

EXPLORING A CASE OF CAR USAGE AND OWNERSHIP REDUCTION IN DUBLIN THROUGH CAR-SHEDDING INTERVENTIONS

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Abstract

This paper examines the concept of 'car-shedding' and the range of interventions it promotes, in addition to identifying suitable target subpopulations in Dublin, Ireland, that could benefit most from their application. 'Car-shedding' is the term given to the collection of measures applied to encourage and incentivise the usage of sustainable transport modes, whilst, making the usage of private vehicles less beneficial. This research proposes that certain subgroups should be targeted for car-shedding measures as a means of shifting car usage to alternative modes. To identify potential car-shedders, a survey was created, which examined the commuting habits of the commuting population to single out those most likely to reduce car ownership/ usage, explored their motives for taking a transport mode as well as their perceptions of private car usage in Dublin and socioeconomic characteristics. The socio-economic characteristics of the respondents were used to isolate those that were keenest to switch to more sustainable modes and those that were completely against the idea of a modal switch. In the event of respondents expressing that they did not wish to switch transport mode, follow-up questions were posed to ascertain why this was so and what could be done to alter this travel decision. The data analysis conducted of results from the survey suggested that individuals with an age profile of 34-44 years, who live in the suburbs but travel to work or study in Dublin city centre, earning on average €25,000 to €49,000 per annum with a least one car available to the household would be best suited and most interested in reducing their usage of their car or car-shedding in favour of making use of sustainable travel modes such as: bus, train, cycling and walking etc. In this way, this paper proposes that these sub-groups should be targets for car-shedding incentives and other measures to encourage voluntary travel behaviour change.

1. INTRODUCTION

'Car-shedding' is hereby defined as the composite term given to the collection of interventions applied to encourage and incentivise usage of sustainable transport modes and simultaneously making usage of private vehicles less beneficial to regular drivers. Such measures aim to stimulate the reassessment of the need to use or subsequently own a private car, and in this way reduce usage/ ownership through selling or forfeiting ownership of the vehicle as a subsequently unused asset (with increasing rates of depreciation) and substituting sustainable options in its place. This concept will hereafter be referred to this definition in this paper, which examines the socioeconomic composition of those commuting to work/education in Dublin and their travel patterns, with a view to identifying commuters who may be more receptive to car-shedding tools. Dublin has recently witnessed a surge in the numbers of commuters taking sustainable transport modes, with 2015 seeing an extra 7.7 million passenger journeys on the Dublin Bus (up 2.8%), Irish Rail (Up 5.3%) and Luas

(Up 6.1%) services. Furthermore, numbers of cyclists entering Dublin city increased by 74.5% between 2010 and 2014 (DTTAS, 2016). Indeed, 2015 showed the highest proportion ever recorded of people using sustainable modes to access the city (Irish Times, 2016). Yet private cars are still the dominant mode as in 2014, 63% of all journeys were taken by car in the Greater Dublin Area (GDA) and there was a 31% growth in new cars being registered in 2015 (DTTAS, 2016). Car-shedding interventions offer a means to attract more commuters to public transport and active modes as well as rewarding car users that carpool or car-share. This paper discusses these interventions and through the analysis the results of an exploratory survey identifies specific cohort of the population of Dublin which have been deemed most likely to consider shedding a private vehicle. The following paper is arranged in four sections: Section 1 has introduced the context for the paper; Section 2 includes a literature review of the mechanisms to encourage car-shedding; Section 3 examines the survey data collection process, as well as presenting the data analysis and results; and Section 4 involves a discussion of the results from the survey and proposes plans for further research in this area.

