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Public Acceptability towards Low Emission Zones: The role of attitudes, norms, emotions, and trust

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Highlights

- Policy specific beliefs underpin the attitudes held towards LEZs
- Emotional reactions towards LEZs are important in public acceptability
- Trust in government supports the beliefs held about LEZs

Abstract
In recent years, the topic of air quality has grown in prominence due to an improved understanding of the detrimental impacts of local air pollutants on human health and wellbeing. The introduction of Urban Vehicle Access Regulations such as Low Emission Zones represents one policy that is being actively considered in city governance to address this problem, whereby the access of highly polluting vehicles is restricted to reduce traffic-related emissions. For such a policy to be implemented, an understanding of public support can prove useful by identifying the issues that underpin citizen reaction.
This paper presents an assessment of public acceptability to Low Emission Zones through the application of a conceptual framework. This framework integrates an array of socio-psychological constructs sourced from theoretical models of behaviour and empirical findings on acceptability to Transport Demand Management measures. The framework is applied through a Structural Equation Model with the results of the analysis indicating that attitudes, policy specific beliefs, trust in government, and problem awareness all represent significant constructs in terms of their direct and in-direct effects on acceptability. This information can contribute to the discussion within local governments by providing guidance in their policy development on what contentious issues need to be addressed in public engagement strategies.

Key Words
Low Emission Zones, Public Acceptability, Air Quality, Transport Demand Management, Psychometric Modelling, Urban Transport

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1. Introduction

Urban transport systems, especially those that rely on private internal combustion engine vehicles to service mobility needs, can generate a set of negative externalities that have economic, social, and environmental implications. One externality which has climbed the public agenda is the emission of local air pollutants from vehicle exhausts, which reduce urban air quality. The presence of high concentrations of local air pollutants can take a heavy toll on society, with the European Environment Agency (2017) estimating that over 520,000 premature deaths across Europe in 2014 can be attributed to exposure to particulate matter, nitrogen dioxide, and ozone.

A series of interventions can be considered to reduce the concentration of local air pollutants in urban areas. These include policies to retrofit existing vehicles to reduce their emissions, stricter regulations of the emission factors of new vehicles, the use of vegetation to absorb pollutants, the introduction of pedestrianised areas, and alterations to the built environment to improve air circulation. The introduction of Urban Vehicle Access Regulations (UVARs) represents one strategy which is being actively considered across the European Union (Ricci et al. 2017). The United Kingdom (UK) is examining the appropriateness of Low Emission Zones (LEZs; also known as Clean Air Zones – see Department for Environmental and Rural Affairs, 2017) which represent a particular type of UVAR. Low Emission Zones generally discourage (either through bans or charges) the operation of certain vehicles within set areas during specified times to reduce the presence of emission sources.

Introducing a policy which may restrict the mobility of citizens is often viewed as a contentious topic (Christiansen, 2018), motivated for example by opinions of limits to personal freedom or by concerns for its distributional impact. Lack of public and political acceptance has prevented or overturned the introduction of UVARs in several cities around the world in the last two decades (Gaunt et al., 2007; Hysing and Isaksson et al. 2015; Ison & Rye, 2005; Rye et al., 2008; Schaller, 2010; Vigar et al. 2011). To guide the development and facilitate the implementation of such policies, a detailed understanding of public acceptance of LEZs will likely prove beneficial. At present, the existing body of research on public acceptability of transport policy is focused on other variants of Transport Demand Management (TDM) such as road user charging (Gu et al. 2018), finding that factors such as the perceived efficacy of the policy (Xianglong et al. 2016) as well as considerations of distributional equity (Schmöcker et al. 2012) represent important issues. As the features of LEZs differ considerably to current TDM measures, such as their objective of curtailing local air pollutants emitted by vehicles as well as their operational processes which can restrict vehicles based on vintage, it is questionable whether public reaction to these policies will follow the patterns so far observed for TDM policies. Moreover, there is the potential for other factors which have so far not been examined in TDM public acceptability to be pertinent for LEZs, such as perceptions of how risky the policy is given its novelty.

This paper addresses these issues by providing a focused examination of the socio-psychological constructs which are associated with public acceptability to the introduction of a LEZ. An existing conceptual framework of citizen acceptance of sustainable policy is adapted to the context of a planned implementation of LEZs in the urban areas of Scotland and applied through a Structural Equation Model. The framework incorporates socio-psychological constructs taken from existing work on public acceptability of TDM and combines these with novel issues such as the emotive reaction citizens can have to coercive transport policies. The novelty and contribution of this paper is twofold. First, while acceptability to TDM measures has been examined in the past, to the best of our knowledge this is the first assessment specifically focused on LEZs. Second, the applied framework includes socio-psychological constructs which have yet to be considered in a TDM context, covering

perceptions of the perceived benefits, costs and risks of the policy as well as affective reactions. As such, the coverage of the conceptual framework goes beyond the existing literature in terms of its construct richness and linkage.

2. Background

2.1 Low Emission Zones

Government policy intended to alter the mobility behaviour of citizens is generally referred to as Transport Demand Management (TDM – see Meyer, 1999; Ison and Rye, 2012). Policies which fit this definition can be further classified based on whether they are coercive, such as push policies designed to hinder a particular behaviour, or supportive, such as pull policies developed to encourage desirable practices. Forms of coercive TDM include road user pricing, congestion charging, license plate restrictions, and parking restrictions. TDM policies have seen application across a wide range of different contexts, with an established evidence base examining the efficacy of these measures in achieving their intended outcome (Santos, 2005; Hensher and Puckett 2007; Eliasson et al. 2009; Börjesson et al. 2012; Percoco, 2014) and the ancillary consequences generated in terms of equity, traffic safety, and economic impact (Quddus et al. 2007; Noland et al. 2008; Levinson, 2010; Jones and Lucas, 2012; Munford, 2017).

Low Emission Zones represent a type of coercive TDM. Restrictions are generally imposed on certain vehicles from circulating in set areas which currently suffer from low levels of air quality. Historically, LEZs covered the operation of large vehicles (e.g. buses and heavy goods vehicles), though in recent years their application has expanded to include private cars (Holman et al. 2015). There are numerous illustrations of this in Europe. The Environment Zones in place across urban areas in Germany (i.e. *Umweltzonen*) represent one of the most extensively applied versions of LEZ, where cars are banned from entering set areas if they do not comply to specified Euro emission standards. Additionally, cities have alternated over time between congestion charges and schemes that differentiate charges or access based of emission levels. For example, the London congestion charge was altered in 2017 to impose an additional £10 daily charge (referred to as the toxicity charge) on cars that do not meet the Euro 4 emission standard. Milan did it in reverse, first introducing a pollution charge in 2008 (for petrol cars that did not meet the Euro 3 emission standard and diesel cars that did not meet the Euro 4), and then upgrading it to a congestion charge affecting all vehicles in 2012 (Mattioli et al. 2012). As of writing, there are over 100 LEZs in operation in the European Union, each taking a slightly different approach to restricting transport sources of local air pollutants in given areas (Ricci et al. 2017).

