Novel packaging films and textiles with tailored end of life and performance based on bio-based copolymers and coatings.

D.7.4 Interim report on BIOnTop value chain and consumer perception

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Acronyms

WP	Work Package
D	Deliverable
EU	European Union
EC	European Commission
BBI-JU	Bio-Based Industries Joint Undertaking
H2020	Horizon 2020
MC	MOVIMENTO CONSUMATORI
EUBP	European Bioplastics
EoL	End of life
ISCED	International Standard Classification of Education
ECU	European Consumers Union
DOI	Digital Object Identifier
CERN	Conseil Européen pour la Recherche Nucléaire

Index of Figures

Index of Tables

1. Executive summary

BIOnTOp is a four-year research project carried out by 21 teams and almost 170 experts from research institutes, the mechanical engineering sector, food and packaging companies, and trade bodies from eight EU countries. The project aims to develop novel bio-based and compostable packaging and textiles through experimental research on copolymers and compounds with customized biodegradability and multifunctional coating solutions.

In order to ensure the sustained alignment of BIOnTOP to market real needs and to help decrease the time-to-market of the proposed solutions, Movimento Consumatori has been appointed to analyse consumer perception on bio-based packaging, identifying awareness, attitudes and willingness to buy.

This research results and the recommendations proposed (Conclusions §5) are drawn from a survey – 3.303 responses collected in n.8 European countries (Germany, France, Italy, Spain, Netherlands, Belgium, Greece, Malta) – and n.3 focus groups focused on consumer associations, food-chain industry companies and institutions.

The study's results examine the following areas:

Awareness and knowledge – The research proved that consumers had a lack of knowledge regarding bio-based products that cannot be easy identified in the market. Although low awareness of bioplastics characteristics was identified, the study verifies positive consumer perceptions that were so positive they wished for more incisive legislative regulations to support it at global or, at least, European level.

Association and connotation – According to awareness and knowledge analysis, even if the European consumers associate bioplastic with an environmentally friendly choice, they also raised some doubts related to the economic (expensive) and social (land consumption) impact connected to bioplastics.

Information and label – Data shows that consumers have more interest in factual advice that maximizes the utility of the selected product. Moreover, the research demonstrated that more information could be provided, mainly in relation to recycling procedures, and that consumers complain about packaging information that is unclear, especially around End of Life (EoL) treatment.

Buying decision and willingness to pay – Buying decisions are strictly connected with the ability to recognize bioplastics. The consumer's difficulties in verifying the nature of product/packaging purchased represents a barrier on market development. Therefore, even if European consumers perceive bioplastic as an environmental-friendly choice, they do not recognize it as such at point of purchase. Furthermore, the study points out that consumer purchasing choices are based not only on environmental concerns but also on social and economic judgements.

2. Introduction

2.1 About BIOnTop

BIOnTOp is a four-year research project carried out by 21 teams and almost 170 experts from research institutes, the mechanical engineering sector, food and packaging companies, and trade bodies from eight EU countries. The project aims to develop novel bio-based and compostable packaging and textiles through experimental research on copolymers and compounds with customized biodegradability and multifunctional coating solutions.

The main impacts expected are:

- Establishing a new bio-cluster connection and intensifying a further four connections, in the bioplastics, packaging, agri-food, personal care and textile sectors.
- Creating three new stable and effective value chains by both creating new interconnections upstream of the current value chain and by remodelling existing value chains to substitute fossil-derived manufacturing with bioplastics.
- Developing two biopolymer-based innovations that will be used to create several consumer-oriented products such as packaging and wrapping.
- Developing and validating two novel approaches: one to obtain copolymerisation, focusing on developing novel, lower-cost bio-copolymers; the other will focus on fatty acid grafting that will coat bio-based films to improve their water-resistance and ease of emptying.
- Minimising the environmental footprint of the packaging materials by developing 'sustainable-by-design' approaches that better suit biodegradability and recycling demands.
- Reducing the overall cost of the end-of-life burden of the packaging products by making materials suited to waste and mechanical recyclability, industrial compostability or biogasification.

2.2 Scope of the document

This report has been conducted within the context of Work Package 7 – *Market strategy and innovation impacts of the BIOnTop project* – under subtask 7.2 – *Study of consumer perception*.

In the BIOnTop framework, a study of consumer perception has been made not only to drive successful future packaging development, but also to ensure a correct alignment of project activities to market needs.

Therefore, the main goal of this study is to analyse consumer perceptions of bio-based packaging, identifying awareness, attitudes and willingness to buy. Therefore, once completed, we will be able to design a set of recommendations to steer project activities towards consumers' requirements and suggest

how to increase consumers' virtuous behaviour. Thus, Movimento Consumatori designed a questionnaire, submitted to consumers from n.8 European countries, the results of which were discussed in three focus group in which associations, companies and institutions participated.

2.3 Document structure

Before presenting the collected data, the report provides a brief description of consumer expectation, based on existing research and reports, followed by a methodology chapter that explains the approach applied to complete this research. Thus, the main results are presented and some recommendations are offered from Movimento Consumatori's (MC) point of view.

Finally, in accordance with BIOnTop rules, MC will make the raw data collected available to any stakeholder, to promote innovation, development and useful change between civil society, companies and institutions.

2.4 The context

According to the United Nation (2019), the global population could grow to around 8.5 billion in 2030, and reach 9.7 billion by 2050. The equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles (United Nations 2016).
Therefore, the European Union launched a concerted strategy – the European Green Deal – to prevent environmental degradation and achieve climate neutrality by 2050, thus ensuring the EU's long-term competitiveness (European Commission 2020A). Moreover, this strategy aimed to encourage changes in consumer and business behaviour and facilitate an increase in sustainable public and private investment (European Commission 2019).
Thus, in order to achieve climate neutrality by 2050, the Commission has defined seven main strategic building blocks. One is related to production of industrial goods, like plastics, that should reduce energy needs and increase recycling rates (European Commission 2018).

Hence, in March 2020, the Commission adopted the *EU industrial strategy* and the ***new circular economy action plan*** with the aim to stimulate the development of leading markets for climate neutral and circular products (European Commission 2019). Moreover, the *Circular Economy Action Plan* intends to provide a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, **consumers**, citizens and civil society organisations (European Commission 2020).

Consumer engagement will be crucial for the success of this agenda as long as its priority is well-defined. According to the latest Euromonitor International report, environmental threats have become one of the

most urgent social priorities in 2021 (Angus & Westbrook 2021). Thus, it should not be a surprise if the first "Consumer Sentiment" (before Covid-19) is related to **reduction in plastic use (64,3 %)**, climate change (61,0%), reduction in food waste (59,7%), **recycled items (58,8%), trust in recyclable labels (57,2%)** and **buying sustainable packaging (48,9%).** In other words, the health and interest of society and the protection of the planet comply with consumer expectations.

However, plastic is still the most common choice for food, cosmetics, or pharmaceutical packaging due to its excellent protection properties (BIOnTop 2019). That is extremely important if we consider that 39,6% of European (EU28+NO/CH) plastic demand is still for packaging and more than half (63.3%) is for food packaging (Plastics - the Facts 2020).

Relying on a new circular economy action plan and new consumer priority, in recent years a strong growth has been observed in bio-based materials in the packaging industry (BIOnTop 2019). According to European Bioplastics, the global production capacities of bioplastics are predicted to grow from around 2.11 million tonnes in 2019 to approximately 2.42 million tonnes by 2024. The number of bioplastics applications has seen great development in recent years, mainly in relation to consumer products and packaging that represent the largest market segment for bioplastics with 47% (0.99 million tonnes) of the total bioplastics market in 2020 (European Bioplastics 2020A, 2020B).

If on the one hand bio-based innovation technology has been characterized by strong expansion, on the other consumer familiarity has not kept pace with its development. According to several studies, consumers do not have a clear notion of 'bio-based' as a concept and do not have much ready knowledge of bio-based plastics either (Sijtsema et al. 2016). Moreover, bio-based plastic packages can differ in their end-of-life disposal options: some can be recycled by consumers, while others cannot; some can be compostable by home, while others can only be broken down in an industrial compost facility (Taufik et al. 2020). Even the information on packaging, bio-based or fossil-based, seems to sow a consumer confusion and is mistrusted so that, even when the consumer is strongly familiar with bio-based products, they do not always carry out the proper disposal actions (UNEP 2020, Taufik 2020).

Therefore, our research aim is to analyse consumers' perceptions of bio-based packaging products, studying citizen's habits in relation to shelf-life information, packaging format preferences, emerging needs, material types and end-of-life (EoL) labelling. Any collected information will be useful to assess how these issues can affect consumer' buying choices.

3. Methodology and research design

The research activity has been initially developed through an exploratory phase typical of mixed methods approaches (Bryman 2006). Sources drew on documented research work and reports on the perception of bioplastics (Biobridge 2020, Feve 2016, OpenBio 2014). Institutional sites and sources were used at the European level and then at the level of individual states involved in the investigation. As documented in the introduction, reports from initiatives promoted by producers' associations, consumer associations, universities, and research centres active on the theme of bioplastics were considered to be valuable sources. In the initial phase, we participated in some online events to deepen the potential of these products promoted by associations of bioplastics producers. From this first document collection, studies with a prevalent technical focus that did not include in their surveys the collection of primary data from citizens were excluded.

At the same time, a specific review of the questionnaires documented by the various studies was undertaken to understand how consumer perceptions have already been explored and to identify the key points to address in this research.

The research design involved two joint actions:

a) The creation of an online questionnaire addressed to the citizens of eight countries belonging to the European community, including 3.303 respondents;
b) the creation of three focus groups to validate the results, the first with consumer associations, the second with companies active in the food supply chain industries; the third with institutions.

Quantitative Data. The data was collected from two different sources. Approximately 1.300 questionnaires came from the proposal and stimulus work carried out by the associations and bodies that are partners in the project and with the support of the European Consumers Union (ECU), the official stakeholder of the BIOnTop project. This data was analysed to check consistency with main demographic variables like sex, age and education, which were compared to official statistics about the populations studied. To maintain consistent representation for the most populous countries in Europe, a random sample was added with approximately 2.000 responses collected from structured panels involving agencies active in the various countries; respondents were identified through quota sampling that took into account sex, age and educational qualification (UNESCO 2013)[1]. Both data sets collected were

[1] ISCED is the UNESCO (2013) reference of International Standard Classification for Education and refers to programmes and related qualifications by levels and fields worldwide. ISCED 2011 classification has been implemented in all EU data collections since 2014.

subjected to a merging procedure to combine them into a dataset of 3.303 cases[2]. The overall sample is considered suitable for representing key European countries with reference to Germany, France, Italy, Spain, the Netherlands, Belgium, Greece, and Malta[3]. Considering the population distribution at the level of the European countries, we consider the sample as being consistent in terms of representing the European populations for these nations.

The questionnaire was divided into four sections: i) awareness and knowledge; ii) associations and connotations; iii) info and labels; and iv) buying preferences and willingness to pay. This subdivision was presented to the BIOnTop consortium, which confirmed the proposed analysis. We allocated the largest number of questions to the section on consumer decisions regarding the purchase of products with bioplastics packaging. In the first section, an attempt was made to investigate how much the concept of 'bioplastics' was known among the interviewees and what normative drives were preferred by national and European institutions. In the section on associations, a few questions were introduced to understand how the label 'bioplastics' is associated with other ecological issues through the technique of semantic differential. In the third section, the focus was on labels and the information present on product packaging. The way people approach information was explored, particularly whether they are really interested in the information on the packaging or only in the contents of the packaging. This section also identified some of the labels that are most frequently found on bioplastics packaging to try to understand whether they are understood correctly by consumers. Finally, in the fourth section respondents were asked to express their projections with respect to the purchase of products packaged with bioplastics materials, particularly whether there was a different preference for purchase among seven types of everyday products.[4] The questionnaire closed with a series of questions for social profiling of respondents.[5] The elaborations were realized with SPSS statistics software. The Annexes present in full the overall frequencies and the most significant tables that were processed.

Qualitative Data. The first action planned was a focus group aimed at consumer associations in four European countries. A second focus group involved large-scale Italian distribution and production companies. Finally, a third focus group was planned to involve public bodies and institutions related to

[2] Samples added were collected from Germany, Spain, Belgium, the Netherlands for about 2.000 respondents. In total we had representative samples from eight countries (Greece, Malta, Italy, France, Germany, Spain, Belgium and the Netherlands).

[3] The disproportion in size between countries prevented a timely differentiation of responses between countries. However, when this projection was deemed useful for the arguments in the report, it is produced in tables and charts without data for Malta, given its small population.

[4] Trays films for fruit vegetables, packaging for tea bags, nets for fruit and vegetables, multilayer trays for modified atmosphere packaging (MAP), coated woven fabrics (i.e. food wraps), carrier bags (by secondary raw material), personal care products.

[5] The full version of the questionnaire can be found in the Annexes.

the field of recycling like municipalities of big Italian towns and a multi-stakeholder Italian consortium. Unfortunately, due to the restrictions imposed by the pandemic and the difficulty of scheduling a single meeting, we changed the research design from a focus group methodology to individual semi-structured interviews. This choice helped us to have a more specific in-depth exploration of the topic understanding several different contexts.

In the first focus group, we tried to explore the perception and role that consumers might have in the transition to bioplastics. In the second group, the companies involved expressed their point of view with respect to the complexity of managing the distribution chain, especially in the food sector, in view of a massive use of bioplastics. In the third group, with the administrators of the municipalities and the Italian consortium of bioplastics, we addressed the issues of changing consumer habits when the latter must commit to the disposal of urban waste by differentiating, recycling, composting and reusing the objects purchased.

The interviews included three sections. The first was intended to allow for a positioning of the interviewees with respect to bioplastics; the second was more oriented towards grasping the challenges and opportunities on the topic from the first quantitative results that emerged; and finally the third section aimed at better understanding consumer behaviour with respect to ecological transition.

The focus groups were transcribed verbatim and analysed using *Atlas.ti* software. The analysis for the qualitative part was carried out following the recursive bottom-up process, from data to concepts, according to the logic of saturation of the labels that emerged, typical of approaches inspired by Grounded Theory (Corbin & Strauss 2007).

Focus	Date	Nature stakeholder involved	Number stakeholder involved
I° focus group	09/12/2020	European national Consumer Association (Italy, France, Malta, Spain and Greece)	5
II° focus group	10/03/2021	Companies of food supply chain industry	3
III° focus group	12/02/2021	Local Public administration	1
	04/03/2021	Local Public administration	1
	11/03/2021	Bioplastics National Association	1
	12/03/2021	National regulation entity	1
	26/03/2021	Local Public administration	1
Total number stakeholder involved			13

Table 1: BIOnTop – Focus group timetable

3.1 Survey structure

The structure of the survey for the quantitative part was based on four areas of interest. Each area included several specific questions with various types of responses. The most important objective was to construct a survey that was suitable for online submission by ensuring that the sample was stable throughout the duration of the questionnaire. In total, about 200 questionnaires were excluded because they were partially completed.

The first challenge was to find a question that would allow us to understand who among the respondents was already informed about bioplastics and who had partial or no knowledge about the topic. Immediately afterwards, a precise check on the most accredited definition (European Bioplastics 2014) of 'bioplastics' was included and, as a third step, a more extensive definition was provided for all respondents. This was necessary to have a common base of minimum knowledge on the topic so that subsequent questions could be asked about perceptions and propensity to purchase by the whole sample and not only for those who declared an appropriate or partial knowledge of the topic.

Another starting objective was to estimate the duration of the interviews. In agreement with the partnership, the duration of the questionnaire was set between 8 and 10 minutes in total. The flow of questions required several images and devices to make the compilation sufficiently varied and appealing.

Survey Section	Questions	Sub-questions	Question type	Answers collected
Knowledge and consciousness about bioplastic	Have you ever heard about bio-based plastic?	No, never; Yes, but I am not sure what this is about; Yes, and I know what it is.	Single choice	3.253
	What is a Bioplastic?	A plastic that can be produced from recyclable resources; A plastic that can be biodegradable; A plastic that can be compostable; A plastic that can be simultaneously compostable, recyclable, biodegradable; A Plastic that can be produced from biomass or biodegradable material; A plastic that can be produced with minimum shares of fossil-based, non-renewable (fossil-based) materials; No answer.	Single choice	2.914
	Please state your degree of agreement/disagreement with the following statements. In the future, the product containers will be built in Bioplastic if:	There will be mandatory laws addressed to the companies to do so; There will be incentives and government investment; There will be citizens' associations from below that put pressure on public opinion; There will be many individuals from below who put pressure on public opinion; The public authority will tax more the Oil companies.	Likert scale	3.185-3.197
	At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?	At a global level (e.g. UN); At European Union level; At single state level; No answer.	Single choice	3.029
Associations and links with bioplastic	In your opinion what could be the ADVANTAGES in the use of Bioplastics? (MAX 3);	It creates new jobs (including vocational training for those employees in current sectors which are due to disappear); It reduces waste management costs; It reduces plastic pollution; It uses biomass and other organic waste; It increase the production of quality compost; It can be recycled and used for the creation of new Bioplastics; There are no advantages	Multiple choice	3.258

	In your opinion what could be the DISADVANTAGES in the use of Bioplastics? (MAX 3);	Currently, scientific evidence has not shown that products in Bioplastics are less polluting; Bioplastics are more expensive than traditional (fossil-based) plastics; Bioplastics lead those who produce traditional (fossil-based) plastics to lay off their employees; It will increase the diffusion of monocultures for industrial purposes (for Bioplastics) by reducing the areas reserved for food use; There is a risk that since they are compostable, many people throw them directly into the environment; There are no disadvantages.	Multiple choice	3.119
	We propose you a series of opposite terms. Please, select a point in the line between them that you think indicates more the link with BIOPLASTIC (please click one of the dots between the two labels that best represents your proximity to the represented labels):	Pollutant $$ Non Pollutant; Compostable $$ Non-Compostable; Infinitely reusable $$ Single use; Sustainable $$ Not Sustainable; Natural $$ Synthetic; Expensive $$ Cheap; Trust $$ Mistrust; Safe $$ Unsafe; Land Consumption $$ Limited Land Consumption.	Ordinal scale	2.770-3.002
information and labels	What information do you read most carefully on a product label?	General information on product properties; Information on the origin of the materials used to produce the content; The additives used in the manufacturing process; Symbols and tips on container recycling; Expiration dates; Information about the supply chain and environmental sustainability; Presence of an internet link (QR, link, app, tel.) where you can check the information displayed if necessary; Other.	Single choice	3.149
	Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol (3 international symbols):	Yes, it indicates that it is a container/pack that needs to be reused; Yes, it indicates that it is a container/package that should preferably be composted at home; Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted;	Single choice	3.094-3.127

		No, I do not know.		
	In the event of separate waste disposal, what are the main practical obstacles you encounter in managing the disposal of products once they are exhausted?	Insufficient information on the packaging; The complexity of local rules; Insufficient knowledge of the recycling chain; The challenge to differentiate correctly in particular or unusual situations (parties, meetings, etc.); The incoherence of information between different products ; Inconsistency of information in different places (cities, towns, holiday contexts, etc.); The large number of symbols that can be encountered; The complexity in understanding the symbols you may encounter ; I do not do recycling; Other.	Multiple choice (max 3)	3.122-3.149
Habits and buying interest	Which of the following factors facilitate the choice of an everyday consumer items?	The lower cost; Organic production; The recyclable container/packaging; The biodegradable container/packaging; The compostable container/packaging; The sustainability of the production chain; None of the above conditions; Other.	Multiple choice (max 3)	3.082-3.130
	When making purchases (shops, market, online store, etc.) do you recognize products whose containers/packs are made of Bioplastic? →Yes, No; (filter-1) (If yes) Do you prefer them in your purchase?; (If no) Would you prefer them in the purchase?; →If Yes, No; (filter-2) →Why Yes - 4 →Why No - 5	Unfortunately, they do not solve environmental problems; They aren't natural products; They do not represent a concrete alternative to plastic; Buying them will not change the pollution levels; I'm not sensing the innovative momentum they claim; They are not compatible with my lifestyle (e.g. waste to be sorted); I'm not interested to be fashionable; Because I am not interested in the projects of companies that produce Bioplastics to support environmental campaigns (for example through donations for each product sold - greenwashing); I do not believe that I can shift other brands to introduce bio-plastics through my purchasing choices;	Single choice, Multiple choice	3.061; (filter-1: 1.046); (filter-2:1.972); (Yes: 2.102); (No: 916)

		The prices are higher and/or I'm not believing in the sustainability of bio-plastics; Even if they are compostable, they will not impact on the final volume of waste (other form); Only time will tell how biodegradable they really are.		
	Comparing Biobased to similar fossil based products, how much would you be willing to pay for a product you normally use if made of Bioplastic - compostable material?	I would buy as long as it's at about the same cost; I would buy even if it costs a little more, about 10% of the final cost; I would buy even if it costs bit more, about 15-20% of the final cost; I would buy even if it costs much more, over 20% of the final cost.	Single choice	3.065
	As a consumer, why would you agree to pay more for a Bioplastic pack?	Because in the long term costs will be lowered thanks to the diffusion of products; These materials are of higher quality for food protection; These materials do not contribute to environmental pollution; I feel an active part in helping to protect the environment; I'm not interested in having to pay more.	Single choice	3.058
	In which way the following elements can encourage the purchase of a product in Bioplastics for everyday use?	The use of raw materials that do not impact on the environment; Knowing that the production of raw materials does not have negative effects on the economy of the producing countries (e.g. monocultures, deforestation, etc.); The presence of the words "Packaging made with 50% recycled plastic"; The awareness that it is a positive investment for health Trademarks and tips on container disposal; The awareness that this helps the planet to save it for future generations.	Likert scale	3.005-3.041
	The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?	Trays & films for fruit and vegetables; Packaging for tea bags; Nets for fruit and vegetables; Multilayer trays for modified atmosphere packaging (MAP); Coated woven fabrics (i.e. food wraps); Carrier bags (by secondary raw material; Personal care products	Likert scale	3.050-3.066

Social profile	Sex	Female, Male, Other or prefer not to say	Single choice	3.071
	Year of Birth	Number (YYYY)	Blank	3.065
	What state are you in?	Belgium; Germany; Greece; France; Italy; Malta; Netherland; Other.	Single choice	3.070
	What is your education level?	Lower secondary education (ISCED-2); Upper secondary education (ISCED-3); Post-secondary non-tertiary education (ISCED-4); Short-cycle Tertiary education (ISCED-5); Bachelor's or equivalent level (ISCED-6); Master's or equivalent level (ISCED-7); Doctorate or equivalent level (ISCED-8); No answer.	Single choice	3.065
	Please, select your current employment status:	Employee or external collaborator; Self-employed, director, manager; Unemployed, precarious, with short and unstable occupations; Homemaker or housewife/house husband; Retired; Student; No answer; Other, specify	Single choice	3.303
	Please, specify the composition of your household:	Couple with children living together Couple with children not living together Couple without children Single without children Single with cohabiting children Single with not cohabiting children I live with my parents Other No answer	Single choice	3.065

Table 2: BIOnTop – Structure of the questionnaire

The areas of interest identified in the questionnaire (Table 2) are the result of a review of other similar research, in particular with the work carried out by RoadToBio, which through a systematic review in 2017 took into account the scientific works available on these issues (RoadToBio 2017). That contribution, a synthesis of various primary research, highlighted how people struggle with products derived from

complex technological processes. Bioplastics, in fact, are completely new as a concept to the consumer. Consumers have to take care to distinguish them from traditional plastics and have to increase their knowledge to dispose of them correctly.

Scientific contributions on the subject confirm that the 'novelty' of bioplastics will require an assessment of knowledge in terms of environmental impact, ethical sustainability of raw material production, and impact on traditional plastics production. As we will see, especially in the qualitative part, citizens and administrators are preparing for even more radical choices, namely the effective abandonment of all types of plastic. The questionnaire therefore has a basic aim of understanding how today's citizens are orienting themselves in the management of this type of material.

The research included in RoadToBio (2017) and Biobridges (2020) indicates that the description on packaging and labels is not sufficient to help consumers to actually 'understand' the meaning, nature and new management practices that bioplastics products require. In general, the aim of this research is to follow up on this work to describe the challenges of the transition to bioplastics. A transition that this research has set out to verify and connect to the new proposals emerging from the market. Finally, the research aims to indicate how people's choice processes are being configured in view of the increasingly significant presence of this material in the packaging of everyday products.

With this awareness of previous work and the need to collect primary data a few years after that research, four areas of interest were identified.

The first area of interest identified was to determine whether knowledge among European populations is increasing in relation to bioplastics. These first questions also allowed us to understand which levers citizens consider important to continue promoting this product. At the same time, those who argue that the leverage should be legislative were asked to indicate which institutional level would be preferable to entrust this task to: the global level, the EU, or national level.

The second area of interest sought to map the associations that consumers currently have regarding bioplastics. Questions explored the possible advantages and disadvantages that may arise from the introduction of bioplastics and tried to understand which terms are most frequently associated with bioplastics today. Some of the terms explored included pollution, cost, and land consumption.

The third section of the questionnaire explored the relationship between consumers and information about consumer products. One question sought to ascertain what information consumers usually look for on labels and what information role the Internet can play. We asked respondents to recognise some of the international labels for bioplastics material now present on the packaging of products in many European countries and to understand the ability to distinguish between 'home compost' and 'industrial compost', the two prevailing ways of disposing of bioplastics. This section also sought to understand the

current obstacles to proper disposal of products. This question aimed to find out where we are in terms of the quality of information available on waste sorting chains.

The last section of the questionnaire included six questions related to purchasing choices. A first question concerned the main factor that guided purchasing choices with reference to price, materials used and the production chain. A second question specifically asked how bioplastics were recognised and considered for purchase by consumers. It asked why these materials were preferred or not when making purchases. A subsequent question asked how much price guides choices when considering two similar products with different packaging. For those consumers willing to spend more, the questionnaire asked them to define the reasons for their choice in order to better understand what drives consumers' purchasing behaviour. In the fifth question, consumers were asked to define what would motivate them to buy bioplastics products in relation to various aspects such as health and environmental impact.

The last question concerned interest in buying seven specific products that the industry has been investing in for future production. These items are diversified by type, but all are dedicated to the world of large-scale distribution that characterise the daily life of each consumer.

The closure of the questionnaire was given over to questions related to the respondents' background and their social profile. The selected questions asked about sex, age, educational qualifications and profession, country of residence and size of household.

3.2 Open data

The research has been constructed with a specific attention to transparency and the possible sharing of the data collected and used for the analysis, according to the logic of open data.

Accordingly, the quantitative data consolidated and used for the analysis has been uploaded to *zenodo* website made available by CERN[6].

Data can be reused, citing the source, by anyone wishing to enrich their work with other datasets or carry out secondary analyses based on the raw data[7]. The histograms contained in the Annexes, constructed in systematic interaction with certain variables, can also be openly reused, citing the source.

However, it is important to emphasise that citing source is a mandatory rule. Therefore, whoever wants to use research outcomes should use the following sentence with corresponding logo:

[6] Zenodo is a global repository made available by Conseil Européen pour la Recherche Nucléaire (CERN).
[7] Raw data available on https://zenodo.org/ (DOI: 10.5281/zenodo.4772351)

BIOnTop project – The project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 837761.

Figure 1: BIOnTop - Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme logo

3.3 Data treatment

Through the online survey platform, a single data matrix was available from the time the survey closed on 31 March 2021, although the survey was administered in seven languages. The structured panel surveys with quota sampling also used the same data structure (see Table 2).

Once the survey was closed, a check was made on the merging of the datasets, followed by a check on the consistency of the records collected to fix any problems in the processing phase (value label check). Some manual corrections were made to the 'other' categories of some variables. For example, in the answer concerning the country of origin, in the 'other' category we found countries already included in the original list but written using national idioms.

All records with four or fewer answers were excluded from the data matrix (about 200 records). Their exclusion did not change the consistency of the representativeness of the sample involved.

3.4 Results

The presentation of the results intends to respect the four survey areas assessed through the questionnaire and the social profiles of the sample in the survey. This will be followed by the presentation of the data for the qualitative side and a conclusion summarising the collected results.

4. Results: survey and qualitative data

The main objective of the analysis is to explore the consumers' side to understand their perceptions related to the development of future successful bioplastics packaging and to assess their interest in new products made using bioplastics. This should ensure the sustained alignment of BIOnTOP goals close to real needs of people and decrease the time-to-market of the proposed solutions.

We conducted a survey to discover consumer habits and knowledge about practices, label information, packaging materials, end-of-life packaging management, and their reaction to the source of new bio-based materials, ethical concerns regarding material origins from food by-products or their potential leaking into the environment.

As stated above, results from the questionnaire were discussed in three focus groups and several other interviews, in which associations, companies and institutions were involved. Findings were considered to write the Conclusions (§5) about the highlights that should be considered to steer the project towards matching consumers' visions of the topic.

The presentation of the results respects the four survey areas assessed through the questionnaire. This is followed by the survey presentation and to some extent the qualitative results. A conclusion summarizes the collected results.

4.1 Sample reliability and respondents' social profile

The starting point of any survey should be an understanding of its representativeness in relation to the identified population. The survey focused on eight European countries: Belgium, France, Germany, Greece, Italy, Malta, the Netherlands and Spain, which according to Eurostat collectively amount to approximately 298 million inhabitants[8]. The calculation of the sample size was based on homogeneous samples of around 500 units for the most populous countries and to a lesser extent for Italy, Greece and Malta[9]. Moreover, since the final sample has been merged from two different collection methods, one by

[8] Eurostat - Population on 1st January by age, sex and type of projection (https://ec.europa.eu/eurostat/databrowser/view/PROJ_19NP/default/table?lang=en, retrieved 10 May 2021).

[9] According to the well-known calculation of sample size in the case of mono-variate observations, assuming a confidence interval of 3.8% and a reliability of the estimates of 95%, it was necessary to arrive at samples of 500 observations. This sample size was also adopted for countries with smaller populations to increase the reliability of the estimates in multivariate analyses. Due to problems linked to the diffusion of research in Italy, the sample size was limited to 300. This limit should be considered in the projection of the data by country. Therefore, in general, it can be assumed that results produced by the analyses will admit a fluctuation between +3.8% and -3.8% from data provided and will represent 95% of the observations made.

random access and the other by panels with stratification by quota, in the following lines we provide an account of the consistency of the social profiles obtained.

The most effective way to check the consistency of the sample is to determine whether the cross-tabulated background variables give similar estimates under different conditions.

The sex variable in the total sample is equally distributed between men and women. A cross tabulation of the sex variable by the country of origin should show similar percentages of men and women given the expected fluctuation in the confidence interval. The results obtained confirm that the sample for each country was split almost 50/50 between men and women. As expected, the only country to deviate was Malta due to the small number of people interviewed there and the small number of inhabitants.

	Belgium	France	Germany	Greece	Italy	Malta	Netherland	Spain
Female	50%	47%	50%	58%	51%	70%	50%	50%
Male	50%	53%	50%	42%	49%	30%	50%	50%
Total	100% (506)	100% (497)	100% (504)	100% (228)	100% (299)	100% (10)	100% (500)	100% (508)

***Table 3: BIOnTOP* - Sex distribution between countries**

Something similar can be observed for the distribution of educational qualifications. In each of the groups of qualifications identified for the analysis (ISCED 1-2, 3-4 and 5-6-7)[10] the distribution by gender was around 50% as it is in the real population. Some other checks of the sample confirm its reliability in representing the population of the eight states considered.

From an employment point of view, the respondents are in line with the structural data and present an active population of about 70% (employed plus unemployed, 68% EU rate)[11], among which 10% are professionals and managers and 44% are employees and workers. Some sample differences were detected in terms of work status: the unemployed are overrepresented (15% vs. 8% EU rate within selected countries)[12] as are students; pensioners are underrepresented compared to the European average in 2018 (15% vs. 25% EU rate)[13].

As far as respondents' education is concerned, the sample is well-distributed with 33% in the ISCED 1 and 2 categories (lower education; eight countries rate 31%), 36% in the ISCED 3-4 classes (eight countries

[10] In the questionnaire we adopted the ISCED 2011 classification, http://uis.unesco.org/sites/default/files/documents/isced-fields-of-education-and-training-2013-en.pdf, (retrieved 24 April 2021).

[11] https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_ergan&lang=en, (retrieved 5 May 2021).

