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**Research Article**

# Sustainable purchasing behavior and the consumer: Pre- and in-store interventions to facilitate the use of carbon labelling

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| ARTICLE INFO | ABSTRACT |
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| | This empirical article presents the results of two interventions at different stages in the purchase process designed to influence consumer purchase behavior towards lower carbon products. Survey and questionnaire results show the potential for targeted interventions to increase awareness and understanding of complex sustainability initiatives, such as carbon labelling. Analysis of supermarket loyalty card data provides further evidence of the widely cited attitude-intention-behavior gap. The value of measuring the behavioral impact of interventions objectively is therefore highlighted. The challenge of attempting to change behavior within real world contexts, such as a retail supermarket setting, is illustrated and the consequences of this discussed. Our findings present valuable insights for researchers studying behavioral change and stakeholders attempting to influence pro-environmental purchasing behavior.<br><br>**Keywords:** carbon labelling, retailing, loyalty card data, sustainable purchasing behavior |

## INTRODUCTION

Within the context of growing awareness of environmental degradation and the need to reduce greenhouse gas emissions there is momentum for manufacturers and retailers to find ways to change purchasing behavior. Labeling has a potential role to play in helping consumers make (purchase) decisions that are aligned with sustainable consumption (Carrero & Valor, 2012). Carbon labeling is a heuristic, designed to raise consumer awareness of the environmental (carbon reducing) implications of discrete choices, in the hope that they might change their behavior and make more environmentally sustainable choices (The Carbon Trust, 2010).

Tesco, the UK's largest supermarket, was the first major retailer to trial carbon labeling as a mechanism for enabling shoppers to make more informed choices. Their carbon labeling initiative was an integral part of their corporate social responsibility (CSR) activities and positioned Tesco at the forefront of 'a new revolution in green consumption' (Leahy, 2007). In April 2008 Tesco launched their initial trial using The Carbon Trust's carbon reduction label on twenty products from four categories (washing detergent, orange juice, light bulbs, and potatoes). More products and other product categories (milk, kitchen towel, and toilet tissue) were subsequently added before the quiet announcement came, in 2012, that Tesco would not be continuing with the project, claiming the lack of consumer uptake and the lack of interest from other retailers as the major reasons behind their decision (Vaughan, 2012). Tesco's experience and their decision to terminate the carbon label pilot raises important questions for the future of carbon labelling, other forms of sustainability labeling and for stakeholders engaging with such schemes which are the subject of on-going debate.

Despite the proliferation of ethical or eco labelling schemes in recent years, evidence of their impact on consumer attitudes and purchasing behavior is extremely limited, for several reasons. First, the limited number of studies that have been undertaken examining the relationship between ethical labels and consumer behavior are largely based on self-reported behavior (Marin et al., 2009; Vázquez et al., 2013) or behavioral intention (Becker-Olsen et al., 2006; Huang et al., 2014; Mohr & Webb, 2005) which are prone to inaccurate recall and self-reporting bias. Second, numerous scholars (for example, Horne, 2009; Vázquez et al., 2013; Vitell, 2015) acknowledge the existence of an attitude–intention-behavior gap, whereby seemingly positive attitudes towards environmental and sustainability issues invariably fail to manifest themselves in corresponding behavioral change at the point of purchase. Finally, there are significant limitations in terms of understanding and awareness of carbon labelling specifically (Upham et al., 2011).

Hornibrook et al. (2015) examined consumer responses to carbon labels within a real-world context by using Tesco

loyalty card data to measure the impact of the initial trial of carbon labels on sales by different consumer segments and revealed no discernible impact in changing behavior to purchase carbon labelled products. Subsequently, they ran a series of focus groups to explore possible reasons for the lack of impact. These focus groups revealed a fundamental lack of awareness and understanding of carbon labelling, in addition to constraining or facilitating social and cultural influences, and the heterogeneous nature of consumer's demand. The present paper builds on the work by Hornibrook et al. (2015) and presents the results of an action research project designed to increase understanding and awareness, and therefore use of carbon labelling.

The article begins by summarizing the literature on labelling and eco/carbon labelling specifically to set the context of the research. We then outline our methodological approach and detail the interventions undertaken. Finally, we discuss our findings, acknowledge limitations, and provide suggestions for future research.

