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Understanding consumers' sustainability knowledge and behaviour towards food packaging to develop tailored consumer-centric engagement campaigns: A Greece and the United Kingdom perspective

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ABSTRACT

Consumer awareness regarding packaging waste is increasing; however, information relating to different food packaging disposal strategies is not always readily available to the consumer. There are also cross-country differences in handling food packaging which add complications and confusion. This study aims to (1) explore consumers' cross-country variations in Greece and the United Kingdom (UK) towards food packaging choice and disposal patterns and (2) develop tailored information campaigns, to encourage sustainable food packaging behaviour. Consumers (18–45 years) in Greece (n = 252) and the UK (n = 249) completed an online survey focused on purchase and disposal related issues for food packaging. Additionally, input from packaging experts (n = 10) was captured via targeted open-ended questions based on consumer insights. Key themes that emerged from the consumer survey were: (1) lack of understanding relating to packaging symbols; (2) confusion about cleaning of food packaging prior to recycling; and (3) excessive packaging for fresh fruit and vegetables, all of which incorporated experts' feedback. Accordingly, these three consumer-centric themes were utilised for campaign development in two information formats (infographics and videos) based on consumer preferences. Findings have been used to create actions, tools and strategies that will influence consumer behaviour and develop solutions to enable transition to a more sustainable European food packaging ecosystem. Next steps should include disseminating tailored information, combined with measuring long-term behaviour together with more support from the government, companies, and shops/retailers so that sustainable food packaging behaviour can be easily adopted in consumers' everyday lives.

1. Introduction

Sustainability typically incorporates three pillars, namely economic, social, and environmental, where sustainable packaging fits within the environmental remit (Otto et al., 2021). Recently, there has been a heightened emphasis on the importance of environmental issues coupled with increasing media attention on food packaging waste; accordingly, consumer awareness is on the rise (Pro Carton, 2018). Despite this, approximately 70% of the United Kingdom's (UK) food waste is household-based resulting in potentially preventable cost and environmental implications (WRAP, 2021). In addition, consumers typically

lack knowledge regarding environmentally friendly food packaging; therefore, more guidance, education and/or information campaigns could be viable approaches to modulate behaviour towards more sustainable solutions (Tobler et al., 2011; Lindh et al., 2016; Boesen et al., 2019; Ketelsen et al., 2020; Otto et al., 2021). It is clear consumers' expectations are changing, and they expect packaging to generate minimal waste, utilise recyclable materials (e.g., biodegradable, reusable, compostable) and have the ability to be recycled post usage (Otto et al., 2021). It is apparent consumers perceive key aspects of sustainable packaging as circular economy, recyclability, and natural-looking material/design, as well as a 'design that evokes explicitly or

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implicitly the eco-friendliness of the packaging' (Magnier and Crie, 2015; Otto et al., 2021). However, it is unlikely consumers are prepared to compromise on sensory quality and price for environmentally friendly packaging (van Birgelen et al., 2009).

There has been a widespread effort from companies and policy-makers to promote recycling solutions (Klaiman et al., 2017). However, a key challenge for global brands is that, despite placing increasing emphasis on recycling, different countries often have varying approaches to recycling, leading to subsequent confusion and difficulties (Klaiman et al., 2017). These cross-country differences are likely to be caused by cultural and/or institutional variations subsequently impacting consumers' perceived environmental behaviour (Herbes et al., 2018). Therefore, it is useful to understand how cross-country variations may impact the perception of sustainable products, especially since such differences exist; accordingly, research is necessary within specific countries to understand better the variations and similarities (Tamani et al., 2015; Liem et al., 2022). For example, Trubetskaya et al. (2022) noted regional differences especially relating to collecting, sorting, packaging waste infrastructure in Switzerland, Austria, Germany, Norway, Estonia, Sweden, Netherlands, Ireland, and Germany. There are also differences in the relative importance of terms such as recyclability, reusability, and biodegradability, as well as the emphasis on reduced packaging and packaging cues (information vs look/feel) in Germany, France, and United States of America (USA) (Herbes et al., 2018, 2020). There are also country-related differences in consumers' familiarity and knowledge relating to sustainable and/or environmentally friendly packaging and some countries are more environmentally aware than others (Scott and Vigar-Ellis, 2014; Jerzyk, 2016; Prakash and Pathak, 2017). Hence, this suggests understanding the role of cross-country differences is important so that global brands can implement improved and appropriate general sustainable packaging solutions in order to subsequently modulate consumer behaviour.

Patra et al. (2022) suggested potential strategies that could influence consumer behaviour relating to food waste include: apps, targeted education, social media, and printed materials. More specifically, targeted information in video formats positively impacted consumer packaging material preferences and encouraged recycling regardless of packaging type (Klaiman et al., 2016). Consumers' sandwich packaging preferences were also shifted from plastic to paper/boxboard by videos and infographics; however, such information formats were unsuccessful relating to altering recycling barriers (Klaiman et al., 2017). Additionally, both these studies (Klaiman et al., 2016, 2017) were completed in the USA and cross-country influences might also be relevant; accordingly, this warrants investigation in our study, coupled with utilising a more tailored approach where information formats will be designed based on key themes from consumer insights.

It is important to understand the common recycling related issues consumers may or could face. For example, Klaiman et al. (2017) noted cleaning prior to recycling was considered a greater barrier to recycling than material separation and time needed for recycling by consumers in the USA. Typically, across Europe fruit and vegetables are often sold in plastic packaging; however, unpackaged fruit and vegetables is also a viable and increasingly common option that could lower the environmental impact of such produce (van Herpen et al., 2016). In addition, fresh produce is a food type that is often wasted; accordingly, provides an ideal opportunity for behavioural change as well as a balance between shelf-life and food waste is needed via optimal packaging solutions (White and Lockyer, 2020). Consumers also perceived avoiding excessive packaging to have the biggest environmental impact (Tobler et al., 2011). Consumers often dispose of packaging materials, such as compostable bio-based packaging, incorrectly despite packaging labelling and this suggests better or clearer information is needed (Taufik et al., 2020). Moreover, consumers would like governments to provide more information relating to environmentally friendly packaging (Pro Carton, 2018; 2021). There is also clear agreement amongst consumers in Spain, Italy, Poland, UK, France, Turkey, Benelux (Belgium,

Netherlands, and Luxembourg), Austria and Germany that governments, companies, and brands need to do more for the environment (Pro Carton, 2021). Therefore, it is important to understand the key challenges consumers might face so that strategies can be developed and whether this needs to vary between countries.

