Can the provision of energy and resource efficiency information influence what consumers buy? A review of the evidence

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Abstract

A wide range of information, including energy labels, eco-labels, and procurement guidance, are provided to encourage individuals and organisations to buy more sustainable goods. An understanding of the most successful approaches can enable more effective labelling approaches to support greater energy efficiency and the circular economy.

This paper presents some results from research for Defra (the UK Government's Environment department) and WRAP[1] investigating how the provision of factual information about the environmental impact of a product influences more sustainable purchasing. The core of the research was a Rapid Evidence Assessment (REA), developing and applying a formal research protocol in order to make the process as objective, robust and transparent as possible. The full REA covers a wide range of environmental aspects (energy use; carbon footprint; sustainability; lifecycle impact; water use; reparability and durability) and products (electrical appliances; vehicles; buildings; textiles and clothing, paper and wood products, cleaning/home chemical and cosmetic products).

This paper presents an overview of the REA methodology and an outline of some of the results and conclusions. It then focuses on the findings of four studies on the effect of provision of information on different non-energy sustainability aspects for energy using products. Information on a range of sustainability impacts were found to be effective, for audiences in Europe and Asia, across an assortment of products, for most products. Further, this focused investigation supports some of the specific conclusions of the broader REA – namely that:

- not all sustainability impacts are equal in the minds of consumers; so a positive response to information on one impact may not guarantee a similar response to information on another.
- information on the same sustainability impact may be perceived differently depending on the product.

The recommendation is that further research will be needed to systematically test information across a range of products and consumer groups to determine which aspect of environmental sustainability will be most effective for which product and for which consumer group. Also testing aspects of environmental sustainability that are clear in their focus will help with comparability of effects between different studies and give an improved understanding of what sustainability aspect participants are responding to.

Introduction

The importance of reducing the environmental impact of products and services is becoming ever clearer. A number of actors, including the EU, are actively working towards a circular economy[2]. Environmental labels, and the provision of other

1. WRAP are a UK charity that works with governments, businesses and communities to deliver practical solutions to improve resource efficiency.

2. Whereby resources are kept in use for as long as possible, extracting the maximum value from them whilst in use, then recovering and regenerating products and materials at the end of each service life.

information with the goal of influencing consumer behaviour, could be an important policy tool to move the market towards more sustainable products and a circular economy.

A wide range of labels, accreditations, procurement tools and other information sources are currently used to persuade buyers (individuals and organisations) to purchase products with lower environmental impacts. In particular, the use of labelling is well established, geographically widespread (for a review of worldwide energy labels see Energy Efficient Strategies and Maia Consulting, 2014), can cover a wide range of sustainability considerations, and can be established by a range of stakeholders (mainly environmental third-sector organisations, Governments and their agencies). Labels cover a wide range of products and environmental aspects (e.g. energy use; carbon footprint; sustainability; lifecycle impact; water use; reparability and durability).

Various factors shape whether such product information is attended to, how it is processed and perceived, and whether it informs behaviour. For example, prior beliefs act as a 'filter' for whether environmental claims are accepted and shape subsequent attitudes and behaviour (e.g., Corner et al., 2012). The information source, as well as content, format, and location, is critical in the consumer's evaluation, with trusted sources tending to be those that appear to have integrity and competence (Clayton et al., 2015). Furthermore, environmental information will be only one type of information taken into account during consumers' decision-making; other types include financial, functional, and social. Consequently, the impact of environmental information on subsequent purchase action is indirect and varies according to multiple psychological and contextual factors.

A rapid evidence assessment (REA) was undertaken by Whittle, Brocklehurst, McAlister and Whitmarsh (2019) to investigate the influence of environmentally sustainable product information on consumer product choice. This paper presents an overview of that REA before focusing on a selection of the literature that investigated the influence of information on non-energy related aspects of environmental sustainability, such as lifespan, on purchases of energy using products.

Defra and WRAP were interested in understanding the potential that providing objective, factual information about the resource efficiency characteristics of a product has to drive more sustainable purchasing. They commissioned research to assess the existing body of research on labelling/information provision through a formal Rapid Evidence Assessment[3] (REA) of the academic and 'grey' literature, accompanied by interviews with experts in the field.

The primary question Defra posed for this research was:

> What evidence is there about the effectiveness of providing factual information (including content, source and format) on the environmental sustainability of a product in influencing consumer (individual and organisational) buying decisions?

The rest of this paper describes the methodology used in the REA and provides an overview of some of the results and conclusions from the REA. It then focuses in on the results of a selection of the studies which offer evidence on the less explored, but increasingly necessary area of whether providing information on environmental impacts of energy using products - beyond energy - influences consumers' preferences.

