Promoting Air Quality Policy Adoption and Change

By

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INTELLECTUAL PROPERTY

The candidate confirms that the work submitted is his/her own, except where work which has formed part of jointly authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

Chapter four (Study one). Sakarias Bank (SB): coordinated the study, screened articles; performed analyses; wrote the chapter. Ian Kellar (IK): Helped conceive the design; consulted on systematic review methods. IK, Rosemary McEachan (RM) and Gregory Marsden (GM): (as with all following studies) provided critical feedback on the chapter write up and performed a supervisory role e.g., provided general guidance, contributed to the design and analysis strategy, helped interpret findings. Luke Budworth (LB) and Amy Atkinson (AA): Double screened articles at the title and abstract levels.

Chapter five (Study two). SB: coordinated the study; conceived the vignette study design; designed online questionnaire; wrote the application for ethics approval; conducted interviews; performed the thematic analysis; wrote the chapter. IK, RM and GM: provided critical feedback on the design and chapter write up; assisted in approaching participants. Sally Jones, James Brass, Sarah Possingham: created lists of potential respondents; helped with respondent interactions.

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ABSTRACT

Air pollution is a localised issue but negatively influences health and finance globally. Conurbations and regional governments struggle to find the best policy solutions to meet air quality limit levels while competing over resources and attempting to secure growth. As such, methods to increase the adoption of effective pollution-focused policies are warranted. This thesis has set out to create a framework for understanding the relationship between behaviour change of policy makers and the adoption of new air quality policies at regional levels of government. Chapter four of this thesis looked into the quality and results of previous literature through a systematic review (study 1), investigating how previous interventions have attempted to promote policy adoption. Within chapter five, a vignette study with policy practitioners (study 2; n = 15) was conducted to evaluate the use of intervention functions. Alongside the vignette study, an online questionnaire looked at perceived barriers to policy adoption. Data from both were amalgamated using thematic analysis. Finally, in chapter six, the use of interventions to promote air quality policy and the state of current UK air quality policy was reviewed (study 3). Collectively these studies have contributed to the understanding of how intervention functions influence policy intention formation and policy adoption. The combined outcomes of these studies suggest a) a need for increased education of policy makers and b) for councils to share learning and take inspiration from each other. Throughout the studies, key barriers to policy intentions and policy adoption were investigated, the most prominent being economic and administrative barriers. Within chapter seven, results are summarised and directions for future research and practice are suggested.

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List of abbreviations

AA – Amy Atkinson

BCT – Behaviour Change Techniques

BCW – The Behaviour Change Wheel

COM-B – Capability, Opportunity, Motivation - Behaviour

DEFRA – The UK Department of Environment, Food and Rural Affairs

EU – The European Union

GM – Gregory Marsden

IK - Ian Kellar

LB – Luke Budworth

NHS – National Health Service

NO_x – Nitrogen Oxide

NO_2 – Nitrogen Dioxide

OECD - Organisation for Economic Co-operation and Development

PM – Particulate matters

RM - Rosemary McEachan

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PSS – Person Shaped Support, social care

SB – Sakarias Bank

WYCA – West Yorkshire Combined Authority

WHO – World Health Organisation

CHAPTER 1. LITERATURE REVIEW

1.1 Introduction: Air pollution - why it is a problem

The World Health Organisation defines air pollution as the occurrence of materials in the air that can have a negative effect on humans and the wider ecosystem (World Health Organisation, 2018). These pollutants come from several sources, but key among the major man-made causes of PM and NO_2 pollution in the UK are road transport, construction, and the electricity supply industry (Department for Environment, Food and Rural Affairs, 2020). Outdoor air pollution is linked to heart disease, stroke, and lung cancer, among other diseases (World Health Organisation, 2018; Lelieveld et al., 2015). Further, it has a large impact on health inequalities, as most deaths caused by air pollution occur in low and middle-income countries, especially in the pacific and South-East Asia (World Health Organisation, 2018). Among the pollutants that are most strongly connected to health concerns are particulate matters (PM), Ozone (O_3) Nitrogen Dioxide (NO_2), and sulphur dioxide (SO_2) (World Health Organisation, 2018).

From the great London smog in 1952 to the current air pollution crisis in India and China, air pollution has quickly become a silent killer in an age of global industrialism (Lelieveld et al., 2015). Air quality is a global issue, with several parts of the world suffering from air pollution problems, even though work has been ongoing to reduce pollution for the best part of 30 years. The World Health Organisation publishing guidelines for air quality in Europe in 1987, and again in 2000 could be seen as examples of a starting point for global work with the issue (World Health Organisation, 2016). Air pollution leads to an estimated 7 million deaths per annum globally (WHO Regional Office for Europe, OECD, 2015), with particulate matters alone leading to an estimated 3.3 million premature deaths per

annum globally. A majority of these deaths happen in Asia, but air pollution is a real and severe problem in the western world as well. In Europe, 600,000 premature deaths are estimated to be attributable to air pollution (WHO Regional Office for Europe, OECD, 2015), and only a handful of countries are showing a decrease in pollution. About 6% of mortality in Austria, France, and Switzerland alone can be attributed to air pollution, while there are 16 million days of restricted activity caused by air pollution (Künzli et al., 2000). These impacts on public health further have a financial toll. WHO estimates air pollution from mortality alone to cost $1.431 trillion within the European Region, and overall costs are estimated to be $1.575 trillion (WHO Regional Office for Europe, OECD, 2015). For the individual, air pollution poses a relatively small immediate risk. But public-health consequences and costs are dire (Künzli et al., 2000).

1.2 How can air quality be improved?

The initial segment of this thesis might paint a picture of air pollution as an unstoppable force. There are, however, steps a conurbation can take to reducing pollution and making the air safer to breathe. As air pollution is a localised issue (e.g. Sifakis & Deschamps, 1992; Department for Environment, Food and Rural Affairs & Department for Transport, 2017c; Department for Environment, Food and Rural Affairs & Department for Transport, 2017c), key areas can be targeted with a range of policies aimed at for instance congestion reduction or fuel use reduction. Not all air quality interventions are equal, and the effectiveness of interventions depends on factors such as what problem they are aimed at solving and how well adapted they are to the local environment. For instance, road transport is still the largest contributor to NO_x pollutants in the areas suffering most from air pollution in the UK (Department for Environment, Food and Rural Affairs & Department for Transport, 2017c; Department for Environment, Food and Rural Affairs &

Department for Transport, 2017c). It is important to note the difference between improving air quality by targeting individual-level behaviour change and creating change at a top-down level by promoting policy-level interventions. This thesis is focused on creating windows of opportunity for air quality policy adoption and hence looks at the top-down level.

1.2.2 Policy formulation

In order to understand how policy can be changed, promoted, and implemented, a basic understanding of the policy implementation process is necessary. Policy has the purpose of setting up goals and solutions to societal problems. They are statements referring to what a government institution plans to do or not do (Knill & Tosun, 2008). Public policy is a more closely defined series of actions aimed at solving societal problems. They are, more or less, the outcome of political systems. Most often, publicly elected officials aim to reach compromises on the goals and agendas of the government institution and aim to elect a common approach. Within the literature, the implementation of policy often includes five or six key steps (Knill & Tosun, 2008). This basic model of policy implementation is called the 'policy cycle'. Within this model, policymakers define sets of social problems that need assessing and solutions. Further to this, goals are formulated, and agendas are set. This is the result not just of the preferences of government actors but is shaped by non-governmental actors such as campaign groups or business lobbies. Secondly, policy proposals are refined, formulated, and assessed for impact. At this point, discussions and political debates will have taken place, and policymakers will have agreed on a format of the policy. The next step is to choose a policy to adopt in strategy documents and other policy documents. The fourth step is implementation, taking the adopted policy into action and making it a reality. Finally, the impacts of the policy are evaluated, leading again into agenda-setting,

where future steps and an agenda are formatted (Knill & Tosun, 2008). It is important to note that scholars do not see these processes as always being followed in a linear manner when policy gets made. For example, a decision-maker may see a shared-bike scheme in a city and believe it would be a good thing to have in their own city. The policy or intervention can precede the agenda-setting.

During this process of policy formulation and implementation, individual bias may influence decision-making. An example is how optimism bias sometimes leads to insufficient project funding (Sharot, 2011). Further, individual influences and political stances may lead to different policies being adopted. This is discussed in further detail in section 1.3.1.2.

1.2.3 Effective air quality policies?

A number of policy options already exist in relation to air quality. In consultation with the UK Department of Environment Food and Rural Affairs, (Conlan et al., 2016) set out to describe the usefulness of several common policy solutions. “Pricing mechanisms” (e.g. taxation and congestion charging) have been found effective, such as in cases where user preferences were guided toward sustainable vehicle choices. Furthermore, the use of taxing schemes is advantageous, as there are already taxing systems in place. There is a risk of such schemes increasing social inequality as those with lower incomes might suffer from increased disadvantages, such as not affording to travel. A further risk is that of displacement, where a pricing scheme in the city centre causes air pollution to move out into disadvantaged suburbs (Conlan et al., 2016).

In a systematic review of vehicular intervention effect on health, Burns et al., (2019) noted significant decreases in pollutants and mortality, related to several interventions such as vehicle charging schemes, changes in speed limits, low emission zones, road closures, infrastructure changes, fuel requirements, vehicle

bans, and compulsory vehicle standards. The certainty of the evidence was considered low or very low and results were mixed, but several of the included interventions were shown to have had an effect on both health and air quality. For instance, mandatory standards for diesel vehicles were shown to have had an effect on mortality in Tokyo (Yorifuji & Kashima, 2016), while Dijkema et al. (2008) noted a significant decrease in PM_{10} (7.4%) at intervention sites associated with a speed limit reduction at a heavily trafficked roadway in Amsterdam. Bel & Rosell (2013) noted significant decreases in PM10 concentrations associated with adaptive speed limits in Barcelona but increases in NOx (1.7%) and PM_{10} (5.4%) connected to a speed limit reduction increase (Bel & Rosell, 2013). There is a multitude of potential interventions to aim at vehicular pollutions. Within this segment follows a literature review on some of the more common options.

The literature on Low Emission Zones (a zone within a conurbation where polluting vehicles are restricted or deterred with the aim of improving air quality, but not necessarily using charging schemes) shows mixed results. Fensterer et al. (2014) shows a significant decrease in PM_{10} concentrations associated with the low emission zone in Munich (19.6% summer, 6.8% winter). Morfeld et al. (2014) further reported a significant decrease in NOx (3.5%), NO2 (2.2%), and NO (2.3%) associated with low emission zones in German cities. Further, Boogaard et al. (2012) noted a significant reduction of $PM_{2.5}$ (30%) associated with Low emission sites in the Netherlands. Such policies, however, are often dependent on the degree of enforcement, the set emission standards, vehicle fleets, among other factors, and may require coordination with other measures (Conlan et al., 2016). If combined with, for instance, retrofitting schemes and the uptake of cleaner vehicle technology incentivisation, these initiatives are more likely to be efficient. Promotion of low emission vehicles can generate substantive air quality benefits but are often limited

by low uptake (Conlan et al., 2016), and further do not add local benefits such as reductions in congestion or increases in physical activity. As stated with each of these cases, having a variety of complementary measures in combination with the technical ones is key to their success. The use of any single intervention is unlikely to sufficiently reduce emissions. Further to this, the interventions are often dependent on being tailored to their environment by the use of several other measures.

These interventions all focus on the change of transport but do not take into account modal shift (aside from cases where this is used as complementary measures). The least polluting means of transport might not always be a less polluting car, but instead active travel or public transport. There are certain risks to increased active travel. Road accidents, especially in areas that have not invested in making active travel safe and convenient do occur, and further, the exposure to air pollution is increased compared to car use. Nevertheless, the positive health impacts by far outweigh the risks, by a ratio of 77 to one at a population level (Rojas-Rueda et al., 2011). DEFRA's Clean Air Strategy (Department for Environment Food and Rural Affairs, 2018) includes major funding for public transport (£1.7bn through a transforming cities fund, £840m to non-mayoral city regions, and £840m to six mayoral combined authorities) and active travel (£1.2bn invested into cycling and walking from 2016-2021, £101m to improve and expand cycle routes and £80m to support local projects to make cycling and walking safer and more convenient). Walking and cycling can have a major impact on air pollution and public health, but just as with low emission vehicle schemes require high uptake to be efficient. There is a risk that this money goes to waste unless the user actually engages in the modal shift.

Scheepers et al. (2014) systematically reviewed modal shift interventions aimed at shifting transport from car use to active travel modes. The interventions included workplace-based interventions, urban adjustments such as increasing footpaths and public lighting, population-wide interventions, and bicycle renting schemes. Most studies investigating active travel interventions showed a positive effect on modal shift (mainly from cars to sustainable modes of transport, e.g. active travel, public transport), and most studies used more than one modal shift intervention. Again, complementary interventions may be of help alongside technical interventions.

1.2.3 Modal shift behavioural interventions

Alongside these technical and financial interventions, behavioural interventions are likely to be key as transport user behaviours are dependent on individual decisions or habits. As an example, Riggs (2016) shows that so-called nudges of social altruism have a high degree of effectiveness in impacting modal shift toward active transport. They even stood up to financial incentives and gifts. The impact is lessened, however, when mixed with market interventions such as fiscal incentivisation. Nudges, as Thaler and Sunstein would describe them, are factors in choice architecture (organizing the context in which people make decisions, for instance by having a healthier option being the opt-in choice, Thaler et al., 2013) that influence behaviours without prohibiting or significantly changing incentives (2008). If someone wants to behave in a sustainable manner, they could be reminded of the sustainable option, but are not prohibited from driving to work or eating meat. Michie, van Stralen and West (2011) choose to describe nudges as “soft persuasion”, which is a similar description, but perhaps misses what a nudge isn’t. A nudge sets out to help us make the decisions we want to make and helps us refrain from unwanted behaviours. Further, Walker et al. (2015) show how changes in the

environment lead to a weakening of habitual travel behaviours, creating an opportunity for modal shift interventions. If habitual behaviours are disrupted by technological or hard interventions such as changes in context, behavioural interventions have a greater chance of being efficient. This was shown by Verplanken et al. (2008), who investigated the effects of context change (having recently moved residence) on habitual change. The study showed that when the context changes, core values are activated and guide behaviour. In other words, changes in the context allow people to break habits to instead act based on values or other central factors. In summary, these individual interventions are cheap and may be coordinated with technological interventions in ways that increase their success rates.

Further of relevance to this thesis is the difference between 'soft' and 'hard' policy measures that set out to promote modal shift (reducing the use of a congested mode of transport by offering and promoting alternatives). 'Hard' policies such as congestion charges tend to be coercive and often face public opposition (Richter et al., 2009). They often relate to physical changes in infrastructure or increased costs for car use. Research on the 'soft' type of modal shift interventions instead include measures that target psychological factors (e.g. motivation, attitudes) which influence behaviour. They are aimed at increasing the motivation or to change behaviours on a voluntary basis, for instance by decreasing single occupancy car use or public transport uptake by the use of school travel plans, car share commute schemes, or work from home initiatives (Richter et al., 2009). The difference in approach is clear, in that hard measures use a legislation-based approach, showing what is 'bad behaviour', while soft measures incentivise 'good', normative behaviours. Soft measures can be combined with hard policy types (such as introducing a congestion charging scheme while incentivising sustainable transport

by increasing the potential modes of public transport or decreasing prices). The advantages of soft measures are that the public is more likely to accept these initiatives (Richter et al., 2009). Further, they tend to be less costly, and are effective in motivating car users to voluntarily switch travel modes (Richter et al., 2009). Fuji and Taniguchi (2006) showed that travel feedback programs reduced carbon emissions by about 19%, and car use by 18%, while increasing the uptake in public transport by about 50% in Japan. It is not a stretch to state that a lowered car use and modal shift toward public transport would have a positive impact on air quality. Soft measures do have some limitations. For instance, Richter et al. (2011) describe how soft measures have different impacts on different groups. Promotion of public transport, for instance, has been shown to be most efficient with those that do not yet have established travel patterns, such as those that aren't habitual car users.

1.3 Why are policies not being implemented?

Thus far, several policy packages that may help decrease air pollution have been outlined. For instance, several cities across the UK and Europe (e.g. London, Edinburgh, Stockholm) have implemented congestion charging schemes (e.g. Leape 2006; Eliasson, 2009; Hu & Saleh 2005). Technological interventions such as congestion charging and public fleet retrofitting and scrappage, along with modal shift interventions aimed toward sustainable transport modes, would help to create cleaner air. Nevertheless, there are many factors that prevent appropriate policies from being adopted. Further, policy can be defined by considering what is not done as well as what is adopted. The following sections will outline the literature on factors that influence policy choices, starting with individual factors and then moving on to social and finally contextual and organisational factors. This structure is based on the socio-ecological model framework (Heinrich et al., 2011), which posits that it is not sufficient to encourage individual user behaviour change, but that

real societal change requires approaching a behaviour at several levels, including top down-approaches such as wide policy adoption.

1.3.1 Psychological processes and individual factors

1.3.1.1 Decision-making under uncertainty. The study of psychological factors in economics and decision-making is relatively recent. The advent of behavioural finance and decision-making can be said to have come with the questioning of the liberal economics stance that people are rational decision-makers that always seek maximisation of resource outcome and personal gain (Persky, 1995; Andersen, 2000). Within this stance, people are thought of as having complete knowledge of the risks and milieu that the decision was made in. Instead, a realisation was made that people act within the framework of "bounded rationality" (Simon, 1972), both as individuals and in organisations. People act upon the limited information that is available, and decisions are made difficult by social and contextual factors (e.g. social norms in Andersson, 2000, time and resource scarcity in Shafir & Mullainathan, 2012) and conflicts between goals. Hence, people satisfice using heuristics and other computational models based on experiences and situation recognition (Kahneman & Tversky, 1979). Even as policymakers and public decision-makers have access to more information about a given issue, time is limited, and decisions are made in uncertain environments. As such, there is always a risk of heuristics and biases.

1.3.1.2 Perspective biases and policy. The bias and heuristics programme (Tversky & Kahneman, 1974; Kahneman & Tversky, 2013) is based on the concept that people either act based on the information available, and on controlled conscious processes (system two), or based on previous experiences, in a heuristic and automatic manner (system one). Heuristics refer to adaptive and practical solutions, that may not be optimal, but are sufficient for the situation. They may, for

instance, be based on what has worked in previous situations or trial and error. Once people are experienced enough with a certain type of system two-thinking, they can start automating it to save cognitive resources. This saving of cognitive resources (and time) is adaptive but causes us to ignore contextual factors. When creating a policy strategy, the policy maker most often faces decisions belonging to system two, but still faces elements of uncertainty. Their rationality is still "bounded", leading to the risk of some pitfalls (Simon, 1990). Faucheux and Froger (1995) further question the idea of the classical Bayesian decision-making procedure, a statistical and inductive system of reasoning that values outcomes based on formal principles of probability (Howson & Urbach, 2006) due to the inherent uncertainties involved in environmental policy making. Even as policy makers are part of a large organisation within which they can seek the support of civil servants and feasibility studies, there will always be potential risks of oversight and a lack of certainty. Environmental policy-making contains a further element of uncertainty, as analysis is done at many complex levels, for instance ranging from local air quality policy through to global climate change linked to CO2. Risk assessment, technological assessments, and economic assessments (cost-benefit analysis) are often the factors in regulatory analysis and can be subject to different types of uncertainty (Frey, 1992). One cannot know with certainty how large an impact any given policy may have on active travel or public transport uptake, how this might influence pollution levels, or how much that pollution will impact health. A common approach of the research done is instead "best guess" assumptions and probabilities (Frey, 1992). A further issue is that the basis for assumptions and the scope of thought that went into them is rarely documented in policy documents (Frey, 1992).

Further to the underlying uncertainties of environmental policy making, regions could face unforeseen events such as economical backlash in three years or

fall prey to a national health crisis. The buses bought as part of the project may have deficiencies, or there may be local administrative barriers that cause barriers to implementation. A policy maker can never know with certainty the exact costs and benefits of a project.

Heuristics and biases have further effects on public policy projects as a tool to deal with the uncertainly. The use of biases and heuristics has been shown within public construction, which relates to the construction of infrastructure and transport. If the initial cost is expected to be large, people are more likely to accept overdrafts. This is known as the "sunk costs fallacy". If people have invested in a project, they tend to stay with that investment even when the project is inefficient, in order to avoid a loss of the initial investment (Friedman et al., 2007). Furthermore, people tend to rate what they have initiated more positively once they have bought into it. This relates to so-called cognitive dissonance (Festinger, 1962). After an actor has made a purchase (or adopted a policy), they may fear that they have made an incorrect decision. People dislike this feeling of potentially having made a mistake, and often protect themselves from this cognitive dissonance by over-justifying the purchase and rating it in a higher manner than they normally would. It is not unreasonable to infer that this includes infrastructure construction and investments, such as in the case of public transport investments. If a council has invested in an expensive air pollution policy that later turns out to be inefficient, the sunk cost fallacy and cognitive dissonance could stop them from changing direction.

A further major factor in public planning is "optimism bias", where an economic planner thinks positively of the project, overestimating the likelihood of future positive events and underestimating future negative events. This may cause an underestimation of potential barriers to the implementation process (Sharot, 2011). The literature on public planning (Flyvbjerg, 2008; Cantarelli et al., 2013) further

suggests that heuristics cause planning inaccuracies in infrastructure and other public construction projects. These inaccuracies are often explained by uncertainties surrounding the project. In an uncertain situation, experienced planners often base their plans on previous experiences (Gigerenzer, 2006). When we have done something several times, we feel confident in a familiar situation. A simplified example most people will be familiar with might be that we do not need to consider potential pitfalls and risks when purchasing ice cream, while car buying makes us uncertain and requires planning. A more fitting example in the context of air quality policy adoption could be that of optimization vs satisficing. No policy decision is as simple as buying a car or ice cream. Optimization means taking time to find the absolute best strategy for any problem. Satisficing means doing the closest thing to optimisation you can by applying feasibility studies and risk analysis but stopping when a reasonable amount of analysis has been done. In many health service contexts, optimisation is costly, slow, and dangerous. For instance, a council could study the effects of air pollution for decades and look for the absolute best solution, but this would lead to severe negative health impacts, and the best solution might instead be to apply some heuristics and accept uncertainty in order to create active change. Experienced people use experience-based solutions such as rule-of-thumb and intuition even when facing uncertainty, rather than become paralysed facing a choice. Using these heuristic methods, the risk of biases such as optimism bias might increase, however. A major risk of optimism bias could then be the lack of accounting for unforeseen factors such as packages arriving late or costs for communication between the implementation site and an overseas producer. A planner may also not have accounted for things like local weather, strikes, or bank holidays.

As this thesis sets out to investigate what is entailed within the decisions of stakeholders, it is important to remember that stakeholders are bound to try and make a decision based on the information available. Even with the cost-benefit calculations and feasibility studies that are standard fare in policy making, stakeholders can never be certain of all the variables involved. They take into consideration how much the innovation costs, what effect it will have on the air quality, how applicable it is in the milieu, and how the public views it. But this information is incomplete, which leads to the use of mental shortcuts, guesswork, and may in some cases (as described by Flyvbjerg et al., 2009), lead to strategic deception.

1.3.1.3 Individual factors informing decisions. Beyond the uncertainty of the context, a further factor that will prohibit policies from being adopted is that no two stakeholders are informed by the same values, goals, and intentions. Nor will all stakeholders find the same solution to a problem to be optimal. Differing ideologies and goals instead mean that stakeholders will have to debate their case, try to persuade others, and often settle for solutions by compromising.

Values. The basic level of determinant informing intentions and goals is that of core human values. Values are the building blocks of behaviour formed early in life, based on early life experiences and environments, and are stable over time. These core principles inform motivations, behaviours, judgements, goals, and attitudes (Schwartz, 1992). Schwartz (1992; 1994) describes a model of values where respondents rate value types along two separate value axes, both of which are cross-culturally relevant. “Openness to change vs. Conservation” describes whether a person values stimulation and freedom or conformity, tradition, and security. Of higher value for this research, however, is the axis of “Self-transcendence vs. Self-enhancement”. This value conflict delves into the tendency of a person to prefer

hedonism, achievement, and power (typically self-focused goals) or universalism and benevolence (typically altruistic goals). Nevertheless, specific values are not necessarily telling of an egotistical or altruistic personality type, as some of the types are closer to the centre of the scale, being more neutral, while others are more extreme (e.g. “Social Power” as part of the “Power” category). Decision-makers and stakeholders that influence policy will be driven by their own core values, as evidenced by different political parties having different approaches to any given issue. For relevance to pro-environmental goals and hence behaviours, are the “Universalism” and “Benevolence” traits, while “Power”, “Tradition” and “Security”, seem to make people less likely to adopt pro-environmental attitudes (Schultz & Zelezny, 1999).

Attitudes. A further decision-influencing factor that is informed by values but also by situational experiences and social norms, is the public attitude toward a given policy. Attitudes are evaluations of stimulus objects (Ajzen, 2001), which happen automatically and through affect change cognition about the stimulus object. There is a line of research on how attitudes inform behaviour. Single system theories of reasoning such as the theory of planned behaviour (Ajzen, 1991) and the theory of reasoned action (Fishbein & Ajzen, 1981) set out to describe this relationship (within these models, attitudes along with social norms and perceived behavioural control are the key factors to inform behaviour). A limitation of single-system models of behaviour such as the Theory of Planned Behaviour or the Health Action Process Approach (Schwarzer et al., 2011) is that they do not take into account the role of the context in human behaviour. The Theory of Planned Behaviour describes determinants of intent and behaviour but does not bring up contextual barriers or limitations in our circumstantial opportunity to act, say if we are limited by habits. Attitudes can have a further indirect impact on policy work as public attitudes and

reactions to policy decision specific behaviour change initiatives tend to vary. Electrical vehicles (Egbue & Long, 2012), congestion charging (Beck et al., 2013; Nilsson et al., 2004; Schuitema et al., 2010), and low emission zones have all faced negative public attitudes, potentially causing a further political barrier to sustainable transport policy.

Goal frames. As described, people often have pro-environmental values and attitudes. Nevertheless, they rarely act upon them and instead select short-term options of gain or hedonism. There are several factors like these that distract from "following one's goals". Lindenberg and Steg (2007) set out to describe the structure of not only explicit focal goals but three so-called "goal frames" that people act on. These goal frames include focal goals, but also so-called "framing effects". These are described as effects that impact cognitive processes, and an example could be selective attention. Goals are not activated one by one, but rather in different levels in different situations. The framing effects further influence the strengths of these goals in the situation. Hedonic goal frames reflect the human wish to feel good, either through pleasure or lack of displeasure. It may cause us to be lazy and take the car to work rather than walk, but is also integrated with the others, as giving or receiving may give us pleasure. "Normative" goal frames are related to the perceived "appropriate" way of acting. People have an internal sense of the correct action, (a sense of morals, norms, praxis, or ethics). They watch others and take note, realising that a certain way of action is perhaps best for the group, and further best for themselves, if they wish to help the group. Pro-environmental behaviours often fall into this category, as they fall into the domain of "morality" in people's minds (Lindenberg & Steg, 2007). This can express itself for instance by choosing organically grown foodstuffs when grocery shopping (even though they are more expensive). "Gain" goal frames make the person alert to their own resources. When

people act upon this goal frame, they do so in a manner that aims to maximise one's own resources, often in the process causing problems or loss for others. It could result in myopia or the loss of the group so that one gains an advantage. Lindenberg and Foss (2011) set out to show the impact of goal framing in governmental organisations. Within these organisations, goal frames influence individuals within the organisation to target certain goals. Within their model, gain and hedonic goal frames influence behaviours that lead to individualistic targets of increasing personal resources and the improvement of one's current state of satisfaction, while normative goals set the agenda of acting as a "collective self," aiming to act appropriately in terms of what is good for the collective. Hedonic goals lead to behaviours that concern having fun at work and avoiding unpleasant tasks, while gain goals lead to behaviours aimed at increasing one's income or status. The normative goal leads to behaviours that profit the group as a whole, in a sense cooperation. The research (Lindenberg & Foss, 2011) further points toward hedonic and gain goals being baseline, while normative goals often need activating through framing.

Within a policy-making setting, these goals will inevitably clash. The individual stakeholder's behaviour is informed by their values and intentions, but at different levels of awareness depending on factors within the context that activate and frame the different goals (Steg & Lindenberg, 2007). An example could be if an issue is framed through normative means, or if the workforce is reminded about economic gain through incentives. Lindenberg and Foss (2011) describe how gain and hedonic goals are often baselines within organisations. When normative goals are not clearly stated, employees often try to find out the goals of management, which often puts gain goals at the forefront as they are a more evident part of the organisational structure. A further risk of unclear normative goals is that of social

loafing, the tendency to put in less effort when working in a group (Karau & Williams 1993; Lindenberg & Foss, 2011). As such, the policy process around air quality and sustainable policy could profit from external normative framings. This could be done by setting up common values and mission statements and an institutional language containing phrases such as “good of the group”, “helping” and “cooperating” as clear goals within air quality policy work (Lindenberg & Foss, 2011).

Dayton (2000) further strengthens the argument that core individual principles and goals influence the policy-making process through the concept of “Policy frames”. Contained within these “Policy Frames” are the pattern sets of beliefs, core values, and goals that guide policy actor conceptualisations and ideas about policies. These are never objective, but rather social constructs dependent on experiences and social contexts in which they arise. In situations of uncertainty, individual policy frames are more likely to impact the valuation of policies, hence impeding policy consensus and enhancing conflicts between policy actors (Dayton, 2000).

1.3.2 Social factors

The previous section of this chapter focused on the decision-maker (whether a member of the public or a policy maker) as an individual. The social structures within organisations are complex, however. There is an established body of literature that would challenge the importing of ideas and concepts from the fields of individual decision-making to institutional contexts. This stems from decisions being made by policy makers acting together in a complex environment where contextual factors and conflicts put further limitations on their work. Hence, some research on the group-level dynamics of decision-making needs to be presented.

Politics is and has always been, an arena of conflict between different ideologies and other belief systems for what should be done (if anything).

1.3.2.1 Social dilemma structures. Literature on social dilemma structures and conflicts shows the theoretical basis for how political conflicts between groups or individuals work (e.g. Biel & Gärling, 1995; Biel & Thøgersen, 2007; Fujii et al., 2001) and how they can be affected by contextual factors. Social dilemmas are fundamentally the conflict between doing what is best for the self and what is best for the group. This conflict can be put at an individual vs. group level or an in-group vs. out-group level, depending on contexts. One may prefer to choose what is best for the wider group in one conflict (say that you prefer for your favourite political party to lose votes if it means that a horrible option doesn't get a majority) but choose personal profit in another. In general, however, choosing the group option (referred to as "cooperating") means that the group will be better off, but at the risk of individual loss for some (Kollock, 1998). More people choosing to cooperate is better for the group as a whole. In this setting, an example of this social dilemma structure could be the cooperation between councils. Regions under federalist political structures compete over resources, including national funding (Breton, 1987; Brown, 2012). This so-called "Competitive federalism" is the effect where state and local officials determine their policies based on competition with neighbouring communities. If councils elected to cooperate and help each other with policies, they would be able to do more, but as a consequence, each individual council could risk losing a competitive advantage. There is, for instance, a conflict between the gain of the electorate in the region, and larger gains for the country and the world. Growth for the own council in this competitive federalism often means that competing councils lose out on the funding. As is the tendency for social dilemma structures, cooperating is more successful if more parts cooperate. Brown

(2012) adds to this statement, by describing how federalist societies are perhaps better than nothing as far as combating climate change, but they might not be the best model. Competitive federalism has advantages when it comes to experimentation and wide implementation of policies but runs the risk of having some regions lag behind. It is important that such regions take part in the cooperative process. All parties need to have an understanding of the problem and the policy goals to reach that problem. There also needs to be an agreed-upon level of contribution that seems fair, an agreed-upon structure of targets, and legal structures to enforce these limits (Brown, 2012). An example where such a system has been implemented is the EU, which has set target levels for air quality.

1.3.2.2 Social norms and institutional isomorphism. Further, norms play a large part in the way people act. People have a natural wish to fit into the group and tend to avoid behaviours that seem unacceptable. They also wish to portray a picture of themselves as helping the group. These social norms can be divided into two main types: descriptive norms and injunctive norms (Schultz et al., 2007). Descriptive norms refer to how the behaviours of others are perceived, while injunctive norms describe the morals in the group by an understanding of what is acceptable behaviour. Nee and Ingram (1998) describe the effects of social norms in a group setting on institutional behaviours. This theory describes two main types of norms – 1) Formal norms: explicit rules within a group and 2) Informal norms: non-explicit norms that relate to social approval and disapproval. These informal norms fit well with the psychological view of injunctive norms. Informal norms arise within groups as the standards of expected behaviour. Groups reward behaviours that conform with these norms, such as cooperating in social dilemmas, while free-riding and opportunism are usually frowned upon.

Related to social norms is the concept of "institutional isomorphism", or when institutions are affected by what others are doing and become more homogenous as they fear diverging from the norm (Dimaggio & Powell, 1983). The happens in the public sector as well (Frumkin & Galaskiewicz, 2004) as copying the policy of others is perceived to reduce policy risk while institutions sometimes fear looking bad or lagging behind if they defer from adopting a policy. Whether the effects are on individual levels or institutional, norms and institutional isomorphism cause a policy transfer where the policies of one council are likely to influence their neighbours and competitors.

1.3.2.3 Public opinion. Further to social norms, stakeholders and policy makers are under voter pressure to create immediate change and may be hesitant toward adopting policies with high immediate costs and long-term benefits that may not show up until someone else is in office. Nordhaus (1975; Veiga & Veiga, 2007) describes the nature of myopic economic politics where voter behaviours follow upon the perceived financial performance of the incumbent. If the incumbent did worse than expected the voter becomes likely to vote for the parties in opposition. Hence, policies with high costs and benefits that only show up in the future might be avoided by pragmatic politicians. Of further relevance to why public opinion and perception matters to policymaking, Kingdon's multiple streams (Kingdon & Thurber, 1984; Kingdon, 1995; Rawat et al., 2016) further identifies three largely independent streams of influence on public policy. These streams are problems, policies, and politics. Within the “Problems” stream, ideas and issue framing for individuals, organisations, and institutional groupings play out. An example is how activist groups that realise air quality is a big problem in the conurbation can create pressure for change by manifestations or by creating a petition. The “Policies” stream is the set of ideas or options which are being discussed and researched by

civil servants, researchers and consultants. In the context of air quality policy, this stage is mostly done by civil servants or researchers who are looking into air pollution effects in the local conurbations or doing feasibility studies and risk analyses for different policy interventions to then present their "best fit" options to the decision-makers to then decide on an approach and implement it. The final stream, "Politics", represents the arguments around the urgency of a need to act. It involves risks, trade-offs, and potential gains or losses from action/inactions. In this stream, different political parties and publicly elected politicians have differing stances on solutions to the problem, but also to the severity of the problem itself. Some political parties may for instance prioritise tax cuts or military spending over dealing with air pollution, climate, and public health. This perceived imperative to act largely reflects the values held by the members of the political organ as described in segment 1.3.1.3 of this thesis and can be impacted by several factors, such as public opinion.

The final element of Kingdon's model is "Events – often but not always focussed by a policy entrepreneur who is able to bring the streams together – problems get recognised because solutions are available or because of the political risk of ignoring potential consequences of inaction leads to poor public attitudes and negative feedback loops (e.g. negative media reports).

Within each of these streams, internal and external factors along with individual values influence institutional decision-making. In the problems stream, individual and organisational values and attitudes combine to set agendas. Within the policies stream, different actors (often civil servants, think tanks, and researchers) discuss, consult and research potential solutions. During the politics stream, political arguments influence the institutional urgency to adopt a direction.

In summary, institutional policy behaviour is complex and is influenced by several participants in the context. Individual factors such as values and attitudes influence the politics stream by the priorities of the political parties and their imperative to act on a problem. Further to this, institutional factors such as power structures and resource scarcity impacts the ability to act. Social institutional isomorphism, public opinion, and social norms influence the problems stream by creating an imperative to act on a matter. A "policy window" of opportunity for policy to come forward is created when the three streams come together. Within this thesis, behaviour change techniques are investigated as facilitators of such policy windows. For instance, this might mean targeting facilitation through the policy stream by educating decision-makers in air quality and how it relates to public health or targeting facilitation of the politics stream by showing how other conurbations have successfully dealt with air pollution.

1.3.3 Institutional barriers

Up to this point, factors that influence the policy maker as an individual, and as an individual within a social group or institution have been described. Decisions are made within an uncertain context, and policy makers are influenced by personal psychological processes and preferences. Further, factors influencing the policy maker as part of a group were described. In order for a policy to be adopted, disputes between stakeholders need to be settled and compromises have to be made. There are several further factors within the organisational context that limit the ability of policy makers to freely adopt the policies. Within the coming segment, the potential limitations that are embedded within organisational decision-making will be described.

1.3.3.1 Organisational control. Bulkeley and Betsill (2005) question the extent to which cities themselves influence sustainability. Cities are parts of

complex political systems, where several tiers of government and non-state influence groups advocate different ideas of development. Some activities which influence what happens in a city originate from outside the city. In addition, many of the rules which influence both the context (i.e. is there a wider policy framing to tackle this problem) and surrounding specific policies (e.g. how bans on particular vehicles can be enacted) originate from guidance documents at national and international levels (e.g. national and EU Air Pollution limit levels). A further account of this complex infrastructure of environmental governance is given by Bache et al., (2015) in the context of climate change targets. They argue that having different responsibilities for action at different levels creates a system wherein accountability is low, and focus can be shifted toward economic growth and job creation over sustainability. Elected politicians are reluctant to make the unpopular and concrete decisions that would be required to truly have an effect, and local governments tend to want clearer directives (Bache et al., 2015). However, air quality may be different from climate policy as it is very clearly spatially bounded and the requirement to act is on the local authority, in contrast to climate policy where accountability is often at a national scale. Even with a clearer mandate to act, local authorities in the UK are particularly dependent on the national government for resources. Marsden et al. (2014) showed that local authorities have incentives to align themselves closely with the policy priority of the day, where the resources are also attached and so taking a lead and being very distinctive on policy in an area such as air quality might be difficult. In summary, the research points toward actors in cities facing important contextual constraints around their environmental policies, because of dependence on the national government, but also due to the need to align several other actors. It represents an important factor to consider when studying the preferences and actions of decision-makers at the city scale.

1.3.3.2 Barriers to sustainable policy. Even where there might be a clear political will to act, there is evidently a range of contextual barriers that limit the opportunity to adopt and implement policies. Banister (2005) sets out to describe six barrier types that inhibit the implementation of sustainable transport policies within the regional government.

1) *Institutional barriers.* Banister (2005) describes "Institutional and policy barriers" as relating to problems with coordinating different decision-making organs and conflicts with other policies already in place or planned. A large number of people and organisations are involved in the decisions, which means that differences in cultures and ideas sometimes inhibit decision-making. There may also be issues with bureaucracy if a decision has to go through several steps before adoption and implementation.

2) Resource barriers. Economic barriers relate to restrictions in the budget of a project or policy. If a policy is to be implemented with success, it has to be paid for. This can be connected to the importance of local-national resource dependence referred to above. This can be a very direct issue, causing the implementation to be impossible, or a barrier over time, where a policy costs more to implement than expected. There are also psychological side-effects of this barrier type, for instance, a costly policy will likely be perceived as less appealing than a cheap one. A clear example is given by Thaler and Sunstein in their reasoning on nudges (2008) being cheaper (and effective) than most 'hard' policy interventions.

3) Legal barriers. Most countries have rules set up that decide the way transport schemes are designed, at both regional and national levels. These may be of benefit, as they impose certain standards to a project, but may also inhibit more innovative solutions (such as where implementation of road pricing is challenged due to privacy concerns). In cases where such barriers exist, policy adoption and

implementation will require the undertaking of a legal process, increasing resources and time required (Banister, 2005).

4) "Side effects". Side effects don't always have an effect on the success of the measure itself but may negatively mitigate other policies and activities. This barrier type is typically complex, and the extent of the side effects is often hard to measure (Banister, 2005). An example in the setting of this thesis could be the perceived risk of air pollution spreading to impoverished suburbs if a low emission zone is implemented in the city centre or the impact on small businesses of additional costs related to emission controls.

5) *Physical (other) barriers.* Other barriers could take the form of space restrictions or are related to the topography of an area. For example, there may not be adequate space on the outskirts of an urban area for the introduction of park-and-ride facilities, and the large parking areas they require.

6) *Social and Cultural.* Social and cultural barriers concern the public acceptability of measures. Public acceptability hinders the effectiveness of certain policies and can be a barrier to their adoption and implementation. Interventions with incentives tend to be more acceptable, while regulation and penalties are not as accepted (Banister, 2005).

1.4 Behaviour change interventions to promote policy adoption

As stated in the previous segments of this chapter, there is an imperative to improve air quality and several ways of doing it. Nevertheless, several factors are inhibiting policy action, and pollution remains a problem. A potential solution that might promote policy adoption is the use of behaviour change interventions to influence policy makers.

Behaviour change theories set out to understand key influences of behaviour. Michie, West et al. (2014) describe how behaviour change theories explain why,

when, and how a behaviour does or does not occur, and the important sources of influence to be targeted in order to alter the behaviour. A behaviour change theory, hence, looks at one or several specific determinants of behaviour and how they influence human decision-making and behaviour. A framework can then be created where one would further systematically look at different behavioural determinants, and then at how interventions impact these determinants and further the behaviour itself. Behaviour change frameworks will systematically look at different constructs and how they impact future behaviour change reliably. A successful behaviour change framework for intervention development needs to take root in theoretical constructs and previous research, and then apply comprehensive empirical testing of interventions and behaviour change techniques.

Which constructs to target depends on the content focus of the individual theories and models. Some behaviour change theories focus on the behavioural impact of single determinants, such as attitudes (e.g. Anable et al., 2006; Gifford & Nilsson, 2014), social norms (e.g. Schwartz, 1975; Perkins & Berkowitz, 1986), goal frames (Lindenberg & Steg, 2007) or uncertainty (e.g. the Prospect Theory by Kahneman & Tversky, 1979), while others apply a more systematic approach, trying to cover several determinants, such as in the case of the theory of planned behaviour (Ajzen, 1991), or the theory of reasoned action (Fishbein 1979). Looking at predictive models like these is a good choice when attempting to predict behaviour but may lack the strong connection between the different steps of behaviour change that behaviour change models possess. It is not always clear, when looking at theoretical constructs, what needs to be done in order to achieve the required change in behaviour.

Michie, van Stralen, et al. (2011) in their review of behaviour change theories, further postulate that behaviour change requires changes in either one or

several of an individual's capability, motivation, or opportunity to engage in the target behaviour. With either approach, it is key that the model chosen bases its approach on a coherent, valid, and reliable theoretical fundament. Beyond these constellations of behavioural constructs, researchers and practitioners may want to look at more complex models of behaviour change.

1.4.1 What is the purpose of behaviour change within this thesis?

Within this thesis, behaviour change does not (as in many cases) relate to the health behaviours of the general public or sustainable consumption behaviours. Instead, the focus lies on the behaviour of expert-level decision-makers and organizations. What this thesis is setting out to understand, is not simply theoretical determinants of behaviour change theories or single behaviour change techniques, but rather the determinants of interventions (phrases such as "intervention functions", "constructs", "types" or "categories" have sometimes been used in other models) that make behaviour change interventions successful.