Consumers are more likely to be 'high food wasters' if aged 18–34 or 35–44 and/or households with children (WRAP, 2021). In addition, such age groups can lack confidence relating to what packaging can be recycled compared with older generations (DS Smith, 2022). Currently, a key challenge for the general public is knowing how to behave in a sustainable way in relation to food packaging. It is evident that most research in this area has taken the form of consumer surveys to understand attitudes and perceptions towards sustainable food packaging. However, the InformPack project (funded by the European Institute of Innovation and Technology, EIT Food) is taking a new and novel approach by aiming to develop a food packaging framework that can be utilised across Europe, based on insights from consumer research and experts in the packaging field. The project uses a four-stage approach (Fig. 1) with the overall goal to develop public engagement actions, tools, and strategies to enable a sustainable shift in food packaging culture in Europe.

InformPack project focuses on educating generations such as Gen Z (18–25 years) and Millennials (26–41 years) via tailored campaigns to promote shifts in sustainable behaviour. This study focused on two countries namely Greece and the UK. The rationale for selecting these countries was that Greece is an EIT Regional Innovation Scheme (RIS; a scheme to promote innovation) country and considered to have waste management infrastructure differences compared with the UK. More specifically, this study utilises InformPack's stages one to three (campaign rationale and development; Fig. 1) and aims to (1) explore consumers' cross-country variations in Greece and the UK in terms of awareness, information gaps and attitudes towards food packaging and disposal patterns and (2) develop tailored information campaigns based on consumer and expert insights.

2. Methods

2.1. Stage one: Consumer survey

Five hundred and one consumers aged 18–45 years from Greece (25.6 ± 5.5 years) and the UK (29.4 ± 7.6 years) completed an online survey in May and June 2021. The sample size was calculated in accordance with Yamane's formula $n = \frac{N}{1 + Ne^2}$, where n = sample size; N = population, and e = precision, which indicated that a minimum of 100 consumers in each country was sufficient (Yamane, 1973). Consumers were recruited via the Prolific Academic platform (Prolific, London) utilising balanced quotas (gender and country). Prior to taking part in the survey consumers provided informed consent for their participation, were notified that the survey would be anonymised, and they were free to withdraw at any time. The study received approval in accordance with the EIT ethics and security procedures.

The survey was deployed online via Qualtrics (Qualtrics, Utah) in two languages: English and Greek, where the translation to Greek followed a double back approach to ensure wording was the same between countries. The survey entailed five sections and key question types included: single selection (yes or no; three-to-ten-point category scales), check-all-that-apply (CATA) and open-ended questions; all responses answers were presented adhering to a randomised design. The consumer survey structure is summarised in Fig. 2.

Section one focused on food packaging purchase related issues for different product categories. This section consisted of four questions aiming to understand: (1) the role of food packaging in product choice; (2) key product categories for food packaging; (3) common shopping locations for relevant product categories; and (4) product categories food packaging related issues. Section two determined disposal related

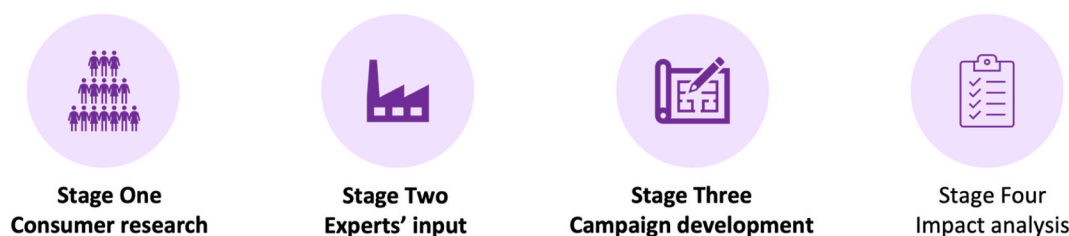


Fig. 1. Summary of the InformPack four-stage approach; stages highlighted in bold denote the focus of this study.

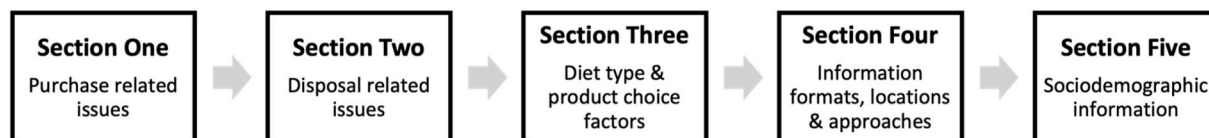


Fig. 2. Brief overview of the consumer survey sections.

issues for different food packaging and materials and consisted of four questions focusing on: (1) understanding whether more disposal issues occur at home or on-the-go; (2) the extent of issues at home for food packaging disposal; (3) key issues regarding food packaging disposal at

home; and (4) common issues relating to food packaging disposal on-the-go. Section three briefly identified whether consumers followed any particular diet type and key factors for product choice. Section four highlighted consumers preferred information formats, locations, and

Table 1

Brief overview of themes and corresponding sub sections for experts (n = 10) open-ended questions (bold font denotes question utilised in subsequent campaign development).

Fruit and vegetable packaging	Snack packaging	Cleaning prior to recycling	Recycling and sustainability
Section one: packaging function	Section one: packaging function	Section one: relevance of cleaning and recycling	Section one: new vs current recycling cycle
(a) Packaging function and benefits	(a) Packaging function and benefits	(a) Importance and why	(a) Recycling vs new product
(b) Packaging balance: shelf-life vs waste	(b) Packaging: shelf-life vs waste	(b) Cleaning importance: food examples	(b) Environmental impacts: new vs reusing
(c) Positive impacts: packaging vs environmental footprint	(c) Environmental footprint: product vs package	(c) Cleaning importance: different materials	(c) Recycling gain: different materials
(d) Environmental footprint: product vs package		(d) How much cleaning?	(d) Repurpose post recycling
		(e) Remove paper labels?	
		(f) Unable to clean: recycle or waste?	
		(g) Paper vs plastic: sustainable?	
Section Two: packed/unpacked and excessive packaging	Section Two: excessive packaging	Section two: leftovers and recycling	Section Two: bioplastics and recycling
(a) Packaging: excessive?	(a) Packaging: excessive?	(a) Impact of leftovers and recycling	(a) Differences novel biomaterials/plastics
(b) Excessive vs non-excessive packaging: examples	(b) Excessive vs non-excessive packaging: examples	(b) Unclean packaging and landfill: frequency	(b) Sustainable to produce
(c) Packed vs unpacked – sustainable?	(c) Individual and outer wrap: why?	(c) Screening progress: unclean packages	(c) Recognisable
(d) Examples of sustainable actions	(d) Why so much plastic packaging?	(d) Consequences: unclean packages	(d) Bioplastics: disposal/recycled
		(e) Unclean: useable output	(e) Environmental benefits
		(f) Challenges of label removal	
Section three: alternative vs conventional packaging	Section three: alternative vs conventional packaging	Section three: future/advice	Section three: recycling and sustainability
(a) Unpacked/sustainably packed: cost	(a) Sustainable products: cost	(a) Updates for consumers	(a) Recycled vs reused: sustainable?
(b) Packaging variety: same product?	(b) Unpacked/sustainable uncommon: why?	(b) Tips for consumers	
(c) Common packaging (plastic, foils, soft wrappings) – why are they used?	(c) What is sustainable for this product category?		
	(d) Alternative packaging: environmental impact		
	(e) Examples of sustainable options		
Section four: packaging disposal	Section four: packaging disposal		
(a) Why poor labelling?	(a) Diverse and inconsistent labelling		
(b) No instructions – solutions?	(b) No instructions – solutions?		
(c) Cleaning food packaging prior to recycling	(c) Cleaning food packaging prior to recycling		
	(d) Hard vs soft plastic: sustainable?		
Section five: novel materials/future	Section five: novel materials/future		
(a) ± of biobased/novel materials	(a) ± of biobased/novel materials		
(b) Future for this category	(b) Future for this category		
(c) Updates for consumers	(c) Updates for consumers		