Methodology

DEVELOPMENT OF RAPID EVIDENCE ASSESSMENT PROTOCOL

The REA protocol was developed in association with a Defra/WRAP steering group and in line with the Defra/NERC guidance on evidence reviews. Specifically, keywords for the literature search were developed based on the PICO[4] elements of the primary research question. A list of existing environmental sustainability labels (individually searched for) was also generated. The keywords were developed in an iterative process of trial and refinement by the research team in order to optimise the coverage of the search results.

Inclusion and exclusion criteria for evidence were determined by the research team, in conjunction with the steering group, based on the PICO components of the primary research question and the initial trialling and refining of search terms. For example, it was decided to include research published between the year 2000 and September 2018 (when the literature search took place), with no geographic restrictions as long as the publication was in English. Research on market impacts (as against direct consumer response) were excluded, as were studies primarily addressing food.

OVERVIEW OF THE REA PROTOCOL

The REA protocol consisted of several stages (the number of pieces of evidence at each stage is shown in Table 1):

Evidence search: Searching using agreed terms in the academic databases 'Scopus' and 'Web of Science' and via the internet (using an online search engine); and a call for evidence from the steering group, expert interviewees (see below) and wider stakeholders. This took place in September 2018.

Screening search results: Screening search results for relevance to research topic in two stages: firstly, on the paper or report title; secondly by the content of the abstract or executive summary.

Extracting the evidence: Extracting evidence from the full paper or report text using a standard form which captured: the details of the source; the nature of the study (e.g. quantitative observation – such as a survey or a quantitative experiment such as a choice experiment, the population studied) and the results (in terms of the REA's primary and secondary questions).

Rating each piece of selected evidence for robustness and relevance against pre-determined criteria, and combining the scores to give an overall confidence categorisation (maximum score of 9). (Some further evidence was rejected at this stage, based on the full text or if found to be a duplicate.)

3. Defra/NERC guidance (Collins, A.M., Coughlin, D., Miller, J., Kirk, S. (2015) The Production of Quick Scoping Reviews and Rapid Evidence Assessments: A How to Guide.) states that an REA aims to provide an informed conclusion on the volume and characteristics of an evidence base together with a synthesis of what that evidence indicates following a critical appraisal of that evidence.

4. Population, Impact, Comparator and Outcome.

Table 1. Description of the evidence identification and selection.

Source of evidence	Search of academic databases	Online search	Stakeholder proposals (steering group, expert interviewees, call for evidence)	Total
Number at each stage				
Evidence search	5,315	NA	NA	>5,000
Initial screening	492	100	136	706
Screened evidence	165	27	63	252
Evidence extraction	68	9	30	107
Included in synthesis				72

Synthesising the evidence: Reviewing the evidence to answer the research questions and reporting on the adequacy of the evidence base: describing the volume and characteristics of the evidence base; describing what the evidence indicates; indicating the implications. (Some further evidence was rejected at this stage, based on a more detailed reading of the full text or if found to be a duplicate.)

The protocol was refined in the course of its application. For example, more exclusions were added to the search terms and some suggested search keywords that were found to be too broadly used (for example "bio") had to be excluded.

EXPERT INTERVIEWS

The interviews were intended to overcome the risk of publication bias by identifying:

- results from studies which do not find effects or impacts, and therefore are less likely to be published;
- recently completed or ongoing research.

They also offered the opportunity to get additional suggestions on the development of the protocol.

Interviewees were identified from amongst the research team's and steering group's contacts to represent experts in the field of consumer behaviour, labelling, resource efficiency and sustainability and reflecting a balance of academics (including different disciplines), industry, non-governmental and policy representatives. In total, ten interviewees agreed to participate.

Interviewees' suggestions for literature were included in the main REA (screening, extraction and synthesis).

The stakeholder 'pool' was expanded by issuing a call for evidence, sent to contacts suggested by the experts and those known to the research team and the steering group. Newsletter publishers, associations and networks were asked to publicise the call, as well as dissemination via social media. The additional sources which were suggested in response were included in the REA.

Selected results from the complete REA

The flow of evidence through each stage of the evidence identification and selection process is shown in the Table 1[5]. A total of 72 pieces of evidence were included in the final synthesis.

5. Evidence online search: Millions of results were brought up by each set of search terms.

EVIDENCE BASE CHARACTERISTICS

The evidence base, while large, was heterogeneous. This is illustrated in Figure 1; more detail is available in Whittle et al. (2019).

EVIDENCE SYNTHESIS

Drawing a clear picture from this very varied evidence base was complex. The synthesis was approached by product group. Confidence statements were allocated to the conclusions based on the amount of evidence and the assessment scores for relevance and robustness that the evidence achieved, developed as part of the REA protocol – as shown in Table 2. It is beyond the scope of this paper to describe the full synthesis of the evidence base, instead a summary of some of the synthesis for energy using products is given here:

Appliances were the most frequently studied product group, with the effect of information on energy consumption, efficiency and monetary running costs the most frequently tested. There is high confidence that the EU Energy Label positively influences the purchase, choice, or intentions towards more energy efficient appliances. There is low confidence in other energy labels (Korean Energy Frontiers and China Energy Efficiency) and contested evidence for the ENERGY STAR label having an influence on appliance consumers. There is medium confidence[6] that the Australian Energy Rating label does not have an influence on online appliance shopping behaviour. The evidence that providing monetary running costs has a greater effect than energy efficiency/consumption alone is contested.

