

Segmenting for Sustainability: The Development of a Welsh Model to Engage the Public in Sustainability and Sustainability-Related Issues

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Abstract

Wales is one of the few countries in the world that has adopted sustainability as a central organising principle for public policy. The Welsh Government has a statutory duty to promote sustainability in all policy areas and functions. This paper describes the development of the Welsh Sustainability Segmentation Model to engage the public in sustainability and sustainability-related issues. A nationally representative survey (n=1,538) was conducted from May to July 2011 on public beliefs about different aspects of sustainability, sustainability-related issues, and a range of behaviours in the domains of household energy use, travel and transport, waste and recycling, and water use. A cluster analysis identified six segments of the public that relate to sustainability in their own distinct ways. Even if the segments were solely constructed on the basis of thirteen distal psycho-social indicators, they had distinct socio-demographic profiles and showed varying patterns of behaviour. A short 15-item screening tool was developed to replicate the segments with at least 70% accuracy. Methodological and practical limitations to the use of segmentation for public policy are discussed.

Key Words: Audience Segmentation; Social Marketing; Wales; Sustainability; Environmental Behaviours.

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Introduction

Background

Sustainable development has become a major policy goal for governments, businesses, and communities around the world. Although the principle of sustainable development was already discussed at the 1972 United Nations Conference on Human Environment in Stockholm, it only received widespread attention through the publication of '*Our Common Future*' in 1987 (Brundtland Commission, 1987). The Brundtland report launched the now widely accepted definition of sustainable development as "*development that meets the needs of current generations without compromising the ability of future generations to meet their own needs*" (ibid). While it is often thought that sustainable development is about protecting the environment, it is much broader than that. Sustainable development involves the creation of *social, environmental* and *economic* conditions that allow each person to reach his or her full potential – now and in the future.

Wales is one of the few countries in the world that has adopted sustainability as a central organising principle for public policy. The Welsh Government has a statutory duty to promote sustainability in all its policy areas and functions, as set out in the '*One Wales: One Planet*' sustainable development scheme (Welsh Assembly Government, 2009). The Welsh Government conceptualises sustainability as enhancing the economic, social and environmental wellbeing of people and communities, achieving a better quality of life for the present and future generations in ways that promote social justice and equality of opportunity, while respecting the limits of the earth's resources (ibid). The Welsh approach thereby covers and integrates the environmental, economic, and social dimensions of sustainable development.

One of the greatest challenges in the pursuit of sustainability has been the development of effective policies and communications to foster meaningful and lasting behaviour change. Various scholars and practitioners have argued that the limited success of environmental policies to establish behaviour change is in part due to them ignoring individual differences and circumstances (McKenzie-Mohr, 2000; Darnton, 2008; Corner & Randall, 2012). Generic policies are likely to lead to sub-optimal results, as not all individuals will respond favourably to interventions or communications that have been designed for the 'statistical everyman' (Darnton, 2008). It is well known that the public experience barriers that hinder their engagement in environmental issues in a variety of ways (Lorenzoni et al., 2007). Identifying the motivations and barriers experienced by different 'publics' is critical to the success of environmental policies (McKenzie-Mohr, 2000); policies are more likely to be accepted if they can be designed to fit around individuals' existing lifestyles rather than the other way around (Corner & Randall, 2011).

Over the past decade, various attempts have been made to profile the public according to their views and behaviours regarding the environment. The most prominent model has been *Defra's framework for pro-environmental behaviours* (Defra, 2008). The model divided the public into seven groups that differed in terms of their *willingness* and *ability* to act on a number of headline behaviours. Perhaps most importantly, Defra's segmentation model has made policy-makers aware of the need to design tailored campaigns, and simultaneously

provided a tool to identify different segments of the public. The model has subsequently been used by a number of government departments (Zimmerman et al., 2012), NGOs (Horton & Doran, 2012) and academics (Miller et al., 2010). Unfortunately, only limited information is available about the rationale, development, and content of the model, making it difficult to determine in what way the seven segments differ from one another and thus how they should be approached.

Other models within the environmental domain have predominantly focused on a specific topic or environmental domain. For example, the *Global Warming's Six Americas* model has identified six unique segments of the American public that engage with global warming/climate change in their own distinct ways (Maibach et al., 2011). The segmentation was based on a comprehensive set of attitudinal and behavioural factors specific to climate change, including beliefs about the reality of climate change, involvement in the issue, climate-relevant behaviours and actions, and policy preferences for climate mitigation. In order to facilitate replication and dissemination of the model, the authors developed a short screening tool alongside the main model. This allowed the model to be used to track attitudes to global warming over time (e.g. Leiserowitz et al., 2012) and by various government and non-governmental organisations for programme planning or evaluation purposes (E. Maibach, personal communication, 17 January 2013). The travel behaviour segmentation model by Anable (2005) took a psychographic approach, only using psychosocial factors that are thought to influence travel behaviour. The model segmented a population of day travellers based on an expanded version of the theory of planned behaviour. The value of segmentation was confirmed by the findings that the same travel behaviour may take place for different reasons. This shows that interventions or communications need to be responsive to the different motivations and to provide acceptable alternatives for the different groups to change their behaviour. The model of Sütterlin et al. (2011) aimed to identify and profile different types of energy consumers in Switzerland. The segmentation was conducted on a theoretically coherent set of energy-related attitudinal and behavioural characteristics. Input variables were developed through an extensive review of the psychological literature on the determinants of energy-saving behaviours and a number of focus groups to gain further insights into consumers' views on energy consumption and saving. Sütterlin et al. (2011) identified six distinct energy consumers that differed in terms of their energy use and willingness and (perceived) ability to save energy. Other models within the environmental domain have attempted to segment the public in terms of their waste management and recycling practices (Barr et al., 2013) and travel and transport behaviours (Barr & Prillwitz, 2012).