approaches. This section involved six questions namely (1) determining trustworthy sources; (2) commonly searched information locations; (3) preferred information formats; (4) frequency of searching for information; (5) key topics consumers would like to know more information on; and (6) an open-ended question relating to disposal and purchase of food packaging. Section five focused on sociodemographic information. For example, age, gender, household description, number of children, income, location type, education, and employment status. Overall, this stage focused on understanding consumers' awareness, information gaps and attitudes towards food packaging and disposal patterns to enable identification of key consumer-centric themes for subsequent input by packaging experts prior to campaign development.

2.2. Stage two: Experts' input

Experts ($n = 10$) from the packaging field (academia, research, companies, and organisations) were invited to complete a series of targeted open-ended questions based on key themes identified from the consumer survey: (1) fruit and vegetable packaging; (2) snacks packaging; (3) cleaning food packaging prior to recycling; and (4) recycling and sustainability (Table 1). It should be noted that the experts only completed questions relevant to their expertise; therefore, not all themes or subsections were answered by all the experts and only relevant findings to the campaigns have been included in this paper. The aim of this stage was to build on the consumer results and ensure suitability of information for the subsequent campaign development. Experts' responses were used to collate and identify key information to be used in the campaigns.

2.3. Stage three: Campaign development

Information obtained from the consumer survey and the experts was utilised for campaign development. The campaign development was twofold: (1) three different consumer-centric themes and (2) consumers' two most preferred communication formats, were developed to maximise impact on the target population. The purpose of this stage was to create suitable, relevant, and targeted campaign material for dissemination and future impact analysis.

2.4. Statistical analysis

XLSTAT 2020.1.3 version (New York, USA) was used to carry out the following analyses from the consumer survey: (i) one-way ANOVA (and Tukey's HSD test) for the CATA data (the sample size was sufficient (over 100 counts) to give comparable results to non-parametric tests such as Cochran's Q test (Cochran, 1950)); (ii) Mann-Whitney test for single selection response (e.g., Greece vs UK); for all statistical analyses $p < 0.05$ was used to describe significant differences. Data from five-point category scales were reported as percentages and categorised as follows: (1) at home = only at home + more at home, but also on-the-go; (2) equally at home and on-the-go; and (3) on-the-go = only on-the-go and more on-the-go, but also at home.

3. Results

3.1. Stage one: Consumer survey

3.1.1. Consumer demographics

Five hundred and one consumers completed the survey as outlined in Table 2. The survey cohort consisted of matched numbers in terms of country and gender; consumers were educated, in employment or a student and not following any special diet. Consumers' key factors in food product choice were value for money, price, and taste preference in both countries (Fig. S1).

Table 2

Consumers' ($n = 501$) demographic overview by country.

Demographics	Greece ($n = 252$)		UK ($n = 249$)	
	n	%	n	%
Gender				
Male	125	49.6	125	50.2
Female	126	50.0	124	49.8
Other	1	0.4	0	0.0
Education status				
Doctorate (PhD)	3	1.2	2	0.8
Graduate degree (MSc)	43	17.1	41	16.5
Undergraduate degree (BSc)	107	42.5	85	34.1
Vocational/technical training	21	8.3	52	20.9
Secondary school	71	28.2	69	27.7
Primary school	7	2.8	0	0.0
Employment status				
Employed, full time	75	29.8	121	48.6
Employed, part time	26	10.3	30	12.0
Freelancer/contractor	6	2.4	5	2.0
Self-employed	7	2.8	11	4.4
Unemployed/unable to work	26	10.3	13	5.2
Homemaker	2	0.8	8	3.2
Student	106	42.1	57	22.9
Retired	0	0.0	0	0.0
Prefer not to answer	1	0.4	2	0.8
Other	3	1.2	2	0.8
Special diet style				
Yes	43	17.1	53	21.3
No	209	82.9	196	78.7
Household				
Single individual	98	38.9	55	22.1
Couple	59	23.4	49	19.7
Family with children	31	12.3	79	31.7
Shared apartment	49	19.4	54	21.7
Other	15	6.0	12	4.8
Income^a				
up to 10,000€ £12,570	119	47.2	65	26.1
10,000–20,000€ £12,571–£38,600	66	26.2	120	48.2
20,000–30,000€ £38,601–£50,270	24	9.5	27	10.8
30,000–40,000€ £50,271–£150,000	7	2.8	16	6.4
over 40,000€ £150,000	33	13.1	1	0.4
Prefer not to answer	3	1.2	20	8.0
Living location				
City	96	38.1	110	44.2
Town	124	49.2	108	43.4
Village	29	11.5	31	12.5
Other	3	1.2	0	0.0

^a Euros and pounds reflect Greece and UK currency respectively.

3.1.2. General survey trends

Food packaging type had a partial impact on product choice in both countries (Fig. 3). There was a tendency ($p = 0.054$) for UK consumers to have a marginally higher impact of food packaging type on product choice compared with Greek consumers. Consumers main shopping location for purchasing all product categories was the supermarket; however, there were country related differences between shopping locations in some cases suggesting infrastructure differences (Table 3).

Consumers typically had more issues relating to disposal of food packaging on-the-go in both countries (Fig. 4A), where key drivers were "no recycling nearby" and "unable to clean/separate materials" (Fig. 4B). Consumers' key issues at home in terms of food packaging disposal related to soft and hard plastic in both countries (Fig. 4C). Consumers open-ended questions were grouped into themes where consumers cited sustainability (advice, packaging, and environmental impact), plastic and cost as key themes (Fig. 5).