There were a few studies on consumer electronics and ICT (televisions and laptops) and these provided medium confidence that the Korean Energy Saving label is associated with a greater Willingness To Pay (WTP) for labelled laptops but contested evidence for the effect of energy consumption on WTP for more efficient televisions.

SUMMARY OF FULL REA FINDINGS (FOR ALL PRODUCT GROUPS)

The evidence was found to be heterogeneous.

There are many variables:

- There are many different products with many different characteristics,

6. On the basis of a single piece of evidence.

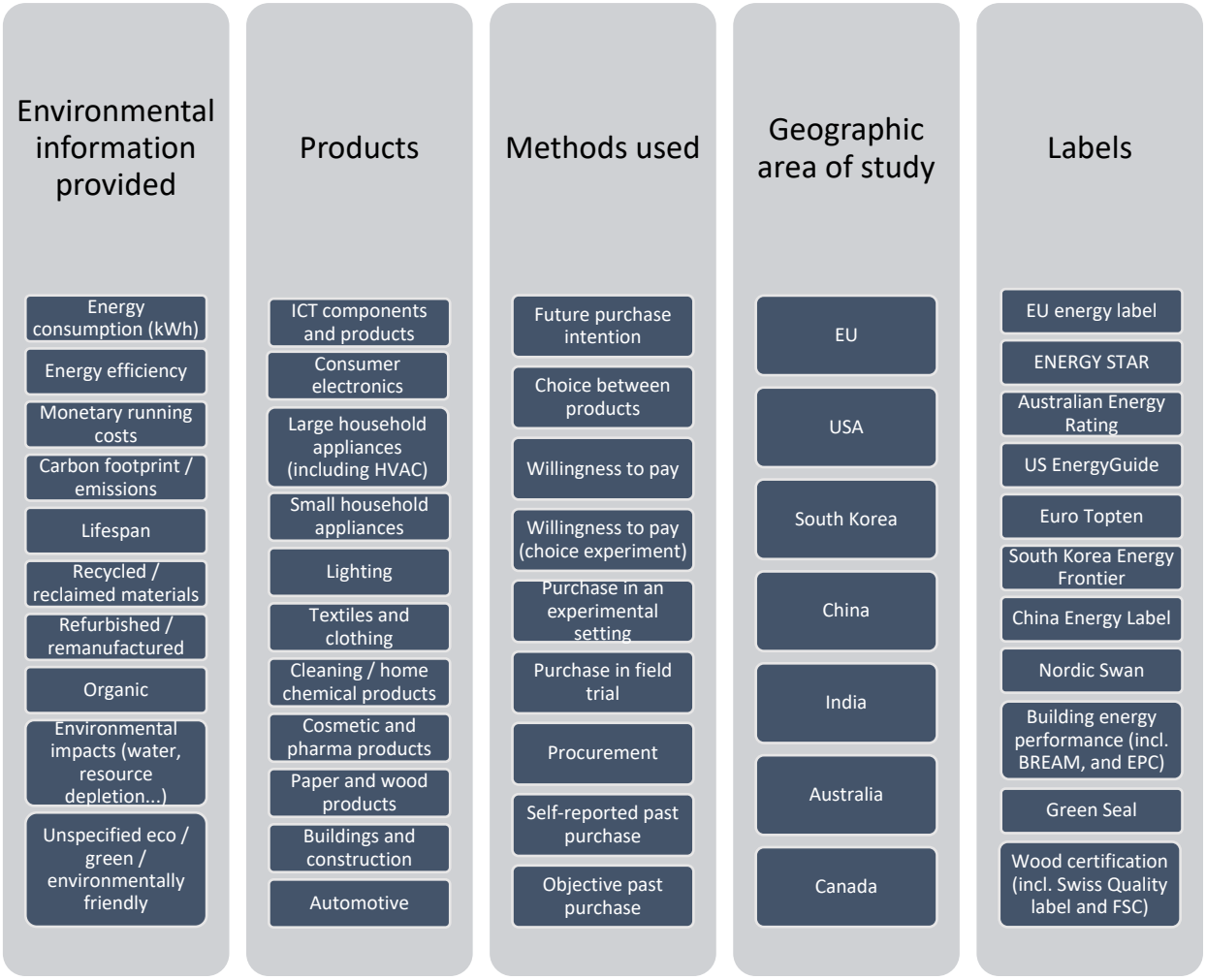

Figure 1. Characteristics of the evidence base.

Table 2. Description of confidence statement classifications.