## CARBON LABELLING

Labeling is widely used as a method of information provision to guide consumer purchasing behavior across all manner of product categories. Simply put labels are provided by sellers to inform buyers of specific product characteristics (de Boer, 2003). However, the efficacy of labelling in influencing product choice and fostering behavior change is widely debated (for example, Tarabella & Voinea, 2013; Van der Merwe et al., 2010). There appear to be enabling factors that may improve the effectiveness of labelling. For example, the impact that nutritional labels have on purchasing behavior has been found to increase when used in conjunction with an education campaign (Drichoutis et al., 2006) and prior (nutritional) knowledge has been found to be an important prerequisite to using food labels effectively (Soederberg Miller et al., 2015).

Eco-labeling is a method of transmitting environmental information to a consumer, where the label carries the information and signifies that the product is better for the environment than other comparable products (Gertz, 2004). It is important that a consumer has confidence in the environmental benefits from purchasing a sustainable product (Peattie, 2001). However, the literature debates the impact and effectiveness of eco-labelling. For example, eco-labels have the potential to reduce the number of alternatives that consumers consider and thereby reduce search costs (Teisl et al., 2002) but need to be part of a range of coordinated CSR activities and should not be relied upon as a trigger for behavioral change in isolation (Horne, 2009; Tzilivakis et al., 2012). Testa et al.'s (2015) study emphasizes the importance of the eco-label for Italian consumers in increasing perceived behavioral control. Moreover, there are limitations in the use of eco-labels as a shopping aid, such as the limited time and capacity for information processing in-store (Caswell & Padberg, 1992).

The literature indicates there are several potential ways the carbon label may help change behavior. For example, many authors point to the importance of perceived consumer effectiveness (PCE) in sustainable behavior (for example, Berger & Corbin 1992; Ellen et al. 1991; Lee & Holden 1999) and Peattie (2001) discusses how important it is that a consumer has confidence in the environmental benefits from purchasing a sustainable product. It could be argued that carbon labelled products may help foster PCE/confidence since reductions in carbon emissions can be seen numerically by choosing alternative products (such as a concentrated liquid rather than powder washing detergent, for example). Research by Fearne (2008) has shown that consumers do not associate environmental problems and sustainability with their food shopping. Hobson (2006) asserts that 'action at home' participants behavior was changed at the realization of personal responsibility that happened as the participants actions were reconsidered; when a connection was created between their action and the consequence. Kronenberg (2007) suggests that in order to make consumption 'reasonable' consumers need to be able to link their own consumption to the wider environmental consequences. Again, it could be argued that carbon labelling could help by making real a direct connection between everyday food/grocery items and carbon emissions, and by extension, environmental problems.

Carbon labeling is a mechanism for changing consumer behavior that remains under-researched (Röös & Tjärnemo, 2011; Upham et al., 2011). In particular, there is very scarce literature reporting *actual* behavioral response to carbon labeling. Where this has been reported the impact appears to be very limited (Hornibrook et al., 2015; Vanclay et al., 2011). Low levels of awareness and understanding of carbon labeling appear to be major barriers to impact, as do constraining or facilitating social and cultural influences; and the heterogeneous nature of consumers (Hornibrook et al., 2015), in addition is the price premia attached to products with lower carbon footprints (Vanclay et al., 2011). Van Loo et al. (2014) found that carbon footprint labels were amongst the least favored type of sustainability label on meat for Belgian consumers, however they suggest that the carbon footprint labels are still novel, and their importance is likely to grow.

Following on from Hornibrook et al.'s (2015) main findings that carbon labelling had no discernable impact on purchasing behavior and that part of the reason for this could be due to a fundamental lack of awareness and understanding of it, interventions for this study were specifically designed to enhance awareness and understanding of carbon labeling and increase the penetration of carbon labeled products. Carbon labeling is a relatively new and complex concept meaning that both awareness of its existence and understanding of its purpose, meaning and how to use it are important. The interventions were designed and targeted towards a specific consumer group, in recognition of the heterogeneity of consumers emphasized by Hornibrook et al. (2015). To our knowledge, no attempt has been made to discover the impact that different *types* of interventions at different stages in the path to purchase may have on awareness, understanding and purchase of carbon labeled products. Therefore, the interventions were designed at different stages on the path to purchase–pre- and in-store, to assess if one type of intervention is more effective. We thus propose that carefully targeted *pre-store* interventions raise awareness, improve understanding and increase the intention to purchase carbon

labelled products, and that carefully targeted *in-store* interventions can also raise awareness, improve understanding and increase the propensity to purchase carbon labelled products.