While the latter models (Anable, 2005; Sütterlin et al. 2011; Barr & Prillwitz, 2012; Barr et al., 2013) all had coherent theoretical frameworks and produced clearly identifiable groups that could be used for public engagement purposes, they did not develop a screening tool alongside the main model. Without a screening tool that can be used to identify the segments with a limited number of questions, a model is less likely to be used by third parties – as there rarely is space to include all items of the full segmentation model. Furthermore, the focus on 'proximal' attitudinal items of certain segmentation models may be problematic. It is well known that environmental attitudes often have little to do with environmental behaviours (Kollmuss & Agyeman 2002) and may not create segments that

are stable enough to reflect more enduring lifestyle patterns (Koenig-Lewis & Palmer, 2008). Reliance upon ad-hoc selected attitudinal items on a single topic risks the development of a 'shades of green' model that does not add much to the conventional linear regression approach (cf., NCC, 1996; Cleveland et al., 2005) and may be less useful for policy makers and practitioners who are interested in engaging the public across different sustainability domains. While the typical psychographic approach is to segment the public by their activities and opinions, some models differentiate the public on the basis of environmental values and attitudes (Anable, 2005) or on environmental behaviours (Barr & Gilg 2006) alone. It could be argued that a comprehensive segmentation based on both attitudinal and behavioural factors can be used to identify specific patterns of living that reflect an individual's values and attitudes (Thornton et al., 2011). However, such an encompassing segmentation may be less useful as a tool for policy-makers and practitioners. By including both the determinants and target behaviours in the same model, the interventions may change the composition of the segments they are targeting.

The current study set out to develop a comprehensive segmentation model that can be used to engage the Welsh public in sustainability-related issues. In order for the model to be applicable across different departments and organisations, it was designed to encompass environmental, social and economic aspects of sustainability. While much is known about how the public perceive environmental and economic aspects of sustainability, attitudes to and/or beliefs about social sustainability remain largely uncharted terrain (Lehtonen, 2004). In this study we used *social capital* and *place attachment* as important indicators of social sustainability (cf., Uzzell et al., 2002). A further requirement of the model was that the segments had to reflect relatively stable publics within the Welsh population. The theoretical framework of the model therefore included core personal values (Schwartz, 1992) alongside public beliefs about the three pillars of sustainability. It was decided to exclude environmental behaviours from the segmentation itself to ensure that the resulting segments are less vulnerable to change as a result of behaviour change, engagement and communication initiatives.

Aims of the Research

The segmentation exercise consisted of a number of subsequent phases and related objectives. *First*, it set out to identify distinct publics in Wales based on their beliefs about sustainability and sustainability-related issues. This was done by conducting a series of cluster analyses on thirteen indices that formed the theoretical framework for the study (see Figure 1). *Second*, the study aimed to determine the socio-demographic profiles of the different segments in terms of gender, age, household type, and social grade, as well as in terms of neighbourhood deprivation and rurality. *Third*, it was examined whether the segments have different patterns of environmental behaviour in the domains of household energy use, travel and transport, waste and recycling, and water use, which are considered the environmental priority areas in Wales. *Fourth*, the study attempted to develop a short screening tool that can be used to identify the segments with a limited number of questions.

Method

The Study

A nationally representative survey was conducted in which 1,538 respondents were interviewed face-to-face. The interviews took place between 9 May and 26 July 2011. A multistage sample strategy was used. First, Wales was stratified into six regions. One hundred and forty four (144) sample points were randomly selected within these six regions.¹ Quotas were set on age, gender and work status for each sampling point to mitigate for known response biases. The rurality and level of deprivation of the sampling points were assessed using Defra's rural-urban classification and the Welsh Index of Multiple Deprivation, respectively.

Segmentation Variables

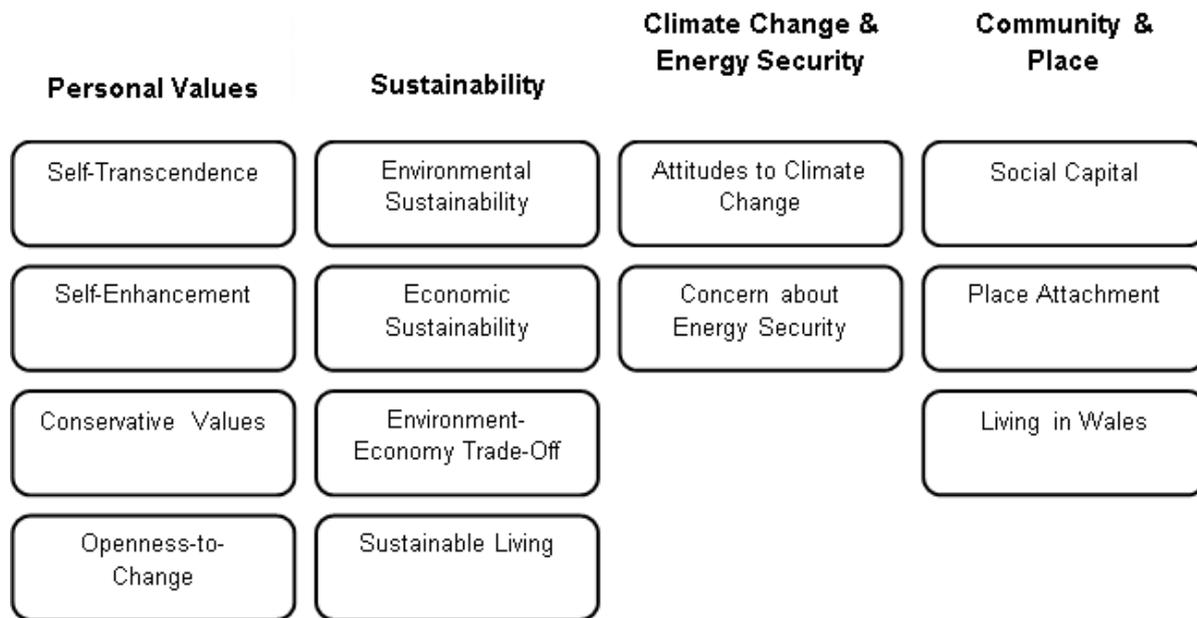
The segmentation analysis was conducted based on thirteen indices (see Figure 1). These scales were constructed from 47 items as described below. All thirteen scales were normalised by calculating their Z-scores.

Personal Values. Respondents were asked how important they found 23 values from Schwartz' Value Inventory (1992). They could respond using a 5-point scale ranging from "not at all important" to "extremely important". Scales were constructed based on the hypothesised value dimensions of *Self-Transcendence* (social justice, protecting the environment, being loyal, being forgiving, and being honest), *Self-Enhancement* (having authority, wealth, being successful, being influential), *Conservative Values* (honouring parents and elders, being obedient, family security, sense of belonging, and respect for tradition), and *Openness-to-Change* (exciting life, being curious, being independent, and enjoy life). A number of items were removed to improve the reliability of the scales. The reliabilities were sufficient for the analyses (Cronach's α of .70, .68, .68, and .60).