Class	Description
High	Evidence from several studies given a score of ≥6 and 1 or more studies scored as ≥7
Medium	Evidence from one or more studies that have been scored as ≥6
Low	Evidence from a small number of studies or studies assessed all of which scored as <6
Contested	Evidence that differs in its conclusions (present the assessment for each study/evidence)

- The environmental impact is presented in a wide range of ways;
- Studies elicit consumers' responses in a wide variety of ways (from surveys to actual purchases in 'bricks and mortar' and online shops) and
- Studies measure the results in different ways (e.g. choices between two similar products, or how much extra consumers are willing to pay for a 'green' product).

This makes it difficult to provide a simple response to the primary question "What evidence is there about the effectiveness of providing factual information (including content, source and format) on the environmental sustainability of a product in influencing consumer (individual and organisational) buying decisions?" The answer is that there are a considerable number of studies, of which many show that providing information on environmental impact can influence consumers' buying decisions, at least in an experimental situation. However the response varies depending on the product, the environmental aspect being labelled and the particular study. If more studies were undertaken with a standardised, robust, methodology on a range of products and environmental information types it would be possible to be more definitive.

The relative importance of environmentally sustainable criteria needs greater exploration

There appear to be preferences amongst consumers for certain aspects of sustainability (e.g., recycled, organic) over others (e.g., remanufactured). But the variety of environmentally sus-

Table 3. Characteristics of selected evidence base.

Reference	Geographic area of studies	Environmental information provided	Methods used	Energy using products studied	Non-EUP products studied
Tang et al. 2004	Hong Kong	Eco-friendly	Purchase of basket of goods within given budget	Lightbulbs Batteries	Hairspray, printer paper
Langley et al. 2012	EU (9 countries)	Carbon footprint or Environmental impact	Bidding exercise and a choice experiment	Washing machines, televisions, lightbulbs	NA
Jeong & Kim 2015	South Korea	Ecolabel, or carbon footprint label	Discrete choice experiment	Laptops	NA
Jahnich et al. 2016	EU (4 countries)	Lifespan	Simulated online purchase	Printers, coffee makers, vacuum cleaners, smartphones, televisions, washing machines	Suitcases, trousers, sport shoes

tainable information is quite large. Outside of energy use only a few studies directly compared specific sustainability aspects: recyclability, a remanufactured product (vs new), durability and so on. It is possible that this may change as consumers' knowledge of the 'other' impacts increases.

The influence of environmental information may be product dependent

Some studies within the evidence base looked at the same information, but across different types of products. From these studies, it is clear that information or labels that work on one product, may not work on a different product. For instance, while a lifespan label influenced choice of washing machines and coffee makers, it did not influence choice of televisions (Jahnich et al., 2016). The addition of running costs to the EU Energy Label was not more effective than just the EU Energy Label for vacuum cleaners, fridge freezers, or washing machines, but it was more effective for tumble-dryers (Kallbekken et al., 2013).

Understanding of labels is important for their effectiveness

A number of studies showed that if consumers understand the benefits associated with the label, the amount they are willing to pay for sustainable products increases.

The paper will now move on to explore four studies, from the REA, in more detail:

The effect of providing information on 'other' environmental impacts on purchasers of energy using products

WHY CHOOSE THIS TOPIC?

In considering what the focus of this paper should be, two possible sets of evidence analysed in the REA were considered and rejected:

1. The impact of energy labels in particular jurisdictions; but this has been well covered (e.g. Molenbroek et al. 2013, ACIL Allen Consulting, 2014 and del Mar Solà 2017).
2. The effect of providing running cost information; but a meta-review on this topic was published recently, in 2018 (Brocklehurst 2018).

The importance of 'other impacts' of energy using products has been recognised for many years in the EU. This was reflected in the formulation of the Ecodesign requirements for the energy-using products framework directive (EC, 2005) and Ecodesign requirements for the energy related product framework directive (EC, 2009), which specified that life-cycle impacts outside energy use and carbon emissions were to be estimated and taken into account. These intentions are starting to be enacted in product-specific regulations, for example the adoption of repairability requirements for fridges and freezers, adopted late in 2018.

In this paper, therefore, the authors choose to address the evidence on the less explored, but increasingly necessary area of whether providing information on environmental impacts of energy using products - beyond energy - influences consumers' preferences.

THE CHARACTERISTICS OF THIS SELECTION OF THE EVIDENCE BASE

A number of papers in the evidence base address the effect of providing information on 'other' environmental impacts of energy using appliances on consumers' preferences; there are four which are rated as high quality and provide clear evidence on the primary research question. These were selected by the authors for further investigation. Some characteristics of these are presented in Table 3[7].