2. MECHANISMS TO ENCOURAGE CAR-SHEDDING

Behaviour change is best attained through a mix of interferences (hard and soft measures), carried out over a considerable length of time. Car-shedding promotes two forms of interventions: firstly, in the form of soft policy delivered through information provision techniques and secondly, by means of market based instruments (MBIs) i.e. targeted taxes, charges, constraints and fees to deter car use and specific compensation schemes, subsidies, service improvements and other incentives to catalyse the adoption of alternative modes. Brog, et al. (2009) suggest that attitude change and subsequently behaviour change, can occur through a 'soft policy' approach, that provides people with personalised information, 'which enables them to improve their perception and to motivate them and empower them to make their own decisions, rather than telling them what they should do'. In the context of discrete-choice of travel modes, soft policy methods seek to provide individual users with more idiosyncratic travel choices based on certain information provision which 'can encourage a shift from car travel to more sustainable modes, and [in this way] may increase public support for direct actions to limit car use' (Cirillo, Axhausen, 2006). Soft policy commonly includes travel demand management (TDM) actions such as: individualised marketing, travel blending, personalised information services and awareness campaigns, travel plans and concessions on particular public transport services, which all seek to simply and ease the switch from car travel to sustainable modes. Companies such as IndiMark® and MaaS Global's *Whim* app are shining examples of this approach put into action (see whimapp.com and socialdata.de). The soft policy approach is supported by Thaler and Sunstein (2008) who consider that offering a choice context in a way that helps individuals overcome their own 'preconceptions highlights the potential benefits and supports their choices, without limiting personal freedom'. To demonstrate its effectiveness, Fujii and Kitamura (2003) provide an example of a soft policy experiment, whereby a free bus travel pass was offered to a sample of car drivers for one month. The expected outcome and research objective was that the drivers would be encouraged to take the bus so that their car-use habit would be broken and subsequently be replaced by a bus-use habit (Garling, Axhausen, 2003). As a result of this, they found that the attitudes of the group of drivers became distinctly more positive towards bus travel, as 'the frequency of use increased even one month after the period when the free bus pass was valid... [and most strikingly] choices of car became less habitual' (Garling, Axhausen, 2003). Consider another setting, this time offered by Martin and Shaheen (2003), of a married couple who usually commute by car to jobs in different locations. The husband begins to choose instead to take a different mode of transport to work, for example: public transport, walking or cycling. The couple consequently decide to shed the older of the two vehicles and the wife then drives the remaining car to commute once they become a one-car household. Car-shedding interventions seek to create scenarios like this, which in essence converts multiple car households to car available public transport/ active mode users or even households with no car available. This paper proposes that personalised marketing and travel planning akin to the Fujii and Kitamura experiment should be trialed in specific areas of Dublin on a community level, which have been noted as having high levels of car ownership and usage, with a range of alternative transport options also available in order to provide a choice scenario potential car-shedders. Personalised

marketing is a behavior change programme which presents 'a combination of education, persuasion and provision of personalized information to either individual households or individual people (O'Fallon, Sullivan, 2003).

The second approach is through market-based instruments (MBIs) consisting of specific economic tools such as taxes, charges, and fees make car usage less beneficial and convenient for people commuting by car as well as offering specific compensation schemes, subsidies and other incentives to award those commuting sustainably. In addition to this, divestment from tax revenues on fossil fuels should be directed towards upgrading the public transport infrastructure and improving facilities for walking and cycling. Of course, such measures should be approached carefully as they can be met with strong opposition and even anger which would not be a politically attractive prospect. Which is why a necessary amount of planning and evidence-based research (e.g. stated preference surveying) must be conducted prior to implementation. This approach is best explained with used of the carrots and sticks idiom (i.e. the carrots represents a reward and sticks - a punishment for opposing behaviour). In this case, the sticks or 'push factors' characterize measures to make car usage less beneficial and the carrots or 'pull factors', characterize measures to encourage or incentivise usage of alternative modes (O'Fallon, et al., 2004). The sticks tools can take the form of pricing (e.g. increasing parking constraints/ surcharges, a cordon/ congestion charge and increasing tolls at peak times, increasing fuel prices and registration tax), or regulatory measures (e.g. converting on-street parking to parking for bicycle or electric/ hybrid vehicles only, restrictions on car usage by license plate numbering and low emissions zones). Common carrots instruments are public transport concessions, grants for purchases of electric/ hybrid vehicles, travel credits for cycling and walking, in addition to free parking for carpoolers/ car-sharers and electric vehicles. Grants of up to €5,000 for purchases of electric vehicles and €2,500 for plug-in hybrid vehicles are currently in place in Ireland in addition to zero vehicle registration tax (VRT) for electric vehicles, yet this paper proposes that more could be done to encourage more people to shift to alternative modes, preferably non-motorised. Restrictions or constraints on the availability of parking offered by employers and cheap inner city parking lots and the removal of cash fares aboard buses as seen in London, whereby fare payments are only handled electronically through the usage of an *Oyster* card or a contactless-debit card in order to minimize bus stop times (TfL, 2016); are examples of push-pull measures that can be implemented in Dublin to restrict car usage and make public transport more time-efficient and in this way more attractive to potential car-shedders.