"Sometimes" searching for information was the most frequently selected option; where Greek consumers did this more frequently ($p < 0.0001$) compared with the UK consumers (Fig. 6). The key trustworthy information sources were "scientists or research centres" and "independent consumer organisations" (Table S1). Consumers typically searched for labels, popular articles, and scientific studies to acquire information and were most keen to find out more information relating to

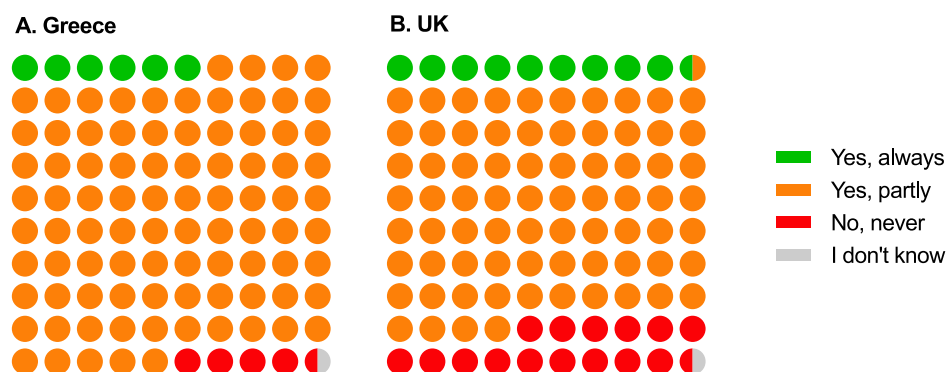


Fig. 3. Consumers' (Greece: $n = 252$ and UK: $n = 249$) perception of impact of food packaging type in product choice. Data expressed as % with each coloured circle representing 1.0%.

Table 3

Consumers' shopping locations by overall and individual product categories.

Shopping location	Overall		Meat/fish		Fruit/vegetables		Snacks		Juices/soft drinks		Alcoholic drinks	
	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK
Supermarket	0.47	0.43	0.35	0.43	0.42b	0.61a	0.59a	0.46b	0.56a	0.41b	0.42a	0.23b
Mini convenience store	0.17a	0.12b	0.008b	0.04a	0.004b	0.06a	0.35a	0.24b	0.28a	0.16b	0.19a	0.08b
Local mini market	0.20a	0.07b	0.004b	0.04a	0.17a	0.08b	0.34a	0.09b	0.31a	0.08b	0.16a	0.04b
Specialised stores	0.15a	0.05b	0.35a	0.11b	0.19a	0.07b	0.04	0.03	0.04	0.02	0.14a	0.04b
Farmers market	0.07a	0.02b	0.06	0.03	0.27a	0.05b	0.008	0.008	0.02	0.01	0.004	0.004
Online	0.03b	0.06a	0.02b	0.06a	0.03b	0.10a	0.02b	0.08a	0.05	0.04	0.03	0.03

Data reported as means and differing letters reflect country significance from multiple comparisons.

food packaging disposal and recyclability (Table S1).

3.1.3. Key themes

Consumers most common purchase related packaging issues for all product categories (fresh meat/fish, fresh fruit/vegetables, snacks, juices/soft drinks, and alcoholic drinks) were: “no clear sustainable packaging information”, “limited sustainable packaging options” and “excessive packaging in both countries” (Table 4). Fresh fruit/vegetables and snacks were considered the key product categories in the UK and Greece respectively which were modulated by buying choice from a packaging perspective (Fig. 7). For instance, UK consumers considered “excessive packaging”, “no clear sustainable packaging information”, and “sustainable packaging/unpacked more expensive” as common issues for fresh fruit/vegetables packaging (Table 4). While snacks packaging presented a similar challenge for Greek consumers with the main issues being “limited sustainable packaging options”, “no clear sustainable packaging information” and “sustainable packaging/unpacked more expensive” (Table 4).

Consumers were typically confused and uncertain about how to dispose of different packaging materials (paper or cardboard, glass, aluminium, soft plastic, hard plastic and bio-based plastic) at home especially relating to material separation and cleaning food residues prior to recycling in both countries (Table 5). Accordingly, key themes were identified for experts input as follows: (1) fruit and vegetables packaging; (2) snacks packaging; (3) cleaning food packaging prior to recycling; and (4) recycling and sustainability.

3.2. Stage two: Experts' input

Based on the above-mentioned consumer insights three key themes were subsequently identified: (1) packaging symbols; (2) cleaning of food packaging prior to recycling; and (3) fruit and vegetable packaging (Table S2). Packaging experts from academic, research, food packaging, recycling companies, innovation and policy were recruited to collate

relevant campaign information.

3.2.1. Packaging symbols

It is evident there is a lack of consistency and noteworthy differences between regions and countries relating to packaging labelling (Table S2). In addition, an expert from a food packaging company cited cost implications (such as certification and laboratory tests) can contribute to poor recyclability and/or sustainability labelling. Accordingly, there needs to be more emphasis on governmental involvement, clearer messaging, and improved regulations and incentives. However, this will not be without its challenges since different packaging materials are available on-the-market and it is unlikely one approach will resolve the problems. Moreover, easiness towards recycling should be an ongoing priority alongside more appropriate, legible, and understandable labelling on packaging. In particular, it is likely consumers are not always aware where to look; therefore, increasing consumer awareness could be vital approach to help decision making via training and/or education.

3.2.2. Cleaning of food packaging prior to recycling

It was clear from the experts' responses that cleaning requirements vary considerably across Europe (Table S2). For example, not all countries require the consumer to clean prior to recycling; however, some countries required packaging to be cleaned initially/partially or completely/thoroughly before recycling. Thus, more consistent regulations would be beneficial. The key aspect of cleaning is ensuring the food residues can be removed; however, in some cases this can be challenging and also depends on the material type (e.g., hard plastic vs paper). For instance, paper packaging containing oily, fatty, or liquid origins can often be difficult to clean. It is apparent that food residues can impact the recycling process and cleaning can also prevent contamination. Typically, cleaning involves rinsing with water and if necessary soap; however, the type of resources and environmental impact should also be considered. If packaging is unable to be cleaned both in Greece and the