7. Carbon footprint or environmental impact: across four different aspects – see below for details.

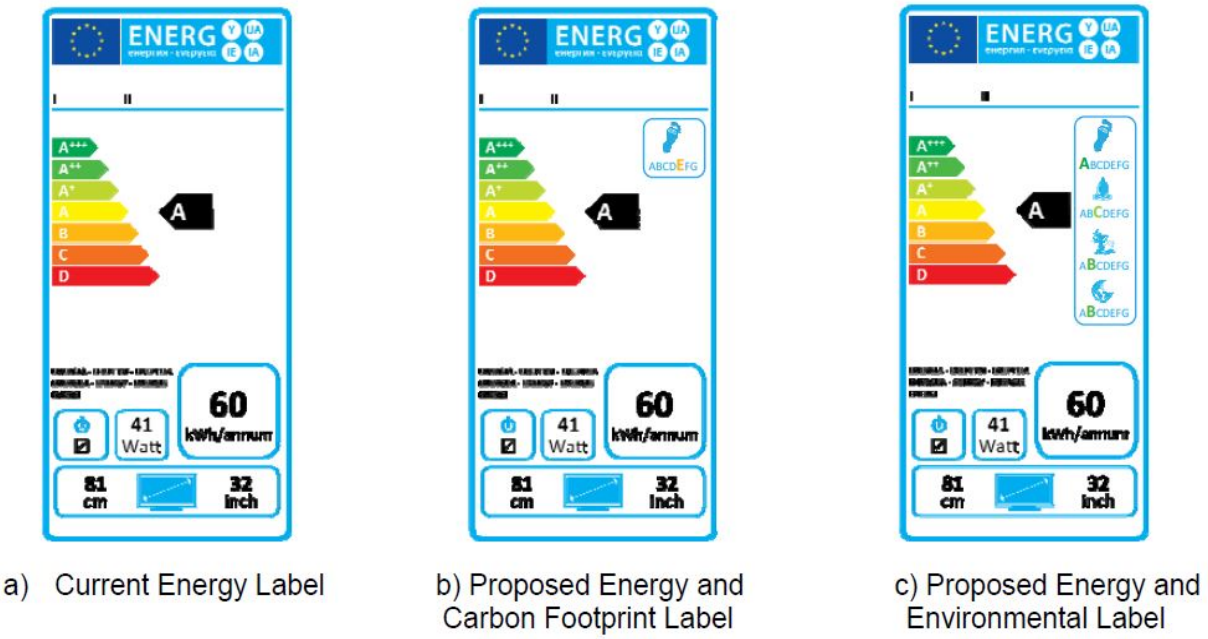

Figure 2. Examples of the different label types (Langley et al. 2012).

The paper will now provide an overview of each study and its findings related to the primary question of the REA, in the order shown in Table 3.

TESTING VISUAL AND VERBAL 'ECO' INFORMATION ON PURCHASE OF A BASKET OF LOW COST GOODS. TANG ET AL. 2004

Methodology

Students were given a (hypothetical) budget of HK$500 (currently around €56) to spend on a choice of ten different products. For each product category there were three choices. There were ten product categories: potato chips, batteries, tissues, washing powder, light bulbs, cooking oil, hairspray, fruit drinks, pain reliever and printer paper[8]. Eco information was provided on only four products: batteries, lightbulbs, hairspray, and printer paper. Participants didn't have to buy any one product or spend the complete budget. Shopping catalogues with a presentation format resembling web pages were used in order to more realistically simulate a web-based shopping experience. These web pages were modelled on a major supermarket chain's website. Shopping for such items, either through catalogues or web, was sufficiently popular in Hong Kong at the time such that the participants were familiar with this approach.

Each student was randomly assigned to one of four treatment groups:

1. No eco information
2. Visual eco information
3. Verbal eco information
4. Visual and verbal eco information

8. These were chosen because they were all low cost, common purchases of students.

Results

The spend on green products was higher when verbal communication was used (mean: HK$92.9 when used vs. HK$71.5 when not) and this was statistically significant.

A similar effect was observed when visual communication was used (mean: HK$92.1 when used vs. HK$71.1 when not) and this was statistically significant.

The highest amount of spending was recorded when both verbal and visual communications were used (mean = HK$99.6). The interaction effect was not found to be significant (the individual effect of verbal communication will neither reduce nor strengthen the individual effect of visual communication and vice versa.). Tang et al's finding was that the visual and verbal communications reinforced each other.

ADDING CARBON FOOTPRINT AND BROAD ENVIRONMENTAL DATA TO THE EU ENERGY LABEL, LANGLEY ET AL. 2012

Methodology

The project explored two variants of the EU energy label:

1. Adding carbon footprint rating (A to G) (Energy and Carbon label).
2. Adding a rating on carbon footprint, water use across the product lifecycle, water eco-toxicity and resource depletion (Energy and Environment label).