## METHODS

Two interventions were designed as part of an action research project in collaboration with Tesco and The Carbon Trust, conducted May-June of 2010. To increase potential impact of the interventions they were specifically designed for a specific consumer group in recognition of consumer heterogeneity in terms of environmental concern and food shopping behavior. The pre-store interventions were specifically targeted towards parents of young families because they were perceived to

(a) be amenable to change (due to the influence of their children),

(b) face a range of constraints (stay at home and working parents, shopping with and without children), and

(c) have a higher level of involvement with food in general and supermarket shopping in particular (Garcia et al., 2010).

In addition, Hornibrook et al. (2015) noted that families with young children identified the important influence of their children on the shopping process and suggest that introducing the topic of carbon measurement and foot printing into the school curriculum may lead to a positive change in sustainable purchasing behavior for this consumer segment. The in-store interventions were also designed with young families in mind but due to their nature were likely to be similarly viewed and accessed by all consumer groups.

### Choice of Intervention Stores

The interventions were designed to assess the effectiveness of pre- and in-store interventions. Several geographically dispersed Tesco stores (the 'intervention stores') were identified and selected based on the following criteria:

- Only stores who employed a Tesco 'community champion' who could help facilitate the project at store-level were selected.

- Only 'extra' (large format) stores were selected on the basis that these stores have more people shopping at them and carry a bigger range of products.

- Price sensitive stores (as identified by Tesco) were not included because it was logical to assume that those with severe budget constraints would not have much flexibility in their purchasing behavior.

- Loyalty card data was then used to determine those stores with the largest number and highest penetration of young families.

### Pre-Store Intervention

The pre-store intervention involved the design and delivery of a 'carbon footprint week' (CFW) with primary schools in the proximity of four of the intervention stores that had most schools in the local vicinity (York, Newcastle, New Malden, and Borehamwood). This consisted of an education pack containing age-appropriate inter-curricular lesson plans linked to climate change, carbon footprints, and carbon labeling to be run during a specified week (that coincided with the in-store interventions). The education pack was written and designed with a primary school teacher and consisted of lesson plans (for years 5-6) and supporting materials, including a CD of MS PowerPoint presentations and a 'display starter pack' to help start the CFW display (as an incentive to participate these displays could be entered into a competition to win monetary prizes). It included related homework (a 'homework challenge sheet') whereby the child was to go with a parent/guardian to a specifically named Tesco store (the intervention store) to obtain information about carbon labels from various products across the store, thereby ensuring a connection with the parent/guardian. Draft materials were sent to the Tesco climate change team and The Carbon Trust for comment and review and amendments were made following their suggestions.

All primary schools within a five-mile radius of the chosen intervention stores were contacted via a letter to ask for their participation in CFW and schools were asked to register their involvement online. Follow up emails were sent and, where possible, telephone calls were made to encourage participation. Education packs were ultimately sent to all schools (who had not declined participation) within a five-mile radius with instructions of how to register. In total two hundred and seventy-seven education packs were sent to individual schools. An email was sent to registered schools prior to the start of CFW to encourage teachers to do everything possible to ensure the homework was completed and emphasizing its importance for the project. **Appendix A** shows some examples of these materials.

### In-Store Intervention

Four of the intervention stores were chosen for the in-store intervention; two that had coinciding pre-store interventions and two without (Poole, Southport, Newcastle, and New Malden). In-store marketing activity has long been used to influence purchase decisions. For example, in-store marketing activities (shelf labeling and signage, prime placement, and taste testing) has been used to draw attention to nutritious foods and has been shown to have a positive impact on awareness, understanding and purchasing behavior (Gamburzew et al., 2016). The in-store intervention therefore involved a range of carbon footprint-themed media:

- A giant carbon footprint floor sticker (2.1 meters × 0.96 meters) was placed in the store entrance. This was designed to raise awareness of carbon labelling at the start of the in-store shopping mission.

- Staff wearing specifically designed T-shirt's (bright green and featuring The Carbon Trust footprint logo) handed out information leaflets at the store entrance. The leaflets were designed to explain carbon labelling in a succinct way and add to the carbon footprint activity in-store, thereby helping to raise in-store states of both awareness and understanding.

- Shelf talkers were placed on the shelf edges adjacent to the carbon labelled products. These were designed to

raise awareness and enhance the opportunity for shoppers to purchase carbon labelled products.

**Appendix B** and **Appendix C** show examples of these materials.

### Evaluation of Interventions

Evaluation of the impact of the interventions came from several sources of evidence. The pre-store interventions were evaluated using an on-line questionnaire of the parents/guardians of the children who had been involved in the CFW. A link to the on-line questionnaire was included in the homework and a shopping voucher was used to incentivize respondents.