Car-sharing, carpooling are similarly smart and affordable alternatives to car ownership which offer all the benefits of owning a car (e.g. freedom, comfort and convenience), without the financial burden that the rising cost of ownership poses. They have been recognized as a means of lowering the total number of vehicles owned (i.e. two car household shedding one car), which supports the claim that shared mobility options influence car-shedding (Martin, Shaheen, 2003; Martin, et al., 2010). In addition to reducing the ownership of private cars, car-shedding tools and shared ownership schemes can deter carless households from car ownership uptake (Martin, Shaheen, 2003), as well encouraging car owners to shed old vehicles and purchase new alternatively fueled vehicles. Car-sharing research conducted by Martin and Shaheen (2003;2010), has projected that approximately four to six vehicles can potentially be shed for every car-sharing vehicle, and that 'every car-sharing vehicle removes between 9 to 13 other vehicles from the road. In reference to similar work conducted by Cervero et al. (2007) they revealed that the convenience of having a fleet of vehicles available on demand, prompted some car-sharers to shed second cars, put off buying new vehicles and even forego car ownership outrightly.

Pooley, et al. (2013) have put forward a number of other policy recommendations to promote sustainable transport usage, which are very much applicable to engendering car-shedding in Dublin. Firstly, there is a critical need to address the safety of cyclists and pedestrians through creating a safe and risk-free environment by reducing traffic speeds especially in residential and inner city areas. The provision of fully segregated cycle lanes, that do not mix with road traffic or pedestrians; as well as well-maintained and well-lit active mode routes that engender a feeling of security which would increase footfall have been stated as appropriate action. Secondly, as previously noted greater attention must be given to campaigns to raise awareness of the benefits of taking sustainable transport, highlighting

issues of health, the environment and climate change. Furthermore, there must be an onus placed on road users such as bus and taxi drivers as well as private car drivers to respect vulnerable road users which could also be conveyed in soft policy publicity campaigns. Thirdly, the spatial structure and urban layout of amenities and facilities of our cities need to be modified so that ordinary errands can be carried out within a short distance, and in doing so increasing the density of our urban areas and ensuring services are in close proximity to each other through planning approaches which give public and active modes priority over the car (Pooley, et al., 2013). Finally, it is vital that social change occurs that normalises the use of public transport, cycling and walking to the extent that car travel may only be necessary for long-haul trips, which could be attained through enabling more flexible working hours and telecommuting (working from home), school transport schemes and community-based childcare initiatives along with advertising campaigns promoting the qualities of active travel and damaging effects of car travel (Ajzen, Fishbein, 1980).

2.1 The Study Area

In study area in question for this study was Dublin, Ireland. In recent years, Dublin has seen the introduction of a number of alternative travel options to the private car. There currently exists two car-sharing/car-club providers in operation; 'GoCar' and Toyota's 'Yuko' car club. GoCar, in partnership with the German car-sharing company 'Cambio' launched in 2008 and has grown substantially in Dublin and continues to be the largest car-sharing provider in Ireland. Yuko (Japanese translation for 'Let's Go') is Ireland's newest car-sharing provider, which, was launched in Dublin in June, 2016. Yuko is a noteworthy addition to the car-sharing scene of Dublin as the fleet of vehicles available to share are plug-in hybrids. In further support of shared mobility, a range of city bike sharing providers are also in operation in Cork, Galway, Limerick as well as the largest operation in Dublin which have grown substantially since launching in 2009. In Dublin, there are at present close to 1,600 bicycles at 102 stations with further station expansions planned, subject to funding. Over 15 million journeys have been made on the Dublin bikes scheme since its launch, with a long term subscription base of almost 60,000 people (Dublinbikes, 2016). A carpool networking website (www.carsharing.ie) similarly exists, which is supported by the National Transport Authority of Ireland (NTA) and acts as an online community for carpoolers that brings together travelers with matching travel destinations. Mobility services such as car and bike sharing, carpooling and on-demand taxi services like Uber etc., offer further sustainable alternatives to commuters, that can help the process of reducing the need to own a car, thus, simplifying the car-shedding process.