Beliefs about Sustainability and Sustainable Living. This section used existing and newly developed items to elicit people's views on environmental, economic and social aspects of sustainability. *Environmental Sustainability* was measured using three New Environmental Paradigm items (Dunlap et al., 2000). The scale was internally consistent (Cronbach's α =.60). *Economic Sustainability* was indicated by two items with a high level of correspondence between them (Cronbach's α =.73). Views on the *environment-economy trade-off* were indicated by two items. The reliability of the scale was just about acceptable (Cronbach's α =.59). *Social Sustainability* was captured by social capital, place attachment and attitudes to living in Wales as described in the 'Community and Place' section. Finally, respondents were asked about their attitudes to *Sustainable Living* (e.g., "Being green is an alternative lifestyle; it's not for the majority"). The internal consistency of the scale was low (Cronbach's α =.55), but could not be improved by adding or removing items.

¹ Each sample point was a Double Output Area (DOA) consisting of two adjacent Census Lower Level Output areas. Each DOA contains on average 250 households.

Figure 1: Segmentation Indices



Attitudes to Climate Change and Energy Security. Respondents' perceptions of climate change were captured by their responses to a number of questions (e.g., "It's not worth us trying to combat climate change, because other countries will just cancel out what we do" and "The seriousness of climate change is exaggerated"). The resulting scale was internally consistent (Cronbach's $\alpha=.73$). *Concern about energy security* was measured by asking respondents how concerned they are that in the future (a) electricity will become unaffordable, (b) supplies of fossil fuels (e.g. coal and gas) will run out, and (c) power cuts will become more frequent. The scale was internally consistent (Cronbach's $\alpha=.72$).

Attitudes to Community and Place. Social capital, place attachment, and attitudes to living in Wales were taken to reflect important components of social sustainability (cf., Uzzel et al., 2002). The *Social Capital* scale (Cronbach's $\alpha=.63$) used three items from the adapted version of Buckner's (1988) neighbourhood cohesion scale (Fone et al., 2006). *Place Attachment* was measured using 5 items from a scale collated by Venables (2011). The scale was internally consistent (Cronbach's $\alpha=.73$). *Attitudes to living in Wales* were measured with items such as "I am proud of living in Wales" and "I am happy to pay a little extra for goods that are produced in Wales". The latter four-item scale was internally consistent (Cronbach's $\alpha=.73$).

Environmental Sustainability Behaviours

A wide range of environmental sustainability behaviours were included in the survey to cover the domains of household energy use, travel and transport, waste and recycling, and water use. Ten scales were constructed after extensive exploratory analyses. The construction of the scales took into account the distinction between *curtailment* and *efficiency measures* (Gardner & Stern, 2002) and clusterings found in previous empirical research (e.g. Whitmarsh & O'Neill, 2010; Barr & Gilg, 2006). Most of the response scales of the original

items were based on the *stages of behaviour change model* (e.g. Prochaska & Velicer, 1997). These response scales were used to allow comparisons with previous segmentation exercises (e.g. Defra, 2008). The variables were dichotomised to simplify the analyses.

Energy Curtailment. The energy curtailment scale was made up of eight energy reduction behaviours (turning off the heating when everyone is out for a few hours in the winter, hanging the washing up to dry rather than using a tumble dryer in summer, switching off lights when no one is in the room, only boiling the kettle with as much water as you need, shutting down your laptop overnight rather than leaving it on standby, switching off your TV rather than leaving it on standby, putting on a jumper or extra layer when you are cold rather than turning up the heating, washing clothes at 30 degrees or less). The internal consistency of the eight energy curtailment behaviours was low (Cronbach's $\alpha=.55$), but could not be improved by excluding behaviours.

Energy Insulation. Energy insulation behaviours are one-off actions that increase the energy-efficiency of houses. The scale included installing cavity/solid wall insulation, loft insulation or top-up loft insulation, double or secondary glazing, and draught proofing. The energy insulation scale was highly internally consistent (Cronbach's $\alpha=.79$).

Energy-Efficient Heating. The energy-efficient heating scale included four one-off actions that improve the efficiency of the heating system: having thermostat controls fitted on individual radiators, installing a hot water jacket to insulate your hot water tank, replacing an old boiler with a high efficiency condensing boiler, and installing pipe work insulation. The reliability of the scale was adequate (Cronbach's $\alpha=.65$).

Transport Curtailment. The transport curtailment scale included five changes that people might make to save energy use for transport purposes (switching to public transport instead of driving for long journeys, switching to walking or cycling instead of driving for short journeys, driving in a more fuel-efficient way, minimising the number of car journeys, and choosing local destinations for leisure trips or shopping). The resulting 6-point scale was sufficiently reliable (Cronbach's $\alpha=.60$).

Energy-Efficient Car. Respondents were asked they had switched to a smaller/more fuel efficient car. The response scale was dichotomised.

Number of Flights. Respondents were asked how many flights they had taken in the last 12 months for leisure/holidays purposes, or for visiting friends and family. A majority had taken no flight at all (64%); 24% had taken 1 or 2 flights; and 12% had taken 3 or more flights in the past 12 months. The highest number of reported flights was 5.

Waste Reduction. Nine behaviours were included that could reduce the amount of household waste: deciding not to buy something because it has too much packaging, reusing items, taking your own shopping bag when shopping, composting household food and/or garden waste, taking a shopping list with you and sticking to it, hiring or borrowing and item to avoid buying something new, repairing or maintaining an item to avoid buying

something new, buying less stuff, and avoiding buying single-use disposable items. The scale was internally consistent (Cronbach's $\alpha=.66$)

Waste Recycling. Waste recycling was indicated with one item. The distribution across the original 4-point scale allowed it to be dichotomised to compare "I recycle everything that can be recycled" to all other responses.

Food Waste. Self-reported food waste was indicated by a single item: "how much eaten food would you say you end up throwing away". The response scale included the answer options "none", "hardly any", "a small amount", "some", "a reasonable amount", and "quite a lot".