The in-store interventions were evaluated through a store exit survey, focusing on awareness, understanding, purchase intention and stated purchase behavior. In addition, the in-store interventions were evaluated through the analysis of loyalty card data to objectively measure the impact on actual purchasing behavior. Most of the sustainable consumption literature utilizes self-reported or intended behavior measures (for example, Robinson & Smith, 2002; Schwepker & Cornwell, 1991; Selfa et al., 2008; Shrum et al., 1995; Vermeir & Verbeke, 2008) rather than using actual behavior data. Such methods are inherently inaccurate due to their reliance on claimed/reported behavior and the existence of social desirability bias (Burgess et al., 2003; Carrington et al., 2010). Store level data from each of the stores was combined to produce a cross-sectional database comprising the number of people who purchased one or more of the following carbon labeled products–Toilet/Kitchen Paper, Chilled Orange Juice, Portions of Orange Juice and Washing Detergent–across the four in-store intervention stores (New Maldon, Newcastle, Southport, and Poole) over a six week period–the two weeks prior to the interventions, the two weeks of the intervention period (one week when the pre- and in-store activities took place and one week to allow for consumers to read the leaflet and act on it in their next shop) and two weeks after the interventions.

Simple regression was used to test the relationship between the in-store interventions and the number of customers buying carbon-labeled products.

The following equation represents the model used for the regression analysis:

$$CUSTOMERS_{it} = \beta_0 + \beta_1 + e_{it}.$$

In the model, $CUSTOMERS_{it}$ represents the total customers, for a given product category, $i$, in a given time period, $t$. The parameters of the model are $\beta_0$, a fixed constant, and $\beta_1$, a dummy variable that measures the 'treatment effect' of the in-store marketing campaign for product category $i$ in the time period $t$. The dummy variable takes the value '0' for all weeks other than the two during which the in-store marketing campaign was running. The dummy variable shifts the intercept ($\beta_0$) term in the regression model to measure the hypothesized uplift in sales as a result of the marketing intervention. The use of dummy variables for the measurement of 'treatment effects' has been widely used in previous studies exploring the impact of periodic marketing interventions on sales (for example, Bolton, 1989; Felgate et

al., 2012; Macé & Neslin, 2004; Sethuraman & Tellis 2002; van Heerde et al., 2004). The error term, $e$, incorporates all the immeasurable factors which may have influenced the number of customers purchasing carbon labelled products aside from the interventions.

Daily store-level sales data was used for the regression analysis, for six weeks–two weeks before, two weeks during (one week when the pre- and in-store activities took place and one week to allow for consumers to read the leaflet and act on it in their next shop) and two weeks after the intervention (dummy variable = 0). The in-store marketing campaign ran for one week (dummy variable = 1).

Several product categories were removed from the analysis for the following reasons:

- **Potatoes:** No potatoes in any of the stores were carbon labelled at all and thus were excluded from the research completely (no shelf talkers and no data analysis).
- **Milk:** No behavior change was anticipated to have occurred as a result of the carbon label on milk since it is not a discretionary purchase.
- **Ambient orange juice:** No ambient orange juice was carbon labelled in at least two of the stores and in one store only one variant was carbon labelled.
- **Light bulbs:** An infrequent purchase.
- During the intervention periods it was observed that some products which should have been carbon labelled were not and hence they were excluded from the analysis for that particular store.
- When no sales were observed for products for a full week prior to or during the week of the intervention they were excluded from the analysis for that particular store.

## RESULTS

### Pre-Store Intervention

A total of fifteen schools from across the four geographical areas participated in the CFW. According to the numbers provided on initial registration this equated to approximately six hundred and twenty children being involved. Parental participation involved a trip to the Tesco intervention store to find a number of carbon labeled products and answer questions about each one. The URL for the on-line questionnaire was included on the homework sheet and schools were also invited to distribute the questionnaire to all participating parents. The number of 'homework challenge sheets' received from each area is indicative of the number of parents who participated. A total of ninety usable responses were received, either as hard copies or via the on-line link to the questionnaire.

The results of pre-store intervention were evaluated by the questionnaire of parents of the children involved in CFW (pre-store intervention). Most responses were from the New Malden area (65.6%), 18.9% came from York, 14.4% came from Newcastle and only one response was received from the Borehamwood area (1.1%). This does correlate with the numbers of questionnaires that were sent out and the number

**Table 1.** Summary of parental questionnaire results (n = 90)

|  | Increased awareness | Increased understanding | Claimed purchasing behavior | Increased purchase intent |
|---|---|---|---|---|
| Percentage of respondents | 70 | 54 | 28 | 13 |

of participating schools. Given that far more questionnaires were sent to Newcastle than York, and that they had the same number of participating schools, it is surprising that there were slightly more responses from York than Newcastle. Differences in responses according to geographical area could be due to certain teachers promoting the CFW work, and specifically the homework challenge sheet, more than others.