Behaviour change in institutional settings needs to be considered with a complex and comprehensive approach. Consider the Dahlgren-Whitehead "rainbow" model (1991), where differing factors, ranging from the very individual factors such as age and gender to the wider socio-economic and cultural are shown in their impact on our health. This thesis takes a similar approach and considers how interventions could impact policy change at different levels, from individual to institutional. Within this thesis, the role of behaviour change is to look at situations where behavioural determinants may create a window for opportunity for policy change, allowing policies to come forward in institutional settings, and basing this on Kingdon's streams (Kingdon & Thurber, 1984; Kingdon, 1995, see segment 1.3.2.3 in this thesis). This could for instance be trying to change the "policies" stream by increasing awareness of the effectiveness of a policy (c.f. the

implementation function "Education" in the "Behaviour Change Wheel" by Michie, van Stralen, et al., 2011; Michie, Atkins et al., 2014), changing the problems stream by providing new information about the nature of the problem itself, or the politics stream by providing a comparative exercise. Such research would require looking at all potential levels of influence, and further to look at any types of techniques. Hence, the setting and concept of this research require a more comprehensive model including any type of determinant.

Within the setting of this thesis, predictive validity is of lesser importance than the flexibility and comprehensiveness of the behaviour change model. The research takes an explorative approach and sets out to map the decisions of organisational decision-makers, rather than to predict behaviours of the larger population. The application of a behaviour change model within this thesis is to look first at how policy decisions are made, what policy barriers are present, and then how behaviour change intervention functions can impact that possibility for policy change to come forward. Finally, the intention is to look at how previous intervention functions may have impacted policy and strategy documents.

1.4.2 Key behaviour change theories and intervention frameworks

Within this segment, some of the key behaviour change models and frameworks that summarise several determinants and their behavioural impact will be described, starting with the literature on implementation science, and then expanding into the behaviour change models that can be used to predict policy adoption. These models and theories may still be of use at a construct level, especially in order to describe potential barriers and facilitators to behaviour change in the context but should not form the complete fundament to this research.

Throughout the past decades, psychology as a field has seen several attempts to create theories of behaviour change. These have ranged from theories that only

looked at a single determinant of behaviour, e.g. goals in "Goal Framing Theory" (Lindenberg & Steg, 2007) or social norms in the "Focus Theory of Normative Conduct" (Cialdini et al., 1991), "Social Change Theory" (Thompson & Kinne, 1990) or the "Social Consensus Model" (Romer & Hornik, 1992), to more generalised protocols for developing interventions, which include theories and models. Several approaches exist to intervention development ranging from implementation theories to theories of behaviour change. O'Cathain, Croot, Sworn, et al. (2019) have created a taxonomy of the most prolific approaches and set out to describe when they can be used, what some advantages and limitations are. Included are also some key principles of intervention development and a framework of actions for intervention development. One of the very key principles of intervention development is that it is iterative and dynamic. Another is that it draws on existing literature and theory. Preferably, this process should draw on multiple theories, as some explain the psychological principles of change, while others explain the institutional context (O'Cathain, Croot, Duncan, et al., 2019; O'cathain, Croot, Sworn et al., 2019). O'Cathain, Croot, Sworn, et al. (2019) set out to describe different approaches to intervention development in a taxonomy through a systematic review. Through this approach, they create eight different categories of intervention development.

Table 1.1 Categories of intervention development approaches

Category	Description
Partnership	People who will use the intervention participate equally with the research team in decision-making about the intervention.
Target population-centred	Intervention is based on the views and actions of the people who will use it.
Evidence and theory-based	Interventions are based on published research evidence and existing theories. E.g. Behaviour Change Wheel, Intervention Mapping
Implementation-based	Intervention is developed with attention to use in the real world.
Efficiency-based	Components of an intervention are tested using experimental designs to optimise efficiency.
Stepped or phased	Interventions are developed with an emphasis on following systematic processes.
Intervention-specific	An approach is constructed for a specific type of intervention.
Combination	Existing approaches to intervention development are formally combined.

Note: adopted from O'Cathain, Croot, Sworn, et al. 2019.

Within the framework of this research, the goal is not necessarily to develop an intervention, but rather to understand what determinants might create windows of opportunity where intentions to adopt air quality policy are increased or formed. As described in segment 1.4.1 of this thesis, the theory elected to describe the institutional context in this thesis (and to connect institutional theory to theories of change) is Kingdon's streams of public policymaking (Kingdon & Thurber, 1984; Kingdon, 1995). The research sets out to describe a specific behaviour and the determinants that might change that behaviour. As the research is exploratory and sets out to extend theory, a theoretical approach to intervention development is fitting (O'Cathain, Croot, Sworn, et al., 2019). As such, the next task on the agenda is to find a behaviour change theory or model that can describe determinants of policy adoption intentions.

1.4.2.1 Generalised predictive theories and frameworks of behaviour change

- The *PRIME Theory of Motivation* (West, 2006) is a general theory of motivation. The theory proposes that there are five sub-systems to the human motivational system, that interact with each other and are influenced by the environment. Michie, West et al. (2014) describes how the PRIME theory fits within the broader COM-B model of behaviour in which capability, motivation, and

opportunity interact as a system to generate behaviour. Hence a wider model of behaviour change is preferred for this thesis.

- *The Social Ecological Model of Behaviour Change* (Panter-Brick et al., 2006) emphasises the importance of embedding interventions in the social and ecological settings that contextualise human behaviour. Constructs such as attitudes, social norms, self-efficacy, behavioural beliefs, and normative beliefs are embedded into the development of interventions, but a wider context is also considered. The context is brought up and understood through a social ecology, where wider constructs such as local and external investment, financial commitment, time constraints, etc. a feedback loop also needs to be created, where the impacts of the intervention are communicated and provide positive feedback, to ensure that the intervention is sustainable.

- *The Systems Model of Health Behaviour Change* (Kersell & Milsum, 1985) again integrates behaviour change with a wider context. It integrates social, environmental, psychological, and physiological factors into a model of behaviour change. with a view to providing a framework for the development of health education curricula. The model is firmly set in health behaviour change and covers several levels of health behaviour influences, including external conditions, personal conditions, socio-psychological factors, and the behavioural condition. As with the Social Ecological Model, a feedback loop is central to the model. This model is centrally focused on individual health behaviour change.

- The *Theory of Planned Behaviour* (Ajzen, 1991) and the *Theory of Reasoned Action* (Fishbein, 1979) are predictive models of behaviour that set out to explain some of the key factors that lead to behaviour, among them intentions, attitudes, and values. The Theory of Planned Behaviour is a model of purposeful human behaviour and evolved from the Theory of Reasoned Action. Intentions are

the direct precursors of behaviour and are, in turn, determined by attitudes towards the behaviour, subjective norms, and perceived behavioural control. Attitudes are determined by behavioural beliefs, subjective norms by normative beliefs, and perceived behavioural control by control beliefs. An issue with the theory is that it only describes purposeful behaviours, and not habitual behaviours or the influence of context. Actual behaviour is often dualist and exists in a complex and interactive environment (especially political behaviour, which is impacted by social interactions, different ideologies, and reaching decisions by compromises). As stated by Klöckner and Blöbaum (2010), a more complex model of behaviour change is likely to be more powerful when attempting to predict or change behaviours.

1.4.2.2 A brief review of generalised behaviour change models and frameworks for intervention development

This segment includes a basic review of some of the most common and relevant behaviour change frameworks that integrate theories and models of behaviour change. This is not a complete review of behaviour change models and frameworks. Whilst several models of behaviour change and several behaviour change frameworks are not detailed here the described frameworks have been selected due to their extended use in health psychology as well as their fit with public sector policy work.

- *Intervention mapping* (Bartholomew et al.,1998) bases its approach on five steps of intervention development:

  - Proximal program objectives matrix creation
  - Theoretical methods and practical strategies
  - Designing and organizing a program
  - Adoption and implementation plans
  - Monitoring and evaluation plans

The basic idea within the framework is to through iterative processes find the correct methods and interventions based on the target population and context. The approach is based on matrixes and mapping of separate constructs and drawing connecting lines between them in order to understand the target behaviour and what may be a successful agent of change. Intervention mapping is hence a comprehensive approach meaning to integrate and bridge the gaps in the available theories and models in order to develop interventions. Needs assessment, program implementation, and evaluation are further brought into the process. O'Cathain, Croot, Sworn, et al. (2019) describe how intervention mapping does not cover the entire range of behavioural techniques available, and further how it may be difficult and time-consuming to operationalise and implement (e.g. McEachan et al., 2008). Further to this, Kok et al. (2016) explain how the parameters within the protocol are developed through literary synthesis, and not always through meta-analysis. Hence, the statistical underpinnings for the methods used in Intervention Mapping are less grounded than desirable (Kok et al., 2016). The model is however extremely rigorous (O'Cathain, Croot, Sworn, et al., 2019; Wight et al., 2016) and has been found useful for developing a range of interventions (e.g. worksite physical activity in McEachan et al., 2008; interventions for stress-related mental health issues in the workspace in van Oostrom et al., 2007). Even considering the rigour of intervention mapping, the Behaviour Change Wheel is more integrated as a tool (Michi, van Stralen et al., 2011).

- The "*MINDSPACE"* framework (Dolan et al., 2010) is an influential government report on how to integrate behavioural theory into policy work through a checklist. The checklist is made up of nine key influences on behaviour: messenger, incentives, norms, defaults, salience, priming, affect, commitment, and ego, and bases its interventions on 'soft nudges'. This follows from an idea that

public initiatives often do not take into account the public reaction (Dolan et al., 2010). The *MINDSPACE* model (Dolan et al., 2010) builds on behavioural economics and mainly focuses on the automatic behaviours of users and consumer groups from the public (behaviours arising from contextual cues rather than cognition, or "system 1 thinking" – Dolan et al., 2010, p.265), and hence lacks certain comprehensiveness. Soft nudging would infer that the public is more willing to behave in accordance with the policy, compared to say legislation or incentives. The focus on automatic behaviours renders the model perhaps less useful when considering the reflexive and more informed decisions and behaviours of policy makers. There are potential cases where nudging may have an effect, but this thesis is likely to require a more varied system of intervention types. Further, as described by Michie, van Stralen, et al. (2011), the model does not encompass all important intervention types and hence lacks cohesiveness.

- The *Context, Executive and Operational Systems Theory* (Borland, 2017) is a comprehensive theory for understanding "hard to maintain" behaviour change. The theory proposes two systems are part of behaviours, an executive and an operational system. The executive system formulates and acts toward goals, while the operational system acts to seek a balance between context and internal needs. Borland (2017) identifies several routes of contextual influence that have the ability to change behaviours, four that emanate primarily from outside the person, and six self-regulatory processes. These are intended to then map onto other theories of behaviour change and the specific interventions related to them. Borland (2017) further proposes that the executive system can only control behaviour when they generate sufficient force to counter the operational system. The pursuit of a goal can be centralised through processes of self-regulation, and through immediate or evaluative feedback. Conceptual behavioural influences can be organised around the

functions of the two systems, clarifying how "hard to maintain" behaviour change can be difficult, and hence assisting in developing interventions (Borland, 2017). Comparing Borlands Context, Executive and Operational Systems Theory (2014) and the dual executive and operational systems to the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014), one might say that the operational system is similar to the Opportunity and Capability segments of the COM-B model, while the executive system is similar to the motivation segment. The executive system draws upon a person's goals, and motivation within the COM-B system focuses on a person's willingness to take part in a behaviour. This is in contrast to opportunity and capability, which are connected to contextual and social factors. Hence, the key segments of the CEOS framework are already covered by the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014). Further to that, the Behaviour Change Wheel adds to the theory by also covering a direct connection to the interventions, and by also containing a more comprehensive and systematic theoretical foundation. Further to this, the review of techniques and intervention in Borland's model (2017) is narrative, and there is limited mapping of specific techniques to determinants.

- The *"Comprehensive Action Determination Model"* (Klöckner & Blöbaum, 2010) is an ecological model that incorporates intentional, normative, situational, and habitual influences on environmentally friendly behaviour. The model sets out to create a more complex theory of behaviour change and does so by combining the Theory of Planned Behaviour, Norm-Activation Model, habits, and ipsative theories of behaviour into a comprehensive model. The primary purpose of the model is to investigate determinants of environmentally friendly behaviours such as travel choice, where (as with the Theory of Planned Behaviour) the model showed stronger predictive power than the individual models it combines. Adding to

and changing situational conditions was showed to have a promising impact on behaviours, even as habitual, normative, and intentional processes still play an important role. The "*CADM"* model (Klöckner & Blöbaum, 2010) shows the impactful behavioural determinants in a meaningful way, but the research as of yet does not describe impacts of specific behaviour change techniques or attempt to create a framework for applied techniques. Nor does it set out to describe what in an intervention actually impacts outcomes. Instead, the focus is on the theoretical determinants (compare: Theoretical Domains Framework, Abraham & Michie, 2008; Michie et al., 2005; French et al., 2012) of behaviour. As with the Theory of Planned Behaviour and other predictive models, the CADM model of behaviour change belongs more within theoretical domains than it does in comprehensive behaviour change frameworks (e.g. The Behaviour Change Wheel and the COM-B model). Even as the model shows strong predictive power, a potential limitation of using the model within the policy choice setting is that it does not easily map onto intervention techniques, nor does it clearly map onto Kingdon's policy streams (Kingdon & Thurber, 1984; Kingdon, 1995).

- The *Behaviour Change Wheel* (Michie, Atkins, et al., 2014), which bases its change constructs on the *Theoretical Domains Framework* (Michie et al., 2005; French et al., 2012), and the COM-B model combined, is based on systematic reviews of 19 theoretical behaviour change frameworks. 9 intervention functions and 7 policy categories were found. None of the 19 frameworks covered all of these. The BCW framework is the first attempt to systematically analyse behaviour intervention frameworks, apply usefulness criteria, and assess the reliability of practical framework applications. While the predictive power of the behaviour change wheel as a protocol for intervention development and COM-B as a behaviour change theory is lower than the Comprehensive Action Determination

Model, the Behaviour Change Wheel links its behavioural determinants (referred to as intervention functions) to policy interventions through systematic reviews of the literature, with inter-rater reliability of 88 and 79%.

1.4.3 What models and theories might be used in the context of this thesis?

As a whole, single-factor models are limited to single behavioural determinants in their scope, and while they can carry great value as research models, they tend to also lack the interaction between intervention techniques and the theoretical constructs. Generalised models of behaviour change tend to contain a wider span of theoretical structures, but again do not always weave determinants of behaviour to the interventions. Within this thesis, it is fundamental that the represented model covers not only behavioural determinants and theoretical frameworks, but also connects them to interventions and is applicable on intentions to adopt policy.

- The Behaviour Change Wheel model is based on a review of all the identified frameworks that appeared in a systematic search and developed one that drew together all relevant components. None of the 19 frameworks reviewed by Michie, van Stralen, et al. (2011) while developing the Behaviour Change Wheel were comprehensive (Michie, Atkins, et al., 2014). None of the other models that have attempted to be more systematic about intervention designs and include frameworks of theory have covered full ranges of intervention options available. Few of them were coherent or clearly linked to models of behaviour change. Models that focused mainly on conscious bias or social environment still needed to be addressed however and are still likely to be important. But they need to be considered alongside other important factors in a comprehensive manner.

Michie, van Stralen, et al. (2011) intend for the tool to be used at multiple levels – individual, community, and target population, in order for real behaviour

change to take place (Michie, Atkins and Gainforth., 2016). Michie, van Stralen et al. (2011) state that the behaviour change wheel can be used by anyone intending to change behaviour, including intervention developers, policy makers, etc. The tool was in fact field-tested by Michie, van Stralen, et al. (2011, p.9) by applying the framework to develop and implement strategies. The Behaviour Change Wheel provides a systematic way of determining which options are most likely to achieve the required change. The "Theoretical Domains Framework" is a related model, out of which the Behaviour Change Wheel has evolved. The Behaviour Change Wheel adds to the Theoretical Domains Framework the COM-B model, which divides the components of the "Theoretical Domains Framework" (Michie et al., 2005) into 'Capacity', 'Opportunity' and 'Motivation' compartments of behaviour.

The use of a framework in this thesis is focused on showing policy makers and strategists what determinants might work to facilitate the policy adoption process by creating windows of opportunity where intentions are enhanced to adopt a policy. Michie, van Stralen, et al. (2011, p.8) describe how the behaviour change wheel tool and COM-B could be used in order to help policy makers and intervention designers from neglecting important options. This along with the description of the different levels of use intended in Michie et al. (2016) is evidence enough that the tool has usefulness in changing the behaviour of stakeholders, and not only the generalised population. Further to this, Michie, van Stralen, et al. (2011) describe how the model is not linear, but components within the behaviour system interact with each other as do the functions within the intervention layer and the categories within the policy layer. Hence, the model is not limited to the behaviour change of populations but could also be used to change public behaviours through first targeting people involved in policy implementation. Nevertheless, relating back to Kingdon's policy streams (Kingdon & Thurber, 1984; Kingdon,

1995), the greatest fit of the behaviour change wheel and the COM-B model, is in the policy effectiveness steam. Extending the use of the COM-B model beyond this means that the theoretical position is somewhat stretched. As this thesis commits to explorative research, attempts could be made to look at effects outside the policy effectiveness steam, but any conclusions made will require future testing, for instance through quantitative experiments.

O'Cathain, Croot, Sworn, et al. (2019) classifies COM-B as a research and theory-based approach to intervention development, meaning that it combines existing theories with published evidence to create interventions. The benefit of the Behaviour Change Wheel is that it encourages intervention designers to consider the full range of options through systematic evaluations of theory and evidence. It is not a blueprint for behaviour change, but a system for making the best use of the resources available. The Behaviour Change Wheel creates an ontology covering the relationship between behaviour change technique, intervention mechanism, and theoretical domain. As this thesis is an explorative approach to the research, looking at a new setting for determinants that may create a change in policy-maker intentions to adopt policy, predictive validity may not be of central concern. The BCW improves theory development by helping to understand why interventions fail or work and draws attention to the different levels at which interventions should work and hence fits primary research (O'Cathain, Croot, Sworn, et al., 2019). There are some limitations to the Behaviour Change Wheel, however. Primarily, judgements are required in cases of exploratory research and substantial knowledge is required about psychological processes in order to make accurate statements (O'Cathain, Croot, Sworn, et al., 2019).

1.4.3 Using the Behaviour Change Wheel

Michie, van Stralen, et al. (2011) set out to present a generally applicable framework for intervention development around a so-called "behaviour change wheel". Within the wheel, seven target policy categories[1] enable behaviour change through nine behaviour intervention function types, upon which specific behaviour change tools map. For instance, a feasibility study of a Low Emission Zone maps onto the education function, while a tax deduction scheme for low emission vehicles would map onto the incentivisation function. Interventions may be complex and map onto several behaviour change techniques. One such case could be public consultation, that would in part model onto education, as it tells stakeholders about public opinion, but it could also relate to enablement or persuasion, as it could put certain demands on the stakeholders, or enable policy adoption through showing other elected officials that a policy has public backing

[1] See table 1 for a summary of the policies and interventions included in the Behaviour Change Wheel and their definitions.

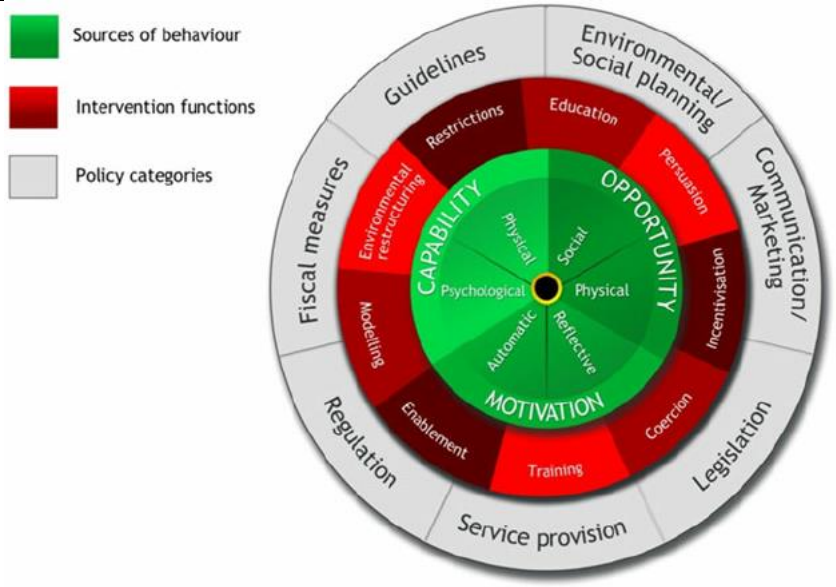
Table 1.2
Intervention functions and policies included in the behaviour change wheel and their definitions

Intervention functions	
Education	Increasing knowledge or understanding
Persuasion	Using communication to induce positive or negative feelings or stimulate action
Incentivisation	Creating an expectation of reward
Coercion	Creating an expectation of punishment or cost
Training	Imparting skills
Restriction	Using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)
Environmental restructuring	Changing the physical or social context
Modelling	Providing an example for people to aspire to or imitate
Enablement	Increasing means/reducing barriers to increase capability (beyond education or training) or opportunity (beyond environmental restructuring)
Policies	
Communication/Marketing	Using print, electronic, telephonic, or broadcast media
Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision
Fiscal measures	Using the tax system to reduce or increase the financial cost
Regulation	Establishing rules or principles of behaviour or practice
Legislation	Making or changing laws
Environmental/Social planning	Designing and/or controlling the physical or social environment
Service provision	Delivering a service

1.4.4.1 The COM-B model. Drawing on previous work attempting to find a consensus model of theoretical domains that explain behaviour change (Michie et al., 2005), the Behaviour Change Wheel framework (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) further sets out to systematically evaluate previous frameworks while developing a new framework, aiming to overcome the limitations of previous models. The framework sets out to cover three criteria that

make it especially useful: 1) the framework needs to have extensive coverage, meaning that it should apply to any intervention that might be developed; 2) the model should be coherent, and its content categories use the same levels of specificity and type; 3) the framework should have links to overarching models of behaviour. Behaviour change frameworks were evaluated based on their comprehensiveness, their coherence, and their links to an overarching theoretical model of behaviour. After a systematic literature review and evaluation of existing behaviour change frameworks, a new framework was created where previous intervention categories were tabulated and refined by establishing links between intervention functions and three key components of the so-called COM-B system: Capability, Opportunity, and Motivation. Further, policies were included in the model separate from interventions, as they are a way for responsible authorities to enable and support interventions (Michie, van Stralen, et al., 2011). Links were drawn between the components of the behaviour system COM-B, the intervention functions, and then to policy categories with an inter-rater reliability of 88%. Within the new framework, seven policy types were placed in the outermost layer, as they only influence behaviour through the interventions they support or enable, nine intervention functions were placed in the middle layer, the behavioural components Capability, Opportunity, and Motivation were placed in the inner layer, and the target behaviour was placed in the middle.

Figure 1.1: The Behaviour Change Wheel.



Note: figure from Michie, van Stralen, et al. 2011.

The three factors of the Behaviour Change Wheel interact with each other, and through this interaction generate behaviours. Within the model, capability is defined as "the individual's physical and psychological capacity to engage in the activity" (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014). Motivation is defined as the "brain processes that energize and direct behaviour". This relates not only to informed processing such as deliberated choice and intentions but also to non-deliberate reactions and behaviours such as habitual behaviours and emotional responses. The final factor described is "opportunity", which relates to contextual factors that make the behaviour possible or prompt it. The "COM-B" model aims to show what factors influence behaviours and then gives a structure for potential interventions that target those relevant factors (Michie, van Stralen, et al., 2011). Behaviour change techniques are then mapped onto the behavioural factors through the intervention functions that they relate to[2]. Following the model, interventions containing training may increase a target actor's reflexive motivation through

[2] See figure 1.1 for a summary of this mapping.

increased understanding. Finally, if there is no social or physical opportunity, one might apply interventions of the environmental restructuring, restriction, or enablement types.

Within this thesis, the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, West, et al., 2014) is used due to its adaptability and fit with policy makers. It draws from both policy work in public health and human psychology and describes diverse intervention types. Relating to Kingdon's streams (Kingdon & Thurber, 1984; Kingdon, 1995) and institutional setting policy choice, the Behaviour Change Wheel is a comprehensive approach to behaviour change, containing factors at several levels. It can be used to create interventions at an individual level, aimed at improving understanding and changing attitudes among the population, but is also a fit for targeting policy effectiveness by creating windows of opportunity for policy change. However, a potential limitation of the COM-B tool is that the included techniques and constructs are abstracted to such a level that they might be difficult to operationalise in interventions.

2.0 CHAPTER 2: PERSPECTIVES, RESEARCH APPROACH AND RESEARCH SETTING

The following chapter will outline the paradigmatic standpoint of this thesis, including the research paradigm, the ontology, epistemology, methodology, and the theoretical perspectives used. The chapter will show the reasoning that led to the perspectives, methodology, and methods used in the included studies of this thesis, and arguments will be presented for the selected approaches. Finally, the aims and objectives of the research are explained.

2.1 Paradigm, Ontology, and Epistemology

The definitions of "paradigm", "research methods" and "research methods" used in Teddlie and Tashakkori (2009) are presented within this segment and subsequently applied throughout this thesis. Teddlie and Tashakkori (2009) present several definitions of research paradigms including, including but not limited to Mertens (2003), and Morgan (2007). In common between these definitions are that a paradigm is a worldview or system of beliefs and practices, but while Mertens (2003, pp.139) refers to a "worldview, complete with the with assumptions that are associated with that view", Morgan (2007, pp.49) refers to "systems of beliefs and practices that influence how researchers select both the questions they study and methods that they use to study them". The definition that Teddlie and Tashakkori (2009) end up with is: "a paradigm is a worldview including philosophical and socio-political issues, whereas a research methodology is a general approach to scientific inquiry involving preferences for broad components of the research process. Research methods are specific strategies for conducting research" (Teddlie & Tashakkori, 2009. p. 21).

Paradigm: The positivist approach makes the assumption that reality is made up of measurable objects that can be tested even when humans are not interacting with them (Teddlie & Tashakkori, 2009). A chair would still be considered a chair, even if no one is sitting on it. If a respondent says they are struggling with budget, this is taken at face value as a measurable problem no matter the perspective. This stands in opposition to the interpretivist paradigm, where reality is made up of subjective experiences – e.g. the budget issues may actually be perceived, while the real issue is resource allocation or bias. A further paradigm is the pragmatist paradigm, which allows research questions to inform the methodology in pragmatist approaches. (Teddlie & Tashakkori, 2009).

Ontology: Following upon the paradigm, ontology covers the science of being and related concepts. A fundament of ontology as it relates to this research is whether the researcher sees a single reality or multiple possible realities (Teddlie & Tashakkori, 2009). Realism posits that there is a single reality, while relativism is based on the concept of multiple realities. This is not taken to mean that there is a universe with several alternative realities, but rather that individuals create their own reality and that different people perceive reality in different ways. Basically, ontology forces researchers to ask themselves whether the perspectives and interpretations of different individuals are sufficiently different to consider within the framework of the research.

Epistemology: Epistemology continues the spectrums of paradigms and ontology. Within the concept of epistemology, the interrelation between the researcher and the research is dealt with. Is the data objective and independent from the researcher, or are the data and the researcher linked? Subjectivity is based on the idea that the researcher influences or is influenced in his/her interpretation of it. (Biesta, 2010).

2.1.1 Inductive and deductive approaches

Inductive reasoning can be defined as *"the process whereby a general law is established by accumulating particular instances"*. Data is gathered and then generalisations are drawn from the data. This is a "bottom-up" approach to the research and data.

Teddlie and Tashakkori (2009) define deductive reasoning as *"arguing from the general (e.g., theory, conceptual framework) to the particular (e.g., data points)"*. In contrast, this is a "top-down" approach where a hypothesis or prediction is stated and then tested through data collection and analysis.

The Abductive approach to reasoning is based on the concept that neither pure induction nor pure deduction is complete. Instead, abductive research looks at general patterns, but also seeks to identify what events or phenomenon are connected to a specific situation (Kovács & Spens., 2005). This is done through an iterative mix of theoretical and empirical study in a learning loop (Kovács & Spens., 2005).

2.2 Thesis research approach

2.2.1 Paradigm, ontology and epistemology

2.2.1.1 Paradigm. This thesis uses a pragmatist perspective, essentially allowing the research questions to guide the paradigm. If the research questions and the data show something, this is taken to be true. The investigative techniques are flexible, qualitative research can be used to inform quantitative research and vice versa. A weakness of pragmatism is the risk of bias related to the methodological approach of the specific study. However, as the idea behind pragmatism is that the variety of options available means that selections can complement each other, this should ideally lead to a strengthening of outcomes rather than a weakening. For example, findings should answer different parts of the same question providing a

more complex picture and strengthening any argument (Teddlie & Tashakkori, 2009).

2.2.1.2 Ontology. This thesis uses a relativistic perspective, meaning that reality can be different depending on the perspective of the data (Teddlie & Tashakkori, 2009). A policy officer may, for instance, view a policy in a sufficiently different perspective from a member of the public or an elected politician, that their perspectives are actually worth considering within the framework of the research. An example of the consequences of this ontology is that student samples might be insufficient for this research, as only experienced professionals will have the necessary knowledge and understanding of the problem to respond to the items within the study. This makes quantitative testing very difficult, as the professionals in this context are a very hard to reach group. For exploratory research, however, it is likely to be the best fit.

2.2.1.3 Epistemology. Within the concept of epistemology, the interrelation between the researcher and the research is dealt with. Is the data objective and independent from the researcher, or are the data and the researcher linked? As there is a large risk of researcher interference with the open-ended nature of the research items within the studies in this thesis, subjectivism should be considered a risk. Within the research, and specifically the interview study in chapter five, certain steps were taken to address this risk. As this study was done with a hard to reach sample, the researcher had to adapt to the needs of the respondents. As most respondents were unable to participate in a lab setting, some interviews were done via telephone, while others were done in the workspace of the respondent. On certain occasions, a civil servant was present to increase the comfort level of higher-level decision-makers. During the coding and extraction of data, an inductive coding scheme was established and maintained without a priori categories, to make sure the

data guides the conclusion, rather than allowing the researcher conclusions to guide the use of data.

2.2.2 Research methodology

2.2.2.1 Mixed methods/qualitative methodology. As stated, the research approach refers to whether quantitative, qualitative or mixed methods will be used to collect data and answer research questions (Teddlie & Tashakkori, 2009). Within this thesis, a mixed-methods approach is used, with a focus on qualitative methodologies. Quantitative research refers to a methodology of research where numerical data is collected and then analysed, often through statistical means. It tends to use positive or postpositive paradigms, deductive logic, and statistical data analysis. Qualitative research instead applies constructivism paradigms, inductive logic, and categorical or thematic analysis strategies (Teddlie & Tashakkori, 2009). Qualitative methods are mostly used for explorative research, while quantitative methods are used for confirmatory research (Teddlie & Tashakkori, 2009). Qualitative research tends to use narrative forms of data, while quantitative uses numeric data (Teddlie & Tashakkori, 2009). Summed up, qualitative data can give researchers deep sets of information that point out key factors or variables that need to be studied with quantitative methods. These qualitative methods can often lack generalisability, where quantitative methods are often stronger. Further, Teddlie and Tashakkori (2009) describe a continuum approach to the research methodology where research can be fluid and have elements that are both qualitative and quantitative at different levels. Although not set in stone, particular research approaches often align with research paradigms, ontologies, and epistemologies. Typically, the positivist, realist, and objective ends of the spectrum lean towards quantitative approaches, while the interpretivist, relativist, and subjective ends lean towards qualitative approaches (Teddlie & Tashakkori, 2009). Mixed methods

appear between these approaches and uses both method types. A mixed-methods approach can use a combination of inductive and deductive logic, a pragmatistic paradigm, and integrated qualitative and quantitative analysis.

The application of a mixed-methods approach is due to the explorative nature of the research, and the fit of this approach with the limited population size and research questions. The thesis aims to find out what factors can be relevant to policy adoption interventions, and not necessarily to seek generalisation. This thesis uses a "bottom-up" inductive approach to the research questions. With explorative qualitative research, this has several advantages. As the thesis is mainly concerned with explorative and novel research questions, the data should be allowed to guide the reasoning and future study of the field. At least until more is known about the factors being studied and their relationships.

2.2.3 Research methods

As described, the mainstay of this thesis is qualitative. Chapters five and six are both heavily qualitative, while chapter four contains a narrative review of previous interventions to promote policy adoption. Chapters five and six both use thematic analysis as the main analysis method. Chapter six is a policy analysis, but rather than using the standardised methodology for policy analysis, the study seeks to find key frames and themes based on a priori themes. Three types of qualitative research methods and analysis were seen as possible for this thesis: framework analysis; grounded theory and thematic analysis. Within this segment, the three types of qualitative analysis are presented along with reasoning for the use of thematic analysis.

2.2.3.1 Framework analysis. Framework analysis was developed as a tool for applied research within organisations. Specifically, it is best suited for research with clear and specific research questions, a limited time frame, a pre-designed sample,

and a priori issues (Srivastava & Thompson, 2009). Within the analysis, data is collected, charted, and sorted into themes using five steps: (1); familiarization, (2); identifying thematic frameworks, (3); indexing, (4); charting and (5); mapping and interpretation. Framework analysis is flexible and dynamic along the analysis process, is systematic in its treatment of the data, comprehensive in nature, and allows between- and within-case analysis through comparisons between and associations within cases to be made (Srivastava & Thompson, 2009). It should be noted that framework analysis is developed in part for when time is limited, for instance in for-profit organisations, public organisations and for policy work (Srivastava & Thompson, 2009).

2.2.3.2 Grounded theory. Grounded theory is a logically consistent set of data collection and analytic procedures aimed at developing theory (Strauss & Corbin, 1994; Charmaz, 1996). Strauss and Corbin (1994) describe grounded theory as a general methodology for developing theory that is grounded in data systematically gathered and analysed through inductive strategies. The method starts with individual cases, incidents, or experiences and develops progressively more abstract conceptual categories, to synthesize, explain, and understand data and to identify patterned relationships within it (Charmaz, 1996). The work begins with the area of study, and then builds a theoretical analysis on what is discovered to be relevant (Charmaz, 1996). Theory is developed through an interplay between analysis and data collection. The sources of data are field observations, qualitative interviews, and document analysis. This makes grounded theory similar to other qualitative methods. It is an interpretive science, which requires perspective-taking (Strauss & Corbin (1994).

In summary, there are similarities between grounded theory and other qualitative methods, but the most fundamental difference is that of theory

development. In summary, grounded theory is a posteriori type of methodology where theory in large part is developed through the data, rather than brought in a priori through research questions (Strauss & Corbin, 1994).

2.2.3.3 Thematic analysis. Thematic analysis is a method for identifying, analysing, and reporting themes within a data set (Braun & Clarke, 2012). Thematic analysis differs from other methods in that it isn't connected to any pre-existing theoretical framework and can be used within different frameworks depending on the need and what one intends to do with them (Braun & Clarke, 2012). As such, a benefit of thematic analysis lies with its flexibility (Braun & Clarke, 2012). Several qualitative types of analysis are fundamentally tied to their theoretical or epistemological standpoint – e.g. conversation analysis and grounded theory (Braun & Clarke, 2012). Others are essentially independent of theory and epistemology and can be applied across a range of theoretical and epistemological approaches. Thematic analysis is firmly grounded in this second camp and is compatible with different research paradigms. This flexibility comes with a need for methodological soundness, however, and assumptions need to be clearly stated (Braun & Clarke, 2012).

As this thesis adopts a pragmatist paradigm, where the research questions are allowed to guide the research methodology, the flexibility of thematic analysis fits the project well. Further, there is a certain lack of theoretical praxis connected to the field, which increases the case for this flexibility and for thematic analysis to be used within this thesis, and specifically the studies presented in chapters five and six.

2.2.4 Narrative analysis

Chapter four covers a narrative review of previous interventions to promote the adoption of policy in regional government. The initial intention of this study was

to write a systematic review of the same subject. To do further research on interventions aimed at a policy level, previous intervention attempts have to be investigated. Think of this chapter as an explorative summary of evidence to guide further work in this field. These objectives are more easily satisfied by the explicit methods used in a systematic review to methodically search, appraise and synthesize the literature on a subject. Due to the lacking literature on the subject, and the variations in fields and hence methodology and reporting, comparing such disparate studies as action research and quantitative analysis in a meta-analysis was deemed impossible.

As stated by Collins and Fauser (2004), the narrative focus and prescribed methods of systematic reviews do not allow for comprehensive coverage. In cases where the coverage is wide, a narrative review is more fitting. Nevertheless, a comprehensive and systematic approach was taken to the method for searching, selecting, extraction of data, and the discussion about the risk of bias.

2.2.4 Policy analysis

Chapter six in this thesis is a policy analysis of the 16 conurbations (see table 5.2, pp.123 of this thesis) in the UK that are facing repercussions from the European Commission due to not reaching EU air pollution limit levels. The chapter is based on a pragmatist paradigm and allows the research questions to guide both the paradigm and the methodology. Hence, where a more typical version of policy analysis could be used (e.g. Browne et al., 2018), an approach is instead adapted where the research questions guide a novel methodology where intervention functions and policy intentions are analysed by applying thematic analysis to a-priori theme groups.

2.3 Aims and thesis outline

2.3.1 Project rationale

As described in chapter one, there is currently a high level of pressure on several UK conurbations to present ambitious Air Quality strategies, in some cases including Clean Air Zones (a Clean Air Zone can choose to charge vehicles, but does not have to) or Low Emission Zones (Low Emission Zones charge the most polluting vehicles). One of these conurbations is the Leeds City Council and by extension the wider West Yorkshire area, which is under the same combined authority. Further, Bradford is another city within the region that is struggling with air quality and planning to introduce new policy. Clean Air Zones are intended to be implemented in the Leeds and Bradford inner-city areas.

At the time of writing this thesis, the specifics of the strategies including the Clean Air Zones were still unclear. Several research projects and studies need to be undertaken as part of such policy work, and research that is important just by face value. This includes things such as feasibility studies and cost-benefit analyses.

Taking a step back and looking at Banister's barriers (2005) to sustainable transport policy, parallels can be drawn between the research and development conducted before a project is implemented, and the different barrier types. Cost-Benefit Analysis is done to investigate whether a policy is achievable from a budget perspective, and further what economic implications it may have in the long-term. Social and cultural barriers have to be taken into consideration when doing feasibility studies. Will the public accept the project, or purposefully inhibit it? Physical or geographical barriers will have an effect on the cost of the project but will also shape the need and shape of the project. There is one final barrier, however, which is more difficult to account for and transgress through economic or natural studies. The administrative barrier type relates to factors such as bureaucracy

and different ideologies of the policymakers themselves. Managing these factors together with different project-specific variables is difficult. This thesis specifically sets out to describe what behavioural mechanics play a part in the policy-making process, what barriers inhibit adoption, and finally what behavioural tools could function as air quality policy adoption facilitators, either at organisational or individual levels.

To understand the operationalisation of this research, it is once again important to understand what makes up the different steps of the policy process. There are several models of the cycles of policymaking (e.g. Nakamura, 1987). Within most of these models, however, key steps can be identified. The initial step concerns identifying the nature of the issue. Sutton (1999) refers to this as "problem formation", the second step concerns the identification of possible solutions. This is referred to as "policy intentions". The third step of the model covers the weighing of alternatives based on their advantages and disadvantages. In some models, this step also includes the selection of the solutions that offer the best outcomes. This is referred to as "policy adoption". The fourth (or fifth) step concerns the implementation of the policy, making sure that it is made real. Finally, the actual outcomes of the implemented policy are evaluated. A wide literature exists already on influencing different parts of this linear model, with a special focus on the "implementation" and "evaluation" stages. However, within the framework of this thesis, which is set in the frame of psychological research, classical ideas around policy cycles may not provide the best of fits. In part as they are often considered idealised, and in part because an understanding of different actors and their roles in policymaking needs to be understood. Kingdon’s multiple streams (Kingdon & Thurber, 1984; Kingdon, 1995) may hence prove a better fit. Policymaking is a complex iterative process where several actors influence the agenda from different

positions. As summarised in segment 1.2.3.2 of this thesis, Kingdon's multiple streams approach to policymaking (Kingdon & Thurber, 1984; Kingdon, 1995; Rawat et al., 2016) further identifies three largely independent streams of influence on public policy. An agenda has been set through the problems stream, arguments are presented in the politics stream, and within the policies stream, the best approach is reasoned by civil servants and academics. The policies stream is the set of ideas or options which are out there being talked about, solved by consultants, or researched. Kingdon (Kingdon & Thurber, 1984; Kingdon, 1995) states that the primary actors within this stream are academics, researchers, and consultants. For instance, civil servants who are researching the feasibility of a policy concept, or consultation with the public on a proposed policy. There is an imperative to combine behaviour change theory and implementation science with political science (Kingdon's multiple streams) by looking at how different frames, determinants of behaviour change, and intervention functions (from Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) may create windows of opportunity (mainly within the policy stream) and shift the set agenda to where the intentions to adopt or implement a policy increase. Such research could create valuable initial insights for facilitating policies around important societal issues such as air quality and public health.

2.3.2 Objectives and aims

This thesis sets out to gain an understanding of what factors influence intentions to adopt air quality policy within a regional government setting. Within the framework of this research, policy intentions are defined as "what is included or not included in policy documents such as air quality agendas and strategies". This thesis sets out to investigate this through a case study of the West Yorkshire conurbation, and through the study of wider UK air quality policy. The thesis further

sets out to create a fundament for the future study into this complex field, which is currently lacking a unified set of methodology and terminology.

- First, to look at what has been done in previous research to promote the adoption of new policy into strategy documents.

Chapter four of this thesis presents the findings of a systematic review of previous interventions aimed at promoting policy adoption and change in a regional setting. This is done to try and understand what such interventions have contained, and to create an initial outline for understanding and coding interventions using the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014). Further, the quality of the literature on policy adoption interventions is evaluated.

- To introduce intervention functions found useful in the systematic review to policymakers through the use of a vignette study. This is intended to test the efficacy of intervention functions in promoting policy adoption.

The fifth chapter of this thesis presents the findings of a narrative vignette interview that trials the use of the intervention functions from the COM-B method (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) that were found impactful in the systematic review with a sample of West Yorkshire stakeholders and policymakers.

- To investigate to what extent the intervention functions that have been useful in previous studies have been used in current UK policy.
- To look at what air quality policies are intended to be implemented within the UK air quality strategies.

Chapter six of this thesis details the results of a narrative policy review of 16 UK air quality strategy documents. The review looks at the air quality strategy documents

of the 16 UK conurbations that are under pressure from the European Commission to present strategies outlining policies to reach EU limit levels at the time of writing of this thesis (European Commission, 2014). The review continues the use of the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) to understand intervention functions, and further describes what policies are intended throughout the 16 conurbations. Any potential patterns in interventions and air quality policy intentions are then described. Further, the review explores the use of stakeholder and community engagement initiatives.

- The final aim of the thesis is to find out what barriers are perceived to have been in play during the policy formulation process.

3.0 CHAPTER 3: STUDY SETTING

3.1 Introduction

This thesis takes a top-down approach to the research topic, rather than a bottom-up approach, focusing on potential ways to influence air quality and transport use at a policy-making level rather than at individual consumer behaviour levels. Contained in this thesis are three mixed-method and qualitative studies looking at facilitators and barriers to air quality policy adoption.