Water Curtailment. Seven water curtailment actions were included in the survey: turning off the tap when brushing teeth, fixing leaking taps, washing up in bowl rather than running water, taking a shower rather than a bath, taking shorter showers, reducing the number of loads of washing by running only full loads. The Cronbach's α was low (.58) but could not be improved by adding or removing items.

Water Efficiency. The survey included a number of water efficiency measures (e.g. dual flush toilet, hippo water saving device). These measures were excluded from the analyses due to a very low uptake and a lack of internal consistency.

Results

Selection of the Segments

Hierarchical clustering and *k-means clustering* were combined to determine the optimal number of segment. First, hierarchical clustering analyses were conducted for 2 to 15 cluster solutions. The number of clusters was determined using the *Euclidean Sum of Squares* between the data instances and their cluster centres. In general, a rapid initial decrease in ESS flattens when further clusters are added. Hartigan (1975) gives an approximate F statistic that can be used to test the significance of the reduction in ESS. The number of clusters was validated visually by the *Elbow* method in which the variance explained by the solution being plotted against the number of clusters. Sharp step changes in explained variance were observed for the five, six, and nine cluster solutions. Subsequently, a number of k-means cluster analyses were conducted to identify which of the three cluster solutions was the most stable. Five randomised starting centres were considered for each of the cluster solutions. The six cluster solution had, on average, the highest proportion of corresponding clusters based on the random starting points (73%), followed by the five cluster solution (70%). The nine cluster solution had significantly fewer corresponding cluster solutions (53%). A cross-tabulation showed that there was a meaningful reallocation of participants from the five to the six cluster solutions. The six cluster solution was therefore deemed optimal. A number of 'naming workshops' were organised after the segments were identified. The workshops were attended by representatives of different Government departments and sustainability-related partner organisations of Welsh Government. After the workshops, the final names were decided upon by the project partners.

Description of the Segments

A MANOVA (Multivariate Analysis of Variance) with post-hoc comparisons (Tukey's b test) was conducted to examine how the six segments scored on the 13 input variables. As might be expected, the segments differed significantly across all 13 indices ($F(65, 7385) = 71.774$, $p < .001$). The segments' mean scores on the input variables are presented in Table 1.

Enthusiasts - Y Brwd stood out as the most positive segment. Enthusiasts appeared engaged with almost all issues raised in the survey. Members of this segment had positive views on all aspects of sustainability (environmental, economic, social, and sustainable living); and were also the most concerned about climate change. Enthusiasts further reported the highest levels of social capital and place attachment, and had very positive views on living in Wales. The segment scored highly on three out of four personal value dimensions.

Pragmatists - Y Pragmatwyr showed slightly lower levels of engagement. While Pragmatists were relatively concerned about climate change, thought that the environment should take priority over the economy, and expressed positive views on sustainable living, they only engaged moderately with environmental sustainability and energy security issues. Moreover, members expressed negative views on economic sustainability. In contrast to Enthusiasts, Pragmatists scored low on all personal value dimensions. The segment reported moderate levels of social capital, place attachment, and views on living in Wales.

Aspirers - Yr Uchelgeisiol scored average on most indices. The segment stood out in terms of their self-enhancement and openness-to-change values, as well as their endorsement of economic sustainability. Aspirers expressed one of the lowest levels of concern about energy security and reported low levels of social capital and place attachment.

Community Focused - Pobl eu Milltir Sgwar can be characterised as being conservative and engaged with their community. The segment reported some of the highest levels of place attachment and social capital, and had very positive views on living in Wales. Although Community Focused endorsed both environmental and economic sustainability, they thought that economic growth and jobs should take priority over the environment. They are generally not concerned about energy security issues.

Commentators - Y Sylwebwyr are arguably the least engaged with environmental sustainability. They were the least likely to endorse pro-environmental beliefs; the most likely to prioritise the economy over the environment; and the most likely to say that a sustainable lifestyle is a low priority compared to other things in their life. Commentators were highly sceptical about climate change but the most concerned about energy security. The segment scored highly on self-enhancement, openness-to-change, and conservative values.

Self-Reliant - Yr Hunanddibynnol were the almost complete opposite of Enthusiasts. They were disengaged with most issues raised in the survey. Members of this segment scored low on all personal value dimensions and had negative views on environmental sustainability, sustainable living, and economic sustainability. Self-Reliant prioritised the economy over the environment, were sceptical about climate change, and expressed high levels of energy security concern. Together with Aspirers, Self-Reliant reported the lowest levels of social capital and place attachment. The segment had the most negative views on living in Wales.

Table 1. Means and Standard Deviations of the Thirteen Standardised Segmentation Indices for the Six Segments

Variables	Scale	Segment						p
		Enthusiasts – Y Brwd (n=257)	Pragmatists - Y Pragmatwyr (n=321)	Aspirers – Yr Uchelgeisiol (n=232)	Community Focused – Pobl eu Milltir Sgwar (n=304)	Commentators - Y Sylwebwyr (n=179)	Self-reliant - Yr Hunanddibynnol (n=244)	
Personal Values								
Self-transcendence	Z	.76 (.65)a	-.35 (.80)d	.33 (.81)b	.13 (.85)c	.04 (.81)c	-1.19 (.91)e	<.001
Self-enhancement	Z	.11 (.85)b	-.71 (.78)d	.60 (.92)a	.26 (.91)b	.58 (.84)a	-.37 (.80)c	<.001
Conservative values	Z	.47 (.81)a	-.69 (.79)c	.18 (.84)b	.49 (.71)a	.40 (.82)a	-.79 (.86)c	<.001
Openness-to-change	Z	.37 (.93)a	-.53 (.86)c	.49 (.84)a	.10 (.84)b	.43 (.82)a	-.83 (.90)d	<.001
Sustainability								
Environmental Sustainability	Z	.67 (.74)a	.01 (.88)c	.12 (.79)bc	.29 (.73)b	-1.17 (.93)e	-.61 (.89)d	<.001
Economic Sustainability	Z	.43 (.76)a	-.37 (.99)b	.34 (.74)a	.38 (.72)a	.26 (.85)a	-.70 (.99)c	<.001
Environment-Economy Trade-Off	Z	.86 (.64)a	.45 (.68)b	-.04 (.78)c	-.52 (.86)d	-.81 (.76)e	-.64 (.78)d	<.001
Sustainable living	Z	.88 (.82)a	.34 (.75)b	-.06 (.72)c	-.49 (.78)d	-.79 (.90)e	-.63 (.66)de	<.001
Climate Change & Energy Security								
Attitudes to climate change	Z	.98 (.60)a	.32 (.64)b	.14 (.70)c	-.15 (.72)d	-1.05 (.86)f	-.66 (.72)e	<.001
Concern about energy security	Z	-.40 (.82)d	.02 (.88)c	-.26 (.78)d	-.34 (.75)d	.91 (1.02)a	.33 (.90)b	<.001
Community & Place								
Social capital	Z	.45 (.79)a	.11 (.79)b	-.78 (.89)c	.38 (.73)a	.06 (.92)b	-.68 (.94)c	<.001
Place attachment	Z	.47 (.63)a	.11 (.70)b	-1.09 (.94)d	.42 (.62)a	.38 (.56)a	-.53 (.86)c	<.001
Living in Wales	Z	.68 (.59)a	-.05 (.78)c	-.05 (.77)c	.43 (.63)b	-.23 (.92)c	-1.08 (.96)d	<.001