As routine decisions we make are not always made rationally and as result of an extensive thought process, many of the mundane choices we make are built into schedules and thus, tend to go unnoticed. Driving a car as opposed to taking public transport, cycling and walking, is an example of one of these habits or repeated actions for many households. 'Taking the bus to work on a regular basis eventually becomes a habit in the sense that little cognitive effort is required for continued execution of the behavior' and such habitual stability occurs due to the consistency of past experience and behavioral control which then correspond strongly to future behavior (Cirillo, Axhausen, 2006). Yet when the objective environment is modified, for example road congestion/ closure, diversions etc., which can lead to lengthy trip delays, the automaticity of behaviour (Bargh, 1997; Ajzen, 1991) is essentially disrupted. Research demonstrates that when habits are broken, this presents a vital opportunity to alter an individual's deep rooted behaviour and this opportunity must be grasped early, in order to make a lasting effect on future conduct (Lanzendorf, 2003; Martin, Shaheen, 2003). Changes in the life-cycle such as family planning and childbirth and changes as a result of employment/ education relocation also present significant windows of opportunity to establish new habits. By instigating car-shedding in areas of high public transport accessibility or areas of high urban density it is projected that trip patterns that are usually reliant on a car, can be shifted through soft policy measures aimed at encouraging more deliberation or reflection on modal choice, to redistribute the modal share of the private car in Dublin to sustainable modes.

This was the aim of the survey conducted in this research, as questions concerning reasons for taking a particular mode of transport and proposing means of shifting unsustainable mode preferences were included, in addition to the presentation of average car ownership

costs. Therefore, it is anticipated that by initiating deliberation amongst commuters that individuals may consider an uptake of more sustainable travel practices. Yet, the target market for soft measures must first be defined and by examining socio-demographics characteristics of the subject population, this can be accomplished. The purpose of the survey conducted as part of this research, was to do exactly this; to identify those most likely to consider car-shedding, i.e. those that should be targeted for soft measures. Time and cost attributes are naturally of concern to any traveler, as the individual will naturally choose the mode that minimises cost and time variables in line with utility maximization. Therefore, the goal is to lessen the temporal risks of taking public transport and active travel modes (through car shedding tools) posed to the individual in order to improve their image and boost a mode shift to sustainable mobility. These attributes were examined in the survey in order for the participant to make informed responses to the survey questions which will now be examined.

An online survey was conducted to gather information on the travel patterns and modal choices of commuters in Dublin, which took place in December, 2015. The survey was sent to a sample of those that live and work/study in Dublin in order to assess their commuting habits and travel preferences. The motives for taking their preferred transport mode and their perceptions of private car usage in Dublin were also analysed. Sociodemographic profiles of the commuters were examined in response to certain questions in the survey to identify those most interested in switching to more sustainable modes.