Several previous projects have explored the behaviour of the consumer as a means to reducing air quality, for instance by finding methods of changing habitual nonenvironmentally friendly behaviours such as driving to work (e.g. Dahlstrand & Biel, 1997; Fuji & Kitamura, 2003; Verplanken et al., 2008) or by looking at the use of social norms to promote sustainable transport (e.g. Schultz et al., 2007; Goldstein et al., 2008). Taking a top-down approach means that behaviour change tools are used to target stakeholders and policymakers. Within psychological sciences, the work of influencing policymakers and stakeholder intentions is limited, with a majority of work in environmental psychology focusing on user behaviours. User behaviours are an important part of sustainably and sustainable transport, but as a large part of transport is done by business and public sector actors, organizational behaviours and stakeholder behaviours are a potential further frontier of environmental and health psychology work. The public sector can increase the usage of sustainable transport by not only adopting sustainable transport within their organizations, but further by implementing policy that has an impact on the transport use of the general public. The novel element of this research is to look at, summarise and order the work that has been done on the possibility of influencing policy intentions and policy adoption using behaviour change tools while creating a

common set of constructs and a direction for future research. The institutional literature does not often consider the behaviour of individual policymakers as it sets out to understand decisions made within hierarchies and networks. However, as the review in chapter 1 showed, notions of policy framing and problem acceptance are relevant to the setting and so this research offers a potentially valuable window into whether these factors can be understood for individual policymakers and those policymakers operating in a wider decision-making system.

To gain comprehension of the issues faced by policymakers, and in order to understand what facilitators there may be, this thesis explores air quality policymaking using a case study of West Yorkshire. This chapter sets out to describe the current situation of air quality and air quality policy in the West Yorkshire region, from several angles. Within the region, cities such as Leeds and Bradford are at risk and may face both national and EU measures if interventions such as Low Emission Zones aren't implemented within the coming years (European Commission, 2014). Furthermore, air quality causes high economical costs at both national levels (through the United Kingdom National Health Services) and council levels (because of public health tools and social care) due to the negative public health effects that a lack of exercise and poor air quality leads to. In 2017, the health and social care costs of air quality in the UK were estimated at £42.88 million, and costs are estimated to reach £5.3 billion by 2035 (Public health England, 2018a; Public health England, 2018b), while air pollution is deemed the cause of 28000 to 36000 deaths per year nationally (Committee on the Medical Effects of Air Pollutants, 2018). At a regional level, 5.1% of all deaths in West Yorkshire (2013) were caused by exposure to particle air pollution, with numbers as high as 6% in some areas (West Yorkshire Local Authorities, 2015).

Within this chapter, a brief is given of the current policy situation, describing the measures that are currently in place to combat air pollution from the five West Yorkshire councils, and how they intend to approach the problem in the future. Subsequently, a description is given of the pollution problem as it currently stands. This will include examples of regional pollution measures, costs for the region and the nation, along with potential national and EU regulations that may concern the region. Finally, an attempt is made to predict and describe the impacts of air quality and transport policy in the region. This will be presented as three topics: (1) economic impacts of air quality and transport policy; (2) Health impacts of air quality and transport; (3) Environmental impacts of air quality and transport.

3.2 Current policy environment in West Yorkshire (as of early 2019)

3.2.1 Summary of the West Yorkshire local transport plan 2011-2026. This 15-year Local Transport Plan for West Yorkshire covers the period 2011 to 2026. The Local Transport Plan is the statutory plan for transport in West Yorkshire that has been developed in partnership with the five West Yorkshire district councils, Leeds, Calderdale, Kirklees, Wakefield, and Bradford. Consultation has been made with the Highways Agency and National Rail, members of the public, transport operators, businesses, and others.

The plan builds on the second West Yorkshire Local Transport Plan, where successes included securing additional train carriages to relieve crowding, the introduction of new “City & Town Bus” services, bus station enhancements, real-time bus information, road safety, travel conditions, air quality and the completion of highway schemes. The plan reflects national policy, including the 2011 White paper, "Creating Growth, Cutting Carbon", but also reflects the Leeds City Region Transport Strategy, and specific local geographical and economic priorities, such as taking into consideration that West Yorkshire has more manufacturing jobs (13%)

than the national average (10%), while Leeds has a higher proportion (86%) than the national average (84%) of service sector jobs (West Yorkshire Local Transport Plan Partnership, 2011). The plan does not cover aviation, international shipping, and the motorway network.

3.2.2.1 Transport Problems. Congestion (car occupancy in West Yorkshire is 1.25, compared to 1.37 nationally during the morning peak) and a lack of investment into public transport (there is a lack of competition between bus companies, leading to higher ticket prices and a reduction in uptake) is a cause of lower than national average economic performance (10% below national average, ranging from 24% below in Bradford, and 12% below in Leeds) within the West Yorkshire region (West Yorkshire Local Transport Plan Partnership, 2011). Transport has an impact on business through access to markets, consumers, and clients, and through transport links with other cities, nationally and internationally.

As relates to air quality, road transport accounts for 21% of carbon emissions in West Yorkshire (West Yorkshire Local Transport Plan Partnership, 2011). 30% of the West Yorkshire rail network is electrified, compared to approximately 40% nationally (Butcher, 2017), and over 70% in seven EU countries, including Italy and Sweden (European Commission, 2019; Swedish Transport Administration, 2016), while 60% of West Yorkshire buses meet Euro III standard or above. Private car use is still the most common form of transport, which leads to congestion, in particular during peak times (West Yorkshire Local Transport Plan Partnership, 2011). This, along with poor road and footpath conditions, also decreases the quality and viability of public transport. Fare levels, frequent network changes, crowding, and lack of integration are seen as barriers to public transport usage. Road casualties are more common than the national average. The predicted growth in population, employment, and housing will increase the problems of congestion and reliability. A

further major economic obstacle is that fares, service cuts, etc. will make the system less ideal to low wage customers (West Yorkshire Local Transport Plan Partnership, 2011).

3.2.2.2 Objectives and aims. The strategy presents a different focus on different levels through its four key components, five central themes, and six big ideas. These have different levels of implementation and abstraction but show a clear direction of focus.

Table 3.1
Four key components of the 15-year strategy

Transport assets	Roads, traffic lights, bus stops, etc.
Travel choices	Helping customers select the most sustainable options.
Connectivity	Providing safe, integrated, and reliable journeys.
Enhancements	Improving the overall system to make it more fit for journeys in the future.

Transport assets. A focus within this component is to prioritise asset management and maintenance standards according to a hierarchy of key transport route networks and users that best support the plan, putting (1) active travellers such as walkers or cyclists and (2) public transport vehicles over (3) commercial vehicles and (4) taxis, motorcyclists and cars. The hierarchy is a toolkit that provides guidance about how the needs of each road user group should be taken into account during the development of transport interventions and to define the order of considering the needs between different user groups along key routes.

Travel choices. The West Yorkshire Local Transport Plan (2011), has developed a new strategy for behaviour change which sets out to guide the best and most cost-effective ways of supporting travel choices. According to the plan, there will be a major focus on marketing, information, and education initiatives (West Yorkshire Local Transport Plan, 2011). There will be work with the health sector to promote active travel and reduce obesity (West Yorkshire Local Transport Plan,

2011). There will also be "push-measures" through appropriate demand management and enforcement (West Yorkshire Local Transport Plan, 2011). Car and lorry trips create the most emissions and hence have the biggest adverse impacts on quality of life (West Yorkshire Local Transport Plan, 2011). According to the plan, bus use is falling while safety is a concern with active and public travel. The main goal set out in the West Yorkshire Local Transport Plan (2011) is to reduce the length and frequency of trips by car by the use of a new behaviour change model. The new behaviour change model has been developed to understand the motivations behind travel choices and how to influence these choices. This model begins with (1) stating awareness that there is a problem, then (2) accepting responsibility, (3) understanding what alternatives one has, and then (4) evaluating options. The user then (5) tries the options, and finally creates a (6) habit. The adaptation of sustainable behaviours is dependent on the beliefs of relevant others and external environments (perceived safety). According to the West Yorkshire Local Transport Plan (2011), providing information is also crucial; this can be done through additional technology. The behaviour change model is meant to increase understanding of what motivates behaviour, and further to influence those behaviours and travel choices. The Transport Plan presents no empirical or theoretical evidence for the practical usefulness of this model, which is problematic. Although the model shows limited basic similarities in some steps to other behaviour change and choice structure models (e.g. intervention mapping: Bartholomew et al., 1998), no evidence is presented within the Transport Plan for its descriptive strength, predictive validity, nor is it described specifically how the model will be applied in order to influence behaviours. Further, few of the steps of the model are sufficiently specific to actually show how the implementation of this behaviour change tool will take place.

Connectivity. This focuses on creating an integrated, reliable, and financially sustainable network of transport services that can provide attractive alternatives to the car, including focusing on the core network and improving interchange between services. This includes transport interchange hubs and smart integrated ticketing. New freight strategy, more road safety (behaviour change, not physical engineering), and facilities to encourage walking and cycling.

Enhancements. The key focus is to get more out of the existing transport system through better network management, the provision of additional rail carriages to reduce overcrowding in the peak period, and to provide the scope for growth. Some added rail stations; targeted investments in the highway network have also been proposed. Also intended is the development of infrastructure to support low carbon technologies.

Five themes.

Table 3.2
The five central themes of the strategy

Equality	Integrated sustainability appraisal.
Safety	Relevant safety and security standards.
The environment	Improving the natural and built environment.
Decision making at the appropriate level	Regional or local?
Alternative funding and delivery mechanisms.	

Six big ideas.

Table 3.3
Six big ideas within the vision

Enhanced travel information.
Fully integrated ticketing.
Investment in low carbon modes of travel
A new approach to buses.
Phasing in stronger demand management
A new approach to network management.

"MyJourney" vision 2026. The "MyJourney Vision for West Yorkshire" (West Yorkshire Local Transport Plan Partnership, 2011) policy document presents three key policy objectives for the strategy: (1) Economy. Improving connectivity in order to support economic activity and growth in West Yorkshire and the Leeds City Region. Transport gives good access to markets, customers, and clients; makes qualified staff available, and creates links with other cities. (2) Low carbon. Making substantial progress towards a low carbon, sustainable transport system for West Yorkshire, while recognising transport's contribution to national reduction plans. (3) Quality of life. To enhance the quality of life of people living in, working in, and visiting West Yorkshire.

The MyJourney Vision for West Yorkshire (West Yorkshire Local Transport Plan Partnership, 2011) further presents several barriers that may influence the outcomes of these key policy objectives:

Economy: Crowding and congestion are high, while access to other city regions is poor. Further, road conditions are poor, but roadwork may increase congestion. There is a lack of competition between bus and rail companies in the region. Bus use fell 8.8% the previous decade, with high fares and concern about value for money possibly having discouraged public transport use (West Yorkshire Local Transport Plan Partnership, 2011). The frequency of bus network changes is a further key issue, as is bus punctuality and rail performance.

Low Carbon: Transport and land-use planning are not sufficiently "joined-up", which contributes to the increasing need to travel, distances travelled, and type of transport. As previously stated, car occupancy is low while only 30% of West Yorkshire trains are electrified, and only 60% of buses meet euro standard emission levels.

Quality of life: One of the barriers to quality of life within the region is the higher number of road casualties than the national average. This discourages cyclists, who are at an increased risk. Obesity is a big problem in the region as is air and noise pollution, with over 30% of adults being obese in Yorkshire and the Humber, compared to 27% national obesity in England (Moody, 2016).

Funding: The first implementation plan covers 2011-2014. The objective during this period was to ensure that the current network is properly maintained and delivers the best possible value for money. It is also part of the plan to take steps toward the six ideas during this period. £154m is expected to be spent over the 3 years, together with an annual spend of £284m. Over half of that goes toward maintaining current transport assets.

In the “Travel Choices” component (which probably relates most to this research), there is an expected budget of £8m over three years with a first-year budget of £3m. The key focus will be on integrating information across all modes of travel and personalising information development through greater use of technology and data.

“Connectivity”: 3-year capital programme (£14m) supported by £177m spend in the first year. Key focus on the continued development of proposals for a bus quality contract scheme, as well as the role of the traffic light priority programme. £33m is allocated to "Enhancements". Here, a range of technical indicators will manage implementation performance.

The largest part of the budgetary expenditures is within the "assets" department, and within this, the focus will lie on connectivity. This includes support for local bus and rail services and concessionary fares. There was a great decrease in funding over the last few years before the plan came into shape. Projects and programmes have therefore been identified and prioritised according to their cost-

effectiveness. Schemes will only be developed where there is a strong value-for-money case and a high probability of funding being available.

3.3 Local transport plans

As with the statutory transport strategy for West Yorkshire, the local transport plans have aimed to support the economy, environment, and quality of life in their districts as well as the region. The previous local transport plans are no longer public documents but presenting their achievements and the local aims and barriers (West Yorkshire Local Transport Plan Partnership, 2011) are nevertheless relevant to this research.

Table 3.4
Previous achievements of the Local Transport Plans

1	Reduced congestion with traffic flows during the peak period reducing and numbers of cycle and rail trips increasing.
2	Enhanced public transport.
3	Increased road safety with 15% less serious injuries in collisions during 2009/10, compared to 2006/07.
4	Improved management of air quality result of district air quality action plans; bio-methane gas refuelling facilities; and a travel to work-project.

Note: collected from the West Yorkshire Local Transport Plan Partnership, 2011.

1) Bradford states a need for the transport system to support their aspirations for major regeneration over the next 15 years, including the city centre and a canal road urban eco-settlement. There is a high level of congestion on some routes into the city and on the outer ring road. Improved connectivity is needed. Making the roads safer and improving the quality of life is also important (West Yorkshire Local Transport Plan Partnership, 2011). 2) Calderdale faces barriers in a geographically confined highway network, peak hour congestion, and a rail route that has to meet local needs as well as long-distance. Calderdale further states a need to develop walking and cycling networks (West Yorkshire Local Transport Plan Partnership, 2011). 3) The key transport priority according to Kirklees is to improve and strengthen connectivity between centres within Kirklees and across the Leeds city

region (West Yorkshire Local Transport Plan Partnership, 2011). 4) Leeds is the principal economic centre within the city region and has had significant employment growth over the past decade. This has resulted in high congestion and overcrowding on the rail network. Leeds states a need to improve traffic flow and to reduce air pollution (West Yorkshire Local Transport Plan Partnership, 2011). 5) Wakefield's plan includes sustainable transport as a support for housing and employment growth. They also state an intention to reduce congestion and supporting greener fuel technologies. Wakefield has a "District Cycle Strategy" and recognises its usefulness (West Yorkshire Local Transport Plan Partnership, 2011).

3.4 What will happen without interventions?

The region expects high growth in the future, while congestion and emission are likely to increase. This will make it harder to get to jobs, while higher bus fares and more crowding on the rail are expected, according to the West Yorkshire Local Transport Plan Partnership (2011a; 2011b). The West Yorkshire Local Transport Plan (2011) states that these factors will constrain economic growth. The plan further states that cycling and walking are unlikely to increase without interventions (2011). The plan also states that quality of life will likely decrease through increases in road casualties and greater emissions (increases in both noise and air pollution). The West Yorkshire Local Transport Plan (2011) states that it is likely that the local natural environment will be negatively impacted. According to the plan, low usage of buses could lead to people feeling less secure at some points in time and some locations (West Yorkshire Local Transport Plan, 2011). Finally, obesity is likely to increase region-wide (West Yorkshire Local Transport Plan, 2011).

Lack of real-time transport information, simplified/smartcard ticketing, and influence over buses have often been raised as issues by respondents in response to which element of the transport they would like to see improved (West Yorkshire

Local Transport Plan Partnership, 2011). There is a lack of competition in the bus market, making it difficult to demonstrate value for money. Four large operators share 92% of the customers (West Yorkshire Local Transport Plan, 2011). Cycling and walking issues have frequently been raised by respondents, and have been rated as relatively important, especially in response to protecting and developing active travel infrastructure.

3.4.1 Economic impacts of air quality and transport policy.

Bradford is at risk of exceeding the EU Limit Values for NO_x but not Particulate matter, while some areas exceed the WHO target levels. Kirklees, Wakefield, and Calderdale are mainly rural councils with lesser air quality issues. Leeds needs to reduce pollution and is currently working on implementing a Low Emission Zone (West Yorkshire Local Transport Plan Partnership, 2011). Not improving the air quality within the council could risk the region facing penalties from the EU, UK government, and the WHO.

Several previous attempts have been done with air pollution-reducing policy innovations. The most impactful ones are Low Emission Zones and congestion charging schemes (Conlan et al., 2016) within major cities. Of further interest are the side-schemes that follow the implementation of such innovations. Conlan et al. (2016) further press the importance of attacking the air quality problem on several flanks using, for instance, public transport, park and ride, and active travel schemes as complements. It is specifically important to make sure that the car as transport is replaced by another people mover. Educating the public on bike safety is also a key consideration (West Yorkshire Local Transport Plan Partnership, 2011). Replacing trips longer than five miles requires different implementations and different thinking. Getting public transport functional requires more buses and trains but could also include bus lanes, large maintenance costs, making sure coverage is

sufficient, timetables being up to time, efficient ticketing systems, etc (West Yorkshire Local Transport Plan Partnership, 2011). All in all, replacing the car with public or active transport is necessary but may turn out to be very expensive for the affected region.

An economic evaluation of air quality interventions within West Yorkshire was undertaken by Lomas et al. (2016), measuring economic impacts as NHS (National Health Services) or PSS (Person Shaped Support, social care) costs, while health impacts were measured by "quality-adjusted life years". The study modelled a scenario where upgrading Euro 4 buses and HGVs to Euro 6 by 2016 would generate annual benefits of £2.08 million and a one-off benefit of £3.3 million. The implementation cost would be £6.3 million. It is important to note that air pollution may have side effects that went unaccounted for in this evaluation (which was based on pharmacoeconomic methods), such as in cases of missed days at work due to health issues, or in the cases where parts of the population are unwilling to commit to active travel due to a fear of travelling by foot or bike in conditions of poor air quality.

Further, Bradford council has made a feasibility study (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014) of adding certain interventions within a Low Emission Zone in Leeds and Bradford. Within this feasibility study is included a set of cost-benefit analyses of the following four different LEZ scenarios:

Table 3.5

Low Emission Zone scenarios in Leeds and Bradford

1. Euro 4 buses upgraded to Euro 6
2. All buses and HGVs meet Euro 6 standard
3. The year 2000 ratio of petrol to diesel met by 2021
4. 10% reduction in journeys by 2021

The low emission zone further bases its assessments on the impacts on four qualitatively measured key components.

Table 3.6
Cost-benefit analysis

Impact	Direction and reason of impact
The productivity of the workforce	Positive impact: Reduces time away from work and increases productivity at work.
Local automotive industries	Slight positive impact: LEZ would increase demand for newer vehicles and retrofitting of vehicles.
Congestion	Impact uncertain: May cause reduction due to modal shift but may also increase tourism trips into the city centre.
Other local economic impacts	Impact uncertain: May decrease local visits to the city centre due to cost, but these may also increase due to city centre being more attractive.

The value of the change in air quality was assessed using unit abatement costs (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014). The advantage of returning to levels of diesel to petrol cars in the car fleet of the year 2000 for air quality impacts in Bradford was estimated to be £6.3 million for the period 2016-2021, while the value of the abatement costs avoided for requiring all buses and HGV's in Leeds was estimated to be £25.6 million for the period 2016-2021 (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014). Further, avoided damage costs for individual measures were estimated to £1.26 million over the period 2016-2021 for the Leeds Outer Ring Road area, and to £0.33 million for the Bradford Outer Ring Road area. The costs assessment of these initiatives took into account the direct changes as well as operating and maintenance costs (e.g. fuel consumption changes). Within these calculations, the most cost-effective intervention option would be to implement low emission zones requiring bus operators to meet Euro VI standard within the Outer Ring Road areas (£2000 per tonne of NO_x abated in Bradford, £1000 in Leeds). Further, compressed natural gas buses are cheaper to run compared to diesel buses, due to cheaper fuel costs. Nevertheless, such alternative bus fuels have not been

used to a wider extent in the UK, and operators may be reluctant to adopt them. If this is the case, the second most cost-effective option in Leeds and Bradford would be to replace current buses with conventional Euro VI-buses (£49,000 per tonne of NO_x abated in Bradford, £20,000 in Leeds). All bus measures in Bradford exceed the abatement costs avoided, but measures in Leeds come closer. The costs for replacing Euro IV buses with Euro VI are less than the abatement cost avoided, and hence become economically attractive.

The costs of replacing car fleets in both Leeds and Bradford would greatly exceed the abatement costs avoided due to the large numbers of cars affected (£47,000 per tonne of NO_x abated in Bradford, £57,000 in Leeds). Encouraging much older diesel cars (e.g. pre-Euro IV) to be replaced by petrol cars would be less expensive but nevertheless have a positive impact on air quality. The cost of requiring all HGVs to meet Euro VI standards (£67,000 per tonne of NO_x abated in Bradford, £107,000 in Leeds) also substantially exceed abatement costs avoided. In this case, abatement costs avoided are also exceeded if the policy only targets older (pre-Euro IV) HGVs.

The cost-effectiveness of reducing car traffic by 10% by means of interventions to promote walking and cycling depends on what measures are applied. The air quality benefits of personalised travel support systems exceed the costs, while the feasibility study states that other interventions cannot be justified (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014).

It should be mentioned that a range of wider benefits is not currently captured given difficulties associated with quantifying these impacts. An example is the impacts on the areas outside the Low Emission Zone and on travel from outside the Zone (Bradford Environmental Health Service, Directorate of Environment and

Sport, 2014). Taken together, these studies point toward Low Emission Zones having a positive impact on finance in the region. The status quo will, in the long term, be costlier both in terms of health and budgetary concerns.

3.4.2 Health impacts of air quality and transport policy

Currently, $PM_{2.5}$ concentrations in Bradford stand for 5.3% of the total mortality, or 222 deaths per year. Road emissions of both $PM_{2.5}$ and NO_x have impacts on birth weights, strokes, and heart attacks within the Bradford population (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014). In general, however, the city average has little problems reaching both WHO and EU target levels (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014).

Again, the Low Emission Zone Feasibility Study (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014) contains an assessment of the four scenarios (See Table 5) on health in the region. With 144 attributable life years lost per year due to air pollution, the scenarios would give 13 attributable deaths avoided per year. In summary, the region as a whole could profit from more initiatives to improve air quality, and a Low Emission Zone would not only improve health but could prove profitable in the long run as well.

4.0 CHAPTER 4: INTERVENTIONS FOR PROMOTING POLICY ADOPTION - OR CHANGE: A SYSTEMATIC REVIEW

4.1. Background

Globally, cities and conurbation struggle with managing air pollution (World Health Organisation, 2016), which is causing health issues (Holgate et al, 2016; Air pollution leads to an estimated 7 million deaths per annum globally according to WHO Regional Office for Europe, OECD, 2015) and inhibiting economic growth (WHO Regional Office for Europe, OECD, 2015). Within the EU, the air quality directive has placed clear time limits, with fines facing those who fail to comply (West Yorkshire local authorities, 2015). Even with all these pressures in place, several regions have yet to meet the demands. There is an imperative for change in policy direction and a rapid acceleration in action toward more rigid and clearer policies. This review sets out to find intervention tools used previously to facilitate the adoption of such policies by regional or local governments. A short-term focus and potential fear of sunk costs (Gifford, 2011) mean that political backlash or voter disagreement might be expected, especially when resources are running low. Hence, a further aim is to find out what barriers are prevalent when promoting policies.

4.1.1 Describing the condition

In order to understand the context of air quality policymaking and what "optimal decision-making" would be in the setting, it is important to understand that several policies have been found likely to have beneficial impacts. Conlan et al. (2016) set out to do just this:

- **Pricing mechanisms** have been found effective, for instance in driving customer choices in a certain direction and may have significant effects over time.

- Conlan et al. (2016) show that **Low Emission Zones** (city centre zones with charging for the most polluting vehicles) have had mixed results and may require coordination with other measures.
- The literature describes the importance of having a variety of **complementary measures** (such as incentives to increase public transport use and transportation network improvements) in combination with the technical ones (Conlan et al., 2016).

4.1.2 Behaviour change

While there is evidence on what could be done as far as air quality policy is concerned, the EU air pollution limit levels are yet to be reached in large areas of Europe and the UK (see Chapter 1 for a review of institutional and individual barriers to the intentions to adopt policy). There is a case for behaviour change to be used as part of the strategy to facilitate the promotion of intentions to adopt new air quality policy. Michie, van Stralen, et al. structure their behaviour change typology around the so-called "Behaviour Change Wheel" (2011; Michie, Atkins, et al.. 2014), which bases its approach to behaviour change on three theoretical factors behind behaviour – Capability, Opportunity, and Motivation. These factors interact with each other and generate behaviours. Within the model, nine so-called “intervention functions” map upon the Capability, Opportunity, and Motivation sources of behaviour. The phrase “intervention function” refers to behavioural factors within any given intervention, and for instance include “Incentivisation”, which is related to the opportunity to perform the target behaviour, and “Environmental restructuring”, which relates to the capability to perform the target behaviour. Behaviour change techniques are then mapped onto the COM-B model through the intervention functions that they relate to. See Chapter 1 for a more in-depth discussion on the use of COM-B and alternative models.

This research will be looking into what type of tools are used most often. It is important to note the difference between interventions to improve air quality and interventions to promote policy adoption. This review is rooted in psychology and aims to find empirically established interventions and other factors that can change the behaviours of policymakers and encourage intentions to adopt new policies, and then to map the active intervention functions. This review will not be judging different policies based on how they affected air quality itself.

4.1.3 Objectives

This systematic review aims to find out what previous interventions have attempted to promote policy adoption in a local or regional setting, and how they performed. A further aim is to find out what barriers affected the policy adoption process. These aims result in the following research questions:

- What interventions have previously been attempted to influence the intentions to adopt new policies?
- What intervention functions are the most successful?
- What are some stated barriers to policy adoption?

4.2. Methods

4.2.1 Search strategy and criteria

The search uses “PsychINFO (2002 to October week 2 2016)”, “Ovid Medliner (1996-2016)”, “Transport database (1988-2016), “Scopus” (browsing only articles and reviews, but limiting neither research field nor time period published), and “Web of science” resources, and gave 26967 results (7th of November, 2017) using the following search terms (Policy AND (Adopt* or Promot* or Diffusion) AND (Regional OR Local) AND government). The terms were separated into a multi-field search in PsychINFO.

4.2.2 Study selection

Inclusion-exclusion criteria were as follows:

1. Written in English.

2. Full text available.

3. Has to include interventions, not a comparison of policy adoption data without control elements.

4. The study must concern the promotion of policy adoption, diffusion, or change.

5. Has to provide policy outcome data, which is compared with a previous baseline or a control comparison.

6. The study has to report adoption, diffusion, or change of new policies, rather than the implementation of existing policies.

The search came up with 29697 results. After duplicates were removed, 21387 results remained for screening. The abstract and title screening was done using "Abstrackr" a semi-automated screening programme. Abstracts were screened up until the point where 100 articles were screened in a row without finding a relevant article. Upon reaching this point, a further 5% of the hitherto screened articles were screened as a buffer. This is seen as an acceptable cut-off using semi-automated tools (Thomas et al., 2011). All in all, 3660 articles were screened and 17727 removed. At the end of the abstract and title screening stage, 56 articles were deemed relevant. Two fellow researchers (LB and AA) double screened 177 and 107 articles respectively.

Abstrackr uses a consensus model in which two researchers need to agree in the labelling of an article as relevant or irrelevant, if there is disagreement, the consensus label doesn't show up. There were no cases where there was a direct disagreement. Two results were seen as "possibly relevant" in the first screening phase. During the full-text screening, 24 articles were removed as they were lacking

proper interventions, ten were removed due to not stating clear policy outcome data, two lacked policy adoption as an outcome, and seven articles that lacked a full text-version were removed. Two articles were not available in English. A final article (Kern et al., 2007) was found through grey literature. During both title/abstract screening and full-text screenings, the reviewer had removed an article the author had not. After discussions, the author also removed this article, as it lacked a proper intervention. All in all, a full consensus was found in 12 out of 14 cases (responding to 85.7% of all potentially relevant articles). As such, the final study count numbered 12 articles, to be taken through bias assessment and narrative analysis.

4.2.3 Data extraction and coding[3]

Data was extracted using an edited version of the data collection items list described by Higgins and Green (2008, p.157). Study design, study duration, whether the study reviewed data or had participants, number of participants, setting, interventions used, and stated outcomes were noted. The final toll stood at 12 studies in 12 articles.

Coding of interventions into intervention functions was done using the nine intervention functions from the Behaviour Change Wheel described by Michie, van Stralen, et al. (2011; Michie, Atkins, et al.. 2014). Barriers described in the literature were coded using Banister's (2005) six barrier types to sustainable transport: economic (e.g. lack of funding); administrative (e.g. conflicts with other policies); cultural (e.g. public acceptability); legal (e.g. national regulations); side effects (e.g. electrical cars furthering congestion) or physical (e.g. space limitations).

4.2.4 Risk of Bias assessment[4]

[3] See appendix A.1 for a full PRISMA flow chart
[4] See figure 4.1 for a complete risk of bias assessment chart.

Due to the diverse nature and outcome data of the included studies, bias assessment was conducted independently by two researchers using the QATSDD (Quality Assessment Tool for Studies with Diverse Designs) model for review of diverse research design presented in Sirriyeh et al. (2012); disagreements were then discussed and resolved. This tool aims to investigate bias in a set of studies with diverse methods. The QATSDD model uses 16 categories to assess the risk of bias, 14 of which apply to qualitative methods, and 14 to quantitative. Each category is graded from 0 to 3 and then aggregated. As such, higher percentage scores reflect a lower risk of bias. If the risk of bias is considered high (a 50% percentage score was used as an acceptable cut-off), conclusions based on the outcomes of the study should only be drawn with caution.

4.2.5 Data Synthesis

As the interventions and outcomes measures used in the studies were found to be too heterogeneous for meta-analysis to be useful, a narrative analysis was conducted where the policy interventions found were coded into tools from the "Behaviour Change Wheel" (Michie, van Stralen, et al.. 2011; Michie, Atkins, et al.. 2014) and then compared based on the outcomes of the interventions to find out what tools were used in the most successful interventions. Further, any mentions of barriers to the policy process were coded into the types of barriers (economic, administrative, legal, cultural, side effects, and physical) described in Banister (2005) and compared based on frequency.

4.3 Results

Of 29697 articles identified in the database search, 3660 records were screened at abstract and title-levels (8310 duplicates removed) using the semi-automated machine-learning tool "Abstrackr". 56 articles were full text screened. Eleven articles met all inclusion criteria and were used in the analysis. Kern et al.

(2007) was deemed relevant but not found in the search. All in all, the results from twelve studies in twelve articles are used in this review.

4.3.1 Assessment of risk of bias in the included studies

Out of the included articles, four (Capleton et al., 2005; Kern et al., 2007; Tyran & Sausgruber, 2005; Wastell, 2006) failed to reach the arbitrary 50% cut-off on the QATSDD risk of bias test. Higher scores respond to a lower risk of bias. These articles should be interpreted with caution.

	Explicit theoretical framework	Statement of aims/objectives in main body of report	Clear description of research setting	Evidence of sample size considered in terms of analysis	Representative sample of target group of a reasonable size	Description of procedure for data collection	Rationale for choice of data collection tool(s)	Detailed recruitment data	Statistical assessment of reliability and validity of measurement tool(s) (Quantitative)	Fit between stated research question and method of data collection (Quantitative)	Fit between stated research question and format and content of data collection tool (Qualitative)	Fit between research question and method of analysis	Good justification for analytical method selected	Assessment of reliability of analytical process (Qualitative only)	Evidence of user involvement in design	Strengths and limitations critically discussed	Total score (%)
Capleton 2005	0	1	1	1	1	1	0	1	x	x	0	0	0	0	0	0	14,3
Clark 2013	3	3	1	1	2	0	2	0	0	3	x	2	2	x	0	3	52,4
Krause 2012	3	3	3	0	0	3	3	0	3	3	x	3	0	x	0	1	59,5
Llamas 2013	3	3	3	1	3	3	3	3	3	3	x	3	2	x	3	2	90,5
Mulvale 2015	3	3	3	0	1	2	1	0	x	x	2	2	1	1	0	2	50
O'Connell 2008	3	3	3	3	3	3	3	3	0	3	x	3	0	x	0	2	76,2
Percoco 2009	3	2	3	0	3	1	1	3	0	3	x	2	0	x	0	2	54,8
Quantz 2006	1	2	3	3	3	2	3	3	x	x	3	3	0	0	0	2	66,7
Scheerer 2015	3	3	3	3	3	3	3	3	x	x	3	2	3	3	2	3	95,2
Tyran 2005	3	2	3	1	0	2	1	2	0	2	x	0	1	x	0	1	40,5
Wastell 2006	3	3	3	1	0	1	0	0	x	x	2	2	0	0	0	1	38,1
Kern 2007	3	3	3	2	3	0	0	0	0	2	x	1	1	x	0	1	45,2

Figure 4.1: Risk of Bias assessment chart

4.3.2 Study Characteristics[5]

A majority of the studies used mixed designs, usually with an element of data or document review (Capleton et al., 2005; Krause & Melusky, 2012; Mulvale et al., 2016; Percoco & Giove, 2009; Quantz & Thurston, 2006; Scheerer, 2015) and a qualitative element such as interviews or surveys targeting key policymakers in the

[5] Key study characteristics are presented in table 4.1

study setting (Capleton et al., 2005; Mulvale et al., 2016; Quantz & Thurston, 2006; Scheerer, 2015) or case study designs where observing the policy process is key (Quantz & Thurston, 2006).

Five studies used a quantitative method (Clark, 2013; Kern et al., 2007; Llamas-Sanchez et al., 2013; O'Connell 2008; Tyran & Sausgruber, 2005), conducting statistical analysis of policy outcomes or institutional change (Llamas et al., 2013). Only Tyran and Sausgruber (2005) used a fully experimental approach in a lab setting. This lack of experimental designs or control groups makes it hard to assure that the possible policy outcomes can be attributed directly to the stated interventions and other determinants of change.

Further, this may be a problem attributed to the structure of intervention functions in the Behaviour Change Wheel. Future research could instead look at using the novel Mechanisms of Action (Carey et al., 2019; Connell et al., 2019; Michie et al., 2018), which might map better onto behaviour change techniques. Eight of the included studies did their research at a local or regional government level, three of which in the USA (Krause & Melusky, 2012; O'connell, 2008; Scheerer, 2015), two in Canada (Mulvale et al., 2016; Quantz & Thurston, 2006), one in the UK (Wastell, 2006), one in Italy (Percoco & Giove, 2009) and one in Spain (Llamas-Sanchez et al., 2013). One study (Capleton et al., 2005) investigated the influence of an EU policy initiative at a national level (in the UK). Finally, one study (Tyran & Sausgruber, 2005), conducted experimental research at an Austrian university.

4.3.3 Measures of outcomes

Policy adoption was mainly measured through a combination of policy reviews and qualitative measures such as focus groups or interviews with key stakeholders (Capleton et al., 2005; Clark 2013; Scheerer 2015; Mulvale et al.,

2016; Quantz & Thurston 2006; Wastell, 2006.) Clark (2013); Krause and Melusky (2012); Percoco and Giove (2009) used only historical data reviews. Two studies (Llamas-Sanchez et al., 2013; Wastell, 2006) only used the qualitative type of measures described without data or policy reviews. Tyran and Sausgruber (2005) was the lone study to use an experimental approach in their study. Due to the differences in methods and data reports in the included studies, a meta-analysis was deemed unsuitable.

In most studies, the variable "policy adoption" wasn't stated outright, but had to be interpreted as such. Only four articles (O'connell, 2008; Tyran & Sausgruber, 2005; Quantz & Thurston, 2006; Mulvale et al., 2016; Capleton et al., 2005) outright used terms of policy adoption, development, or diffusion as the target behaviour. Kern et al. (2007) and Llamas-Sanchez et al. (2013) measured diffusion and implementation of the LA21 Local Policy Agenda, a local government version of a non-binding United Nations 21st century action plan for sustainable development (United Nations Sustainable Development, 1992) in their regions. The LA21 agenda has different content in different regions but should remain relevant to this review, as adoption of this policy agenda is the main focus. Scheerer (2015) looked at the involvement of municipalities in climate programs. This has been interpreted as policy diffusion among municipalities. Clark (2013) looked at factors that influence the likelihood of legislation being adopted, which can be seen as similar to factors that promote policy adoption. Percoco and Giove (2009) investigated the funding of projects as their target behaviours while Krause and Melusky (2012) looked at policy spending growth. These three studies relate to but do not directly cover policy adoption, and their results should be interpreted with some caution.

4.3.4 Interventions and determinants of change[6]

Four studies (Clark, 2013; Kern et al., 2007; Llamas-Sanchez et al., 2013; Mulvale et al., 2016; Percoco & Giove, 2009) used some kind of higher policy frameworks or new systems in order to facilitate policy adoption. Clark (2013) measured the effects of existing development bank aid in the country affected, country development levels, and finally external effects from the World Health Organisation on new legislation. Llamas-Sanchez et al. (2013), and Kern et al., (2007) both looked into what factors have an effect on the adoption of local area agenda transfer agencies. Mulvale et al., 2016 investigated the effects of national frameworks on local framework development. Percoco and Giove (2009) investigated the effects of an integrated policy funding program where policy projects are promoted if consistent with local contexts and development strategies. O'connell (2008) measured the effects of changes in local factors on smart-growth policies. Three studies (Capleton et al., 2005; Quantz & Thurston, 2006; Wastell, 2006) investigated projects that, through education or communication, aim to change the policy-making process. Scheerer (2015) investigated the evolvement of municipalities and non-profit agencies in climate programs. Krause and Melusky (2012) measure how levels of governor control over policy would affect spending growth. It is doubtful whether this should be seen as an intervention, even though policy effects are an outcome. Tyran and Sausgruber (2005) measured the effects of information about policy adoption decisions and implementation in other (hypothetical) markets.

[6] See table 4.2 for a full chart of the coded variables.

Table 4.1
Characteristics of included studies

Reference	Study design + underpinning theory	Study duration	Participants or data review	Data reviewed	*n*
Capleton et al., 2005	Review of policy documents, a questionnaire survey of key stakeholders in environment and health; evaluation workshop	Oct - Nov 2002	Both	36 UK Government documents	14 stakeholders within environment and health
Clark, 2013	Event history analysis.	Not stated.	Data review	EHA data covers 1980-1993.	
Krause & Melusky, 2012	Statistical evaluation of the effect of unilateral guvernal power on fiscal spending growth	Not stated.	Data review	N/A	Not stated
Kern et al., 2007.	Comparison of Adoption of LA21 agendas in German federal states based on diffusion pattern analysis.	Not stated.	Data review	2610 local authorities	
Llamas-Sanchez et al., 2013	Institutional theory: focus groups, questionnaires.	Not stated.	Participants		694 questionnaires sent, 148 returned,
Mulvale et al., 2016	Case study research, Literature review, reflections and meetings, interviews.	Not stated.	Participants		8 policymakers
O'Connell, 2008	Survey sent to city councils.	October 2003 - February 2004	Participants		202 cities responded, out of 340 contacted
Percoco & Giove, 2009	Discrete choice economic model.	Not stated.	Data review	6000< submitted projects	Not stated.
Quantz & Thurston, 2006	Case study design using qualitative methods. - 1. document review 2. Interviews. 3. Participant observation.	Nov 1999-Nov 2000	Participants		13 interviews
Scheerer, 2015	Qualitative methods (semi-structured Interviews with planners, plan content analysis, case typology, case studies).	Sept 2012-Sept 2015	Participants		30 interviews with 26 participants
Tyran & Sausgruber, 2005	Experimental, lab setting	Not stated.	Participants		115 students
Wastell, 2006	Case study research: attending partnership meetings, one on one interviews, discussions. Data from: policy documents, field notes & interviews, ad hoc survey data.	Not stated.	Both	N/A	23 respondents, community safety officers from 9 Crime Reduction Partnerships.

Table 4.1 (Continued)

Reference	Setting/country	Intervention	Stated outcomes	Risk of bias rating[7]
Capleton et al., 2005	EU	5-yearly Ministerial Conferences on environment and health.	Precipitated the development of the UK NEHAP, which only had a limited impact nationally.	16.7
Clark, 2013	World.	Development bank aid, WHO, Country development level	WHO positively influenced the likelihood of legislation, as did Development bank aid. Developed countries acted earlier.	52.4
Krause & Melusky, 2012	50 US states	Amount of direct power governors have over budgetary spending	Governor control over fiscal policymaking increases spending growth compared to when policy tools are shared with or controlled by others.	59.5
Kern et al., 2007.	German states (Länder)	Financial and political support of local actions, agenda transfer agencies. Comparisons based on capacity, pioneering cities.	The diffusion of LA21 in German states depends on driving forces at local levels and state levels. Larger cities with financial resources tend to do better. University cities also do better.	35.7
Llamas-Sanchez et al., 2013	694 Spanish city & town councils	A national framework meant to encourage the adoption and development of a local "LA21" sustainability strategy.	The local councils that most accept normative pressures, collaborate more, seek legitimacy, and are more embedded in their institutional contexts are better at implementing the LA21.	90.5
Mulvale et al., 2016	Yukon policymakers	"Evergreen", a national framework and resource for developing child and youth mental health care policy and systems.	National frameworks can play important roles at the program and strategic levels. They save time and money in developing local frameworks, strengthen rigour, help to build consensus, and lead to long-term success being chosen over short-run expedience.	50

[7] A higher score means a lower risk of bias.

Table 4.1 (Continued)

Reference	Setting/country	Intervention	Stated outcomes	*Risk of bias rating*
O'Connell, 2008	50 US cities asked, 26 responded	Four specific social factors (education, local environmental activism, race, and homeownership)	The adoption of smart growth policies was connected with the presence of environmental activist groups and educated residents. Median income was a negative predictor of smart growth policy.	76.2
Percoco & Giove, 2009	Regional Government in Lombardia, Italy.	The PISL (Integrated programs of local development), a public-private partnership promoting project-funding proposals closely consistent with the local socioeconomic context and with the local development strategy.	Projects within the PISL have a slightly greater probability of being funded. PISL may have a negative effect on the formal quality of the project as measured by the probability of passing administrative control.	54.8
Quantz & Thurston, 2006	Calgary Health Region's Aboriginal Community Health Council, Canada.	A Health Council, which functions as a strategy for increasing aboriginal representation in local health policy and program development.	The Council provided the kind of dynamic and adaptable process that resulted in long-term relationships and opportunities for both proactive and reactive participation in health policy development.	66.7
Scheerer, 2015	Municipalities and community non-profit agencies in Colorado.	Climate planning implementation mitigation programs.	Involvement in such programs depends on four factors: political will, federal funding support, local government capacity, and diffusion of innovations.	95,2
Tyran & Sausgruber, 2005	Lab setting, Austria.	Information about the adoption and success of policy innovations in other markets.	Providing political decision-makers with information about policy innovations in other states is a causal factor in the diffusion of an efficiency-enhancing policy innovation.	40.5
Wastell, 2006	Crime Reduction Partnerships in the county of Lancashire, UK.	Multi-Agency Data Exchange (MADE), an evidence-based policy Geographic Information System instigated to support a group of Crime Reduction Partnerships in carrying out their crime audits, and to provide ongoing support in planning, delivering, and evaluating crime reduction interventions.	Evidence-Based Policy can have a major impact, especially in multi-agency collaboration settings, but the expertise and understanding of users need to be improved.	38.1

Table 4.2
Intervention Function Coding

Author and year	1. Education	2. Persuasion	3. Incentivisation	4. Coercion	5. Training	6. Restriction	7. Environmental restructuring	8. Modelling	9. Enablement	10. Outcomes
Capleton et al., (2005)								x		LIMITED
Clark, (2013)			x				x	x	x	INCREASE
Krause & Melusky (2012)									x	MIXED
Kern et al., (2007)	x							x	x	MIXED
Llamas et al., (2013)		x					x	x		INCREASE
Mulvale et al., (2016)	x				x			x		INCREASE
O'Connell (2008)	x					x	x			MIXED
Percoco & Giove (2009)			x					x	x	MIXED
Quantz, & Thurston (2006)	x				x		x			MIXED
Scheerer (2015)			x				x			MIXED
Tyran & Sausgruber (2005)	x		x					x		INCREASE
Wastell (2006)	x									LIMITED

4.3.5 Intervention Effects[8]

Across the 12 studies, four (Clark, 2013; Llamas-Sanchez et al. 2013; Mulvale et al. (2016); Tyran & Sausgruber, 2005) reported an increase in policy adoption uptake. It should be noted that the policy adoption increases found by Llamas-Sanchez et al. (2013), might have come at the expense of policy quality (e.g. policies that are inefficient in scope). Three of the studies (Llamas-Sanchez et al., 2013; Kern et al., 2007; O'connell, 2008) only described the effects of contextual factors on policy adoption, rather than using interventions. Several studies were investigating the effects of context factors or national interventions on a policy programme in a natural environment in the field. It is hard to say whether these factors have actual effects, and especially whether they would have effects in another environment. Where studies have results stated as "mixed", results were mainly positive, but are unclear due to possible confounding variables or negative side effects.