The key results of the parental questionnaire are summarized in **Table 1**.

The pre-store intervention raised awareness of carbon labeling amongst 70% of the parents of the children who participated in CFW. When asked what precisely they had become aware of because of the intervention, the majority cited the very existence of carbon labeling on specific products, whilst a small number identified the need to change behavior and become more environmentally conscious when making purchasing decision.

When asked if their understanding of carbon labeling had improved because of their child's participation in the CFW, over half (54%) of respondents said it had. However, when asked to specify what they understood better after CFW than before it, respondents provided a range of responses, the majority of which were relevant and broadly accurate but indicative of mixed messages being conveyed by the use of carbon labels on different products and still illustrating a degree of confusion. Participants demonstrated more understanding concerning technicalities of labelling ('how manufacturing processes affect our carbon footprint and the labelling on products'); product specific understanding ('never really appreciated how one soup can be more damaging than another!'); personal action understanding ('that the everyday things you buy can count') and awareness of the purpose/existence of carbon labelling ('I understand to look at the footprint and the percentage'). Other respondents were open about their confusion ('Think it's confusing'; 'Sorry don't really understand a lot about it, my child tries to explain, he knows more').

Overall, these results suggest that understanding of carbon labelling increased as a result of the pre-store intervention, but this was to a limited extent.

Respondents were asked to report any change in purchasing behavior, either actual or planned, resulting from their involvement in CFW. Just over a quarter (28%) of respondents claimed they had purchased low carbon products as a direct result of their child's involvement in CFW and 13% indicated they were either likely or extremely likely to buy low carbon products in the future. The significant proportion of respondents who claimed to have changed their behavior is encouraging for government agencies and lobby groups seeking to 'educate' current and future generations about the benefits of sustainable (low carbon) consumption and their ability to make more sustainable (low carbon) choices. However, the significant decline in the percentage of respondents who became aware of carbon labeling and those who intended to purchase is indicative of the attitude-intention-behavior gap.

## In-Store Intervention

The in-store intervention was evaluated by the store exit survey of shoppers who were exposed to the in-store interventions and analysis of loyalty card data, for the four stores, for the two weeks before, during and after the respective in-store interventions.

The store exit survey was administered by interviewers' in-store during the intervention weeks for each of the four stores (Southport and Poole–in-store interventions only, Newcastle and New Malden–pre- and in-store interventions). The purpose of the survey was to gain a baseline understanding of awareness concerning Tesco's carbon label trial prior to entering the store, to determine if awareness was raised/created by the in-store interventions, if there was effect on purchasing as a result of information on the label and if there was likely to be any effect on purchasing in the future. The main objective was to assess the success of the in-store interventions in terms of creating/raising awareness about carbon labelling and facilitating and prompting purchase of a carbon labelled/low carbon variant. Although young families were the target shopper segment for the pre-store intervention, the exit survey did not focus exclusively on them as the in-store activity had the potential to impact all shoppers. A total of seven hundred and eighty-six usable responses were obtained.

Every effort was made to capture an adequate number of responses across the participating stores and at different times of the week. 30.3% (n = 238) of responses were obtained in Southport, 29.4% (n = 231) of responses were obtained in Poole, 20.7% (n = 163) in Newcastle, and 19.6 (n = 154) in New Malden. A good distribution was achieved across three of the four days that the interviewers were in store: 26.7% (n = 210) responses received on Thursdays, 27.6% (n = 217) on Fridays and 27.7% (n = 218) on Saturdays. The slightly smaller sample of 17.9% (n = 141) from Sundays was the result of reduced opening hours which restricted the amount of time available to interview shoppers.

Tesco precluded collecting any demographic information from respondents. Thus, the only personal information recorded was the existence (or otherwise) of young children in the household. This enabled the comparison to be made between responses from young families (to whom the pre-store intervention was targeted) and other life stage segments (who were exposed also exposed to the interventions). This was achieved in the sampling process, with one of the interviewers focusing primarily on shoppers with young children and the other interviewer focusing on other life stage segments. In total 43.3% (n = 340) responses were obtained from young families, 56.7% (n = 446) from other life stage segments.

The key results of the store exit survey are summarized in **Table 2**.