While LEZs are similar to other forms of TDM in a number of ways, there are two prominent attributes which distinguish LEZs from area based TDM measures such as congestion charging. First, LEZs have the intended objective of reducing the concentration of local air pollutants within set areas rather than improving the operation of the transport system. In this sense, LEZs connect with a wider social goal of enhancing the liveability of cities by promoting healthy environments for citizens to inhabit. As a result of this, the benefits which LEZs produce are likely to be felt by a wider spectrum of the urban population which may broaden their appeal amongst citizens. Second, LEZs can vary their intervention dependent on the emission levels of the car (e.g. applying an escalating charge structure based on car emission level) rather than applying a set charge to a vehicle class (e.g. car, motorcycle, or goods vehicle). This differentiation by emission level is arguably fairer than a universal charge and follows closer to the polluter-pays principle of sustainability. In addition, it demonstrates the capability of transport policy makers to devise a measure which is aware of the complexities present on the topic of urban air quality and thus more likely to deliver on the intended objectives.

These points of distinction could affect the way in which the public evaluate the introduction of a LEZ. For example, previous studies have suggested that public acceptance is greater when TDM measures are presented as being aimed at reducing air pollution (Eliasson and Jonsson, 2011; Jaensirisak et al., 2005; Mattioli et al., 2012; Souche et al., 2012) as compared to simply improving the efficiency of the transport system. The research reported in this paper provides insight on these issues by assessing the factors associated with public acceptability towards the introduction of a LEZ.

2.2 Acceptability of Low Emission Zones

The existing evidence base on public acceptability towards TDM measures provides a starting point through which to consider what factors may be associated with citizen reaction to LEZs (Gu et al. 2018). To date, the majority of the work which has examined this issue has utilised socio-psychological modelling to uncover the relationships that are present between acceptability and a set of antecedent constructs. These antecedent constructs can be classified as either proximate factors, which cover constructs that are directly linked to the measure being evaluated, or distal factors, which represent deeper aspects of the psyche further removed from the issue being evaluated. Each of these two sets of constructs are outlined in the following paragraphs, whereby their relevance in the TDM literature is set out alongside how they may perform in a LEZ context.

For proximate factors (also referred to as policy specific beliefs), evaluations of the development and operation of the measure are prominent features. With TDM policies designed to achieve specified outcomes (e.g. relieving congestion), perceptions of the effectiveness of the policy in reaching its aims are a commonly considered issue. In an assessment of public reaction to the Gothenburg congestion charge, Jagers et al. (2017) found that perceived effectiveness of the policy represented a significant issue in public reaction both before and after implementation. With LEZs being introduced with the aim of reducing the concentration levels of local air pollutants, public support of LEZs could be bolstered if these schemes are expected to generate improvements to air quality. A similar concept covers perceptions of the balance between costs and benefits of the measure, which features as a prominent construct in past work examining the public acceptability of license plate restrictions (Jia et al. 2017) and congestion charging (Hansla et al. 2017). The possibility for negative consequences of the scheme has also been examined specifically, with individuals that consider TDM schemes to infringe on personal freedoms more inclined to hold low levels of public acceptability towards these policies (Schade and Baum, 2007; Xianglong et al. 2016). The restriction of certain vehicles circulating in LEZs due to the implementation of bans or additional charges may well mean that the public interpret these policies as limiting their mobility options and form a negative reaction to them because of this.

The impacts of a TDM policy are often not equitably distributed across society, such as when at-risk groups (e.g. low-income households and ethnic minorities) find their ability to engage with public life hindered due to the introduction of a congestion charge (Bonsall and Kelly, 2005). As a result, perceptions of fairness of TDM measures are commonly included in acceptability models (Jakobsson et al. 2000). The analysis of the public reaction to road user charging in the UK and Japan undertaken by Schmöcker et al. (2012) found that different dimensions of fairness (i.e. procedural, distributive, and scenario) have varying effects over the acceptability of introducing a congestion charge in the UK and Japan. Given this, public reaction to LEZs could hinge on whether the policy is viewed as being equitable in terms of the citizens who gain and loss because of it.

For distal factors, constructs at different levels of abstraction from acceptability have been considered. At the most removed, Kim et al. (2014) evaluated whether personality traits are indirectly associated with the acceptability of introducing a carbon tax, with the results indicating that extraversion, agreeableness, and conscientiousness are playing a role. Another set of core characteristics are value orientations, with the work of Eriksson et al. (2008) and Cools et al. (2011) demonstrating that pro-environmental value orientations underpin awareness of the problems that TDM measures are focused on. Problem awareness itself is generally viewed as a precursor to the personal norms that individuals form concerning an issue, which cover if a problem is viewed as being important and the felt obligations to act (Eriksson et al. 2006; Cools et al. 2010; Kim et al. 2014). The problem which LEZs are attempting to alleviate is high concentration rates of local air pollutants. Putting these issues together it can be proposed that if a citizen perceives air quality to be a problem they are likely to form positive personal norms toward LEZs and ultimately have a higher likelihood of accepting the introduction of such a measure.

With TDM measures designed and introduced by government bodies, perceptions of the competencies of these institutions can affect public reactions to the measures. In a qualitative examination of a hypothetical road pricing introduction in the UK, Nikitas et al. (2018) found that perceptions of political motives and commitment are important in citizen evaluation of the policy. Similarly, in an examination of public acceptability of transport carbon taxation conducted in Japan, Kim et al. (2014) found that trust in government underpins the perceptions of fairness and effectiveness of the policy. This indicates that how citizens consider the ability of governments to successfully develop and implement a LEZ reinforces the policy specific beliefs held about the measure which in turn promote attitude formation and public reaction.

2.3 Situation in Scotland

The level of public attention on urban air quality in the UK has increased in recent years, partially motivated by controversies surrounding the diesel vehicle emissions situation and an improved understanding of the health implications of prolonged exposure to local air pollutants (Brand, 2016). Calls for action to address high concentration levels through enforcement of the existing regulations have likewise become more prominent. The existing regulations are stipulated in the Environment Act of 1995 and require local authorities to conduct annual assessments of air quality levels within their jurisdiction. If concentrations exceed set limit values, an Air Quality Management Area (AQMA) is designated, which necessitates the local authority to develop and implement a mitigation strategy.

Currently, there are thirty-nine AQMAs in effect across Scotland, mostly situated in urban areas. To address this issue, the Scottish Government (2015) introduced a national strategy through which to achieve their legal responsibilities. The introduction of LEZs represents one possible option in this national strategy, which would encapsulate AQMAs. The Scottish Government is intending to introduce LEZs which restrict the access of cars that do not comply with the Euro 4 emission standard (i.e. cars manufactured before January 2005) if fuelled by Petrol and the Euro 6 emission standard (i.e. cars manufactured before September 2014) if fuelled by Diesel. Non-compliant cars would be prohibited from entry to the LEZ, with fines being levied on drivers of cars that enter which do not meet the specified emission standards. The first LEZ was introduced in Glasgow (i.e. Scotland's largest city) at the end of 2018 with restrictions placed on buses. It is expected that Glasgow's LEZ will be extended to include cars in 2022, with LEZs also planned for the cities of Edinburgh, Aberdeen, and Dundee.