Example of these label types are shown in Figure 2. The effect of the labels on consumers was tested in two ways:

1. **Bidding exercise**. Respondents bid for each of three products: washing machines, televisions, and lightbulbs. They were incentivised so they didn't bid randomly (if they got the product cheaper than the sales price they won points which they could convert to shopping vouchers, if less they lost points; if they won product with a high environmental

Table 4. Laptop attribute and levels.

Attribute	Level		
Price (KRW million)	1.3	1.5	1.7
Weight (kg)	1.3	1.6	1.9
e-standby label	Energy saving label	No label	Standby warning label
Eco-label	Present	Not	
Carbon footprint label	Present	Not	
ENERGY STAR label	Present	Not	

rating a donation was made to an environmental cause). There were two groups, one bid on products showing either the standard Energy label or the Energy and Environment label; the other one bid on either the standard Energy label or the Energy and Carbon label.

2. **Choice experiment.** Respondents chose between pairs of product, with a better and worse environmentally performing product in each pair. The better rated product could have one of seven prices, ranging from the same as the worse performing. up to 30 % more expensive than this. There were the same two groups as for the bidding exercise.

The 'other' characteristics of the products were not changed (e.g. the energy rating, sound emissions from a washing machine, screen size of a television).

Results

In the bidding experiment respondents made higher mean and median bids for 'better' performing washing machines or televisions with either 'extra' label than they did for those with the 'plain' label or with 'worse' performance and the results were statistically significant[9]. For lightbulbs the mean results were not significant[10]; the median results were the same as for the larger products and were significant.

Increasing the difference between the ratings of the 'better' and 'worse' performing products increased bids in a way that was statistically significant (although small, at €3–5 against a premium for the labelled washing machine or television of €60–70) for the Energy and Carbon label for washing machines and televisions, but not for lightbulbs. For Energy and Environment labels increasing the difference in rating increased bids for washing machines and televisions for all environmental impacts, although this was not statistically significant for resource depletion for washing machines and water usage across the product lifecycle for televisions. Again there was no impact for lightbulbs.

In the choice experiment respondents were prepared to pay more for better over worse performing for the 'extra' labelled products. This increased when the difference in rating increased for all products, in a statistically significant way for both 'extra' label types. Respondents were also prepared to pay more for products with an 'extra label', even when the sustainability ratings were not top of the range (a median product). This applied for all product types.

There was a only a small difference between the results for the Energy and Carbon and Energy and Environment labels; the bids were slightly higher for the former but the difference was only statistically significant for washing machines; in the choice experiment the differences were small, being higher for the Energy and Carbon label for lightbulbs and higher for the Energy and Environment label for televisions.

THE EFFECTS OF ENERGY EFFICIENCY AND ENVIRONMENTAL LABELS ON APPLIANCE CHOICE IN SOUTH KOREA, JEONG & KIM (2015)

Methodology

This approach is described as a 'discrete choice' experiment[11]. The laptop attributes and their levels used are shown in Table 4[12, 13, 14, 15]. Laptop attribute levels were determined based on "the most purchased laptop with a high performance CPU". The attributes were grouped into sixteen combinations. Respondents were asked to choose a laptop from a set of three.

The paper reports that at that time 1,167 laptops on the market carried the Energy Saving Label, 185 the Eco-Label, 117 the Standby Warning label and 2 the Carbon Footprint label[16].

Results

The results indicated that all the labels had a statistically significant effect on the likelihood of purchase (positive for all but the standby warning label). All the standard deviations, except the one for the Eco-Label variable, are statistically significant, suggesting that people's preference for the labels vary. The Mean Willingness To Pay (MWTP) was highest for the Energy Saving label (14 to 18 % of purchase price), followed by (in order) the Eco-label, ENERGY STAR, Carbon Footprint label and then the absence of the Standby Warning label (3 to 4 %).

THE INFLUENCE OF LIFESPAN LABELLING ON CONSUMERS, JAHNICH ET AL. 2016

Methodology

Participants were asked to purchase three items from a simulated online store, one each of a household appliance, a high-tech product and an item of clothing. For each product, participants

9. At 1 % level.

10. The authors speculate that "the lower stakes associated with light bulbs in the bidding experiment, and the need to input bids which included decimal points, may have led to more manual errors creating noise in the light bulb bid data. This has resulted in observations for the light bulbs not being as clear as those for the washing machines and televisions".

11. No further information on how this is administered is given.

12. Price: At current exchange rates 1.3 million KRW is about €1,000.

13. Energy saving label: Devices that are automatically switched to energy saving mode, minimizes standby power and meet the standby power reduction standards are allowed to bear energy saving label.