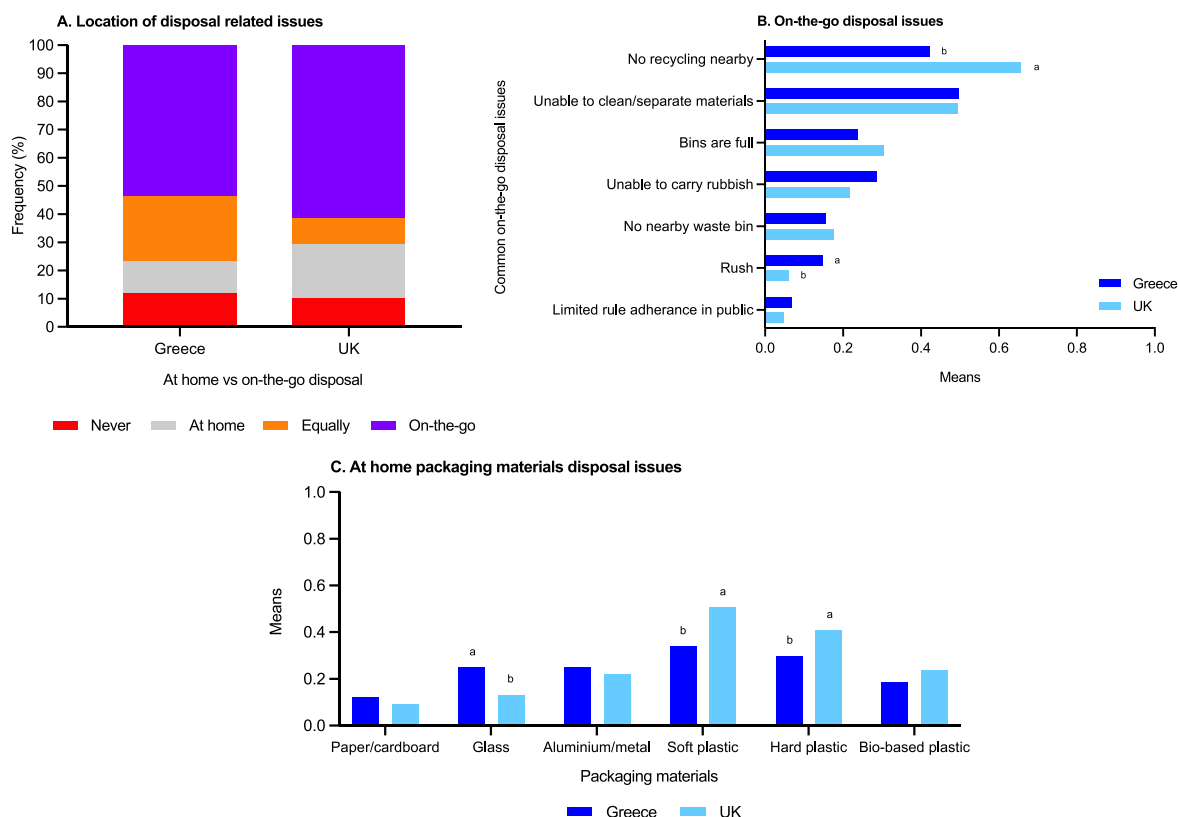


Fig. 4. Consumers' disposal related issues relating to (A) at home vs on-the-go; (B) on-the-go food packaging disposal; and (C) at home food packaging materials disposal. Data reported as: (A) % (at home: only at home/more at home, but also on-the-go; equally at home & on-the-go; and on-the-go: only on-the-go/more on-the-go, but also at home) and (B) and (C) means and differing letters reflect country significance from multiple comparisons.



Fig. 5. Summary of key themes identified from consumers' open-ended questions by country (A) Greece (n = 111/252) and (B) UK (n = 143/249), where the total represents number of comments provided by the consumers.

UK it should go in the general waste bin; this is considered more sustainable practice due to waste management challenges (i.e., sorting process) and often resulting in it going to landfill. This can change depending on the consumers' specific location (e.g., country and/or region). Accordingly, uncleaned food packaging can also contribute to increased environmental impact. A question was raised by an expert in Academic and Research who asked how much effort should the consumer place on cleaning at home? It is likely that if the consumer understood the cleaning requirements for food packaging recycling this might impact purchase related decisions.

3.2.3. Fruit and vegetable packaging

The experts highlighted that fruit and vegetable packaging can help to extend shelf life and subsequently reduce food waste (Table S2) and this is considered fundamental to sustainability. Additionally, packaging

can provide key functions and benefits such as information, convenience, protection, and preservation of quality. It was suggested more guidelines relating to the environmental impact of packaging coupled with a standardised approach to fruit and vegetable packaging is needed. There should also be increased emphasis on the whole supply chain, rather than just the end product, to help minimise waste and cost implications. In some cases, fruit and vegetable packaging can be described as excessive. For example, an expert working at a food packaging company stated 'apples with individual polystyrene cushioning and stuck label, placed on draw piece in corrugated box with lid' is excessive packaging. Moreover, some fruit and vegetables have a protective skin; therefore, may need less packaging. It was noted fruit and vegetable packaging is often plastic (such as foils/wrappings) and this is most likely due to the transparent nature, cost, lightweight, stability, durability, and space efficiency.

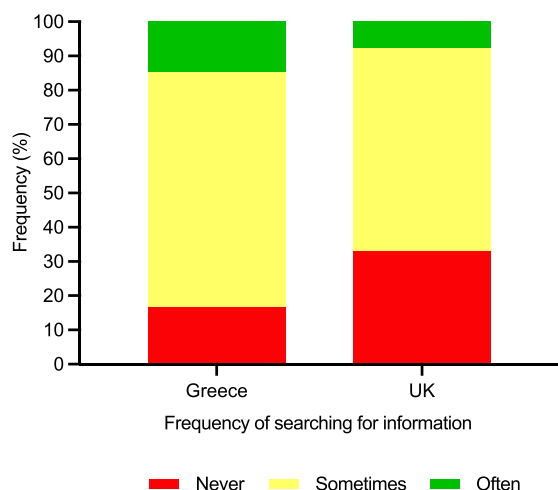


Fig. 6. Frequency of searching for information relating to sustainable food packaging behaviour.

3.3. Stage three: Campaign development

Videos (less than 1-min) and infographics (information in a visual format) were selected based on consumer insights as the most preferred and relevant information formats for both countries (Fig. 8). Key consumer-centric themes and expert feedback were used to develop three campaigns in Greek and English on: (1) packaging symbols; (2)

cleaning of food packaging prior to recycling; and (3) fresh fruit and vegetable packaging, all in video and infographic format (Fig. 9).

4. Discussion

4.1. General trends

Food packaging type influenced product choice in both countries. This finding was as expected, since food packaging can influence attention, expectations, perception and purchase related decisions coupled with fundamental functionality roles (Marsh and Bugusu, 2007; Ares and Deliza, 2010). Accordingly, any sustainable food packaging needs to be able to deliver and fit within this remit to avoid negatively impacting purchase decisions.