In 2005, the city of Edinburgh (i.e. the national capital of Scotland) held a referendum on introducing a congestion charge which would have involved two cordons (an outer cordon at the city limit and an inner cordon at the urban core) and charged inboard cars a flat rate of £2 for crossing either boundary. Over 74% of the public voted against the introduction of this congestion charge, indicating that a substantial level of local opposition exists for this TDM measure. Through the application of a household survey, Gaunt et al. (2007) investigated the factors linked to public reaction to the proposed congestion charge in Edinburgh. Their analysis indicates that mode use represents a useful means through which to differentiate supporters from opponents, with car drivers tending to be against the charge while bicyclists are more inclined to favour it. In a related piece of work, Rye et al. (2008) examined reasons for non-implementation of the congestion charge in Edinburgh through a content analysis and stakeholder interviews. The results of their work suggest media coverage tended to present negative viewpoints on the policy and that uncertainties regarding the adverse consequences that the policy may generate (e.g. reduced footfall at city centre retail and detouring car trips around the cordons) were likely contributing factors to low levels of public acceptability.

3. Methodology

3.1 Conceptual Framework

The study reported in this paper adapts a conceptual framework designed to explain acceptability of sustainable policy (Huijts et al. 2012; 2014) to public reaction to LEZs. This framework is displayed in Figure 1, where the ovals represent socio-psychological constructs and the arrows represent hypothesised connections between the constructs. To adjust the framework to make it suitable for evaluating public acceptability to LEZs, each of the links between the constructs hypothesised in the framework will be tested to determine their applicability while all the relationships between constructs will be measured to consider whether any new links are required. This culminates in the specification of a parsimonious model, whereby only the constructs and links found to be significant in the LEZ context are presented. As such, the conceptual framework acts as a starting point and is subsequently tailored to the specific topic under investigation.

The constructs incorporated in this framework are derived from two sources, being general socio-psychological theories of behaviour and the empirical research on citizen acceptance of sustainable policies. Constructs positioned to the right of the framework are sourced from two theories of human behaviour. The first is the theory of planned behaviour (Ajzen, 2005), which postulates that action is motivated by the beliefs an individual holds regarding the attitudes, appropriateness and self-efficacies related to that action. The second is the norm activation model (Schwartz, 1977), which stipulates that behaviour is controlled by the degree to which the action agrees with personal morals and social conventions. Constructs positioned to the centre of the framework relate to policy specific beliefs such as perceptions of the efficacy, cost, fairness, and the assignment of emotions to an issue. A set of distal constructs, measuring the trust held in government and the awareness of the problem being addressed by the policy, are positioned on the left of the framework.

The composition of constructs incorporated in the framework combines those which have previously been examined in past research on TDM acceptability with issues that have yet to be considered. For instance, the inclusion of the policy specific beliefs such as perceptions of fairness, efficacy, and problem awareness alongside personal and social norms are common features in the existing literature on TDM acceptability (Schmöcker et al. 2012; Xianglong et al. 2016). Likewise, distal constructs covering perceptions of the problem being addressed by the policy and the effectiveness of government to solve the problem are regular inputs in models aimed at explaining citizen reaction

to coercive policies (Eriksson et al. 2008; Kim et al. 2014). This overlap allows the analysis to compare the findings of existing work on TDM acceptability to the proposed implementation of a LEZ and consider where similarities and differences exist.

The novel elements included in the framework cover measurements of emotive reaction in terms of positive and negative affect alongside a clearer breakdown about how perceptions of the costs, benefits, and risks of the policy feed into attitude formation. Overall, the scope of this framework is arguably more extensive in terms of its construct and linkage richness than the current material. As such, the framework provides a comprehensive examination of the socio-psychological constructs which affect acceptability to the introduction of a LEZ.

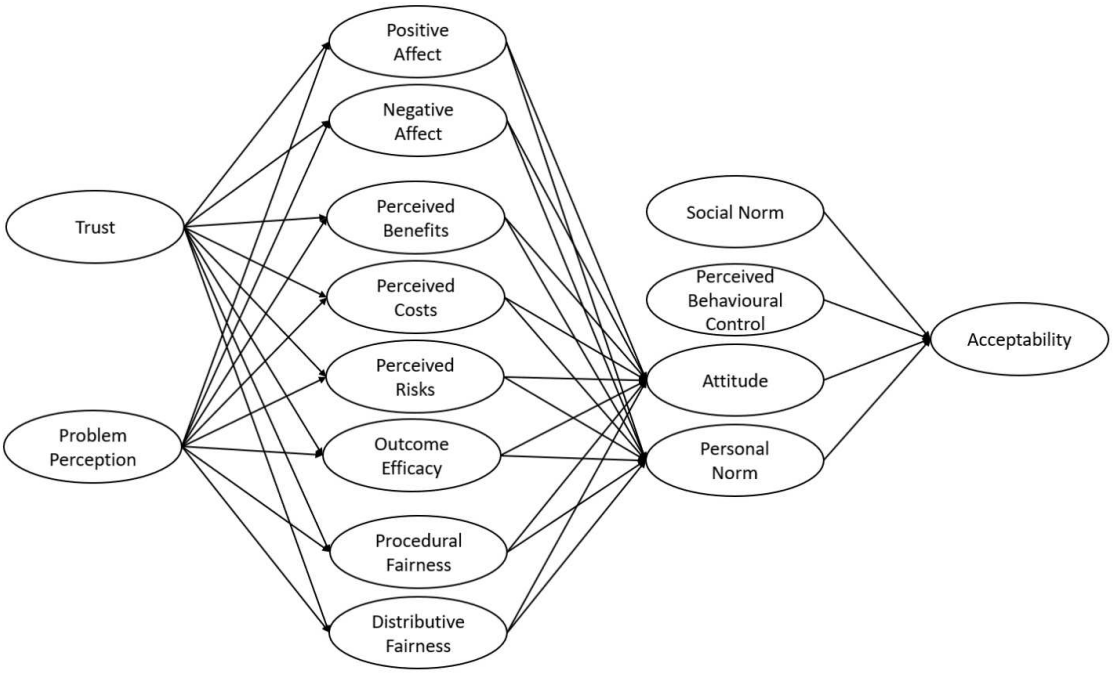

Figure 1: Conceptual framework of acceptability towards sustainable policy (adapted from Huijits et al. 2012; 2014)

3.2 Method of Measurement

Socio-psychological constructs are generally referred to as latent variables, meaning that they cannot be directly observed. To measure such variables an indirect approach is often employed, whereby opinion statements are used to triangulate on the construct. To apply the conceptual framework, three opinion statements were created by the authors for each of the constructs (i.e. 45 statements in total – see Table 2). For the constructs derived from the two behavioural theories, opinion statements were developed which translated these constructs into a LEZ context. For instance, personal and social norms were positioned as whether a policy is in keeping with personal values and would be endorsed by important others (e.g. friends and family). The same process was followed for the policy specific beliefs and distal constructs. For instance, perceptions of cost and benefit were framed as encompassing positions on economic prosperity and personal health while trust in government incorporated issues on competency and efficiency. Individuals were invited to express the degree to which each statement corresponds with their view across a 5-point Likert scale anchored from 'strongly disagree' to 'strongly agree'.

The development of the statements involved an iterative process of refinement to ensure that the statement was closely aligned to the intended construct (Netemeyer et al. 2003). To determine whether the opinion statements were capable of measuring the intended latent construct, a pilot study (of 100 participants) was conducted with the correlations between the statements associated with a particular construct inspected to determine convergent validity. Following this pilot, a number of minor modifications were introduced to improve measurement performance.

