	S	F	I	T	S	F	I	T	S	F	I	T	S	F	I	T		
Businesses					1.7	1.0	0.0	2.7					0.0	0.5	0.0	0.5	0.0	2.0	0.0	2.0					3	1.7
Political support of the central government					0.7	0.7	0.0	1.3	3.4	0.0	0.0	3.4					0.0	0.5	0.0	0.5					3	1.7
Motorists									0.7	0.0	0.0	0.7					0.0	2.0	0.0	2.0	0.0	2.4	0.0	2.4	3	1.7
Cost	0.0	1.1	0.0	1.1	0.0	0.3	0.0	0.3									0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	3	1.3
Implementing organisation	1.1	0.0	0.0	1.1	0.3	0.0	0.0	0.3									0.0	1.0	0.0	1.0					3	0.8
Risk management					0.3	0.0	0.0	0.3	0.7	0.0	0.0	0.7	0.0	0.5	0.0	0.5									3	0.5
Support of the road authority					0.3	0.3	0.0	0.7					4.9	1.0	0.0	5.9									2	3.3
Severity of the problems					1.7	0.0	0.0	1.7													0.0	2.4	0.0	2.4	2	2.0
Perceptions on exemptions																	0.0	1.5	0.0	1.5	0.0	2.4	0.0	2.4	2	2.0
Revenues													0.5	0.0	0.0	0.5					1.2	0.0	0.0	1.2	2	0.8
Political support of the council					0.0	0.0	0.3	0.3									0.0	0.5	0.0	0.5	0.0	1.2	0.0	1.2	2	0.8
Duration of the process					0.3	0.3	0.3	1.0									0.0	0.5	0.0	0.5					2	0.8
Various context factors					0.7	0.0	0.0	0.7					0.5	0.0	0.0	0.5									2	0.6
Decision-making procedures					0.3	0.0	0.0	0.3					0.5	0.0	0.0	0.5									2	0.4
Political support of the mayor					6.0	0.0	0.0	6.0																	1	6.0
Partial funding of the central government													5.9	0.0	0.0	5.9									1	5.9
Perceptions of cost and benefits																					0.0	4.8	0.0	4.8	1	4.8
Automobile associations									0.0	1.3	0.0	1.3													1	1.3
Political support within political party																	0.0	1.0	0.0	1.0					1	1.0
Industry interests													0.5	0.5	0.0	1.0									1	1.0
Teething troubles in early stage of operation					0.3	0.3	0.0	0.7																	1	0.7
Various actors					0.0	0.3	0.0	0.3																	1	0.3
Procurement and tenders					0.3	0.0	0.0	0.3																	1	0.3

Is the number of cases in which the implementation factor is listed.

Av. is the average percentage indicating how frequently this implementation factor is mentioned in all cases together.

S = success factor, F = failure factor, I = implementation factor, T = total.

focus on road pricing implementation (11% of the selection) only half of these papers give some clarity on the data sources. This could result in papers echoing the role of prominent implementation factors and, as a result, an overestimation of the importance of the most listed factors in our paper. However, we still consider our analysis to be valuable, for two reasons. First, an analysis of data for which the sources are not made explicit can be valuable if the author is an expert on the case. Second, our analysis combines not just a few papers but the insights of at least 20 different (co)authors for each case. This makes our work less vulnerable to the possibility that in our selection of papers, biased analyses are included. However, given the importance of policy implementation, we think a more rigorous case analysis with a specific focus on the implementation issues would be a valuable scientific contribution. We specifically recommend that future (case) studies on road pricing make their methodology, including the data sources, transparent. Furthermore, the use of empirical data in case studies on road pricing policy implementation is highly recommended.

The last comment we would like to make is that it was not an a priori choice to only select urban road pricing schemes. However, that our selection criteria resulted in this set of cases, might not be a coincidence given the relevance of context specific factors. We feel that the implementation in cities and at the national level can require both a huge effort in coordination across governmental layers (e.g. a failure factor in the Edinburgh case and for the nationwide road pricing implementation in the Netherlands (Vonk Noordegraaf et al., 2012)). However, practice has showed that in specific circumstances, e.g. a mayor with implementation power or sufficient governmental support, the level of coordination for cities is not the main issue. Perhaps the main key to implementing road pricing in cities lies in having adequate transport alternatives in place, with winners outnumbering the losers.

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Appendix A. Overview of reviewed papers

See [Table A.1](#)

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