Note: all scales were normalised by calculating the Z scores; means in the same row with different subscripts differ from one another.

Table 2. Socio-Demographic Characteristics of the Six Segments (in %)

Variable	Category	Segment						Overall (n=1,538)	p
		Enthusiasts – Y Brwd (n=257)	Pragmatists - Y Pragmatwyr (n=321)	Aspirers – Yr Uchelgeisiol (n=232)	Community Focused – Pobl eu Milltir Sgwar (n=304)	Commentators - Y Sylwebwyr (n=179)	Self-reliant - Yr Hunanddibynn ol (n=244)		
Gender	Female	62	47	47	57	51	45	52	<.001
	Male	38	53	53	43	49	55	48	
Age group	16-24	8	12	28	13	16	18	15	<.001
	25-34	14	11	20	15	12	12	14	
	35-44	18	18	16	16	9	17	16	
	45-54	21	21	14	14	16	15	17	
	55-64	22	18	13	14	17	11	16	
	65+	18	20	9	30	30	28	22	
Household Type	Single	22	31	38	27	37	38	32	<.001
	Married/cohabiting, no children	26	18	26	32	26	31	26	
	Having children at home	33	33	29	29	24	22	29	
	Have children grown up	19	18	7	12	12	8	13	
Tenure	Non-home-owner	22	26	43	26	18	38	29	<.001
	Home-owner	78	75	57	74	78	62	71	
Social grade	AB	32	24	23	16	21	8	21	<.001
	C1	32	28	25	31	27	25	28	
	C2	12	19	20	20	26	25	20	
	DE	24	28	32	33	26	42	31	
Welsh Identity	No	48	42	30	28	30	38	36	p<.001
	Yes	52	58	70	72	70	62	64	

Note: not all values sum to 100% due to rounding.

Table 2: Cont'd

Area	Urban	60	57	72	56	61	74	63	p<.001
Classification	Town and fringe	14	20	16	17	13	15	16	
	Village	17	13	7	16	18	5	13	
	Hamlet and isolated dwelling	9	9	5	11	8	6	8	
WIMD ¹	Low	48	41	28	41	43	32	39	p<.001
	Medium	35	40	36	36	40	42	38	
	High	17	19	37	24	17	26	23	

Note: not all values sum to 100% due to rounding; (1) Welsh Index of Multiple Deprivation

Table 3. Means and Standard Deviations of Ten Sustainability Behaviour Scales for the Six Segments

Behaviours	Scale	Segment						Overall (n=1,538)	p
		Enthusiasts – Y Brwd (n=257)	Pragmatists - Y Pragmatwyr (n=321)	Aspirers – Yr Uchelgeisiol (n=232)	Community Focused – Pobl eu Milltir Sgwar (n=304)	Commentators - Y Sylwebwyr (n=179)	Self-reliant - Yr Hunanddibynnol (n=244)		
Household Energy Use									
Energy curtailment	0-8	6.20 (1.47)a	6.04 (1.50)ab	5.80 (1.71)bc	5.62 (1.82)c	5.51 (1.68)c	4.96 (1.87)d	5.71 (1.71)	<.001
Energy insulation	0-4	1.73 (1.38)ab	1.68 (1.41)ab	1.32(1.43)c	1.73 (1.48)ab	1.98 (1.45)a	1.49 (1.44)bc	1.65 (1.44)	<.001
Energy-efficient heating	0-4	1.43 (1.31)ab	1.41 (1.26)ab	.90 (1.05)c	1.33 (1.20)ab	1.51 (1.32)a	1.19 (1.29)b	1.30 (1.25)	<.001
Travel and Transport									
Transport curtailment	0-5	2.88 (1.44)a	2.69 (1.45)a	2.01 (1.36)bc	2.33 (1.45)b	2.26 (1.31)b	1.92 (1.32)b	2.37 (1.44)	<.001
Energy-efficient car	0-1	.37 (.48)a	.34 (.48)ab	.31 (.46)ab	.39 (.49)a	.38 (.49)a	.23 (.42)c	.34 (.47)	<.01
Number of flights	0-50	1.10 (1.68)ab	.72 (1.53)a	1.40 (2.41)b	.93 (1.86)ab	1.37 (4.32)b	.80 (1.67)a	1.01 (2.27)	<.001
Waste and Recycling									
Waste reduction	0-9	5.53 (1.90)a	5.18 (1.95)a	4.10 (1.94)c	4.66 (2.05)b	4.06 (2.10)c	3.45 (2.13)d	4.57 (2.12)	<.001
Waste recycling	0-1	.70 (.46)a	.49 (.50)bc	.44 (.50)c	.59 (.49)ab	.55 (.50)b	.43 (.50)c	.53 (.50)	<.001
Food waste	0-5	1.80 (1.09)a	1.78 (1.17)a	1.89 (1.15)a	1.73 (1.07)a	1.70 (1.16)a	1.93 (1.17)a	1.81 (1.13)	n.s.
Water Use									
Water curtailment	0-7	5.39 (1.42)a	4.96 (1.47)b	4.59 (1.67)b	4.86 (1.71)b	4.61 (1.60)b	4.21(1.75)c	4.79 (1.64)	<.001

Note: means in the same row with different subscripts differ from one another.