**Table 2.** Summary of store exit survey results (n = 786)

|  | Awareness of carbon labeling | Understanding of carbon labeling | Claimed purchasing behavior | Purchase intent |
|---|---|---|---|---|
| Percentage of respondents | 20 | 13 | 10 | 28 |

**Table 3.** Likelihood of future purchase of carbon labelled products

|  | Response count | Percentage (%) |
|---|---|---|
| Definitely | 219 | 26.4 |
| Possibly | 416 | 53.9 |
| Probably not | 112 | 14.2 |
| Definitely not | 39 | 5.5 |
| Total | 786 | 100 |

Respondents were initially asked if they had noticed anything different in the store during their shopping mission (without prompting) regarding the visual merchandising around carbon labeling. Only a third (32%) said they had noticed anything different and of these by far the biggest proportion (60%) noticed something that was not relevant to the intervention. One fifth said they noticed the leaflets and 10% noticed the green shirts. These were the most prominent of the activities associated with the intervention, but the low level of recall suggests they were not sufficiently impactful or prominent.

When asked if they were aware that some of the products in Tesco had on-pack labeling with information about the product's carbon footprint, the vast majority (80%) of respondents were unaware. This is not surprising, given the low level of awareness reported elsewhere and the low level of recall of the in-store interventions. However, it highlights the fundamental lack of awareness amongst shoppers about the very existence of the carbon label, let alone what it meant.

When asked to indicate their understanding of carbon labeling, the majority of respondents struggled to provide a meaningful explanation of their purpose or the information they contained. Over 38% thought the purpose of carbon labeling was connected to informing or raising awareness but only over 13% identified that it was connected to changing (shopper) behavior.

Respondents were asked if they had purchased any products, on that day or previously, specifically due to the information provided about the product's carbon footprint. The vast majority (90%) of respondents said they had not purchased any products specifically because of the information relating to the product's carbon footprint.

However, when asked if they were likely to make use of carbon labeling when making future purchases, 28% of respondents claimed that carbon labeling would 'definitely influence' their purchasing behavior in the future, a

significantly greater share of the shoppers surveyed compared to the parents in the pre-store intervention (**Table 3**).

Overall, the results of the store exit survey suggest that in-store interventions of this kind are likely to have at best, a limited impact on raising awareness and very little impact on increasing understanding or claimed purchase behavior. The one area in which the reported association was higher for shoppers than parents was the intention to purchase. However, as already highlighted, purchase intent is likely to be exaggerated and in this study was measured objectively, through the analysis of store level loyalty card data.

Using loyalty card data to assess the impact of the interventions provided a unique opportunity to bring to the case study actual behavioral data, void of social desirability bias. The post intervention data analysis used loyalty card data aggregated at the store level for all shopper segments. Data analysis included a pre- and post-intervention time period to measure differences in purchasing behavior before, during and after the interventions, again increasing the reliability of the findings.

The regression results for each of the four product groups analyzed (washing detergent, kitchen towels and toilet paper, long-life portion-sized sized orange juice and chilled orange juice) are summarized in **Table 4**.

All of the regression coefficient for the dummy variable are statistically insignificant. Thus, the evidence from the analysis of actual purchasing behavior is at odds with the reported behavior from the store-exit survey and suggests that

(a) the intervention had no significant impact on the actual purchases of carbon labeled products in the stores and

(b) shoppers who were exposed to the interventions (pre- and/or in-store) were no more likely to purchase carbon labeled products than shoppers who were not.

## DISCUSSION & CONCLUSIONS

Previous research has highlighted that consumers have confusion in understanding and interpreting the carbon label (Gadema & Oglethorpe, 2011; Hornibrook et al., 2015). The pre-store intervention school project, however, provided evidence of the role that targeted interventions can have in raising awareness and therefore increasing knowledge about complex and/or multi-dimensional constructs that shoppers are unlikely to engage with, for the first time, in a retail

**Table 4.** Results of the regression analysis

| Product group | Estimated coefficients | |
|---|---|---|
|  | Constant (standard error) | Intervention-dummy variable (standard error) |
| Washing detergent | 90.62 (4.41)* | -9.41 (28.72) |
| Kitchen towels & toilet paper | 102.13 (2.62)* | -24.65 (16.73) |
| Long-life portion size orange juice | 41.15 (1.21)* | -6.92 (8.14) |
| Chilled orange juice | 226.14 (6.54)* | -58.88 (42.41) |

Note. *Significant at the 1% level

environment. The results of this case therefore provide evidence to support those who call for multi-pronged approach to behavioral change (Science and Technology Select Committee, 2011), starting with awareness raising and knowledge enhancing interventions outside of the retail environment, the impact of which are likely to be greater the more aligned they are with the motivations of the target group.