3. SURVEY AND RESULTS

An exploratory survey was conducted in December, 2015 with a total of 402 responses being recorded. The responses were collected online and the survey was distributed to various organisations, companies and businesses in Dublin. It was accepted that this survey focused on the commuting population in Dublin and was solely internet based, and would be generating a sample that would require access to the internet and be either in employment or education. As a result, the sample was not representative of the entire population of Dublin, but representative of the commuting population, which were of sole interest in this study. The respondents were asked attitudinal questions related to their chosen mode of travel to work/education in order to ascertain why their preferred mode was chosen over other modes and what, if anything, could be done to modify this preference. The questions gathered perceptions of the objective environment and explored the respondents' judgements on modal choices in order to provoke deliberation. The defining feature of their preferred mode was noted in order to analyse a scenario whereby, if this feature was present in another mode of transport, this would motivate the respondent to reconsider use of this mode in future. This question was in effect gauging interest in car-shedding and evaluating modal switch potential. The respondents were then questioned on their perceptions of private car usage and ownership regardless of whether they drive or not. This proved interesting in many respects, as a significant number of the respondents were aware of the environmental effects of driving a car (i.e. detrimental to air quality, noisy, stressful, expensive), however these aspects did not outweigh the benefits of car ownership (i.e. comfort, freedom and independence, symbol of prestige and success). Many of the respondents voiced their opinion that accessibility in their residential area was poor and this led to having no other option but to drive to work/ education, in other words, forced car ownership. Garling and Axhausen (2003) agree that the 'unavailability of alternatives [to the car] is of course a main obstacle [that prevents switching to other modes]. Yet, inertia or habit may also play an important role'.

3.1 Characteristics of the sample

Table 1 displays the characteristics of the sample collected from the survey. The results illustrate that a higher proportion of the sample were male, within the age cohort of 35 to 44 although closely followed by the 25-34 age profile. Just over half of the respondents were married with no children and earned on average between €25,000 and 49,999 per annum. A large percentage of the sample possessed a driver's license which, however, did not necessarily correlate with a decision to commute to work/ education by car. The residential location of the sample is in distinct contrast to the employment location of the sample, as a higher percentage of the sample live in the suburbs and urban fringe which, are predominantly low density areas and work/ study in Dublin city centre. This is indicative of

the large numbers of people commuting in Dublin by car to their place or work/ education, a commute which is renowned for long commuting times due to the longer distances, from residential areas with poor public transport accessibility (DTTAS, 2016). In terms of the modal split of the sample: driving a car had the highest share with almost 40%, followed by taking the bus, cycling, the train and walking, of which 77% of respondents stated were taken five times per week.

TABLE 1: Characteristics of the Sample

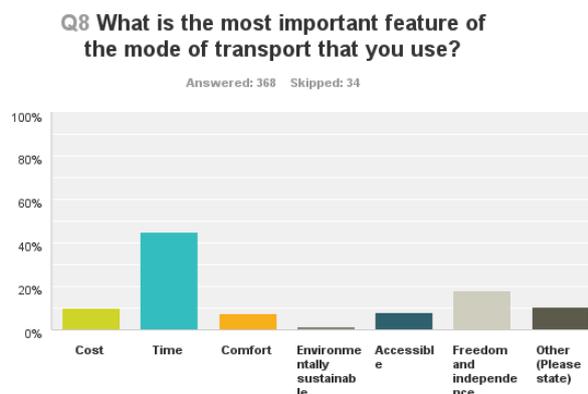
	N	%		N	%
<i>Gender</i>			<i>Possession of a driver's license</i>		
Male	159	52.13	Yes	293	86.23
Female	146	47.87	No	42	13.77
Total	305	100	Total	305	100
<i>Age</i>			<i>Average annual income range</i>		
18-24 years old	15	4.90	€24,999 or less	32	10.50
25-34 years old	76	24.92	€25,000 - 49,999	130	42.62
35-44 years old	95	31.15	€50,000 - 74,999	87	28.52
45-54 years old	82	26.89	€75,000 or more	31	10.16
55+ years old	37	12.14	I'd rather not say	25	8.20
Total	305	100	Total	305	100
<i>Marital status</i>			<i>Residential location</i>		
Married	156	51.15	Dublin City Centre	40	13.11
In a relationship	75	24.59	Suburbs	195	63.94
Single	64	20.98	Urban fringe/ rural	70	22.95
Other	10	3.28	Total	305	100
Total	305	100.0			
<i>Number of children/ dependents</i>			<i>Location of employment/ education</i>		
None	160	52.46	Dublin City Centre	167	54.75
One	42	13.77	Suburbs	118	38.69
Two	64	20.98	Urban fringe/ rural	20	6.56
Three or more	39	12.79	Total	305	100
Total	305	100	Total	305	100