The supermarket was the main shopping location in both countries for all product categories; however, there were infrastructure differences between countries. For instance, UK consumers mainly only shopped at supermarkets, whereas Greek consumers more regularly shopped at supermarkets as well as smaller outlet type shops (such as farmer markets and specialised stores). This latter finding might suggest why excessive packaging was less of a concern in Greece compared with the UK. Moreover, unpacked products (especially in the fruit and vegetable area) are becoming more common and can reduce the environmental impact (van Herpen et al., 2016). Consumers cited price, taste, and value for money as key factors in product selection; accordingly, this supports the literature where consumers in most cases are unlikely to be willing to compromise on product fundamentals (such as price, quality, functionality, cost) for sustainable packaging (Jerzyk, 2016; Ketelsen et al., 2020; Oloyede and Lignou, 2021; Norton et al.,

Table 4

Consumers' purchase related packaging issues by overall and product categories.

Common issues	Overall		Meat/fish		Fruit/vegetables		Snacks		Juices/soft drinks		Alcoholic drinks	
	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK
No clear information	0.17	0.15	0.16	0.19	0.15	0.19	0.21	0.15	0.20a	0.11b	0.14	0.09
Limited packaging options	0.15a	0.12b	0.12	0.12	0.12	0.16	0.23	0.17	0.16	0.10	0.14	0.03
Excessive packaging	0.09b	0.19a	0.08b	0.17a	0.14b	0.36a	0.13b	0.23a	0.06b	0.12a	0.03	0.07
Expensive	0.16a	0.11b	0.10	0.12	0.16	0.18	0.21b	0.13a	0.21a	0.08b	0.12	0.04
Difficult to recognise	0.11a	0.07b	0.06	0.07	0.09	0.05	0.16a	0.07b	0.15a	0.09b	0.11	0.06
Limited unpacked options	0.07b	0.11a	0.04b	0.12a	0.06b	0.13a	0.09	0.14	0.06	0.09	0.09	0.04
No issues	0.08	0.07	0.07	0.05	0.07	0.10	0.06	0.04	0.10	0.08	0.08	0.08
Limited time	0.08a	0.06b	0.05	0.06	0.05	0.08	0.10	0.08	0.11	0.07	0.06	0.04
Choosing is complicated	0.06	0.04	0.06	0.05	0.03	0.04	0.08	0.06	0.07	0.04	0.05	0.03
Spoil easily	0.04	0.03	0.04	0.03	0.05	0.06	0.03	0.01	0.04	0.02	0.02	0.004
Limited trust	0.02	0.01	0.02	0.02	0.008	0.02	0.02	0.02	0.03	0.02	0.01	0.00

Data reported as means and differing letters reflect country significance from multiple comparisons.

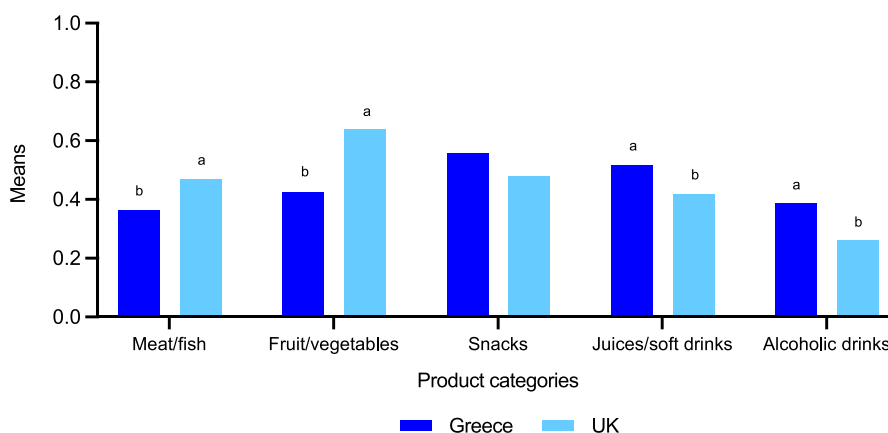


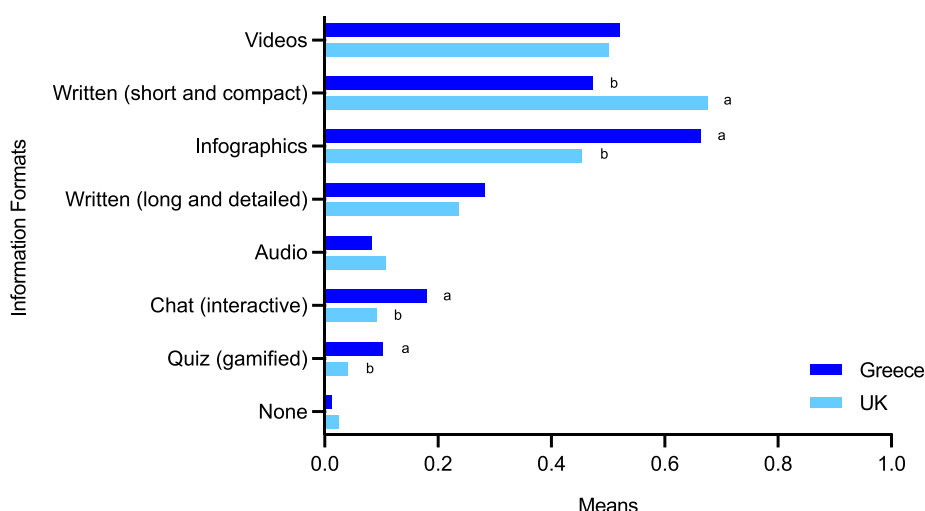
Fig. 7. Consumers' product categories that influence buying choice from a packaging perspective. Data reported as means and differing letters reflect country significance from multiple comparisons.

Table 5

Consumers' disposal related issues commonly faced at home by overall and packaging materials.