4.3.6 Intervention and determinant of change coding

A majority of the studies used multifaceted interventions with three tools. Three studies only used a single tool: Capleton et al. (2005: "Modelling"); Krause and Melusky (2012: "Enablement"); and finally, Wastell (2006: "Training"). Scheerer (2015) used two tools ("Incentivisation" and "Environmental restructuring"). Clark (2013) used four tools ("Incentivisation", "Environmental restructuring", "Modelling" and "Enablement").

4.3.6.1 "Modelling". Seven (Clark, 2013; Llamas-Sanchez et al., 2013; Kern et al., 2007; Mulvale et al., 2016; Tyran & Sausgruber, 2005; Percoco & Giove, 2009; Capleton et al., 2005) out of the twelve included studies described the influences of actions in other regions on policy adoption in the investigated region.

[8] See table 3.2 for a complete list of interventions.

Out of these, four (Clark, 2013; Llamas-Sanchez et al., 2013; Mulvale et al., 2016; Tyran & Sausgruber, 2005) reported positive outcomes. All studies with stated positive outcomes used some kind of "Modelling".

4.3.6.2 "Education" and "Training". *"Education"* refers to interventions aimed at increasing the knowledge or understanding, such as where information is provided in order to promote public transport policies, while *"Training"* refers to interventions where imparting skills is the key, such as sending stakeholders to a sustainability workshop (Michie, van Stralen, et al., 2011, pp.7). Six studies (Kern et al., 2007; Mulvale et al., 2016; O'Connell, 2008; Quantz & Thurston, 2006; Tyran & Sausgruber, 2005; Wastell, 2006) were coded as having used "Education" as methods of affecting policy adoption. Out of these, two (Mulvale et al., 2016; Tyran & Sausgruber, 2005) reported successful outcomes. Two studies (Mulvale et al., 2016; Quantz & Thurston, 2006) used the "Training" of decision-makers as a method to facilitate policy adoption. Out of these, one (Mulvale et al., 2016) was successful.

4.3.6.3 Other intervention functions. "Environmental restructuring" refers to changing the physical or social context (Michie, van Stralen et al., 2011, pp.7). Five studies (Clark, 2013; Llamas-Sanchez et al., 2013; O'Connell, 2008; Quantz & Thurston, 2006; Scheerer, 2015) used "Environmental restructuring". Two (Clark, 2013; Llamas-Sanchez et al., 2013) of these were successful. Again, it may be unwise to judge the tool based on such limited and mixed results.

Four studies (Clark, 2013; Percoco & Giove, 2009; Scheerer, 2015; Tyran & Sausgruber, 2005) used the technique "Incentivisation", or "creating an expectation of reward" (Michie, van Stralen et al., 2011, pp.7). Out of these, two (Clark, 2013; Tyran & Sausgruber, 2005) were successful. "Enablement", or "increasing means/reducing barriers to increase capability or opportunity" (Michie, van Stralen

et al., 2011, pp.7) was also used in four of the included studies (Clark, 2013; Kern et al., 2007; Krause & Melusky, 2012; Percoco & Giove, 2009), out of which one (Clark, 2013) had positive outcomes. Again, it may be unwise to connect this to the enablement factor. Only Llamas-Sanchez et al., (2013) used "Persuasion" (or "the use of communication to induce positive or negative feelings to stimulate action", Michie, van Stralen, et al., 2011, pp.7) as a method to facilitate policy change or adoption. This study was successful. It is not advised to judge the feasibility of success of the persuasion tool based on the outcomes in only one study. "Restriction*"* was used in O'Connell (2008). Here, it had mixed results. "Coercion*"* was not used in any of the twelve included studies. There is a lack of literature where these three functions were used; hence they cannot be linked to success.

4.3.7 Barrier coding and frequencies[9]

To describe the barriers that were encountered in the literature, problems hindering policymaking were re-coded using the six barriers to sustainable transport found in Banister (2005): economic (e.g., lack funding); administrative (e.g., conflicts with other policies,); cultural (e.g., public acceptability); legal (e.g., national regulations); side effects (e.g. electrical cars furthering congestion) or physical (e.g. space limitations). Administrative and institutional barriers were the most frequent (n = 15). Ten cultural barriers were found, and even as two of these (endorsement of local leaders, engaging the wider public in decisions) concerned a specific setting, they could still be relevant. Economic barriers (n = 6) should also have an impact. No barriers that could be described as "legal", "side effects" or "physical" were found in the literature. This could be an effect of flawed reporting on the side of the literature but could also show that the majority of respondents focused on administrative and economic factors.

[9] See table 4.3 for complete coding of barriers

Table 4.3
Barrier frequencies and coding

Study	Brief Intervention	Cultural	Administrative	Economic
Capleton et al., 2005	Ministerial Conferences on environment and health	Competing influences	Lack of awareness	
Clark, 2013	Development bank aid, WHO, Country development level		Lack of response to a problem. Lack of bureaucratic infrastructure.	
Kern et al., 2007	Financial and political support of local actions, agenda transfer agencies. Comparisons based on capacity, pioneering cities.	Lack of education. Lack of pioneering.	Lack of political support.	Lack of funding.
Krause & Melusky., 2012	Amount of direct power governors have over budgetary spending		Unilateral control may lead to irresponsible policymaking.	Shared control may cause low fiscal spending-growth.
Llamas-Sanchez et al., 2013	A national framework to encourage the adoption and development of a local "LA21" strategy.		Lack of: Legitimacy; Normative; Pressure; Institutional embeddedness; Collaboration.	No government backing.
Mulvale et al., 2016	National framework and resource for mental health care policy and systems.	Privileging some areas over others. Lack of endorsement from local leaders.	Differing clinical and philosophical approaches. Difficulties of bringing people from separated areas of policy together.	Low resources.
O'Connell, 2008	Education, local environmental activism, race, and homeownership	Local environmental activism groups. Homeownership in the region.	Lack of education.	
Percoco & Giove, 2009	Integrated programs of local development		Asymmetric information. Overconfidence with managers.	Transaction costs.
Quantz & Thurston, 2006	Health Council strategy for increasing representation.	Involving the wider public in council activities.		
Scheerer 2015	Climate planning implementation mitigation programs.	Political will.	Local government capacity.	Lack of support.
Tyran & Sausgruber, 2005	Information about the adoption and success of policy innovations in other markets.			
Wastell, 2006	Evidence-based policy geographic Information system.	Resistance from practitioners.		Lack of expertise.

4.4 Discussion

Within this study, the authors have reviewed the literature on interventions and determinants of change to promote intentions to adopt policy at regional or local levels of government. Four studies out of the twelve included had positive outcomes on policy adoption or policy change. The successful studies (Clark, 2013; Llamas-Sanchez et al., 2013; Mulvale et al., 2016; Tyran & Sausgruber, 2005) used interventions that included three (Mulvale et al., 2016: "Education", "Training" and "Modelling"; Llamas-Sanchez et al., 2013: "Persuasion", "Environmental restructuring" and "Modelling"; Tyran & Sausgruber, 2005: "Education", "Incentivisation" and "Modelling") or four (Clark, 2013: "Incentivisation", "Environmental restructuring", "Modelling" and "Enablement"), of the intervention functions. All successful interventions contained "Modelling" elements. Two of the successful studies (Mulvale et al., 2016; Tyran & Sausgruber, 2005) also contained an "Education" element, two used "Incentivisation" (Clark, 2013; Tyran & Sausgruber, 2005), and two used "Environmental restructuring" (Clark, 2013; Llamas-Sanchez et al., 2013). Use of "Persuasion", "Enablement" and "Training" were also found once each in the successful cases. They did also appear in some unsuccessful ones, however, save for "Persuasion", which only appeared in a single case, leaving it without sufficient data for a judgement. Conlan et al. (2016) suggest that a combination of measures should be combined to reach the maximum possible outcome; this is in agreement with the included studies. Based on the evidence, the use of "Modelling" and "Education" (or "Training") elements in any future interventions is encouraged.

4.4.1 Key barriers

'Administrative and institutional' barriers were the most frequent and should be seen as the key barrier type in this setting. Further, 'social and cultural' and

'economic' barriers were frequent (ten and six appearances each) and should also be considered when targeting policy adoption through behaviour change. There were no recorded instances of side effects, legal barriers, or physical barriers. Banister (2005) defines administrative and institutional barriers as relating to the coordination of decision-making organs and conflicts with other policies. In other words, organisations should seek cooperation to overcome these barriers. Social and cultural barriers relate to the public acceptability of measures. It is difficult to successfully implement a controversial policy without cooperation from the public, and policymakers will have to consider how the public will perceive a policy innovation. Educating the public or normatively framing a policy might make help people more willing to cooperate (Gärling & Biel 1995). Economic barriers relate to the funding of a project. This could relate to the direct implementation costs of policy innovation or the cost over time. If the funding for a policy isn't available, this barrier is difficult to overcome. Hence this might be the most rigid and difficult barrier to overcome. Policymakers should oversee different policy options and not limit themselves to the most expensive ones. A recommendation could be to look into non-price behaviour change intervention policies aimed at the public (e.g. appealing to social norms, commitment devices, and default options) as they are inexpensive and often effective (Allcott & Mullainathan, 2010).

4.4.2 Quality of the literature

The quality of the identified studies was limited. Most used mixed designs and lacked clear reporting. As most studies didn't have control groups or other means to manage variables, intervention effects could not be singled out. Only Tyran & Sausgruber (2005) used a control group and an experimental design. Further, a large part of the studies used historical data reviews. These may be useful, but don't conform to specific research questions and study designs.

4.4.3 Strengths and limitations

Based on the literature search, this is the first paper to explore the area of policy adoption. The approach to the review process is also novel, including but not limited to the use of machine learning. Another novel approach is the coding of interventions and change determinants into intervention functions alongside relevant barriers. Using Abstrackr had both upsides and backsides. The amount of screening needed was reduced which made the project far more manageable, making it possible to undertake far wider search terms. But the use of Abstrackr may also have reduced the sensitivity of the screening. The included studies were primarily conducted in western countries (e.g. the USA, UK, Germany, and Italy). As such, outcomes and conclusions made in this research may not generalize to non-western and developing cultures. Further, the included studies were heterogeneous, and several were perceived to have had a high risk of bias. This suggests that the included studies may be of low data quality.

4.4.4 Recommendations for practice

Some tendencies are shown of how certain intervention functions and barriers affect policy adoption projects. The key to successfully promoting policy adoption seems to be the use of multiple behaviour change tools aimed at policymakers and decision-makers, mapping on to several intervention functions. Looking at previous sets of policies or higher-level policy networks seems to be key, as does the education or training of stakeholders and decision-makers. Furthermore, administrative, economic and cultural barriers need to be kept in mind.

4.4.5 Recommendations for researchers

There is a general lack of studies conducted with the specific purpose of using interventions to facilitate policy adoption. Further, the methodology and reporting of the included studies in this research is heterogeneous and unclear.

Researchers are encouraged to use methodologically sound designs where the contents and purposes of interventions are transparent and interpretable. In conclusion, more research is required on specific policy adoption interventions where actual intervention effects are measured in controlled settings and with control groups. There is a need within this seemingly new (or limited in scope) field to establish common terminology, a common fitting methodology, and a way of reporting data.

4.5 Conclusion

The literature contained a very limited number of articles focused specifically on intentions to adopt policies; a majority instead focused on the implementation of policy. In addition, the standard of reporting of several studies was often low, which made the relevance and quality difficult to assess. Unclear descriptions of participants, objectives, outcomes, and analysis methods may have decreased the accuracy of the data extraction, coding process, and narrative analysis. Even with the flawed literature on the subject, some trends can be seen. A combination of intervention function tools seems to be the most efficient, and all the successful included attempts at policy promotion have included elements of “Modelling”. “Education” may be another key tool.

Finally, several barriers have been found to policy adoption. Most frequent in the literature are the administrative type, followed by cultural and economic barriers. Regional barrier factors could be harder to affect through psychological measures.

5.0 CHAPTER 5: PROMOTING POLICY ADOPTION – WHAT INFORMATION SETS TO PRIORITISE?

5.1 Background

The focus of this chapter is on air quality policy adoption within the case study of West Yorkshire and the five councils in the region. All while air quality is a growing problem, the region is struggling with economic growth. Cars are likely to remain the main driver of transport for some time, even for short trips of 1-5 miles (West Yorkshire Combined Authority, 2016). A lack of funding and competition between public transport companies has caused rail and bus uptake to decrease (West Yorkshire Local Transport Plan Partnership, 2011). High pollution exposure and low uptake in active travel further increase obesity, cardiovascular disease, and respiratory disease, resulting in high costs for the NHS (Holgate et al., 2016; West Yorkshire Local Transport Plan Partnership, 2011).

Within the UK, several cities struggle to reach air quality targets (World Health Organisation, 2016; European Commission, 2014). In the EU, the air quality directive has placed clear time limits, with fines facing those who fail to comply (West Yorkshire Local Authorities, 2015). In the UK, National Air Quality Strategies have been in place since 1997 (Department for Environment Food and Rural Affairs, 2007), with further regional and local strategies also adopted. Even with the policies already in place and further political and legal pressure from external sources, several regions in the country have yet to meet the demands. Hence, there is an imperative for change in policy direction and a rapid acceleration in action toward more rigid and clearer policies. This chapter contains a set of two mixed-method studies aiming to understand how decision-makers think around this

issue and further how behaviour change might facilitate change in policy behaviour: a questionnaire and an interview.

5.1.1 Air Quality interventions

To gauge what can be done about the pollution, and what solutions are the best fitted to tackle the issue, Conlan et al. (2016) conducted a literary review in consultation with the UK Department for Environment, Food and Rural Affairs. The aim of this review was to find out what type of interventions are most efficient in reducing pollution. **Pricing mechanisms** were found to be effective in the Conlan et al. review (2016), for instance in driving customer choices in a certain direction and may have significant effects over time. The literature on **Low Emission Zones** shows more mixed results and may require coordination with other measures (e.g. retrofitting measures, incentivising of cleaner vehicle uptake, or shifting of freight to rail). The effectiveness of Low Emission Zones has depended on the set emission standards, enforcement degree, the potential number of affected vehicles, geographic extensions, and pre-existing fleet types (Conlan et al., 2016). The literature describes the importance of having a variety of **complementary measures** in combination with the technical ones. Conlan et al. (2016) further describe how a combination of measures should be used.

5.1.2 Factors that delay or inhibit policy adoption

Factors on several levels influence the ability of policymakers to adopt new policies. Presented within this segment are several such factors, ranging from those at individual levels to social and contextual factors. Within this study, participants will be presented with a study concept where they will have full decision-making power, and hence individual factors such as ideology may have a larger impact than usual.

Values. The study of value-orientations should be seen as the most basic study of human behaviour factors. Values are the building blocks of behaviour that are most difficult to change later in life, as they are stable over time. Often based on early life experiences and environments, values are core principles that affect behaviours, judgements, and attitudes. Schwartz (1992; 1994) describes a study of values where respondents rate value types from zero to nine along two separate value axes, both of which are cross-culturally relevant. Openness to change vs. conservation describes whether a person values stimulation and freedom or conformity, tradition, and security. Of higher value for this research, however, is self-transcendence vs. self-enhancement. This value conflict delves into the tendency of a person to prefer hedonism, achievement, and power (typically egoistic goals) or universalism and benevolence (typically altruistic goals). These could be compared to being group-directed or self-directed in social dilemmas. Nevertheless, specific values aren't necessarily telling of an egotistical or altruistic personality type. Some of the types are closer to the centre of the axis (e.g. valuing "intelligence", which is considered part of the category "achievement", is close to the category "universalism", and the value type "wisdom"), while others are more extreme (e.g. "social power" as part of the "power" category). For relevance to pro-environmental attitudes and hence behaviours, are the "universalism" and "benevolence" traits, while "power", "tradition" and "security", seem to have a negative effect on pro-environmental attitudes (Schultz & Zelezny, 1999).

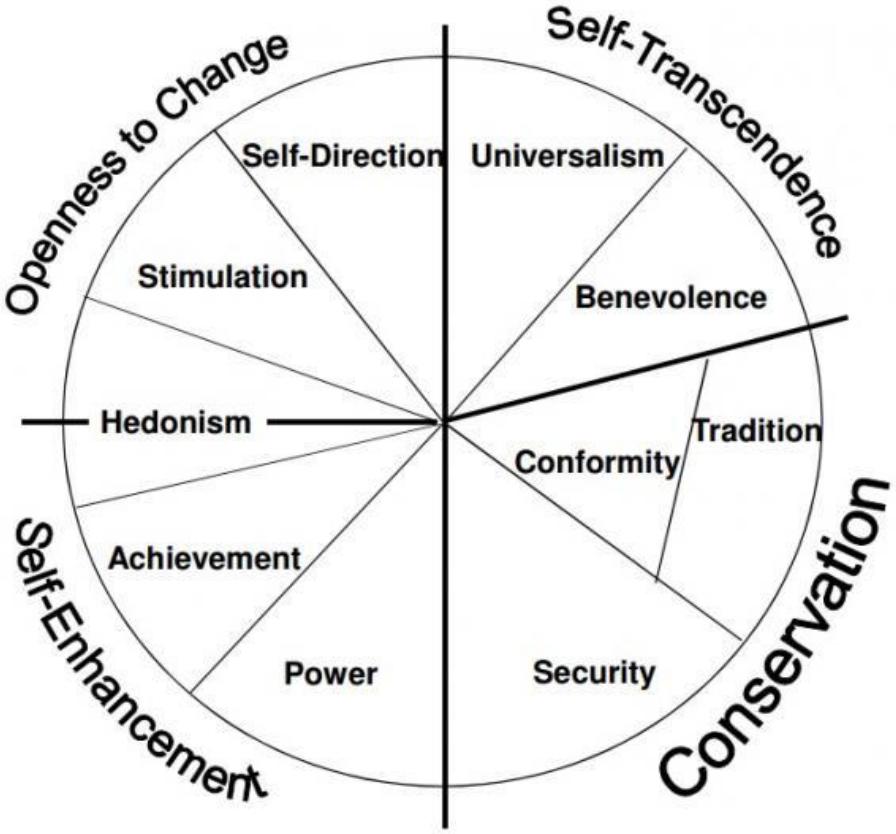


Figure 5.1: S.H. Schwartz value wheel (1992, 1994).

Attitudes. When it comes to specific behaviour change initiatives, both attitudes and reactions to policy decisions vary. Electrical vehicles (Egbue & Long, 2015), congestion charging (Beck et al., 2013; Nilsson et al., 2004; Schuitema et al., 2010) and low emission zones have all faced both negative attitudes and public uproar. Further, public attitudes toward both choices of transport type and congestion charging have an impact on the implementation of such innovations and can influence the extent of their success (Beck et al., 2012). An example is a difference in attitudes relative to the success of implementation in Stockholm and Edinburgh (Beck et al., 2012; Allen et al., 2006). The public in Stockholm had voted for congestion charging while the public in Edinburgh voted against it. This public vote correlated with the success of the schemes. Relating this to Kingdon's three streams (Kingdon & Thurber, 1984; Kingdon, 1995), the public opinion and perhaps

especially policymaker awareness of the public opinion can influence the political stream. Further, the core values of the public carry over into voter behaviours and political choices (Schwartz et al., 2010). Further adding to this effect, the combination of attitudes (toward specific policies) and values (general core principles) are together a key part of what makes up the ideologies within the political parties (the ideational aspect of Kingdon's problem stream, Kingdon & Thurber, 1984; Kingdon, 1995). Political parties and within them their members will carry different levels of pro-environmental attitudes and values (Dunlap, 1975), which are then likely reflected in the policies they want to adopt.

Goal frames. Lindenberg and Steg (2007) describe three types of goals that people act on. Hedonic goals reflect the wish to feel good, either through pleasure or lack of displeasure. It may for instance cause people to take the car to work rather than walk. "Normative" goals are related to the perceived appropriate way of acting. People have an internal sense of the correct action, a sense of morals or ethics. They watch others and take note, realising that a certain way of action is perhaps best for the group, and further best for themselves, if they wish to help the group. This can express itself through choosing organically grown foodstuffs when grocery shopping, even though they are more expensive; or helping an old lady cross the street, even though it will take you longer to get where you want. "Gain" goals make the person alert to their own resources. When people act upon this goal frame, they do so in a manner that aims to maximise one's resources, perhaps in the process causing problems or loss for others. It could result in myopia or losses for the group so that one gains an advantage.

The policy-making setting is a complex context where attitudes to specific policies, core values, and goals are put against each other. Within this context,

policymakers set out to find compromises and agree on an agreeable direction. This often turns into a so-called ‘social dilemma’.

Social dilemma structures. Social dilemma structures and conflicts form the basis for how political conflicts between groups or individuals work (e.g. Biel & Gärling, 1995; Biel & Thøgersen, 2007; Fujii et al., 2001) and how decision-makers are influenced by the social context. Social dilemmas are fundamentally the conflict between doing what is best for the self (or the in-group) and what is best for the wider group (or the out-group), which can be compared to the normative vs gain/hedonic conflict of the goal frame literature (Lindenberg & Steg, 2007), or the self-enhancing vs. self-transcendence axis of the Schwartz value wheel (1992). One may prefer to choose what is best for the wider group in one conflict but choose personal gain in another conflict. In general, more people choosing to cooperate is better for the group as a whole. In this setting, an example of this social dilemma structure could be the cooperation between councils. If councils elected to cooperate and help each other with policies, they would be able to do more, but as a consequence, each individual council could risk losing a competitive advantage. An example of this potential loss in competitive advantage is described in chapter one of this thesis, where competitive federalism contains a conflict between the gain of the electorate in the region and larger gains for the country and the world. Councils compete with each other for not only funding from national sources but also about tourism and trade.

Barriers to sustainable policy making. Even where there might be a clear political will to act, a range of contextual barriers may inhibit policy adoption. As described in chapter one of this thesis, sub-section 1.3.3.2, several factors influence policy makers in their work and act as barriers to their abilities to implement barriers.

5.1.2 Behaviour change

Environmental and sustainable behaviour change can be affected by an incredibly wide set of factors, both internal and contextual (Gifford & Nilsson, 2014). Attempting to influence all of them would be near impossible. As such, researchers have attempted to create efficient models that bring us closer to a simplistic taxonomy.

Behavioural models such as the theory of planned behaviour and theory of reasoned action (Ajzen., 1985; 1991; Fishbein., 1979; Fishbein & Ajzen., 1981); Steg and Vleks framework for encouraging pro-environmental behaviour (Steg & Vlek, 2008) and Banduras Social Cognitive model (1991) have focused on the application of theoretical individual constructs in different combinations. The relevant constructs in these models have ranged from attitudes and values (Ajzen 1985; 1991; Fishbein., 1979; Fishbein & Ajzen., 1981) to constructs from environmental psychology, such as goal frames, motivations, and habits (Steg & Vlek, 2008; Lindenberg & Steg, 2007; Fujii & Kitamura, 2003). Methods have been brought forth with the explicit aim to change or apply such constructs in a manner that would make respondents aware of their behaviours and hence act in a way more in line with potential pro-environmental attitudes.

5.1.2.1 The Behaviour Change Wheel. The general public, no doubt, is a group level at which behaviour change is needed. Nevertheless, policy and decision-makers have a large effect on general behaviours both through direct legal action and through the normative message sent out by public policy. As such, this research focuses on policymaker intentions to adopt policy. The research continues the systematic review in Chapter 4, which focused on what intervention functions and determinants of change were efficient in promoting policy adoption intentions, by

testing the intervention functions deemed efficient in the review with a policy maker sample.

To compare and understand the content of the interventions, the intervention functions described in Michie, van Stralen, et al. (2011), have been used as coding variables. Michie, van Stralen, et al. (2011) structure their behaviour change typology around a so-called "Behaviour Change Wheel", which bases its approach to behaviour change on the unilateral influence of three theoretical factors behind behaviour – capability, opportunity, and motivation. The three factors interact with each other, and through this interaction generate behaviours. Seven target policy types are countered with nine intervention functions aimed at influencing policy behaviour. Behaviour change techniques are then mapped onto the behavioural factors through the intervention functions that they relate to. Within the interview study, the intervention functions found most useful in a policy promotion setting (within chapter four) will be trialled. Specifically, “Modelling”, “Training”/”Education” and “Incentivisation” will be used.

5.1.4 Aims and research questions

This research has a twofold aim; First off, it sets out to find out whether the intervention functions found effective in promoting policy adoption intentions within the systematic review (chapter four) can be used to promote air quality policy adoption in a regional government setting. Secondly, barriers to air quality policy making are looked at. These aims result in the following research questions:

- What intervention functions facilitate policy adoption within the case study of the West Yorkshire regional government?
- What barriers to air quality policy making are prevalent in the West Yorkshire policy-making setting?

The primary aim will be looked at through the use of semi-structured vignettes and using a qualitative thematic analysis which is explorative rather than hypothesis-driven. The second aim will be investigated through a semi-structured questionnaire.

5.2 Methods

5.2.1 Vignette interviews

The intention of the interview study was to present a policy to stakeholders, that they would then judge and make adoption decisions around. To do this, a vignette was created with the goal to put stakeholders in the correct policy-making mindset. Vignette studies are short descriptions of situations and persons shown to respondents within survey studies. Characteristics within the vignettes can be changed in certain subsets of vignettes in order to create randomised selection experimental trials (Atzmüller & Steiner., 2010). Within this vignette, respondents were told they'd have full decision-making power over their hypothetical council. An air quality policy suggestion (a congestion charging scheme in the city centres) was presented to the respondents. Further, two other hypothetical councils were given the same policy suggestion. Information was given about the progress these other councils made with the policy over five cycles, referred to as years. 'Hypothetical Council 1' adopted the policy in cycle two, and 'Hypothetical Council 2' adopted the policy in cycle three. These information sets included how much the policy had cost, how much pollution and congestion had decreased, and how much money the councils were making back from congestion charging. Respondents were asked in every cycle whether they would adopt the policy and then asked to give an overall favourability rating of the policy, on a Likert scale from 0-9. The policy itself would have to be believable but would also need to be presented alongside a short cost-benefit analysis, or at least the material required to undertake one. The Conlan et al. (2016) consultation on air quality policies was used to construct a

realistic policy that could be presented to policy makers. A feasibility study (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014) done by Bradford council was further used to create reasonable baseline costs and air quality results, while also taking into consideration the outcomes and costs of congestion charging schemes in Stockholm (Hugosson & Eliasson, 2006; Johansson et al., 2009), Gothenburg (Börjesson & Kristoffersson, 2015; Sjöberg, 2013), London (Centre for Public Impact, 2016), along with the feasibility studies for Bradford and Glasgow (Bradford Environmental Health Service, Directorate of Environment and Sport, 2014; Weir et al., 2004). In order to make these applicable on smaller districts such as Halifax, Wakefield, and Huddersfield, some changes were made to costs (it is not realistic that cities of ca. 100.000 inhabitants like Halifax or Wakefield would be able to afford to spend the same amount of money as Stockholm or London, both international cities with populations in the millions).

Further, the information sets reaching participants would have to be presented in a manner where the information that represents behaviour tools could be manipulated and controlled. As such, variables were needed that changed throughout the experiment and gave external information about the policy. The innovation here was to use two hypothetical councils, that would have the policy be presented to them simultaneously and react in unpredictable ways to it. This gave the further advantage of creating a synthetic uncertainty, or a created uncertainty that reflects the uncertainties present in real-world policy-making situations. Along with the policy decisions a policy rating was given by the respondents in each cycle (or ‘year’). The cycles were rounded off with a question on what two information sets (e.g. economic information, air quality information, etc.) made respondents most likely to adopt the policy. Finally, respondents were asked to rate the policy innovation on its efficiency in reducing pollution relative to cost.

The vignettes and questionnaires were pilot tested with three respondents from the Bradford City Council. Changes were made to the information given (rewritten for clarity) and the information sets in the second to last question were rephrased. Respondents were further asked to accustom themselves to the material and read the tasks before the start of the interviews. The pilot interviews took between 15 and 25 minutes.

5.2.2 Interviewer information

All interviews were conducted by Sakarias Bank, the main author of the thesis. Sakarias is a male Ph.D. student in health psychology at the University of Leeds. Previously, he has an M.Sc. in societal psychology from the University of Gothenburg. Sakarias undertook training in qualitative analysis from the Social Research Association in London previous to working on this study. Respondents knew that the interviewer was doing the research for his Ph.D. on behalf of the Department of Environment, Food and Rural Affairs, Born in Bradford and the University of Leeds. Respondents were told that the purpose was to understand what barriers and facilitators there are to policy adoption.

5.2.3 Respondents, identification, and recruitment.[10]

Recruiting was done by Sakarias Bank, with assistance from Sally Jones, Sarah Possingham, and James Brass, at the time public servants at Bradford City Council. The intention was to recruit stakeholders with policy experience from across the five West Yorkshire councils. A list of potential participants was created by Sally, Sarah, and James. This list was based foremost on the air quality and public health officers and file managers in the five West Yorkshire districts and then widened to also include transport and economy managers and officers. Publicly elected councillors and Members of Parliament that worked in similar fields were

[10] See table 5.1 for summary information about the participants.

also contacted, three of which took part. The initial hope was that the project recruitment would snowball, meaning that participants would be spreading information about the project to other relevant prospects. Three participants were identified through snowballing. The recruitment process was initiated by the sending of an e-mail containing information about the purpose of the project, information on sponsors and organisations taking part, and finally an information sheet and a brief. Respondents were given 14 days to respond, at which point a "reminder"-email was sent. If respondents still hadn't responded after two months, the recruiter personally called their work phones. All in all, 70 people were contacted, and 16 replied. Four of these dropped out due to scheduling conflicts or other reasons. Three of the dropouts booked a colleague to replace them (in one case two colleagues replaced the respondent).

The aim was to conduct at least 15 interviews, with an as even distribution between the five West Yorkshire districts as possible. 15 interviews were conducted in total, ten with males and five with females. To protect the anonymity of participants, job titles were coded into levels in the political hierarchy (either civil servant or publicly elected). Higher numbers refer to a higher place in the hierarchy[11]. Four of the participants were from Kirklees, three each from Leeds and Wakefield, two from Bradford, and one from Calderdale. Two participants were also from the West Yorkshire Combined Authority, and one from York. Three participants were publicly elected at a councillor level or higher, while twelve were civil servants.

In the case of the first interview, the researcher was joined by a council worker during the interview, as a guide of proceedings. Two of the meetings were done by phone, the rest in person at the workplace of the respondent. When possible

[11] See table 5.1 for these hierarchies.

(sometimes the participants had very limited time), the interviewer and participant would often have a general conversation before and after interviews. The participants would for instance often offer to collect the interviewer in a reception, talk to the interviewer on the way to a meeting room, and then offer drinks. A small chat about the purpose of the research and the situation in the district would take part, and then the interview would commence. The interviews were recorded using audio recorders, and field notes were collected during the interviews (keywords). With the exception of a single major outlier (1hr 45 minutes), interviews took between 13 and 45 minutes. After 15 interviews were conducted nothing new was appearing. After analysis, no new themes were discovered, and data saturation was considered to be achieved. For further insights into data saturation, see Francis et al. (2010), who describe how setting the minimum sample size for interview studies at 13 is very likely to capture most of the important information.

Table 5.1
Basic information about participants.

Participant:	Council:	Gender:	Elected official or Civil servant:
1	Bradford	F	E
2	Leeds	M	C
3	Calderdale	F	C
4	Leeds	M	C
5	Kirklees	F	C
6	Kirklees	F	C
7	Kirklees	M	C
8	Wakefield	M	C
9	Kirklees	M	C
10	Leeds	M	C
11	WYCA	M	C
12	York	M	C
13	Wakefield	F	E
14	Wakefield	M	E
15	WYCA	M	C

5.3 Analysis

5.3.2 Vignettes

Four researchers took part in the coding process. Using NVivo (v. 11.4.3), full transcripts were uploaded and coded individually with no themes assumed a priori. Rather, the coding tree was created based on key factors or themes brought up by the coders separately. The main author coded all transcribed data. Rosemary McEachan, Gregory Marsden, and Ian Kellar double-coded two of the interviews. Cross-referencing of these codes was done by the main author. As only the main author coded all transcripts, the main author would construct a more complete coding tree, with additional themes compared to the other authors. This tree was then discussed with the others until agreement was reached.

Content analysis. Aside from the thematic analysis applied to both cases, several information frames were decided a priori. One of these a priori themes relates to the nine intervention functions found in the "Behaviour Change Wheel" (Michie, Van Stralen, et al., 2011; Michie, Atkins, et al., 2014). Specifically, intervention functions were used based on the results found in the systematic review presented in chapter four. These results pointed toward a few tools ("Modelling", "Education" or "Training", "Incentivisation", and "Persuasion") being key. "Modelling" is reflected by information coming from other councils as predecessors. "Education" and "Training" are reflected by the information about the policy. "Incentivisation" is reflected by the first policy presented coming out as less of a pressure than expected toward the council budget. Finally, "Persuasion" is reflected by the environmental activist group. Specific effects of these intervention functions will be analysed by looking at what cycle the innovation was adopted in combination with the self-reporting of what information sets carried the most

weight. These factors, through the use of content analysis, should tell us what specific information made the respondent finally adopt the policy.

To describe the barriers that were encountered in the literature, problems hindering policy making were re-coded into a theme category containing five barrier types that can be compared to the six barriers to sustainable transport found in Banister (2005): economic (e.g. lack funding); administrative (e.g. conflicts with other policies,); cultural (e.g. public acceptability); legal (e.g. national regulations); side effects (e.g. electrical cars furthering congestion) or physical (e.g. space limitations).

5.4 Results

5.4.1 Major themes.[12]

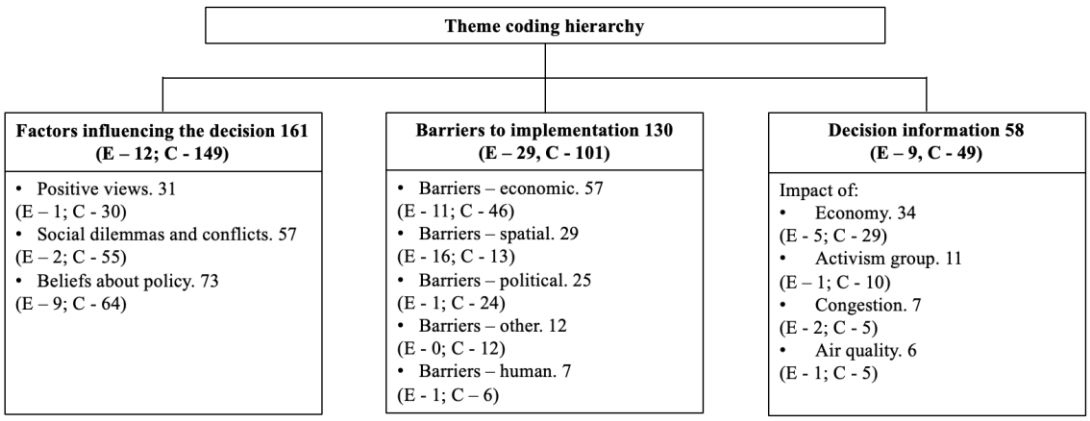


Figure 5.2. Main themes and subthemes. Each theme is followed by the number of nodes attributed to it (E – publicly elected C – Civil servant).

The general coding hierarchy shows us that respondents most often discussed different factors that had decision weight to them. Respondents were keen to talk about how they found the project. The theme "positive views" often correlated to comments about the project working well or being realistic. "Beliefs about the project" instead often connects to comments on wanting more information or preferring other methods. It is not surprising that respondents discussed the project

[12] See figure 5.2 for a coding hierarchy of the main themes and selected subthemes.

itself. What was surprising, however, is the key role played by "Social dilemmas and conflicts". More often than being positive about the project, respondents discussed how the project related to different conflicts between groups or goals.

The second most prevalent theme was “Barriers to implementation”. Economic barriers were the most discussed, followed by spatial (regional barriers based on factors of geography, etc) and political barriers.

Finally, the third theme was made up of "Decision information". This theme was made up of the types of information respondents claimed to be the most important. The second to last item in the vignette asked respondents to give the two types of information that carried the most weight toward their decision. Discussions about these information sets (save about relationships with the “other councils”, which counted as social dilemmas for the purposes of this coding exercise) were coded into this theme.

5.4.1.1 “Factors influencing the decision” themes.

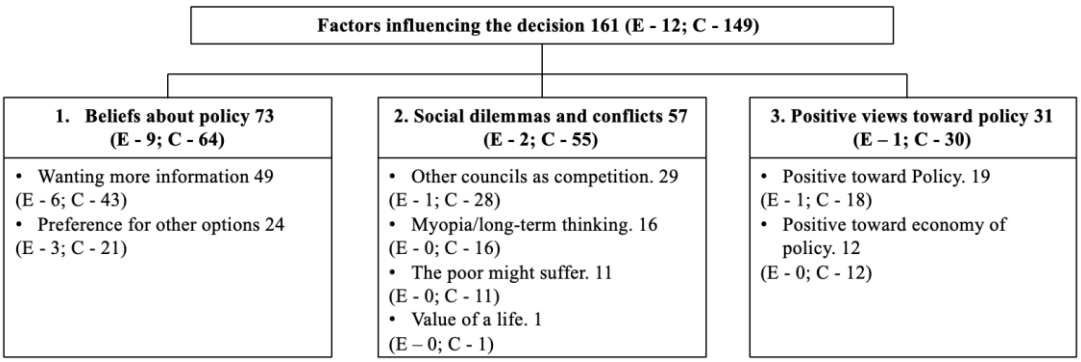


Figure 5.3 The “Factors influencing the decision” theme and its subthemes. Each theme is followed by the number of nodes attributed to it (E – publicly elected C – Civil servant).

Beliefs about the policy. Here, nodes related to the lack of information in the vignettes, or information relating to other preferences among respondents are included. “Positive views toward the project” could be seen as part of this theme, but it was made a separate category to increase clarity. This could be compared to the “Motivation” category of behavioural sources in the COM-B model: respondent opinions of the policy should directly reflect their motivation to adopt it.

Participant:	Quote:
15	"I would be looking for more information. So a bit of social and economic information. You know, the kind of experience of that."
1	"…I don't think there is enough information for me there"
9	Okay, I think there could be other, more cost-effective measures to deal with air pollution, other than the implementation of a clean air zone.

Social dilemmas and conflicts. This theme included all types of conflicts between different groups and goals. The primary conflict topic was between the respondent's council and other councils, followed by short-term or long-term benefits being prioritised, and finally, the fear that certain groups (primarily the poor) within the own council suffering due to displacement of the congestion. Displacement is a phenomenon where a congestion charging scheme does not remove congestion fully but instead moves it from the city centre to other areas of the conurbation. Once again relating to the COM-B model, social dilemmas and conflicts would often fall under the "Opportunity" category as respondents described a need for adoption to happen at the correct time in relation to their competitors.

Participant:	Quote:
4	"…well now we're really feeling pressure because we're in danger of being left behind all of a sudden and politically that would look bad."
4	"Ehm we're going to have to sell the longer-term benefits which will be difficult anyways with elections coming up this year. A lot of the councils will be under pressure for why we're doing it, but I think we're going to get on the board"
11	"The problem is abutting that, adjacent to that, are your inner city deprived areas of population, a lot of instances and therefore how could you justify a policy that makes it all nice and clean in the centre whilst absolutely ruining the health of residents in the most deprived areas that probably need the greatest support anyway."

5.4.1.2 "Barriers to implementation" themes.

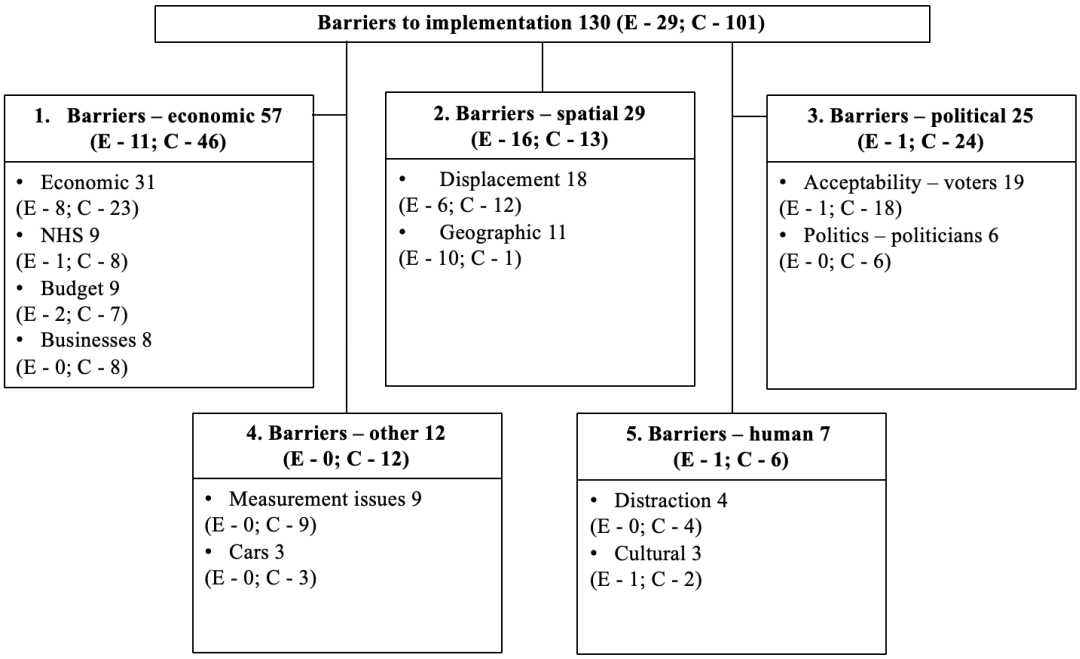


Figure 5.4. The "Barriers to implementation" theme and its subthemes (E – publicly elected C – Civil servant).