3.2 Data Analysis

This section of the paper examines the results from the survey. In one question from the survey, the respondents were asked if they would be willing to 'car shed' if the most important feature of their preferred mode of transport was present in another more sustainable mode. The most important features (cost, time, comfort, environmental sustainability, accessibility, freedom and independence) of their mode of transport were noted in the question previous, in which, *time* was the leading answer, as illustrated in figure 1 below. Thus, this question observed, if public transport, cycling or walking were faster or more time efficient etc., than the respondent's current mode of choice, would this result in the respondents shifting their preference from car ownership to this alternative mode?

59% of the sample previously stated that they would consider switching to a sustainable mode if there were time or cost savings to be made. Many respondents stated that they would also switch for environmental, health and well-being reasons. The results of this question were crossed with socio-economic characteristics from the sample and cross tabulation and chi-square tests were conducted. The basis for conducting this analysis was to identify the characteristics of those in the sample that would consider reducing car ownership/ usage by switching to an improved or more attractive sustainable transport mode. The chi-square test revealed that residential location, annual income and the number of cars accessible to a household were most significant with a p-value of considerably lower than 0.05 (0.000, 0.010 and 0.000 respectively). Whereas work/education location showed no significant difference to the responses gathered. More respondents expressed that they would not consider shedding a car, nevertheless this research centred on those interested or those that could be persuaded to consider car-shedding, i.e. those who answered yes and maybe. Owing to these indicators, those residing in the suburbs (i.e. defined as outside the grand canal border surrounding inner city Dublin), working in Dublin city centre, earning between €24,999 and €49,999, with at least one car accessible to the household have been observed to be the subgroup most likely to consider shedding a car in favour of using more sustainable transport and in this way should be targeted to promote 'shedding' behaviour. Giuliano and Dargay (2006) draw comparable observations in terms of the significance of income, car ownership, and employment characteristics in an analysis of car ownership, travel and land use between the US and Britain. The decision to car-shed was made on the condition that alternative modes would have time-savings in order to properly compete with car travel times as well as fares becoming cheaper, hence making sustainable modes increasingly attractive options. These characteristics are useful in helping to target the recipients of car-shedding measures.

FIGURE 1: The most important feature of the mode of transport



The survey then proceeded to ask respondents for details of the car they drive, such as the engine size, model etc., this allowed the average costs of car ownership for this vehicle to be calculated. This was based on standing costs (i.e. average carbon emission based motor tax, insurance, parking) and operating costs (i.e. fuel, oil, tyres, servicing and repairs), presented in Euros (€) per month as well as cents per kilometre. Respondents who identified as non-drivers were not required to answer such questions as skip logic was applied. The sample were subsequently asked if they found the car ownership costs surprising in relation to their expenditure and secondly, by knowing these average costs if this would deter them from owning a car or simply commuting to work/education by private car. These results were then crossed with the socio-demographic characteristics and cross tabulation and chi-square tests were performed to analyse the results, these are presented in Table 2. The results taken from the cross tabulation show that there were significantly more surprised respondents, 206 (68%) stating yes and 94 (32%) stating no. Those most surprised were male in the 35-44 age bracket, who were married with no children, and earning on average €25,000-49,999 per annum. Chi-square tests were also run alongside the cross-tabulation, however these results proved insignificant.