Common issues	Overall		Paper/cardboard		Glass		Aluminium/ metal		Soft plastic		Hard plastic		Bio-based plastic	
	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK	Greece	UK
Uncertain about materials separation	0.09b	0.12a	0.05	0.04	0.09a	0.04b	0.07	0.07	0.13b	0.24a	0.21a	0.12b	0.10	0.11
Unaware of special collection	0.08b	0.11a	0.02	0.02	0.06	0.04	0.08	0.09	0.15	0.21	0.07b	0.17b	0.08b	0.14a
Uncertain about cleaning	0.08	0.07	0.06	0.03	0.06	0.03	0.09	0.07	0.12	0.14	0.12	0.11	0.05	0.05
No trust	0.08a	0.06b	0.03	0.02	0.06	0.03	0.05	0.04	0.12	0.10	0.14	0.09	0.06	0.04
No nearby collection	0.07	0.07	0.02	0.02	0.09	0.05	0.07	0.04	0.10	0.15	0.06	0.08	0.06	0.07
Confusion/complicated system	0.04b	0.07a	0.02	0.03	0.02	0.02	0.05	0.05	0.05b	0.14a	0.03b	0.11a	0.05	0.05
Uncertain about reusability	0.05	0.04	0.04a	0.000b	0.05a	0.000b	0.06	0.03	0.05	0.08	0.06	0.10	0.03	0.03
Time consuming	0.04	0.03	0.03	0.02	0.04	0.03	0.04	0.03	0.04	0.03	0.06	0.03	0.02	0.02
System full/not working	0.05a	0.02b	0.03a	0.000b	0.05	0.02	0.06a	0.01b	0.05	0.02	0.07a	0.03b	0.03b	0.004a
No incentives	0.02	0.02	0.01	0.008	0.02	0.02	0.03	0.03	0.02	0.04	0.03	0.02	0.02	0.02

Data reported as means and differing letters reflect country significance from multiple comparisons.

**Fig. 8.** Consumers' (Greece: n = 252 and UK: n = 249) preferred information formats. Data reported as means and differing letters reflect sample significance from multiple comparisons.

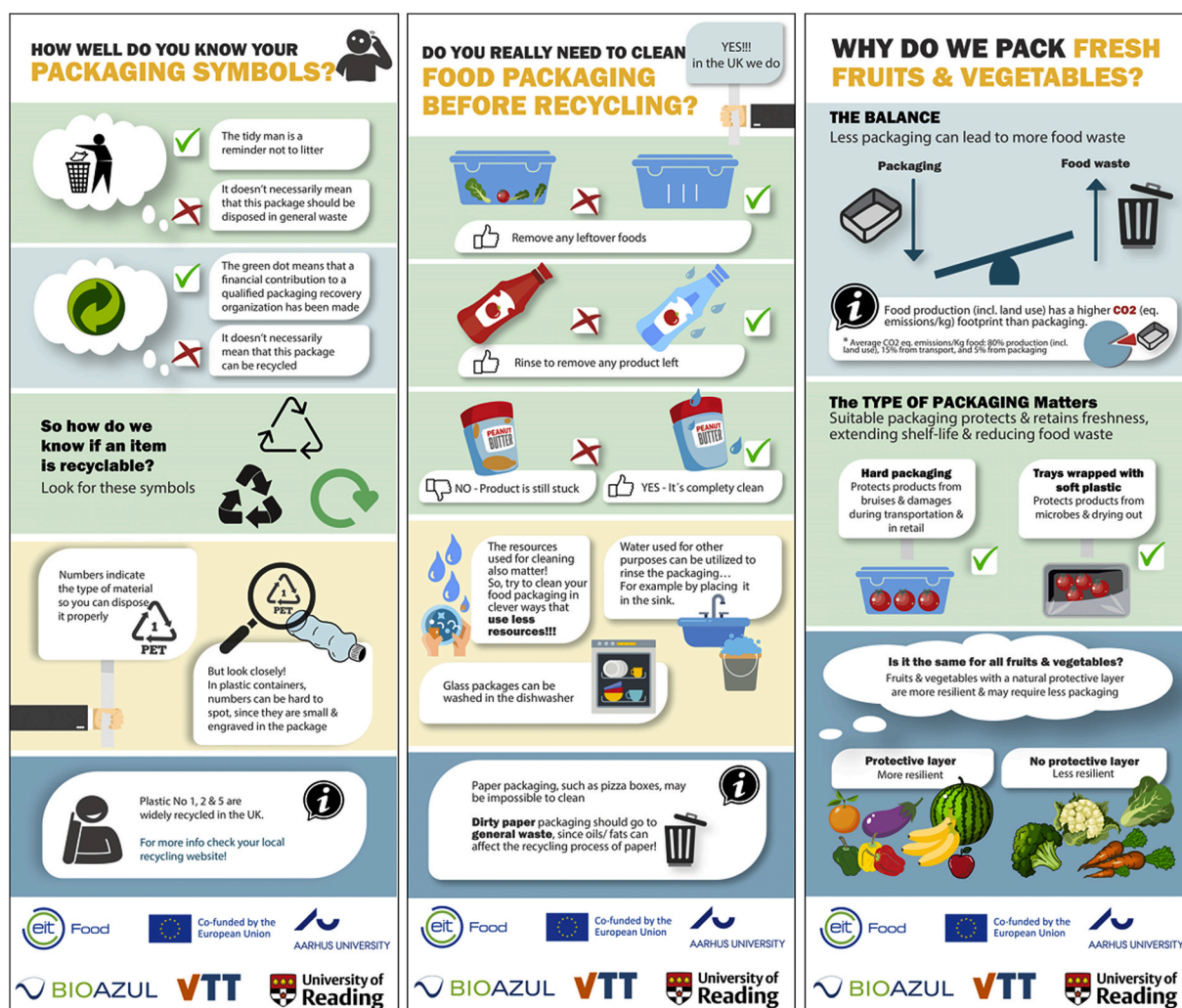
2022). Accordingly, it is hoped interest in sustainable food packaging approaches can now be translated into positive consumer behaviour utilising studies with ecological validity in the future.

Another key infrastructure related challenge facing consumers is disposal on-the-go and such findings were demonstrated in our study. Consumers cited no recycling nearby and unable to clean/separate materials; accordingly, more governmental, company and brand involvement is needed to help overcome such issues (Pro Carton, 2018; 2021). Moreover, the take-away market is on the increase and is associated with widespread sustainability concerns (Gallego-Schmid et al., 2019). Such issues could be a contributing factor to the results demonstrated by the survey cohorts. Going forwards, it would be suggested consumers aim to bring their own reusable food containers to minimise single-use containers to overcome disposal barriers on-the-go (Gallego-Schmid et al., 2019). Plastic (soft or hard) was identified as a key problem in a home setting relating to disposal by consumers in both countries. Plastic was also a noteworthy theme from the consumers open-ended questions, especially in the UK. It is likely the increasing awareness of the environmental issues associated with plastic contribute to such findings (Dilkes-Hoffman et al., 2019). In both countries, there has been recent government related initiatives to minimise single-use-plastic (e.g., reducing plastic bag use by introducing a charge) and subsequent retailer related pressure to implement such changes (Two Sides, 2020; Oloyede and Lignou, 2021; Mentis et al., 2022).