Each theme is followed by the number of nodes attributed to it. "Economic" barriers were the most frequently reported. Respondents most often discussed potential negative effects on the local economy. Examples could be how less transport into the city centre could mean a consumer shift to other nearby towns, or the fact that the money paid into the congestion charge would come from the public of their own council, which isn't really a profit for the council. After barriers to the local economy, the NHS and budget as barriers were the most common topics. "The NHS" becomes a barrier to a project like this, as the NHS gets a large part of the financial profit but doesn't pay anything back into the council. The budget as a barrier is a bit more obvious, several respondents thought the project was too expensive. The "businesses" theme concerns how local business would react to a project such as this, would they move to another town? Economic barriers could relate to the "Capacity" compartment of the COM-B model, if a limited budget makes adoption difficult, but could also relate to the "Opportunity" compartment, if

the timing isn't perceived as just right, or if a competitive advantage might be had with a different option.

Participant:	Quote:
8	"But it's the economics that's the problem. It means a lack of jobs. It would affect tourism because people may not want to come."
10	"Some interesting elements there, I think, that we've had to work through is the bit about the costs, savings, and the NHS might see a medium to a long-term reduction in the call for services, but they'll not pay into it, I wouldn't expect."
2	"And if you're the leader of a council, the difficulty you'd get is that you'd probably not know your budget. You won't know your budget. So, it's a question of councils tend to think, therefore, in the short term. So, is the cost, actually (inaudible) which is the difficulty."
11	"I think as well we, as a Combined Authority we have the transport interest and also economic interests of businesses, and the business aspect would really be a difficult one too, yeah, so I think at this point it would probably be no on this decision."

Spatial barriers were formed into two main categories, "displacement" and "geographical". The first concerns the risk of displacement, or congestion and air quality just moving out of the city centre but remaining severe over a larger area. Respondents feared that car transport would remain at similar levels, only with different, perhaps longer routes. "Geographical" barriers instead concern how some cities felt that their town planning would not suit congestion charging. Most of the smaller cities and even Bradford lack the infrastructure (ring roads, public transport routes, etc) required to diverge transport with other means. Spatial barriers should relate to "Opportunity" or "Capability" from the COM-B model, as respondents felt that this policy might be good, but possibly wouldn't fit in their conurbation. If certain changes could be made, the opportunity might present itself for the policy to be a good fit.

Participant:	Quote:
8	"What happened was that you saw a significant increase in rat running around the zone, and actually what was happening when they modelled that through was you saw a huge negative impact on congestion and therefore air quality in the bit around the centre, and the bits around the centre"
2	"The question is always, where has all the congestion gone? Has it just moved out of that area? Has the air quality deteriorated all the way around? Is the economy of the council tanking? Is it going down because of displacement etcetera?"
14	"… whether there are alternative route systems. And in the case of Wakefield, there aren't. the traffic does have to go through the town centre."

Within political barriers, public acceptance was a far greater topic than barriers related to administration, conflicts with colleagues, etc. This is likely to be related to how the vignettes gave respondents full decision-making power. Some respondents quickly accepted this facet of the study, and never discussed what others would think of their decision. Even so, it was clear that respondents didn't want to be seen as charging their population. Several of them instead reported their preference toward other policies, such as higher fuel taxes. It is of interest that civil servants, in general, reported more political issues. Only one publicly elected participant mentioned voter acceptability. This is in direct conflict with theories on voter influence on political behaviours (e.g. Kingdon's three streams of political influence, Kingdon & Thurber, 1984; Kingdon, 1995). It is possible that the publicly elected sample didn't want to outright state that voter concerns influence their decisions. Political barriers as they appeared in this context (more relating to public acceptance than administration etc.) should relate to the "Opportunity" source of behaviour in the COM-B model. Public opinion and especially voter pressure to combat air pollution should give the mandate to adopt air quality policy.

Participant:	Quote:
2	"Gonna get a huge backlash from the… well politically and even though people probably want to do it altruistically, in terms of it sounds like a good thing to do. The problem is again the short-term budget ramifications in terms of … you're gonna upset a lot of drivers who will then have to pay the charge."
5	"I'd also want to get the views of the electorate because again, our recent experiences here in Kirklees have demonstrated that these things don't always go down too well. So you'd need the electorate on board."
3	"We're not that good at commercialising what we do."

Within "Other" barriers, issues with measurements and numbers (e.g. the monitoring of air quality) were the most common. The difference between publicly elected participants and civil servants is again noticeable. Measurements issues came up nine times with civil servant respondents, and not at all with politicians. This could relate to the type of civil servants that took part in this study. These

participants were often scientific officers and would as such often work specifically with measurement.

Participant:	Quote:
10	"And record it and monitor it, because erm… the built environment, and there is some talk of changes with the built environment and weather, and all that kind of stuff is equally important. And there are places, for example, in Leeds that you would not believe are areas of poor air quality, because there's more trees than anything else."

The "Human" barrier theme is mostly made up of "the public" as a distraction or public behaviours acting as a barrier. This often refers to a distraction from important work (as in the case of the activist group). Further, cultural barriers are reported to be a factor. Some respondents reported certain subgroups in their council to have differing views of health, transport, and the environment.

Participant:	Quote:
3	"…unless they come up with a solution that helps you, it almost just becomes like an earache."
14	"I've got Asian colleagues, they, and I interact a lot with Asian people by virtue of my position as a (…). And yeah. They come, they arrive by car or by cab. Almost all the time."
7	"People for unknown reason drive five minutes to school and sit outside a primary school for half an hour in order to pick their kids up because it's more con… somehow that's more convenient than walking five minutes, pick the kid up, five minutes home, so it's going to take you ten minutes, but you're happy to wait 40 minutes in order to sit, my children's primary school generally sit illegally on the double yellows in order to get your child, that breaking that barrier down is very difficult."

5.4.1.3 "Decision information" themes.

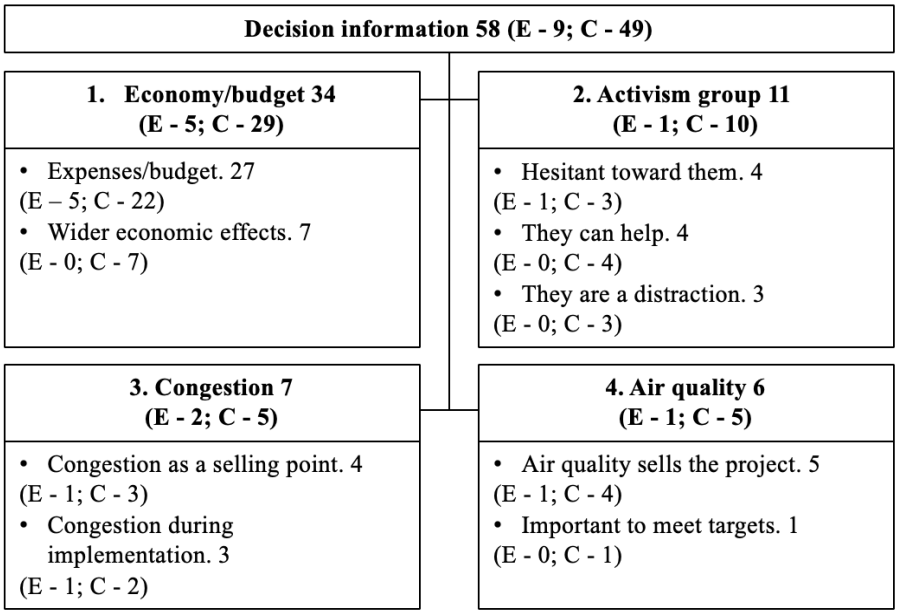


Figure 5.5. The "Decision information" theme and its subthemes. Each theme is followed by the number of nodes attributed to it (E – publicly elected C – Civil servant).

This theme reflects what respondents replied to the end of vignette item concerning what information types carried the most weight in their policy decision. As such, this should tell us what information was actually perceived to be the most important. The subtheme relating to budget or economic information was the most prevalent (although rarely seen as the "most important" factor when respondents self-assessed information types by importance). Respondents were most often concerned with direct budget expenses but also brought up some wider financial effects or worries. Considering the difference of the ”economic information” theme frequency within the discussion and the self-stated importance of the factor, it is plausible that respondents fell for a so-called response bias (or social desirability responding) in the self-rated items. This should especially relate to social desirability responding. Social desirability responding is a phenomenon where people want to present a favourable image of themselves in questionnaires (Van de Mortel, 2008). Considering how environmental awareness is a normatively desirable trait (Lindenberg & Steg, 2007), one might assume that rating air quality as a high-

importance factor might be socially desirable, while rating budget might be perceived as of lesser social desirability. Further, a decrease in cost of about 7.5% was seen as very positive, while an increase of the same amount was seen as expected. Further noteworthy is how publicly elected participants often discussed budgetary factors, while the wider economic effects of the policy were discussed only in the civil servant group.

Participant:	Quote:
4	“In relation to our capital program it’s a huge chunk out of it, so if it’s been funded locally, there’s lots of other schemes that aren’t being funded while we're implementing this and while it starts to pay back.”
12	I’d still say ‘no’ because it’s poor value for money
9	And the economic impacts will affect everyone, and whereas the air quality might only be a discrete number of people

The second most prevalent type of information concerned the activist group, which was often seen as a barrier or distraction.

Participant:	Quote:
7	we have had them, they had a positive impact with the from an air quality perspective, but they wouldn't realise that necessarily, nor was it the action they were after unfortunately
12	“sometimes the activists are pressuring us in a positive way.”
3	“They actually can use up your time and pull you away because you have to explain things and try and get them to a level of understanding where they realise that you can’t take action unless XYZ happens.”

Congestion was brought up on seven occasions. It should be mentioned that “side-effects” and the fear of displacement both relate to congestion. As such, there may be a large amount of "hidden" congestion information that has been coded as something else.

Participant:	Quote:
4	“Congestion has always been a big problem in our city so it’s this other benefit to sell as well.”
5	"And then congestion impacts upon the economy."
3	“Some congestion due to construction costs wouldn’t worry me. Unduly or anything I think just let’s get on with it, assuming I got 40 million quid to do it.”

Finally, air quality was the least prevalent information type to be discussed. A lot of the discussion instead focused on a fear of ‘displacement’ of congestion, a phenomenon where congestion charging has the effect that congestion doesn’t cease

but instead moves into other areas of the city, and the potential effect this could have on the poorer areas in the region. The fact that air quality was the least-discussed information type points toward the weight that other factors carry, and potentially where the interests of policy makers lie (e.g. congestion, budget) when judging a policy. It may also be the case that air quality was an accepted and baseline factor that respondents were already focused on, meaning that they focused on tackling air quality without disrupting other areas, such as budget.

Participant:	Quote:
14	"Air quality. Right, air quality because that's what it's about. So, if we got a huge increase in air quality, then yes you know. We'll accept drawbacks on the others."
9	I care about them, the people living in poor air quality areas. Then the information about air quality, because that's going to have health impacts for certain people.
4	"I think the information about the air quality as well as we know we have targets to meet so now we've seen a project that will deliver that when we get it installed."

Minor cases/outliers. "The value of a life", this social dilemma case came up in one interview, where it was discussed as a way of selling the project financially.

Participant:	Quote:
3	"If it saved one life then umm you know is one life worth 50 million?"…
3	"We know what one life costs, you know 1.3 million or whatever. Umm, it would be interesting to have, to be able to create similar value to that. You know in road safety one life

5.4.2 Intervention functions

Table 5.2
The year that participants adopted the hypothetical vignette policy, self-reported influencing factors, and codes of what caused adoption or drew respondents from it.

Participant no:	Adoption year:	Influence no.1:	Influence no.1:	Content reflexion:
1 (E)	Never	Economic	Air Quality	Too expensive
2 (C)	1	Economic	Air Quality	Liked project
3 (C)	2	Innovation itself	Economic	Positive news
4 (C)	3	Air Quality	Progress others	Pressure others
5 (C)	3	Air Quality	Congestion	Needed numbers
6 (C)	3	Economic	Progress others	Pressure others
7 (C)	1	Economic	Air Quality	Liked project
8 (C)	1	Economic	Congestion	Liked project
9 (C)	Never	Economic	Air Quality	Too expensive
10 (C)	1	Innovation itself	Air Quality	Liked project
11 (C)	4	Air Quality	Congestion	Needed numbers
12 (C)	Never	Economic	Air Quality	Too expensive
13 (E)	1	Economic	Congestion	Liked project
14 (E)	Never	Economic	Air Quality	Inefficient
15 (C)	3	Progress others	Economic	Needed numbers

Note: participant status as publicly elected (E) or civil servant (C) stated in brackets.

"Modelling" was a key factor in the systematic review presented in Chapter four of this thesis. Perhaps surprisingly, only two of the respondents reported that "progress in other councils" was a key information set. Nevertheless, it is possible to also see "Modelling" (at least in part) as any cases where respondents were informed about the project and made decisions based on how the other councils were doing. In other terms, this would reflect as any cases where a positive adoption decision was made after the initial presentation of the policy. By this definition, five of the 15 respondents used "Modelling" to inform their decision.

"Training" and **"Education"**, taken together, were the second most important factors in the literature. In this case, these intervention functions can be seen as cases where respondents were hesitant but made the decision after having received sufficient information about the policy innovation. This makes it hard to separate these factors from "Modelling" and even "Incentivisation". As Michie, van

Stralen, et al. state (2011), the behaviour change wheel inevitably involves judgements when conceptualising intervention functions and policy categories. These can be done in a multitude of ways, and there is no guarantee that the model always proves the best fit. Further, this study contains elements developed by the authors that were meant to represent intervention functions, and it is possible that these functions could have been more strictly separated. Whether this lies with the limitations of the framework or the writing of the vignette is unclear. Nevertheless, two respondents claimed to "need more evidence about air quality" and were satisfied at the same point where they made the positive adoption decision. This should be seen as "Training" or "Education".

Economic factors seemed to be key, as they were brought up in more than half the cases (8/15). As relates to intervention functions, a single case was found where the policy was adopted after respondents who valued economic information faced positive economic information. In the other cases, respondents made a decision either based on the initial information given (which points toward the entire policy being positive, this happened in four cases) or never decided to adopt the policy (which points toward a low rate of incentives). This points toward "Incentivisation" being of lesser importance compared to some of the other tools.

5.4.3 Barriers

An added facet to this barrier analysis came through the online questionnaires that ran alongside the vignettes. These were coded into the barrier categories used in the vignette coding.[13]

[13] See table 5.3 for these codes and categories.

Key barriers to sustainable travel policy	Key barriers for general air quality policy
Finance, understanding of benefits. The status quo - build roads buy cars.	A change from the status quo, lack of strategic direction from government to tackle the problem, finances and difficult choices to make that may not be welcomed by voters
Political concerns relating to impacts on business and personal use vehicles	The linkages between evidence and impacts of poor air quality need to be strengthened, Clearer case to be made
Investment in road infrastructure.	Motor industry and infrastructure
Continued car culture, investment in better roads and decongestion - it encourages people to continue to drive. lack of investment in public transport, entrench behaviour, poor perception of public transport.	Lack of appreciation of the risks among the public, Apathy among the public, Lack of political courage, Need a mayor - similar to the mayor of London who will make unpopular decisions
The contradictions realised in development outcomes that don't align with active travel policies. e.g. providing high levels of parking and accommodating the motorised vehicle at all costs whilst supporting active travel in theory.	The concern that it will make the economy inefficient and upset people who might then vote for another political party. Lack of understanding by the general public. Inertia and the fear of changing norms quickly.
Perceptions of danger, apathy, equality of choice for all, the car lobby.	Deprivation in some areas. People seeing the purchase of a car as an increase of status. It's difficult for people to envisage air quality problems. Many don't connect their car as a cause of the problem.
Cost and resources to implement. Conflicting policies within the council, and policies which can be interpreted differently.	Sustainable travel infrastructure is not robust, with alternatives other than the car being cheaper, quicker and more attractive to the majority. More steer needs to come from the government with more enforceable measures. Needs buy-in from key stakeholders particularly elected members where in theory is generally supportive but in practice is not. planning policies do not lend themselves to sustainable travel in practice.
The 'car is king' mentality. Lack of will within organisations to commit to increasing the numbers of people travelling actively. Lack of funding for good quality infrastructure. The refusal to tackle poor driver behaviour and to enforce traffic law violations.	'Car is king' mentality. Refusal to do anything to upset the electorate. The fact that councils are so reliant upon the income that car parking brings.
Resources, Citizen rejection.	Political support. Economic development objectives. Citizen support.
Devolved finances - to deliver on active travel policy - the all parliamentary cycling group recommends a spend of £10 per person on cycling infrastructure. Integration of transport and land use planning - to effectively build sustainable development that promotes active travel. Collaboration - resourcing and mechanisms by which to deliver more cohesive activities with health authorities and employers.	Challenge of developing economic, social and environmental policies without generating indirect negative impacts. Lack of long-term national leadership on air quality including appropriate resources and funding including locally devolved abilities to regions. Contradictory national policy which often contradicts environmental and economic policy. Political cohesion on agreed mechanisms by which to improve air quality.
Lack of skills and expertise in the built environment sector in local government to shape and deliver policies at a local level.	The myth that air quality policies are anti-business and will put the brakes on economic growth. Need greater education and understanding of the issues.

Figure 5.6: Self-reported barriers to 1) sustainable travel, 2) general air quality policy.

Table 5.3
Coding of the self-reported barriers into previously used categories.

Barrier:	Economic	Spatial	political	other	human
1.	2		4	1	
2.			2		
3.	1			1	
4.	2		3	1	2
5.	1		3		1
6.		1	3	3	1
7.	1	1	5	1	
8.	2		3	2	
9.	2		3		
10.	1	1	5		
11.	1		1		1
Tot:	13	3	32	9	5

The self-reported barriers are different than those formulated in the vignettes. The most prevalent barriers here are political. After that follows “economic” barriers and “other” barriers (mostly related to car use and car lobbyism). “Human” and “spatial” barriers only had limited prevalence. Taking the coding further, the barrier themes used in this research compare to the “Barriers to Sustainable Transport” found in Banister (2005) in the following manner:

Table 5.4
Comparison of the themes found in this study and the barrier types found in Banister (2005).

Themes in this study:	Economic	Spatial	Political	Human	Others
Banister:	Economic	Physical	Administrative, Legal	Cultural	Side effects

The coding of barriers in this vignette analysis are different semantically but line up in a similar way to Banister (2005). There are some minor and major differences, however. Economic barriers are the same in this coding as Banisters (2005) and mostly related to budgetary issues. Spatial barriers and physical barriers are very similar, as they both relate to the geographic makeup of the region where a policy is being implemented. Displacement might be considered a ‘side effect’ within Banisters barrier system (2005). Political barriers are again similar to

administrative or legal barriers from Banisters system. Public acceptance was a key barrier type within this political barrier theme and is highly related to cultural barriers within Banisters barrier system (2005). The coding of ‘Other barriers’ does not produce an exact analogue to Banisters ‘side effects’, which relates to the wider effects of the implementation of a policy. ‘Other barriers’ in this vignette analysis related heavily to measurement issues, while ‘side effects’ in Banisters system relate more heavily to further effects of the policy itself.

5.5 Discussion

Participants rarely outright stated that the economy or budget was the key factor to their decision, but nevertheless talked more about the budget than any other factor. The economy and budget seem to be key factors when it comes to adopting a policy project, in order to make it appealing to the public. Further, a decrease in cost of about 7.5% was seen as very positive, while an increase of the same amount was seen as expected. Respondents often reacted by seeing themselves as more likely to be like the successful council than the one that struggled. This could be a case of optimism bias, a phenomenon where people overrate the chances of positive future events and underrate the risks of negative future events (Sharot, 2011). But this may also reflect how respondents thought that they make use of information from previous councils, believing that they could avoid the mistakes made in the council that struggled.

Only a very small number of respondents stated that air quality or congestion were key factors in their decision. A lot of the discussion instead focused on a fear of “displacement” of congestion and the potential effect this could have on the poorer areas in the region. This could be seen of egalitarianism or balance being more of a factor than wanting to “fix” problem areas.

5.5.1 Intervention functions

Reconnecting to the “Behaviour Change Wheel” and intervention functions (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014), “Modelling”, “Training” and “Education” were found to be key potential influences on respondent behaviour within this thematic analysis. This is in agreement with previous interventions aimed at policy adoption or change, as found in the systematic review presented in Chapter four of this thesis. Separating the effects of intervention functions in order to see individual influences was all but straightforward, but in several cases, participants stated outright that they were influenced by other council decisions, several participants also wanted more information about the policy. As expected, based on previous research, “Incentivisation” has a relatively small effect on decision making, even though the economy is very important, and often deters from positive adoption outcomes (i.e. finance is a key barrier, but not a key facilitator).

Taken together, this shows us that the different intervention functions are hard to separate, and presumably work together. The innovation was created with the specific aim of using information sets that convey several intervention functions. In hindsight, this may have muddled the separate impacts of interventions.

5.5.2 Barriers

In the case of the vignettes, economic barriers were seen as the most important, followed by spatial and political. When respondents self-reported barriers in the questionnaires, political barriers were the most prevalent, followed by economic and "other" (mainly relating to cars). The main change in the self-reporting compared to the vignettes is how often respondents brought up barriers relating to political processes and conflicts. It should be stated that the vignettes had respondents enter a hypothetical situation where they had complete decision power.

As such, it is likely that they ignored their real-life political struggles. Further, in the case of "spatial" barriers, the decrease of reporting in the questionnaire is expected as the questions are more diffuse and don't relate to a specific project where geographical or displacement issues are relevant. Further potential risks of bias may lie with the respondents themselves. Respondents may suffer from availability bias, a phenomenon where the risk of events that are easier to recall are considered more likely to happen, perhaps also in this context (Tversky & Kahneman, 1973; Dube-Rioux & Russo 1988). The conscious awareness being brought by self-reported barriers may cause this availability bias, as respondents are being made aware of certain potential barriers within the vignette study, but not others. It is possible, for instance, that segments or information in the vignette, such as presented costs of a policy, activate economic awareness and hence the awareness of economic and budgetary barriers. This could make economic barriers easier to recall than other barriers. The measuring of barriers should be seen as a combination of the self-reported barriers and the coded ones from the vignettes. Converting the coded themes into more established ones, such as Banisters (2005), doesn't produce an exact analogue. Nevertheless, by these barrier terms, administrative, legal, economic, and physical barriers are key. Removing the context of West Yorkshire and congestion charging, physical barriers seem to be replaced by a focus on political barriers.

5.5.3 Limitations and strengths

This study has been done with a novel and very hard to reach sample group. The population of higher-level policy workers and politicians in Western Europe are rarely willing to take part in any larger scale of studies due to time limitations and other pressing work which is often prioritised. This research is supported by both Bradford Council and the Department of Environment, Food and Rural Affairs,

which is likely to have made this project seem worthy of the respondent's time. A strength of the project is that it uses a large amount of diverse data from this scarce resource. Further, research into the process of adopting a policy is a novel field, and this study adds to the understanding of the policymaker's thought process.

Nevertheless, the project has its weaknesses. It would have been desirable to achieve sample outreach with the questionnaire part of the study. Further, the study coincided with a general regional election in the UK, which meant that elected officials were struggling to find time to participate. If the study was to be repeated, researchers are encouraged to avoid conducting research during public elections, so that participants would be in a more natural frame of mind, rather than having to think about appealing to the public. Further adding to this, Bradford City Council was facing severe budget cuts, and several council workers had been let go. In practice, this meant most stakeholders were under a lot of pressure and couldn't participate in the study, as they had to focus on tasks more central to their workload. Several of the contacted stakeholders didn’t reply unless they were actually working directly with air quality matters. As such the recruiting cohort had to be broadened, contacting people from the department of health and councils outside West Yorkshire.

Considering all such factors while also keeping within the daily deadlines and time restraints of research, is impossible, however, but may be of relevance to future research. Researchers could especially consider repeating this study during a period of political stability, in order to investigate the effects of political uncertainty on policy decisions. The vignettes gave the respondents full decision-making power. This may likely have had a negative impact on reporting of administrative or political barriers. Some respondents clearly accepted this facet of the study, and never discussed what others would think of their decision.

5.6 Conclusion

Economic barriers, voter acceptability, and spatial barriers (displacement) were found to be key in this study. Spatial barriers relate to the geographical setting and mostly line up with Banister's physical barrier type (2005). In this study, displacement has been coded as a spatial barrier and was found to be key in the interview study. Within the questionnaire self-reports, respondents most often talked about political and economic barriers. Social dilemmas were the most discussed topic. Respondents often contemplated negative displacement effects of moving transport out of the city centre, hence causing harm to poorer suburban areas. Further, the conflict between short-term loss and long-term gain was explicit. Another social conflict was established between the own council and others.

Further research is required into the subject of intentions to adopt policy and how behaviour change techniques may be useful in creating a window of opportunity where the promotion of policy adoption has greater effect. If this is done with policy workers or other hard-to-reach groups, researchers should make efforts to approach them in times of political stability and to state groups or people involved with the project that makes them seem more reliable.

6.0 CHAPTER 6: INTERVENTION FUNCTION USE AND AIR QUALITY POLICY INTENTIONS

6.1 Background

The air quality in several regions of the United Kingdom is poor. Cars are likely to remain the main driver of transport for some time, even for short trips of 1-5 miles (West Yorkshire Low Emission Strategy, 2016). High pollution exposure and low uptake in active travel further increase obesity, cardiovascular disease, and respiratory disease, resulting in high costs for the NHS (Holgate et al., 2016; Public Health England, 2018a; Public Health England, 2018b). Globally, cities struggle to reach air quality targets (World Health Organisation, 2016). The EU air quality directive has placed clear time limits on targets to improve quality, with fines facing those who fail to comply (West Yorkshire local authorities, 2015). In the UK, National Air Quality Strategies have been in place since 1997 (Department for Environment Food and Rural Affairs, 2007), with further regional and local strategies also adopted.

Even with these policies, 16 zones in the UK (including 9 cities and several regional areas) had not reached the legal air pollution limit levels set out by the EU at the time this research was conducted. Hence, the UK was taken to court by the EU commission (European Commission, 2014). There is a clear directive to improve air quality and potentially change the policy direction. The latest UK air quality action plan (2017) sets out to describe the current UK situation and posits a few key points of change. Local change is needed, and the regional government needs to manage the diverse air quality hot spots around the country. The national government further sets out to assist the local authorities, for instance by means of funding (£ 2.7 billion being invested nationally into cleaner transport and air quality,

further £ 355 million for local authority funds) and regulation (e.g. the UK was the first country in the world to announce its intention to end conventional car sales by 2040). A national framework is also set up with the goal of facilitating the actions required for local authorities to reach air quality limits.

Nevertheless, many competing pressures impact policymaker decision-making. This policy review sets out to find out what regions have been successful in adopting high-impact strategies, and why they have been successful. Within this research, judgements of policies as high or low impact have been based on the air quality policy consultation of DEFRA (Conlan et al., 2016). See chapter one for an evaluation of this consultation. Policies included in this consultation (Table 5.1) are seen as high impact. If a strategy includes several of these policy types, it is seen as being ambitious.

Table 6.1.
Policies consulted by DEFRA.

1	Retrofitting technologies and new fuels
2	Buying ULEVs and encouraging local transport operators to do the same.
3	Encouraging private uptake of ULEVs via ensuring adequate charge-points.
4	Public transport, active travel, and car-sharing.
5	Improving road layouts and junctions to optimise traffic flow, for example by considering removal of road humps
6	Working with local businesses and neighbouring authorities to ensure a consistent approach
7	Charging certain types of vehicles to enter or move within the zone.

Within this review, the analysis will be broken down by the 16 UK areas that are facing penalties from the European Commission (European Commission, 2014). Further, this review sets out to describe how these may relate to the intervention functions (fundamental categories of behaviour change tool types, such as incentivising or persuading others to partake in or refrain from a certain behaviour) that were brought up in the air quality strategies.

6.1.1 Intervention functions

Michie, van Stralen, et al. (2011; Michie, Atkins, et al., 2014) structure their behaviour change typology around a so-called "Behaviour Change Wheel". See figure 1.1 (pp. 22 of this thesis) and pages 21-23 for a layout and more complete description of the Behaviour Change Wheel. As described in chapter one of this thesis, the model is non-linear and can be applied at the policy level behaviour change or general public levels of behaviour change. Hence certain interventions types and functions will be more suitable for public behaviour change, (e.g. environmental restructuring to make it easier for the public to use public transport), while others may be more relevant to policy change (e.g. regulation in the form of wider air quality strategy documents that influence all policy work across an organisation).

6.1.1.1 Community and stakeholder engagement. In addition to the intervention functions described by Michie, van Stralen et al. (2011; Michie, Atkins, et al., 2014), engaging with the community is likely to be a further intervention type to be of sufficient relevance and separation in scope to be handled as a unique factor. A systematic review conducted by Bowen et al. (2010) showed positive outcomes on public acceptance and so-called firm legitimacy from community engagement through three different strategies. Transactional strategies use a very basic approach of providing investment into the community, for instance by educating the public or donating to charities. Transitional engagement aims to build bridges with the community, for instance through meetings between stakeholders and the electorate. Finally, transformational engagement concerns cases where the community is invited to take a direct part in the leadership of a project, through joint decision-making or project management. These strategies did not necessarily translate into direct gains and benefits but did lead to an increase in public

acceptance over the long-term perspective (Bowen et al., 2010). Public acceptability has a part in the policy-making context, hence, it stands to reason that community engagement has impacts on policy promotion patterns and intentions to adopt policies. In summary, factors such as the public opinion and organisational barriers can exert a powerful influence on policy decisions, which may explain why some evidence-based intervention initiatives may not be implemented.

6.1.2 Limited behaviours

In order to understand what may have caused adopted policies to be less than necessary to comply with the EU target limits from a psychological point of view, it is important to understand the context a policy decision is made in, and further how individual decision-makers are limited.

6.1.2.1 Bounded rationality. Policy makers suffer from bounded rationality in much the same way as the general public does (Simon, 1972). Factors from within the decision-maker (our limited cognition, limited information about the situation) and external to the stakeholder (unknown risks, “acts of nature” etc.) decrease the ability to make optimal decisions, and as such, they tend to be satisfied with lower gains, if it means a great reduction in effort. Even as organisational stakeholders often have access to more information surrounding their decisions (through the help of environmental and scientific portfolio holders, feasibility studies, etc.) and have a support structure of co-workers and civil servants, they still suffer from incomplete information and have to manage a wider set of factors and resources such as budgets, considerations of wider systems, and public acceptability. There is also often a pressure to create regional growth, which could lead to effects of psychological scarcity (e.g. *Mullainathan & Shafir, 2009; 2013; Mani et al., 2013; Shah et al., 2012*), further binding rationality and the ability to make complete decisions, as stakeholders feel that the resources have to be spread wide over several

goals. Further, they face a diverse set of situational limitations and barriers (e.g. political and social barriers created by limited mandate periods). Politicians and policy officers often also tend to prefer different options based on ideological and personal factors and fall prey to the cognitive biases explained by Kahneman and Tversky (Tversky & Kahneman, 1974; 1983; Kahneman & Tversky, 2013). Further, structural and contextual factors affect public decision-making. Chaudoir et al. (2013) describe several factors (e.g. lack of agreement on what factors affect implementation success) on a structural and organisational level that act as barriers to implementation. The field of implementation theory looks at policy from a different view than psychology, and approach decisions from a more complex organisational angle. To fully understand such decisions, both approaches must be applied, organisational decisions cannot be viewed in the same way as decisions made by individuals.

6.1.2.2 Biases, heuristics, Construal Level Theory, and Myopia in politics. The concept of biases and heuristics is based on the idea of two separate systems of human decision-making. When people need to make controlled and conscious decisions based on the information available, they use systems two thinking (Tversky and Kahneman, 2013). If a person is used to making a certain type of decision and knows that the risks of the behaviour are lesser than the profits (e.g. minor everyday purchases), they will instead automate the behaviour, turning it into a system one type decision. Availability heuristics or the ease of recall leading to the events being judged as more frequent (Schwarz et al., 1991) is likely to make the most urgent and relatable problems take priority (think of firefighting, where short-term solutions that "patch up" urgent problems are prioritised, over investing in long term solutions). Construal level theory adds to these issues, in that future events are more abstract than current events. If climate change or environmental issues such as

air pollution are seen as a distant phenomenon in time and space, people are less prone to act (Sacchi et al., 2016). Unless one suffers directly from air pollution, it is difficult to grasp the actual effects it has on public health. Further to this, the public might not understand the risks.

6.1.2.4 Contextual factors. Aside from internal bounded rationality, stakeholders and policy makers are further inhibited in their work by contextual and situational factors.

Scarcity. As political and human entities, stakeholders have minds set on resource management. This could relate to any scarce resource, whether it is time, finance, space, or public acceptability. Few situations of public management contain full resource saturation. Imagine a hospital, where even if there is plenty of funding, there may be a lack of surgery rooms or available doctors. In all decisions, stakeholders weigh pros and cons and try to pick the option that will increase gain, whether this is health gains, scheduling gains, or economic gains (it is usually a careful balance).

In these calculations, however, people tend to include other factors than arbitrary monetary valuations. These could include things such as the amount of time that is required, personal involvement, and whether a risk of loss is involved. Stakeholders and policy makers often struggle with this so-called "psychological scarcity" (Mullainathan & Shafir, 2009; 2013; Mani et al., 2013; Shah et al., 2012), whether it is money or time that is scarce. Having a constrained budget often leads to short-term focus, or myopia, causing an adapted behaviour of fire-fighting leadership types or so-called patching of big problems with less expensive solutions that solve immediate problems, but may lack sufficient long-term effects (Mullainathan & Shafir, 2013). Such behaviours are rational, but only in the demanding context. In long-term perspectives, they may lead to a lack of long-term

planning, which is crucial in environmental planning. If people perceive limited access to a certain resource, the management of that resource becomes the main focus. If instead there is some “slack”, or a buffer of the limited resource available, short-term focus can be mitigated within organizations (Mullainathan & Shafir, 2013). Scarcity has been shown to inhibit self-restraint in group members as the future availability becomes more uncertain, leading to group members seeking more short-term gains and cooperating less in social dilemmas (Aquino & Reed, 1998).

Further to this short-term perspective brought on by lack of a resource, Nordhaus (1975) describes the partisan nature of myopic economic politics and posits that voter behaviours follow upon the perceived financial performance of the incumbent. If the incumbent did worse than expected (or rather, if performance was lesser than the voter's "standards"), the voter will vote for the opposition. Hence, delayed outcomes of expensive policies will likely decrease electorate affect, something that has to be considered, at least in the case of swing votes. Nordhaus further states that incumbents are likely to seek maximisation of votes by implementing policies toward the end of the political cycle (as related to the trade-off between inflation and unemployment), while the initial period is usually mired by austerity.

Kingdon’s multiple streams (Kingdon & Thurber, 1984; Kingdon, 1995 Rawat et al., 2016), describes how two factors influence administrative decisions, “Processes” and “Participants”. Participants relate to those people who have an impact on policy, from policy makers to civil servants. Processes are divided streams that include different actors: problems; policies and politics. The public is a type of participant that mainly impacts politics by criticising those in power and the decisions they make. Robinson and Eller (2010) describe how the public is expected to influence decision-making either directly, through interest groups or community

engagement programs, or indirectly, through influence on elected officials. Taken together, the research shows how the role of public opinion in politics and public decision-making. It does indeed have an impact on the work of politicians and policy makers.

The research by Nordhaus (1975) described earlier points towards this being done in a myopic way (in other words, when elected officials need public acceptance, they may choose policies with short-term rather than long-term gains). Aside from public acceptance, scarcity, and the political business cycle, many other reasons may cause this hesitance, increasing the likelihood that policy makers pick a less effective or less sustainable option. Policy makers act in an institutional context, causing conflicts between ideologies, preferences, and ideas. Political ideologies may cause other factors to be more prevalent and therefore more prioritised (e.g. economic growth or fighting poverty).

In summary, it is likely that those under voter pressure to create immediate change are hesitant toward adopting policies with high immediate costs and long-term benefits that may not show up until someone else is in office. This would be especially true when the outcome is distant not only timewise but abstract in impact. A combination of factors influences these tendencies, including but not limited to personal myopia, construal distance to the effects of air pollution, and public opinion.

6.1.3 Aims and research questions

The research sets out to look at air quality strategies over a relevant time frame to gain an understanding of what regional government has done to reduce air pollution and which regions have adopted the most ambitious air quality policy since the initial air quality limits were proposed. Once this is done, the intention is to look at the formulations of the strategies, specifically looking for the use of

determinants of change and intervention functions that might have created windows of opportunity to let more ambitious air quality policies come forward.

Summarised, the aim is to look at what Intervention functions and argument frames were used in the 16 affected UK areas and then at what policies have been adopted.

1. What intervention functions from the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) have been incorporated into air quality policy initiatives across the 16 conurbations?
2. Are there patterns of certain intervention functions being prevalent in strategies that presented ambitious policy intentions compared to strategies with fewer policy intentions?
3. What barriers to policy adoption were reported?
4. Has community and stakeholder involvement been applied in the creation of the strategy documents?

6.2 Method

6.2.1 Design. The research questions were answered through a policy review, using thematic analysis of 16 regional air quality strategies. The data was collected from official council sources (e.g. web pages) of the related conurbations, and then uploaded or transcribed into NVivo (version 11.4.3). the reviewer first got accustomed to the data by reading the documents, and then through the generation of codes. The themes were deductive, and codes were adopted to fit into these themes. Finally, the thematic analysis looks at what intervention function themes were prevalent in areas with greater amounts of policy intentions. The research looks at patterns of intervention function prevalence in the council strategies with ambitious policy intentions, such as those with the intention to implement a clean air zone.

6.2.2 Data Retrieval. Coding nodes were extracted word by word from the air quality strategies of the 16 areas. The air quality strategies were selected as they were the official documents presented on the council webpages of the 16 councils that are under pressure from the European Commission to create feasible air quality strategies that will help the areas reach pollution limits by 2020 (European Commission, 2014). The next step was simply to retrieve these council's publicly available air quality strategies from the council websites. There was a single case where a council did not have an air quality strategy, but an Air Quality Annual Status Report. This was used as a replacement for that council. One of the Strategy Documents (Newcastle) was older than the others (January 2006), compared to later documents from the other city councils, presented between 2011 and 2019.

Table 6.2
Areas included in the study, with population size and air pollution exceedances.

Area	Population size	NO_x Exceedance
Birmingham	1,137,100[14]	Two sites of exceedance.[13]
Bristol	454,200	Ranging from 45 to 65μg/m^3.[15]
Coventry	360,100[16]	Between 40-100 in certain sites.
Derby	248,752[17]	N/A
Hull	257,200[18]	No yearly relevant exposure, hourly exceedances in one area.[19]
Leicester	342,627[20]	Sites with 53, 43 52μg/m^3.
Liverpool	466,415[21]	One site over 40μg/m^3.
London	8,787,892[22]	Exceedances ranging from 40 to 120μg/m^3.[23]
Manchester	541,300[24]	10 sites in exceedance, ranging from 40.09 to 58.54μg/m^3.[25]
Newcastle	309,873[26]	Highest predicted exceedance (2005) 71μg/m^3.[27]
Nottingham	329,200[28]	Exceedances in several sites, with one site over 50μg/m^3.
Sheffield	575,400[29]	Sites with 40+ and one site with over 60μg/m^3.[30]
South Wales (Cardiff)	363,093[26]	68 μg/m^3 measured in one site.[31]
Southampton	254,275 (est.)[32]	39 μg/m3. Target achieved.
Stoke on Trent	277,051[33]	26μg/m3. Target achieved.[34]
West Yorkshire (Leeds)	751,500[35]	46 sites of exceedance, varying from 42 to 99μg/m^3.[36]

Notes: NO_x limit levels are currently set at 40μg/m^3 annually (Bristol City Council, 2018).

6.2.3 Inclusion and exclusion criteria

Inclusion. The inclusion or exclusion of data relates to what councils and document types that are relevant for this research. The main intention was to look at the air quality strategies of the 16 UK areas that were exceeded European Union

[14] Birmingham City Council, (2017; 2018).
[15] Bristol City Council, (2018).
[16] Coventry City Council, (N/A; 2019).
[17] Derby City Council, (2017; 2019).
[18] Hull City Council, (2014; 2018).
[19] Department for Environment, Food and Rural Affairs; Department for Transport. (2017a).
[20] Leicester City Council, (2015a; 2015b).
[21] Liverpool City Council, (2011a; 2011b).
[22] World Population review, (2018).
[23] City of London, (2015).
[24] Manchester City Council, (2016).
[25] Greater Manchester Combined Authority, (2016).
[26] Population UK, (2018a, 2018b).
[27] Newcastle City Council, (2006)
[28] Nottingham City Council, (2017; Nottinghamshire County Council, 2017).
[29] Sheffield City Council, (NA).
[30] Sheffield Cabinet, (2017).
[31] Department for Environment, Food and Rural Affairs; Department for Transport. (2017b).
[32] Southampton City Council, (2016a; 2016b; 2018).
[33] City Population, (2018).
[34] Stoke-on-Trent City Council, (2013); Air Quality England, (2018).
[35] Leeds.gov.uk, (2011).
[36] West Yorkshire Local Transport Plan Partnership, (2011a, b).

guidelines for air pollution in 2016. Hence, the official web pages of the 16 area councils were browsed for the strategies. On four occasions (Bristol, Newcastle, and Coventry), the councils lacked updated 2016 or later air quality strategies. These councils were approached by e-mail. Instead, an annual air quality status update from 2017 was used in the case of Bristol, and the most recent available air quality strategy update in the cases of Newcastle and Coventry (2005 and 2006 respectively). Leeds and Cardiff did not have air quality strategies for their specific councils, but instead were part of the strategies of larger conurbations (West Yorkshire and South Wales, respectively).

Exclusion. Only the official air quality strategies of said 16 councils were included. Hence, no letters, meeting reports, or feasibility reports were included. The most recent upload of one strategy document per council was included. This work relates to air quality and transport policies only, with specific weight toward active travel and public transport policies. Hence, no attempts have been made to code and analyse policies or policy documents relating to, for instance, new development construction.

6.2.4 Coding

Intervention functions. This theme was based around the nine intervention function types described by Michie, van Stralen, et al. (2011; Michie, Atkins, et al., 2014), and codes were included if they related to specific interventions within these categories.

Barriers. The coding of barriers continues on the themes in Chapter five of this thesis, where barrier types were based on Banisters barriers to sustainable transport (2005) and expanded where suitable. In this work, Barrier categories are as follows:

- *Administrative* barriers. Within this research, Banisters' "legal" and "institutional" barriers were often combined into a single category, "administrative barriers". These barriers relate to the undertaking of a legal process, increasing resources and time required for policy adoption and implementation. Bureaucratic and red band barriers are also covered within this barrier type.
- *Social and Cultural barriers.* Social and cultural barriers concern the public acceptability of measures. Public acceptability hinders the effectiveness of certain policies. In the case of this research, acceptability was joined by other social and cultural factors that work as barriers.
- *Economic barriers.* Economic barriers can be described as budget barriers. If a policy is to be implemented with success, it has to be paid for. This can be a very direct issue, causing the implementation to be impossible, or a barrier over time, where a policy costs more to implement than expected.
- *Physical barriers.* These barriers could take the form of space restrictions or are related to the topography of an area. Barrier themes were included if they explicitly were said to inhibit policy work and the possibility of adopting policies.