[12] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=une_rt_a&lang=en, (retrieved 5 May 2021).

[13] https://www.infodata.ilsole24ore.com/2020/07/14/rapporto-tra-occupati-e-pensionati-italia-agli-ultimi-posti-in-europa/?refresh_ce=1, (retrieved 5 May 2021).

rate 40%) and the remaining 30% in tertiary education (eight countries rate 31%). Also, in this case the distribution matches the actual distribution of the countries considered[14].

Similarly, survey variables are often analysed by considering the age of the sample in relation to the different consumption styles that people have in relation to their age (Sroka 2020). In this case, however, to simplify the presentation of the analysis, the age variable was re-coded into three classes: 18-30 years, 31-56 years, and over 56 years. This distinction was made in order to recognize the different approaches to consumption and economic availability between those who are young, those who are mature, and those who belong to the 'boomers' generation (born between 1946 and 1964).

4.2 Awareness about bioplastics

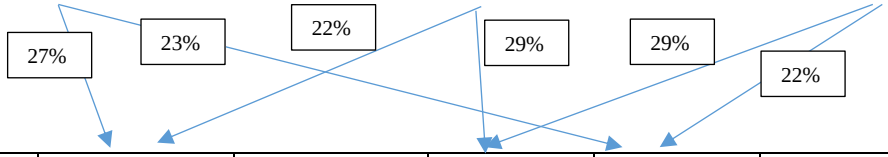
In line with other research at European level, our respondents' knowledge of bioplastics was limited. Among the sample, 19% claimed to have certain knowledge about the characteristics of bioplastics (OpenBio 2014, UNEP 2020); 50% claimed to have some uncertain knowledge; and about 30% had have never heard of bioplastics. Italians claimed to have the most knowledge of this type of material (29%), followed by the Netherlands and Spain (21% and 20%). French respondents mainly reported having uncertain knowledge (63%), followed by Italians and Greeks (57% and 52%).

However, a follow-up question asking about the quality of this knowledge showed that respondents in the three groups ("Never heard of it", "Heard of it but don't really know what it is", "Know what it is") often did not know exactly what the term 'bioplastic' meant. Those who had never heard of it claimed that the prevailing characteristic is 'biodegradability', those who were 'unsure' as well as those who were 'sure' what the material is, declared that it is above all a material that is "simultaneously biodegradable, compostable and recyclable".

The most precise answer introduced in the questionnaire to define what bioplastic was stated as: "A plastic that can be produced from biomass or biodegradable material". This answer was chosen by 23% of those who had never heard of it, 22% of those who were sure they knew this material, and 14% of those who were unsure.

[14] Data considered for comparison with the actual population from Eurostat 2019 https://ec.europa.eu/eurostat/databrowser/view/PROJ_19NP/default/table?lang=en, (retrieved 4 May 2021).

Have you ever heard about bio-based plastic?		
No, never	Yes, but I am not sure what this is about	Yes, and I know what it is



A plastic that can be produced from recyclable resources	A plastic that can be biodegradable	A plastic that can be compostable	A plastic that can be simultaneously compostable, recyclable, biodegradable	**A Plastic that can be produced from biomass or biodegradable material** (most correct)	A plastic that can be produced with minimum shares of fossil-based, non-renewable (fossil- based) materials	No answer

***Table 4: BIOnTop* - Two main answers from the first question "Have you ever heard about bio-based plastic?" by "What is a bioplastic?"**

These answers define an initial picture of great uncertainty with respect to bioplastics, and even among the citizens who declared that they were informed, there was no greater knowledge about the subject. The level of education of the respondents affects the distribution of the answer "never heard of bioplastics": 41% of respondents with a low educational qualification had never heard of it, against 22% of those with ISCED 5-8. This is in line with trends found in other works (OpenBIO 2014).

Cross-referencing between the first questions and the social profiles of the respondents shows how this question breaks down regarding knowledge. For example, the over 56s tended to report an approximate perception of the topic, choosing in one case out of three the answer, "A plastic that can be simultaneously compostable, recyclable, biodegradable", similar to people aged 31-56, although to a lesser extent (23%). Respondents in the 18-30 age group were more scattered in terms of response, with 2 out of 10 opting for the definition of bioplastics as "A plastic that can be produced from recyclable resources", or "A plastic that can be biodegradable" or "A plastic that can be simultaneously compostable, recyclable, biodegradable". Again, 2 out of 10 respondents chose the more comprehensive definition, which stated that bioplastics is "A plastic that can be produced from biomass or biodegradable material".

Similar issues arise regarding the education of respondents. As the topic is knowledge-sensitive, one would the more educated to be more confident in identifying the salient features of bioplastics. This group states in 28% of cases that they know what bioplastics is (13% more than their less educated peers), but when asked what bioplastics is, they chose imprecisely in 29% of cases "A plastic that can be biodegradable", in 23% of cases "A plastic that can be simultaneously compostable, recyclable, biodegradable", and only in 17% of cases did they choose the most appropriate definition. Similarly, there

were some differences between occupations in the ability to define what bioplastics are. For example, those in management positions did not demonstrate a greater ability to choose the correct definition. It is worth noting that pensioners stand out in identifying the answer "A plastic that can be simultaneously compostable, recyclable, biodegradable" (36%, 10% above the average of all the groups) and "A plastic that can be produced from biomass or biodegradable material" (12%, 5% below the average).

This confirms that the first important work to be done regarding bioplastics is to correctly inform consumers what they actually are in the most complete and up-to-date sense. This focus, however, cannot rely on expectations of greater ability on the part of more educated people to understand complex materials. Bioplastics are a material that has its own network of practices running through the habits of all citizens to which no particular social profile corresponds. However, social profiles help us understand the level of potential and attention.

The most effective key factor according to citizens in promoting bioplastics is the enactment of binding legislation. One in two respondents said that they "strongly agree" with this proposal. The idea of promoting investments and incentives (35% "strongly agree") as well as the promotion of new taxes for the oil industries (35%) was also very much appreciated. Citizens and their associations play an important, albeit slightly lesser, role in lobbying public opinion (29% and 32% “strongly agree”).

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	Total
Mandatory laws	3%	3%	14%	28%	51%	100% (3.241)
Incentives and government investment	4%	5%	22%	34%	35%	100% (3.185)
Pressure on public opinion from citizens’ association from below	4%	6%	27%	31%	32%	100% (3.197)
Pressure on public opinion from citizens from below	5%	8%	27%	31%	29%	100% (3187)
More taxation for oil companies	5%	7%	28%	25%	35%	100% (3.197)

***Table 5: BIOnTop* - Key factors for accelerating the uptake of bioplastics**

The social profile of the supporters of mandatory laws as a driver for the promotion of bioplastics showed a higher presence among highly educated people (56%), over 56-year-olds (60%), and managers or retirees (55% and 68%). It is important to underline that between the different occupations, students, young people and the unemployed chose mostly "neither agree nor disagree" in relation to the possibility that pressure from associations and citizens can achieve results in promoting bioplastics (38% and 37% respectively).

Most respondents agreed that globalization is now a widespread phenomenon that everyone recognizes; 57% stated that the rules for promoting bioplastics should be drawn up by an appropriate organization that can provide precise guidelines for the behaviour of all countries, i.e. a global body such as the WTO or the UN (Table 6).

Only just over one in four respondents said that the optimal level was the EU, and the role of individual states was definitely marginal (10%). The role of the EU was recognised by the most educated (36%), 13% more than the least educated (23%). The EU was also acknowledged more strongly by the employed (33% managers and self-employed; 29% employees).

At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?	N° Replies	% Replies
At a global level	1.729	57,1%
At European Union level	836	27,6%
At single state level	294	9,7%
No answer	170	5,6%
Total	3.029	100%

***Table 6: BIOnTop* - At what level should rules be enacted to encourage companies to produce packages in bioplastics?**

Respondents recognised the following key advantages of using bioplastics: reduction of pollution (29%); creation of new jobs (20%); and reduction of the cost of waste management (17%). Disadvantages include higher costs (24%); risk of abandonment in the environment (23%); and risk of spreading monocultures dedicated to the industrial production process (Table 7). Both positive and negative characteristics were most recognised by people over 56, with high educational qualifications, retired and those who were willing to pay up to 10% more for bioplastics products (Table 7).

The first three ADVANTAGES:	Women	Over 56	ISCED 5-8	Retired	Willing to pay more 10%
It reduces plastic pollution (Total 2.170)	**70%**	**78%**	**67%**	**85%**	**74%**
It creates new jobs (including vocational training for those employees in current sectors which are due to disappear (Total 1.487)	45%	**50%**	40%	**60%**	**51%**
It reduces waste management costs (Total 1.258)	39%	37%	**40%**	38%	42%

The first three DISADVANTAGES:	Women	Over 56	ISCED 5-8	Retired	Willing to pay more 10%
Bioplastics are more expensive than traditional (fossil-based) plastics (Total 1.391)	44%	44%	**46%**	**48%**	**46%**
There is a risk that since they are compostable, many people throw them directly into the environment (Total 1.306)	**44%**	**50%**	**43%**	**52%**	**46%**
It will increase the diffusion of monocultures for industrial purposes (for Bioplastics) by reducing the areas reserved for food use (Total 1.118)	34%	**42%**	**38%**	**47%**	**40%**

***Table 7: BIOnTop* - Main advantages and disadvantages in bioplastic use by main groups that say "Yes" (numbers in bold represent maximum distribution)**

We must note that other works have gone into more detail on the relationship between gender and bioplastics (WCEF 2017). This work highlights how the ethnographic analysis of plastic use practices changes the perception of advantages and disadvantages in relation to the environment. Indeed, a comprehensive analysis of these issues must include the processes of production, use and disposal of plastics.

HIGHLIGHTS

1. Bioplastics is a term that is identified by approximately 2 out of 3 people, but its meaning is blurred and does not allow people to properly indicate the specificity of this material.
2. Approximately 8 out of 10 people 'strongly agree' or 'agree' with the idea that laws should regulate the dissemination of bioplastics. These laws should be enacted at global (57%) and European (28%) level.
3. About 60% of respondents recognise a role for consumer associations and individual citizens in supporting bottom-up pressure.
4. More educated adults aged over 56 years are most likely to believe in the benefits that bioplastics can offer in protecting the environment.
5. About 4 out of 10 people can identify cost, misuse of bioplastics and the risk of monocultures for raw material production as possible disadvantages.

4.3 Associations about bioplastics

Through a battery of adjectives of opposite meaning, usually referred to as semantic differentials, it was possible to qualify the main ideas associated with bioplastics and the intensity of these associations (Filho et al. 2021).

Bioplastics are most positively associated with the terms "non-polluting" (63%) and "compostable" (64%), and to a slightly lesser extent with "natural" (59%), "sustainable" (58%) and "safe" (53%). Associations also continue positively with the terms "trust" (51%), "expensive" (49%) and "infinitely reusable" (48%). More controversial were the choices related to the semantic field "land consumption-limited land consumption" (38%).

The projections of the association of the term bioplastics with the various adjective pairs show that on the one hand there is a convincing adherence to the more immediate positive traits of bioplastics while it can be noted that on other adjective pairs, citizens point out the possible limitations of the industrial processes required to produce bioplastics. Bioplastics seem to be associated with a view of the production chain that could have negative consequences on land consumption through monocultures being dedicated to the raw material of bioplastics. Thus, respondents in these categories were distributed roughly evenly for each dimension: "Land consumption" 38%; "no association" 32%; "Limited land consumption" 29% (Table 8).

Left		No association	Right		Mode	Respondents
Pollutant	17%	19%	**63%**	Non-Pollutant	6	3.002
Compostable	**64%**	16%	20%	Non compostable	1	2.979
Natural	**59%**	19%	22%	Synthetic	2	2.917
Sustainable	**58%**	19%	23%	Not sustainable	2	2.925
Safe	**53%**	26%	21%	Unsafe	4	2.835
Trust	**51%**	26%	24%	Mistrust	4	2.773
Expensive	**49%**	23%	27%	Cheap	3	2.777
Infinitely reusable	**48%**	23%	29%	Single use	4	2.873
Land Consumption	**38%**	32%	31%	Limited Land consumption	4	2.770

***Table 8: BIOnTop* - Frequencies of semantic differential about bioplastics followed by mode indicator and total respondents. The percentage for the most commonly selected term is in bold**

The principal component analysis confirmed that respondents were convinced that the positive aspects of the introduction of bioplastics is consistently associated with the terms "compostable", "infinitely reusable", "sustainable" and "natural" (40% of variance); then with the terms "trust" and "safe" (12% of variance) and finally, individually, the three factors "pollution", "expensive" and "land consumption" (total 27% of variance).

The social profile of the respondents confirmed that the positive view of bioplastics was highest among people over 56 (67% stated an association with "non-polluting", 67% with "natural", 67% "compostable", 63% “sustainable”). This finding was confirmed in the case of the most educated people. 71% of whom associated bioplastics with "compostable", 70% with "sustainable" and 66% with "natural". This also fits with those who were retired (73% associated bioplastics with "natural", 70'% with "compostable" and

64% with "sustainable"). This seems to confirm the idea that bioplastics are products that fits into the framework of ecological production but they are still characterised by a mixed interpretation. Adults express fully positive associations, while young people indicating a more marked distance from the proposal because they see elements of uncertainty in the real possibilities of 'solving' the problems of pollution and the consumption of the planet's resources (UNEP 2013).

HIGHLIGHTS

1. The perception of bioplastics is positively associated with less pollution (63%), compostability (59%), and sustainability (59%).
2. Half of respondents associate bioplastics with increased costs, while there is concern about the possible increase in land consumption to produce them.
3. Half of respondents positively associate the term bioplastics with "confidence" and "safety".

4.4 Labels and product information

The third section of the questionnaire focused on what information is followed and sought by consumer citizens on labels and product descriptions. The picture that emerged from the data analysis confirmed that consumer interest is very selective. One out of three citizens mainly paid attention to expiry dates (32% women vs. 35% men; 31% younger vs. 38% older) and one out of four mainly paid attention to general information about the properties of the product (27% women vs. 22% men). Attention to features related to the origins of materials, recyclability of the container and environmental sustainability did not rise above about 10%.

Attempts to offer other product information material through links to websites or through QR codes did not seem to be of general interest (Table 9). These aspects appeared to be strongly influenced by the age of the respondents; younger respondents were committed to identifying brands that guaranteed the recyclability of their packaging. Those up to 30 years old engaged in this activity in 16% of cases against 10% of the over 56s.

What information do you read most carefully on a product label?	N° Replies	% Replies
General information on product properties	764	24,3%
Information on the origin of the materials used to produce the content	320	10,2%
The additives used in the manufacturing process	385	12,2%
Symbols and tips on container recycling	366	11,6%
Expiration dates	1.057	33,6%
Information about the supply chain and environmental sustainability	134	4,3%
Presence of an Internet link (QR, link, app, tel.) where you can check the information displayed if necessary	98	3,1%
Other	25	0,8%
Total	3.149	100%

Table 9: BIOnTop - Information considered about a product

An important aspect related to the labelling of bioplastics products is the possibility of recognizing them through international brands that are becoming more established over time. The data emerging from the research regarding the recognition of international brands confirms the disorientation felt by consumers. For example, less than one in three people recognized the TUV-Austria industrial composting label. Citizens' answers on brand recognition were influenced by several background variables. For example, the "TUV-Home" label was correctly recognized by only 27% of the youngest age group compared to 43% of adults and the over 56s. This aspect was also confirmed by the level of education, which showed that only 30% of the least educated recognized the label compared to 47% of the most educated.

Figure 2: BIOnTop - International TUV marks for biobased products presented in the questionnaire

International logo for bioplastics	Yes, packaging to be reused	Yes, packaging to be composted at home	Yes, packaging to be composted industrially	Don't know	N
TUV- industrial	14%	17%	**30,6%**	38%	3.127
TUV-home	11%	**38,3%**	15%	36%	3.095
Ok Biobased	28%	13%	19%	40%	3.094

Table 10: BIOnTop - Answers to the TUV-Austria international marks for bioplastics. Correct answer in bold

These two aspects, age and educational qualification, confirm the complexity of the readings that brands can get from consumers. As far as the wrong answers are concerned, it is observed that educational

qualification did not generate differences in the answers, which overall were around 15-17% of respondents (Table 10). In addition, the respondents' occupation showed a different ability to identify the correct definition for the brand. The unemployed and students were significantly less able to recognize the brand than those who were employed or retired (27% vs. 44%). These differences suggest that brands generate specific connotations in the perception of consumers and at the same time different range of practices in different subgroups. A recent United Nations report (UNEP 2020), which analysed a much wider range of symbols and material markings, verified consumers' understanding of this topic as highly problematic. Therefore, one of the main reasons for inefficient waste management is directly related to the labels used on packaging.

Are you familiar with the following symbols that certify the packaging material of the product?	18-30	31-56	Over 56
Yes, it indicates that it is a packaging that needs to be reused	17,2%	9,9%	5,7
Yes it indicates that it is a packaging that should preferably be composted at home	**27,4%**	**42,6%**	**41,8%**
Yes it indicates that it is a packaging that goes into the wet waste bin an d industrially composted	16,8%	14,3%	13,5%
No, I don't know	38,6%	33,2%	39,0%
Total	100% (809)	100% (1363)	100% (854)

Table 11: BIOnTop - TUV-Home mark for bioplastics by age. Correct answer in bold.

It is likely that these differences with respect to occupations testify to a different proximity to waste disposal practices that is more evident in adults than in young people. Reviewing the answers obtained in different countries showed that Italians and French (55% and 63%) had a greater capacity to recognise this label compared to other countries such as Belgium and the Netherlands (32% and 25%). An overall assessment of these aspects was not the subject of this study. However, it is reasonable to think that the diffusion of these labels and the different national regulatory frameworks may affect their perceptions. A third label ("ok Biobased", also from the certification body TUV Austria) was included for this purpose, to discover how people respond when the label does not offer disposal information but rather indicates the packaging composition. In this case, a large proportion of respondents were expected to answer, "I don't know". In fact, only 4 out of 10 chose this option, the others tried to choose one of the possible options that could not be directly linked to the brand. This is a sign that there is a strong risk of inaccuracy in relation to international brands. Finally, no significant differences were observed according to the gender of the respondents.

Are you familiar with the following symbols that certify the packaging material of the product?	18-30	31-56	Over 56
Yes, it indicates that it is a packaging that needs to be reused	19,8%	13,6%	8,5
Yes it indicates that it is a packaging that should preferably be composted at home	23,4%	18,7%	10,4%
Yes it indicates that it is a packaging that goes into the wet waste bin an d industrially composted	**17,7%**	**31,5%**	**41,1%**
No, I don't know	39,2%	36,2%	40,0%
Total	100% (809)	100% (1378)	100% (869)

Table 12: BIOnTop - TUV-Industrial mark for bioplastics by age. Correct answer in bold

For the "TUV-Industrial" label, the picture was almost identical. The over 56s correctly recognized the label in 41% of cases, compared with 18% of the under 31s. With the second symbol, however, the youngest cohort gave the word "industrial" a value that legitimized domestic compostability in 23% of cases, compared with only 10% of the oldest. It is important to consider that the label was not recognized by about one in three of the respondents (36% TUV-Home; 38% TUV-Industrial). The more educated respondents showed a higher capacity of brand recognition for both TUV-Home (47% more educated vs. 30% less educated) and TUV-Industrial (36% more educated vs. 26% less educated) (Figure 3).

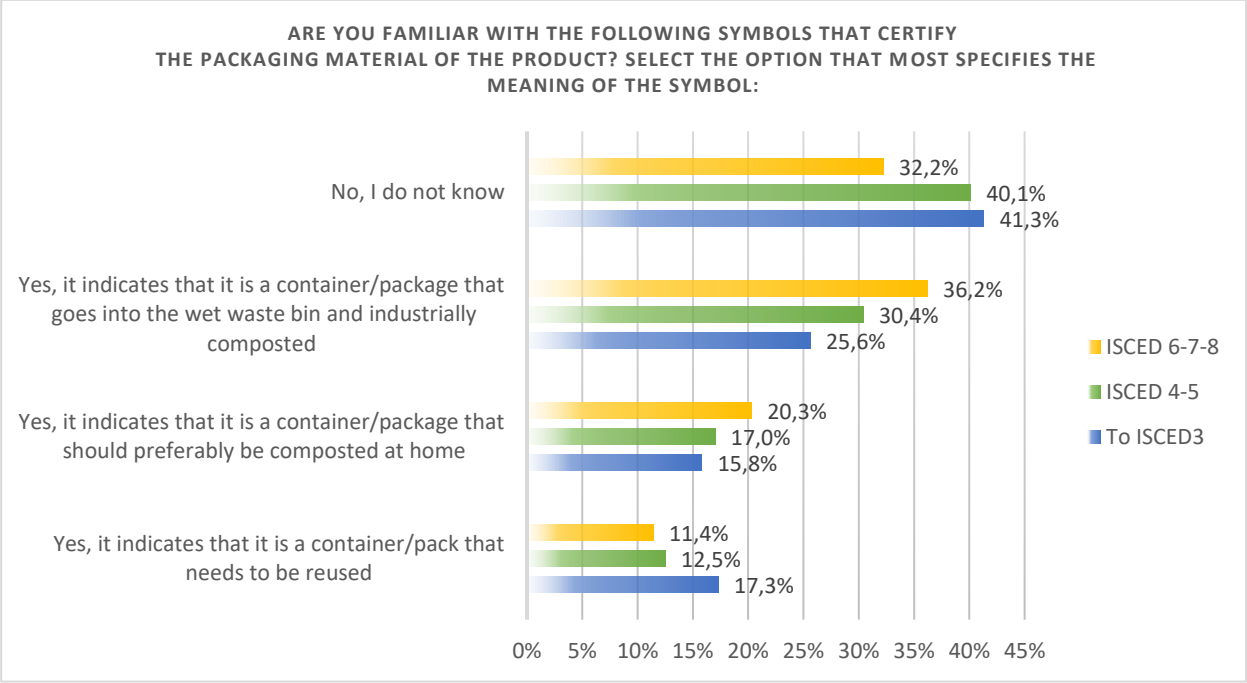


Figure 3: BIOnTop - TUV-Industrial mark by education

To focus further on exploring the level of effectiveness that waste disposal instructions have among consumers, all respondents were asked: "what are the main practical obstacles you encounter in

managing the disposal of products once they are exhausted?" The indicators aimed to identify how respondents' practical knowledge affected the effectiveness of waste disposal. Of these indicators, the most selected was the insufficient quality of the information printed on the packaging of the various products (36%). The second problematic aspect concerned local rules on how to dispose of waste (28%), as well as insufficient knowledge of the recycling chain (29%), and the complexity arising from the different situations in which waste is generated, such as party meetings and festivals (29%). The answer about not being interested in disposing of waste properly was chosen by only 4% of the sample. Despite the large investments made over the years to change citizens' behaviour regarding waste disposal, the path still seems long and difficult (European Union 2008, EEA 2020). These indicators draw a map of great complexity and difficult response from citizens. The research verified a strict relationship between respondent answers and home country. In fact, mainly Italian, Greek and French consumers (respectively 52%, 50%, 45%) underlined the lack of clarity about local waste treatment rules. Consumers from Belgium, the Netherlands and Germany selected this issue to a much lesser extent (respectively 25%, 29% and 35%). Although the study cannot accurately assess the reasons for the differences between countries, it is possible to assume a difference in national waste management policy. Other differences can be noted in relation to the age and, to a lesser extent, the education and gender of the respondents. On the other hand, the complexity of local rules shows a small difference by gender (74% women vs. 69% men), probably because in some countries gender differences give more responsibility to women in household waste management (Oates and McDonald 2006, Cairns et al. 2010).

Differences of the consumers interviewed by country of origin showed that the Central European countries involved in the research had far fewer problems with local rules (about three out of four people did not indicate this as a problem). The social profile of consumers also indicated that it was mainly students and the unemployed, the younger and the better educated who had least/no problems with local rules.

The issue of insufficient knowledge of the recycling chain did not show any internal differentiation with respect to the social characteristics of the sample, indicating that the issue of the chain is more general and less related to the social practices of citizens. On the other hand, the indicator relating to public events that produce waste (parties, events, exhibitions, etc.), involves more active people and more educated people, probably because of the practicalities of events that involve an active population.

The inconsistency of information encountered in different places seems to be a typically Italian phenomenon. 38% of Italian respondents indicated this as a problem compared to an average of 22% of

the whole sample. It is worth noting an over-representation of the most educated people in selecting this indicator. This seems to indicate that the more educated feel the insufficient quality and reliability of waste disposal rules more strongly in their daily experience.

However, other works have shown that the difficulty in finding one's way around waste management characterizes this work on the citizens' side (White et al. 2019). These reports also confirm that too often the onus is placed on consumers to understand an array of confusing, contradictory, or misleading information (UNEP 2020).

In the event of separate waste disposal, what are the main practical obstacles you encounter in managing the disposal of products once they are exhausted? (MAX 3)	YES
Insufficient information on the packaging	36%
The complexity of local rules	29%
Insufficient knowledge of the recycling chain	29%
The challenge to differentiate correctly in particular or unusual situations (parties, meetings, etc.)	25%
The large number of symbols that can be encountered	24%
Inconsistency of information in different places (cities, towns, holiday contexts, etc.)	23%
The complexity in understanding the symbols you may encounter	21%
The incoherence of information between different products	19%
I do not do recycling	4%
Total	(3.045)

Table 13: BIOnTop - Share of some reasons about practical obstacles in managing the disposal of packaging

A final comment is reserved for the 4% of responses to the "I do not recycle" indicator. These responses were consistent with other research using similar data (Feve 2016)

HIGHLIGHTS

1. Attention to labels is selective and in general the information that prevails is the expiry date (34%). The second most sought-after information concerns the product's properties (24%).
2. Only 1 in 10 people say they are concerned about the marks on packaging for recycling or information on chemical additives. The presence of an Internet link for further information does not seem to be of interest (3%).
3. Only 4 out of 10 people correctly interpret the TUV-Home label and 3 out of 10 the TUV-Industrial label. Overall, more than a third say they do not know what these labels mean.
4. 36% of the respondents say that the main limitation to the correct disposal of waste is insufficient information on the product packaging.
5. 3 out of 10 respondents say that it is local regulations that pose the biggest problem in helping consumers to dispose of product packaging correctly.

4.5 Willingness to pay

The fourth section of the questionnaire was dedicated to the understanding of the main reasons driving consumer purchases of products. A series of questions explored how consumers reflect on cost, packaging composition and pollution issues, both in general and in relation to bioplastics.

From a general point of view, the element that most respondents said was most significant was cost (47% of total choices), followed by the organic nature of the products (34%), and ability to recycle the packaging (34%). This data confirms the nature of the rational choices made when making purchasing decisions. The first two items are both useful for maximizing consumers' well-being, so their interest focuses on low cost and organic products where possible. Third in importance is the recyclability of packaging (34%), followed by the biodegradability of packaging (28%), the sustainability of the production chain (26%), and the compostability of packaging (18%). The sample was distributed differently with in relation to different social characteristics.

Which of the following factors facilitate the choice of an everyday consumer items? (max 3)	
The lower cost	47,9%
Organic production	34,2%
The recyclable container/packaging	34,3%
The biodegradable container/packaging	27,6%
The sustainability of the production chain	25,6%
The compostable container/packaging	17,6%
None of the above conditions	6,4%
Total	(5.949)[15]

Table 14: BIOnTop - Share of factors facilitating choice of daily purchase

Among the respondents, men (51%) were more likely to cite cost reasons, while women were more likely to look for organic production (35%) and were also more likely to consider the possibility of recycling the packaging (36%) or assessing its biodegradability (29%). The over 56s would invest more in organic products (44% of over 56s' choices vs. 23% of 18-30s) and in the possibility to evaluate the supply chain (28% of over 56s' choices vs. 21% of 18-30s). Predictably, a low level of education characterizes those who made their choices mainly by thinking about the cost of the products to be purchased. At the same time, people with high educational qualifications were much more likely to choose to buy organic (28% ISCED 5-8 vs. 19% ISCED 1-2). Similarly, those with higher educational levels were more concerned about the biodegradability of packaging and the supply chain of various products (36% and 33% respectively). Those with lower educational qualifications tended to focus less on compostability and sustainability of

[15] The percentages exceeded 100% as it was possible to choose up to three options.

production (17% and 19% respectively). With respect to the occupations of the respondents, it emerges that all categories were cost-conscious, whereas if we look at the propensity to buy organic products, students and unemployed people chose this reason for purchase only 2 times out of 10. As each occupation corresponds to a different income capacity, we can understand why the attention to organic products concerns managers and professionals the most (33%) and students the least (17%). However, more than half of pensioners (56%) selected organic food as a concern.

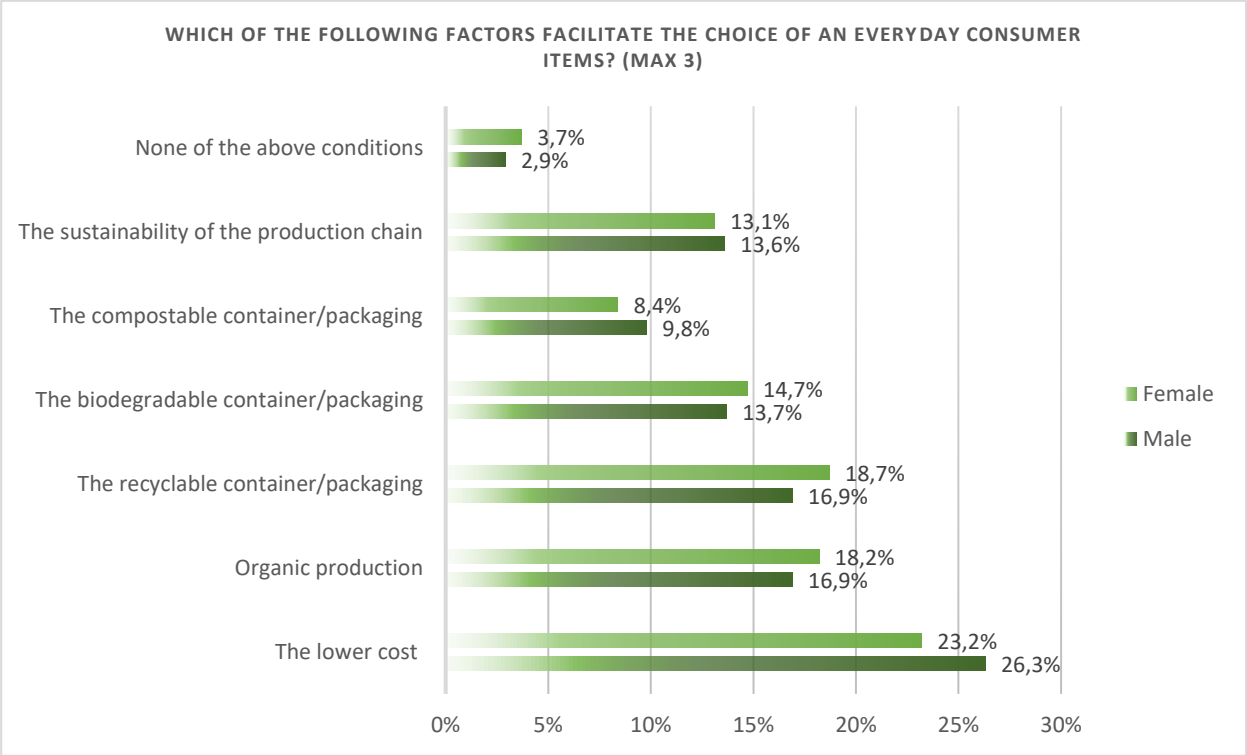


Figure 4: BIOnTop - Histogram about the factors facilitating choice of daily purchases

4.5.1 The purchase of bioplastics products

The purchase of bioplastics products is a knowledge-sensitive activity strongly characterized by the life contexts and social conditions of consumers. The first question was related to consumer ability to recognize bioplastics products in their daily purchases. Table 15 shows that only one in three admitted to recognizing such products, displaying a strong relation between answer and age, with a weaker link between education and occupation.