Socio-Demographic Characteristics

Table 2 shows that the six segments differed significantly in regards of gender, age, household type, tenure, social grade, and Welsh Identity. The segments also differed in terms of the rurality and level of deprivation of their community. *Enthusiasts - Y Brwd* were more likely to be female, middle aged (between 35 and 64), and to have children. Enthusiasts were also more likely to have a high socio-economic background and to be a home-owner. The segment contained the lowest proportion of 16 to 24 year olds, singles, and social grade C2DE. Enthusiasts were among the least likely to live in deprived urban areas and to have a Welsh identity. *Pragmatists - Y Pragmatwyr* had an average age profile. However, they were more likely to be male, home-owner, and to have grownup children. Just as Enthusiasts, Pragmatists were among the least likely to live in deprived urban areas and to have a Welsh identity. The segment was the least likely to be married or cohabiting without children. *Aspirers - Yr Uchelgeisiol* were the youngest of all segments. The segment contained a high proportion of single men with a Welsh identity. Although Aspirers had an average socio-economic background, they were less likely to be home-owner. Members of this segment were among the most likely to live in deprived urban areas. *Community Focused - Pobl eu Milltir Sgwar* were one of the older segments of the study. Members were likely to be a home-owner and to live in a neighbourhood with low levels of deprivation. However, they were among the least likely to come from social grade AB. Community Focused had a strong Welsh identity and were likely to be married or cohabiting without children. *Commentators - Y Sylwebwyr* were, together with Community Focused, one of the older segments. Commentators were among the most likely to be a home-owner and to live in a village with a low level of deprivation. Just as Community Focused, Commentators had a strong Welsh identity. *Self-Reliant - Yr Hunanddibynnol* were likely to be male, single and married/cohabiting without children. Self-Reliant were the most likely to live in deprived urban areas and to be from social grade C2DE, and the least likely to be a home-owner. The segment had an average age profile.

Sustainability Behaviours

Table 3 shows the average scores and standard deviations of the ten behaviour scales for the six segments. The segments reported widely varying patterns of behaviour ($F(50, 7550) = 6.908, p < .001$). *Enthusiasts - Y Brwd* were the most likely to behave in a sustainable way. The segment stood out in terms of their engagement in curtailment behaviours. The segment was also among the most likely to have insulated their house, taken actions to improve the efficiency of their heating system, and to have an energy-efficient car. *Pragmatists - Y Pragmatwyr* were to a large degree comparable to Enthusiasts. The segment was similarly likely to have curtailed their energy use, transport and waste production. Pragmatists were among the most likely to have insulated their home, to have taken actions to improve the efficiency of their heating system, and to have an energy-efficient car. They took the fewest flights of all segments. *Aspirers - Yr Uchelgeisiol* were among the least likely to behave in a sustainable way. Members were particularly less likely to have insulated their homes, to have taken actions to improve the efficiency of their heating system, and to have recycled everything that can be recycled. Aspirers took the most flights in the past 12 months. The segment was average in regards of their engagement in curtailment behaviours.

Community Focused - *Pobl eu Milltir Sgwar* scored average on most behaviour scales. Members of this segment were more likely to adopt energy-efficiency measures than to curtail their behaviour. *Commentators* - *Y Sylwebwyr* were the most likely to have insulated their house, to have taken one-off actions that improve the efficiency of their heating system, and to have an energy-efficient car. However, they were less willing to engage in curtailment behaviours. This segment took an average number of flights in the past 12 months. *Self-Reliant* - *Yr Hunanddibynnol* were the least likely to behave in a sustainable way. Overall, members of this segment were the least likely to have reduced household and transport energy use, to have reduced or recycled waste, or to have curtailed water use. They were equally unlikely to engage in curtailment behaviours or to have taken energy-efficiency measures. Self-Reliant took relatively few flights in the past 12 months.

The Screening Tool

The study further set out to develop a screening tool with a small number of items that can be used to replicate the segments with a limited number of items. It was attempted to identify the fewest number of items that can predict group membership with the greatest possible accuracy, while having all 13 input scales represented within the tool. A series of *discriminant analyses* found that 15 items could replicate the six segments with an average likelihood of 72% (see Table 4).² The 15 items are reported in Appendix A. The discriminant analyses provided useful information about the differences between the six segments. The first function can be interpreted as an *Environmental Sustainability* dimension. Table 4 shows that there was a clear gradient in environmental sustainability from the first 'Enthusiasts' segment to the last 'Self-Reliant' segment. The second *Economic Sustainability* function was characterised by conservative and self-enhancement values, together with a prioritisation of economic growth over the environment. This function mainly discriminated between Community Focused and Commentators on the one hand and Pragmatists and Self-Reliant on the other. The third function was dominated by place attachment and social capital. This *Social Sustainability* function sets Aspirers –who give it a very low priority– apart from all other segments. The fourth function can best be described as an *Energy Security* dimension. This function discriminated mainly between Community Focused and Commentators. The fifth function was the least important (explaining less than 1% of all between group variance). This *Landscape Protection* dimension was a combination of finding protection of the Welsh landscape important and self-transcending values (finding preserving nature important). This dimension mainly discriminated between Pragmatists on the one hand (who find landscape protection important) and Enthusiasts and Self-Reliant (who find landscape protection relatively less important).

² Segment 1 73%; Segment 2: 74%; Segment 3: 70%; Segment 4: 73%; Segment 5: 71%; and Segment 6: 71%.