3.3 Scenario Evaluated

To provide a policy for the respondents to consider, a hypothetical introduction of LEZs across the urban areas of Scotland was formatted. This scenario positioned the policy as a national rather than a local measure and covered the banning of diesel and petrol cars from specified vintages. The exact phrasing of the scenario is presented in Box 1, with respondents being asked for their opinion of implementation in the nearest city.

Box 1: Policy Scenario

Low Emission Zones have been introduced in a number of European cities (such as Milan and Berlin) in order to address high levels of local air pollution caused by the emission of noxious gases from motorised transport. These zones cover significant areas of the city centres and restrict the entry of heavily polluting vehicles. Certain cars are restricted by these zones, with the current thresholds set at:

- Diesel cars registered before September 2014
- Petrol cars registered before January 2005

Cars which are registered before these dates are prohibited from entering the Low Emission Zone either entirely or at certain times of the day. If a driver of a car registered before these dates enters the Low Emission Zone they will be subjected to a fine.

We would like to ask your opinions on this transport policy being introduced in your nearest city.

3.4 Data Collection

A self-completion online survey was administered during the summer of 2017 to attain a sample of Scottish respondents. The sampling frame covered the panel developed by the YouGov market research firm, which contains over 800,000 British households. The YouGov panel is constructed to provide a representative national picture across the socioeconomic spectrum and corrects for hard-to-reach groups. A sample of 2,004 responses was randomly extracted from this sample frame, with Table 1 comparing this sample to a number of the core characteristics to the 2016 Scottish Household Survey (an annual survey of households conducted by the Scottish Government (2017)). From the comparison, it is apparent that the sample contains a lower proportion of respondents over the age of 65, leading to an under-representation of retired individuals. Moreover, the sample has over-represented individuals that hold full driving licenses, with a corresponding higher proportion of respondents coming from households that have access to one or more cars. This divergence between sample and population could limit the ability of the statistics calculated in the analysis to accurately represent the parameters present in the population. The analysis may lean towards overemphasising the downsides of LEZs as a result of the sample including a greater proportion of car owners. As a

result of this, the estimated statistics should be interpreted as a conservative approximation of the views held amongst general society.

Table 1: Description of the sample and comparison to the Scottish Household Survey

Variable	Category	Sample	SHS
Sex	Female	50.5%	45.7%
	Male	49.5%	54.3%
Age (years)	Under 26	10.2%	8.8%
	26 to 45	35.3%	28.6%
	46 to 65	41.7%	33.7%
	Over 65	12.8%	28.9%
Economic status	Working full-time	38.7%	38.9%
	Working part-time	15.2%	10.0%
	Unemployed	5.5%	3.3%
	Student	7.3%	4.4%
	Retired	21.2%	33.0%
	Other	12.1%	10.4%
Driving license	Yes	74.4%	67.7%
	No	25.6%	32.3%
Car availability	0 cars	9.2%	27.7%
	1 car	51.0%	43.2%
	2 or more cars	39.8%	29.2%

3.5 Statistical Analysis

The conceptual framework is applied through structural equation modelling (SEM), which represents a collection of multivariate techniques developed to examine complex systems of variables (Kline, 2015). SEM is a common approach utilised in psychometrics due it its ability to integrate the measurement of latent psychological constructs (e.g. attitudes, norms, and beliefs) with path diagrams which hypothesise how psychological constructs effect intentions and actions (i.e. human behaviours). The increasing prominence of transport psychology over the past 20 years has led to an expansion of SEM applications aimed at understanding the travel behaviour of citizens such as mode choice, vehicle preference, and trip satisfaction (Outwater et al. 2003; Scheiner & Holz-Rau, 2007; Lois and López-Sáez, 2009; De Oña et al. 2013). SEM also represents a typical approach to examining the acceptability of transport policy (Eriksson et al. 2008; Kim et al. 2008; Xianglong et al. 2016), which allows for the results generated in this analysis to be compared to past work in TDM. The application of the conceptual framework progresses through 5 stages:

Stage One: Exploratory Factor Analysis

The first stage involves the application of Exploratory Factor Analysis (EFA) to the scale of 45 opinion statements which comprise the conceptual framework. This step provides guidance on whether the statements assigned to a given construct exhibit expected covariances and if the constructs can be effectively separated. A principal axis factoring with direct oblimin rotation is conducted on the statements. The results of the analysis are inspected to determine [1] if any statement has been assigned (in terms of highest loading) to the incorrect construct and [2] if any statement cross loads on multiple constructs (i.e. a difference of less than 0.2 in the factor loading). Statements which meet either of these two conditions are removed and a reduced scale is then applied (6 statements removed in total). The list of the 39 retained opinion statements is reported in Table 2.

Stage Two: Confirmatory Factor Analysis
The second stage takes the reduced scale and generates a measurement model using the generalised least squares estimation method through a Confirmatory Factor Analysis (CFA). This measurement model restricts the CFA to only examine the links between the statements and their assigned constructs and provides a robust means through which to evaluate the ability of the framework to accurately measure the embedded constructs. The validity of the construct measurements is evaluated through the calculation of the composite reliability (CR), actual variance extracted (AVE), and the square root of AVE. Model fit statistics covering CMIN/DF, AGFI, and RMSEA are examined to determine the ability of the measurement to reproduce the data.

Stage Three: Correlation Analysis
The third stage reports on a correlation analysis between the constructs identified in stage two. This stage displays the relationships which are present between the constructs and assists in determining whether the hypothesised connections between the constructs exist. In addition, strong correlations between constructs which are not linked in the conceptual framework are identified to consider if any modifications to the path diagram are necessary.

Stage Three: Demographic Analysis
The fourth stage considers how the measurement of public acceptability towards LEZs differs across demographic cohorts. Descriptive statistics of the EFA factor score for acceptability are calculated across common demographics including age, economic status, and car availability. Non-parametric tests-of-difference (i.e. Mann-Whitney and Kruskal-Wallis) are applied to consider whether demographic cohorts display significantly different levels of acceptability.

Stage Five: Structural Equation Modelling
The final stage of the analysis covers the estimation of a structural equation model using the covariance based generalised least squares estimation method which evaluates the structure of the conceptual framework. To begin, the framework is examined in its entirety (i.e. with all constructs and links present). An iterative process of removing paths found to be insignificant (i.e. p-value exceeding 0.05) is then conducted to reduce the framework to a parsimonious model. Model fit statistics covering CMIN/DF, AGFI, and RMSEA are examined to determine the ability of the path diagram to reproduce the data.

4. Results and Discussion

4.1 Exploratory and Confirmatory Factor Analysis
The results of the exploratory factor analysis are summarised in Table 2, covering the descriptive statistics (i.e. mean and standard deviation) and factor loadings for each statement as well as the CR, AVE, and square root AVE for each construct. A series of statements have their polarities reversed to ease the interpretation of the results (e.g. the statements associated with outcome efficacy have been reverse coded so that this construct measures perceived improvements on this issue).

The exploratory factor analysis found that two statements loaded onto incorrect constructs, while four statements had cross-loadings closer than 0.2. The analysis was re-specified with these statements removed, with the results identifying the expected construct structure and statement assignment. The diagnostics of the exploratory factor analysis on the reduced scale prove satisfactory

(Kaiser Mayer Olkin measure: 0.973; Bartlett's test 65281.61, df 741, p-value < 0.01), indicating that the scale is suitable for structure detection.