Pensioners were the least likely to recognise products with bioplastics packaging: only 16% claimed to have this ability. Managers claimed to be able to do so in 41% of cases. The difference between young and old is also large in terms of making this choice (28% less for the over 56s). These 1,044 subjects were asked whether they not only recognised products but were also usually interested in buying them. About 8 out of 10 of those interviewed declaring that they preferred to buy such products. There were no

significant differences in terms of the gender of the respondents, but there were differences in terms of education (72% for those with lower educational qualifications; 89% for those with higher educational qualifications). A similar difference could be observed in terms of occupation, with students stating that they were interested in buying a car in only two out of three cases, 22% fewer than those in managerial positions. Respondents who answered that they were unable to recognise products with bioplastics packaging were nevertheless asked whether they would be interested in buying them despite this difficulty. In this case, out of almost 2,000 respondents who said that they could not recognise products with bioplastics packaging, 2 out of 3 stated that they would be interested in buying them.

Table 15 shows that among students the preference in purchase stops at 45% against 73% of those in managerial positions, marking a gap of 28 percentage points. To a lesser extent, the unemployed also confirmed in half of cases that they were not interested in buying products with bioplastic packaging.

Do you recognize products whose containers/packs are made of Bioplastic?	Yes, I recognize product in bioplastic	(IF YES) Do you prefer them in your purchase	(IF NO) Would you prefer in purchase
Female	35%	81%	65%
Male	34%	80%	63%
18-30	48%	73%	49%
31-56	36%	84%	68%
Over 56	20%	84%	69%
Lower education (ISCED 1-2)	39%	72%	52%
Middle education (ISCED 3-4)	31%	82%	65%
Higher education (ISCED 5-6-7-8	33%	**89%**	**75%**
Director, entrepreneur, self employed	41%	87%	73%
Employee	36%	87%	68%
Unemployed	35%	69%	55%
Retired	16%	83%	74%
Student	45%	67%	45%

Table 15: BIOnTop - Ability to recognize products made in bioplastics; preference declared in purchasing them divided by background variables

To complete the picture that allows us to understand the different sensitivities of the respondents regarding the purchase of bioplastics products, a wide range of multiple-choice 'motivations' were identified. These indicators aimed to collect the motivations to buy (or not) products with bioplastics

packaging (Table 16 and 17). Among the reasons for buying, selected almost 6.000 times by the 2.097 respondents, were the desire to support an environmentally sustainable material (60% of respondents selected this item), and because buying these products would reduce environmental pollution (45%). Moreover, the response options consider some indicators that related more to the lifestyles of the respondents and some others were oriented to push companies to produce/use these items. In percentage terms, these indicators were not often selected (by fewer than 10% of respondents).

Why? (more answers allowed) - If yes	
They represent a sustainable choice for the environment	60,3%
By buying them, I am contributing to reduce pollution	45,3%
They represent an alternative to plastic	41,8%
To push also other brands to introduce Bioplastics thanks to my purchase choices	27,1%
They are compostable and thus contribute to reducing the volume of non-recyclable waste	26,2%
They are natural products	22,3%
They are biodegradable	17,3%
Because Bioplastics companies are often involved in environmental campaigns, (e.g. they make donations for every product sold)	11,2%
They are consistent with my lifestyle (for example, they are vegan choices)	10,9%
So I can finance innovative ideas	9,3%
Prices are more or less similar, but Bioplastics are more sustainable	8,7%
They make me feel fashionable	4,9%
Total	(5.980)[16]

Table 16: BIOnTop - Why do you prefer products packaged in bioplastic?

The 1.440 respondents who stated that they were not interested in buying this type of product mainly focused on the idea that "only time will tell how biodegradable these products really are" (35% of respondents). Two other items considered important by these respondents were the idea that buying them would not solve environmental problems (22%), and that the prices were high and there was no assurance that bioplastics would be sustainable for the environment. The social profile variables did not allow us to identify particular subgroups in this type of projection.

[16] The percentages exceeded 100% as it was possible to choose up to three options.

Why? (more answers allowed) - If no	
Only time will tell how biodegradable they really are	35,2%
Unfortunately, they do not solve environmental problems	22,5%
The prices are higher and/or I'm not believing in the sustainability of bio-plastics	21,8%
They do not represent a concrete alternative to plastic	12,1%
Buying them will not change the pollution levels	11,6%
I do not believe that I can shift other brands to introduce bio-plastics through my purchasing choices	11,4%
I'm not sensing the innovative momentum they claim	9,8%
Because I am not interested in the projects of companies that produce Bioplastics to support environmental campaigns (for example through donations for each product sold - greenwashing)	9,9%
Even if they are compostable, they will not impact on the final volume of waste (other form)	9,2%
I'm not interested to be fashionable	7,6%
They aren't natural products	5,5%
They are not compatible with my lifestyle (e.g. waste to be sorted)	5,1%
Total	(1.452)[17]

Table 17: BIOnTop - Why don't you prefer products packaged in bioplastic?

4.5.2 Willingness to pay more: how much more?

Having addressed the shift in intentions towards purchasing products with bioplastics packaging, an important next step is to identify the cost variations that consumers are interested in with such products. The first projection of the data confirms that consumer orientation is evenly split. Some 48% of consumers were only interested in buying products packaged in bioplastics on the assumption that they remain at the current cost. 35% were willing to consider a 10% increase in cost, and only 17% were willing to consider products if they cost over 10% more than at present. Differences by age in relation to cost were not found to be significant. In the groups of citizens willing to pay more, however, over 56s were more willing to accept a 10% increase in cost, but less willing than other ages to pay more than 10%. A similar trend could be observed concerning the level of education. Citizens with the highest level of education were more likely to be "willing to pay" 10% more, but were less well-represented in the group of citizens willing to pay more than 10% (Fig. 5).

Conversely, people with lower educational qualifications were more likely to accept the products at the current cost (54%) and much less likely to be willing to pay 10% more (28%). However, people with lower

[17] The percentages exceeded 100% as it was possible to choose up to three options.

educational qualifications indicated to a slightly greater extent than others that they would be willing to pay more than 10% for bioplastics products. The different occupational groups also significantly affected willingness to pay more. Pensioners were above average in terms of their willingness to pay 10% more but well below average in their willingness to pay more than 10%. Counter-intuitively, the unemployed and students declared a prevailing interest in buying such products at the current cost but were also willing to a certain extent (24% and 25% respectively) to buy the products if they cost more than 10%.

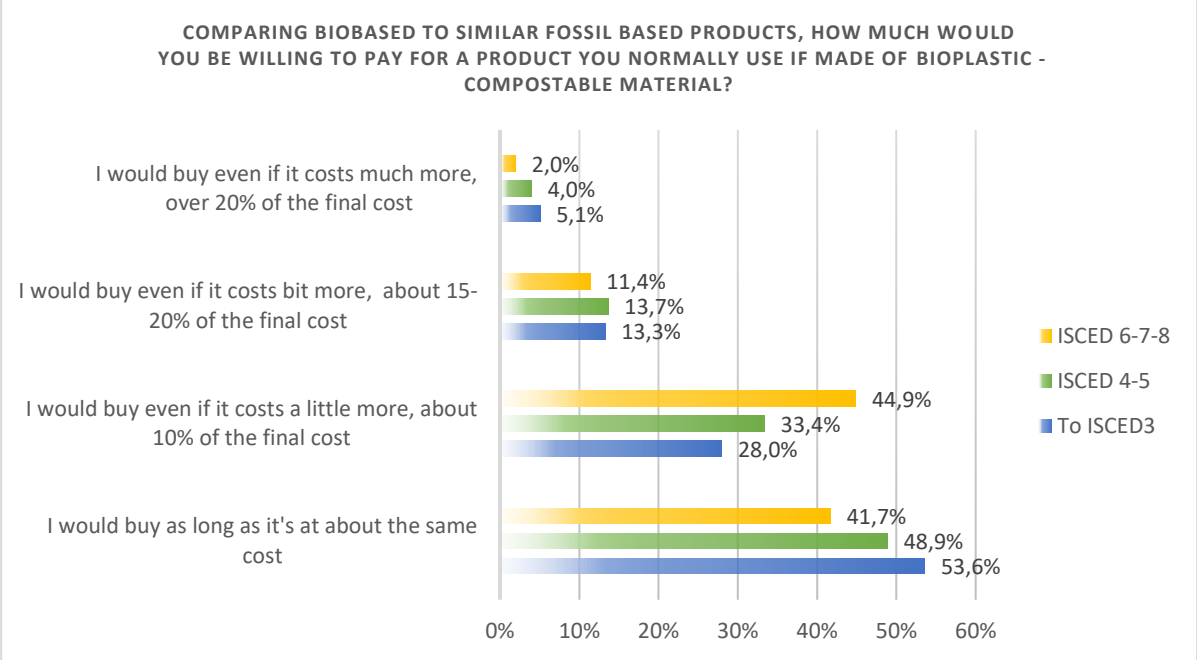


Figure 5: BIOnTop - Willingness to by products with packaging in bioplastics by education

One question sought to explore the reasons for this availability. Among the reasons given by the sample, the most common were equally the hope that these materials would not have an environmental impact and that, in the long run, as they become more widespread, the purchasing costs would decrease (both at 24%). To a lesser extent, one motivation cited was the hope that consumers could play an active role in helping to protect the environment (16%). However, respondents who stated that they were not interested in purchasing bioplastics products at a higher price totalled about 21%. This group was characterised by an over-representation of unemployed people and students (28% and 25%) and an under-representation of people in management positions (12%).

As a consumer, why would you agree to pay more for a Bioplastic pack?	
Because in the long term costs will be lowered thanks to the diffusion of products	23,7%
These materials do not contribute to environmental pollution	23,8%
I'm not interested in having to pay more	20,5%
I feel an active part in helping to protect the environment	16,4%
These materials are of higher quality for food protection	15,6%
Total	100% (3.058)

Table 18: BIOnTop - Reasons to pay more for products using bioplastic

A further step that the survey explored involves the specific elements supporting the purchase of bioplastics products.

Among the elements considered most relevant in encouraging the purchase of bioplastics products, the use of materials that do not impact the environment was recognised as a key factor (52% considered it 'much encouraging'). Slightly less strong was the indicator describing the awareness of helping the planet to be saved for future generations (48%). Another indicator highly regarded by respondents concerned the knowledge that these products do not have negative effects on national economic systems (40% 'much encouraging'). Respondents chose as the least effective indicator to encourage the purchase of bioplastics products the practice of indicating: "Packaging made with 50% recycled plastic" (21% 'much encouraging'). Only one in three respondents indicated branding on containers as an element that would encourage the purchase of bioplastics products (31% 'much encouraging').

In which way the following elements can encourage the purchase of a product in Bioplastics for everyday use?	Nothing (%)	Little (%)	Enough (%)	Much (%)	Total
The use of raw materials that do not impact on the environment	5,2%	9,4%	33,8%	51,6%	100% (3.052)
The awareness that this helps the planet to save it for future generations	7,9%	13,2%	31,3%	47,6%	100% (3.041)
Knowing that the production of raw materials does not have negative effects on the economy of the producing countries (e.g. monocultures, deforestation, etc.)	5,4%	13,9%	40,5%	40,2%	100% (3.038)
The awareness that it is a positive investment for health	6,0%	15,4%	40,5%	38,1%	100% (3.032)
Trademarks and tips on container disposal	6,7%	17,8%	44,2%	31,3%	100% (3.005)
The presence of the words "Packaging made with 50% recycled plastic"	8,5%	26,8%	43,5%	21,2%	100% (3.014)

Table 19: BIOnTop - Elements that can encourage the purchase of bioplastic products

Among the background dimensions that point most clearly to an internal differentiation between these responses are education and age. Respondents over 56 were most likely to consider the use of environmentally friendly materials to manufacture bioplastics products as very encouraging in terms of their purchasing decisions (60% vs. 43% of those under 31). Similarly, those with high educational qualifications defined this indicator as ‘much encouraging’ to a greater extent than those with lower educational qualifications (61% vs. 44%). As can be seen from the table below, this trend was repeated with the exception of answers obtained from the indicator, "Packaging made with 50% recycled plastic". This trend seems to confirm the idea that European consumers are aware of the ecological complexity at stake and of the opportunities offered by bioplastics. They consider the underlying issues related to the impact on the planet much more relevant than issues related to simple product communication. At the same time, as has been pointed out many times, skills and education levels are crucial in supporting environmentally conscious choices and in driving purchasing decisions towards more environmentally friendly products. The strong differentiation by age indicates that over time the baby-boomer generation, despite having experienced the economic development of the 60s and 80s, today has more awareness than others of the urgency of addressing environmental concerns. For example, 2 out of 3 retired people stated that awareness of non-impacting materials is a major reason for buying bioplastics products. It is important to note that the data collected in this survey is clear about the main ecological and social issues related to the environment and bioplastics. However, age is an important for acquiring awareness on this subject and public communication could also further reassure consumers. In relation to the concern that these new products might adversely affect the traditional economy, respondents differed by age. 58% of those over 56 stated that knowing that industrial development would be careful not to generate negative effects on production chains encouraged them to buy these products. However, for younger people, this interest was reduced to 28%. No social profile seemed to characterise the positive judgements regarding the presence of labels such as "Packaging made with 50% recycled plastic" on products. Having pointed out these differences, it is important to remember that all of these indicators achieved answers in the positive range (summing up the categories ‘enough and much’) between 70 and 90%.

	Positive Range	18-30	31-56	Over 56
The use of raw materials that do not impact on the environment	Much	43%	51%	60%
	Enough	36%	35%	31%
The awareness that this helps the planet to save it for future generations	Much	35%	47%	59%
	Enough	32%	34%	28%
Knowing that the production of raw materials does not have negative effects on the economy of the producing countries (e.g. monocultures, deforestation, etc.)	Much	28%	38%	58%
	Enough	46%	42%	33%
The awareness that it is a positive investment for health	Much	24%	38%	51%
	Enough	44%	42%	35%
Trademarks and tips on container disposal	Much	24%	30%	40%
	Enough	47%	45%	41%
The presence of the words "Packaging made with 50% recycled plastic"	Much	21%	21%	23%
	Enough	38%	46%	45%

Table 20: BIOnTop - Elements that can encourage the purchase of bioplastics products by age (just category "much" and "enough" only)

4.5.3 Willingness to pay: seven products

The last section of questions included in the questionnaire concerns the explicit evaluation that respondents had for seven different everyday consumer products that could soon be the subject of research and development programmes to perfect bioplastics packaging. Such packaging is also beginning to appear in some products in large-scale distribution.

To explore this area, products were chosen that in some way could be considered typical of everyday consumption, which are still offered with traditional plastic packaging, and present in all European supermarkets. The products selected were: "trays for fruit and vegetables", "packaging for tea bags", "nets for fruit and vegetables", "multilayer trays for modified atmosphere packaging (MAP)", "coated

woven fabrics (i.e. food wraps)", "carrier bags (by secondary raw material)", and "personal care products" (Table 21).

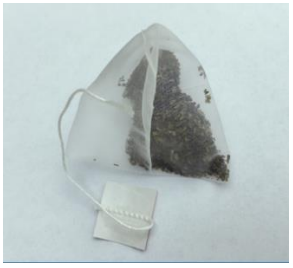
IMAGES PRESENTED IN QUESTIONNAIRE			
TRAYS FILMS FOR FRUIT AND VEGETABLES	PACKAGING FOR TEA BAGS	NETS FOR FRUIT AND VEGETABLES	
			
MULTILAYER TRAYS FOR MODIFIED ATMOSPHERE PACKAGING (MAP)	COATED WOVEN FABRICS	CARRIER BAGS (BY SECONDARY RAW MATERIAL)	PERSONAL CARE PRODUCTS
			

Table 21: BIOnTop – Products presented in the questionnaire

The questionnaire asked respondents to express their purchasing intention of these seven products considering the hypothesis that these products might cost a little more if produced with bioplastics packaging.

40% of respondents expressed "very much" interest in buying bags made of recycled material. Combining "somewhat" with "very much", this product was indicated by 74% as interesting, although more expensive than its equivalent in traditional plastic. All other products in the "very much" category did not exceed 30% of the responses. The products of least interest for a possible purchase at an increased price were vegetable trays and foils (20%). The choices expressing "somewhat" interest for a purchase at an increased price all varied around one third of the total. If we combine all the choices that consider even a small interest in buying one of these products at an increased price, we obtain very high values, oscillating between 85 and 90% of all choices (Table 22). This data can be interpreted as a general willingness to buy these products at an increased cost, but converting this willingness into concrete purchasing decisions remains a difficult issue. The choice to buy at an increased cost can be reasonably suggested to about one

in four citizens without any particular differences from a social profile point of view. Sex, age, education and occupation are not differential variables for this type of data.

Products	Somewhat	Very Much	Total: Little, somewhat, very much
Carrier bags (by secondary raw material)	34%	40%	90%
Nets for fruit and vegetables	34%	29%	88%
Multilayer trays for modified atmosphere packaging (MAP)	33%	29%	85%
Packaging for tea bags	33%	28%	84%
Coated woven fabrics (i.e. food wraps)	34%	26%	84%
Personal care products	34%	26%	88%
Trays films for fruit vegetables	38%	20%	85%

Table 22: BIOnTop - Willingness to buy several products even if they cost more ("Somewhat" and "Very much "only)

HIGHLIGHTS

1. Half of the respondents' state that cost is the main lever on which purchasing decisions are based. One third of respondents declare that the organic origin and the possibility to recycle the packaging are among the reasons that influence purchasing decisions.
2. The desire to buy products made of bioplastic is a concern for 8 out of 10 people, although only 1 in 3 admits to recognizing such products when buying them.
3. The prevailing reason that fuels interest in buying bioplastics is that the choice to buy them helps to protect the environment (60%) and reduce pollution (45%).
4. Half of the citizens surveyed would prefer the cost of bioplastic packaged items to remain unchanged. Even those who would accept an increase would do so now in the hope that it would lead to lower costs in the future.
5. Interest in paying more for bioplastics sits at around 10% at most, especially among older people and those with high levels of education and good jobs. There does not appear to be a significant consensus beyond the 10% extra cost.
6. Respondents state that they are "very" or "somewhat" encouraged to buy bioplastic products because they do not have an impact on the environment (86%).
7. Interest in incurring higher costs across seven example products made of bioplastics is concentrated on reusable products such as carrier bags.

4.6 Qualitative data: focus groups and interviews

4.6.1 Data and analysis

Focus groups and individual semi-structured interviews were conducted to investigate the representation of bioplastics with key informants. Interviewees were selected to represent relevant stakeholders who could influence the adoption of bioplastics on a larger scale (i.e. consumer associations, municipalities, large-scale retailers, bioplastics producers, and companies interested in using bioplastics).

Stakeholders selected to participate mostly belong to Italian institutions, associations and the business world. Italy has been a forerunner at EU level regarding bioplastics production: according to the Bioplastics National Association, the Italian market is about half the value of the whole European market. The interviewees constitute a sample of early adopters of new sustainable solutions.

The focus groups and interviews were organized by Movimento Consumatori and conducted online via a teleconferencing system. This choice was imposed by the outbreak of Coronavirus which made face-to-face encounters with interviewees unrealistic. Staff from Movimento Consumatori acted as moderators/interviewers during the research sessions. The outline was modelled around four main themes in parallel with the survey: a) knowledge about bioplastics; b) perceived risks and opportunities in bioplastics production; c) perspectives regarding promotion and branding; and d) key obstacles and potential enablers of scaling up and adoption. Focus groups and interviews were video-recorded, transcribed and analysed thematically. A first analytical template was built around the topic outlined, then refined to allow for emerging themes to be represented in this report.

This section of the report is organized as follows. Firstly, we present a general overview of the knowledge of each group of stakeholders regarding bioplastics to illustrate the existing gaps among them. The analysis of the data is organized into four sections:

1. Awareness of the general public regarding bioplastics;
2. Opportunities and threats associated with bioplastics production;
3. Information and branding: labelling bioplastics;
4. Opportunities and barriers to increase the appeal of bioplastics.

The report ends with a conclusive section containing indications for policies that emerged from focus groups and interviews.

4.6.2 Knowledge of stakeholders about bioplastics

Before discussing the results of the qualitative analysis in detail, we shall briefly present one of the main outcomes of our research: the significant discrepancy in both the specific knowledge about the topic, the sense of urgency of developing a strategy, and setting the agenda for discussion. At one end of the

continuum, bioplastics are a relatively new topic for consumer associations whose representatives have not yet developed a precise knowledge about their distinctive features or agenda. At the opposite end, manufacturers and representatives of waste end-of-life present themselves as having a clear understanding of the topic and as having a strategy to promote. Municipalities and large-scale distribution can be ideally placed in the middle of the continuum. This gap is somehow reflected in how the different stakeholders present their views on bioplastics: a precise knowledge is reflected in the use of numbers and data; a vaguer understanding is signalled by the use of metaphors and reasoning by analogy.

While a difference in terms of specific knowledge regarding bioplastics was expected, such a gap indicates that some stakeholders will need to develop more familiarity with the nuances of the issue to have the chance to influence and steer future debates and choices related to the production, promotion, branding and disposal of bioplastics, developing the expertise needed to confront more knowledgeable counterparts.

4.6.3 Awareness about bioplastics among the general public

As noted above, one of the insights offered by the qualitative section of our research is that even among some key informants there was a limited knowledge regarding bioplastics and the specific features that distinguish it from other materials. Several representatives of consumer associations, for instance, revealed that BIOnTop's survey was their main source of information on bioplastics, as it provided a definition of bioplastics and some key distinguishing features.

> *I've heard something about these bioplastics… but, yes, I have some information as a consumer [myself], and I believe there is no great awareness among consumers about this theme. (Representative of consumer association #1)*

> *Bioplastics is a change of mind because we do not focus on its disposal but on its creation. Bioplastics is not only biodegradable, it's biobased packaging, organic-made. (Representative of consumer association #4)*

Limited knowledge about bioplastics is also shared by companies, which are still in the process of gathering information. For instance, the representative of the Bioplastics National Association and the national regulation entity reported several anecdotal cases in which manufactures had inquired about the possibility of adopting bioplastics packaging and they had to be told that bioplastics packaging is not suitable for non-biodegradable items.

Our job as an association is to explain to those who call and ask for support. The moment they ask us to make a table out of biodegradable and compostable polymers, we ask them "what is it for?" Maybe it's greenwashing, maybe you're trying to mislead the consumer. (Representative of the Bioplastics National Association)

Municipalities confirm that local enterprises and citizens have limited knowledge about bioplastics and there is also some confusion among consumers. Moreover, bioplastics are regarded as something that belongs to the future, and requires additional research and investigation, rather than a family of materials already in the market requiring immediate attention.

In our perception the common knowledge is low. We had a meeting with traders in the city who asked us about bioplastics. "We spend a lot of money to buy it. But then, how is it recycled?" So we explained to them that not all bioplastics are digestible in a plant. (Representative of Local Public administration #1)

For consumer associations but also for some representatives of institutions (e.g. some municipalities), bioplastics is regarded as a sibling of other, well-known materials which possess some of its features (i.e. biodegradable, made from biomass or by-products) and the respondents discussed the challenges, opportunities and strategies by mean of association and analogy with products they were more familiar with. In some cases, bioplastics were attributed features they do not necessarily possess (i.e. biodegradability) and, for such reason, they were presented as a solution to several environmental issues and endowed with great expectations.

If we can, in one way or another, in our countries, encourage the use of bioplastics… I don't know, scientifically, what they are but I know that they are remedies against the ways we are using plastic at the moment. (Representative of consumer association #2)

The narrow understanding of some of the key informants on the issue is significant as it indirectly signals that organizations that should have a role promoting and shaping the policies of adoption of bioplastics have not yet invested in developing a clear strategy on a topic which needs to be urgently addressed. This depends on the still limited volume of bioplastics in relation to traditional plastic and it can be related to the perception that bioplastics belongs to the future rather than the present.

Certainly, the topic is there but more as an area of research and development and future vision than being on the agenda. (Representative of Local Public administration #2)

Increasing the awareness of bioplastics, however, is a daunting endeavour considering some of the implied technicalities and language issues.

Some people suspect that when we say bioplastics are made from 40% or 50% renewable raw materials, we mean that the rest is not compostable and remains as traditional plastics in the compost heap. This is not the case. The moment a bioplastics product is certified to the standard, it means that microorganisms eat that biopolymer and turn it, because they digest it, into [regular] compost. (Representative of the Bioplastics National Association)

The excerpt illustrates one of the complexities regarding communication about a material that can be made from both agricultural by-products and traditional use plastic, materials which belong to two opposite worlds in terms of what the average consumer perceives as eco-friendliness. According to the Representative of the Bioplastics National Association, it could soon be possible to obtain bioplastics entirely from renewable biomass, making it possible to claim that the packaging is made from 100% renewable raw material, which would be unlikely to create confusion among consumers. At present, there are not enough facilities to produce additional amounts of bioplastics compared to current production and, according to the Bioplastics National Association, the industry is reluctant to invest consistently since there are no guarantees the market will favourably accept bioplastics.

On a side note, some interviewees noted that communication regarding bioplastics could lead to unintended consequences and be in contention with other environmental-friendly policies. The representative of a local public administration, for instance, has over the years favoured the use of re-usable materials, promoting washable cutlery and dishes at large public events, and they expressed concerns that bioplastics could encourage a cultural shift towards disposable alternatives, undermining their efforts to promote the idea that 'compostable' is only a second-best option and re-use should be favoured whenever possible.

4.6.4 Opportunities and threats associated with bioplastics production

The key informants, each from their own perspective, stressed the importance of putting bioplastics in a broader context, agreeing that adoption strategies will need to consider the complete cycle of life, from the raw materials and their availability to the disposal and the technologies needed. “Land consumption” and “greedy industries” – a common pair of issues in many discussions about greenwashing – surfaced in the words of some stakeholders as a key concern.

> *We know, there is a downside. Bioplastics need raw materials to be produced, so we are talking about land consumption. So, you have to be very careful, it can become a business on a par with normal packaging. (Representative of local public administration #3)*

Consumer associations, for instance, were invited to reflect on the long-term effects of any change in widely used materials, as illustrated in the following excerpt.

> *But it’s also a preoccupation, because we think if we don’t analyse really well how we are in such a situation we may reproduce exactly the same problems. Technology is something good to change our behaviour, but it is also important to think about why we are acting like this. […] I think that bioplastics is a much better solution than fossil plastic. Fossil plastics are not a solution. It was believed they were a solution in the fifties. But maybe tomorrow we'll discover that there is a problem with bioplastics, it’s not impossible, it already happened. We strongly believed in plastic and plastic was an amazing product in the fifties. […] We totally agree to go in this direction [adopting bioplastics], but we want to have control and we believe that this control cannot be given to the companies. It should be shared with all stakeholders, it means with consumer associations, governments, enterprises. (Representative of consumer association #3)*

This long extract exemplifies a conundrum. On the one hand, key informants share a conditional enthusiasm about bioplastics, where the attractiveness of the novelty is mitigated by the experience of previous technological dreams gone bad. On the other hand, they want to be involved to monitor the process of adoption and have their voice heard at any point during this process. Such a position, however, would require being knowledgeable about the topic to have the chance to discuss the fine-grained details regarding all the stages of the process that will define the regulatory aspects related to bioplastics. At present, though, only a few organizations and stakeholders seem to have invested in research on the

topic. The confusion and lack of trained personnel (see previous section) are at odds with their claims of playing an active role in the process ("we want to have control").

Large-scale retailers show a similar concern regarding the production process since it can affect the final decision of consumers regarding products packed with bioplastics. There is growing attention on eco-friendly purchase choices and details of the manufacturing process are one element considered by green consumers. Preventive measures to avoid a backlash are not merely confined to the actual production process but, according to retailers, require investment in communication and creating a narrative for the products.

A different concern was proposed by manufacturers of products that could be interested in using bioplastics as packaging. There is still a gap between the manufacturers of bioplastics and industries interested in adopting them. Such a gap could be filled by the association of producers of bioplastics, but our research revealed that, at least in the Italian case, its existence and role is still partially unknown to industries. For example, a cheesemaker complained about the lack of a packaging with specific features he would need despite "making my own research" and contacting several producers by himself.

From the perspective of manufacturers of bioplastics, there are no threats associated with its production. First and foremost, manufacturers stress that the current volume of production of bioplastics is only an infinitesimal fraction of traditional packaging. Secondly, at present bioplastics do not require dedicated crops but are made from agricultural production waste or weeds (e.g. thistles) and do not take land away from agriculture or animal husbandry.

Despite presenting the manufacturing process as a win-win situation for both the environment and consumers, producers stress that such a result depends on clearly defining some boundaries and following some principles. In particular, producers see the benefits of bioplastics only as long as they comply with the existing waste management systems rather than considering bioplastics as products requiring their re-adaptation. From this perspective, bioplastics could help safeguard the environment by reducing the amount of traditional plastic and increasing the quality of compost. For these reasons, both producers and institutions that promote them, bioplastics should not try to enlarge their business opportunities beyond packaging of organic and compostable products. On the contrary, an indiscriminate use of bioplastics (in products like shampoo bottles) could lead to a decrease in the performance of waste management and, indirectly, to rising costs.

With regards to the opportunities, the Bioplastics National Association ensures that bioplastics could increase employment, since for every 1.000 tonnes of organic waste, 1.5 jobs are created (for a more comprehensive and detailed forecast on the impact of green economy on employment with reference to the US and California see Goldstein and Electris (2014) and Goldstein (2014)). Furthermore, the

traceability of bioplastics makes it impossible to produce them off the books, unlike what could happen with traditional plastics. A partial substitution between the two materials and a reconversion of the sector could lead to a reduction in the black economy and an increase in tax revenues.

Besides employment, bioplastics are playing a role in diminishing the backlash of the crisis of EU plastic packaging factories that are unable to compete with Asian manufacturers capable of producing massive volumes of products at low cost, as a Representative of Bioplastics National Association observed. Partially converting some production facilities to bioplastics has already led to the survival of some companies and saving the jobs of workers.

4.6.5 Information and branding: labelling bioplastics

Our informants were required to express their opinion on the role of labelling to increase awareness among consumers and promote products. Several consumer associations discussed the pros and cons of labelling at this early stage of bioplastics packaging diffusion in the market. Considering the relative little knowledge among consumers regarding bioplastics (as confirmed by several studies as well as the research presented in the first part of the report), some regarded labels as an opportunity to increase awareness and promote this new product.

> *If in the labelling wording we can put short important information that will explain more clearly the importance of change (to bioplastics). As you realize, labelling has to be short, you cannot put a lot of words, but I think using this resource […] we can create some positive results. (Representative of consumer association #2)*

This perspective was not shared by all the representatives of other consumer associations involved in the focus group. As one noted “When the packaging says, “it’s bioplastics”, what does that mean?” If ‘bioplastics’ is a vague concept in the mind of consumers, labelling products or packaging would not make any significant difference. These two positions exemplify one of the challenges in branding bioplastics and the need to strike a balance between providing additional information, requiring consumers to read some text, and a clean and recognizable logo that points to a somehow undefined concept.

A final note of caution from consumer associations relates to the general issue of the trustworthiness of companies. The excerpt below highlights a broader theme of credibility of companies when describing their products.

> *Does the customer trust the packaging? A lot of packaging says "bio", "recyclable", "social responsibility". Every week, every month in France we have a scandal about the use of labels that correspond to nothing. The question today is, okay, companies can make specific labels saying this is a responsible product. But do consumers believe that? That's not so sure. (Representative of consumer association #1)*

Institutions provided a different perspective on promoting the use of bioplastics. For the national regulation entity, for instance, bioplastics should be considered in relation to the ease of its correct disposal with end-users in mind. As we note below (see section §4.6.6), the work consumers do to separate waste is crucial to ensure a high quality of waste management since it heavily affects its end-of-life and measures need to be taken to ensure a smooth waste management process. To this end, institutions can leverage waste management costs paid by companies to guide them to adopt packaging solutions in line with the overall efficiency of the process.

> *If the packaging does not fit well with waste management, if it may cause issues in the treatment plant, it may be that a penalty may come through a contributory system. (Representative of the National regulation entity)*

Both institutions and consumer associations consider branding bioplastics products a way of increasing their recognizability and appeal. At the moment at EU level there are several logos that identify the compostability of materials that can be composted but there are no brands for bioplastics per se.

Figure 6: BIOnTop - Four logos that attest to the compostability of bioplastics products presented by representative of the national regulation entity during the interview

As noted by the national regulation entity, the labelling could be used not only to increase consumer awareness, but it could also serve the purpose of adopting technologies capable of separating waste during the end-of-life of products, a major issue in increasing the overall efficiency of the lifecycle of bioplastics packaging (see paragraph §4.6.6).