Table 4. Results of the Discriminant Analysis (Structure Matrix and Group Centroids)

Item ⁽¹⁾	Structure Matrix	Function				
		1	2	3	4	5
8	Environment-Economy Trade-Off	.41	-.21	.04	-.25	-.04
11	Attitudes to Climate Change	.40	-.19	-.06	-.04	-.07
9	Environment-Economy Trade-Off	.38	-.38	.06	-.24	.23
1	Self-Transcendence	.37	.25	-.06	-.05	.34
3	Conservative Values	.16	.48	-.10	-.12	-.19
2	Self-Enhancement	.05	.43	-.23	-.12	-.21
7	Economic Sustainability	.12	.41	-.15	-.04	-.15
4	Openness-to-Change	.12	.33	-.12	-.25	-.10
14	Place Attachment	.10	.16	.73	.02	-.29
13	Social Capital	.12	.21	.73	.10	-.04
5	Environmental Sustainability	.37	-.06	-.07	-.59	-.18
12	Concern about Energy Security	.23	-.01	-.10	.48	-.07
10	Sustainable Living	.26	-.25	-.05	-.35	-.09
15	Living in Wales	.31	.24	.05	.10	.67
6	Environmental Sustainability	.25	-.22	-.10	.11	-.31

Group Centroids	Function				
	1	2	3	4	5
Segment 1	2.26	.01	.22	.28	-.19
Segment 2	.32	-1.15	.43	-.01	.20
Segment 3	.24	.23	-1.60	-.00	.08
Segment 4	.01	1.08	.43	-.63	.01
Segment 5	-1.69	1.23	.44	.77	.08
Segment 6	-2.14	-.97	-.09	-.12	-.23

Note: factor loadings of .30 and higher are in bold; items are recoded so that higher values represent higher levels of agreement; ⁽¹⁾ items are presented in Appendix A; function interpretations: [1] Environmental Sustainability; [2] Economic Sustainability; [3] Social Sustainability; [4] Energy Security; [5] Landscape Preservation.

Discussion and Conclusions

In this study we set out to develop a segmentation model that can be used to engage the public in sustainability-related issues. The research took a psychographic approach in that the segmentation was based on psycho-social variables that could be considered determinants of a wide variety of environmentally-significant behaviours. The project represents the first attempt to comprehensively segment the general public on their views on sustainability and sustainability-related issues. A theoretical framework was developed that included beliefs about environmental, economic and social aspects of sustainability, attitudes to climate change and energy security, as well as fundamental personal values. Six different publics were identified who relate to sustainability in their own distinct ways. Members of the *Enthusiasts* segment were highly engaged with all aspects of sustainability and the most willing to behave in a sustainable way across the board. *Pragmatists* were –just as *Enthusiasts*– willing to engage in various efficiency and curtailment behaviours. However, they appeared less ideological than the *Enthusiasts* segment. This segment was therefore interpreted as being pragmatically engaged with sustainability issues. *Aspirers* represented the youngest segment of the analysis. Although this segment showed little involvement in environmental and social sustainability, they considered economic sustainability relatively important. *Aspirers* were among the least likely to behave in an environmentally sustainable way. The *Community Focused* and *Commentators* represented older segments of the Welsh population. Both were more engaged with economic and social sustainability than with environmental sustainability. However, there were some distinct differences between the two. *Commentators* expressed very negative attitudes to climate change, combined with high levels of concern about energy security. In contrast, *Community Focused* expressed more positive views on community and place. Both *Community Focused* and *Commentators* were more likely to adopt energy-efficiency measures than to curtail their behaviour for environmental reasons. The *Self-Reliant* segment was almost the complete opposite of the *Enthusiasts* segment. The segment was disengaged with all aspects of sustainability and the least willing to perform a wide range of sustainability behaviours.

Even if the segments were solely determined by thirteen sustainability-related psycho-social indicators, they had distinct socio-demographic profiles and behavioural patterns. This suggests a number of things. *First*, values and sustainability-related beliefs vary across different socio-demographic groups and could change throughout a person's lifetime as experiences and circumstances change. The segments could even be interpreted as representing different life stages, with *Aspirers* being the younger segment (cf., young adulthood), *Enthusiasts* and *Pragmatists* representing middle adulthood, and *Community Focused* and *Commentators* being more common among the older age groups (cf., late adulthood; Erikson, 1963). The disengaged *Self-Reliant* segment was represented across all subsequent life stages. As the segments were identified through a cross-sectional survey, it is not clear whether the differences reflect age and/or cohort effects. The age differences in values and beliefs could reflect life-stage changes or could be considered attributes of different age cohorts that are created by unique circumstances in which they grew up and aged (Ryder, 1965). While it is likely that both age and cohort effects are reflected within the model, the understanding that motivations and circumstances are likely to change throughout a person's lifetime shows that there is a need for more dynamic models that can

grasp such temporal changes, rather than assuming that the identified segments have fixed preferences. *Second*, the distinct patterns of environmentally-significant behaviours associated with the six segments shows that there is continuing value in the idea of 'sustainable lifestyles'. The different segments demonstrate distinct patterns of behaviour that are more or less in line with their sustainability-related values and attitudes, which (if not directly captured in the study) are likely to be supported by corresponding systems of provision (cf., Spaargaren & Van Vliet, 2002). The close association of the segments with the different environmentally-significant behaviours is surprising, as the segments were constructed using 'distal' psycho-social variables (i.e. values) and generic beliefs about sustainability-related aspects and issues. This shows that such distal variables may be predictive of sustainability behaviours if they are considered in conjunction. It also confirms the observation of Eimers and Pieters (2002) that distal value orientations are more predictive of more general patterns of behaviour (cf., lifestyle) than of specific environmental behaviours.

The research presented in this paper has a number of strengths. It is to our knowledge the first comprehensive sustainability segmentation. The model contained a new battery of sustainability-related questions capturing the breadth of the sustainability concept (i.e., environmental, economic and social aspects). Together, these questions provide a more rounded view of public engagement with sustainability than previously has been achieved. This broad approach was chosen to support the Welsh Government in its obligation to promote sustainability in all its policy areas and functions. By including all three sustainability pillars, the model can be used across different departments and organisations. A further strength is the wide range of sustainability behaviours that was included in the study. Whereas most segmentations studies focus on a single or a limited number of domains, the current research covered the environmental priority areas of the Welsh Government.

For a segmentation model to be useful for policy makers and practitioners, it should possess a number of attributes (McDonald & Dunbar, 1995; summarised in Maibach et al., 2011). The *Welsh Sustainability Segmentation Model* has most of these attributes. The identified segments relate to sustainability and sustainability-related issues in distinct ways, and are all large enough to justify the time and effort to target them separately. Furthermore, the purely psychographic approach and inclusion of core personal values ensures that the segments are relatively enduring and are not liable to change as a result of behaviour change initiatives. The 15-item screening tool that was developed alongside the main model can replicate the six segments with an average accuracy of at least 70%. Although this may lead to some misclassifications, the tool will help policy-makers and practitioners to identify the different segments with a small number of questions.