The internal consistency of the constructs is generally favourable, though the constructs measuring social norm and outcome efficacy have CRs in the range of 0.6 to 0.7, indicating that the statements which comprise these constructs are not strongly aligned. The construct structure is further evaluated in a confirmatory factor analysis with the standardised regression weights reported in Table 2. The goodness-of-fit statistics are generally favourable (CMIM/DF: 4.150, AGFI: 0.917, RMSEA: 0.040, PCLOSE: 1.000) implying that the model can appropriately measure the constructs of the conceptual framework (Kline, 2015). The AVE for all constructs exceeds 0.5, inferring that the statements adequately converged on the intended construct. Additionally, the square root AVE for each construct exceeds the correlations with other framework constructs reported in Table 3, indicating that the constructs sufficiently diverge from one another.

Table 2: Results of the factor analysis covering statement descriptive statistics and loadings on relevant constructs. Note: the opinion statements were originally developed by the authors, based on the construct structure set out by Huijts et al. (2012; 2014).

Construct and Statement	M.	S.D.	F.L	S.R.W
Acceptability (CR: 0.957; AVE: 0.882; SQRT AVE: 0.939)				
Overall, I would support the introduction of Low Emission Zones in my nearest urban area	3.30	1.16	0.95	0.96
I think the implementation of Low Emission Zones is an acceptable policy	3.41	1.08	0.84	0.92
I'd vote in favour of Low Emission Zones in a local referendum	3.22	1.20	0.91	0.94
Social Norm (CR: 0.682; AVE: 0.525; SQRT AVE: 0.724)				
I think people are becoming much more concerned about air quality	3.61	0.82	0.68	0.61
My friends and family are worried about the level of air pollution	2.99	0.98	0.62	0.80
Perceived Behavioural Control (CR: 0.829; AVE: 0.621; SQRT AVE: 0.788)				
It would be straightforward for me to adapt my travel behaviour around a Low Emission Zone	3.32	1.18	0.81	0.88
I don't need a car to get to the city/town centre so a Low Emission Zones is unlikely to affect me	3.25	1.31	0.73	0.68
The implementation of a Low Emission Zone would make my travel arrangements much more difficult [R]	3.25	1.21	0.75	0.80
Attitude (CR: 0.817; AVE: 0.692; SQRT AVE: 0.832)				
Low Emission Zones should not be considered by policy makers [R]	3.29	1.08	0.71	0.77
Investing in Low Emission Zones would be a waste of public funding [R]	3.20	1.09	0.60	0.91
Personal Norm (CR: 0.851; AVE: 0.742; SQRT AVE: 0.861)				
The idea of Low Emission Zones fits in well with my values	3.32	1.02	0.49	0.90
Improving air quality is a policy which is personally important to me	3.42	0.99	0.80	0.75
Positive Affect (CR: 0.950; AVE: 0.864; SQRT AVE: 0.930)				
Establishing Low Emission Zones would make me proud	2.90	1.08	0.82	0.91
I would be excited by the prospect of Low Emission Zones	2.80	1.10	0.88	0.91
I'd be glad to see Low Emission Zones introduced	3.23	1.11	0.56	0.93
Negative Affect (CR: 0.938; AVE: 0.835; SQRT AVE: 0.914)				
The introduction of Low Emission Zones would annoy me	2.73	1.15	0.94	0.94

I think the regulations surrounding Low Emission Zones would cause me frustration	2.91	1.15	0.84	0.85
I would be disappointed if Low Emission Zones were introduced	2.65	1.14	0.67	0.93
Perceived Benefits (CR: 0.848; AVE: 0.736; SQRT AVE: 0.858)				
The health of citizens would be better if Low Emission Zones are introduced	3.63	0.90	0.79	0.91
Walking within a Low Emission Zone would be a more pleasant experience	3.79	0.86	0.82	0.84
Perceived Costs (CR: 0.743; AVE: 0.591; SQRT AVE: 0.769)				
The public costs of implementing and operating Low Emission Zones would be huge	3.29	1.00	0.68	0.78
Implementing Low Emission Zones would reduce economic prosperity	2.94	0.98	0.73	0.78
Perceived Risks (CR: 0.697; AVE: 0.537; SQRT AVE: 0.733)				
Low Emission Zones would just relocate highly polluting vehicles to other areas	3.60	0.90	0.76	0.70
People will find ways around Low Emission Zone regulations	3.51	0.84	0.58	0.51
Introducing Low Emission Zones would likely generate negative unintended consequences	3.36	0.92	0.40	0.80
Outcome Efficacy (CR: 0.753; AVE: 0.508; SQRT AVE: 0.713)				
Low Emission Zones would not be effective at lowering the levels of local air pollution [R]	3.21	0.95	0.41	0.76
There are better ways to improve air quality than introducing Low Emission Zones [R]	2.65	0.85	0.66	0.63
Trust (CR: 0.888; AVE: 0.726; SQRT AVE: 0.852)				
I am confident that the Government would introduce Low Emission Zones correctly	2.57	0.99	0.98	0.92
I trust that Low Emission Zone regulations would be developed and implemented effectively	2.80	1.01	0.68	0.83
I think the Government would make a mess of introducing Low Emission Zones [R]	2.48	1.02	0.76	0.80
Procedural Fairness (CR: 0.842; AVE: 0.643; SQRT AVE: 0.802)				
The government would be right to consider restricting the use of polluting cars in towns/cities	3.54	1.04	0.76	0.86
Low Emission Zones would be an appropriate measure to improve local air quality	3.46	0.98	0.84	0.86
The types of cars restricted by a Low Emission Zone would be selected carefully by the Government	3.04	1.02	0.54	0.62
Distributive Fairness (CR: 0.899; AVE: 0.748; SQRT AVE: 0.865)				
While Low Emission Zones maybe good for some people, they would significantly hinder other people [R]	2.38	0.95	0.84	0.83
I think Low Emission Zones would have unfair impacts on some people [R]	2.51	1.00	0.91	0.91
Low Emission Zones would penalise people who are already in vulnerable positions [R]	2.60	1.01	0.84	0.87
Problem Perception (CR: 0.771; AVE: 0.535; SQRT AVE: 0.731)				
Car use is having a severe impact on people's health and wellbeing	3.33	0.99	0.66	0.70
I am very concerned about the level of air pollution	3.66	1.00	0.88	0.88
I do not think there is a big problem with air quality [R]	3.75	1.01	0.65	0.64

[R]: Statement has been reverse coded

M. - Mean; S.D. - Standard Deviation; F.L – Factor Loading; S.R.W – Standardised Regression Weights

The response on all items ranged between 1 and 5

4.2 Correlation Analysis

The results of the correlation analysis are summarised in Table 3. It is clear that a substantial degree of association between the constructs of the conceptual framework is present. Acceptability shares positive relationships with social norm (r: 0.416), perceived behavioural control (r: 0.451), attitude (r: 0.449) and personal norm (r: 0.443) which are in agreement with the expected relationships of the conceptual framework. A similar agreement in interaction is observed for the remaining endogenous variables included in the framework (i.e. variables that are explained within the SEM) and the constructs which are connected to them. For example, personal norm is conceptually informed by the policy specific beliefs included in the framework, with moderate correlations being present to positive affect (r: 0.490), perceived benefit (r: 0.459), and negative affect (r: -0.423).