TABLE 2: Cross-Tabs and Chi-Square Test Results

	Did these findings surprise you?					
	Yes		No		Total	
	N	%	N	%	N	%
<i>Gender^a</i>						
Male	107	51.9	50	53.2	157	52.3
Female	99	48.1	44	46.8	143	47.7
Total	206	100	94	100	300	100
<i>Age^b</i>						
18-24 years old	12	5.8	3	3.2	15	5
25-34 years old	48	23.3	27	28.7	75	25
35-44 years old	66	32	26	27.7	92	30.7
45-54 years old	56	27.2	26	27.7	82	27.3
55+ years old	24	11.7	12	12.8	36	12
Total	206	100	94	100	300	100
<i>Marital status^c</i>						
Married	110	53.4	44	46.8	154	51.3
In a relationship	49	23.8	25	26.6	74	24.7
Single	42	20.4	20	21.3	62	20.7
Other	5	2.4	5	5.3	10	3.3
Total	206	100	94	100	300	100
<i>Number of children/ dependents^d</i>						
None	102	49.5	55	58.5	157	52.3
One	27	13.1	14	14.9	41	13.7
Two	46	22.3	18	19.1	64	21.3
Three or more	31	15	7	7.4	38	12.7
Total	206	100	94	100	300	100
<i>Average annual income range^e</i>						
€24,999 or less	19	9.2	12	12.8	31	10.3
€25,000 - 49,999	91	44.2	37	39.4	128	42.7
€50,000 - 74,999	63	30.6	23	24.5	86	28.7
€75,000 or more	22	10.7	9	9.6	31	10.3
I'd rather not say	11	5.3	13	13.8	24	8
Total	206	100	94	100	300	100

- ^a Gender result: not significant ($p < 0.841$, chi-square = 0.40, 1 degrees of freedom).
^b Age result: not significant ($p < 0.712$, chi-square = 2.131, 4 degrees of freedom).
^c Marital status result: not significant ($p < 0.494$, chi-square = 2.397, 3 degrees of freedom).
^d Number of children/ dependents result: not significant ($p < 0.221$, chi-square = 4.400, 3 degrees of freedom).
^e Average annual income range result: not significant ($p < 0.97$, chi-square = 7.868, 4 degrees of freedom).

The average distances travelled to work/ study by the majority of people who live in Dublin are between 4-8 kilometres which have a duration of on average 15-30 minutes (CSO, 2014). Such trip attributes are very attainable by public transport and active modes as alternatives to the private car. The importance of time savings is similarly reflected in the results of Table 3 in which the demographic characteristics of age, residential location, work/education location and number of cars accessible to a household were run and analysed. The chi-square results indicated that age and the number of cars accessible were significant with p-values of 0.009 and 0.000 respectively. While there was no significant difference between the location of work/education and residential location variables. Predictably, the costs of car ownership did not phase many of the respondents in the sample as 174 expressed that they would not consider substituting usage of a car for alternative transport modes, yet this research aimed, to focus on those respondents who would be most likely to deliberate and could possibly be persuaded (i.e. those signalling a yes or maybe answer). The results are akin to those from Table 2, in revealing that those within the 35-44 age category, living in the suburbs, employed in the city centre and with one car available would be most likely to reassess commuting by car after reflecting on the costs owning a car.

TABLE 3: Cross-Tabs and Chi-Square Test Results

	By knowing the costs of owning a car would it make you reconsider car ownership or commuting by car to work/education							
	Yes		No		Maybe		Total	
	N	%	N	%	N	%	N	%
Age								
18-24 years old	7	18.4	5	2.9	3	3.4	15	5.0
25-34 years old	9	23.7	48	27.6	18	20.5	75	25.0
35-44 years old	11	28.9	49	28.2	32	36.4	92	30.7
45-54 years old	9	23.7	48	27.6	25	28.4	82	27.3
55+ years old	2	5.3	24	13.8	10	11.4	36	12.0
N	38	100.0	174	100.0	88	100.0	300	100
Residential location								
Dublin city centre	6	15.8	17	9.8	14	15.9	37	12.3
Suburbs	24	63.2	111	63.8	59	67.0	194	64.7
Urban fringe/ rural	8	21.1	46	26.4	15	17.0	69	23
N	38	100	174	100	88	100	300	100
Employment/ education location								
Dublin city centre	26	68.4	86	49.4	53	60.2	165	55
Suburbs	11	28.9	74	42.5	30	34.1	115	38.5

Urban fringe/ rural	1	2.6	14	8	5	5.7	20	6.7
N	38	100	174	100	88	100	300	100
Number of cars								
None	4	10.5	3	1.7	17	18.9	24	7.9
One	21	55.3	88	50.6	41	45.6	150	49.7
Two or more	13	34.2	83	47.7	32	35.6	128	42.4
N	38	100	174	100	90	100	302	100

^a Age result: significant ($p < 0.009$, chi-square = 20.411, 8 degrees of freedom).