However, the key challenge with plastic is that it is not always recyclable and there are a number of different types of plastics; subsequently, requiring the consumer to have sufficient knowledge to understand how to correctly dispose of packaging. Therefore, it could be suggested that information campaigns led by the government, companies and/or supermarkets could be a vital approach to help inform better the consumer.

4.2. Information formats

In order to develop tailored and targeted information, it is important to understand the consumers' perspective. It was apparent consumers were sometimes searching for information relating to sustainable food packaging behaviour; therefore, it is vital to ensure that suitable information is readily available to consumers. Previously, it has been suggested European consumers' sustainable packaging related knowledge is limited and differences exist between consumer understanding and scientific information; therefore, training/information could be viable approaches (Boesen et al., 2019; Ketelsen et al., 2020; Otto et al., 2021). Maximising the impact by understanding typical locations where consumers commonly searched for such information, topics of interest and key information sources is needed. It was clear consumers often utilise labels, popular articles, and scientific studies, coupled with an interest in learning more relating to food packaging disposal, as well as key



<https://vimeo.com/734704584> <https://vimeo.com/734705524> <https://vimeo.com/734705934>

Fig. 9. Overview of infographics and video links used in consumer centric campaigns (English version) on packaging symbols, cleaning food packaging prior to recycling and fresh fruit and vegetable packaging.

information sources which were scientists/research centres and independent consumer organisations. Therefore, these areas should be the focus of future information circulation; however, information needs to be provided in a format which best conveys the message to successfully 'nudge' consumers (Klaiman et al., 2016). Effective communication strategies are vital in promoting such messages (Chan, 2004). Therefore, next steps need to combine consumer preferred information dissemination approaches with measuring long-term behaviour impact, so that the approaches can be tailored best to suit consumer's needs; this is an objective of the InformPack project.

4.3. Key themes

Consumer insights are fundamental to understanding purchase and disposal related issues for food packaging. This is especially relevant since Klaiman et al. (2017) noted that recognising and understanding consumers' barriers to recycling is deemed a vital stage so that industry can make changes to maximise recycling behaviour. Consumers in our study demonstrated key issues relating to: (1) no clear sustainable packaging information across different product categories; (2) challenges and awareness relating to cleaning of food packaging prior to recycling (especially on-the-go); and (3) fruit and vegetables packaging can be excessive (more relevant to the UK). Experts from the packaging

field also provided input on such issues and they highlighted the: (1) lack of consistency and high variability associated with packaging labelling; (2) importance of removing food residues prior to recycling; and (3) balance between shelf life and food waste for fruit and vegetable packaging. Overall, it is clear more emphasis on improved regulations, guidelines, incentives, and consistency, as well as more company and governmental involvement is needed to aid consumers to make better decisions in terms of sustainable food packaging behaviour. This supports the literature where consumers' barriers to sustainable packaging and recycling can include: cleaning prior to recycling, material separation, time, effort, cost, confusing, collection system related issues, unable to recognise sustainable packaging and lack of knowledge in this area (Klaiman et al., 2017; Ketelsen et al., 2020). Additionally, fruit and vegetables are often associated with food waste where finding the optimum between food waste, shelf life and packaging needs are key (van Herpen et al., 2016; White and Lockyer, 2020). Therefore, taking together both the consumer insights and experts' feedback, the InformPack project provided tailored and specific campaign material for Greece and the UK for subsequent development.

4.4. Campaign development

Consumers' insights were at the forefront of campaign development;

this is an important step to ensure suitability and relevance for consumers. Accordingly, infographics (information in a visual format) and videos (less than 1-min) were utilised in both countries. Moreover, formats such as infographics and videos were considered viable digital communication tools which can have a positive impact on consumer behaviour in this area (Klaiman et al., 2016, 2017; Tu et al., 2018; Wharton et al., 2021). Three themes (packaging symbols, cleaning of food packaging prior to recycling and fresh fruit and vegetables packaging) were developed as campaigns in both infographic and video formats. It should be noted there may have been cross-country differences identified in this study in some cases; however, campaign material selection was based on the key consumer-centric themes, which were dominant relatively speaking in both countries. Therefore, it is considered suitable and relevant for dissemination in both countries and campaign material was present in the countries correspondingly language (e.g., Greek and English). It is hoped that campaigns will: (1) improve consumer awareness and knowledge on packaging symbols; (2) provide clarification and advice on cleaning related issues; and (3) insights into fruit and vegetable packaging. Targeted education is considered an approach that could modulate consumer behaviour (Wharton et al., 2021; Patra et al., 2022). The subsequent impact of campaign material on consumers self-report behaviour was considered positive as outlined by Vázquez et al. (2023); accordingly, simple approaches that can be readily incorporated into everyday lives are fundamental, coupled with measuring the long-term impact on consumers behaviour.

It should be noted there may have been some limitations that could have influenced the consumers responses. For example, the survey was recruited anonymously via an external agency; therefore, information on consumers' background was not recorded. In addition, balanced quotas for age would be recommended to overcome any potential age-related skews. There are also challenges associated with cleaning food packaging prior to recycling and it is important the resources (e.g., water) utilised are re-used if possible for other purposes. However, it could be argued that using such resources requires additional energy and cost subsequently no longer being a sustainable action; therefore, finding the appropriate balance is key (Marcinkowski and Kowalski, 2012).

5. Conclusion

This study utilises input from both consumer research and packaging experts so tailored and targeted information can be developed for future dissemination. Consumers demonstrated that food packaging type had a partial impact on product choice; therefore, sustainable food packaging needs to fit within this remit to avoid negatively impacting purchase decisions. Key consumer-centric themes and expert feedback were used to develop campaigns: (1) packaging symbols was identified as a key issue since there was no clear sustainable packaging information across different product categories as well as inconsistency/variability; (2) cleaning of food packaging prior to recycling provided a considerable challenge especially on-the-go and food residues removal prior to recycling is often misunderstood; and (3) fresh fruit and vegetable packaging can be perceived as excessive and the balance between shelf life and food waste is key. Three campaigns were subsequently developed in two formats (infographics and video) based on consumer preferences. Findings are being used to create actions, tools and strategies that will influence public behaviour and develop solutions to enable transition to a more sustainable European food packaging ecosystem. Moreover, increased awareness and improved sustainable food packaging knowledge can hopefully help modulate consumer behaviour; however, this needs to be tested with studies utilising ecological validity so that long-term behaviour can be captured. There also needs to be additional support by government, companies and shops so sustainable food packaging solutions can be readily incorporated into everyday lives. Currently, the InformPack project is expanding its approach and

target population to other countries so that a toolkit of food packaging knowledge can be developed and utilised for future use.

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Author statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclepro.2023.137169>.

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