Policy intentions. In order to operationalise the themes, specificity is required within the themes. Special care has been used to find the cases relating to policies related to active travel, public transport, and congestion charging/low emission zones. It has been shown that a wider range of policies will also have the best effect in reducing air pollution (Conlan et al., 2016). DEFRAs consultation on transport policies for tackling nitrogen dioxide in towns and cities (Conlan et al., 2016), describes a set of recommended policies to be included in the air quality strategies[37].

[37] See table 6.1 for these consulted policies

These recommendations and the policy types described to have positive outcomes for air quality in Conlan et al. (2016) lead into the following policy themes for the coding schemes: (1) Active travel policy types; (2) Public transport policy types; (3) Retrofitting and new fuel; (4) Scrappage policies; (5) LEV/ULEV schemes; (6) Optimisation of traffic flow by road or time pattern changes; (7) Clean air zone schemes; (8) Charging schemes and finally (9) General air quality and transport policies. It should be mentioned that clean air zones are not required to include charging schemes. Instead, Conlan et al. (2016) recommend that charging should only be used where no equally effective measures are feasible. Hence charging schemes are unlikely aside from in the most extreme cases of pollution exceedances. Further, Clean Air Zones were included as a separate policy theme from charging initiatives, as they may, but do not always charge polluting vehicles. In this, they are different from Low Emission Zones, which do charge polluting vehicles. A final general theme of air quality and transport policy initiatives was included, for those policies that did not fit into any other theme. These general codes may not directly influence air quality, but relate to it or have indirectly mitigating effects, such as in the case of expanded monitoring. Only new policy intentions are included in the analysis, no older policies have been coded unless updates are made to them.

Double coding was done of a single strategy document by SB, GM, and RM in an initial instance, where 84.9% agreement was found within the three coding sets. After discussions, 100% agreement was reached. A further step was done by SB and RM, where 73% agreement was initially reached. After discussions about interpretations of the coding nodes, 100% agreement was reached. Editing was done to the entire coding set to fit with the consensus agreements.

6.2.5 Reviewer information

All datasets were reviewed by Sakarias Bank, the main author of this thesis. Sakarias is a male Ph.D. student in health psychology at the University of Leeds. Previously, he has an M.Sc. in societal psychology from the University of Gothenburg.

6.3 Data analysis

Thematic analysis has been applied in order to figure out what intervention functions (e.g. incentivisation, modelling) from the "Behaviour Change Wheel" (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) were present in the individual air quality strategies, if they could work to promote policy intentions, and to find out whether any patterns exist in how certain arguments have been more successful than others in a real context.

This research uses a set of deductive a priori themes based on previous results in the systematic review presented in chapter four of this thesis, and the vignette study presented in chapter five of this thesis. The coding scheme was based on barriers to sustainable transport (Banister, 2005), Michie, van Stralen, et al.s "Behaviour Change Wheel" (2011), and a final theme that covered what policy intentions were prevalent. The analysis was done using NVivo version 11.4.3.

This model for analysis will as such show the use of intervention functions within these councils, along with policies they intend to adopt. Further, barriers to air quality policy adoption are again looked at. This follows naturally upon previous work in this thesis. It is key to separate focus on behaviour change factors and the outcomes they may have caused.

6.4 Results

A general presentation of the complete aggregated data is presented at the beginning of this section[38]. For information on the individual councils and the coding therein, see appendix one. The most popular policy types were related to active travel, public travel, and low emission vehicle initiatives, intended to be implemented in 14, 12, and 12 areas, respectively. Clean air zones and retrofitting schemes were both intended to be implemented in eight areas, while route and time management was intended to be implemented in 11 areas. Finally, eight conurbations mentioned transport and air quality policies that didn't fit into these previous policy types.

Table 6.3

Policy intentions themes	Amount of councils	Amount of policies
Active travel policy types	14	104
Public transport policy types	12	75
Retrofitting and new fuel.	8	16
Scrappage policies.	1	1
LEV/ULEV schemes	12	107
Optimisation of traffic flow by road or time pattern changes.	11	41
Clean air zone schemes.	8	24
Charging schemes.	3	3
General air quality and transport policies.	8	43

In addition to the a priori theme categories described within the methods section of this article, more general policy intention categories had to be used for those transport policies that were unique or only appeared in a few cases (referred to as "general air quality and transport policies") In summary, three overlying theme categories were used, containing themes for barriers, intervention functions, and policy intentions. The "Policy intention" theme category contains nine policy themes. The "intervention functions" category contains the nine intervention functions described by Michie, van Stralen, et al. (2011). The "barriers" category

[38] See table 6.2 for this aggregated data.

contained the five barriers to sustainable transport described by Banister (2005). Numbers in tables relate to unique cases, rather than mentions of the same phenomenon or policy. A summary of the codes divided by conurbations is available in table 6.6.

6.4.1 Policy intention themes

LEV/ULEV schemes. Low emission vehicle schemes were prevalent throughout several councils and had the most mentions of all policy intentions. These policy types included initiatives to increase the retrofitting of buses, taxis, and private vehicles, in order to either be driven in a way to decrease fuel usage or to use less polluting fuel types. Nevertheless, they weren't mentioned in as many different councils as active travel policies. Instead, Low emission vehicle schemes tended to be the main policy focus where they were mentioned, while other councils didn't include them. This likely comes down to budgetary reasons. Low emission schemes are often more pricey than active travel, and it may be difficult to persuade users into LEV uptake.

LEV/ULEV schemes

Conurbation:	Code:
Hull	"From a greener transport perspective procuring alternative refuelling infrastructure to promote electric vehicle recharging is happening along with retrofitting exhaust gas recirculation systems to existing heavy vehicles and buses."
London	"…from January 2018, all new taxis and all private hire vehicles less than eighteen months old presented for licensing in the capital for the first time will need to be 'zero emission capable'"
Nottingham	"… a Euro VI minimum entry standard will be in place across the full local authority area for all bus services."
West Yorkshire	"Support for ultra-low emission vehicles – e.g. electric charging network."

Active travel policy types. 104 unique active travel policies were intended to be adopted, and further, each council but two (Coventry, Stoke) intended to adopt

such policies. It is the policy type that has been intended in the greatest number of councils. These policy initiatives and intentions covered everything from cycling awareness and safety schemes to rent a bike-schemes.

Active travel policy types

Conurbation:	Code:
Birmingham	”The plan also references the recently published Cycling & Walking Investment Strategy.”
Derby	"Expand city-wide cycle and pedestrian training, including adult, family and child, commuter and leisure trip training."
Hull	”Improvements are underway to the cycle network that will be helped by marketing to encourage the further take up of cycle use.”
Liverpool	“Promote healthier lifestyles by providing opportunities for people to walk or cycle for work or leisure purposes.”
West Yorkshire	”A separate Walking and Cycling Plan will be developed to support the West Yorkshire Transport Strategy, and this will complement our ambition to create a low emission future.”

Public transport policy types. This thematic category includes initiatives aimed at improving public transport or increasing the use of public transport.

Public transport policy types

Conurbation:	Code:
Liverpool	”The development of a Coach Strategy to identify sites for coach parking and subsequently reduce city traffic has been achieved.”
West Yorkshire	"Increasing public transport integration for example with increased park & ride or park & rail schemes."

General air quality and transport policies. As stated, these policies form a wide category that does not fit into the other themes. These codes can relate to park-and-ride schemes, car share schemes, idling enforcement, or schemes concerning sharing information about traffic or air quality with the public.

General air quality and transport policies

Conurbation:	Code:
Manchester	"Bus idling enforcement in Manchester city centre."
Newcastle	"Introduction of different levels of charging for car parking in all main centres…"
Sheffield	"Designing a clean air city – build the ambition of clean air into our approaches to transport, economy, housing, planning and health and wellbeing."

Clean air zone schemes. This category includes mentions of intentions to expand existing clean air zones or adopt new clean air zones. A related policy intention type is where additional measures to clean air zones are formulated, such as infrastructure changes.

Clean air zone schemes

Conurbation:	Code:
Southampton	"Establish the Southampton Clean Air Zone (CAZ) on a voluntary basis, with no charging, by 2017 and deliver an associated package of measures."
Leicester	"introduce a Low Emission Zone for the most polluting vehicles in the city centre."

Optimisation of traffic flow by Road or Time pattern changes. These policies relate to changes done in how transport flows, in order to stop congestion and hence air pollution. The ambition is to spread out road use to other routes or times in the day.

Optimisation of traffic flow by Road or Time pattern changes

Conurbation:	Code:
Birmingham	"Encouraging travel/transport in the off-peak where possible (especially freight deliveries). Supporting freight consolidation where appropriate to reduce freight traffic in congested centres and working with freight operators to minimise failed deliveries"
Liverpool	"Hall Lane Strategic Gateway, under construction, is intended to provide an improved traffic route for vehicles entering Liverpool from the east and will take traffic out of the residential areas."

Retrofitting and new fuel. This policy type relates to mechanically changing older vehicles to run on more sustainable fuels or use fuels that pollute less. This

could relate to either council fleets, public transport fleets, or private car use incentive initiatives, such as within Clean Air Zones.

Retrofitting and new fuel

Conurbation:	Code:
Manchester	"Purchase of new low-emission vehicles through bids to Green Bus Fund/Clean Bus Technology Fund."
Nottingham	"The proposed clear zone permit scheme will ensure that the City Council has the regulatory powers to encourage all bus operating companies within Nottingham to implement the retrofit programme."

6.4.2 Barrier type themes

Table 6.4
Barrier type themes

	Number of councils	Number of Barriers
Administrative	6	11
Social and Cultural	6	11
Economic	8	16
Physical	7	25
Technical	1	1

Physical barriers. Physical barrier types were the most prevalent, with 25 mentions. These often related to local geographical issues, such as a lack of infrastructure or the fear of negative impacts of transport displacement.

Physical Barriers

Conurbation:	Code:
Birmingham	"The air quality challenge for Birmingham is linked to limited road capacity and high levels of transport demand."
Newcastle	"Increasing pedestrian areas will dramatically improve air quality in those locations. It may, however, depending on location, move the congestion and air quality issues elsewhere."
Sheffield	"Our city is unique in its geography. We are a city of hills which needs to be considered when finding solutions to encourage active travel."
West Yorkshire	"Energy production closer to where people live and work can deliver significant environmental benefits, but we recognise that this can also introduce localised pollution and has the potential to negatively impact on air quality."

Economic barriers. Economic barriers were the second most common, and often related to budgetary issues. Other factors were brought up, such as fears of sunk costs, and the conflict between growth and health.

Economic Barriers

Conurbation:	Code:
Birmingham	”Upgrading to completely new vehicles would be prohibitively costly and there are uncertainties around the ability of the market to supply the number of new vehicles in such a short space of time.”
Birmingham	"however, the cost is prohibitive and no financially viable second-hand market exists."
Nottingham	“The NPV of both CAZ options modelled is negative, which suggests the costs of work to address urban air quality issues in Nottingham will outweigh any benefits.”
West Yorkshire	“Reducing emissions from road traffic, particularly from older diesel vehicles in towns and city centres, is our greatest priority, but we need to recognise that increased traffic can also be associated with the need for more housing and more jobs for the region.”

Administrative barriers. Administrative barriers were mentioned in 11 cases, and most often related to differences in ideology within the organisation or red tape.

Administrative Barriers

Conurbation:	Code:
Birmingham	“Government should refrain from using competitive models to fund proposals aimed at tackling air quality as this will introduce an unnecessary element of risk that will jeopardise the ability of the UK and local areas to achieve compliance”
Newcastle	”Stakeholder acceptance / “political” feasibility”
	"Pollutants such as sulphur dioxide, carbon monoxide and some heavy metals used to be monitored in Bristol, however, this has ceased as compliance with health-based air quality objectives for these pollutants was demonstrated."

Social and Cultural barriers. These barrier types are related to the beliefs, perceptions, and specific cultural setup of the population within the relevant region. This has a barrier effect as the public disapprove of or is unable to adhere to public

policy, such as in cases of public opinion going against intended policies. Social and cultural barriers were mentioned eleven times.

Social and Cultural Barriers

Conurbation:	Code:
Bristol	"There have been some negative responses against 20mph limits."
Nottingham	"The Islamic faith prohibits certain loan and other financial arrangements, which given the significant purchase costs of ULEV hackney carriages, can act as a barrier to existing taxi operators."

Several documents did not report any barriers. There may have been a reporting issue, as different models were applied to the structure and purpose of the strategies. Some strategy documents went into great depth on how policies would be applied, what risks were present, and how different policies could influence each other. Other documents simply described a list of policies. There may be a great number of "hidden barriers" in play.

6.4.3 Intervention function themes

Table 6.5
Intervention function themes

	Number of councils	Number of intervention functions
Coercion	0	0
Education	15	100
Enablement	12	51
Environmental restructuring	4	12
Incentivisation	6	9
Modelling	6	10
Persuasion	6	7
Restriction	6	14
Training	7	13

Education. "Education" was the most used intervention function, used in every case but one (Southampton). "Education" relates to cases of stakeholders, decision-makers, and policy workers being educated, whether that be through research in the local area (e.g. monitoring and feasibility studies), or workshops and courses. There is a tie-in between this category of intervention functions and

stakeholder engagement (e.g. community consultations). As such, there is some double coding of these programmes as both "Education" and "Community and stakeholder engagement".

"Education" codes

Conurbation:	Code:
Birmingham	"Through the feasibility study, we will be engaging with local businesses and national businesses that operate within Birmingham, to understand their challenges and help tailor the solutions."
Bristol	"A communications, awareness raising and engagement programme to increase understanding of the air pollution issue."
Liverpool	"LCC has also consulted widely with local organizations and the general public. This wider consultation has included an exercise in the form of a „Citizens" Jury" which has played an important role in identifying and developing measures for inclusion within the AQAP update."
Sheffield	"In line with our Transport Strategy, we will establish a series of "Congestion Conversations" to fully understand any areas where congestion hotspots could be tackled with some small changes."

Enablement. Enablement was used 51 times, with a large amount of those cases happening in London (21). Enablement was the most common intervention function to be applied in London by some margin (the second most common was education, with 17). In most cases, enablement is related to working together with other groups or creating a setting that will facilitate policy adoption, for instance through lobbyism or other initiatives.

"Enablement" codes

Conurbation:	Code:
London	"The City Corporation will work with the Mayor of London on air quality policy and action in order to improve air quality in both the Square Mile and across London."
Derby	"Support development of East Midlands Air Quality Network."
London	"The City Corporation will continue to liaise with Greater London Authority and Transport for London over additional action to reduce emissions from buses and taxis."
Sheffield	"We will lobby Government to provide UK-wide incentives for big fleet operators to reduce emissions and to incentivise, at a local and national level, the movement of a greater proportion of heavy goods via rail or water."

Other intervention functions. Even with lesser use, several other intervention functions are likely to have been in play and had effects. “Modelling” (10 uses), “Training” (13 uses), “Persuasion” (7), and “Restrictions” (14) were all applied in six councils. “Environmental restructuring”, saw some use (12), but only in four councils.

“Intervention function” examples

Intervention function	Example	Conurbation
Incentivisation	”Funding could be made available to residents or to businesses or employees with a business address who are able to supply appropriate evidence of their address within the CAZ.”	Birmingham
Training	“A communications, awareness raising and engagement programme to increase understanding of the air pollution issue.”	Bristol
Modelling	“This Strategy then considers air quality in the context of other key regional plans and strategies and how we can use these to Create a Low Emissions Future.”	Leeds
Environmental restructuring	“In addition maintenance measures are being carried out to footpaths, street lighting and bridges.”	Hull
Persuasion, Environmental Restructuring	”We will continue to apply pressure to the government to ensure the Sheffield Midland Station is appropriately upgraded in a way that improves air quality.”	Sheffield

Table 6.6
Summary of results in each zone, and coding of outcomes.[39][40]

Area	Barriers	Intervention functions	intervention Functions coding	Policy intentions	Policy Intentions coding	Community Engagement
Birmingham	16	9	Ed	8	CAZ, R	1
Bristol	6	13	Ed, T	5	AT	5
Coventry	-	6	Ed	-	-	-
Derby	1	16	Ed, Ena, T	42	PT, LEV, AT, R&T-M, CAZ, TG	2
Hull	-	7	Env, Ed	10	AT, R&T-M	-
Leicester	2	17	Ed, Ena	43	AT, PT, LEV, CAZ TG, R/T-M	1
Liverpool	2	11	Ed, Ena	69	AT, R&T-M, G, PT	3
London	-	46	Ena, Ed, I, Env, T	19	AT, LEV, R&T-M	23
Manchester	5	27	R, Edu, Ena, Env	21	G, AT, PT, LEV	-
Newcastle	11	18	Ed, M, I,	25	PT, AT, G, CAZ	1

[39] Abbreviations: CAZ = Clean Air Zone, PT = public transport, S = scrappage, R = retrofitting, LEV = low emission vehicles, R/T-M = route and time management, G = general air quality and transport policies. C = Coercion, Ed = Education, Ena = enablement, Env = environmental restructuring, I = Incentivisation, M= modelling, P = persuasion, R = restriction, T = training.
[40] For policy outcome coding and behaviour change tool coding, we are including only those policy outcomes and intervention functions mentioned multiple times. Codes are in order of prevalence.

			Ena, T			
Nottingham	4	7	Ed	34	LEV, PT, AT, R, G	3
Sheffield	4	14	Ena, Ed, R	28	PT, AT, G, LEV, R	3
Southampton	2	-	-	3	CAZ	-
South Wales	-	1	-	6	AT, PT	-
Stoke	-	2	-	-	-	-
Leeds	11	24	Ed, Ena, M	102	LEV, AT, PT, CAZ, R&T-M	6
Total:	64	218	-	415	-	

6.4.3 Community and stakeholder engagement

"Community and stakeholder engagement" was mentioned 48 times in ten cases. These intervention types ranged from working with public awareness in schools and other awareness programmes to the use of public consulting on specific policies. The mentions of community and stakeholder and division of these mentions by conurbation are summarised in table 5.6.

Community and stakeholder engagement codes by conurbation

Conurbation:	Code:
London	”The City Corporation will continue to work with schools to provide information on how to reduce the impact of air pollution on children’s health.”
Leeds	"Public consultation on the draft WYLES was undertaken during November and December 2015 via an online survey."
Bristol	”A communications, awareness raising and engagement programme to increase understanding of the air pollution issue.”
Liverpool	“LCC has also consulted widely with local organizations and the general public. This wider consultation has included an exercise in the form of a “…” Citisens Jury” which has played an important role in identifying and developing measures for inclusion within the AQAP update.”
Nottingham	“Initial public consultation was carried out in May 2018.”
Sheffield	”We will commission a Clean Air Community Champion Scheme where volunteers can pledge to make simple changes that will make Sheffield’s air cleaner and help the people in their community to do the same.”

6.5 Discussion

The aim of this chapter has been to look at what intervention functions were used in 16 UK regions and then at what policies have been adopted. The research follows the results in 1). A previously conducted systematic review (presented in chapter four), and 2). A vignette study conducted with regional stakeholders (presented in chapter five).

6.5.1 Intervention functions.

It is impossible to state with confidence any direct relationship between any single intervention functions and policy intentions, this segment instead sets out to trace any possible patterns. What can be stated with some confidence is that strategy documents that contain a lower use of intervention functions also contain a lesser amount of policy intentions. Policies that were described several times were only counted once. This should function as a control for cases where documents were simply longer. In this section, the relation between the most prevalent intervention functions and outcomes in policy intentions is described.

Education. "Education" (or "increasing knowledge and understanding") was the most used intervention function (104 mentions in 14 documents) and related to a wide set of intervention types, ranging from public consultation to feasibility studies. "Education" was used in eleven cases and out of these, eight were successful in adopting a wide range of new, ambitious policies. Looking at cases where "Education" was of prevalent use (more than ten uses), five out of seven cases where "Education" ("increasing knowledge or understanding" Michie, van Stralen, et al., 2011) was used also adopted a high level of sustainable transport policies.

Enablement. "Enablement" relates to the facilitation of policy use, such as through lobbyism and creating an environment where new initiatives can be implemented, for instance through working together with other organisations. "Enablement" was used in few areas, but where it was applied, it was used to a major extent, for instance in the case of London. All five councils where enablement was applied also intended to adopt a wide range of air quality policy.

6.5.2 Previous literature

Within the systematic review presented in chapter four and the vignette study presented in chapter five of this thesis, "Modelling" and a combination of "Training" and "Education" were found to have the greatest impact on policy intentions. Further, there is a tendency toward "Incentivisation" relating to higher degrees of policy intentions.

Modelling. The "Modelling" tool has been used to a relevant extent in 4 cases: Birmingham; London; Newcastle and Leeds. Overall, the limited use of "Modelling" makes its impact impossible to assess alongside other tools. Nevertheless, a wide extent of policies was adopted in three of the four cases where "Modelling" was used.

Education/training. "Training" wasn't used to any relevant extent, while "Education" was used widely in thirteen cases (Birmingham, Bristol, Coventry, Derby, Hull, Leicester, Liverpool, London, Manchester, Newcastle, Nottingham, Sheffield, and Leeds), out of which eight had intentions to adopt a wide range of new policies. As stated, "Education" seems to have had a positive effect on policy intentions.

*Incentivisation. "*Incentivisation" was used to a relevant extent in four cases: Birmingham; Leicester; London and Newcastle. Out of these, three had intentions to adopt a wide range of new, ambitious policies.

In summary, the intervention functions previously found successful have rarely been used. "Modelling" and "Incentivisation" were used in only four cases, while the application of "Education" was prevalent. "Education" again seems to have had a positive effect on policy intentions, while the results for "Modelling" and "Incentivisation" were positive but limited.

6.5.3 Policy intentions

Clean air zones were intended or are in place in seven cases: Birmingham; Derby; Leicester; London; Newcastle; Southampton and Leeds. Active travel policies were intended to be adopted in eleven cases: Derby; Hull; Leicester; Liverpool; London; Manchester; Newcastle; Nottingham; Sheffield; South Wales and Leeds. New public transport policies were intended in eight cases: Derby; Leicester; Liverpool; Manchester; Newcastle; Nottingham; Sheffield and Leeds. Scrappage or retrofitting schemes were intended in four cases: Leicester; Nottingham; Sheffield and Leeds. Low emission vehicles were intended to be adopted in five cases: Derby; Leicester; Nottingham; Sheffield and Leeds. It is important to note, however, that there is a disparity in need for these different councils. London has a bigger problem with air pollution than most other conurbations and hence needs to take sterner steps toward reducing it than South Wales, for instance.

6.5.4 Barriers

The most prevalent barriers were physical and economic barriers, with 24 and 15 mentions, respectively. These are followed by administrative (11 mentions) and social/cultural barriers (12 mentions).

6.5.5 Community and stakeholder engagement

An interesting facet is that of engagement with the public and stakeholders. It seems that programmes related to awareness or public consultation tended to coincide with a higher degree of policy intentions (a higher number of policies intended to be adopted or already adopted). Community and stakeholder engagement was used in ten cases, out of which eight were successful. No region intended a wide range of policies without also using some type of engagement. It is difficult to state with certainty that the engagement itself caused success, but the

correlation shows that regions that are more ambitious in their work, with wider intervention function use and other consultation, also tends to adopt a wider range and more ambitious policies.

6.5.6 Recommendations to stakeholders

Based on the systematic review presented in chapter four, and the vignette study presented in chapter five, practitioners are recommended to look at what other councils have done and model strategy documents on others rather than dealing with the entire process as a separate entity. There was a low prevalence of such so-called "Modelling" interventions within this policy review. Aside from stating the glaring lack of a variable that has been deemed so key in previous literature and chapters four and five of this thesis, clear statements cannot be made about the usefulness of the function within the setting due to lacking data. "Education" has frequented extensively as an intervention function in almost all strategy documents and seems to have had a positive effect. The same is the case for enabling policies through for instance lobbyism, which has been labelled "Enablement" within this research. "Incentivisation" seems to have a positive effect, but as the use within interventions is limited, it is difficult to state anything with confidence.

6.5.7 Recommendations to researchers

This is a relatively new subject matter, and few previous studies have looked at the relationship between intervention functions and policy intentions. More work is encouraged to be done on what factors relate to policy maker intentions.

6.6 Conclusion

Regional government and researchers are encouraged to look further into the usefulness of "Modelling" interventions to promote policy aimed at improving air quality. Specifically, this modelling should look at what (if anything) other councils have done to successfully reduce pollution. This could take the form of looking at

what others have done in order to more quickly be able to adopt ambitious policies. This could also save the councils money as they wouldn't have to undergo expensive and time-demanding cost-benefit analysis and research. Such an action could prove risky, as a policy that may have worked elsewhere could have lesser effects in their context, but may prove successful if others have similar demography, financial situations and face similar barriers. It is important to note that several of these intervention functions are difficult to code correctly, as only very few of them are direct interventions directly connected to existing behaviour change theory. It is not a stretch to state that politicians and policy makers do not write their documents with behaviour change literature in mind. As such, several interventions can be interpreted as containing several different intervention functions, and may in fact be related to other effects, such as modelling relating, at least in part, to institutional isomorphism (Dimaggio & Powell, 1983; Frumkin & Galaskiewicz, 2004), a phenomenon where institutions get more similar over time, either through competing or setting out to be inspired by others as they face uncertainty. Further research is encouraged into the implementation of the intended policies. There is a need to investigate what effects intervention functions have on the long-term implementation of air quality policies.

7.0 CHAPTER 7: SUMMARY AND DISCUSSION

7.1 Introduction

There is currently a high level of pressure on several UK conurbations to present air quality strategies to meet set EU pollution levels (European Commission, 2014). The policy-making process as a whole contains a complex spectrum of participants with different ideologies, other policies needing funding, and the pressures of the election cycle itself. The novelty of the research has been to act upon the imperative to combine behaviour change theory and implementation science with political science (Kingdon's multiple streams, Kingdon & Thurber, 1984; Kingdon, 1995) by attempting to understand that the attitudes of decision-makers might be important in explaining their preferences towards particular policy interventions and subsequent adoption, and further, looking at how different frames, determinants of behaviour change and intervention functions (from the Behaviour Change Wheel: Michie, van Stralen, et al., 2011) may create windows of opportunity and shift the set agenda to where the intentions to adopt or implement a policy increase. Whilst this simplifies much of the institutional framework through which decisions get made it appears that there is space to connect ideas in the problem stream, preferences for particular policy approaches in the policy stream, and beliefs about the responses of the general public in the politics stream of Kingdom's model of policy change (1984). As such, the research could create valuable initial insights for facilitating policies around important societal issues such as air quality and public health.

This thesis has specifically set out to find tools that could help policy makers and stakeholders facilitate the process of adopting new policy innovations in the sphere of air quality policy. Several of these facilitators may lie within recent

innovations within the study of behaviour change and social psychology (e.g. Michie, et al., 2008; Michie, van Stralen, et al., 2011). The overarching aim of this thesis has been to gain an understanding of what factors influence intentions of and the adoption of air quality policy within a regional government setting. These factors have been explored through the scope of a case study of the West Yorkshire conurbation, and through the study of wider UK air quality policy.

7.1.1 Research progress and linking of aims to studies

The first aim has been to look at what has been done in previous research to promote the adoption of new policy into strategy documents. The fourth chapter of this thesis describes the results of a narrative systematic review, which investigated what previous there is into the use of interventions and behavioural determinants to facilitate intentions to adopt new policy into strategy documents, and in what ways. It is important to understand what these contained and to create a framework for understanding and coding such interventions.

The second aim has been to introduce intervention functions found useful in the systematic review to policy makers through the use of a vignette study. This is intended to test the efficacy of intervention functions in promoting policy adoption. Chapter five looks at the use of intervention functions from the Behaviour Change Wheel (Michie, van Stralen, et al., 2011; Michie, Atkins, et al., 2014) to promote the formation of policy intentions in a regional government setting. Within this vignette study, basic intervention functions were trialled, to gain clarity in what elements of the functions have an effect. By using the behaviour change wheel, the intention was to demonstrate what intervention functions can be used in the setting, and further to evaluate the usefulness of the model.

The third and fourth aims of the thesis have been to investigate to what extent the intervention functions that have been useful in previous studies have been

used in current UK policy, and to look at what air quality policies are intended to be implemented within the UK air quality strategies. The sixth chapter of this thesis describes the results of a narrative policy review, which focuses on the 16 UK councils that are under pressure from the European Commission to reach EU air pollution limit levels. The review of these 16 councils and their air quality strategy documents set out to investigate what intervention functions have been used, and what policy intentions the councils had focused on.

The final aim of the thesis was to find out what barriers are perceived to have been in play during the policy formulation process. This has been looked at in varying proportions throughout these previous chapters. The results of the three studies and chapters are summarised below.

7.2 Summary of findings and contributions to knowledge

The systematic review in chapter four was conducted to understand the amount of research previously undertaken into the subject of policy adoption promotion. It reviewed the literature on interventions to promote policy adoption or change on a regional or local level of government. This review could then be used as a basic framework for understanding interventions and intervention functions, model how to code them in a policy context, and further indicating key intervention functions. Three studies out of the twelve included showed positive outcomes on policy adoption or policy change. The successful policy adoption interventions (Clark, 2013; Llamas-Sanchez et al., 2013; Mulvale et al., 2016; Tyran & Sausgruber, 2005) have been interpreted as including three or more of the intervention functions (Clark, 2013, used four tools) from the Behaviour Change Wheel (Michie, van Stralen, et al., 2011). The four successful interventions contained “Modelling” elements. Two of the successful policy adoption interventions (Mulvale et al., 2016; Tyran & Sausgruber, 2005) also contained an

“Education” element, while two (Clark, 2013; Tyran & Sausgruber, 2005) used “Incentivisation”, and “Environmental restructuring” (Clark, 2013; Llamas-Sanchez et al., 2013). Use of “Enablement” and “Training” was found once each in the successful cases, but also appeared in unsuccessful cases. “Persuasion” only appeared in a single case, leaving it without sufficient data for a judgement. The limited amount of specific literature on the promotion of adoption and often flawed reporting of outcomes in the literature also decreased the possibility to make any clear recommendations for future intervention attempts. There is a gap in reporting and formatting between the psychological and the political sciences, in that APA structuring of publications and systematic descriptions create easily readable and standardised literature that aids replication. This does not appear in political sciences, which complicates interdisciplinary research.

The qualitative vignette study in chapter five followed upon the systematic review by trialling the most successful intervention functions from the systematic review with air quality and transport policy practitioners within the case study setting of the West Yorkshire conurbation. Along with these vignette interviews, a short online questionnaire was done with the same cohort, aiming to create an understanding of the barriers perceived as prevalent within the case study setting of West Yorkshire. Participants rarely outright stated that economy or budget was the key factor to their decision, but talked more about budgets than any other factor. Further, respondents showed a potential optimism bias by considering themselves as more likely to be similar to successful councils than ones that struggled. Only a very small number of respondents stated air quality or congestion to be key factors in their policy decision. This could be seen as examples of egalitarianism or balance being more of a factor than desperation in wanting to "fix" problem areas. Reconnecting to Michie, Van Stralen, et al., and the "Behaviour Change Wheel"

(2011), "Modelling", "Training" and "Education" seem to have been key potential influences on respondent behaviour. This is in agreement with the previous studies on interventions aimed at policy adoption or change reviewed within the narrative systematic review. Several participants also wanted more information about the policy. The effect of "Incentivisation" was unclear even though the economy was considered very important. This is taken to mean that finance is likely to be a key barrier, but not a key facilitator.

Chapter six details the findings of a narrative policy review of the strategy documents from 16 UK councils, to explore the current policy situation within the UK. The narrative policy review looks at conurbations that, similarly to parts of the West Yorkshire area, are under pressure from the European Commission to reach EU air pollution limit levels. Due to a limited amount of data and difficulties separating variables, it is impossible to state with confidence any direct relationship between single intervention functions and the policy intentions of the strategy documents through qualitative means, limiting the findings to the identification of patterns between intervention functions and policy intentions. An example is that strategy documents that describe a lower use of intervention function, also contained fewer policy intentions.

Within the narrative policy review, "Education" was found to be the most commonly used intervention function. It was used in thirteen cases, out of which eight presented a wide range of policy intentions. "Education" interventions were used to a wide extent (defined as ten or more times) in seven conurbations. Five out of these seven conurbations presented a wide range of policy intentions. "Enablement" was used in only five areas, but where it was applied, it was used to a major extent. All five councils where "Enablement" was applied also showed a wide range of policy intentions. The "Modelling" and "Incentivisation" tools were used to

a relevant extent in four cases. This limited use of "Modelling" and "Incentivisation" within the strategy documents makes their impact difficult to assess. Nevertheless, a wide extent of policy intentions was reported in three of the four cases where "Modelling" and "incentivisation" tools were used. The review further set out to look at how the conurbations engaged with the public and stakeholders. Throughout the strategy documents, programmes related to increasing awareness or consultation with the public tended to coincide with more ambitious policy intentions. Community and stakeholder engagement was used in ten cases, out of which eight intended to adopt a higher number of policies. No region described a wide range of policy intentions without also using some type of engagement.

The identified potential effect of "Training" and "Education" was hardly unexpected – knowing more about an environmental problem often increases the willingness to act (Gifford, 2011), while uncertainty has been to act as a barrier to climate action in individuals (Hine & Gifford, 1996). There is also a potential effect of incentivisation (even as the use is limited). Such an effect would not be unexpected, as framing economic or gain goal frames have been shown to have an effect on behaviour (Lindenberg & Steg, 2007). If anything, it was surprising that this effect wasn't stronger, especially with those respondents from the interview vignette study and the councils from the policy review that focused heavily on growth. The potential influence of "Modelling" on policy behaviour is not surprising either. Rather, somewhat surprising is how few of the respondents in the interview study wanted to cooperate with other councils (rather, they saw other actors as competitors and wanted to gain an advantage by acting differently).

Looking at a recent Cochrane review of interventions to reduce ambient air pollutions (Burns et al., 2019), Burns et al. (2019) found monitoring and

measurement of policy effectiveness to be of limited quality and validity. Linking changes in public health and mortality to air pollution is complex and uncertain. Increasing monitoring validity is key to showing the importance of decreasing air pollution. Relating these results to the intervention functions and determinants that this thesis has focused on, increased monitoring and studies in this field should not only serve as an efficient means to set an agenda and increase willingness to adopt further air quality interventions but may also increase the effectiveness (or at least our understanding) of air quality interventions.

7.2.1 Barriers

The final aim of the thesis was to look at barrier prevalence in policy making. This was done throughout the three studies. All in all, economic barriers were the most often stated, with 89 mentions. Administrative and physical barriers are also likely to have had an effect, with 61 and 51 mentions respectively. A smaller role was played by cultural and social barriers, with 30 and seven mentions, respectively. All barriers should, of course, be taken within their context, and all studies should be seen as separate entities. Nevertheless, economic barriers played a key role in both the vignette study and the policy review. In all cases but the systematic review, physical barriers were stated to be prevalent. Further, administrative barriers were found to be important in all studies.

Table 7.1
Barriers to implementation found in the Systematic Review (chapter four), Vignette study (chapter five), the policy review (chapter six), and finally an aggregate of the three studies

Systematic review	**32**
Administrative	16
Cultural	10
Economic	6
Vignette study	**130**
Economic	57
Spatial (Physical)	29
Political (administrative)	25
Other	12
Human (Social and Cultural)	7
Policy review	**64**
Economic	16
Physical	25
Administrative	11
Social and Cultural	11
Other (Technical)	1
Aggregate	**224**
Economic	79
Administrative	52
Physical	54
Social and Cultural	28
Other	11

Together, these studies were intended to create a view into the pitfalls and opportunities of policy making. Chapter four creates a basic and wide understanding of what interventions have been used and what intervention functions they might relate to. Chapter five brings the research to a regional UK level and is intended to clarify the relationship between the policy maker and the policy. The final study looks at what is happening in UK air quality policy making, and attempts are made to understand why different conurbations may have had different results.

7.2.2 Post-study note

After the completion of this research, Leeds and Bradford have both adopted clean air zones within the city councils. The launch of the Leeds Clean Air Charging Zone will be implemented after January 2021 and is a class B Clean Air Zone. Within the zone, this means that no vehicles are banned, but all heavy goods vehicles, buses, coaches, taxis, and private hire vehicles that do not meet emission

standards will have to pay a daily fee. Private vehicles and light goods vehicles will not be charged. Bradford is instead set to implement a Clean Air Zone type C, which includes light goods vehicles such as taxis, but not private vehicles (City of Bradford Metropolitan District Council, 2020). Bradford modelled a class D Clean Air Zone (the strictest type, that includes all vehicles, including private cars), but found that it would have had greater negative impacts on household income, ethnic communities, disabled residents, and children under 16. Further to this, the C-class clean Air Zone achieves greater air quality improvements (City of Bradford Metropolitan District Council, 2020). The pressure on Bradford and Leeds to reduce air pollution was high from EU and national legislation as they had unlawful levels of pollution. The Department for Environment, Food and Rural Affairs identified Leeds as one of six places in England that was not expected to meet air quality standards by 2020 (Leeds City Council, 2018a). In 2017, plans for a Clean Air Zone were outlined. In this plan, only commercial vehicles that do not meet minimum emission requirements would be affected. Following this, consultations were done with businesses and non-businesses (residents, workers, etc.) in 2018 (Leeds City Council, 2018a; 2018b). Within the first consultation, 77% stated that air quality within the shortest time possible should be a priority, while 63% stated that a charging Clean Air Zone would have a significant impact on air quality (Leeds City Council, 2018a). 45% stated that private vehicles should not be charged, and 44% stated that they should. Fewer businesses agreed that private vehicles should not be charged. Within the second, statutory, consultation, 62% stated that in the future, the council should consider charging non-compliant vehicles (Leeds City Council, 2018b).

Why focus on freight, public transport, and taxis in Leeds? It is interesting to note how private vehicles are not affected by the Leeds Clean Air Zone. The

consultation documents do not mention why the Leeds clean air zone only applies to business vehicles, nor does the proposal for a charging clean air zone. Instead, the proposal states there is a need to accelerate the use of ultra-low emission vehicles in the taxi and private hire sector (Leeds City Council, 2018a). It could be the case that Leeds City Council perceiving uptake in the taxi and private hire to be the primary need. Another possibility would be that the council considered public opinion and voting to be an important factor, and hence didn't want to implement a stricter policy aimed at the public.

Would the research in this thesis have been able to predict the intentions to adopt this Clean Air Zone? Following the behaviour change wheel, regulation and legislation intervention functions had a direct effect, while the consultation responses indicate some public pressure to adopt the Clean Air Zone. Following Kingdon's policy streams (Kingdon & Thurber, 1984; Kingdon, 1995), arguing about policies or creating an urgency to act usually happens in the politics stream, but in this case, the urgency to act comes from national legislation. If Leeds and Bradford City Councils didn't act, they could have risked fines. When there is a potential risk embedded in not acting or ignoring potential consequences, this would relate to events. The public consultation of the proposed Clean Air Zone is another factor and lies within the policy stream. Here, the public voice got heard and created further pressure to act. The combination of national legislation and regulation, along with the positive public opinion about the proposal, may have been an enabling determinant of the intention to adopt the policy, despite national regulation and legislation seldom appearing in this literature.

7.3 Key thesis limitations

Within chapter four, the quality of identified studies was found to be limited. Most studies used mixed designs and lacked clear reporting, and this limited the

attempts to examine whether interventions had a causal impact on policy adoption. Several articles only used qualitative methods and had heterogeneous reporting of outcome data. As these studies didn't have control groups or other means to control for co-variates, single intervention effects were difficult to single out. Only Tyran and Sausgruber (2005) used a control group and an experimental design. Further, a large part of the studies used historical data reviews. These may be useful, but don't conform to specific research questions and study designs. Further, the use of the "Abstrackr" machine learning screening tool may also have reduced the sensitivity in study retrieval somewhat.

The vignette study in chapter five was conducted with a hard-to-reach sample group. The population of higher-level policy workers and publicly elected politicians in Western Europe are rarely willing to take part in any larger scale of studies due to time limitations and other pressing work which is often prioritised. The research conducted within this thesis was done with aid from both Bradford Council and the Department of Environment, Food and Rural Affairs, which is likely to have made the project seem worthy of the respondents' time. Still, it would have been desirable to achieve a higher sample outreach with the questionnaire part of the study. The study coincided with a general regional election in the UK, which meant that elected officials were struggling to find time to participate. If the study was to be attempted again, it is encouraged to avoid scheduling at times of public elections, so that participants would be in a more natural frame of mind, rather than having to think about appealing to the public. A further weakness of the vignette format was the lack of control for confounding variables, it also struggled in separating variable effects. An example is the difficulty in separating "Modelling" effects from potential institutional isomorphism.

The use of qualitative research in chapters five and six leaves a lot to be wished for when attempting to show what effects policy interventions have on policy intentions. Within this novel field of study, the studies conducted within this thesis have served the purpose of collecting as much varied data as possible to map facilitators and barriers to intentions and adoptions of policy, rather than outright drawing conclusions about direct influences. As a result, the results presented are meant to initiate research into the complex study of interventions to promote policy adoption, while also presenting several directions of behaviour change influences on policy intentions and policy adoption.

7.4 Implications for future research

There is deep previous literature on the use of interventions to change or promote certain behaviours, from individual behaviour change tools such as nudging by Thaler and Sunstein (2008) to more complex systems of behaviour change tools such as the Behaviour Change Wheel by Michie, van Stralen, et al. (2011). These interventions have been used within governmental institutions and to aid the implementation of policies (e.g. Michie, van Stralen, et al., 2011). The other stages (e.g. formation, intention, and adoption of policies) of the policy process have however received precious little attention. This especially concerns the behavioural intervention frameworks that already exist. Together, the studies included in this thesis add novelty through applying behaviour change models and frameworks, and specifically the behaviour change wheel (Michie, van Stralen, et al., 2011) at a top-down policy implementation level. This has been done before to a limited extent (Michie, van Stralen, et al., 2011), but more work is needed. The thesis adds a common framework of language and theory to the relevant factors: the Behaviour Change Wheel (Michie, van Stralen, et al., 2011) for determinants and interventions; Kingdon's Multiple Streams Framework (Kingdon & Thurber, 1984; Kingdon,

1995) for an understanding of the interaction between psychological determinants and policy intentions; and finally barriers to sustainable transport (Banister, 2005), and sets out to show the usefulness of behaviour change within a policy setting, future research will need to look at the validity and replicability of behaviour change frameworks in this setting.

Furthermore, the existing literature on interventions to promote policy adoption generally lacks clear descriptions of interventions and intervention outcomes. Finally, in the context of policy adoption, few studies found in the systematic review have attempted to measure the effects of interventions quantitatively. The intention of the systematic review presented in chapter four was to look at studies attempting to promote policy adoption. If the previous studies into this subject would have been more comparable in terms of analysis, methods, and reporting of outcome data, a meta-analysis would've been possible. As is the current state, studies had to be compared through narrative means, and the possibility to compare effect sizes of interventions has decreased. Researchers are encouraged to use methodologically sound designs where contents and purposes of interventions are transparent and interpretable, such as through the use of TIDieR guidelines (Hoffmann et al., 2014). Future studies should set out to report their methods and analyses in a manner that renders the studies repeatable. Further, outcome data should be presented in a quantitative manner, reporting how many and what type of policies are intended or have been adopted. Future studies should also describe exactly what is included in the interventions they report on so that they can be understood and repeated. It is further important for researchers to consider reporting on interventions based on what intervention functions the interventions relate to, and to consider what behavioural factors (Capability, Opportunity or Motivation) from the COM-B model (Michie, van Stralen, et al., 2011) interventions target.