Whilst the interventions were designed to raise awareness it would appear that they were not impactful or prominent enough to influence purchasing decisions. This itself is an important finding for food businesses and emphasizes the scale of the challenge facing government and industry in pursuit of sustainability and the behavioral change that is sought through initiatives such a carbon labeling. In particular, this highlights the difficulty in changing behavior within a supermarket context amongst the myriad of choices and competing promotional activities and is an important consideration for retailers who may need to acknowledge the conflict between promoting environmental issues and their other in-store promotions which may both over-shadow and contradict the former.

The discrepancy between those who claimed to have purchased a low carbon variant and the lack of discernable impact on purchasing behavior from the pre- and in-store interventions provides further evidence of the attitude-intention-behavior gap that is widely cited. The gap that exists between the generation of a positive attitude towards sustainable purchasing behavior and actual purchase decisions is well documented (for example, Röös & Tjärnemo, 2011; Vermeir & Verbeke, 2006). The reasons for the existence of this gap between attitude and behavior and the proposed mechanisms for closing it are the subject of more substantial debate (Carrington et al., 2010). Therefore, this supports findings from a host of previous authors (for example, Horne, 2009; Vázquez et al., 2013; Vitell, 2015) and emphasizes the challenge of changing consumer behavior towards more sustainable consumption. This is an important lesson for policy makers who may now need to think beyond voluntary measures to change behavior. This also highlights the importance of using objective (actual) behavioral data to evaluate the impact of initiatives, such as carbon labeling, on purchasing.

Given our findings, this study maintains the assertions of previous researchers that labeling should be positioned as one of a number of interventions involving various stakeholders and partnerships (Tzilivakis et al., 2012). The evidence also supports the view that the role of labeling is to 'pave the way' for regulation, which some authors regard as an inevitability consequence of market failure in the context of sustainability (Horne, 2009; Röös & Tjärnemo, 2011). Likewise Gadema and Oglethorpe (2011, p. 821) suggest reducing carbon consumption using voluntary carbon foot printing policies is likely to have little impact on reducing carbon consumption and encouraging pro-environmental behavior due partly to the limitations of scope and category comparison from voluntary schemes and suggest switching to mandatory measures 'to ensure widespread and simultaneous uptake, market proliferation and within-category labelling' as '(t)his may actively facilitate a drive towards a stage where producers' claims of carbon consumption is commonplace, giving the food consumer more of an opportunity to differentiate meaningfully carbon footprints within same product categories.'

Over a decade has passed since Tesco's initial announcement of their intention to carbon label their own label products and whilst momentum surrounding carbon labelling specifically appears to have declined, there remains an ever-increasing urgency to facilitate amongst consumers pro-environmental food purchasing behavior. Little progress seems to have been made on this journey towards more sustainable behavior however these findings provide some important 'lessons learned'.

## Limitations and Recommendations for Further Research

This was a 'one-shot' case study that cannot be replicated and was not designed to be representative of sustainability initiatives in general or supermarket schemes in particular. The key strength of this paper is the 'real-world' nature of the interventions, conducted in supermarkets and in schools. However due to the research being conducted in these settings the level of control that the researchers can assert over the data collection becomes lessened. For example, data on the size of population (shoppers and parents) was not available, some products were found not labeled when they should have been, and there was a lack of control as to how the CFW was executed in schools. There were budgetary constraints to the in-store activities.

The interventions were carefully targeted but, as a result, focused on a segment (young families) that represent less than 20% of supermarket shoppers. Different interventions targeting different shopper segments could have yielded different results, for example, by focusing on benefits of product efficiency or price promotions for price sensitive consumers.

An additional benefit of carbon labeling not explored in this study is the potential impact of carbon labeling upstream, throughout the supply chain. One of the key benefits of undertaking the carbon foot printing process as a precursor to carbon labelling is the identification of carbon 'hotspots' (carbon intensive areas) within the supply chain. Such identification can also enable businesses to make substantial carbon savings. Indeed, it is this 'upstream' benefit and business response to it that many see as a key part of the value of carbon labelling. The objective of eco-labelling is to use market forces to persuade industry to change negative environmental practices, meaning that there can be environmental benefits both up and down the supply chain (Berghoef & Dodds, 2011).

**Declaration of interest:** No conflict of interest is declared by the authors.

**Ethical statement:** The authors stated that, at the time of the original research there were no formal research ethics requirements at the University of Kent (where the PhD was based), however this was fully discussed with the supervisory team.