Retailers also highlighted branding as key to promoting bioplastics, insisting on the need to provide a fast and easily identifiable 'story' to consumers. From their perspective, only motivated consumers are willing to invest their time and money to make an informed choice. However, as noted by the representative of a popular chain of organic stores, "we are lucky, our customers spend five minutes to read each label". Such an investment of resources is unthinkable for the average consumer whose choices are made in a hurry and mostly motivated by price. Only a relatively small number of consumers take advantage of the additional information (i.e. dedicated websites) provided by large-scale retailers regarding selected lines of products. As stressed by both retailers interviewed, communication cannot count on the average

consumer becoming more interested in the history of the bioplastics or on the green consumer spending additional time on each product. To this end, branding should both reassure and facilitate the purchase.
Bioplastics manufacturers, instead, proposed a different way of addressing the problem of disposal aimed at identifying some packaging as 'compulsorily compostable' to avoid any ambiguity. Building on the successful example in Italy with shopping bags, which are compostable by law, manufacturers are pushing to make the use of bioplastics obligatory for products used to package or manage food (i.e. disposable dishes, glasses, cutlery). This strategy, according to the association of manufacturers, would ensure that some products are intrinsically associated by consumers with organic waste, avoiding any ambiguity regarding the end-of-life cycle. Such a proposal transforms the object itself into a 'brand': it is not a logo that signals its composition but (as with shoppers in Italy) the product speaks for itself regarding its composition and the procedures associated with its use and disposal.
As noted in the introductory section, being labelled as 'bioplastics' does not necessarily mean that packaging can be disposed of in a home composter (while it can always be industrially composted).

4.6.6 Opportunities and barriers to increase the appeal of bioplastics

Bioplastics belong to the category of environmental-friendly products, which are increasingly appreciated by consumers. However, consumer organizations are convinced that consumers need to be nudged into adopting bioplastics through education and by making sure there is no impact on costs. Regarding consumers' education, consumer organizations represent themselves as one of the key actors involved since they have both the knowledge, the expertise and the motivation to do so.

> *With regard to consumers' education, I think that consumer organizations can play a crucial role because they have the know-how, the knowledge to educate consumers. I think actions are needed at school level or university level, because the new generations can be the engine, hoping it's not too late for this change. (Representative of consumer association #5)*

As noted by representatives of consumer associations involved in our focus groups, while consumers are more and more eco-friendly-inclined, they feel like environmental sustainability should not come with an increased price of the final product. The conundrum can be addressed only with a regulatory intervention aimed at making the use of bioplastics compulsory or counting on the responsibility of retailers motivated not only by immediate economic results but also interested in playing a role in building a sustainable future.

> *Bioplastics should be obligatory by law. If it's a choice by consumers, it will stay only at the consideration of the price. (Representative of consumer association #1)*

> *Retailers [can play a role] by selling sustainable products at a reasonable price. (Representative of consumer association #5)*

> *But regarding what you are buying in a supermarket, I really believe that many people do not pay attention to the packaging, the nature of the packaging. The first thing, I'm sure, it's the price. And packaging is long behind that. I want to add that we are living in a very particular, dramatic situation, because of [pandemic]. Don't forget that 20 million people in Europe are going into poverty. I'm afraid about that. Bioplastics should be obligatory by law. If it's a choice by consumers, it will stay only at the consideration of the price. (Representative of a consumer association #3)*

The representatives of Italian consumer associations recalled what happened a few years back when the plastic bags used in grocery stores for fruits and vegetables were replaced by compostable bags – the law required retailers to charge for these bags, at their discretion. The 'protest' from consumers was used by consumer associations as a reminder of the need to consider the potential adverse effects of bringing to the market packaging that could be ethically attractive but more expensive than their traditional alternatives.

> *I remember two years ago when in Italy the biodegradable packaging for fruit and vegetables were charged 2 cents of Euro [traditional plastic bags, outlawed, were not charged before]. Then, so many protests started from customers. For 2 cents. There is not only education, it's also cost [that motivates consumers]. (Representative of a consumer association #6)*

From the perspective of institutional stakeholders, attention shifts from the purchase to waste management. In their view, the key strategy to promote the adoption of bioplastics is to reconsider the production and disposal change through new regulatory and industrial arrangements. Municipalities, for instance, play a role in trying to coordinate waste management companies, local retailers, and consumers.

We have a role, I am the coordinator for the whole province, and three or four times a year we meet and give recommendations to the waste management company. We try to maintain the relationship with the company to manage the collection and disposal service in the best possible way. (Representative of local public administration #2)

The role of municipalities is crucial since, according to the Italian regulation, they oversee local waste management. While such a fine grain approach to waste management can ensure the best fit for each region, it can be dysfunctional if considered from the perspective of producers of bioplastics, which can be classified differently across the country depending on how waste is collected or the specificity of the waste management facilities.

A significant step forward, for instance, is how bioplastics have been re-classified according to their disposability through an industrial plan developed jointly with producers, public administrations and waste management companies, leading to a significant reduction of end-of-life management costs. Such arrangements are not just negotiations about producers' costs, but they affect the whole use cycle of bioplastic, impacting on how waste management is re-organized. From this perspective, end consumers are presented as 'passive' recipients of high-level institutional arrangements and required to comply with regulations, for instance adapting to door-to-door waste collection and household waste separation.

However, from the perspective of institutional stakeholders there is a need to act on consumers through education/communication since their behaviour can significantly impact the wider process and overall costs.

Reducing only by 1% the non-compostable waste incorrectly put in the organic waste by mistake, that means waste incompatible with the waste management flow, we would reduce the cost of municipalities, waste management companies and thus bills for 60 million euros. Consider that for each kilogram of non-compostable waste we also lose 2.6 kilograms of compostable waste. Communication to increase the performances of organic waste disposal, explaining that bioplastics belongs to organic, and plastic belongs to plastic, would have a secondary effect that could increase quality and thus reduce costs. (Representative of national regulation entity)

[Referring to salad packaging] when the packaging is dirtied by the product, I can dispose of them [packaging and product] together. […] Obviously, the product must be compatible not only with the packaging but also with the separate collection of organic waste, as all becomes compost

and must therefore have a guaranteed chemical and physical balance so that the material can be used with peace of mind. (Representative of national regulation entity)

A similar position was expressed by bioplastics producers, which are sometimes faced with requests they deem impractical if not completely out of their scope with regards to the overall objectives of introducing bioplastics packaging in the market.

Part of our job is to explain that some dreams of making bioplastics containers are not consistent with organic collection. One case in point is bottles. We could imagine having bioplastics bottles, which are compostable, but the meaning is that they are inconsistent with organic collection and do not solve any problems. Because a PET bottle is perfectly recyclable. Making a bottle out of bioplastics that can be disposed of would generate a series of problems, firstly for the user, who could get confused, and then of a managerial nature at home, since with two bottles you fill a small organic container. Then, when you deliver it, there is a problem for the receiver who has to understand if that bottle is compostable or not. (Representative of Bioplastics National Association)

The excerpt from the Bioplastics National Association points to the perceived need to keep consistency with the objective of adapting to existing waste management procedures and avoiding creating packaging that substitutes traditional products which do not pose issues in terms of recyclability or make consumers' lives more complicated. The extract also reveals the complexities and constraints, not to mention the variables to be taken into account, when launching new packaging to the market, ranging from the existence of recyclable alternatives, the size of the organic container, the product it contains, the effort required by consumers to understand and perform waste separation, to mention just a few. From the perspective of producers, the challenge is thus to promote their products while avoiding raising unrealistic expectations from the industry (sometimes regarded as interested in greenwashing their brand with little attention given to the consequences) or increasing the burden on the consumers' waste management.

HIGHLIGHTS

1. Knowledge of the specific features of bioplastics among the stakeholders interviewed can be ranked from lower (consumer association and municipalities) to higher (retailers, manufacturers and representatives of waste end-of-life).
2. For consumer associations, bioplastics belong more to the future than the present and there is still research to be done.
3. Bioplastics could be used by some industries for greenwashing purposes. To avoid this, national bioplastics associations discourage its use as packaging for non-food industry compostable products.
4. Consumer associations perceive threats associated with the production of bioplastics through analogy with other 'green' products (i.e. land consumption).
5. According to the national bioplastics association, increasing bioplastics use could lead to a triple-win: for the environment, the job market, and for national economies.
6. Correct household disposal of bioplastics is essential. Consumers need to be educated through communication and labelling of the products.
7. The cost of bioplastic packaging should not exceed that of traditional plastic since price is the most relevant issue for most of consumer choices.
8. European and national regulations are required to align different systems to reduce external issues related to bioplastic dissemination on consumer choices.

5. Conclusions

The analysis of qualitative and quantitative data allows us to provide a picture of the main research findings. Both sides offer a map of the representations and strategies of consumers and the key stakeholders with an array of points to consider the potential of bioplastics.

Despite being generally regarded favourably, there are some limits that could hinder the acceptability and future development of bioplastics. Accordingly to the study's scope, we focus on such barriers to provide some recommendations.

The first consideration is that a lack of bio-based technology knowledge is the most important barrier for bioplastics adoption. Therefore, consumer associations, in partnership with producers and retailers, could play an important role in leading this green transition process from traditional plastics to bioplastics. The second point is that experts use the term 'bioplastics' in different ways (i.e. institutions point out the EoL treatment aspects, whereas manufacturers push compostability characteristics).

The third consideration involves the stakeholder differences regarding the relationship between fossil-based and bio-based plastics. Thus, even though some doubts remain, whereas the municipalities and consumer associations favour a "greener" plastic; bioplastics producers are more "comfortable" with considering bioplastics as a tool that can contribute to a more sustainable economy but that cannot completely substitute fossil-based plastics. It is worth noting that, at least in the short term, producers' best-case scenario is a relatively small market confined to food packaging and delivery, while consumer associations have less concerns regarding more widespread use of bioplastics packaging. Those limits are also visible through the quantitative analysis. Bioplastics is a term recognized by about 2 out of 3 people and its meaning is blurred, meaning that people do not properly understand this material. Therefore, consumers must grapple with a complex product. Meanwhile, all key informants, each with their own line of reasoning, considered consumers as key players who need to be more involved in green transition, to achieve faster tangible outcomes.

Recommendation n°1:

European institutions, industry and consumer associations should increase collaboration to reduce consumer knowledge gaps and, possibly, identify a common strategy to manage "complexity" related to bioplastics.

A long-term European plan to increase consumer awareness represents a key factor in achieving a green transition.

Therefore, the challenge is to unlock consumers' potential through measures that empower, support and enable every consumer to play an active role in the green transition, as stated by the New Consumer Agenda (European Commission 2020B).

Data confirms that many adults – mostly those over 56 and the more educated – believe in the benefits that bioplastics can offer in protecting the environment. These people are on the wealthy side of society, but despite this, about 4 in 10 people identify cost, misuse of bioplastics and the risk of monocultures for raw material production as the main concerns in systematic bioplastics adoption.

Recommendation n°2:

As specified by the New Consumer Agenda, the research confirms consumers' concern about "greenwashing" activities. Therefore, a correct communication focus on the sources of raw materials involved in creation of new packaging and on EoL treatment will represent a key factor to incentivize the use of bio-packaging.

The consumer associations point out that even though consumer choices are based on ethical aspects, cost is still the most important factor in purchasing decisions. With the notable exception of consumers inclined to organic products, most purchases are based on the cost of the product being low. From this perspective it is not surprising that consumer associations, which have limited possibilities to promote cost-cutting at production sites, favour the intervention of political institutions in supporting bioplastics, making its alternatives less convenient or banning them.

For institutions, citizens are the hardest actors to align to an efficient waste management procedure, considering both the impact of imperfect waste separation in the end-of-life cycle and the limited leverage institutions have on them.

However, for both consumer associations and institutions, communication is the key to ensure an increased awareness, both when deciding what to buy and how to dispose of packaging. It should be noted, however, that communication here has different implications and distinctive features. Consumer associations consider communication necessary to promote a change in consumption style through a broad cultural change. Institutions, on the contrary, envision communication as having a more normative and procedural dimension. Data collected from customers confirms that they are convinced (8 in 10 people declared that they "strongly agree" or "agree") that laws should ensure mandatory regulation about bioplastics. These laws should be enacted at global (57%) and European (28%) level at least. At the

same time, about 60% of the respondents recognised a role for consumer associations and individual citizens in supporting bottom-up pressure to adopt bioplastics.

Recommendation n°3:

In relation to bioplastics, the research suggests focusing the message on sustainable production procedures and high safety and preservation standards of food protection and EoL choice.

Generally, consumers associated bioplastics with positive terms such as less pollution (63%), compostability (59%), and sustainability (59%). However, half of respondents associated bioplastics with increased costs, while there was concern about the possible increase in land consumption to produce them, although at the same time bioplastics are associate with trust and safety by consumers.

Communication is by far the most relevant theme for all the stakeholders. All participants shared a concern about raising consumers' awareness regarding bioplastics. We could identify two main communication issues to be addressed. First, communication should be aimed at increasing the desirability of bioplastics and stimulating the demand from the consumer side. Consumers need to be informed about the distinctive features of bioplastics to be able to identify and distinguish them from other similar materials. Such knowledge is one of the keys to promoting its adoption in a market where consumers are increasingly ethically driven in their purchasing decisions. Such communication could be aimed at the general public through dedicated campaigns, and reinforced through detailed information regarding on each product's labels. Research data shows that attention to labels is selective and, in general, the most salient information for consumers is the expiry date of the product (34%). The second most sought-after information concerns the product's properties (24%) – only 1 in 10 said they were concerned about the marks on packaging for recycling or information about chemical additives. Unfortunately, the presence of Internet links for further information did not seem to be of interest to consumers interviewed (only 3% were interested).

Moreover, bioplastics should be well presented and communicated to allow people to know how to deal with them. Bioplastics should not just be easily identifiable but its production should also be traceable to reassure green consumers that each step of the packaging process has avoided harm to the environment. To this end, the analysis reveals the need to align the interests of retailers and bioplastics producers. The former stresses the impossibility of shouldering the full costs of communication without the help of the

latter or increasing the costs of the products, which will decrease their desirability in the eyes of consumers.

Secondly, as stressed by institutional actors, communication is needed to ensure consumer compliance with correct waste disposal given its significant impact on the overall waste management system and the costs for both producers and consumers. With respect to the communication aimed at suggesting a preference for bioplastics over alternatives beyond marketing, informing citizens about waste separation is harder and more procedural and probably requires a dedicated information programme.

There are a few certifying bodies that attest to the compostability of bioplastics products. Some are uncommon and their lack of recognition among consumers can lead to confusion.

Only 4 in 10 consumer respondents correctly interpreted the "TUV-Home" label and 3 in 10 the "TUV-Industrial" label. Overall, more than a third did not know what these labels meant, which suggests how significantly complex the practice of waste disposal is.

Some stakeholders suggested adopting a single logo for bioplastics products – directing the consumer to the correct disposal method could eliminate ambiguities and make the products immediately recognisable. An initiative to pursue this objective should be taken at EU level since products travel across countries. The future logo should clearly identify bioplastics and display, in a simple way, the correct EoL treatment.

Logos and brands should help to disambiguate which among the bioplastics are biodegradable since this single piece of information is the most relevant when it comes to consumers separating household waste.

Recommendation n°4:

Consumers need to be informed about the distinctive features of bioplastics to be able to identify and distinguish them from other "similar" materials.

European authorities should create a common logo at European level that identifies bioplastics to maximize efficiency and lead standardization.

The future logo should be able to identify bioplastics and display, in a simple way, the correct EoL treatment.

The lack of clear and homogeneous policies across the EU and within single countries is a major barrier for the take-up of bioplastics. For example, 36% of respondents reported that the main limitation to the correct disposal of waste is insufficient information on the product packaging and 3 in 10 respondents

said that it was local regulations that were most problematic in helping consumers dispose of product packaging correctly.

This means that despite the lack of leverage stakeholders have in steering European or national policies, a step forward in aligning different systems is needed to allow the widespread adoption of bioplastics. For example, in the Italian case, the waste management system controlled at municipality level constitutes an obstacle to the standardized procedures needed to manage bioplastics waste in households. Besides the lack of consistency in waste management, EU regulations are considered an obligatory point of passage to ensure promotion of bioplastics and to make them the preferred choice for consumers by either penalizing or banning alternatives.

Industry has specific requirements regarding packaging. Rapid changes in terms of consumer preferences and retailers pose additional complexity. The bioplastics manufacturers association (and similar organizations) plays a role in facilitating the connections with industry and small producers, but it is still not well known. This is an issue especially for small producers, which need to invest heavily to find a bioplastic product in the market that is tailored to their needs.

Recommendation n°5:

The study suggests that companies interested in using bioplastics for their products will benefit from technology innovation. However, right now, companies complain about the limited availability of bioplastic products.

The bioplastics should be used only to produce packaging for food-industry products to align both with compostable waste and bioplastics packaging disposal.

The research's quantitative and qualitative data confirms that the transition from traditional plastics to bioplastics should take place without additional costs for consumers. Consumers are very price conscious at the time of purchase: 1 in 2 stated that cost is the main lever on which purchasing decisions are based. Even those who would accept an increase in price in the short-term would do so in the hope that this would make it easier to lower costs in the future.

On the positive side, consumers are very "environmentally oriented", with around 60% supporting an interest in conscious purchasing. Respondents stated that they were "very" or "somewhat" encouraged to buy bioplastic products precisely because they do not have an impact on the environment (86%).

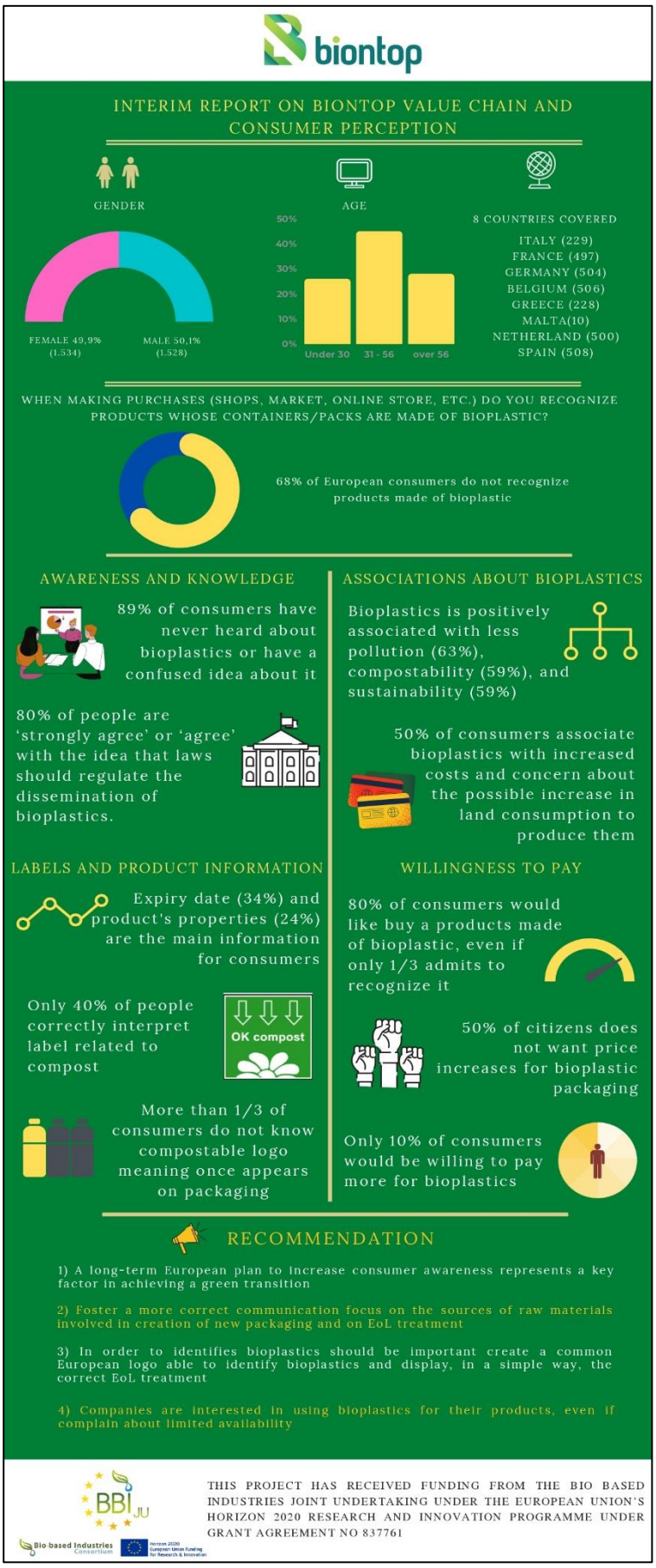
However, just a third of consumers declared that organic origins and the possibility of recycling the packaging were among the reasons for choosing to buy a product. This share is lower in the case of bioplastic products. Despite the desire to buy products made of bioplastics reported by 8 in 10 people, only 1 in 3 admitted to recognizing such products.

Interest in paying more for bioplastics sat at around 10% at most, especially among older people and those with high levels of education and managerial jobs.

However, work with stakeholders has shown that the process does not have to be 'linear'. It is in everyone's interest to create a smooth transition to bioplastics without them becoming the "solution" and the replacement material for any traditional plastic product. The possibility of maintaining the goal of reuse and avoidance of single-use products by consumers and local authorities should be safeguarded, while at the same time encouraging agreed developments between producers and disposal consortia to ensure that an already functioning supply chain is not jeopardized.

6. Annexes

6.1 Figures & tables

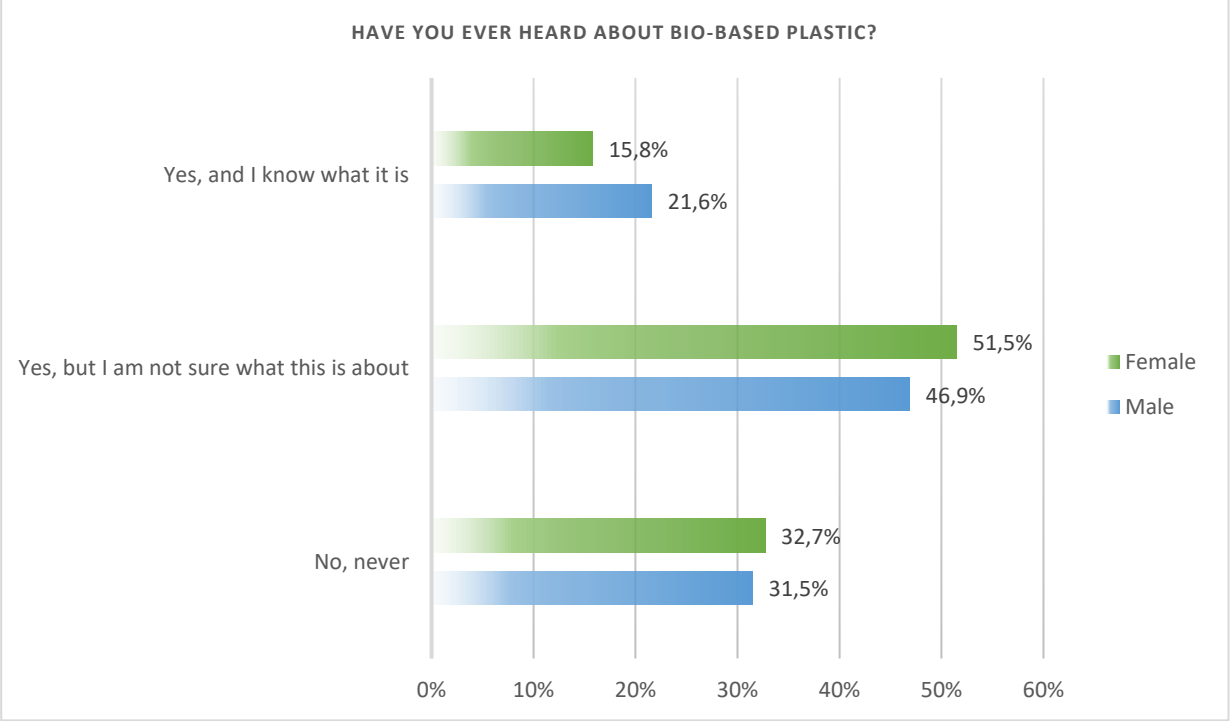


Annex 1 – Factsheet about consumers consultation

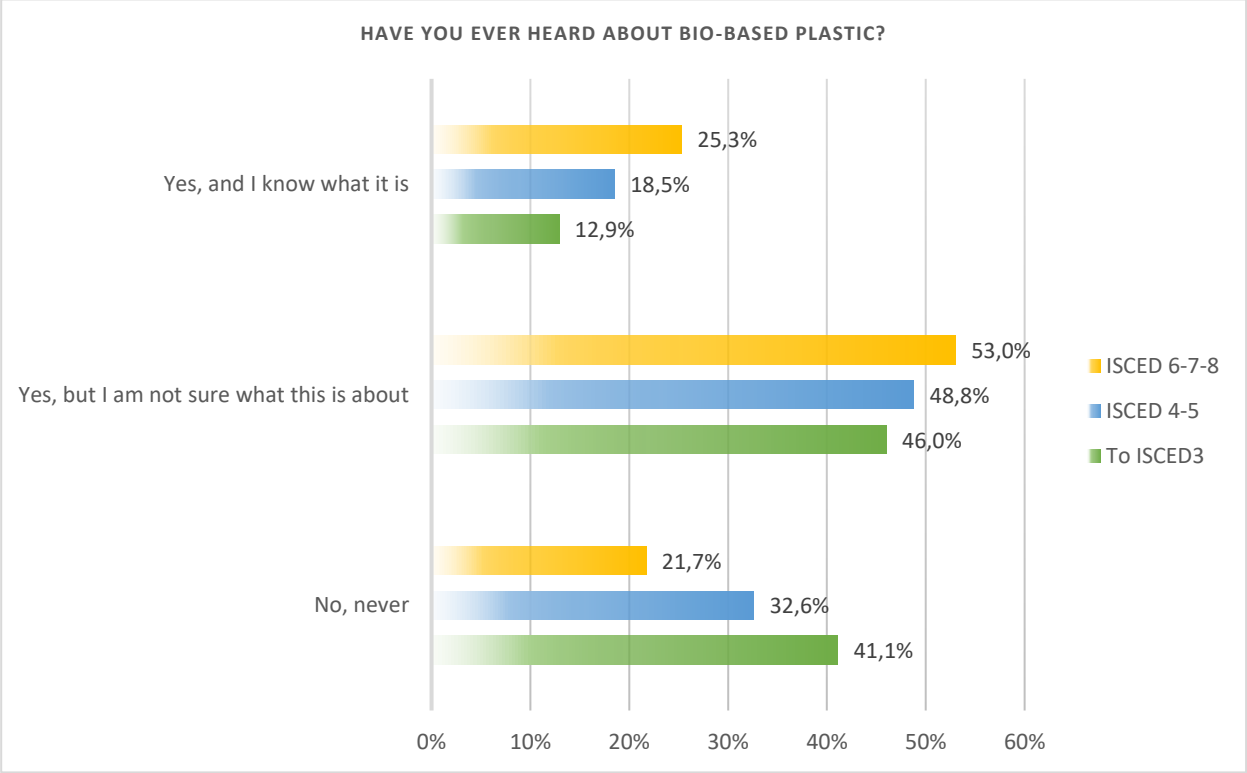
In this section, each variable is presented through tables and graphs after crossing data with specific indicator (Gender, age, education and willing to pay). Absolute values, percentages and diagrams are always provided in the same order.

Have you ever heard about bio-based plastic?	N° Replies	% Replies
No, never	1.059	32,6%
Yes, but I am not sure what this is about	1.593	49,0%
Yes, and I know what it is	601	18,5%
Total	3.253	100%

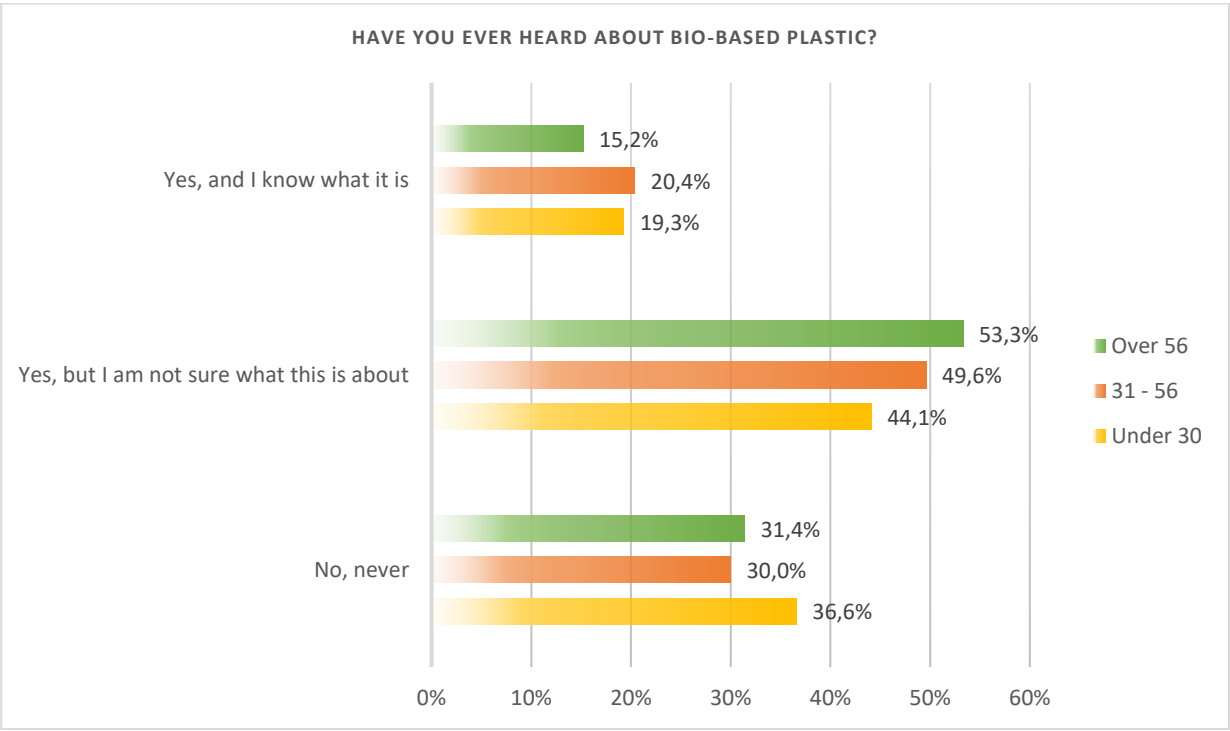
Annex 2 - Number and percentage of respondents (Have you ever heard about bio-based plastic?)



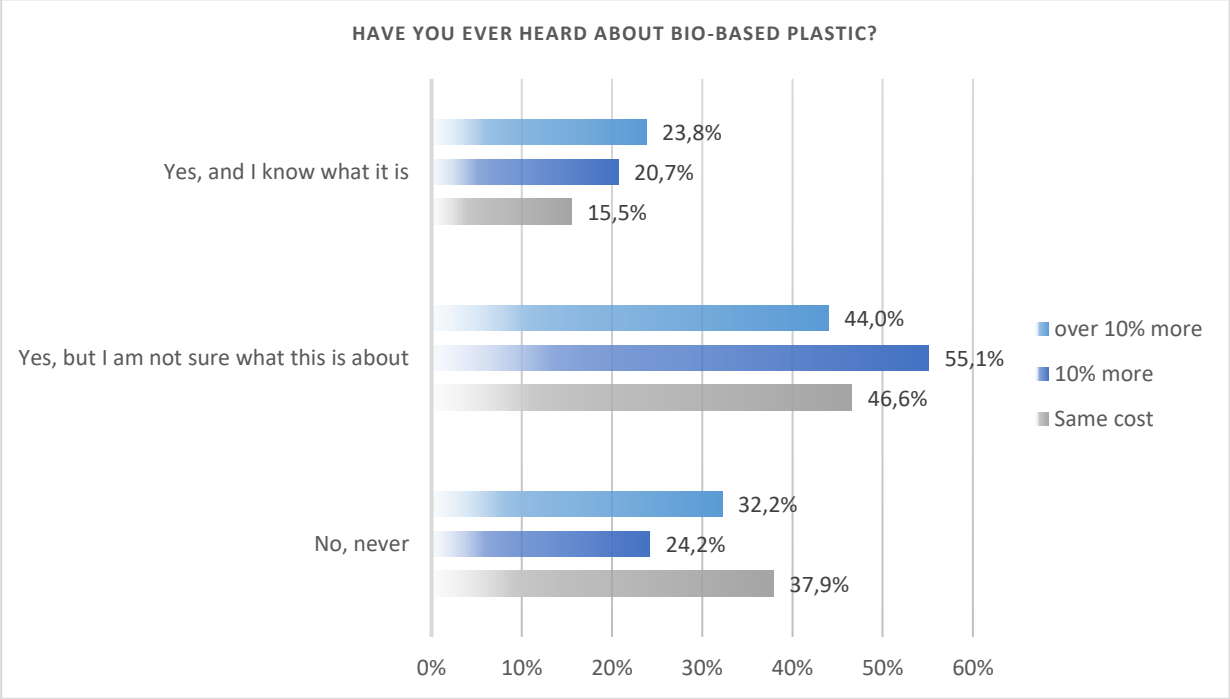
Annex 3 - Replies (%) per gender (Have you ever heard about bio-based plastic?)