14. Standby warning label: Mandatory if standby exceeds 1 W.

15. ENERGY STAR label: Incorrectly descried in the paper as an 'eco-label'.

16. No data was provided on number of ENERGY STAR labelled laptops.

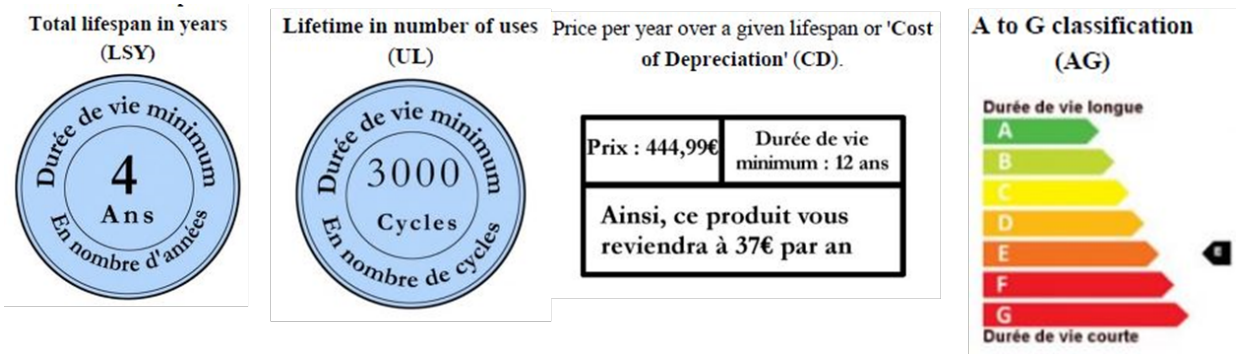

Figure 3. Different designs of lifespan labels used in the trial (Jahnich et al. 2016).

could choose from 10 models. Of these, three were low-priced, three mid-priced, three high-priced, and the 10th model was assigned to different price categories for different products and always had an ecolabel (the EU Eco-label, the EU organic label or the Möbius loop[17]). For each price range a low and a high lifespan product was included.

The project developed four different types of lifespan display as shown in Figure 3. Two different displays were tested for each product and each type of display was tested on at least one of each product categories. Participants were evenly allocated to one of three web sites: one for each of different combinations of two lifespan labels and one control, with no lifespan labels.

Results

There was a substantial and statistically significant increase in the proportion of purchases of long lifespan products from a lifespan label for most energy using products, for most price ranges, the exception being televisions[18]. For energy using products the effect was strongest for printers (20 %) and weakest (where there was an effect, ie excluding televisions) for smartphones (11 %). For 'other' products the results covered a similar range, suitcases 24 %, trousers 16 % and sports shoes 15 %.

Results by label design were as follows:

- AG: with a scale from A to G (20.4 %), tested on coffee makers, printers, smartphones, sports shoes and suitcases.
- UL: displaying useful lifetime (14.1 %), with number of cycles for washing machines, number of prints for printers, number of hours for TVs and number of washes for trousers.
- CD: displaying the cost per year (11.4 %) tested on smartphones, washing machines, vacuum cleaners and trousers.
- LSY: for the label displaying the lifespan in years (9 %), tested on vacuum cleaners, coffee makers, sports shoes and suitcases.

Discussion of selected evidence

Importantly, the four reviewed studies took steps to try to get as close as they could to obtain a 'real world' response from consumers, so that the results were as robust as possible. In that respect, the bidding exercise undertaken by Langley et al. (2012) and the simulated online shopping experience used by Jahnich et al. (2016) stand out as being particularly strong. None of the studies included online or in-store field trials, which might have provided a different, if not necessarily more accurate, indication of what consumers' response might be in the real world[19].

All four of the studies found a distinct and statistically significant positive effect of provision of information on environmental sustainability on consumer choice of most of the products[20]. This suggests that labelling may be helpful in directing consumer purchasing behaviour to buy goods with a lower environmental impact thereby moving towards a circular economy. This positive finding is despite the fact that, as in the overall REA evidence base, there is heterogeneity within this sample of studies. The means of providing the 'other environmental' information on products varied:

- Jeong & Kim (2015) used only existing labels,
- Langley et al. (2012) added new information to an existing, very familiar label (the EC energy label),
- Jahnich et al. (2016) tested four new and quite different label designs, albeit one of which referenced the EC energy label.

Also, none of them address the same sustainability impact – some are quite broad (eco-label) and some specific (carbon footprint, lifespan).

The findings of the REA (Whittle et al. 2019), suggest that, to the consumer 'all aspects of a product's environmental sustainability are not equal' – consumers respond to information on some impacts more than others. Reasons for this may include familiarity. For example, the importance of lifespan in purchasing is a long-standing one – relating directly to value for money and product satisfaction. There is another reason that lifespan is different from the most of the other sustainability impacts - a longer lifespan may, depending on the product

17. used to indicated recyclable or manufactured at least partially from recycled content.

18. Janich et al suggest that the motivations when buying TVs might be an explanation for this; alternatively the very close similarity between the range of available televisions meant that participants did not pay much attention to the attributes of these very similar products.

19. See Brocklehurst (2017) for a discussion of the pros and cons of field trials over experiments in the context of measuring the effect of providing information on operating costs.