The distal constructs of trust in government and problem perception hold a mixture of weak to moderate correlations with the policy specific beliefs. In the case of trust, moderate correlations are observed with perceived risk (r: -0.414) and outcome efficacy (r: 0.414) while a weak relationship is present with perceived benefit (r: 0.258). Interestingly, the strongest relationships present for problem perception are with social norm (r: 0.581) and personal norm (r: 0.643). These findings may imply that the link between problem perception and norms is not only mediated by the policy specific beliefs but also holds a direct connection. Such a link is partially supported in the existing literature on TDM which has identified a significant path between problem perception and personal norms (Cools et al. 2010; Eriksson et al. 2006). To evaluate whether such links are present for LEZs, the structural equation model will modify the conceptual framework to include hypothesised connections between problem perception and personal norm as well as problem perception and social norm.

Table 3: Correlation analysis between the constructs included in the conceptual framework

	ACC	DF	TRU	PBC	PP	PR	PA	PB	SN	NA	PC	OE	PF	PN
ACC	1.000													
DF	.504	1.000												
TRU	.369	.361	1.000											
PBC	.451	.440	.263	1.000										
PP	.429	.243	.160	.306	1.000									
PR	-.303	-.492	-.414	-.208	-.144	1.000								
PA	.645	.419	.376	.339	.434	-.284	1.000							
PB	.534	.205	.258	.329	.466	-.180	.376	1.000						
SN	.416	.237	.293	.252	.581	-.145	.409	.458	1.000					
NA	-.645	-.605	-.382	-.627	-.393	.391	-.496	-.408	-.349	1.000				
PC	-.350	-.539	-.295	-.329	-.232	.521	-.229	-.247	-.204	.530	1.000			
OE	.510	.488	.414	.271	.223	-.471	.394	.453	.307	-.538	-.411	1.000		
PF	.463	.210	.482	.276	.222	-.152	.297	.444	.317	-.351	-.177	.352	1.000	
PN	.443	.252	.279	.279	.643	-.267	.490	.459	.580	-.423	-.293	.281	.255	1.000
ATT	.449	.268	.268	.276	.348	-.356	.228	.387	.310	-.514	-.529	.466	.312	.349

ACC – Acceptability; **SN** – Social Norm; **ATT** – Attitude; **PN** – Personal Norm; **PA** – Positive Affect; **NA** – Negative Affect; **PB** – Perceived Benefits; **PC** – Perceived Costs; **OE** – Outcome Efficacy; **TRU** – Trust; **PF** – Procedural Fairness; **DF** – Distributive Fairness; **PP** – Problem Perception

4.3 Demographic Analysis

Table 4 reports on a series of test of differences which consider whether public acceptability to LEZs vary across demographic cohorts. For all the characteristics included in the analysis, significant differences are observed with LEZ acceptability. Females tend to exhibit higher acceptability as compared to males. Acceptability tends to scale with age, with younger individuals typically being most favourable towards the introduction of LEZs while those over the age of 65 are more inclined towards negative views. This overlaps with how acceptability varies by economic status, with students

generally exhibiting positive acceptability of LEZs whereas retired individuals are more likely to disapprove of the policy. Acceptability towards LEZs also tends to be lower for individuals that hold a driving license and have access to cars within the household.

These results typically follow what would be expected given how interest in sustainability policies is predominant in younger age groups while drivers are most likely to be incumbered by the introduction of LEZs. One practical use of these results is to identify the demographic cohorts that may require focused attention in order to gain wide support for LEZ introduction. For instance, retired individuals tend to be more engaged with political activity and can hold a disproportionate ability to steer policy design and implementation. Given that retirees are more inclined to view LEZs in a negative light, targeting this demographic cohort with awareness raising campaigns that emphasise the positive implications of LEZs may improve the chances of the policy being approved by local government.

Table 4: Tests of difference on public acceptability towards Low Emission Zones with reference to demographic cohorts

		Acceptability Factor Score		
Variable and Test Result	**Category**	**Mean**	**Std. Dev.**	**Mean Rank**
Sex	Female	0.059	0.894	1095
(Z: -2.094, p-value < 0.05)	Male	-0.063	1.061	1043
Age	Under 26	0.423	0.862	1316
(χ^2: 46. 395, p-value < 0.01)	26 to 45	0.037	0.972	1098
	46 to 65	-0.097	1.000	1008
	Over 65	-0.125	0.950	998
Economic status	Working full-time	-0.010	0.998	1064
(χ^2: 36.162, p-value < 0.01)	Working part-time	0.018	0.931	1081
	Unemployed	-0.006	1.104	1078
	Student	0.384	0.946	1313
	Retired	-0.135	0.955	979
	Other	0.173	1.056	1091
Driving license	Yes	-0.114	1.004	1000
(Z: -8.683 p-value < 0.01)	No	0.330	0.834	1267
Car availability	0 cars	0.287	0.902	1257
(χ^2: 15.596, p-value < 0.01)	1 car	-0.014	0.967	1057
	2 or more cars	-0.034	1.002	1024

4.4 Structural Equation Model

The initial structural equation model of the conceptual framework found a series of anticipated links to be insignificant in terms of their effect on the endogenous variables (i.e. p-values exceeding 0.05). The reduced version of the framework is illustrated in Figure 2, where the insignificant paths are removed from the analysis to generate a parsimonious model.

Two expected links are noteworthy for their absence. Perceived behavioural control, which measures whether an individual considers a LEZ to have consequences for their mobility patterns, does not hold an affect over acceptability. In a general sense, perceived behavioural control is typically the most prominent indicator of behavioural intentions across different application topics (Armitage and Conner, 2001). While perceived behavioural control does not feature prominently in the existing empirical research on TDM acceptability, the analysis of public reaction to congestion charging in China conducted by Xianglong et al. (2016) does indicate that this construct is the most important in explaining willingness to reduce car use. The insignificance of perceived behavioural control in

explaining public acceptability to LEZs could be motivated by respondents tending to believe that urban centres in Scotland are generally well connected by public transport (i.e. extensive bus networks and park-and-ride services being present), meaning restricting access by car to the city centre may not adversely impact their acceptability of LEZs.

Distributive fairness, which covers perceptions of the allocation of costs and benefits of the policy across society, does not have an effect over the attitudes or personal norms held towards LEZs. This is a somewhat surprising finding, as considerations of fairness have been shown to be one of the most important issue in evaluations of TDM measures in past work (Cools et al. 2011; Kim et al. 2014; Jagers et al. 2017). One element of the Scottish Government's overall strategy is the pursuit of just transitions, with the theme of social equity featuring heavily in Scotland's national performance framework which underpins policy making activity. Given this, the finding suggests that distributive fairness, while important per se, may not play a key role in the acceptability of measures like LEZs, if issues of procedural fairness are satisfactorily addressed.