There are however a number of methodological and practical limitations that relate to (a) the approach taken in the research, (b) segmentation methodology in general, and (c) the use of segmentation models for social marketing purposes, respectively. The broad approach that was taken to develop the Welsh Sustainability Segmentation Model is a strength and weakness at the same time. One of the main attributes of an audience segmentation that makes it useful for social marketing purposes is that it should be relevant to the campaign objectives (McKenzie-Mohr, 2000). This could be interpreted as that separate models should

be developed for each campaign and/or policy area. Indeed, a focus on a specific issue or domain would allow a more fine-grained segmentation. This would however require substantial resources, be impractical in many cases, and risk fragmented sustainability policy. The critique that broad segmentations are problematic because they cannot capture the complexity of environmentally-related practices (cf., Barr et al., 2013) is justified. However, from a pragmatic perspective, segmentation is primarily an analytical tool that may help policy makers and campaigners to improve the *efficiency* of behaviour change, public engagement, and/or communication initiatives (Barnett & Mahony, 2011). A model that would capture the whole variability and complexity of a wide range of environmentally-related practices would lack the analytical power that is needed to establish widespread engagement. Segmentation models will have to find a balance between capturing relevant motivations and circumstances that support various environmentally-significant consumption patterns and remaining a tool that can be used by policy-makers and practitioners to improve the effectiveness of their interventions. It is important to consider here that even small improvements in efficiency may contribute to substantial gains in the overall effectiveness of engagement initiatives at the population level.

The second point relates to cluster analysis as a strategy to segment the general public. Cluster analysis is an exploratory statistical technique that can recognise patterns in large sets of data (McDonald & Dunbar, 1995). The problem is that cluster analysis can find patterns in any dataset without providing an explanation or interpretation. For the model to be capturing genuine and meaningful 'publics', it needs to be based on a clear theoretical framework that is relevant to its purpose. The observation that the six segments of the Welsh Sustainability Model have diverging values and sustainability-related beliefs, as well as distinct patterns of behaviour, suggests that the model is fit for purpose to engage the public across the different environmental policy priority areas.

The final point relates to practical difficulties in adopting and implementing segmentation models for social marketing purposes (McDonald & Dunbar, 1995; Barnett & Mahony, 2011). As argued before, it is essential for a segmentation model to provide a screening tool that can be used in further research and/or public engagement initiatives in order to avoid being left on the shelves. However, even with a screening tool the recruitment of psychographic segments can be challenging. A lack of a geographical grounding makes psychographic segmentations vulnerable at the recruitment level. That is, the geographically spread of the different segments makes it difficult to identify and target them specifically. It becomes even more problematic where it is not possible to screen the public beforehand. This could be (partly) solved by including geo-demographical indicators that can be used as a proxy in the absence of a screening tool.

The present research has shown that it is possible to segment the public according to their sustainability related beliefs in a meaningful way; and can be used across different environmental policy priority areas. We would however warn against a deterministic interpretation and use of this and other segmentation models. The division of individuals into segments may fuel a misperception that everyone should conform to the archetype of the segment. Even if the clusters represent relatively coherent publics, there is still considerable within-cluster variation. Furthermore, the clusters are not fixed entities, but constructed

through a complex decision-making process. The number, size and content of the segments are therefore dependent on a multitude of factors, including (the content of) the input variables, (the choice of) statistical criteria and algorithms, and personal judgments of the model owners. Audience segmentation is therefore as much of an 'art' as it is a statistical 'science'. Despite segments being constructed rather than representing 'real' publics, audience segmentation remains a practical analytical tool that can assist practitioners in improving the effectiveness of their behaviour change, engagement and communication initiatives. In light of these issues, it is useful to conduct additional qualitative research to triangulate the findings and to get a deeper understanding of the complexity of sustainability-related practices and the motivations and barriers experienced by different publics to engage in them (cf., Barr et al., 2013). Follow-up research has shown the six segments have distinct characteristics, motivations and sustainability 'narratives' (Nash et al., 2012). It confirmed that life-stage plays an important part in how beliefs about sustainability and sustainable development are constructed, but also that 'place' matters more than is currently accounted for in the model. Together, this shows that segmentation in itself is not sufficient to fully understand the complexity of public engagement in sustainability and related consumption patterns, but needs to be combined with other methodological and theoretical approaches.

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Appendix. The Screening Tool

Item No	Scale	Item
1	Self-Transcendence	Protecting the environment (preserving nature) ⁽¹⁾
2	Self-Enhancement	Being influential (having an impact on people and events) ⁽¹⁾
3	Conservative Values	Sense of belonging (feeling that others care about me) ⁽¹⁾
4	Openness-to-Change	Being independent (self-reliant, self-sufficient) ⁽¹⁾
5	Environmental Sustainability	If things continue on their current course, we will soon experience a major environmental disaster ⁽²⁾
6	Environmental Sustainability	People who fly should bear the cost of the environmental damage that air travel causes ⁽²⁾
7	Economic Sustainability	It is very important for Wales to have a high level of economic growth ⁽²⁾
8	Environment-Economy Trade-Off	There are much more important things for me to do than protect the environment ⁽²⁾
9	Environment-Economy Trade-Off	Economic growth and creating jobs should be the top priority, even if the environment suffers ⁽²⁾
10	Sustainable Living	Being green is an alternative lifestyle; it's not for the majority ⁽²⁾
11	Attitudes to Climate Change	The effects of climate change are too far in the future to really worry me ⁽²⁾
12	Concern about Energy Security	Supplies of fossil fuels (e. g. coal and gas) will run out: how concerned in the future? ⁽²⁾
13	Social Capital	I feel like I belong to this neighbourhood ⁽²⁾
14	Place Attachment	If I were to move I would like to live in a similar place to where I live now ⁽²⁾
15	Living in Wales	We should act to protect the Welsh landscape so it can be enjoyed by future generations ⁽²⁾

Note: ⁽¹⁾ question: "I am going to read out a list of different values. Please rate the importance of the following values to you personally" with the response options: Extremely important, Very important, Fairly important, Not very important, Not at all important, and Don't know; ⁽²⁾ question: "To what extent do you agree or disagree with the following statements?" with the response options: Strongly agree, Tend to agree, Neither agree nor disagree, Tend to disagree, Strongly disagree, and Don't know.