Annex 4 - Replies (%) per each education group (Have you ever heard about bio-based plastic?)



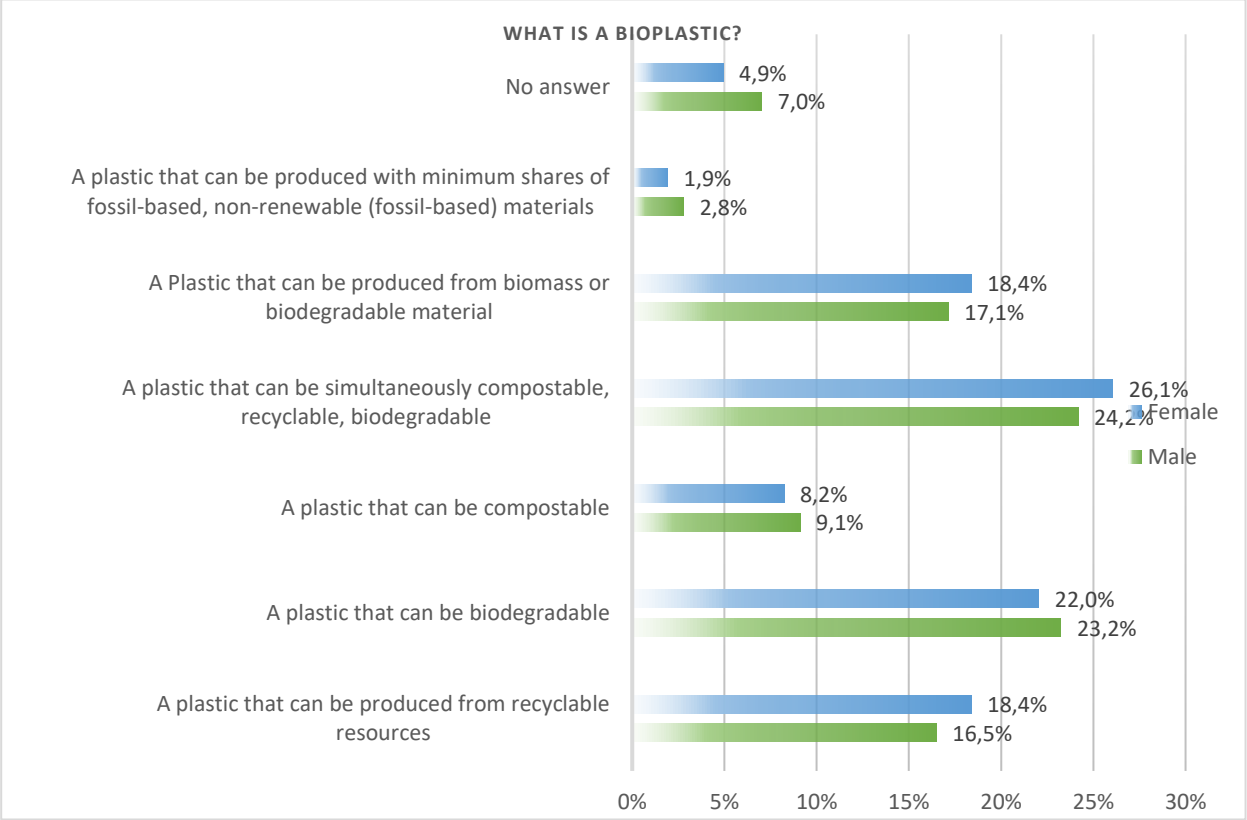
Annex 5 - Replies (%) per each age group (Have you ever heard about bio-based plastic?)



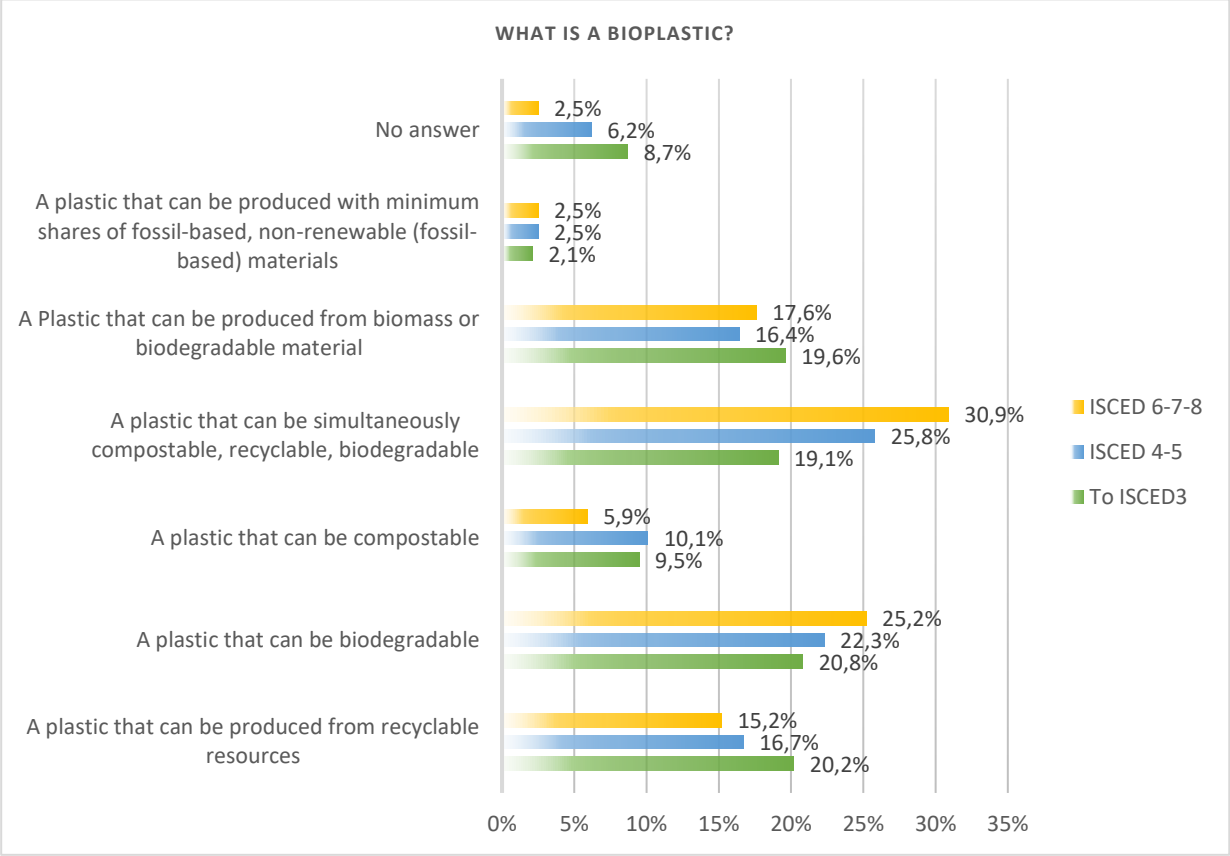
Annex 6 - Replies (%) per each willingness to pay (Have you ever heard about bio-based plastic?)

What is a Bioplastic?	N° Replies	% Replies
A plastic that can be produced from recyclable resources	505	17,3%
A plastic that can be biodegradable	646	22,2%
A plastic that can be compostable	247	8,5%
A plastic that can be simultaneously compostable, recyclable, biodegradable	750	25,7%
A Plastic that can be produced from biomass or biodegradable material	519	17,8%
A plastic that can be produced with minimum shares of fossil-based, non- renewable (fossil- based) materials	70	2,4%
No answer	177	6,1%
Total	2.914	100,0%

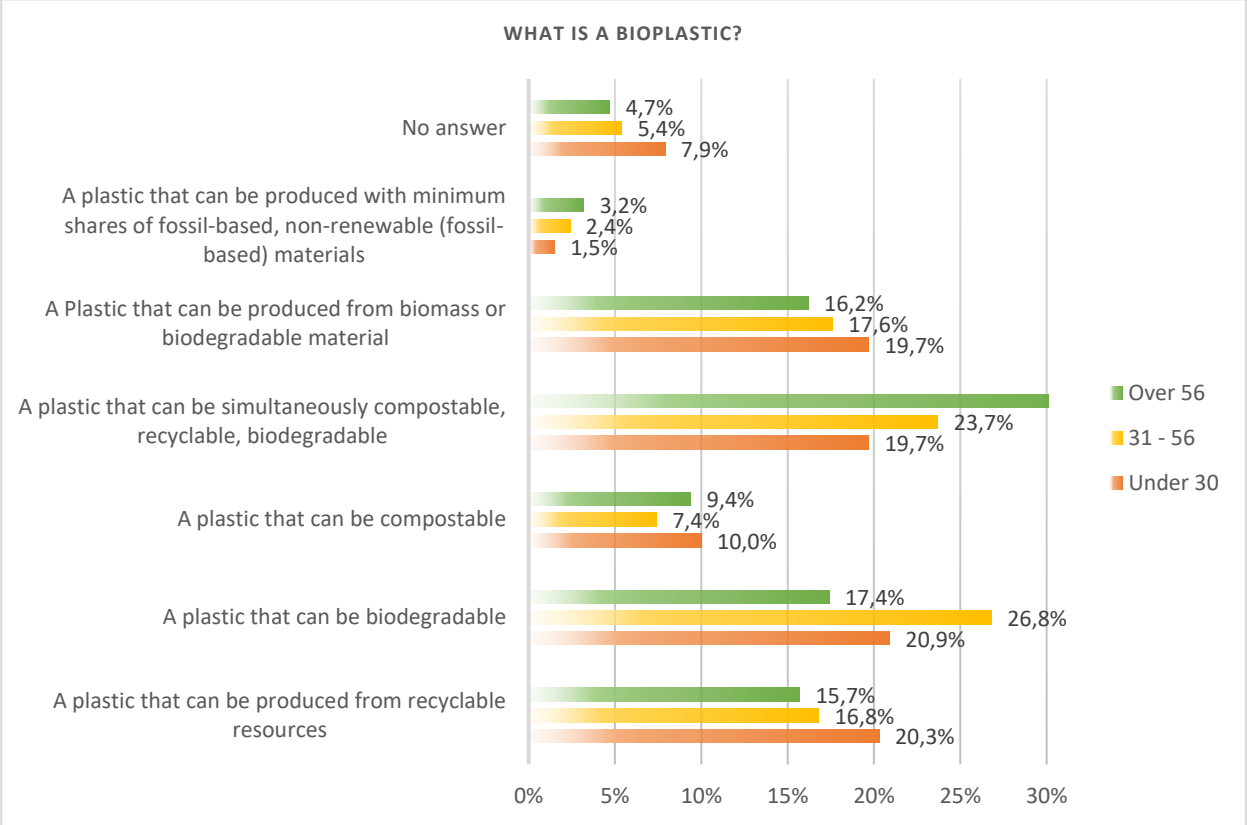
Annex 7 - Number and percentage of respondents (What is a Bioplastic?)



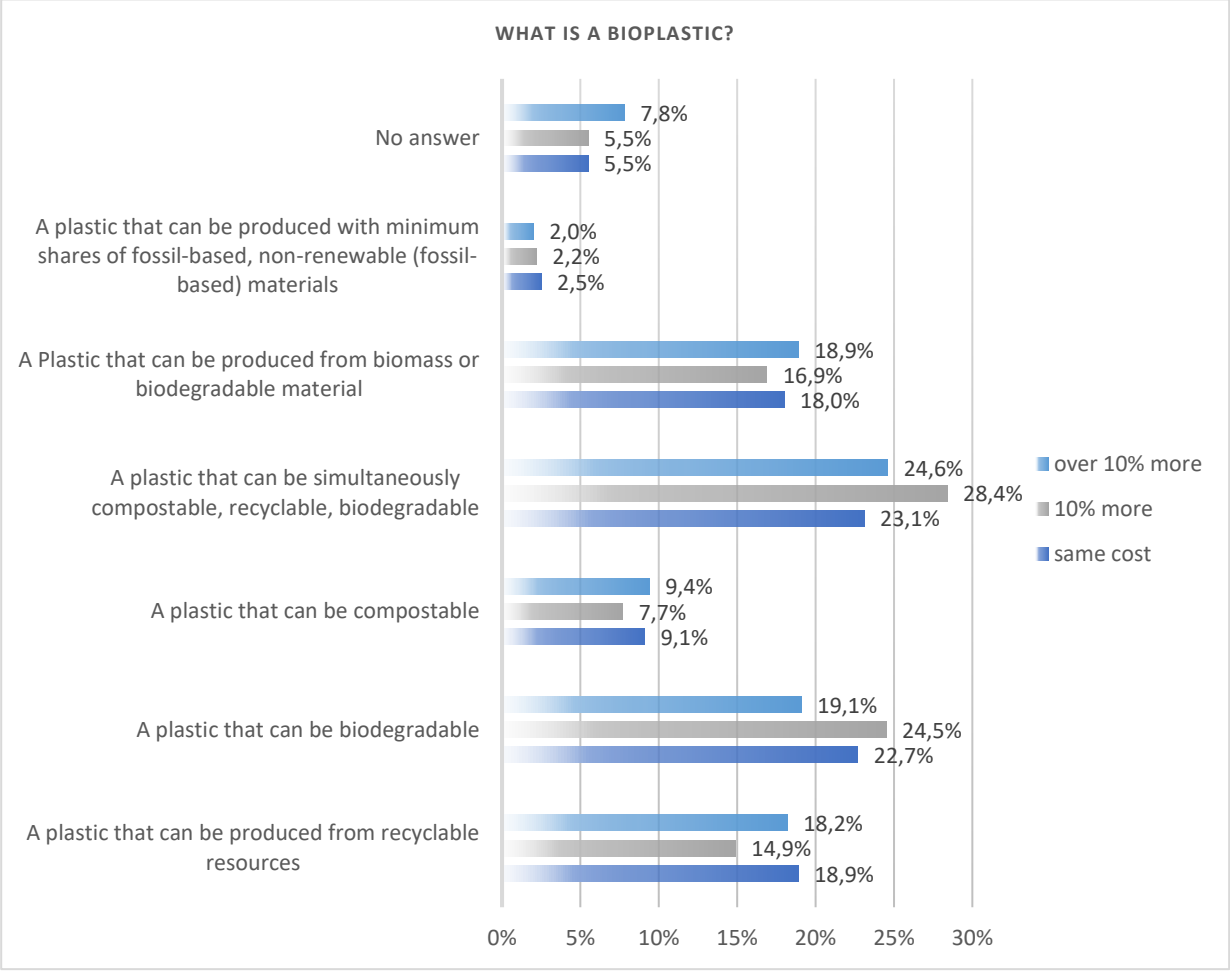
Annex 8 - Replies (%) per gender (What is a Bioplastic?)



Annex 9 - Replies (%) per each education group (What is a Bioplastic?)



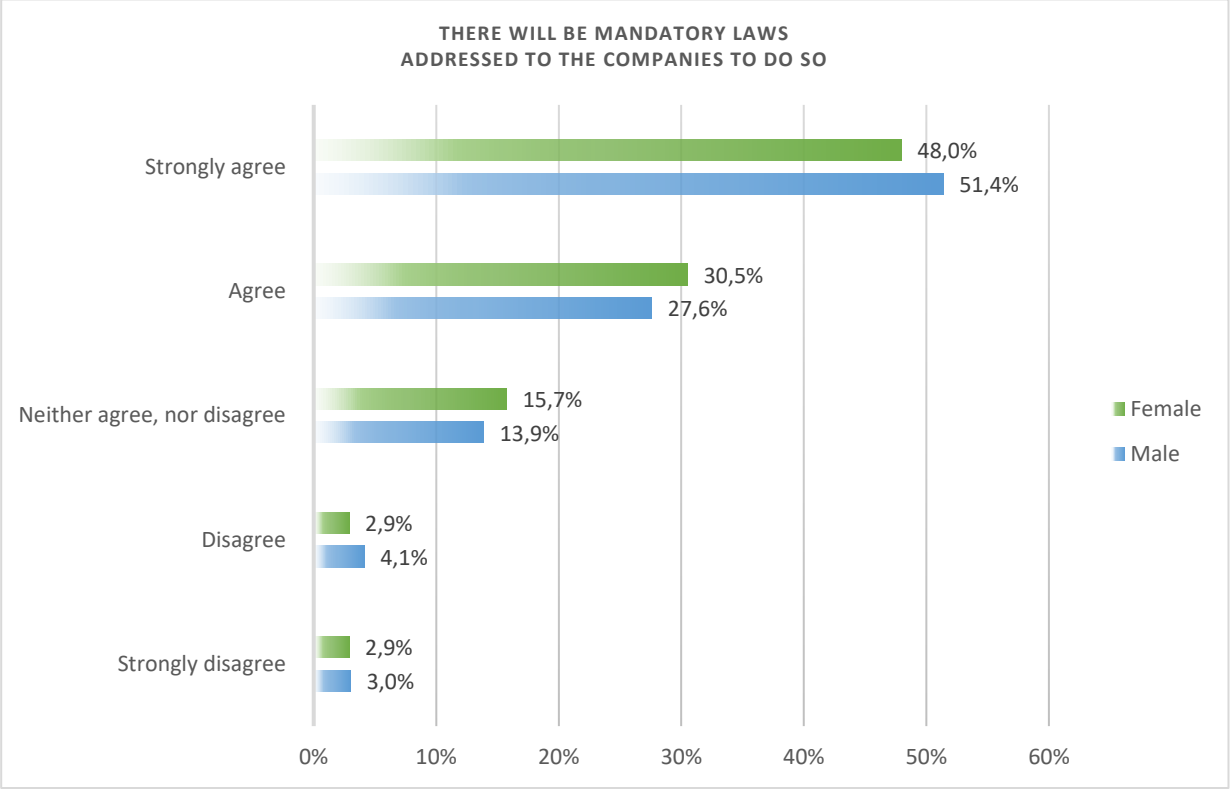
Annex 10 - Replies (%) per each age group (What is a Bioplastic?)



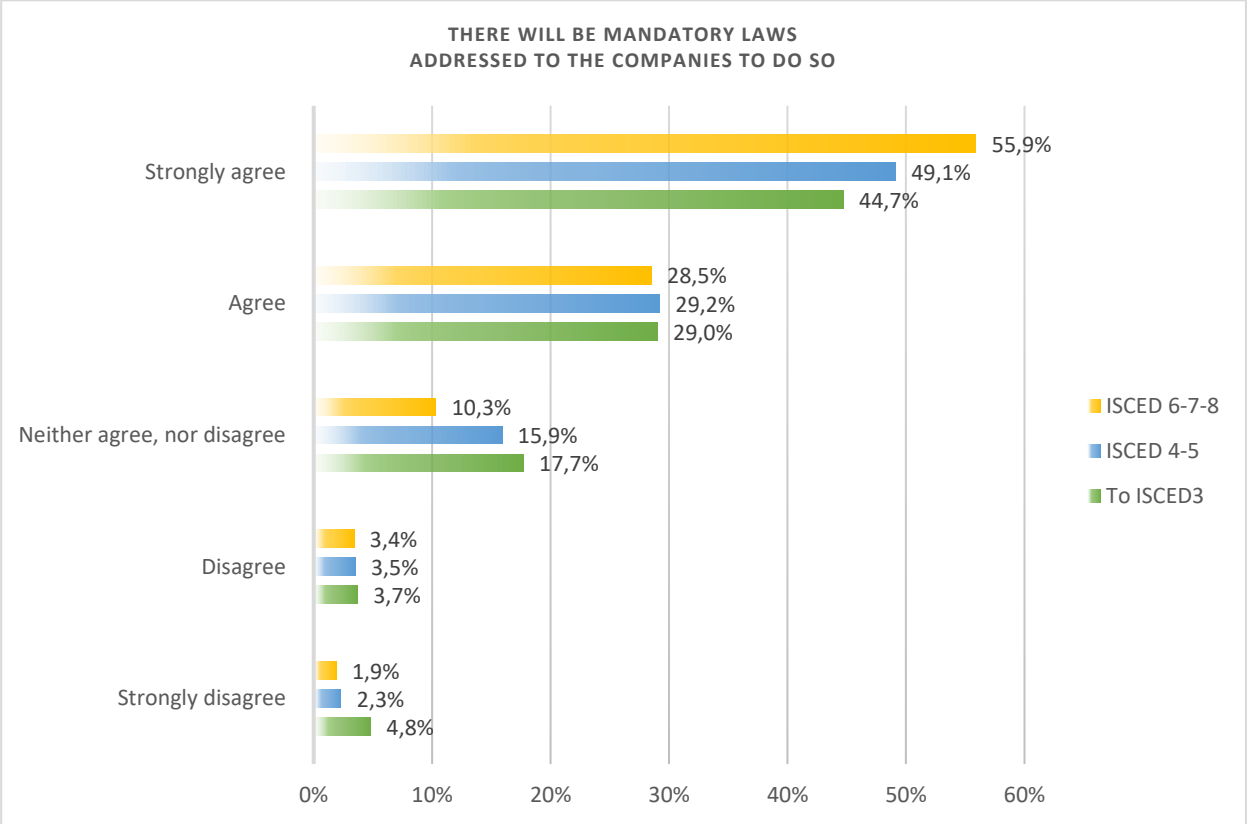
Annex 11 - Replies (%) per each willingness to pay (What is a Bioplastic?)

Please state your degree of agreement/disagreement with the following statements. In the future, the product containers will be built in Bioplastic if:											
Degree of agreement/ disagreement	Strongly disagree	Disagree	Neither agree, nor disagree	Agree	Strongly agree	Strongly disagree (%)	Disagree (%)	Neither agree, nor disagree (%)	Agree (%)	Strongly agree (%)	**Total**
There will be mandatory laws addressed to the companies to do so	96	109	467	914	1.655	3,0%	3,4%	14,4%	28,2%	51,1%	**3.241**
There will be incentives and government investment	118	163	705	1084	1.115	3,7%	5,1%	22,1%	34,0%	35,0%	**3.185**
There will be citizens' associations from below that put pressure on public opinion	124	204	867	974	1.028	3,9%	6,4%	27,1%	30,5%	32,2%	**3.197**
There will be many individuals from below who put pressure on public opinion	170	253	873	979	912	5,3%	7,9%	27,4%	30,7%	28,6%	**3.187**
The public authority will tax more the Oil companies	174	220	883	791	1.129	5,4%	6,9%	27,6%	24,7%	35,3%	**3.197**

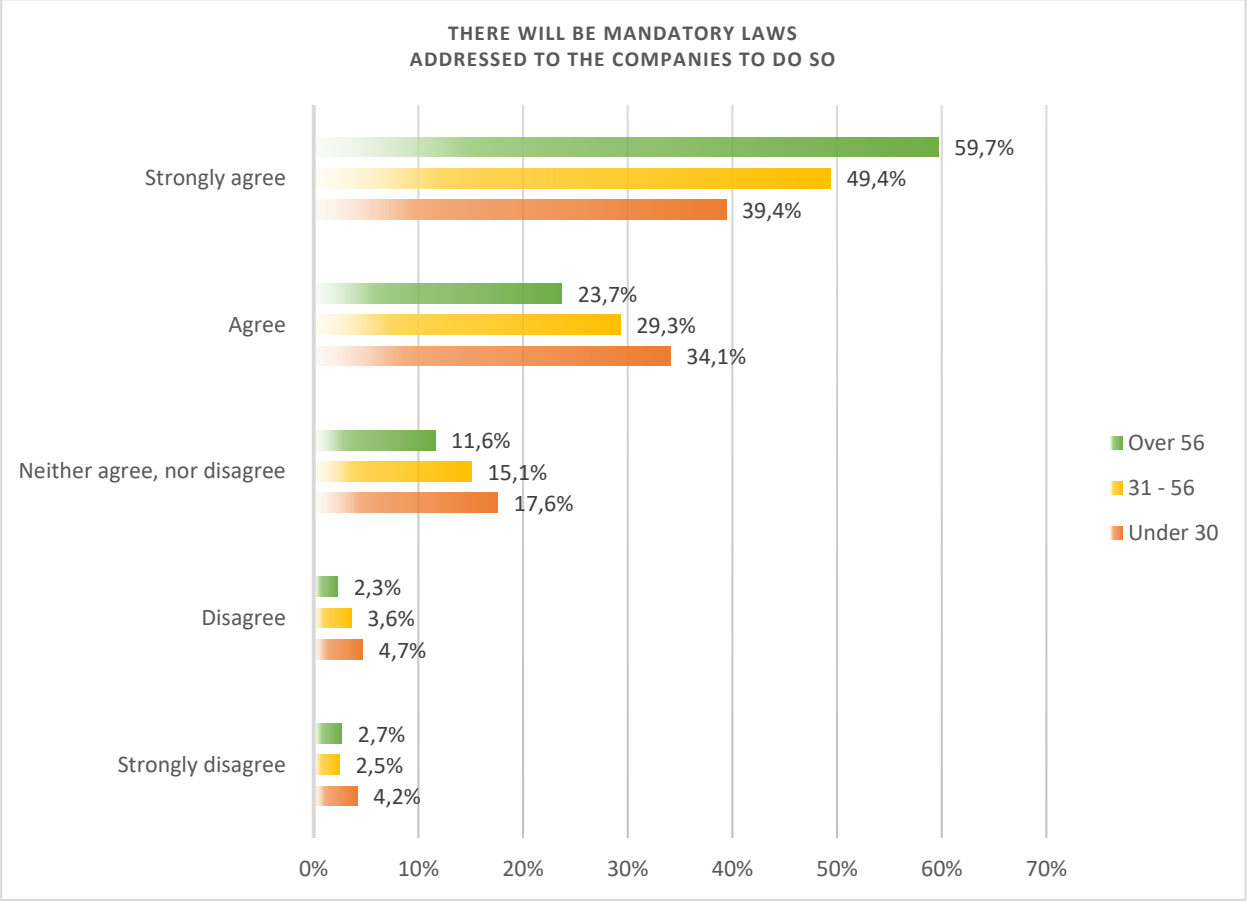
Annex 12 - Number and percentage of respondents (Please state your degree of agreement/disagreement with the following statements)



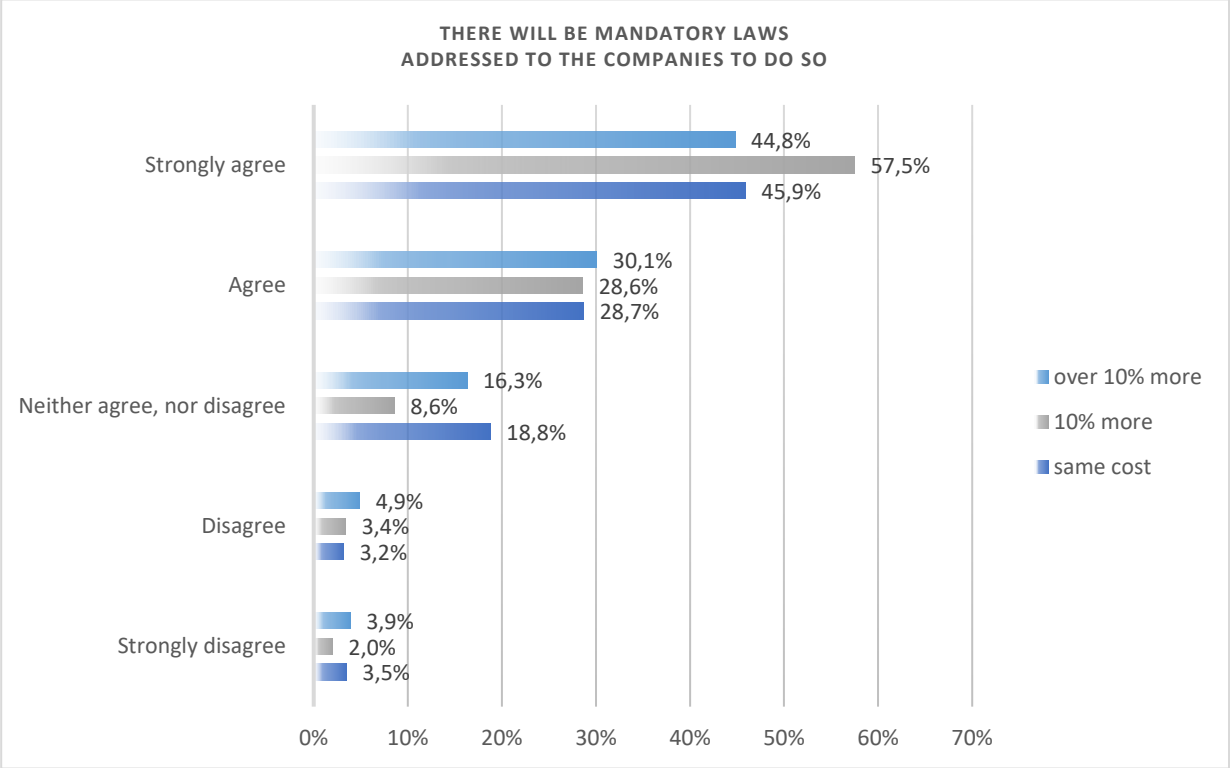
Annex 13 - Replies (%) per gender (There will be mandatory laws addressed to the companies to do so)



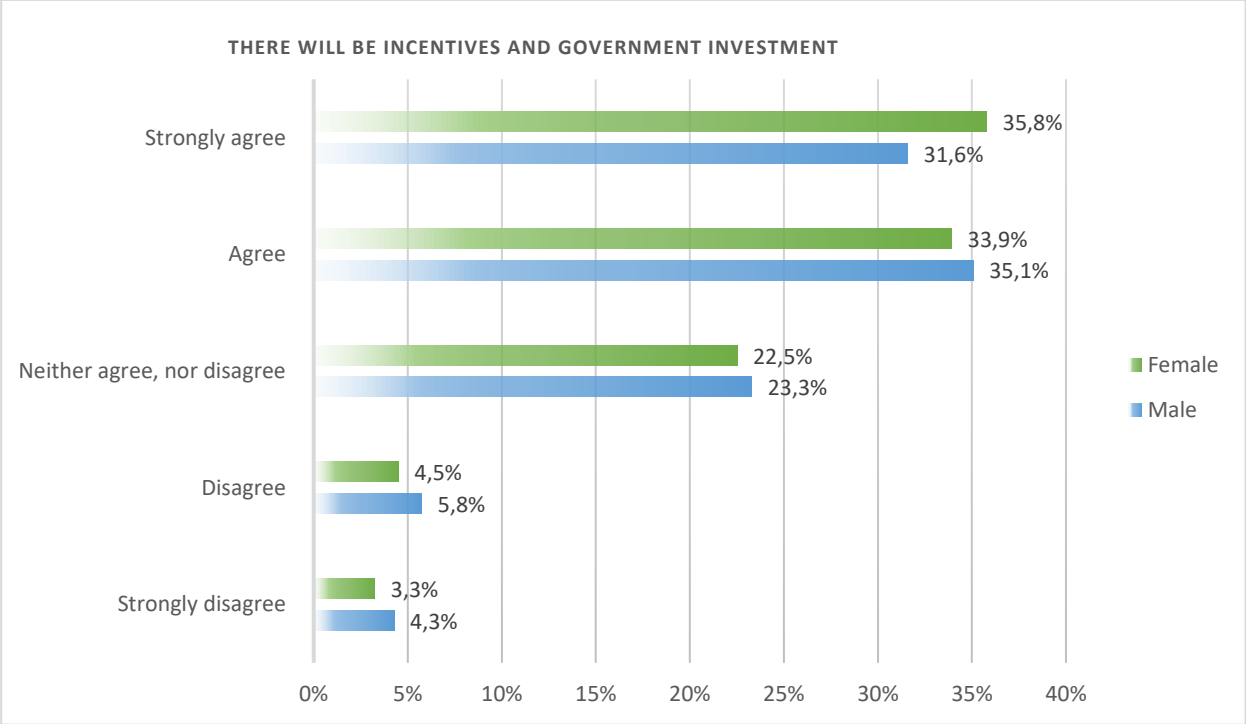
Annex 14 - Replies (%) per each education group (There will be mandatory laws addressed to the companies to do so)