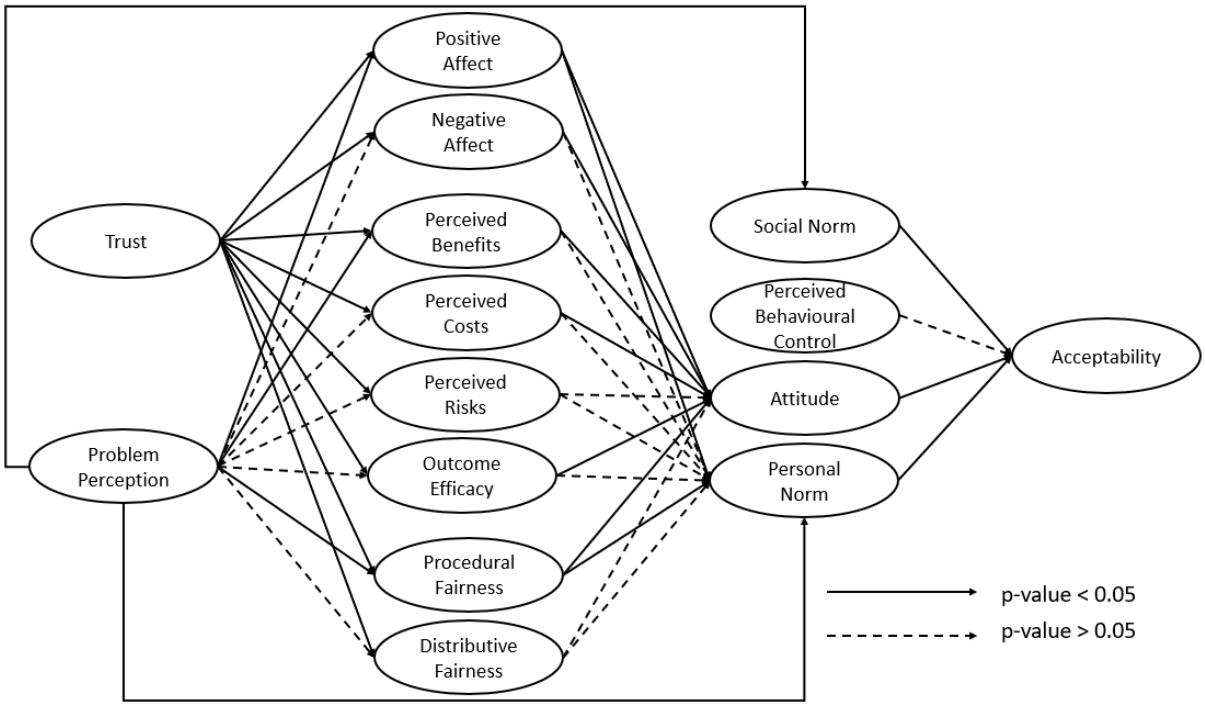

Figure 2: Reduced version of the conceptual framework with the parsimonious model incorporating significant paths

The structural equation model on the reduced version of the framework (i.e. the parsimonious model) is summarised in Table 5, covering the standardised direct, indirect, and total effects This model is satisfactory in terms of its goodness-of-fit (CMIN/DF: 4.035, AGFI: 0.919, RMSEA: 0.039, PCLOSE: 1.000), with the model's structure adequately representing the data. To facilitate the discussion of the model, each of the endogenous variables included in the framework is examined.

Acceptability

The attitude held toward a LEZ, measured by perceptions of value-for-money and policy priority, represents the most important issue informing acceptability of LEZs (Direct Effect: 0.785). Given the close affinity between the statements that comprise the attitude and acceptability measurements, it is unsurprising that they are strongly linked. In this sense, the difficulty in untangling attitude from

acceptability could be the reason why the construct of attitude is generally omitted from evaluations of public reaction to TDM. Personal norms also appear to support acceptability (Direct Effect: 0.120), though the size of the estimated parameter indicates they are of secondary importance. This subordinate role for personal norms in acceptability is generally identified in past work on TDM pubic response, with both Eriksson et al. (2008) and Xianlong et al. (2016) finding personal norms to be the least important factor on the acceptability of raising fuel duty and introducing congestion charging respectively. Social norms display the smallest effect on acceptability (Direct Effect: 0.066), indicating that the thoughts of important others may not be of primary concern when individuals are forming their views of LEZs. Taken as a whole, the results of the framework indicate that the attitudes formed regarding LEZs are playing a dominant role in the level of public acceptability held towards this policy while the prominence of norms is muted.

Attitude

Given the central importance of attitude in LEZ acceptability, it is important to consider what constructs underpin the positions held. In the conceptual framework, attitudes are informed by a series of policy specific beliefs. The results of the analysis indicate a subset of these policy specific beliefs are useful in explaining how the public respond to the proposed implementation of a LEZ. How effective LEZs are considered to be at improving air quality tends to promote positive attitudes for these measures (Direct Effect: 0.117). This finding is in agreement with past research on TDM acceptability, which has generally found that perceived effectiveness of the policy is linked to public reaction (Eriksson et al. 2008; Cools et al. 2011; Kim et al. 2014). Similar findings are observed for the assignment of positive emotions to LEZs (Direct Effect: 0.280) and viewing the procedures governing the operation of the policy to be developed in the correct manner (Direct Effect: 0.203). Conversely, considering the social costs of a LEZ to be substantial (Direct Effect: -0.232) and assigning negative emotions to the implementation of LEZs (Direct Effect: -0.218) tends to depress attitudes.

Personal and Social Norms

A reduced set of policy specific beliefs informs the personal norms formed around LEZs. The degree to which LEZs are viewed as generating benefits for society positively affects personal norms (Direct Effect: 0.118), with optimistic views on the procedural fairness of the policy also positively linked (Direct Effect: 0.139). The most important factors for personal norms are the attachment of positive emotions to the policy (Direct Effect: 0.426) and the awareness of air quality issues (Direct Effect: 0.299). This corresponds well with Eriksson et al's. (2006) appraisal of public acceptability of TDM measures, where understanding of the problem being targeted by the measure was found to be prominently linked to the personal norms held. A similar situation is also present for social norms, where perceptions of air quality as a problem that needs to be solved is positively linked with the perceived importance of this issue in society (Direct Effect: 1.111).

Policy Specific Beliefs

The feelings and evaluations held on LEZs are themselves informed by a set of distal precursors covering trust and problem perception. Trust in the ability of the government to effectively implement a LEZ is linked to the assignment of positive emotions to the policy (Direct Effect: 0.635) as well as the egress of negative emotions (Direct Effect: -0.938). Moreover, trust is positively associated with perceived benefits (Direct Effect: 0.518), policy effectiveness (Direct Effect: 0.848), and the fairness of the procedures governing LEZ operation (Direct Effect: 0.764) alongside the distribution of outcomes (Direct Effect: 0.712). Awareness of air pollution problems appears to be playing a secondary role in policy specific beliefs, supporting perceptions of social benefits (Direct Effect: 0.347), procedural fairness (Direct Effect: 0.203), as well as the assignment of positive emotions (Direct Effect: 0.245).

This arrangement corresponds to the findings of both Schmöcker et al. (2012) and Kim et al. (2014), whose assessments of public acceptability of TDM measures indicate that trust in government and problem awareness underpins policy specific beliefs, though perceptions of trust tend to be dominant.