Further within the same theme, few previous studies have looked at the relationship between intervention functions and policy intentions. Further research into what factors relate to policy maker intentions is encouraged. Within this thesis is an attempt to do a mapping of these factors within chapters five and six, but there is an imperative for this to be done using quantitative means. The thesis presents a uniting framework for intervention function labelling and mapping, along with a framework for coding policy adoption and intention outcomes. Future research should aim to lend strength to the relationships between policy interventions and policy adoption or intentions by testing them in controlled settings, and by using quantitative approaches.

Within the studies included in this thesis, "Education", "Training" and "Modelling" seem to have some positive impact on policy adoption. As such, there is a basis to further study interventions including these intervention functions with a more rigid quantitative or mixed-methods approach. Further to this, studying for instance "Incentivisation" focused interventions is encouraged. The previous data on the effects of "Incentivisation" on policy adoption is limited, but some evidence points toward a tendency existing.

The vignette study within chapter five is an example of a type of study where interventions could be tested with stakeholders in a controlled setting. This type of tool could well be used in future research, but it is recommended to adapt the tool to create better separation between manipulated variables. Doing a quantitative version of this study would add a lot of insights along with generating more reliable results. For instance, future versions of the study may seek to use a questionnaire version of the vignette, with more data points added separately. Within this hypothetical questionnaire, interventions could be presented to respondents on their own, to make sure that any policy adoption outcomes are a result of the intervention alone. The

vignette study presented in chapter five uses a qualitative approach to collect as many data points as possible from the point of view of the stakeholder. Applying a quantitative approach this early into the research would've given more reliable results and stronger effect sizes, but at the cost of a broader understanding of the research topic. The vignette study further reflects an attempt do a mapping of these factors, in order to present a uniting framework for intervention function labelling and mapping, along with a framework for coding policy adoption and intention outcomes. Future attempts with this type of vignette study have to take into consideration the difficulties in recruiting stakeholders and policy makers. This cohort is made up of a small group of highly experienced individuals, that also have very limited time to give. Gaining access to a sufficient sample of experienced policy makers for quantitative analysis will prove difficult. Hence, researchers may have to consider the trade-off between on one side using qualitative research methods aimed at stakeholders and policy makers resulting in potentially unclear results that cannot be tested for significance, or on the other side applying quantitative research methods with a wider cohort of perhaps less experienced policy officials that might not apply the same type of thinking. In the case of this thesis, access was given to a cohort of policy makers through cooperation with regional councils. Nevertheless, only a small group of policy makers agreed to participate. If future research is done with policy workers or other hard-to-reach groups, researchers should make efforts to approach them in times of political stability. Further, future research is encouraged to reference any groups or people involved with the project that lends credibility to the research during the recruiting stage. Finally, the use of this vignette tool in different geographical locations is encouraged, to see whether the results generalise culturally. Further to this, there is a clear difference between publicly elected officials and civil servant responses and

priorities in chapter five. Specifically, civil servants more often described voter acceptability as a barrier to policy implementation. Only one publicly elected participant described this as a barrier. This is surprising as acceptability should mainly be a political issue, and according to theories on political behaviours (e.g. the role of the public within the three streams of political influence according to Kingdon (Kingdon & Thurber, 1984; Kingdon, 1995), public pressure influences the choices made by politicians. These results point toward civil servants at least being aware of the issues of public acceptance in policy-making, which shows that even with civil servant respondents, these vignettes were successful in activating realistic political pressure. Nevertheless, the difference in responses from civil servants and publicly elected politicians points toward a need to study the differences further. There may be a relevant difference in priorities and workflow between the two groups.

At the time of writing this thesis, exploratory linking of mechanisms of action to behaviour change techniques was still being done (e.g. Connell et al., 2019; Carey et al., 2019). As the intervention functions presented within the COM-B model were difficult to link to separate interventions and techniques, future research might profit from investigating this link further within the setting of the research themes presented in this thesis.

7.5 Implications for practice

Within chapter four, even with the flawed literature on the subject, a few trends can be seen. Using a combination of intervention functions seems to be the most effective approach, and all of the successful attempts at promoting intentions to adopt air quality policies found in the systematic review of chapter four included elements of “Modelling". Behaviour change tools that model onto this intervention function are based on the concept of learning from or taking inspiration from others

and is defined by Michie, van Stralen, et al. (2011) as "providing an example for people to aspire to or imitate". In this research, behaviour change interventions aimed at policy makers are looked at. Hence "Modelling" has often meant presenting examples of other air quality policy programmes that have been adopted successfully in other councils. These intervention functions were deemed impactful in the systematic review presented in chapter four and within the vignette study presented in chapter five. Further, the results surrounding "Modelling" within policies presented in chapter six, are limited but point toward a positive impact. Further, research around the diffusion of tobacco prevention programmes (Brink et al., 1995; Parcel et al., 1995) has shown that certain methods of spreading information about the adoption of a tobacco prevention programme in other districts led to a significant increase ($p < 0.001$) in the adoption of the programme compared to a comparison setting, lending further credence to the efficiency of modelling as an effective intervention function. Interventions such as a newsletter containing information about districts where the programme had been adopted (photographs and stories about early adopters) were applied with the aim to give districts in Texas opportunities to learn about and model themselves after these ‘successful’ school districts. Districts where these interventions were applied adopted tobacco prevention programmes to a higher degree. Only 10.53% of the districts that did not receive the interventions adopted the programme, while 56.25% of intervention districts adopted the programme. In summary, further research should be done into modelling, an intervention function that seems to be underused in practice but may have a key role in policy promotion. In general, however, cooperation between organisations and regional governments may prove fruitful. Doing united initiatives where resources are added together may increase efficiency and decrease individual project costs for councils.

Further to “Modelling”, “Education” and “Training” both seem to have uses in policy promotion. Making sure that policymakers and civil servants both are given as much information about air quality as possible should prove key. Further, training policymakers in the best available policy practices could provide increased willingness to adopt ambitious policy. It might seem obvious that a deeper understanding of a problem leads to increased willingness to find a solution, nevertheless, this approach is paramount.

Some of the most prevalent discussion topics brought up within the vignette interviews related to the need for more information and social dilemmas. Further, the conflict between short-term loss and long-term gain was explicit. Another social dilemma conflict was established between the own council and others, as respondents in the interview study of chapter five often described a perceived conflict and competition with other councils. Respondents sometimes described how they wanted to get an advantage over other councils by getting ahead of them, and sometimes how they wanted to create their own alternative policy that was different from what the other councils had adopted, in order to compete. This competition between councils could be advantageous for individual councils, but cooperation is encouraged, and again modelling approaches could prove useful.

7.6 Concluding remarks

Finding new methods to promote air quality policy is currently crucial as regional governments struggle to meet pollution limit levels. The studies presented within this thesis have collectively set out to create a framework for understanding the relationship between behaviour change interventions and the adoption of new air quality policies at regional levels of government. The influences of behaviour change tools have been described through the intervention functions they make use of, while policy intentions and adoption have been described. Further, the thesis has

taken initial steps towards an understanding of what intervention functions are the most effective in influencing the policy adoption process. Future research may profit from using this framework to gain an in-depth understanding of the influences, while practitioners are encouraged to use tools that fit with the intervention functions deemed useful. Collectively these studies have contributed to the understanding of what barriers there are to sustainable transport and air quality policy making, and how behaviour change tools can be used to facilitate policy adoption.

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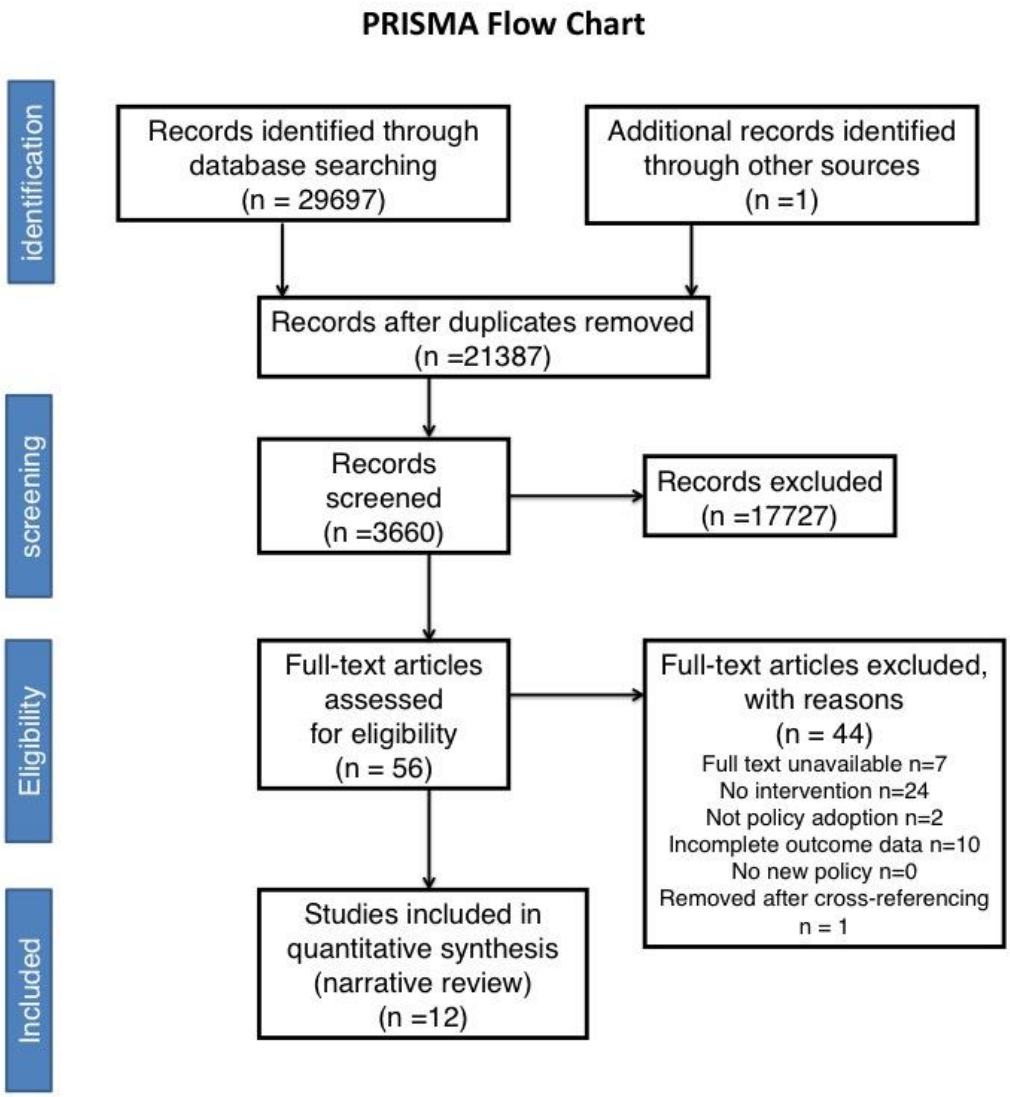
APPENDIXES

Appendix A: PRISMA flow chart



Appendix B: Vignette study form

What factors help or hinder adoption of policies to improve air quality?

Policy Adoption Vignettes Consent Form v1 16-04-17

Participant Identification Number:

Chief investigator: Sakarias Bank, 07938421535 or Pssesb@leeds.ac.uk

Information

In this vignette, you need to put yourself in the role of "the decision maker", a leader of your local council with full decision-making power. An air quality policy innovation will be presented to you and two other nearby councils. The other councils are hypothetical, but similar to yours in population size, urban/rural distribution and experience the same sort of air quality struggles. In five rounds, diverse information will be presented to you about the innovation and experiences with the innovation in the other councils. At the end of each round, you are expected to give a decision on adoption of the innovation and a favourability rating of the innovation. Each cycle of information responds to a year in real time.

Year 1

Basic information about the innovation.

The innovation presented here is a new type of low emission zone in city centres, implemented by a congestion charge scheme where transport within a city centre zone is charged a set amount per journey given the amount of average pollution from the vehicle type (e.g. lorries are taxed on a higher quota than electric cars).
Some rebuilding of the city centre infrastructure will be required, including the cost of adding car entry sensors and air quality sensors. Implementation will also require man-hours due to extended measurement. Full costs of implementing the project are expected to be around £40 million, with added annual costs of £22 million. Annual revenues from congestion charges and decreases in costs to the NHS are expected to pay the cost of the initial investment (accounting for annual costs) back within 10 years, at which point the programme will run with a net profit.
The innovation is expected to decrease congestion in the city centre, making it more appealing for housing and business investments. Furthermore, positive effects on air quality are expected to increase tourism and investments while decreasing mortality and costs for the NHS.

The other councils have yet to make a decision on the policy.

---

1. Decision

Yes ☐

No ☐

2. Rating of the innovation

Negative			Somewhat positive			Neutral			Somewhat positive			Very positive
0	– 1	– 2	– 3	– 4	– 5	– 6	– 7	– 8	- 9			

Year 2

Council 1 has adopted the innovation and is currently working on implementing it. As such, no effects on air quality or congestion have appeared. The costs of implementation in this council have become clearer, however. Initial implementation costs were £37 million, with an anticipated £21 million in yearly costs over the first 5-year period, and expected revenues of £30 million. The innovation is on pace to be paid off within nine years. The policy has been adopted and implemented within a reasonable time frame. The greatest negative aspect of the implementation has been a slight increase in congestion during a construction period.

Council 2 has yet to make a decision.

1. Decision

Yes ☐

No ☐

2. Rating of the innovation

Negative Somewhat positive Neutral Somewhat positive Very positive

0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

Year 3

Council 1 has started seeing effects of the innovation. Congestion has decreased by 4% within the zone. Air quality has started to slowly improve within the zone as well (NO_x pollution from cars has decreased by 2,8% the first year). The innovation is on pace to be paid off within eight years.

Council 2 has adopted the innovation and is currently working on implementing it. As such, no effects on air quality or congestion have appeared. The costs of implementation in this council have become clearer, however. Direct costs (infrastructure etc.) were dearer in this council, with a final cost of £42 million, an added yearly cost of £23m. The innovation is on pace to be paid off within eleven years.
Adoption and implementation are slower in this council due to administrative barriers. Again, an increase in congestion due to construction can be seen.

1. Decision

Yes ☐

No ☐

2. Rating of the innovation

Negative			Somewhat positive		Neutral		Somewhat positive		Very positive
0 – 1	– 2	– 3	– 4	– 5	– 6	– 7	– 8	- 9	

Year 4

Council 1
NO_x pollution from cars has decreased by a further 4% in the second year. Congestion has decreased by 7.5% within the zone. The innovation is on pace to be paid off within seven years.

Council 2 has started seeing effects of the innovation. Congestion has decreased by 3%. Air quality has started to slowly improve as well (NO_x pollution from cars has decreased by 2% within the zone the first year). The innovation is on pace to be paid off within ten years.

1. Decision

Yes ☐

No ☐

2. Rating of the innovation

Negative		Somewhat positive		Neutral		Somewhat positive		Very positive
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9								

Year 5

Council 1
Effects of the innovation are now clearly visible. Congestion has decreased by 10% within the zone. NO_x pollution by cars has decreased by another 4% this year, making a total decrease of 10.8% within the zone since adoption.
The innovation is on pace to be paid off within six years.

Council 2
Pollution from cars has decreased by 2.8% the second year. Congestion has decreased by a further 3.5% within the zone. The innovation is on pace to be paid off within nine years.

Your council
An environmental activism group has been founded within your council, and is holding regular manifestations demanding that you do something about the air quality. Regular meetings are held with the leaders of this group, and they claim to be willing to help out with measures and implementations of new policies.

1. Decision

Yes ☐

No ☐

2. Rating of the innovation

Negative		Somewhat positive		Neutral		Somewhat positive		Very positive
0 – 1	– 2	– 3	– 4	– 5	– 6	– 7	– 8	- 9

End of cycles

Reasoning behind decision

1. What piece of information made you most likely to adopt the policy? Pick two

Information about the innovation itself
Economic information
Information about air quality
Information about congestion
Information about progress in other councils
Information about the environmental activism group

2. How effective do you think the policy innovation is in reducing pollution, relative to the cost, considering the information you´ve been given during the 5-year cycle?

Rating of the innovation

Negative				Somewhat positive				Neutral				Somewhat positive				Very positive
0	–	1	–	2	–	3	–	4	–	5	–	6	–	7	–	8	-	9

This is the end of the study.
Thank you for participating.

Appendix C: online questionnaire

What do you *really* know about policies?

The purpose of this questionnaire is to find out what experience you as a stakeholders have with policy work, what attitudes you have toward certain air quality policies and further what barriers affect you in your work with policies related to air quality. We are hopeful that some of you will also be willing to participate in a second interview study (expected to take around 25-30 minutes). During this interview, you will be asked to judge a specific air quality policy innovation based on different sets of information.

Job description
What is your role within your organisation?

Which stakeholders influence policy and decision making in your organisation?

What part do you play in the decision-making process?

Policies
How effective would you think pricing mechanisms such as congestion charges would be in improving air quality in your region?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

How confident are you in understanding the air quality impacts of a congestion charge?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

How acceptable do you think congestion charges are?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

7. How important do you think congestion charging is as part of an overall air quality strategy?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

8. How feasible overall do you consider the implementation of congestion charging to be in the next 5/10 years?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

9. How effective would you think Low emission zones would be in improving air quality in your region?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

10. How confident are you in understanding the air quality impacts of a low emission zone?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

11. How acceptable do you think low emission zones are?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

12. How important do you think low emission zones are as part of an overall air quality strategy?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

13. How feasible overall do you consider the implementation of low emission zones to be in the next 5/10 years?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

14. How effective would you think vehicle scrappage schemes and retrofitting of vehicles would be in improving air quality in your region?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

15. How confident are you in understanding the air quality impacts of vehicle scrappage schemes and retrofitting of vehicles?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

16. How acceptable do you think vehicle scrappage schemes and retrofitting of vehicles are?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

17. How important do you think vehicle scrappage schemes and retrofitting of vehicles are as part of an overall air quality strategy?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

18. How feasible overall do you consider the implementation of vehicle scrappage schemes and retrofitting of vehicles to be in the next 5/10 years?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

19. How effective would you think low emission vehicle promotions would be in improving air quality in your region?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

20. How confident are you in understanding the air quality impacts of low emission vehicle promotions?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

21. How acceptable do you think low emission vehicle promotions are?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

22. How important do you think low emission vehicle promotions are as part of an overall air quality strategy?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

23. How feasible overall do you consider the implementation of low emission vehicle promotions to be in the next 5/10 years?

Not at all Not very Neutral Somewhat A lot
0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 - 9

24. What additional factors influence whether policies are successfully adopted in your organisation?

Barriers to policy adoption
25. (A) Active travel
What are the key barriers to developing a more ambitious active travel policy?

26. (B) Air quality
What are the key barriers to developing more ambitious air quality policy in general?

Thank you for your participation!

The next step in this research project is a linked interview study (expected to take around 15-25 minutes). During this interview, respondents will be asked to judge a specific air quality policy innovation based on different sets of information. Further, a literature review of previous attempts to facilitate policy adoption is also being written with the aim of finding out what tools are useful to remove barriers and find facilitators to policy adoption.

Name:

Email:

Appendix D: Council coding

D.1 Birmingham

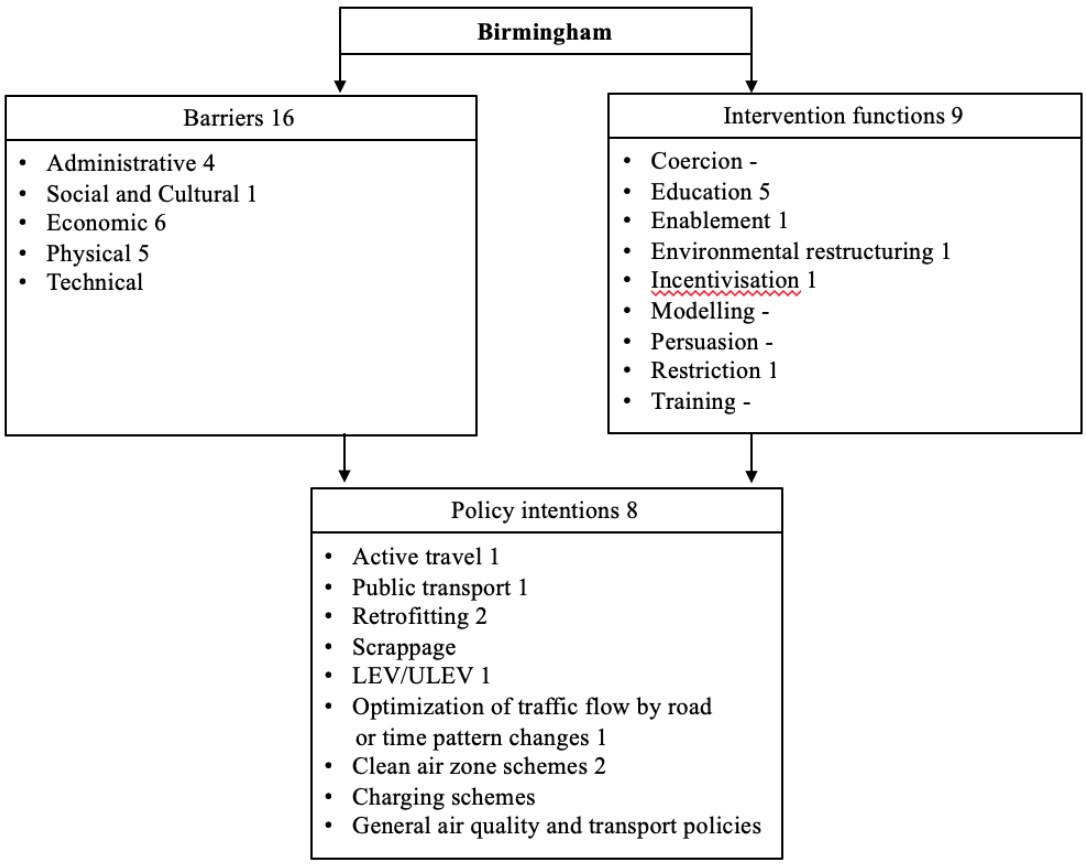


Figure 1: Coding scheme for Birmingham.

Barriers. Birmingham reported "Economic" (6) and "physical" (5) barriers to be the most common, with "Administrative" barriers also carrying some weight. "Social and cultural" barriers were mentioned twice. Economic barriers mainly related to budget issues, while the administrative barriers mainly related to perceived limitations in the previous plan and why it needs to be updated. The physical barriers were often geographical and concerned a fear of displacement effects or limited infrastructure.

Economic barriers
"City Council requests that Government provides further funding to support the uptake of walking and cycling in cities with the most severe air quality issues."
"Birmingham and the West Midlands have been unsuccessful in securing funds from the Go Ultra Low city scheme to support ULEV infrastructure development and from the Access Fund."
"Upgrading to completely new vehicles would be prohibitively costly and there are uncertainties around the ability of the market to supply the number of new vehicles in such a short space of time."
Administrative barriers
"Council believes that the draft 2017 air quality plan is inadequate and does not contain the right mix of measures at the local or national level, provide sufficient detail or the level of commitment required to achieve air quality in the shortest possible time."
"The draft plan completely underplays the value of Raising Awareness as part of action to tackle air quality."
Physical Barriers
"The air quality challenge for Birmingham is linked to limited road capacity and high levels of transport demand."

Intervention functions. Birmingham applied a wide range of intervention functions, with instances of each tool being used. Nevertheless, education was the most commonly used intervention. "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholders about air quality and its importance. From the strategy itself to different practical initiatives.

Education
"The evidence from the CAZ feasibility study and business case will set out the most appropriate measures and the class of CAZ which will be required to address air quality problems as quickly as possible."
"This will look at determining the potential positive and negative impacts e.g. impacts, primarily relating to reducing premature mortality from NO_x exposure and changes to exposure to air pollution."

Outcomes. Birmingham described a smaller set of policy intentions than several other councils. Nevertheless, their focus is on high-impact policies such as "Clean Air Zones" and "retrofitting or vehicle scrapping". There are also active travel initiatives planned, along with mentions of "Low Emission Vehicle" schemes

and Route/Time schedule planning schemes. Birmingham perceives a need for a Clean Air Zone, due to difficulties reaching the EU limits.

Clean Air Zone
“The Council supports the emphasis on locally designed action CAZ.” “Birmingham believes that it will still be required to implement a Clean Air Zone (CAZ); however, the plan is not explicit that this is the case.”
Scrappage and Retrofitting
”Retrofitting will be a key response in order for fleet operators to ensure that their vehicles achieve compliance ahead of 2020.”
Active travel
”The plan also references the recently published Cycling & Walking Investment Strategy.”

D.2: Bristol

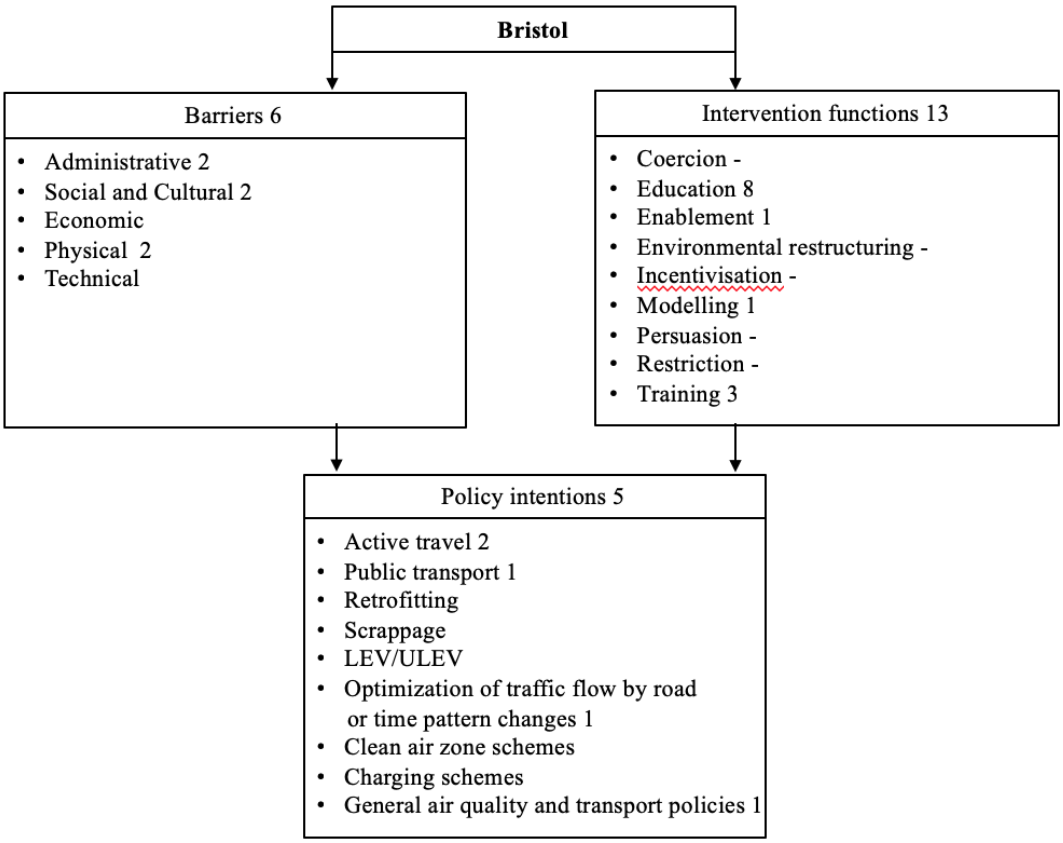


Figure 2: Coding scheme for Bristol.

Barriers. Bristol described two cases each of "Administrative", "Social and Cultural" and "Physical" barriers. The administrative barriers related to potentially flawed or limited air quality monitoring. There were single descriptions of what can be construed as economic and physical barriers.

Administrative barriers
"Pollutants such as sulphur dioxide, carbon monoxide and some heavy metals used to be monitored in Bristol, however, this has ceased as compliance with health-based air quality objectives for these pollutants was demonstrated."
Social and Cultural barriers
"There have been some negative responses against 20mph limits."

Intervention functions. "Education" was the most common intervention used (with eight mentions). "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance.

Outcomes. Two active travel initiatives are intended.

D.3: Coventry

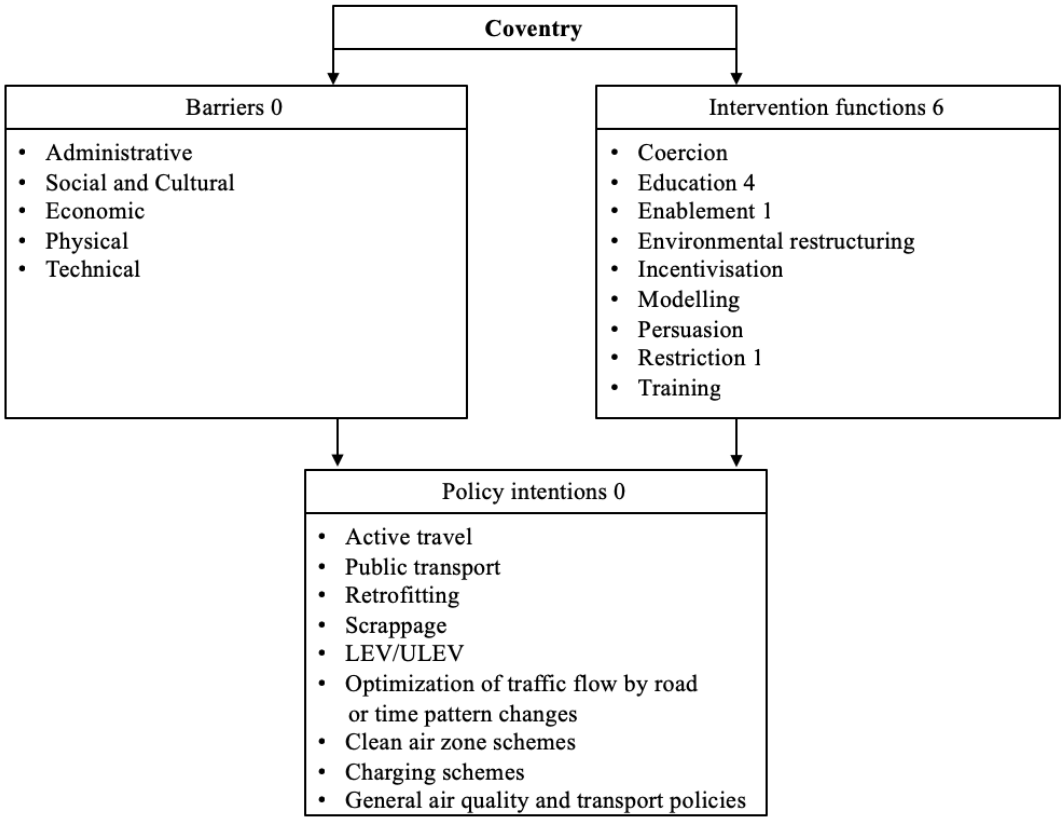


Figure 3: Coding scheme for Coventry.

Barriers. The Coventry air quality strategy did not report barriers.

Intervention functions. Coventry depended mainly on "Education" (4). "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance.

Education
"Stage 1 (Review and Assessment) involved the identification of the main sources of air pollution within and around Coventry City's boundary, reviewing the levels of air pollutants for which prescribed standards and objectives have been set, and estimating the likely future levels."

Outcomes. Coventry adopted no new policies, but through a Review and Assessment process has demonstrated that they should reach the UK air quality objectives by the required dates.

D.4: Derby

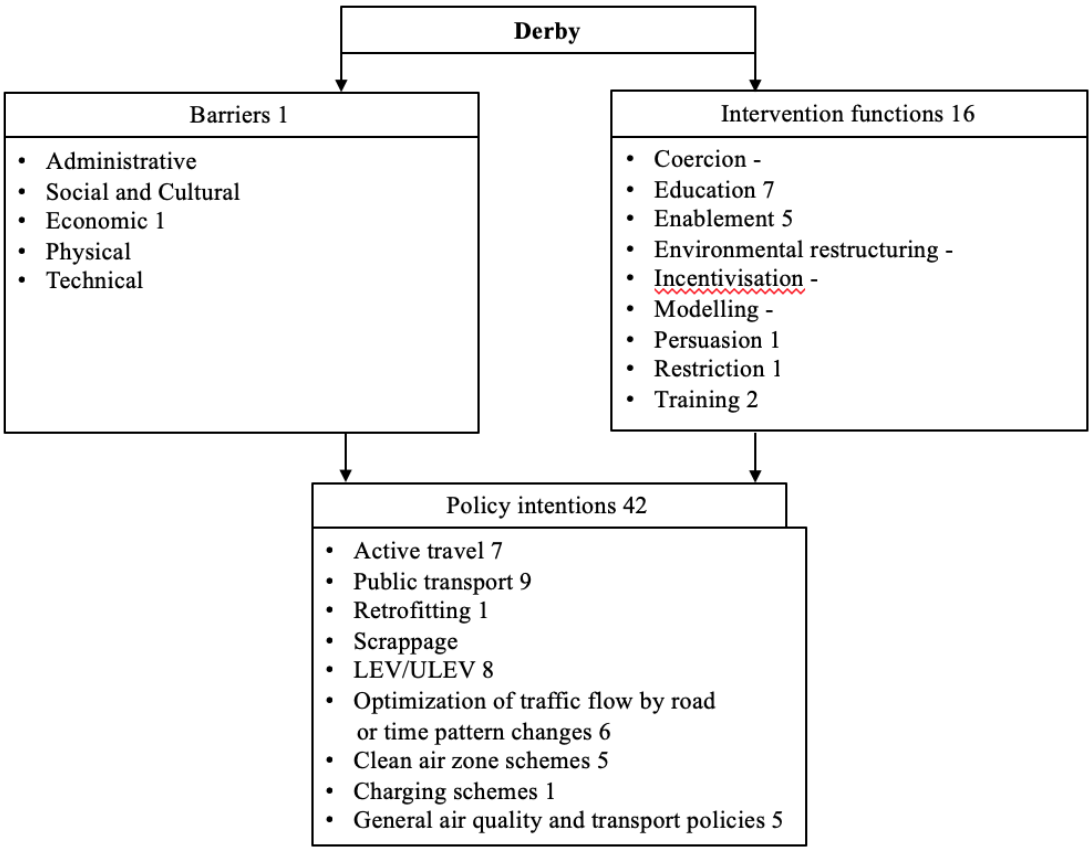


Figure 4: Coding scheme for Derby.

Barriers. Derby reported one case of economic barriers.

Economic barriers
”Key challenges will be obtaining funding.”

Intervention functions. “Education” (7), and “Enablement” (5) were the key used intervention function types. “Education” has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance. “Enablement” was coded as the use of political cooperation and wider policies that made the adoption of air quality policy easier.

Education
”…modelling and feasibility study to test CAZ options…”
Enablement
“Develop Guidance on Air Quality for spatial planners/regeneration…”

Outcomes. Derby are working on adopting a Clean Air Zone. Along with that follows several related policies that have proven difficult to categorise as relating to the categories in the coding scheme. Hence, several of them are included in the "General air quality and Transport policies" themes. These policies include measures such as "personalised journey planning", however, the theme also includes unrelated measures such as "new street lighting" Derby also adopted several other high-impact policies such as low emission vehicle schemes, route and time management measures, along with public transport and active travel schemes. Derby has also applied for and received funding for a retrofitting scheme of the council vehicle fleet.

Transport general
"Clean Air Zone - Complimentary / supporting measures design and implementation."
"Encourage bus companies to enforce policies about idling engines and the benefits of smoother driving."
Low Emission Vehicles
"Ensure bus, taxi and private hire vehicle emission standards are improved to meet CAZ standards using licensing, franchise or partnership approaches as appropriate."
"Electric vehicle parking promotion scheme."
Public transport
"Increase the percentage of low floor buses operating in Derby."
"Encourage bus operators to purchase replacement vehicles with the lowest available emission levels."
Active travel
"Maintain and improve footway condition and signage for ease of pedestrian access."
"Expand city wide cycle and pedestrian training, including adult, family and child, commuter and leisure trip training."
Clean Air Zone
"…work has begun to determine the nature and extent of a charging-based CAZ."

D.5: Hull

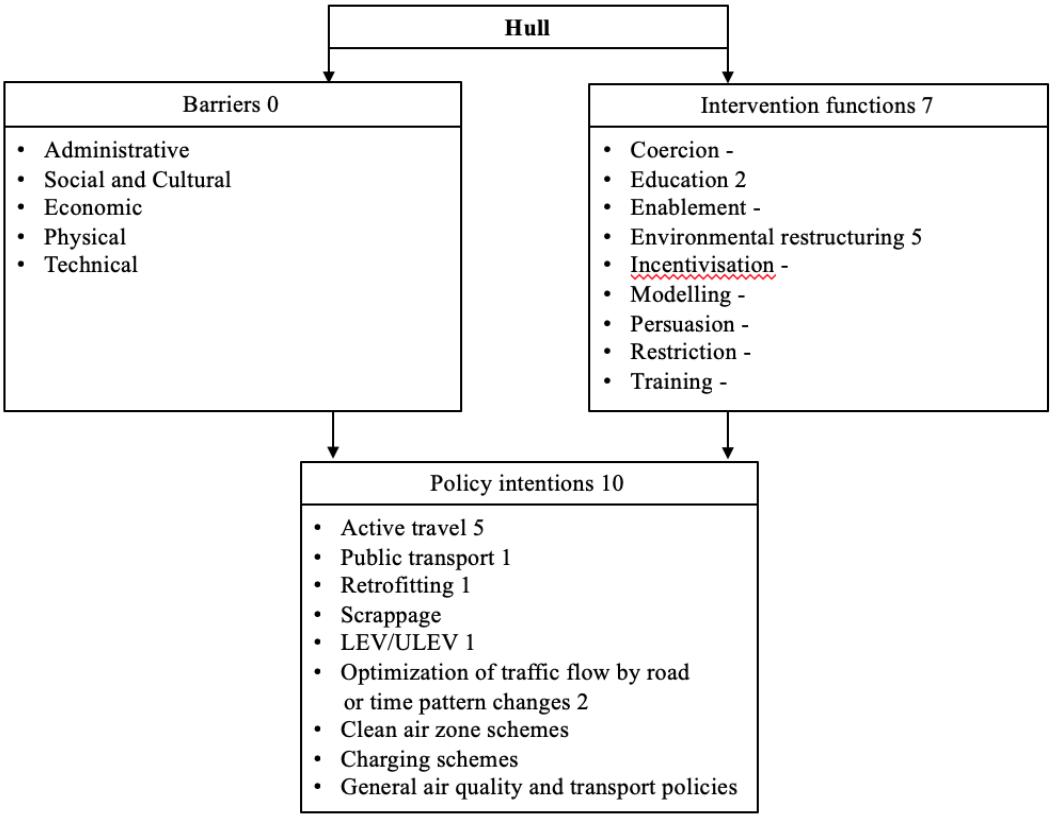


Figure 5: Coding scheme for Hull.

Barriers. Hull reported no barriers.

Intervention functions. Hull used "Education" (2) and "Environmental Restructuring" (5). "Education" often concerned the application of monitoring and availability of information to the public. "Environmental restructuring" in this case related to spatial planning, with the ambition to reduce impacts of new developments in the city.

Outcomes. Hull intend to adopt five active travel schemes. There was also mention of a plan to increase charging stations for low emission vehicles and to retrofit buses and other heavy exhaust vehicles.

Active travel

"Improvements are underway to the cycle network that will be helped by marketing to encourage the further take up of cycle use."
"Significant enhancement of the local cycle network and improved public transport provision."

D.6: Leicester

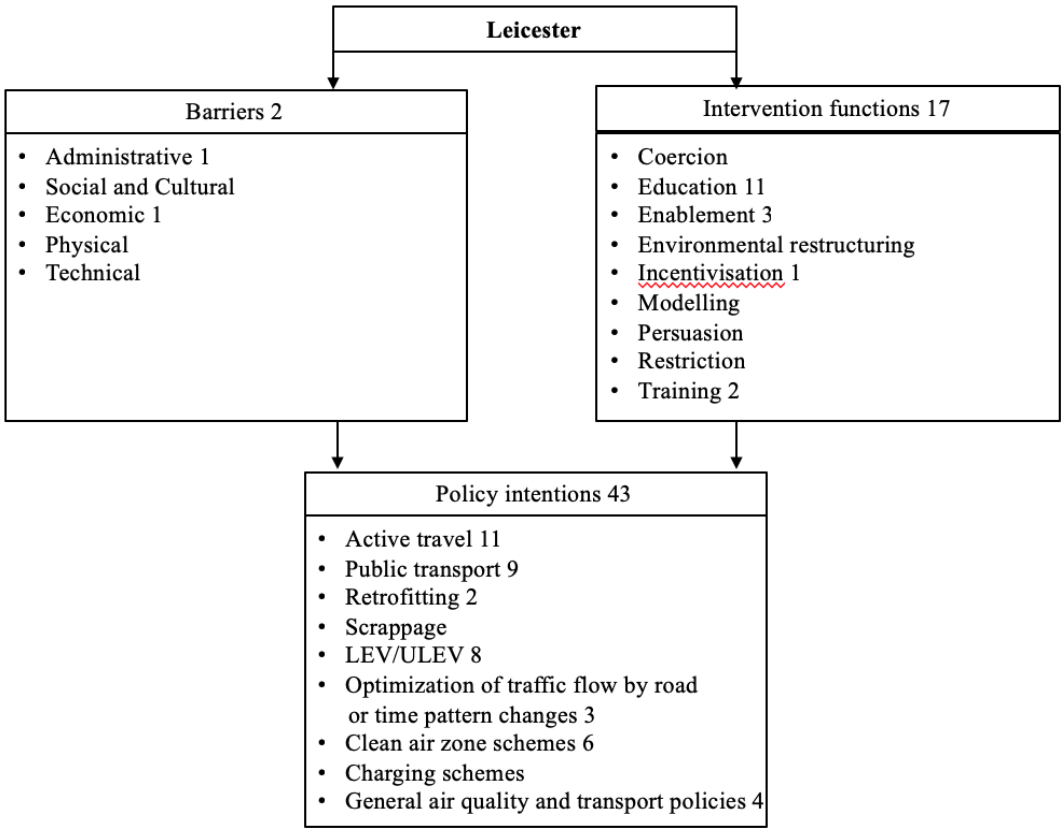


Figure 6: Coding scheme for Leicester.

Barriers. Leicester reported one case each of administrative and economic barriers.

Intervention functions. Leicester saw a heavy use of "Education" as a behaviour change tool (11). There were minor uses of "Training" and "Enablement" tools. "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance.

Education
"Installing a programme of trackers on our vehicles. This provides monitoring information and analysis of driver behaviour which can help encourage improved driver performance that has been demonstrated to save fuel and reduce emissions"
"Using our AIRVIRO dispersion model, we worked out that the total tonnes of (NO_x) emitted by various sources inside the boundaries of Leicester."

Outcomes. Leicester's strategy has a heavy focus on Low Emission Vehicle schemes (8 mentions). Other high impact polices were also intended, with active

travel (11) and public transport (9) initiatives, a clean air zone (6) and retrofitting initiatives (5) being intended. There was also mention of different initiatives for time and route management (2), and several policies that didn't fit into our coding scheme (4 general transport policies adopted).