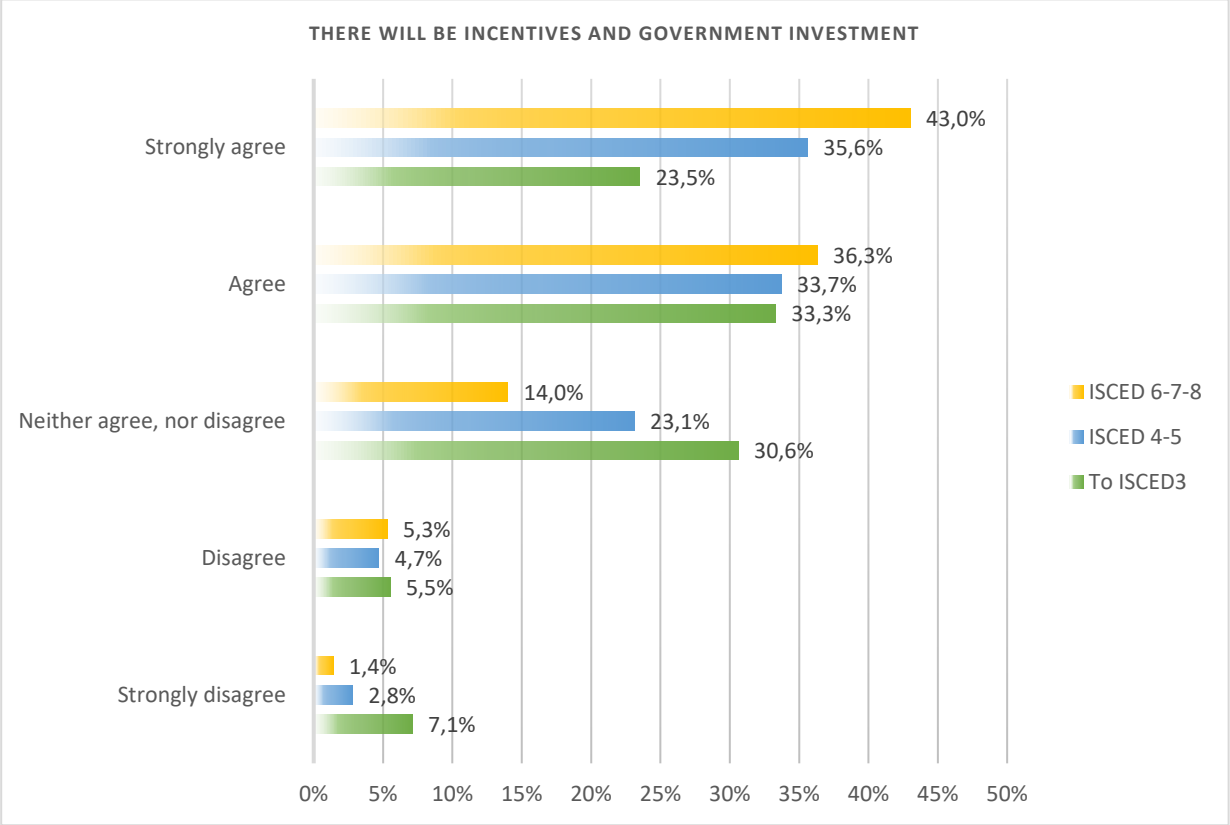
Annex 15 - Replies (%) per each age group (There will be mandatory laws addressed to the companies to do so)



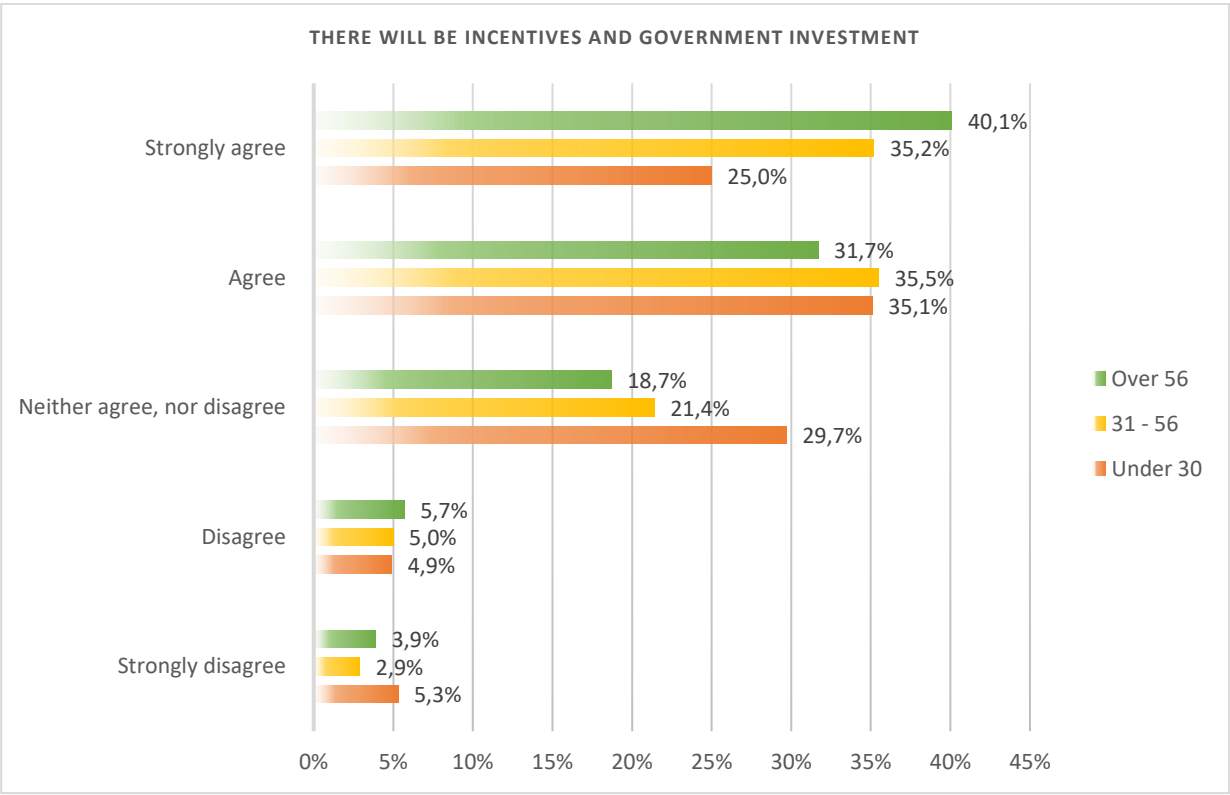
Annex 16 - Replies (%) per each willingness to pay (There will be mandatory laws addressed to the companies to do so)



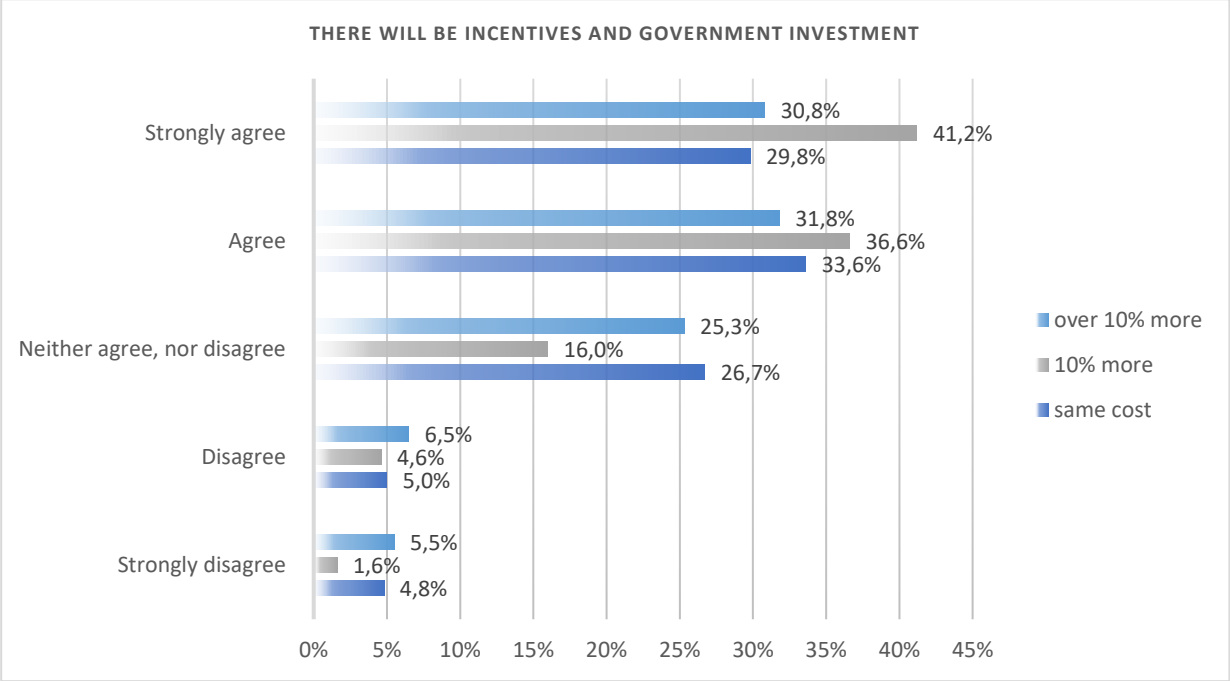
Annex 17 - Replies (%) per gender (There will be incentives and government investment)



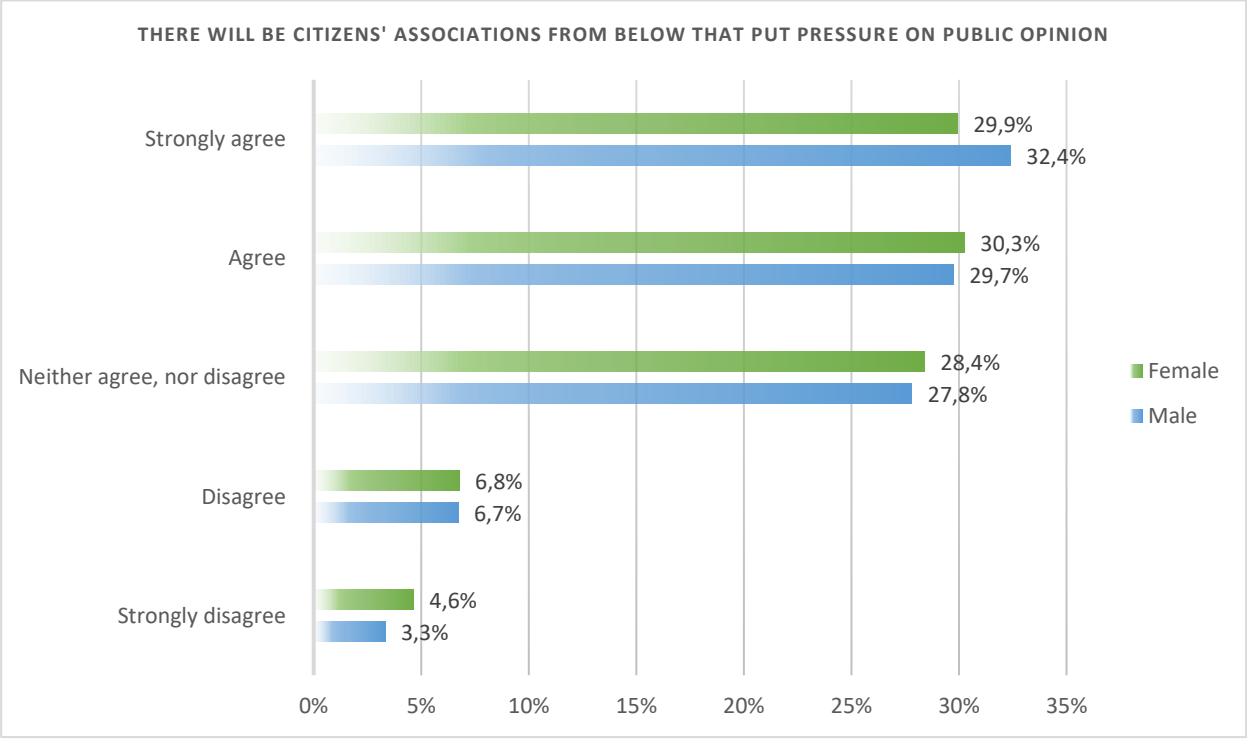
Annex 18 - Replies (%) per each education group (There will be incentives and government investment)



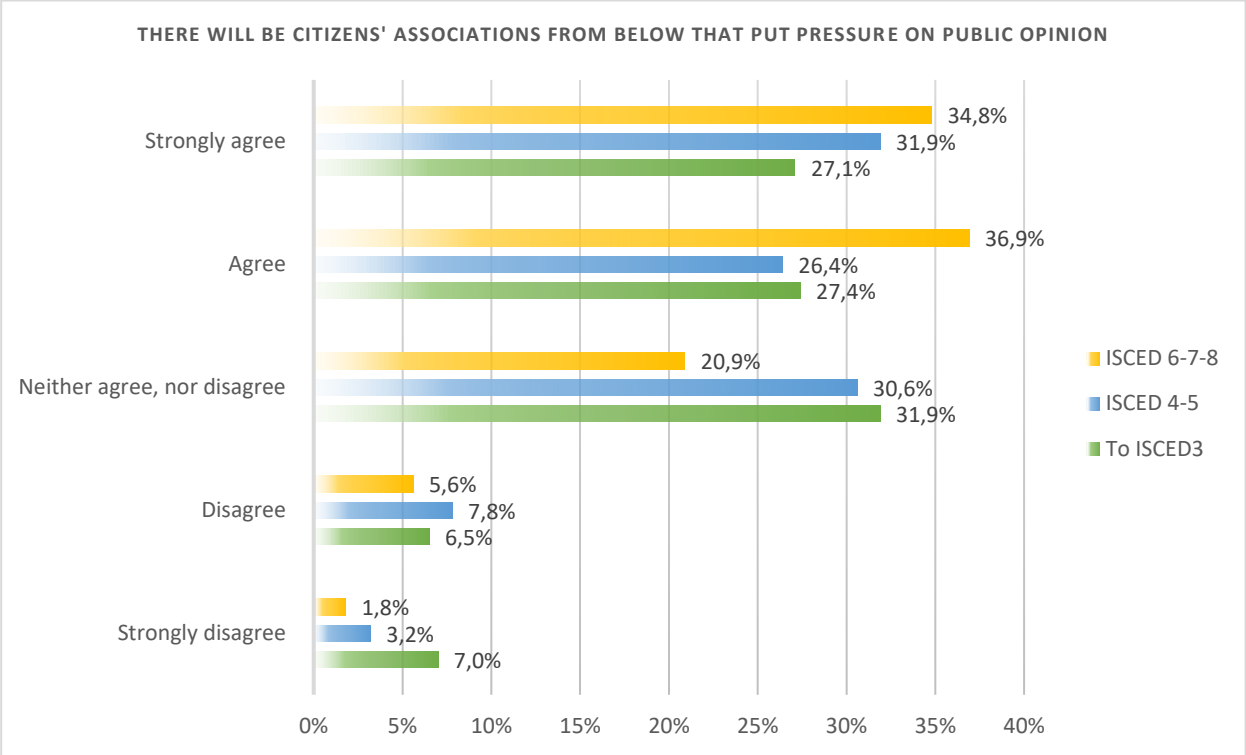
Annex 19 - Replies (%) per each age group (There will be incentives and government investment)



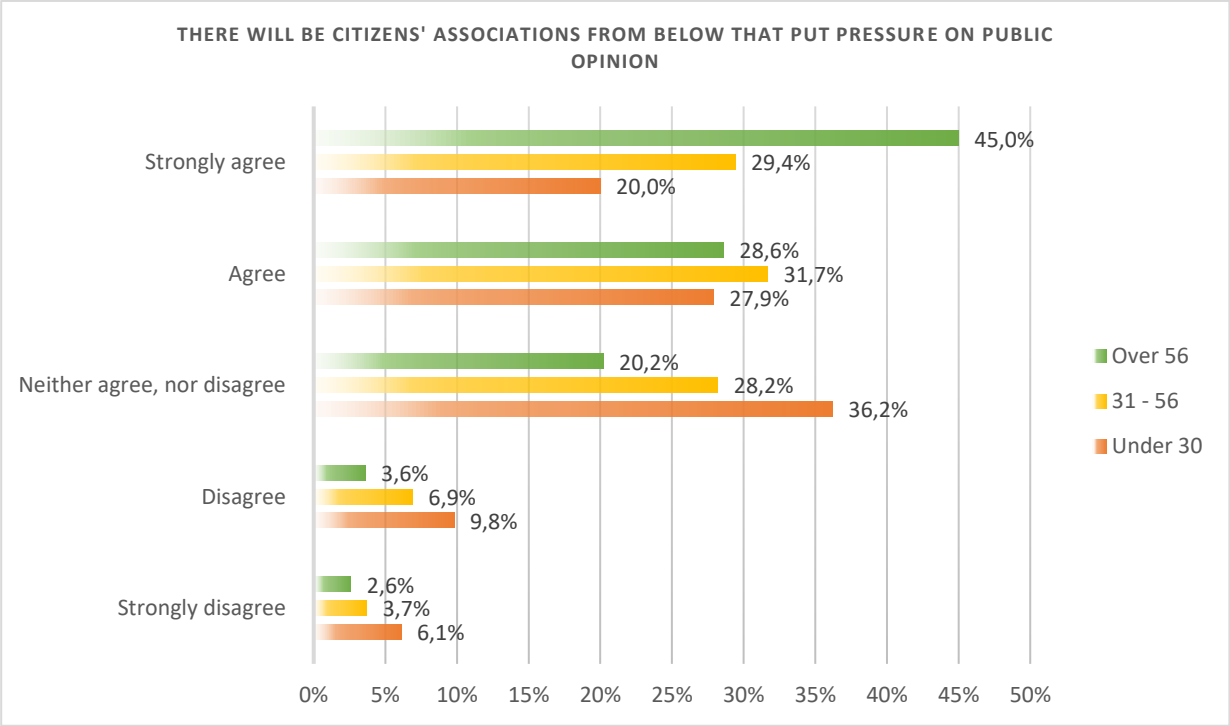
Annex 20 - Replies (%) per each willingness to pay (There will be incentives and government investment)



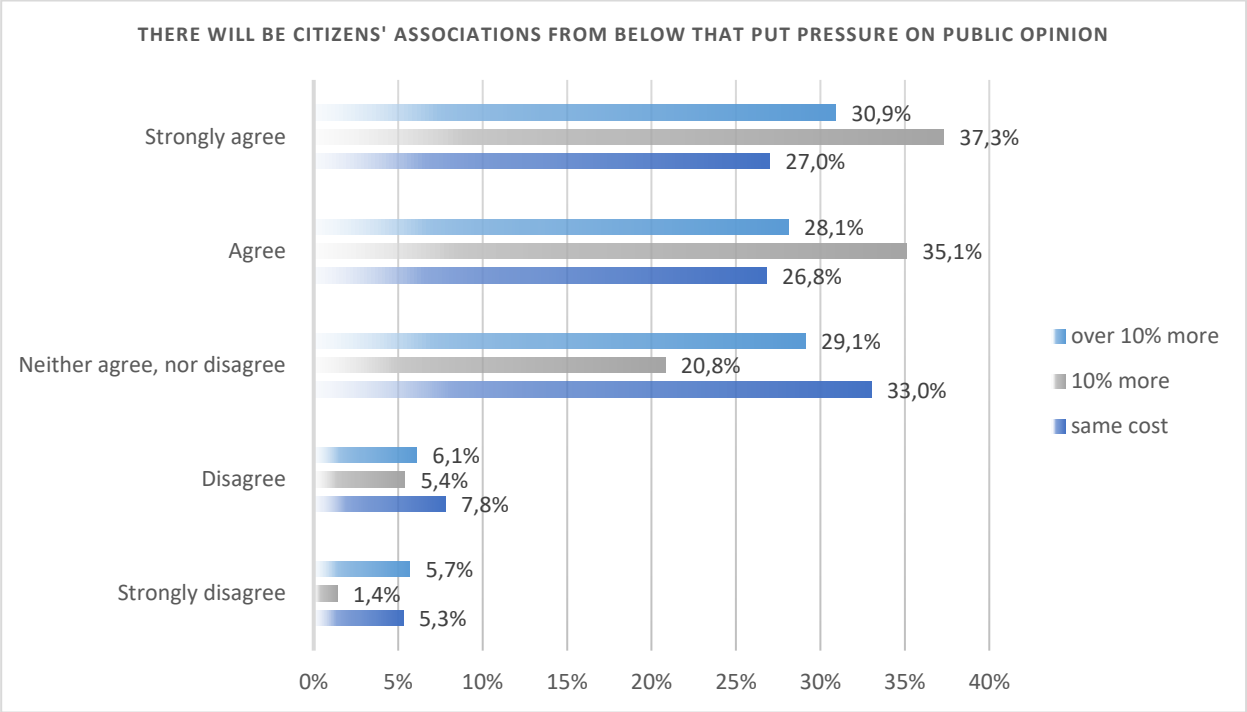
Annex 21 - Replies (%) per gender (There will be citizens' associations from below that put pressure on public opinion)



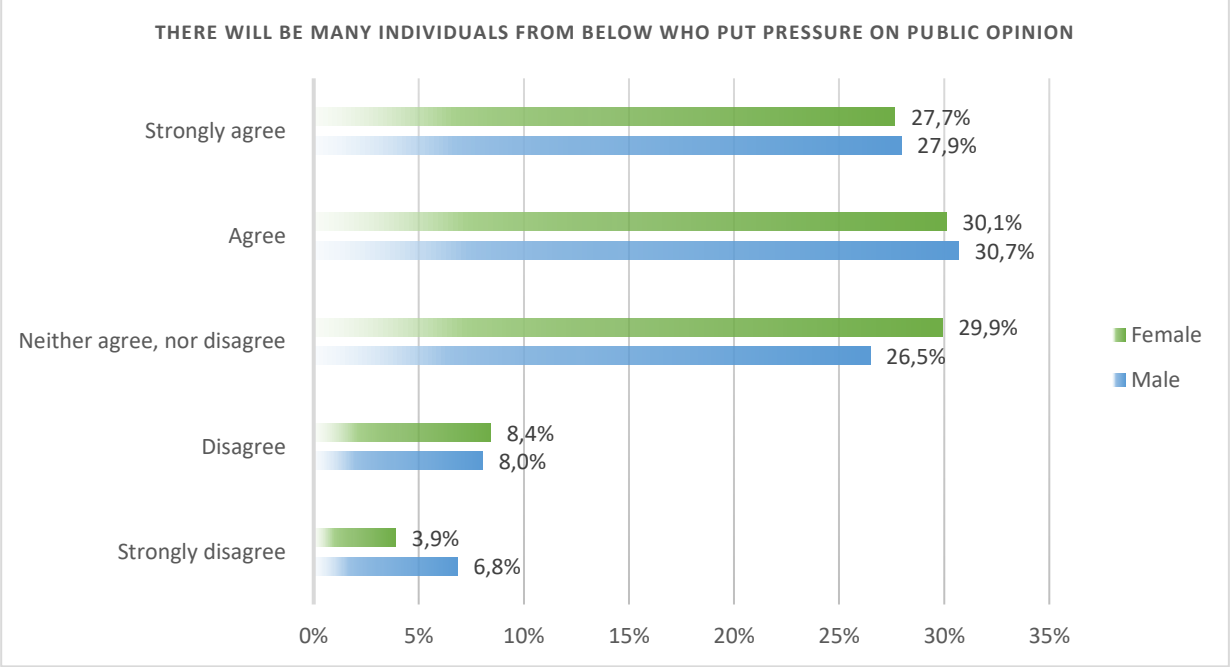
Annex 22 - Replies (%) per each education group (There will be citizens' associations from below that put pressure on public opinion)



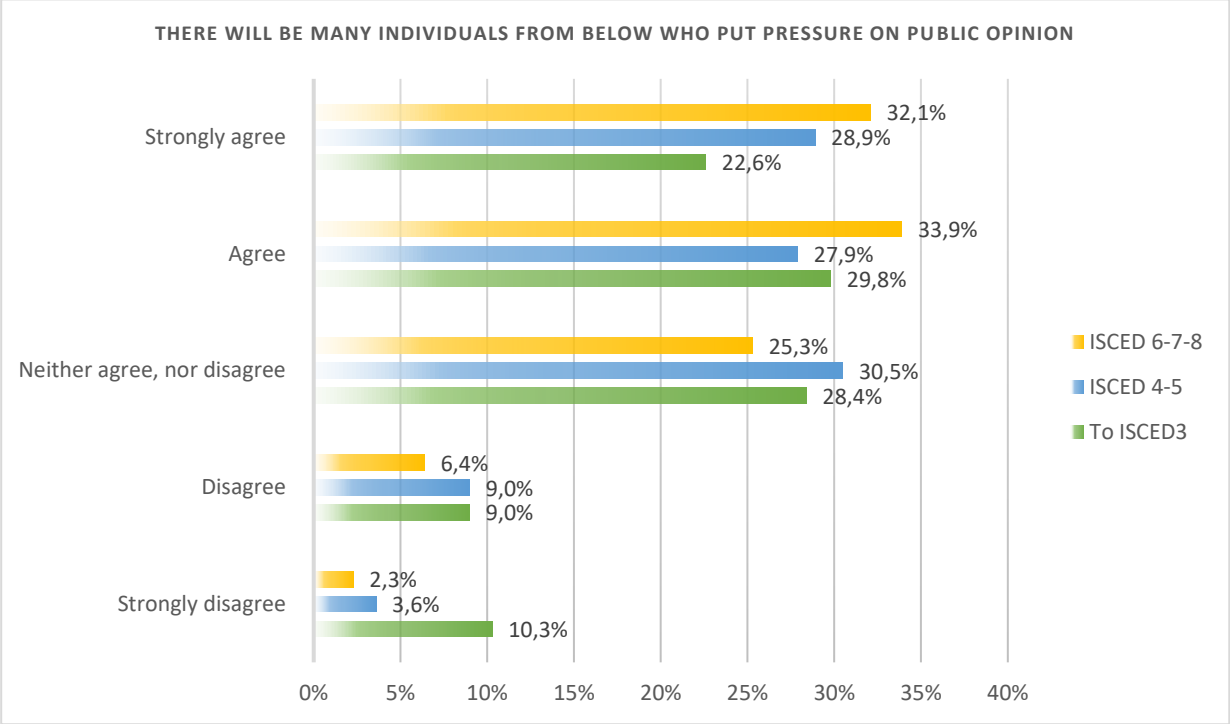
Annex 23 - Replies (%) per each age group (There will be citizens' associations from below that put pressure on public opinion)



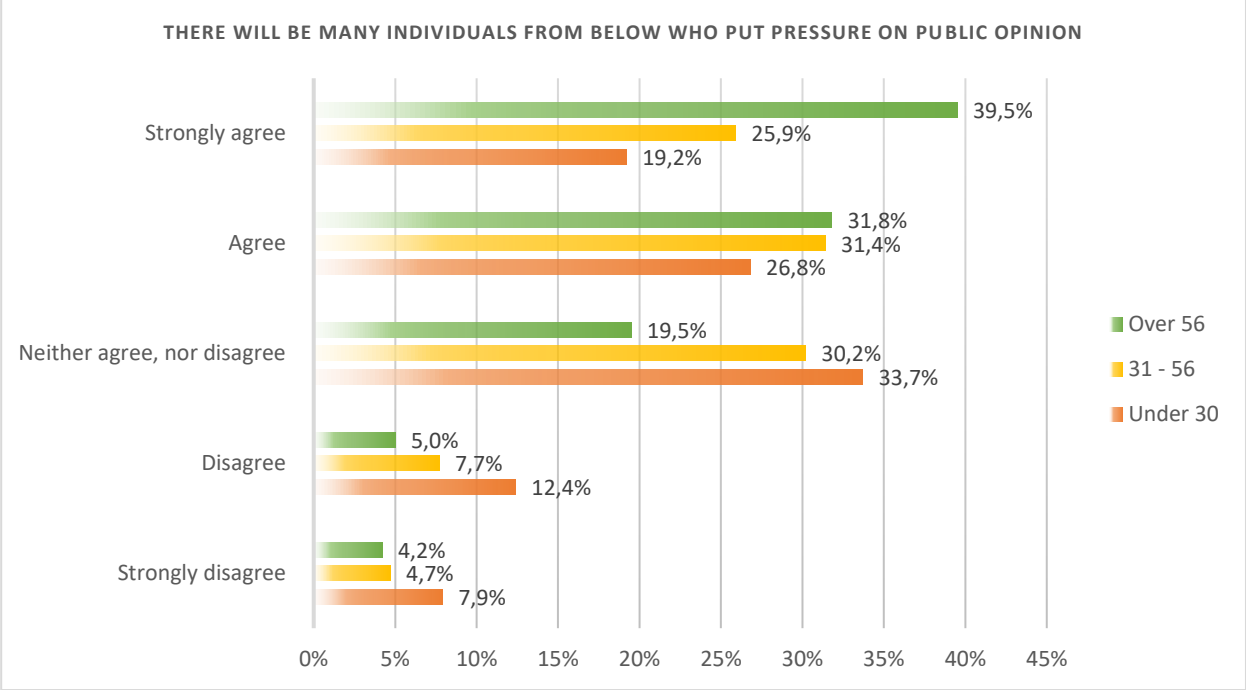
Annex 24 - Replies (%) per each willingness to pay (There will be citizens' associations from below that put pressure on public opinion)



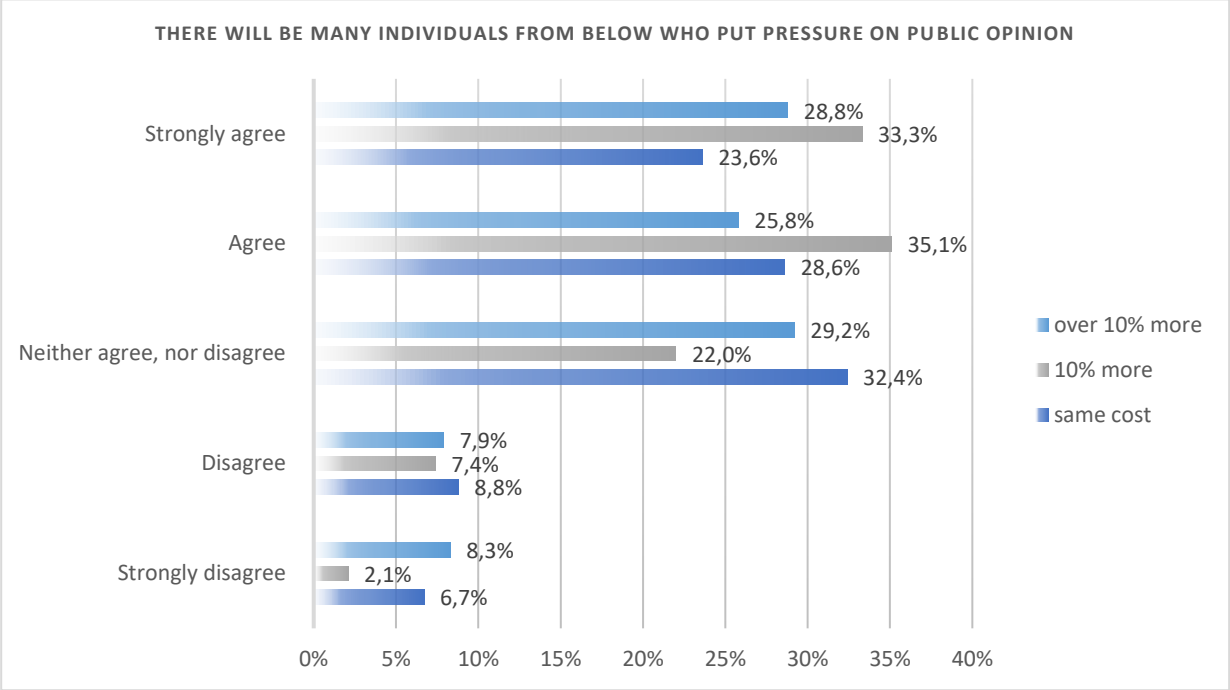
Annex 25 - Replies (%) per gender (There will be many individuals from below who put pressure on public opinion)