Table 5: Results of the structural equation model on the reduced framework covering direct, indirect, and total effects of the exogenous variables on the endogenous variables

Endogenous Variable	Exogenous Variable	Direct Effect	Indirect Effect	Total Effect
Acceptability	Personal Norm	0.120**		0.120**
	Attitude	0.785**		0.785**
	Social Norm	0.066*		0.066*
	Problem Perception		0.243**	0.243**
	Trust		0.712**	0.712**
	Procedural Fairness		0.176**	0.176**
	Outcome Efficacy		0.092**	0.092**
	Perceived Benefit		0.014**	0.014**
	Perceived Cost		-0.182**	-0.182**
	Negative Affect		-0.171**	-0.171**
	Positive Affect		0.271**	0.271**
Attitude	Procedural Fairness	0.203**		0.203**
	Outcome Efficacy	0.117**		0.117**
	Perceived Cost	-0.232**		-0.232**
	Negative Affect	-0.218**		-0.218**
	Positive Affect	0.280**		0.280**
	Problem Perception		0.137**	0.137**
	Trust		0.840**	0.840**
Personal Norm	Problem Perception	0.299**	0.219**	0.518**
	Procedural Fairness	0.139**		0.139**
	Perceived Benefit	0.118**		0.118**
	Positive Affect	0.426**		0.426**
	Trust		0.438**	0.438**
Social Norm	Problem Perception	1.111**		1.111**
Positive Affect	Problem Perception	0.334**		0.334**
	Trust	0.635**		0.635**
Negative Affect	Trust	-0.938**		-0.938**
Perceived Risk	Trust	-0.782**		-0.782**
Perceived Cost	Trust	-0.872**		-0.872**
Perceived Benefit	Problem Perception	0.398**		0.398**
	Trust	0.518**		0.518**
Outcome Efficacy	Trust	0.848**		0.848**
Procedural Fairness	Problem Perception	0.215**		0.215**
	Trust	0.764**		0.764**
Distributive Fairness	Trust	0.712**		0.712**

*: p-value < 0.05
**: p-value < 0.01

5. Conclusions

With governments across the globe considering the implementation of policies designed to improve air quality, understanding how the public react to such measures represents an important issue for

policy development and deployment. The conceptual framework applied in this paper provides guidance on this issue by examining the constructs which underpin acceptability to the introduction of a LEZ. The performance of this framework is compelling, displaying high levels of construct validity as well as explanatory capability.

The results of the framework indicate that acceptability to a LEZ is informed by a complex assortment of precursor constructs. These constructs are arranged in a tiered structure, with distal factors feeding into policy specific beliefs which in turn connect with theoretical antecedents to acceptability. The attitudes held towards LEZs, which reflect how an individual views the sensibility of such schemes, is found to be the most prominent factor connected with acceptability to the policy. This suggests that strategies aimed at affecting the constructs which underpin the attitudes held towards LEZs could be a means through which to improve public acceptability of the policy. The results of the analysis indicate that the policy specific beliefs covering perceptions of the cost, procedural fairness, and efficacy of the scheme display a significant direct effect on the attitudes held towards LEZs while awareness of air quality issues holds a significant indirect effect.

Taking each of these policy specific beliefs linked to LEZ attitudes in turn, a set of plausible recommendations can be put forward. Strategies to ensure that project costs are effectively estimated have been found in the past to be linked with public support for green infrastructure (Vandermeulen et al. 2011), indicating that transparency in the quantity surveying of any proposed LEZ implementation could promote public confidence in the policy. A similar approach could be taken in terms of project fairness, whereby the conduct of public consultations and openness in the planning process could be used as a means to demonstrate the equity implications of such schemes. In terms of project efficacy, empirical research has generally found LEZs to be successful in reducing the concentration rates of local air pollutants after implementation (Grange and Carslaw, 2019), with positive implications for public health (Pestel & Wozny, 2019). Such past evaluations could be brought to the attention of the public (including as part of participatory exercises) to show how the benefits intended from the policy are likely to be realised. This attention raising exercise could be combined with a drive to educate citizens about the harm air pollution has on human health (Mahajan et al. 2020) to ensure awareness of the issue is raised amongst citizens.

The norms held towards LEZs hold a secondary role in terms of their linkages to acceptability, though scope still exists to utilise norms in order to improve perceptions of such schemes. For instance, a strategy to align LEZs with the wider shift in personal norms towards sustainability could be a means to connect the policy to the core values that citizens hold. Similarly, promoting a positive social opinion of the policy could convey the message that LEZs are not being imposed 'top-down' by policy makers, but are backed by a 'grassroot movement' of citizens concerned about air quality. This was for example the case in Milan, where a bottom-up referendum promoted by citizens' associations led to an upgrade of the LEZ scheme, going further than the city government's plans (Mattioli, et al., 2012). Further support could be attained by highlighting public support from key opinion leaders (e.g. City Mayors). Hysing and Isksson (2015) note that decisive political leadership was a visible aspect of the successful introduction of congestion charging in Gothenburg, Sweden, while a lack of a clear political champion is highlighted by Rye et al. (2008) as being a factor leading to the non-implementation of such a policy in Edinburgh, Scotland.

The assignment of emotions to a TDM policy is an area that has received little attention in the existing research on the topic. The preliminary work by Bamberg et al. (2011) indicates that anticipated emotions play a role in underpinning personal norms towards reducing car use. To determine if this

holds true for acceptability of LEZs, the conceptual framework contains measurements of positive and negative affect, covering such elements as pride, excitement, frustration, and annoyance. These constructs are found to hold significant direct effects to both the attitudes and personal norms held towards a LEZ. In addition, the measurements of emotion display moderate indirect effects on acceptability through these mediating constructs. The policy implications of these results are that ensuring LEZs are connected with positive feelings and avoid negative emotions would be a means through which to boost public acceptability. Communication and marketing campaigns developed to promote public engagement with the policy could prominently include positive emotional content, linking the policy with feelings of happiness while connecting the occurrence of local air pollution with negative emotional imagery such as sadness.

Certain TDM policies can be positioned in such a way which brings into questions the motives of the government bodies which design and implement them. A usual example of this is the view that increases to fuel duty or parking charges are a means to generate more revenue for the state rather than as a way to mitigate environmental damage and urban congestion. The results of the conceptual framework indicate that trust in government underpins the policy specific beliefs held about LEZs, with increases in trust linked with improved feelings and evaluations of the policy. The high degree of linkage that trust holds with the policy specific beliefs also feeds through the conceptual framework, with large indirect effects being present with attitudes, personal norms, and ultimately acceptability. Governments considering the introduction of LEZs can utilise this knowledge to promote public acceptability through such means as ensuring the development process for the policy is transparent and inclusive. This could be achieved by an extended public consultation on the policy where the competency of the government in delivering complex transport measures is reinforced, potentially by highlighting previous success stories to demonstrate a track record of effective delivery.

One issue that this project did not examine relates to preferences for ancillary measures, which are designed to improve public perceptions of the LEZ. Such measures could cover the expansion of public transport operations, the subsiding of public transport fares, and investment in active travel infrastructure. Hypothecation of revenues generated by TDM schemes towards improvements in the transport system have been found to be linked to increased acceptance of these policies (Schuitema and Steg, 2008). This is likely due to the introduction of TDM schemes being framed as policies to enhance the operation of the transport systems. With LEZs being implemented to reduce the concentration of local air pollutants, it is arguable whether allocating the revenue generated by these policies to such accounts as public health would be preferable. Future research may want to consider this issue to determine what ancillary measures could be introduced to improve public acceptability of LEZs and how acceptability of LEZs generally as well as ancillary measurers differs across environmental contexts and demographic structures.

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