20. These results were not 'cherry picked' – there were no good quality studies with an inconclusive or negative finding in the evidence base.

and the consumer's intended use of it, have a private benefit to the consumer. Putting a longer lifespan into the context of the 'circular economy' adds public benefit to this – the eco-system as a whole and therefore society benefits. Thus increasing lifespan may be more similar to reducing energy use than the other environmental impacts discussed. In both cases providing information about this property for products may tap into more than one motivation, making this labelling more effective. Other sustainable choices, for example buying a product with an eco-label, lack this direct personal payback. Nevertheless, information on other, non-direct impacts was still found to have a significant effect.

The fact that the four studies included energy using products may, in itself, influence the effectiveness of the 'additional' information: energy using products, particularly appliances, have been labelled in South Korea and the EU for a long time – since 1992 and 1994 respectively. EU consumers are familiar with these labels, understand them and when surveyed say that they are one of the most important factors in their purchase decisions (Promotion 3e, 2011; Schmitz and Stamminger 2014). One Korean survey suggests that consumers have a high awareness of the energy label, even if they do not always take this into account in their purchase decisions (Hwang et al. 2016). It is possible that consumers' response to information on 'other environmental' impacts is increased by their being accustomed to thinking about the energy consumption impacts of energy using products, particularly in the case of Langley et al. (2012) where information was actually added to the EU energy label. Against this, Jahnich et al. (2016) found that the product which had the strongest effect from the lifespan label was suitcases[21], not an energy using product. The experiment by Tang et al. (2004) also argues against this; the first mandatory energy label wasn't introduced in China until 2005, after this study was published.

Another aspect of purchasing that is worth considering is the cost category of the product. One could hypothesise that consumers pay more attention to purchases when they are spending more money; therefore the scope to influence the purchase of lower cost items would be limited. The findings of these selected studies would appear, at least partially, to refute this: Jahnich et al. (2016) found that the influence of lifespan information on lower cost items, printers and coffee makers, was greater than on the more costly washing machines (and none at all on televisions). The study by Tang et al. (2004) also suggests that high cost is not important, as it found that the purchase of a range of low cost items (batteries, lightbulbs, hairspray and printer paper) were affected by environmental information. It may be that issues related to specific products are over-riding the cost aspect; or that the hypothesis that more costly items get more purchasing attention is false.

Conclusions and recommendations

The paper presents an overview of the evidence collected by an REA on the effect of environmental information on consumer purchasing behaviour, simulated in various ways (Whittle et al., 2019). The overview of the REA's methodology and the overall findings was followed by a closer look at a sub-set of four studies on the effect of providing information on 'other' (non energy and in-use CO_2 emissions) environmental impact for energy using products[22].

The findings from the sub-set of evidence, on the effect of 'non-energy' information on the purchase of energy using product in the four studies in the REA evidence base were that, generally, providing information on environmental impact can influence consumers' buying decisions, in an experimental situation. This was for a range of environmental impacts (eco-friendly, lifespan, carbon footprint), audiences and products (from batteries and lightbulbs to washing machines and televisions).

This investigation supports some of the specific conclusions of the broader REA – namely that:

- The relative importance of environmentally sustainable criteria needs greater exploration some environmental impacts may have more impact; in the case of lifespan this may be partly due to a combination of personal and public benefit.
- The influence of environmental information may be product dependent.

Therefore, the recommendation of the REA and this focused review is that further research will be needed to systematically test information across a range of products and consumer groups to determine which aspect of environmental sustainability will be most effective for which products and for which consumer groups. Also testing aspects of environmental sustainability that are clear in their focus, such as "recycled parts content" (as opposed to vaguer claims, such as "eco-friendly") during future studies will help with comparability of effects between different studies (even if a complete standardisation is not possible) and give a clearer understanding of what sustainability aspect participants are responding to (Whittle et al., 2019).

The findings of the REA also suggest that the evidence for individuals as consumers is more prolific than the evidence available for organisations as consumers. As organisations can frequently have strong buying power, understanding the use of environmental information within their procurement strategies will be important if organisations are to be persuaded to buy and use products which are less environmentally harmful.

One of the recommendations of the REA was that studies should be standardised and robust. One aspect of robustness is that studies should be conducted to match 'real life' situations as closely as possible to. For example:

- Participants shouldn't be told that they are involved in a study about the effect of labelling.
- Products should look like and have features matching those which are available on the market'.
- Information should be presented in a way that matches that used on real web sites or shops.

21. Jahnich at al (2016) hypothesise that consumers consider lifespan was particularly important for suitcases because it is essential that they are robust and when they are used infrequently consumers can legitimately expect them to last a long time.

22. Selected as because it is a less explored area of research and of interest in the context of moving towards a circular economy.

- Participants should have a choice process that matches a real experience (e.g. choosing from multiple models, not just two).
- Participants should be incentivised to make choices that match their choices when shopping for themselves.

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