Low emission vehicles
"All Gas Buses by 2021."
"Financial incentive of free licence fee to taxi drivers if their vehicle has Euro VI engine or a half price for a Euro V."
Active travel
"To encourage walking, cycling and the use of public transport."
"To deliver a phase II 'connecting Leicester' initiative by 2019 encouraging walking and cycling."
Public transport
"…implement our programme of SMART and integrating ticketing and real time bus information, development of ticketing deals and on-going marketing and promotion."
"…improve the environment for bus users in particular."
Transport general
"…improve the environmental performance of their fleets including eco-driving, better service and maintenance and low emission vehicles."
"We will work with the Rail industry to open up possibilities for rail delivery of freight in the city."
Clean Air Zone
"The low emission zone will be developed further through implementation of an Ultra-Low Emission Zone for all vehicles that are either zero or low emission."
Retrofitting
"The current programme of retrofitting will be complete by 2016."
Route and time management
"Traffic management improvements, for example to improve the management and operation of the highway network and to deliver a programme of 20 mph zones."

D.7: Liverpool

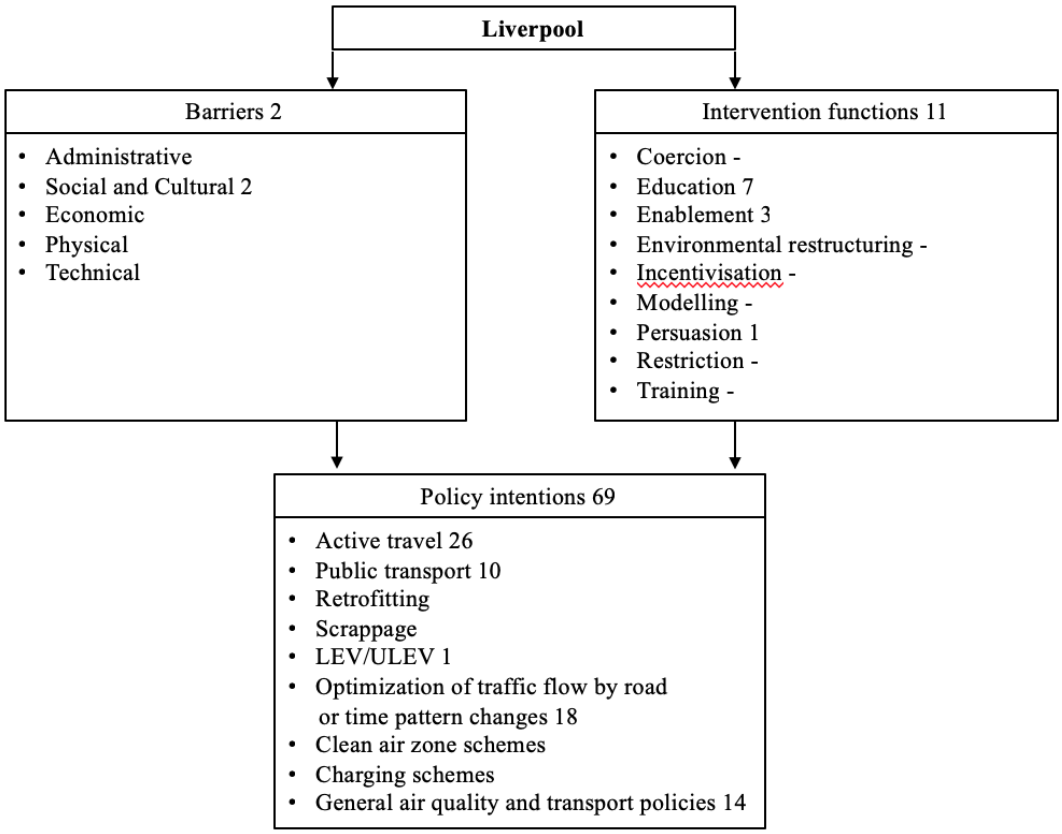


Figure 7: Coding scheme for Liverpool.

Barriers. Liverpool at two occasions described what we have chosen to interpret as social and cultural barriers.

Social and Cultural Barriers

"Unfortunately, the scheme has now closed owing to cars being vandalised."
"In Liverpool, this is compounded by a growth in road traffic, decreasing bus patronage, low environmental standards for the majority of buses, and an increase in congestion."

Intervention functions. Liverpool mainly used "Education" tools (7). Use of "Enablement" (3) and "Persuasion" (1) was also present. "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance. "Enablement" was coded as the use of political cooperation and wider policies that made the adoption of air quality policy easier.

Education
”Transport Assessments (TA) and Transport Statements (TS) - a set of criteria is provided for when a developer would have to complete a TA. The findings of a TA can be used to inform an air quality impact assessment and will be important when considering the potential effect of larger developments.”
”The LTPSU are now gathering evidence on travel behaviour in the region in preparation for consideration of further options within the next LTP.”
Enablement
“The Merseyside Transport Partnership (MTP) consists of Knowsley, Liverpool, Sefton, St Helens, and Wirral, Councils and Merseytravel. MTP produce the five-year Local Transport Plan (LTP) which runs from 2006 to 2011 and is a £230m delivery programme of transport investment and service improvements. The aim of the LTP is to give Merseyside a safer, sustainable, efficient and integrated transport network, accessible to all.”

Outcomes. Liverpool has adopted a wide range of transport policies that do not fit into the coding scheme, they have been coded as general transport policies (14), in the case of air quality policies that do not focus on transport specifically. Aside from this, several high impact policies such as those focused on active travel (26) and public transport (10) were adopted. Liverpool also adopted policies focused on optimisation of traffic flow by road or time management (18).

Transport general
“Ensuring equality of travel opportunity for all, by setting out in the Access Plan a programme of action to ensure all members of the community have equal access to opportunities and services.”
“Creating a safe and secure travel environment by continuously reducing the level of accidents on the highway network and ensure personal security across all modes.”
“Undergoing a £65m improvement scheme which will transform the route from the M62 to the city centre by road widening to remove congested hotspots and help regenerate the city centre.”
Active travel
“Improve road signage, road conditions, speed reduction measures on designated cycle routes and areas of high cycle usage.”
”Adoption of cycling strategy.”
Public transport
”A Voluntary Bus Quality Partnership established in July 2008 between the bus operators, LCC and Merseytravel. This set out the requirements to improve bus movements along three routes in the city.”
Route and time management
“New direction signage for all classes of vehicle on primary routes has been installed. This forms part of the Freight Management Strategy and includes freight routes where appropriate.”

D.8: London

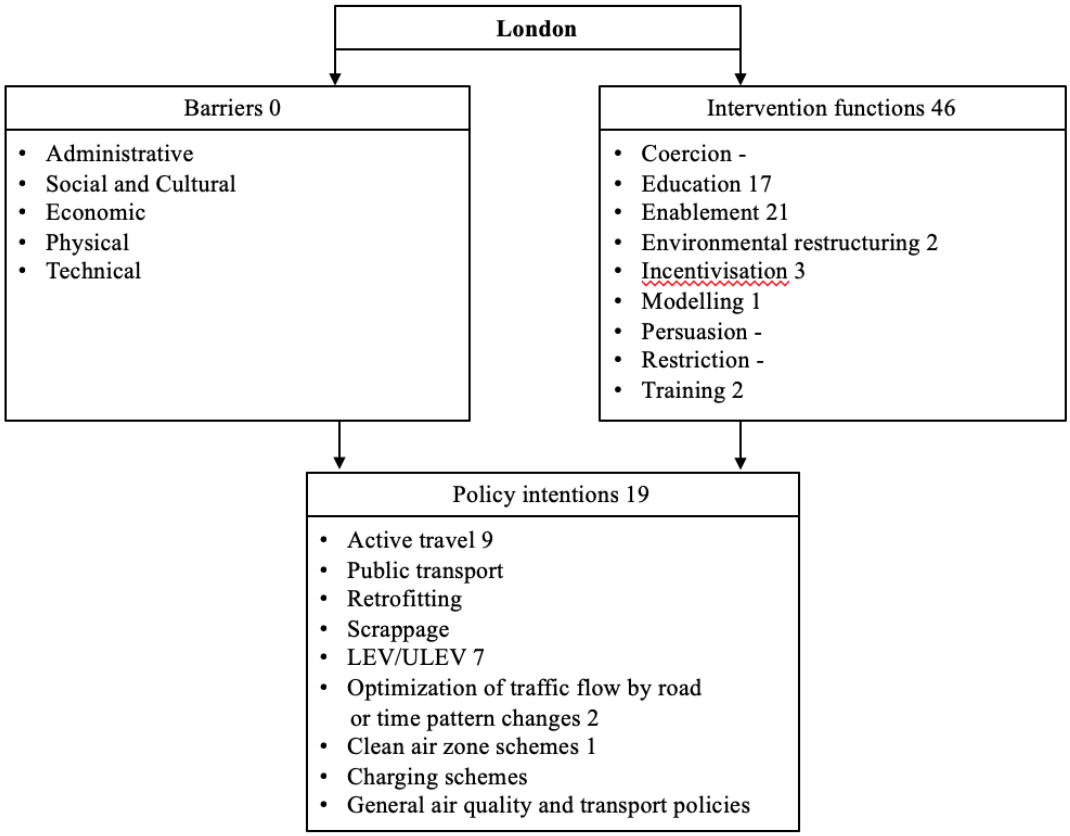


Figure 8: Coding scheme for London.

Barriers. London described no barriers.

Intervention functions. "Enablement" (21) was the most commonly used behaviour change tool by far, followed by "Education" (17). Of lesser, but still potentially important use, was "Incentivisation" (3).

Enablement
"The City Corporation will seek opportunities to influence air quality policy across London to secure lower levels of air pollution in the Square Mile."
"The City Corporation will explore further options for joint action with politicians in neighbouring authorities."

Outcomes. There are 9 new active travel policies intended. A clean air zone with charging has previously been implemented in London. Work continues with the zone, on two new policy points, with 7 additional relating to Low Emission Vehicle use within the zone.

Active travel
"City Corporation will continue to support measures to encourage safe cycling in the Square Mile."
"The City Corporation is introducing a number of schemes designed to improve conditions for pedestrians."

D.9: Manchester

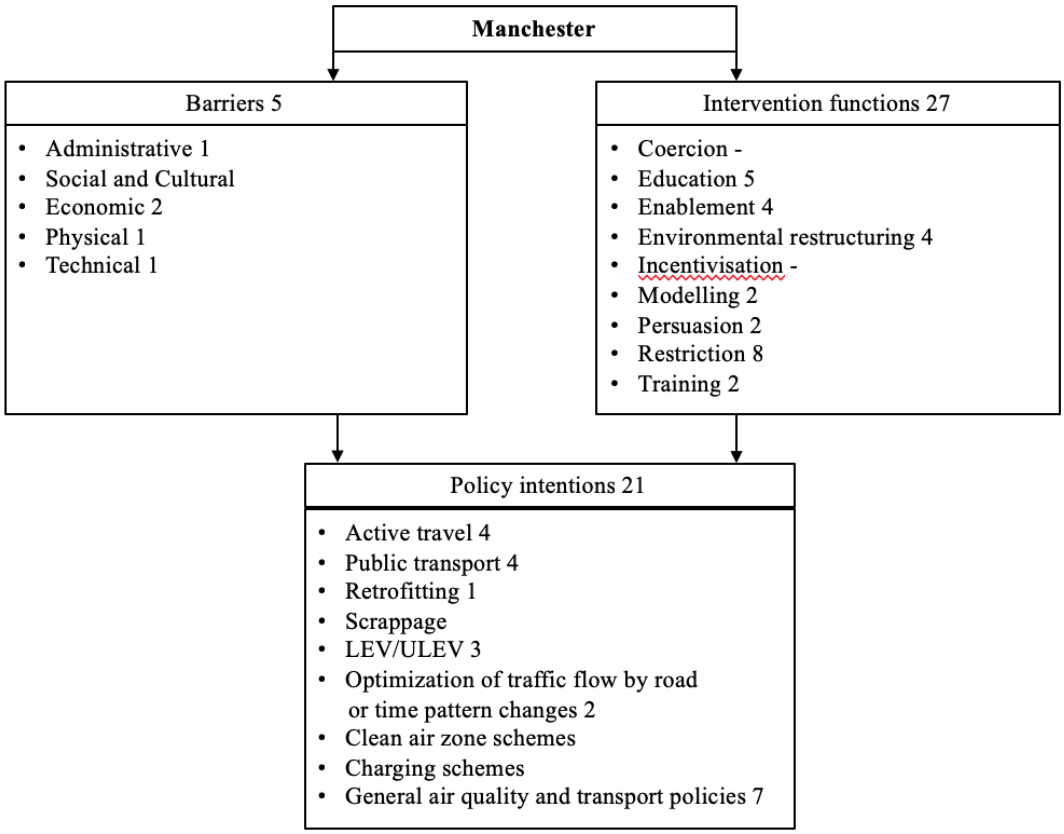


Figure 9: Coding scheme for Manchester.

Barriers. Manchester described what we have coded as Economic (2), Physical, Technical and Administrative (1) barriers.

Cultural barriers
"However, the volumes of public transport passenger trips are relatively low, in line with national trends…"
Administrative barriers
"However, these measures have been less effective than hoped in tackling emissions, … but largely because the Euro IV and V engines have not delivered as big a reduction in emissions 'on the road' as was predicted in the laboratory."

Intervention functions. Manchester used "Restriction" 8 times and "Education" 5 times, giving them key roles. "Enablement" and "Environmental Restructuring" were used in four cases each. "Restriction" was coded in cases where legal means were used to promote air quality policy making.

Outcomes. Manchester intended to adopt 7 policies that do not fit the coding framework. Further, Active Travel and Public transport policies made up the mainstay of the strategy (with 4 policies each mentioned), along with minor focus on Low Emission Vehicle schemes, with 3 policies mentioned.

Transport general
”Installing Bluetooth sensors to monitor flows on key traffic routes and enable proactive management of traffic lights to smooth flows and give priority to buses.”
“Bus idling enforcement in Manchester city centre.”
Active travel
”Travel Choices interventions, focused on the journey to work and school.”
Public transport
”A major programme to triple the size of the Metrolink network, which is zero-emission at the point of use.”

D.10: Newcastle

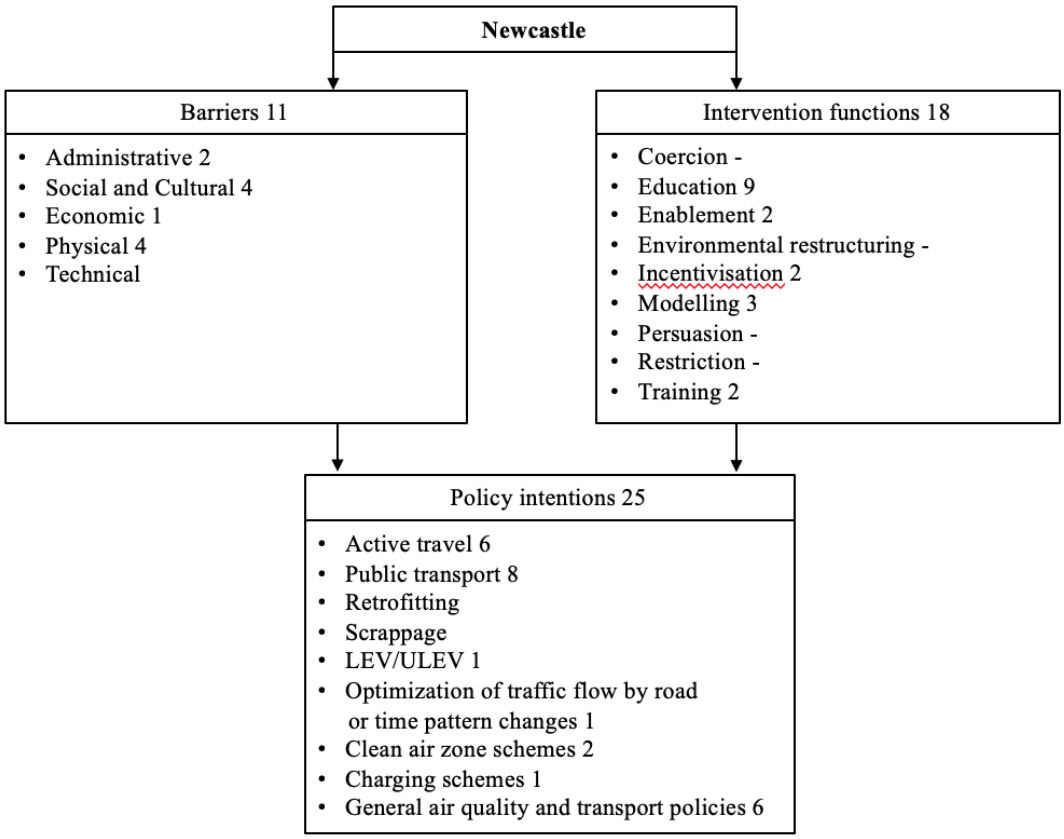


Figure 10: Coding scheme for Newcastle.

Barriers. Newcastle, similarly to Birmingham, described a wide range of barriers. All barriers occurred at least once, with Social and Cultural (4) and physical (4) being the most prevalent. Administrative barriers were brought up twice.

Social and Cultural barriers
"There is a modal shift away from public transport for journeys to work…"
Physical barriers
"Increasing pedestrian areas will dramatically improve air quality in those locations. It may however, depending on location, move the congestion and air quality issues elsewhere."

Intervention functions. In the case of Newcastle, "Education" was the most commonly used intervention type (9), followed by "Modelling" (3). "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance. "Modelling" relates to cases where

the council has looked at what others are doing and taken inspiration from their work.

Education
”A detailed evaluation of these measures is ongoing in close consultation with planners, development control and transport engineers.”
Restriction
“Local authorities are also required to set out a 2004/05 baseline, a 2010/11 target, and “intermediate outcomes” to measure progress against the target. These may include indicators such as total emissions within the AQMA, traffic flows, etc.”

Outcomes. Newcastle has applied a set of policies related to transport but not fitting into our policy categories, coded as “Transport General” (6). They have also adopted policies related to Public Transport (9), Active Travel (6) and Clean Air Zones (2). Newcastle formalised a Clean Air Zone in 2005, that will continue to be built upon.

Transport General
”Introduction of different levels of charging for car parking in all main centres.” “In Newcastle, and across the rest of Tyne and Wear, ‘no-car lanes’ will continue to be implemented. These permit buses, taxis, HGV’s and vans to use the lanes to promote sustainable public transport modes whilst supporting the economy by also giving advantage to freight transport.”
Public transport
”·Policies to provide widespread road space reallocation on strategic routes to improve running conditions for buses and investigate the need for mitigating measures to avoid traffic diverting onto other routes.”
Active travel
“The first Local Transport Plan for Tyne and Wear developed a hierarchy of road users which gave the pedestrians and cyclists highest priority over other modes of transport and, in particular, over the private car.”
Clean Air Zones
”With the formalisation of the Clear Zone in central Newcastle, a speed limit of 20 mph applies to all vehicles in the zone. This zone may be extended in the future to meet the shared priorities for road safety and air quality.”

D.11: Nottingham

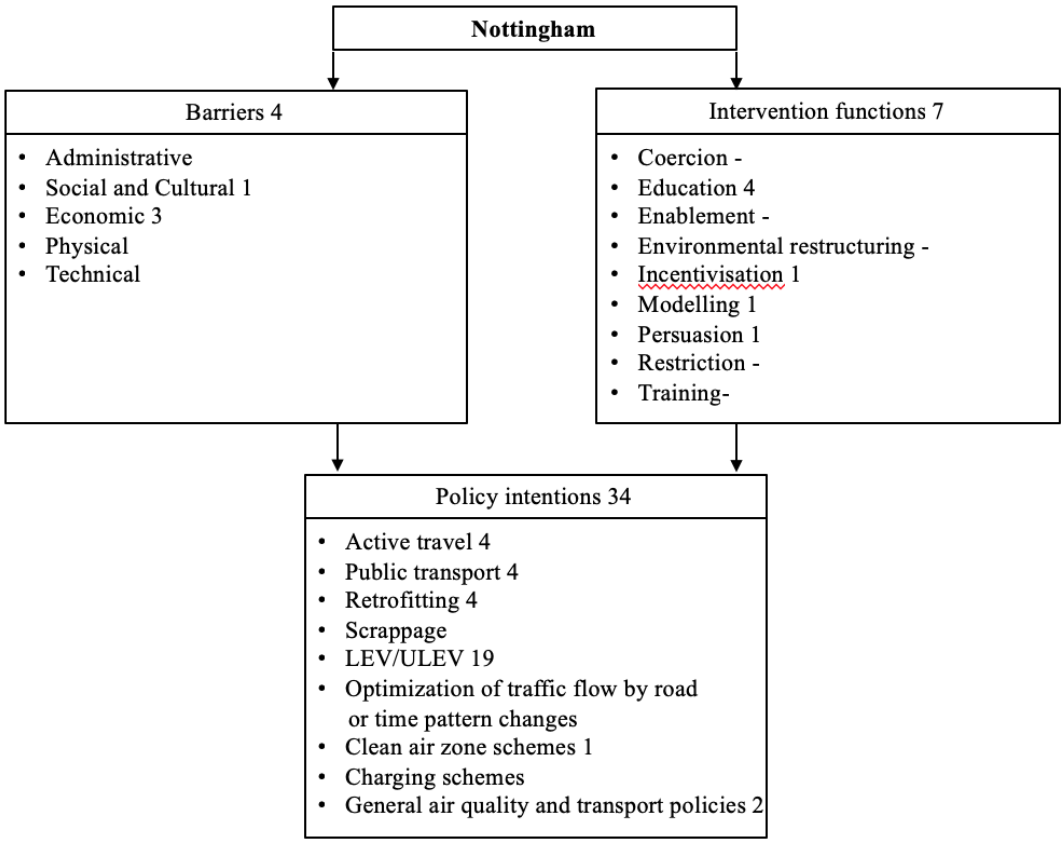


Figure 11: Coding scheme for Nottingham.

Barriers. Nottingham described economic barriers as the most prevalent type with three mentions. Social and cultural barriers were brought up once.

Economic barriers
”A second key impact in analysis is the cost of upgrading vehicles.”

Intervention functions. “Education” was the most commonly used intervention types with 4 mentions. “Education” has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance.

Education
“…initial public consultation was carried out in May 2018.” ”A comprehensive modelling process was required to evaluate all possible options. Those which do not meet the compliance threshold and/or have excessive socioeconomic impacts were subsequently discounted.”

Outcomes. A major focus is put on the promotion of Low Emission Vehicles, with 19 related policies. Aside from this, public transport, active travel and retrofitting schemes were prevalent with 4 mentions each

Public transport
”… reduce the number of bus stops in the city centre and to impose waiting and idling restrictions on buses these measures will help to increase the efficiency of bus movements in the centre.”
“…the use of contactless payments across the public transport network.”
Active travel
”The strategy highlights the need to create an environment that encourages walking and cycling as a way in which its objectives can be achieved.”
“Nottingham City Council was recently successful in winning £2.7m funding from the DfT’s Access Fund to deliver a programme of behaviour change activities working with households and businesses to promote sustainable travel options to improve air quality, including support for cycling.”
Retrofitting
“The remainder of the fleet, 185 Euro V midi and double decker’s will be retrofitted via funding from the clean bus technology fund to Euro VI emission standard…”

D.12: Sheffield

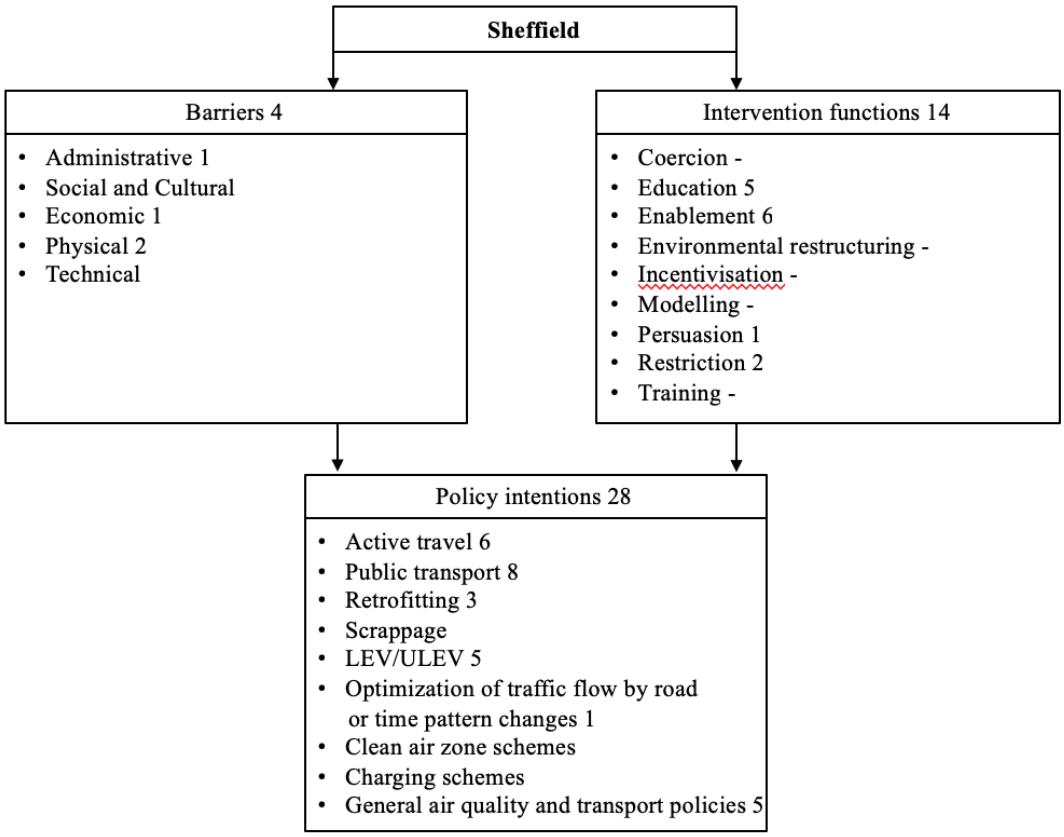


Figure 12: Coding scheme for Sheffield.

Barriers. Sheffield struggles with physical barriers (2 mentions), while administrative and economic barriers may carry some weight with one mention each.

Physical barriers
"Our city is unique in its geography. We are a city of hills which needs to be considered when finding solutions to encourage active travel."

Intervention functions. Sheffield applied a wide range of behaviour tools, with "Enablement" and "Education being the most prevalent with 6 and 5 mentions, respectively. "Enablement" was coded as the use of political cooperation and wider policies that made the adoption of air quality policy easier. "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance.

Enablement
”…seek investment from Government for a fund to help taxi operators/owners to improve their vehicles. This will be particularly focused on the most polluting taxis.”
”We will lobby Government to provide UK-wide incentives for big fleet operators to reduce emissions and to incentivise, at a local and national level, the movement of a greater proportion of heavy goods via rail or water.”
Education
”Feasibility Study – determine if a Clean Air Zone is required in Sheffield.”

Outcomes. Sheffield has adopted several transport related policy schemes that aren’t covered in out coding scheme (5 mentions). Aside from this, public transport policies were the most common type of new adopted policy with 8 mentions. Active travel was a key set of policies in the strategy (6 mentions) and was adopted alongside low emission vehicle schemes (5). Taken together, this shows an ambition to have greener cars and more sustainable transport, but without a Clean Air Zone, neither with or without charging.

Public transport
“Work in partnership with the bus companies to improve the bus fleet and reduce emissions through replacement low-emission buses or retrofitting vehicles with cleaner engine technology.”
“Work in partnership with SYPTE and operators to make the bus a more attractive choice – delivering improved journey time reliability and bus speed on our network – encouraging people to switch from car to bus.”
Active travel
”Promoting clean travel – encourage more walking, cycling and active commuting…”
”We want to make it easier for people to choose cycling for short trips as a natural choice. The specific actions associated with this will be covered in greater detail in our forthcoming Transport Strategy.”
Retrofitting
“Support this by seeking investment to enable the retrofitting or replacement of the bus fleet in the city. To work towards this, we have recently submitted a bid for funding to retrofit 117 buses…”
Low emission vehicles
”– consider specific schemes to support people on lower incomes to change to lower emission vehicles, particularly where their job or responsibilities require unavoidable and frequent use.”

D.13: South wales

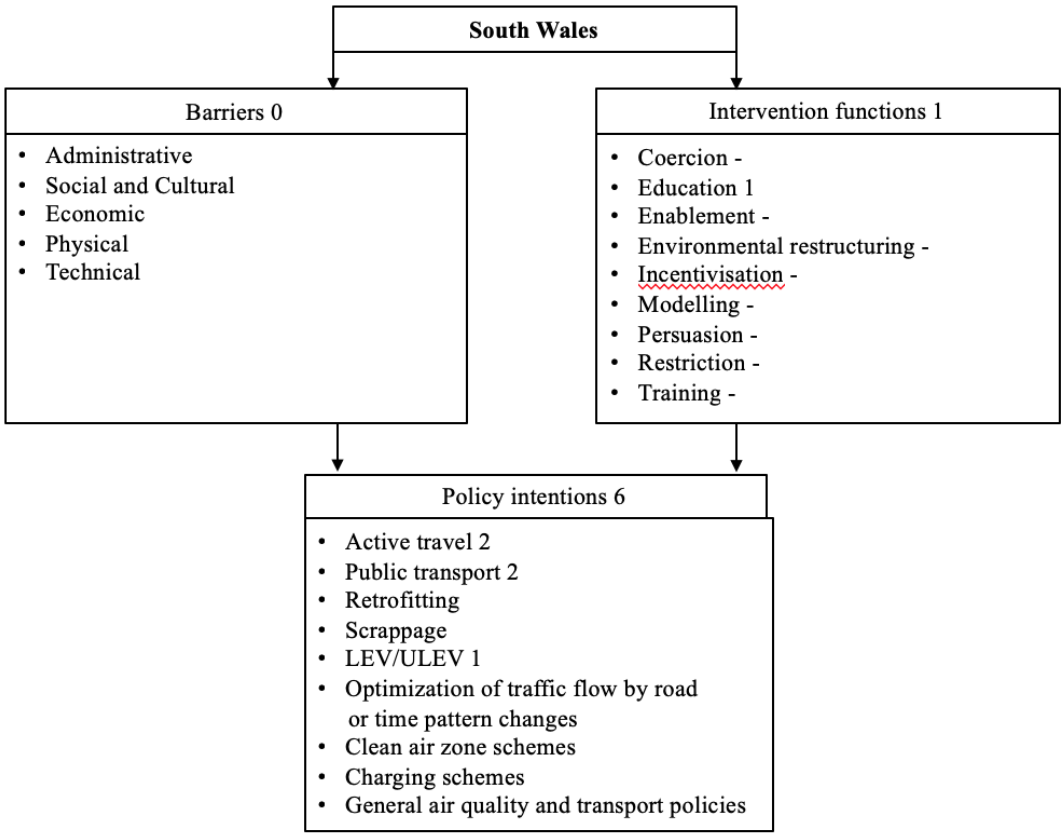


Figure 13: Coding scheme for South Wales.

Barriers. South wales reported no barriers.

Intervention functions. The South Wales has monitoring in place, which has been coded as an "Education" tool.

Outcomes. South wales discuss a wide range of policies, but only to a limited extent. Active travel and Public transport policies are the main focus with two mentions each. There is also a minor focus on Low emission vehicle policies, which has been mentioned once.

Active travel
"Safe routes to schools have also been set up and will reduce car usage around schools."
Public transport
"Bus corridor enhancements that will also encourage modal shifts."

D.14: Southampton

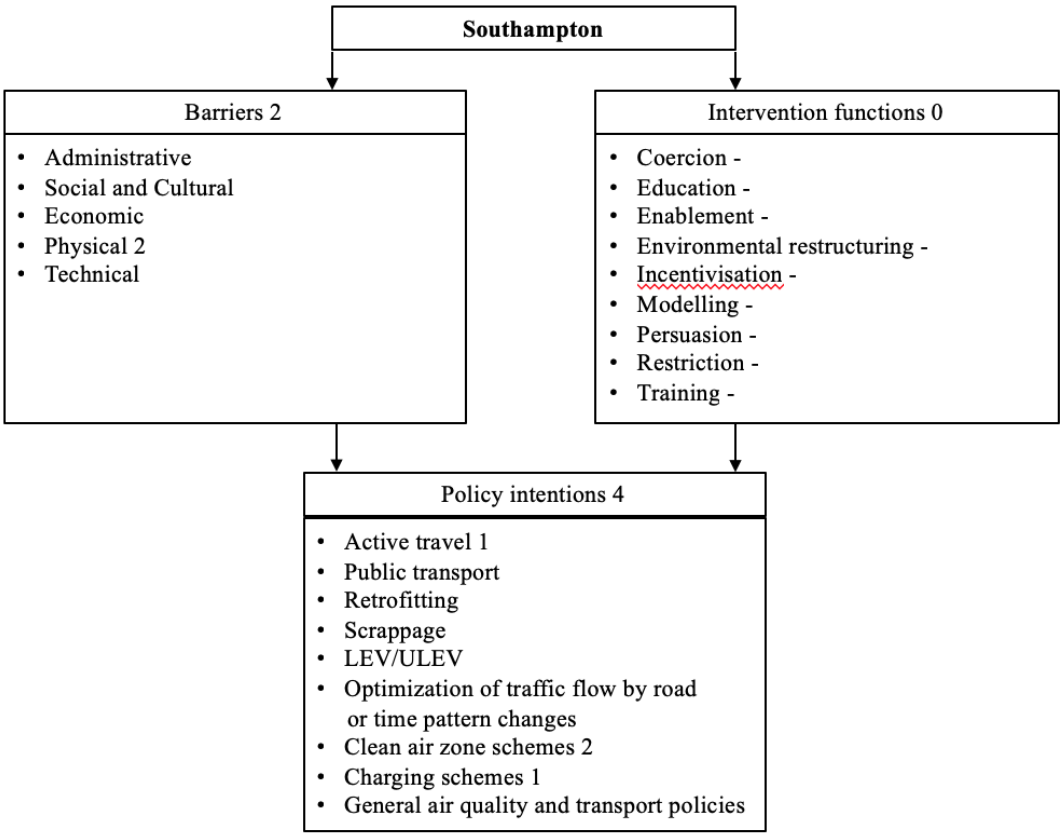


Figure 14: Coding scheme for Southampton.

Barriers. Southampton mentioned physical barriers twice.

Physical barriers
"Southampton's port is the busiest cruise terminal and second largest container port in the UK. Its continued success is vital to the city's economy."

Intervention functions. Southampton reported no use of intervention functions.

Outcomes. Southampton are intending to implement a charge free, voluntary Clean Air Zone, aside of this there is mention of a single active travel policy, the so called "My Journey Campaign".

Clean Air Zone
"Establish the Southampton Clean Air Zone (CAZ) on a voluntary basis, with no charging, by 2017 and deliver an associated package of measures."
"Fulfil our statutory requirements and introduce penalty charges in 2019/20 for the most polluting commercial vehicles entering the CAZ."

D.15: Stoke

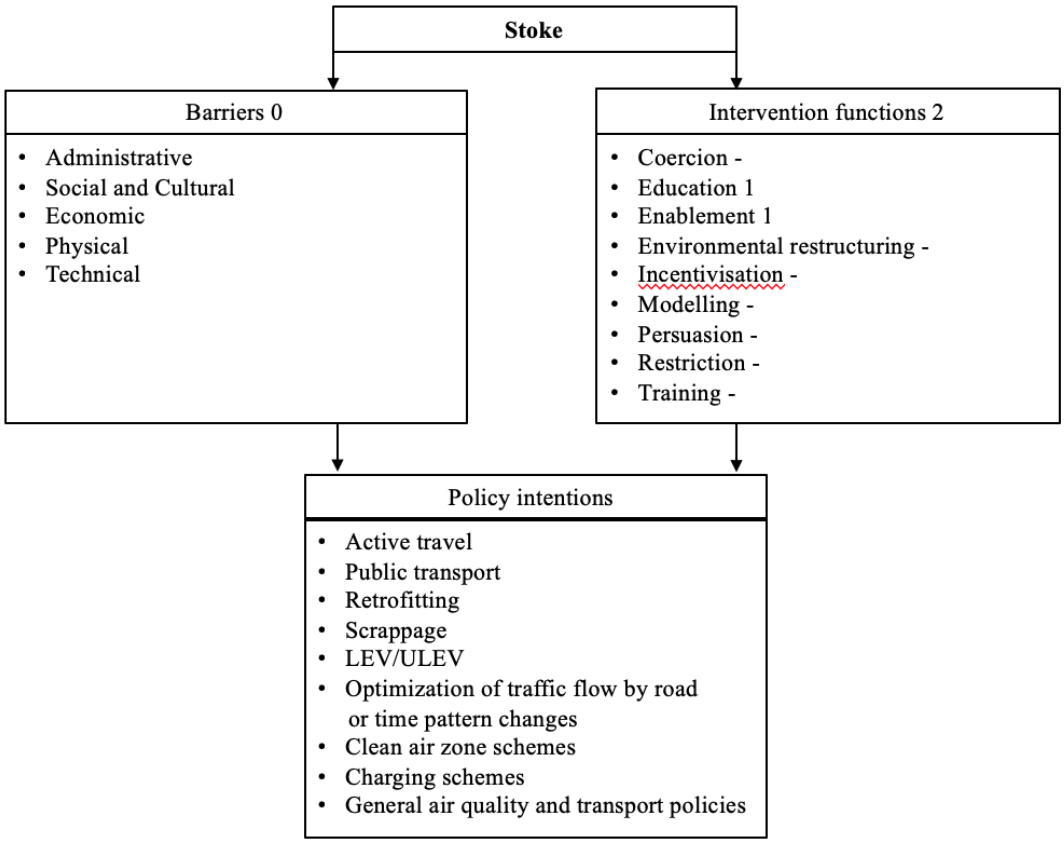


Figure 15: Coding scheme for Stoke.

Barriers. Stoke reported no barriers.

Intervention functions. In Stokes Air Quality Strategy, "Enablement" and "Education" were used once each.

Outcomes. Stoke has not yet adopted any hands-on policies aside from further monitoring and reporting on air quality.

D.16: West Yorkshire (Leeds)

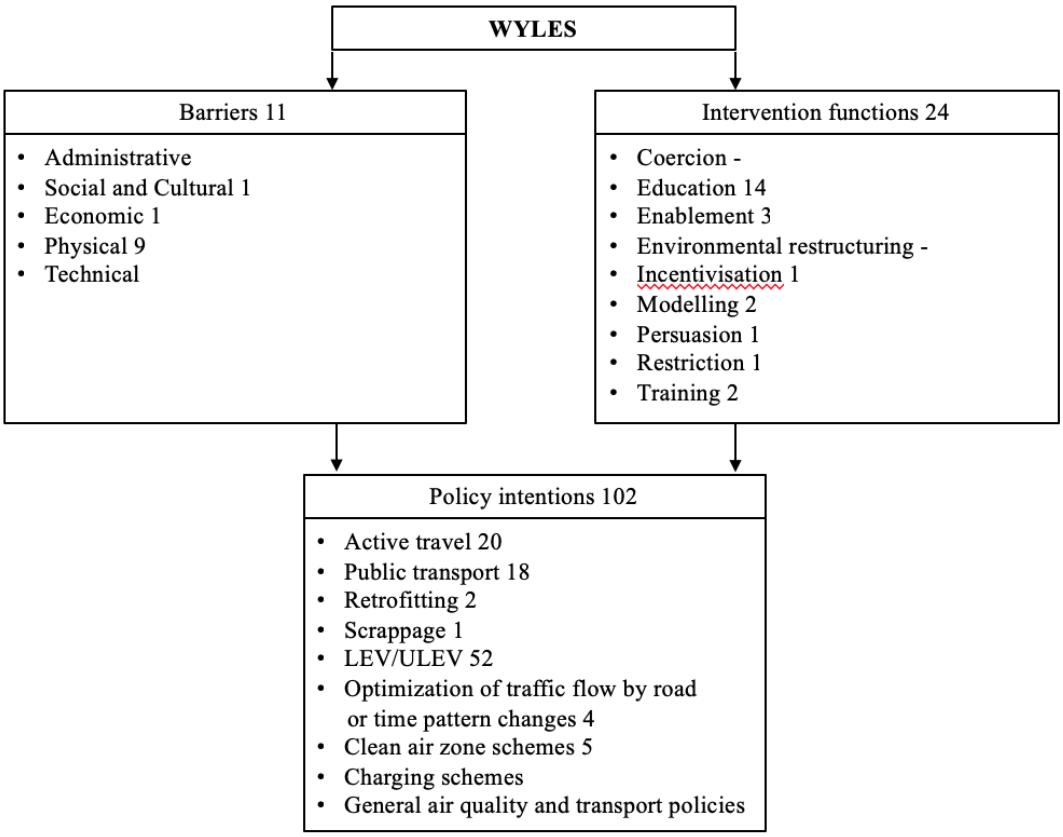


Figure 16: Coding scheme for West Yorkshire (Leeds).

Barriers. West Yorkshire (Leeds) described a wide range of barriers, with Physical barriers being the most prevalent (9 mentions). Social and Cultural (2) and Economic barriers (1) were also featured.

Physical barriers
"Unlike the smoke and smog problems of the past, nitrogen dioxide and particulate matter emissions are invisible, leading to a perception that the air is "clean"."
Moving air quality problems away from city centres to residential areas."
Cultural barriers
"Rapid growth in the number of diesel cars on our roads compared to a decade ago is one of the main reasons why air quality targets have not been achieved across the UK."
Economic barriers
"Although it must also be recognised that economic growth, more housing and the potential for more traffic on our roads has the potential to make air quality worse unless this is considered at an early stage and action is taken to mitigate and reduce emissions."

Intervention functions. Leeds applied a wide range of behaviour tools, with instances of each tool but coercion and environmental restructuring being used. "Education" was the most commonly used tool (14), followed by "Enablement" (3), "Modelling" and "Training" (2 each). "Education" has been coded from a diverse set of cases where the council educates inhabitants and stakeholder about air quality and its importance.

Education
"Public consultation on the draft WYLES was undertaken during November and December 2015 via an on-line survey."
"We will use the West Yorkshire Air Quality and Planning Technical Guide to deliver sustainable developments and deliver air quality improvements."
Enablement
"…technical support provided by Low Emissions Strategies Ltd."

Outcomes. Leeds has a heavy focus on Low emission vehicles, as this is by far their most mentioned type of new policy (52 mentions). Another heavy focus is on Active Travel and Public Transport policy, with 20 and 18 mentions respectively. Clean Air Zones or Low emission Zones have also been discussed as a potential adoption. This potential was mentioned 5 times.

Active Travel
"A separate Walking and Cycling Plan will be developed to support the West Yorkshire Transport Strategy and this will complement our ambition to create a low emission future."
"Support for multi-modal travel, including park and ride, park and rail and cycling facilities."
Public Transport
"Increasing public transport integration for example with increased park & ride / park & rail schemes."
"Improved connectivity and capacity of local, regional and national rail network, including HS2."
Clean Air Zone
"A Clean Air Zone will be introduced within the Leeds district, and elsewhere where necessary, to control emissions from the most polluting vehicles."
Time and route management
"Flexible working arrangements, including home-working and mobile working to reduce the need to travel to workplaces."
Retrofitting

”Commercial bus services operating in pollution hotspots across West Yorkshire will be required to retrofit all pre-Euro IV buses with NO_x and Particulate abatement equipment by 2018.”