**Data sharing statement:** Data supporting the findings and conclusions are available upon request from corresponding author.

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# APPENDIX A



**Figure A1.** Examples of pre-store materials (CFW materials and completed display competition entry) (Source: Authors' own elaboration)
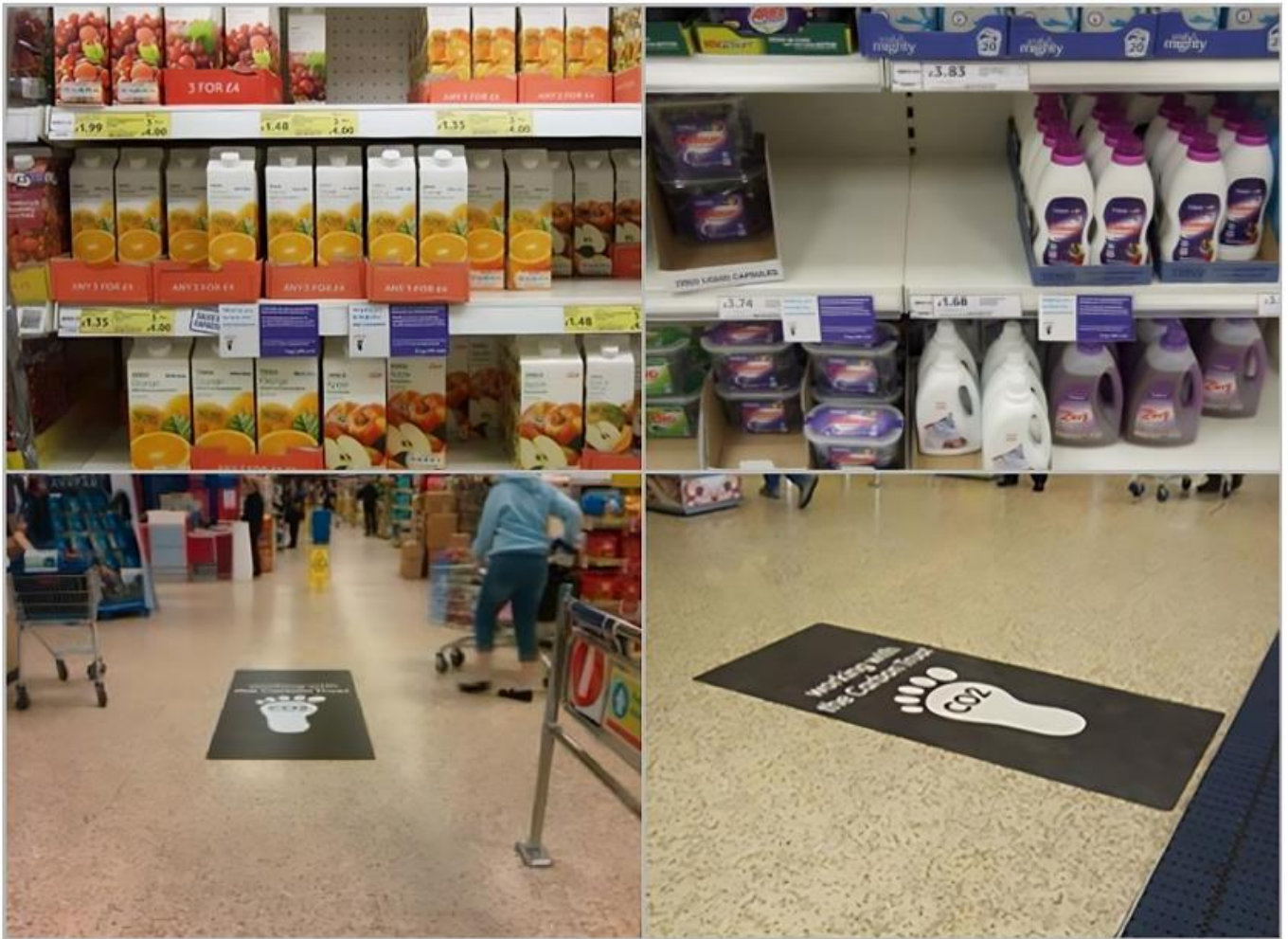
## APPENDIX B



**Figure B1.** Examples of in-store materials (shelf talkers and floor stickers) (Source: Authors' own elaboration)

## APPENDIX C



**Figure C1.** Examples of in-store materials (T-shirts) (Source: Authors' own elaboration)