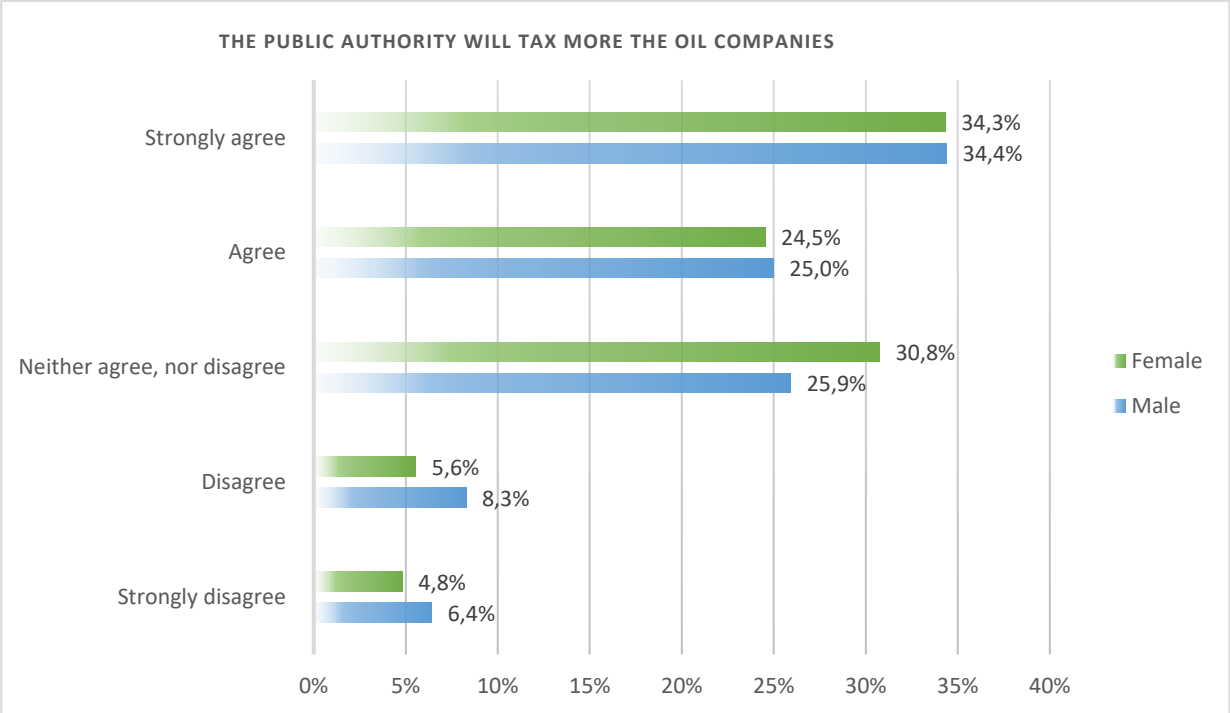
Annex 26 - Replies (%) per each education group (There will be many individuals from below who put pressure on public opinion)



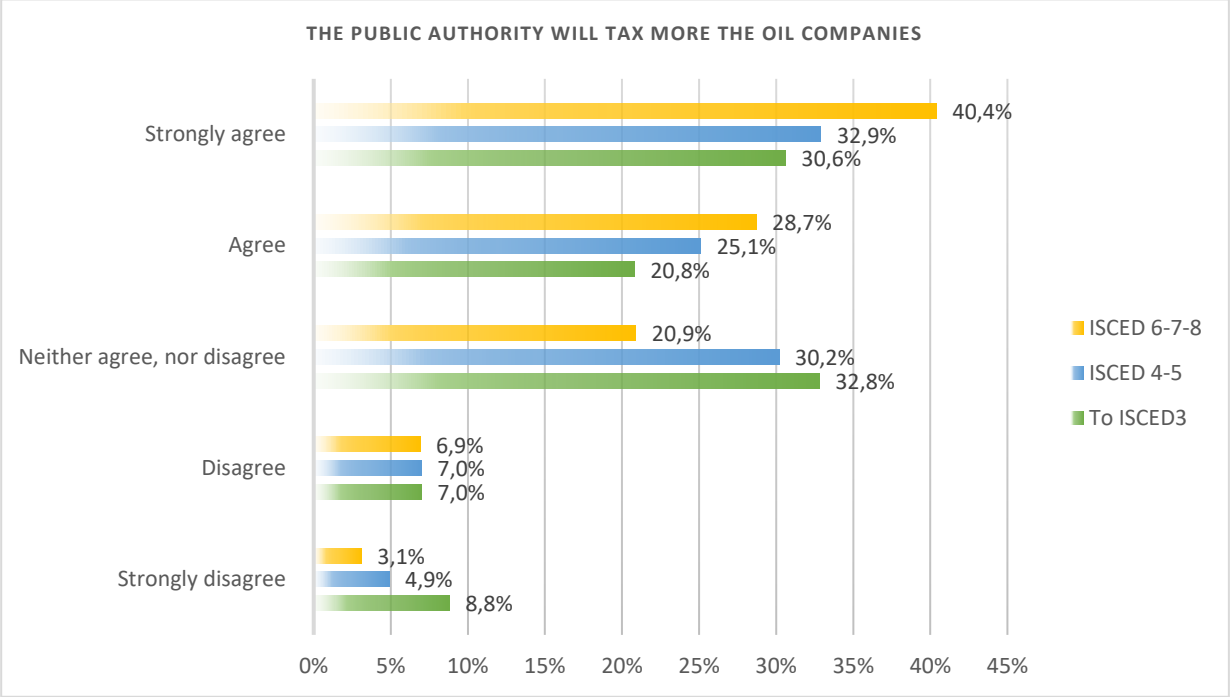
Annex 27 - Replies (%) per each age group (There will be many individuals from below who put pressure on public opinion)



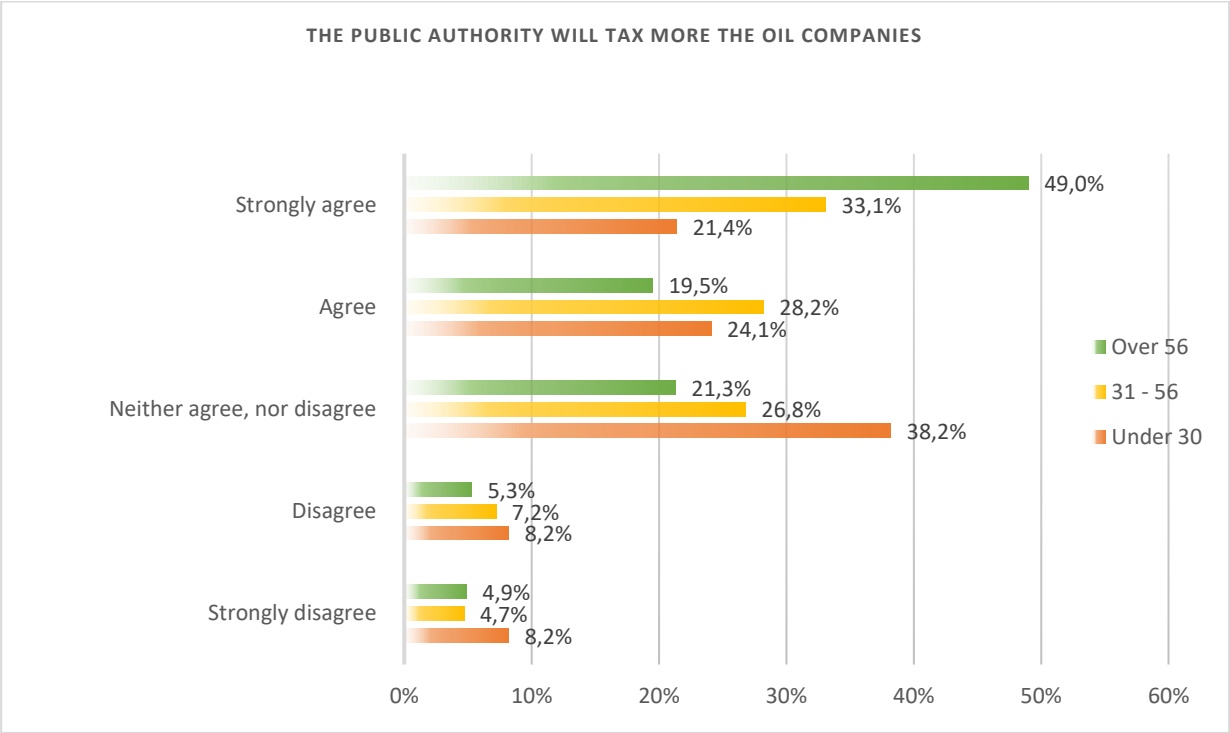
Annex 28 - Replies (%) per each willingness to pay (There will be many individuals from below who put pressure on public opinion)



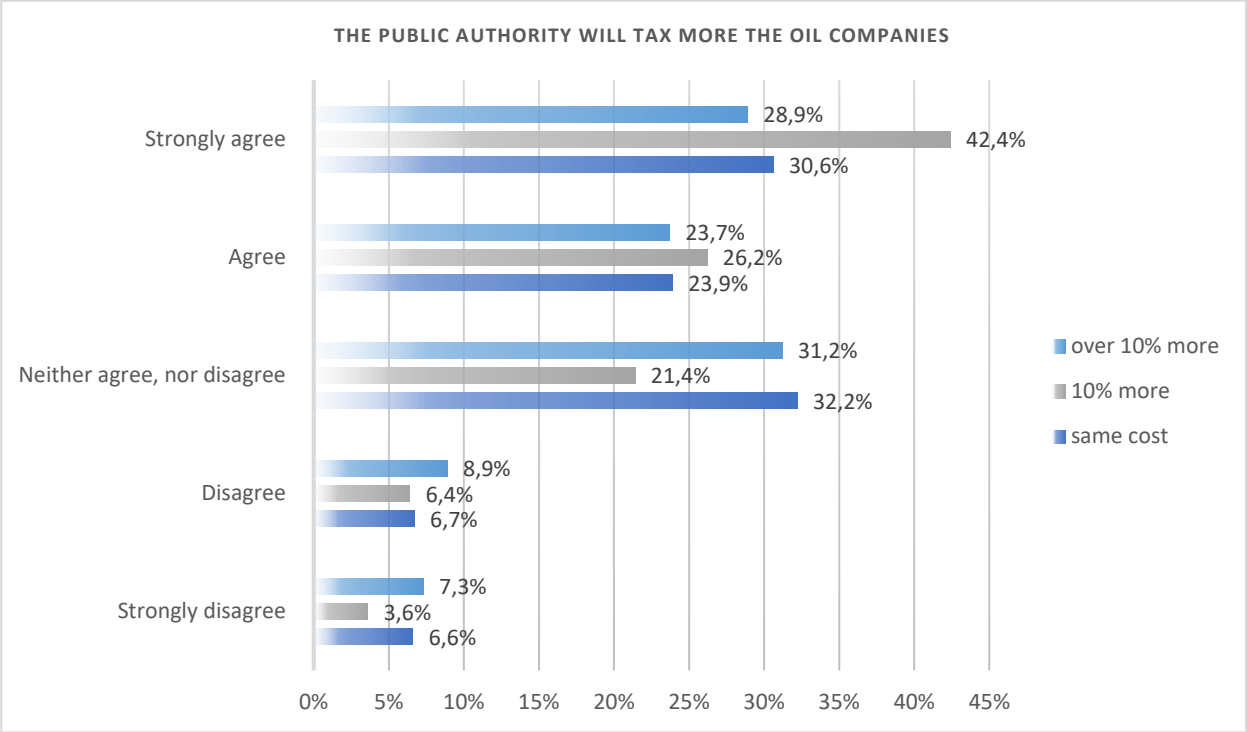
Annex 29 - Replies (%) per gender (The public authority will tax more the Oil companies)



Annex 30 - Replies (%) per each education group (The public authority will tax more the Oil companies)



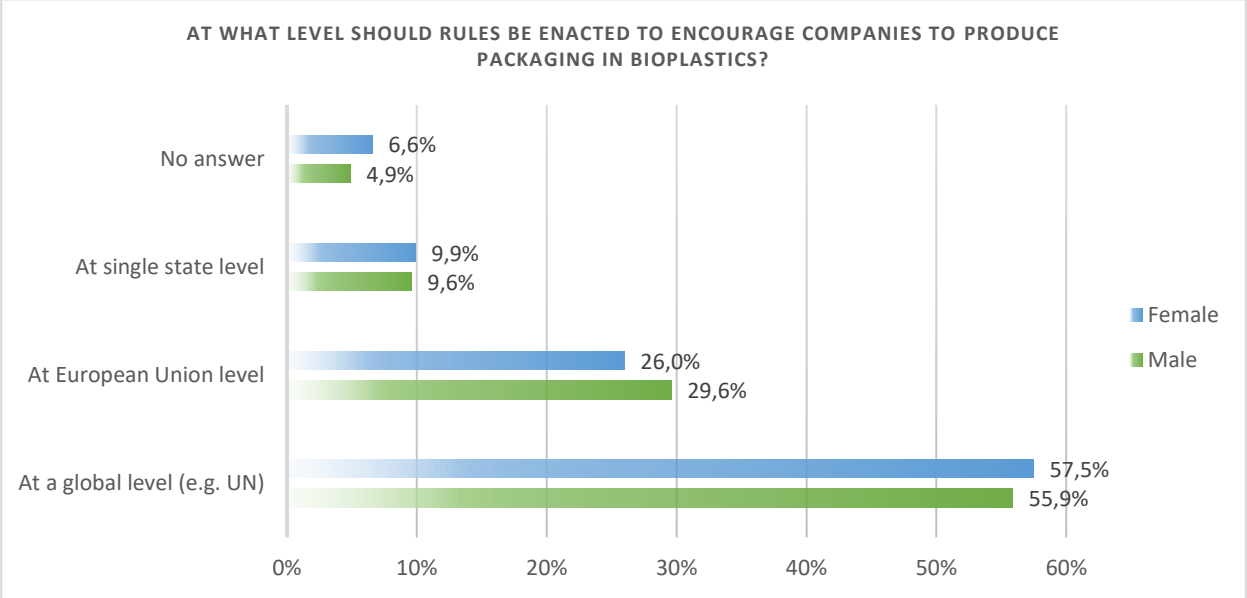
Annex 31 - Replies (%) per each age group (The public authority will tax more the Oil companies)



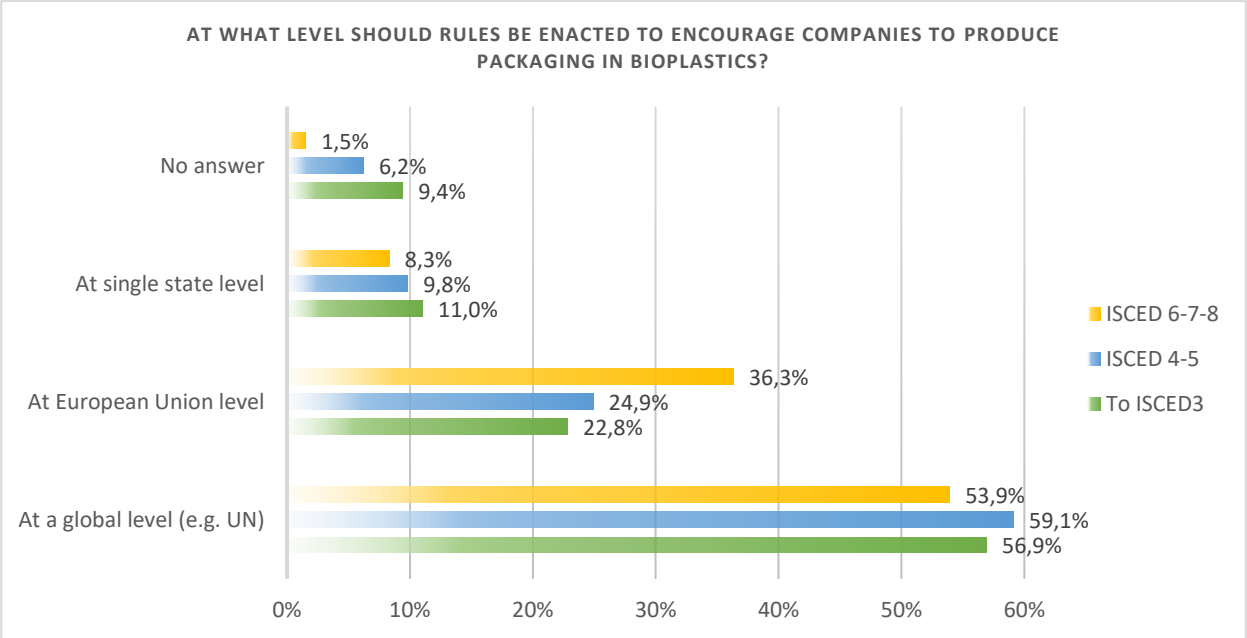
Annex 32 - Replies (%) per each willingness to pay (The public authority will tax more the Oil companies)

At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?	N° Replies	% Replies
At a global level (e.g. UN)	1.729	57,1%
At European Union level	836	27,6%
At single state level	294	9,7%
No answer	170	5,6%
Total	3.029	100%

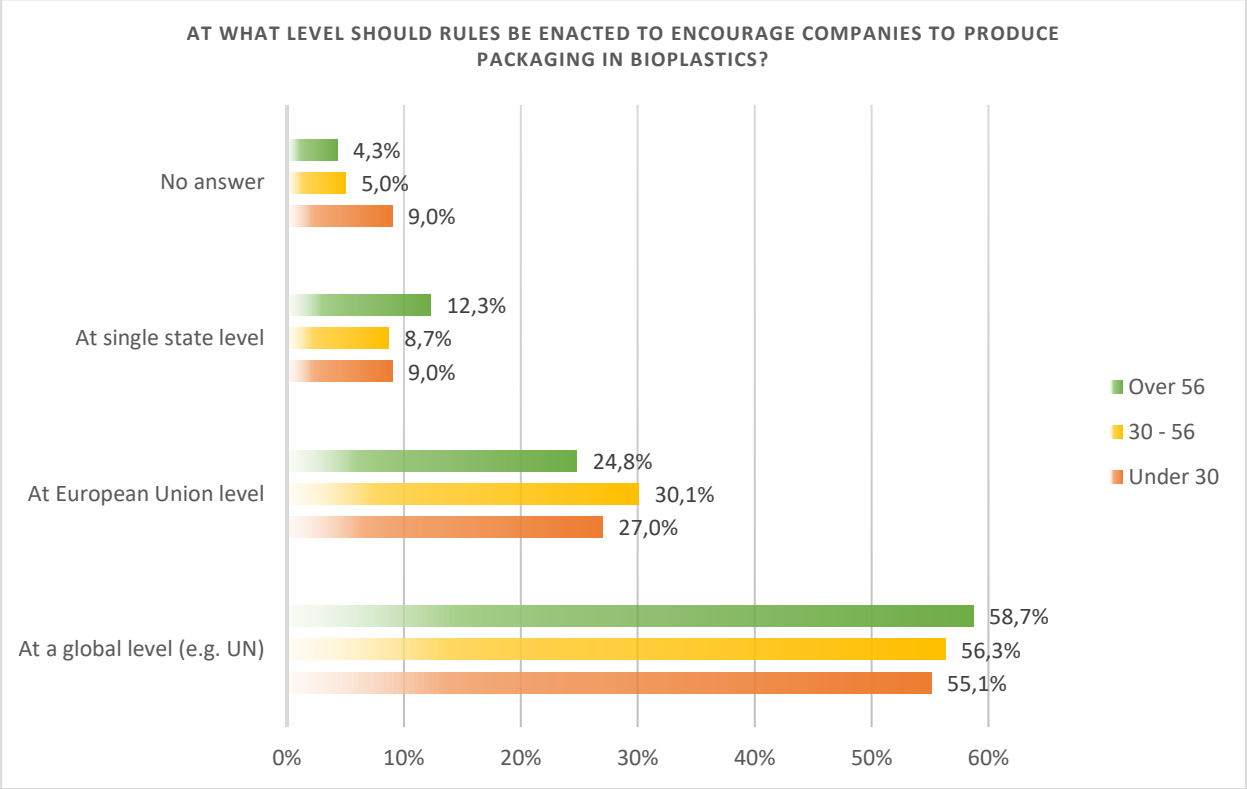
Annex 33 - Number and percentage of respondents (At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?)



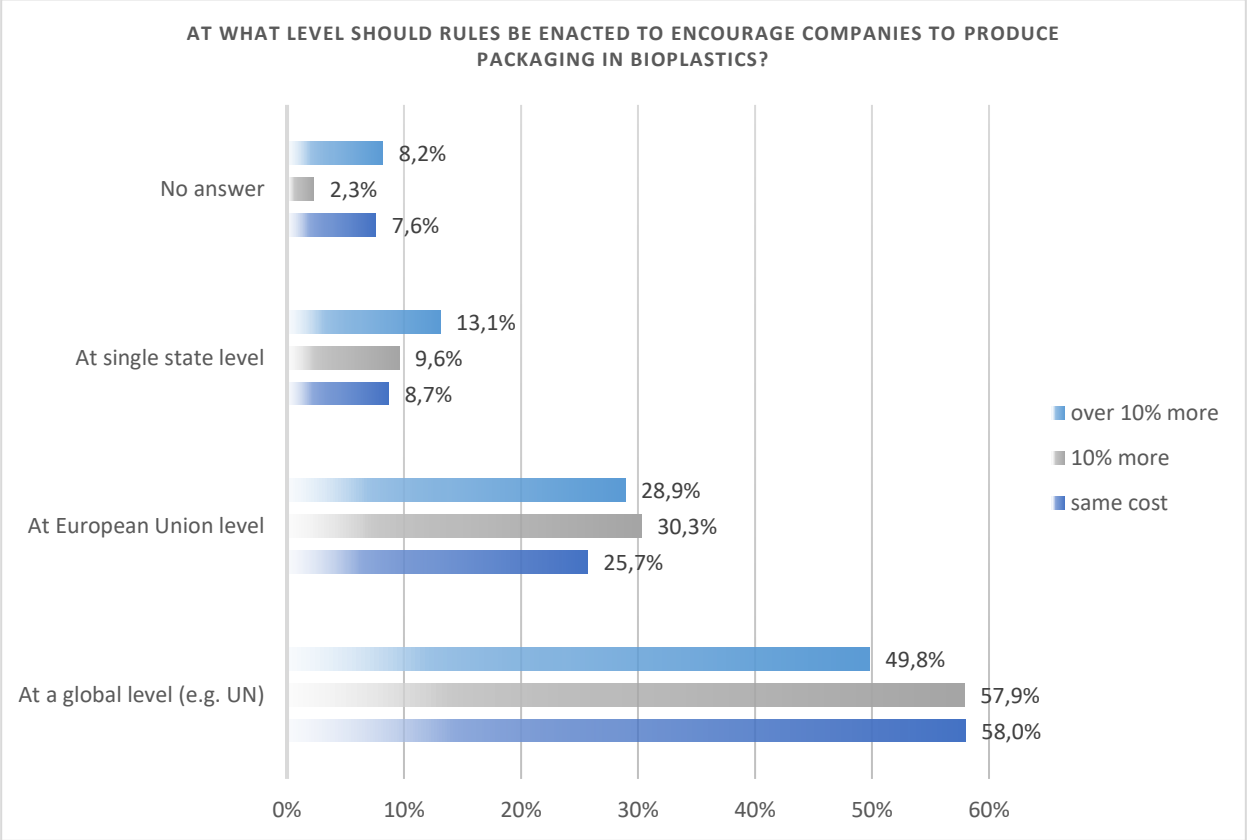
Annex 34 - Replies (%) per gender (At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?)



Annex 35 - Replies (%) per each education group (At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?)



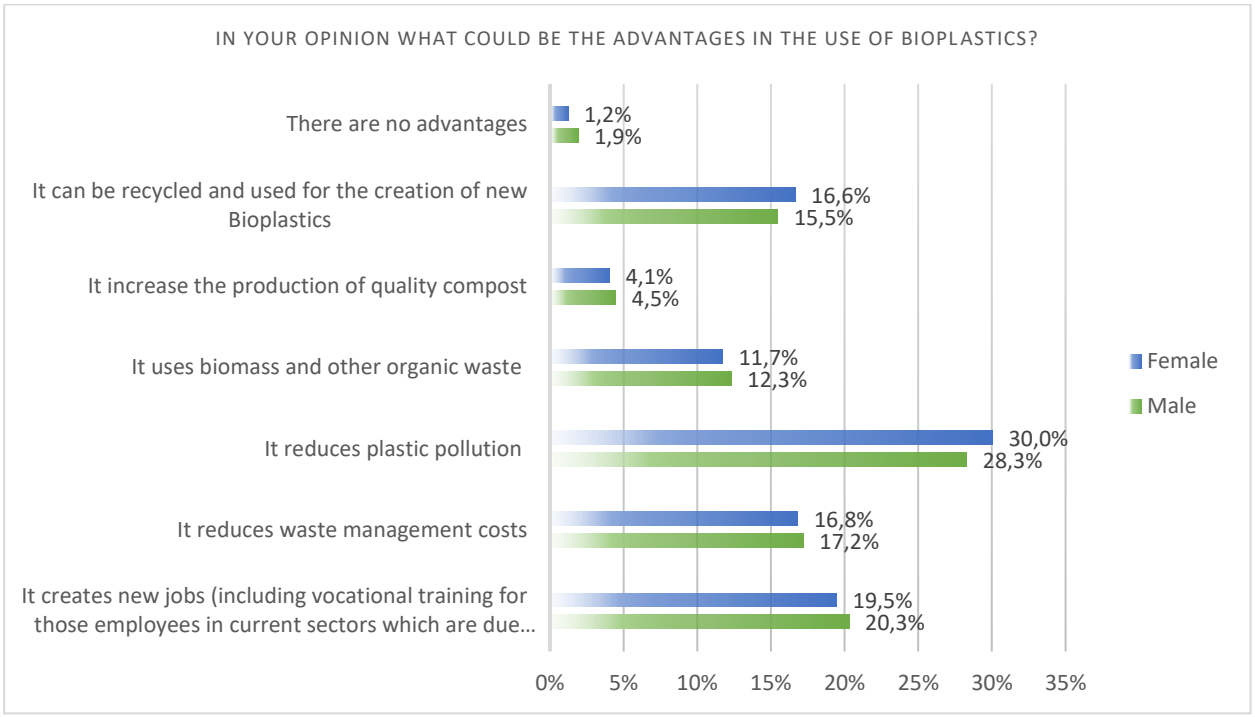
Annex 36 - Replies (%) per each age group (At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?)



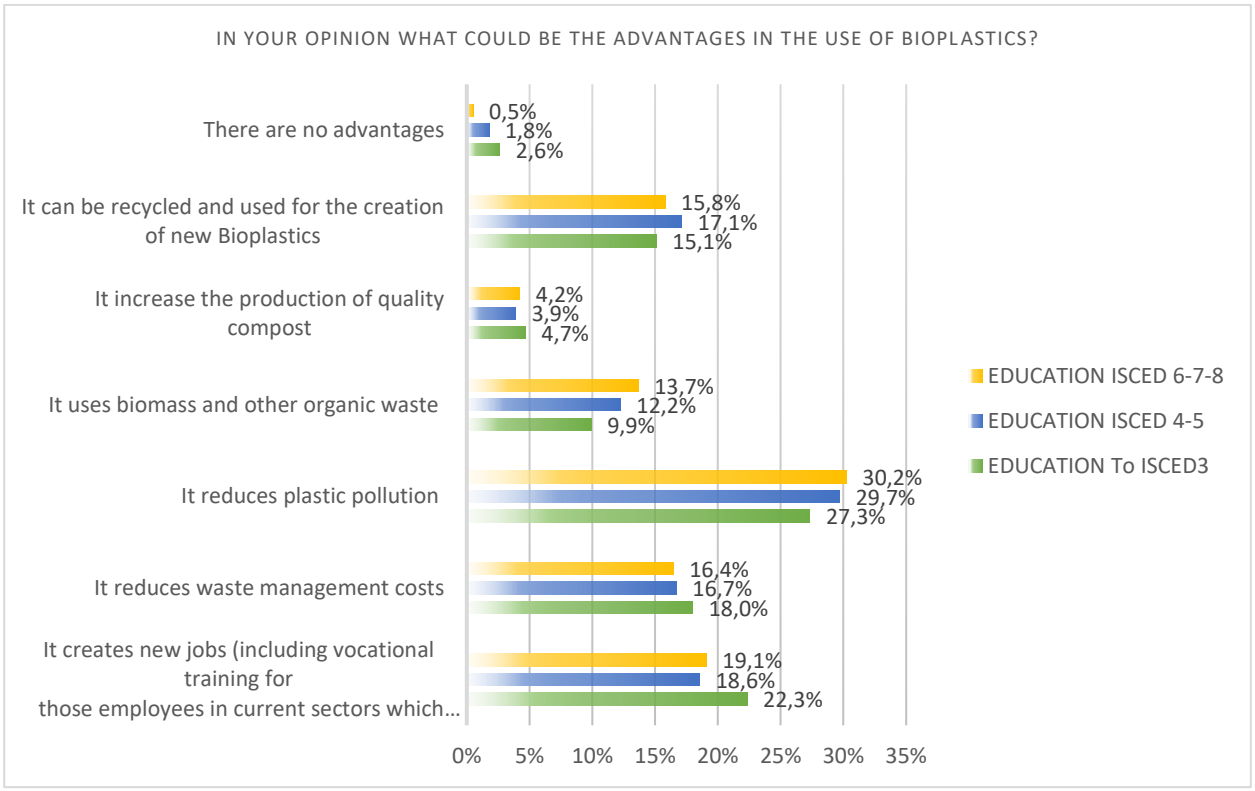
Annex 37 - Replies (%) per each willingness to pay (At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?)