^b Residential location result: not significant ($p < 0.327$, chi-square = 4.631, 4 degrees of freedom).

^c Location of work/ education result: not significant ($p < 0.178$, chi-square = 6.303, 4 degrees of freedom).

^d Number of cars accessible result: significant ($p < 0.000$, chi-square = 25.680, 4 degrees of freedom).

Table 4 presents the results of a One-way ANOVA analysis which was conducted using some of the socio-demographic variables present in Table 2 and 3. The ANOVA was crossed with the first question from the analysis as the chi-square results were more significant with the lowest p-values. According to the p-value results, the difference between means of the residential location (0.000) and number of cars accessible (0.000) variables were statistically significant in the decision to car-shed if the most important feature of their chosen mode of transport was present in another available mode. Average annual income (0.042) and the walking distance to public transport services (0.022) variables were also shown to be statistically significant but to a lesser extent. As a comparison the variables of gender and age were also run, though they produced statistically insignificant results as the p-value was greater than alpha. These statistically significant variables are also represented with larger F-ratios/statistics than the gender and age variables.

TABLE 4: Summary of One-Way ANOVA Results

Would you be willing to either sell a car that you own or delay buying a new car in favour of taking public transport/ walking or cycling if the most important feature you indicated was present?		
	F-statistics	Pr > F
Demographics		
Gender	0.322	0.571
Age	0.635	0.638
Residential location	9.818	0.000
Average annual income	2.504	0.042
Walking distance to public transport	3.271	0.022
Number of cars accessible	16.489	0.000

These results add further weight to the proposal for car-shedding measures to be targeted at those living in suburban areas, with an income of €25,000-49,999 per annum, with at least

one car available as these socioeconomic attributes are linked with a higher likelihood for consideration of switching to more sustainable alternatives than the private car.

4. DISCUSSION AND CONCLUSION

This paper has introduced the concept of car-shedding and has highlighted a number of strategies that car-shedding measures wish to promote to reduce usage of private vehicles. The paper presented the results of a survey reviewing the travel patterns and characteristics of commuters residing and employed/ studying in Dublin. The primary aim in conducting this research was to examine people's perceptions of car ownership and usage and to determine those more suitable for car-shedding initiatives if changes were to be made to the existing public transport services or walking and cycling infrastructure. It was noted that a high proportion of the sample expressed negativity towards the concept of car-shedding, though the reasons stated for this was due to poor access to or lack of alternatives to the private car as a means of transport to work or education. The results outlined in this paper suggest that individuals with an age profile of 34-44 years, who live in the suburbs but travel to work in Dublin city centre, earning on average €25,000 to €49,000 per annum with a least one car available to the household would be best suited and the most appropriate car-shedders. For this reason, travel behaviour and more specifically the perceptions of other modes, amongst the other policy recommendations noted, must be highlighted as the way forward in promoting more sustainable transport practices. Soft policy interventions that have significant effects on attitudes and perceptions of behavioural control have been purposed in this paper as actions going forward to stimulate positive and sustainable transport practices. Soft policy measures or travel demand management (TDM) tools have been proven to be most effective and have levels of acceptability, if pull and push policies are implemented as a combination as part of a package, than delivered individually or separately, i.e. multi-instrumentality (Vieira, et al., 2007; Eriksson et al., 2010; Habibian, Kermanshah, 2011). However, hard measures to improve public transport accessibility as well as infrastructure for all sustainable modes must take place alongside soft measures in order to maximise their effectiveness. These results will be useful in the next stages of this research when a more in-depth stated preference survey will be conducted to further examine potential of car-shedding measures in certain future scenarios in Dublin. Ultimately, in the event of more commuters opting to 'shed' one or more of their personal vehicles, along with improvements being made to public transport, cycling and walking infrastructure, changes in the modal shares could be experienced in the near future.

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