In your opinion what could be the ADVANTAGES in the use of Bioplastics?	N° Replies	% Replies
It creates new jobs (including vocational training for those employees in current sectors which are due to disappear	1.487	20,0%
It reduces waste management costs	1.258	17,0%
It reduces plastic pollution	2.170	29,3%
It uses biomass and other organic waste	890	12,0%
It increase the production of quality compost	320	4,3%
It can be recycled and used for the creation of new Bioplastics	1.180	15,9%
There are no advantages	113	1,5%
Total	7.418	100%

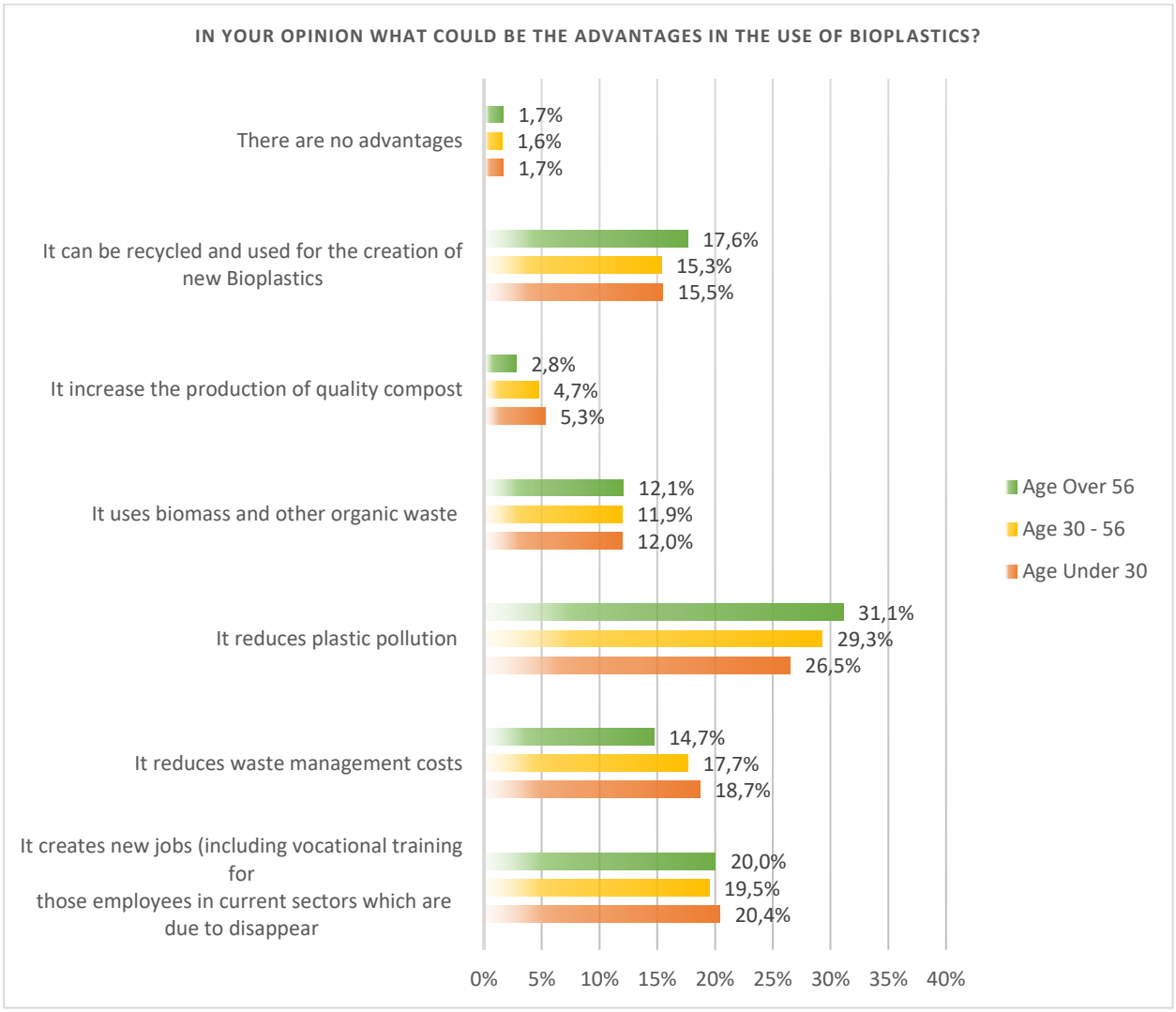
Annex 38 - Number and percentage of respondents (ADVANTAGES in the use of Bioplastics)



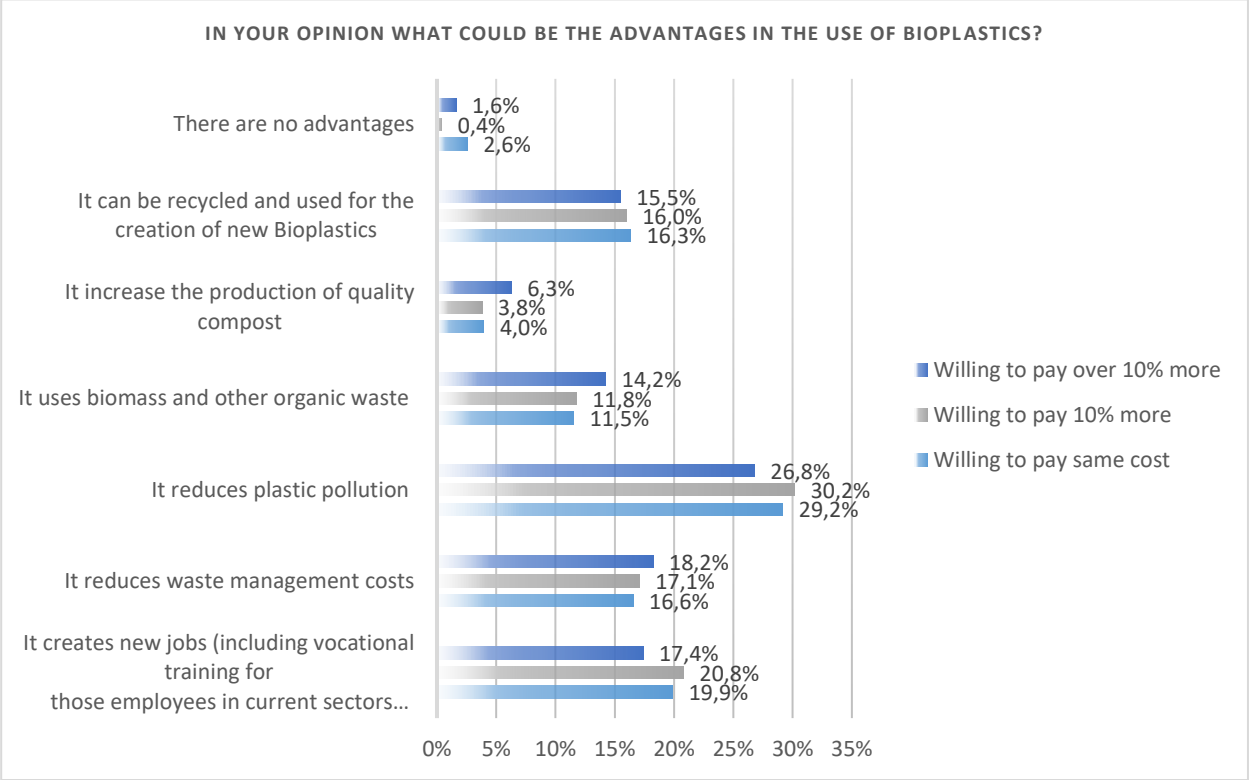
Annex 39 - Replies (%) per gender (ADVANTAGES in the use of Bioplastics)



Annex 40 - Replies (%) per each education group (ADVANTAGES in the use of Bioplastics)



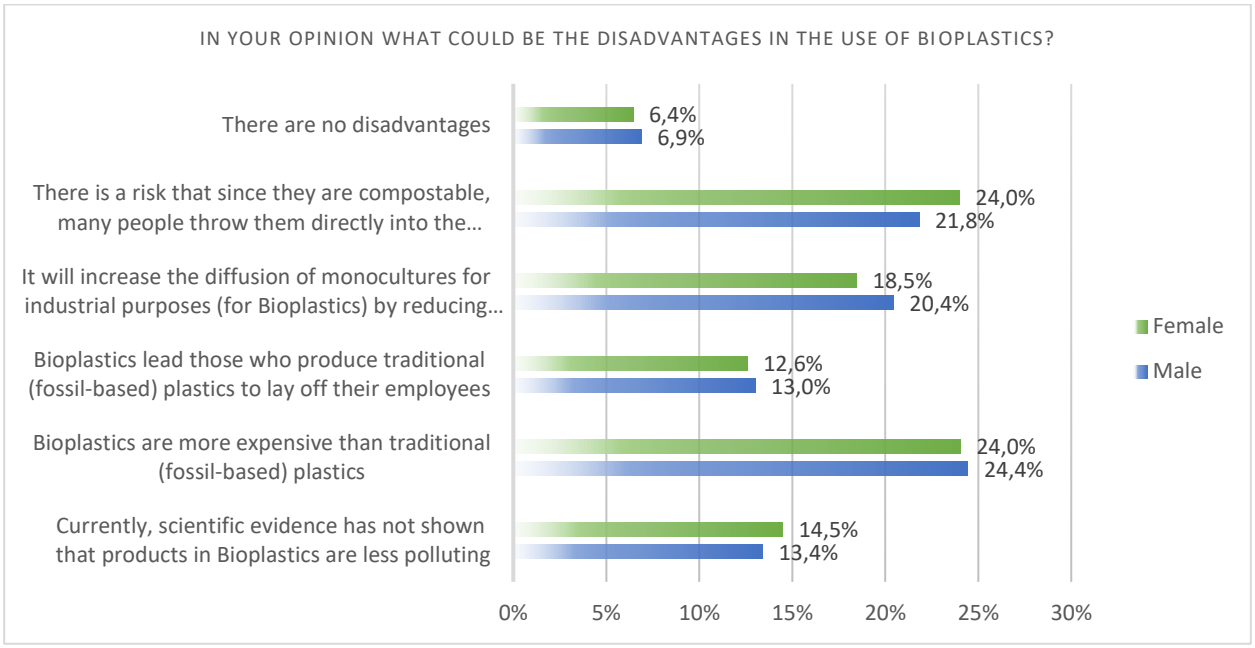
Annex 41 - Replies (%) per each age group (ADVANTAGES in the use of Bioplastics)



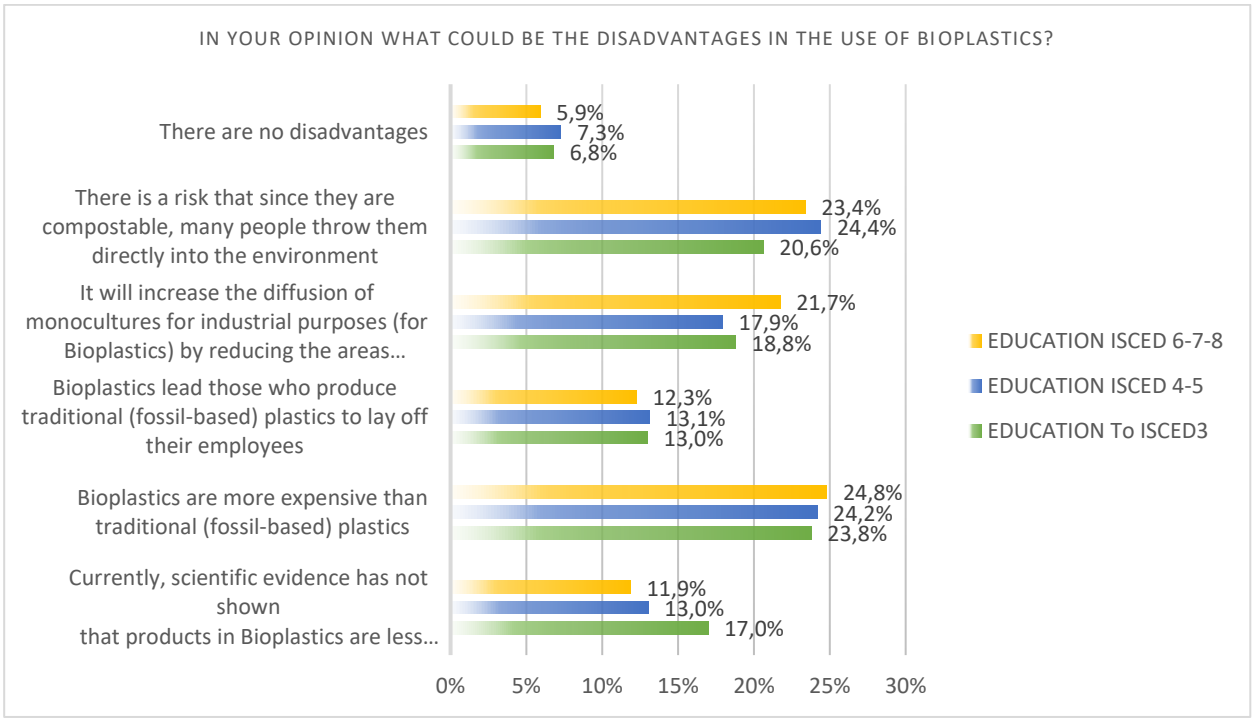
Annex 42 - Replies (%) per each willingness to pay (ADVANTAGES in the use of Bioplastics)

In your opinion what could be the DISADVANTAGES in the use of Bioplastics?	N° Replies	% Replies
Currently, scientific evidence has not shown that products in Bioplastics are less polluting	794	13,9%
Bioplastics are more expensive than traditional (fossil-based) plastics	1.391	24,3%
Bioplastics lead those who produce traditional (fossil-based) plastics to lay off their employees	724	12,7%
It will increase the diffusion of monocultures for industrial purposes (for Bioplastics) by reducing the areas reserved for food use	1.118	19,5%
There is a risk that since they are compostable, many people throw them directly into the environment	1.306	22,8%
There are no disadvantages	389	6,8%
Total	5.722	100%

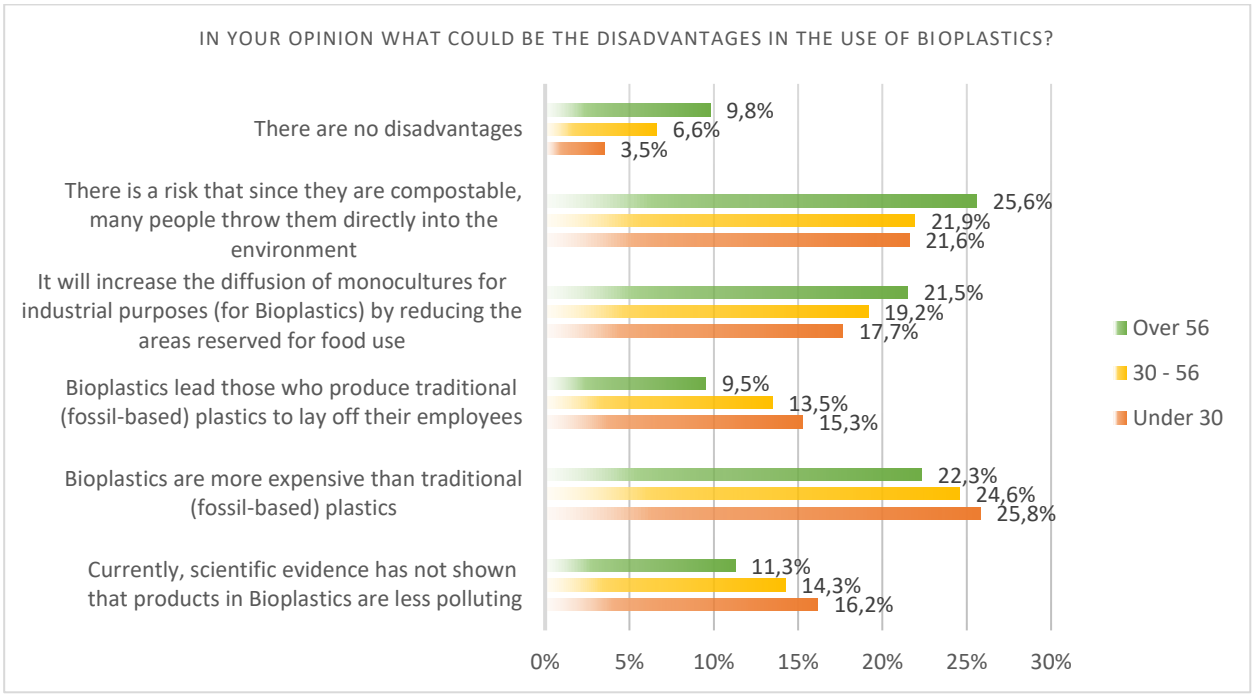
Annex 43 - Number and percentage of respondents (DISADVANTAGES in the use of Bioplastics)



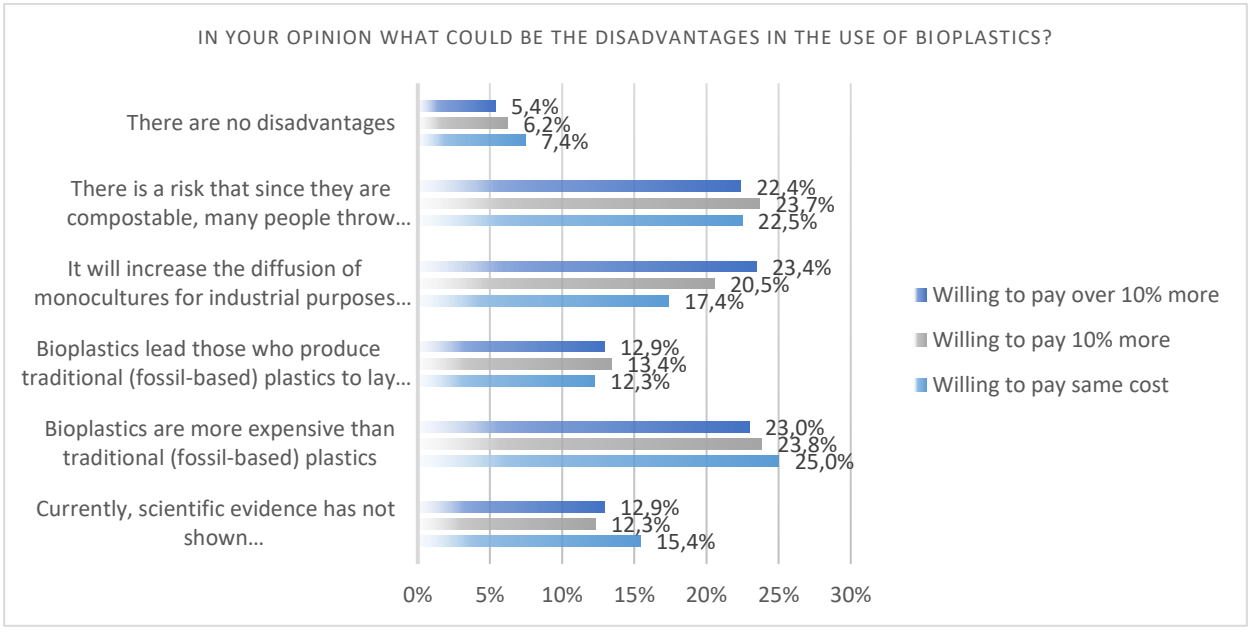
Annex 44 - Replies (%) per gender (DISADVANTAGES in the use of Bioplastics)



Annex 45 - Replies (%) per each education group (DISADVANTAGES in the use of Bioplastics)



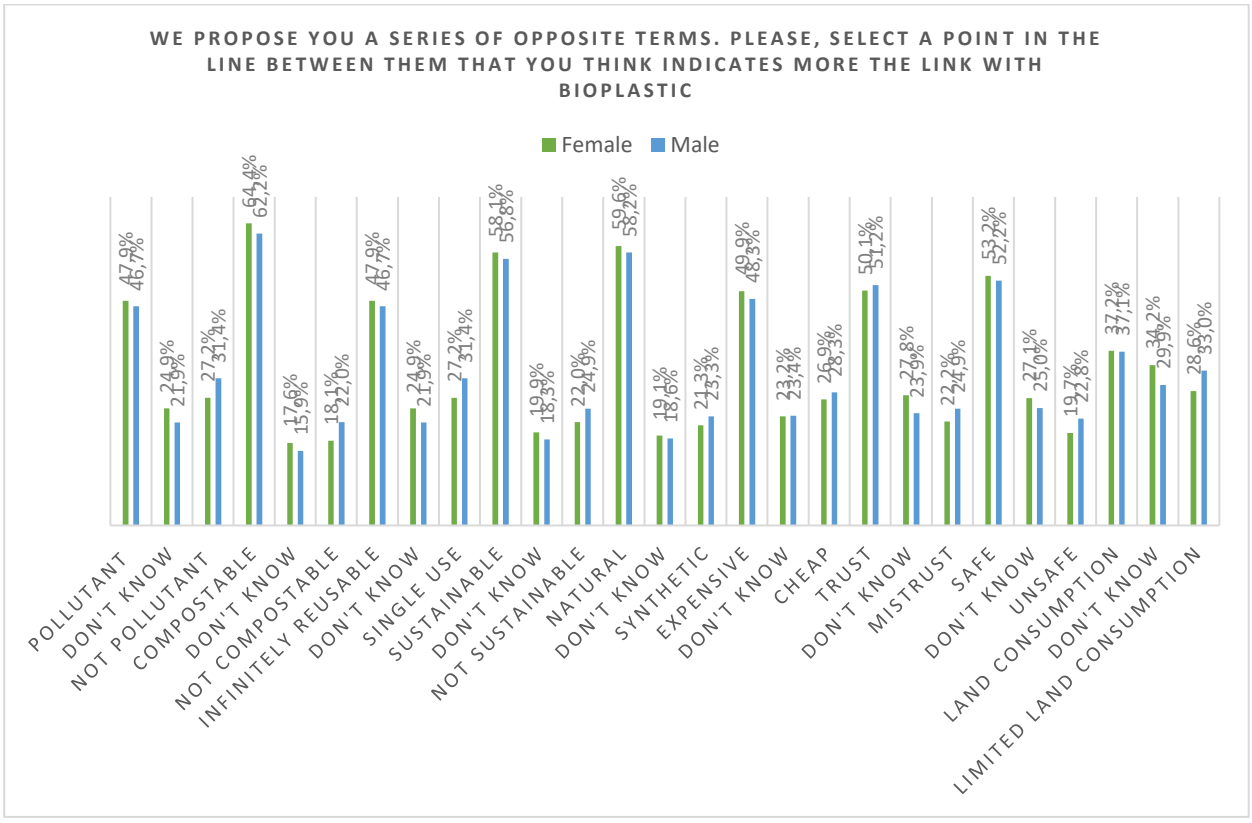
Annex 46 - Replies (%) per each age group (DISADVANTAGES in the use of Bioplastics)



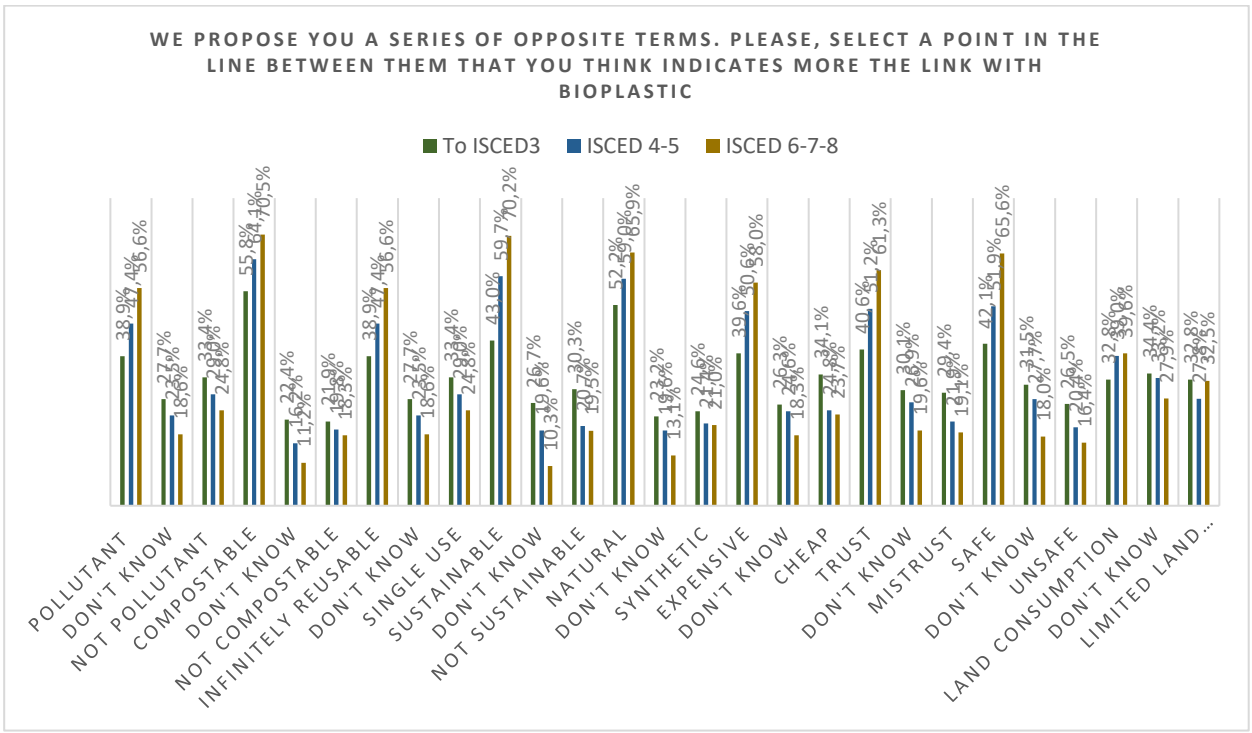
Annex 47 - Replies (%) per each willingness to pay (DISADVANTAGES in the use of Bioplastics)

We propose you a series of opposite terms. Please, select a point in the line between them that you think indicates more the link with BIOPLASTIC	N° Replies	% Replies
Pollutant	519	17,3%
Don't know	580	19,3%
Not Pollutant	1.903	63,4%
Compostable	1.894	63,6%
Don't know	489	16,4%
Not Compostable	596	20,0%
Infinitely reusable	1.366	47,5%
Don't know	666	23,2%
Single use	841	29,3%
Sustainable	1.690	57,8%
Don't know	550	18,8%
Not Sustainable	685	23,4%
Natural	1.725	59,1%
Don't know	544	18,6%
Synthetic	648	22,2%
Expensive	1.371	49,4%
Don't know	644	23,2%
Cheap	762	27,4%
Trust	1.415	51,0%
Don't know	706	25,5%
Mistrust	652	23,5%
Safe	1.506	53,1%
Don't know	731	25,8%
Unsafe	600	21,1%
Land Consumption	1.039	37,5%
Don't know	876	31,6%
Limited Land Consumption	855	30,9%

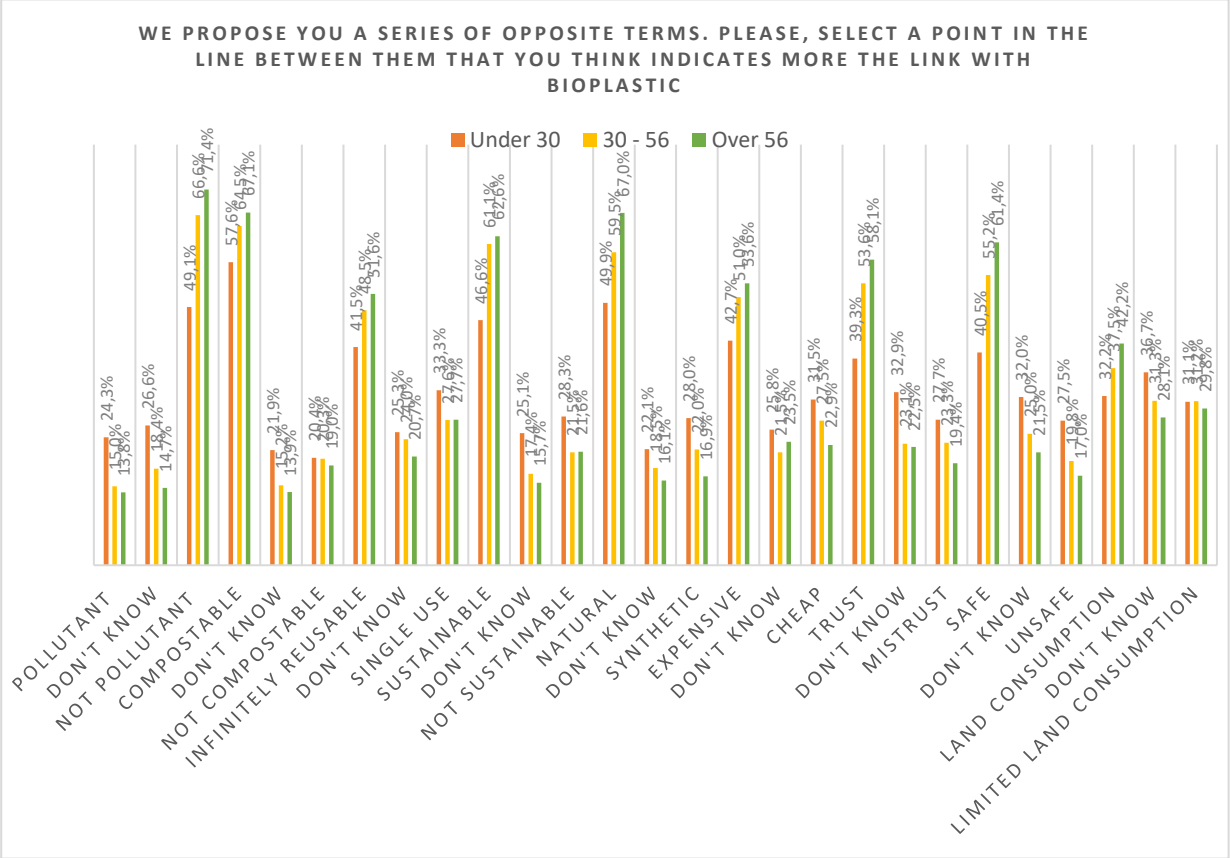
Annex 48 - Number and percentage of respondents (Series of opposite terms)



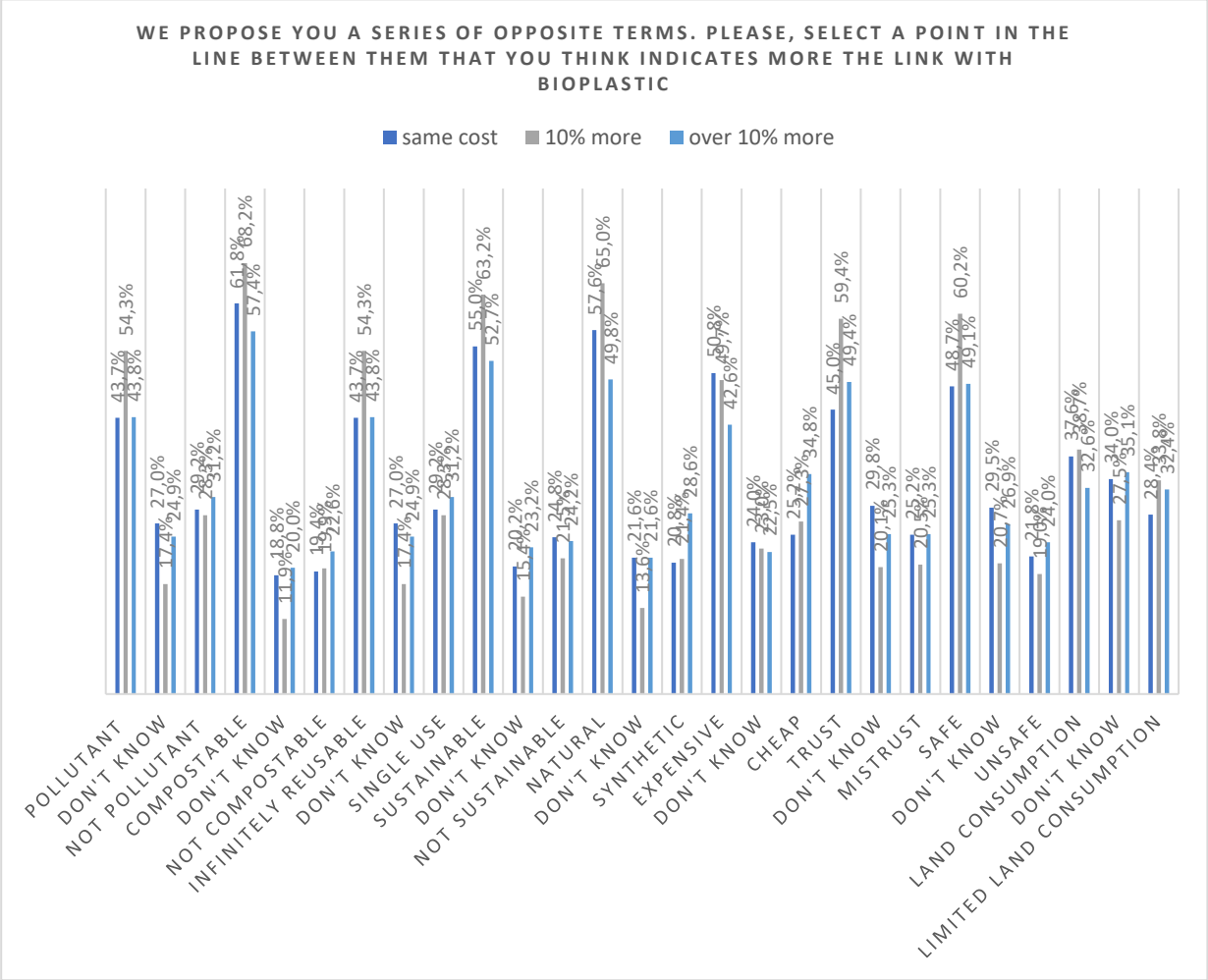
Annex 49 - Replies (%) per gender (Series of opposite terms)



Annex 50 - Replies (%) per each education group (Series of opposite terms)



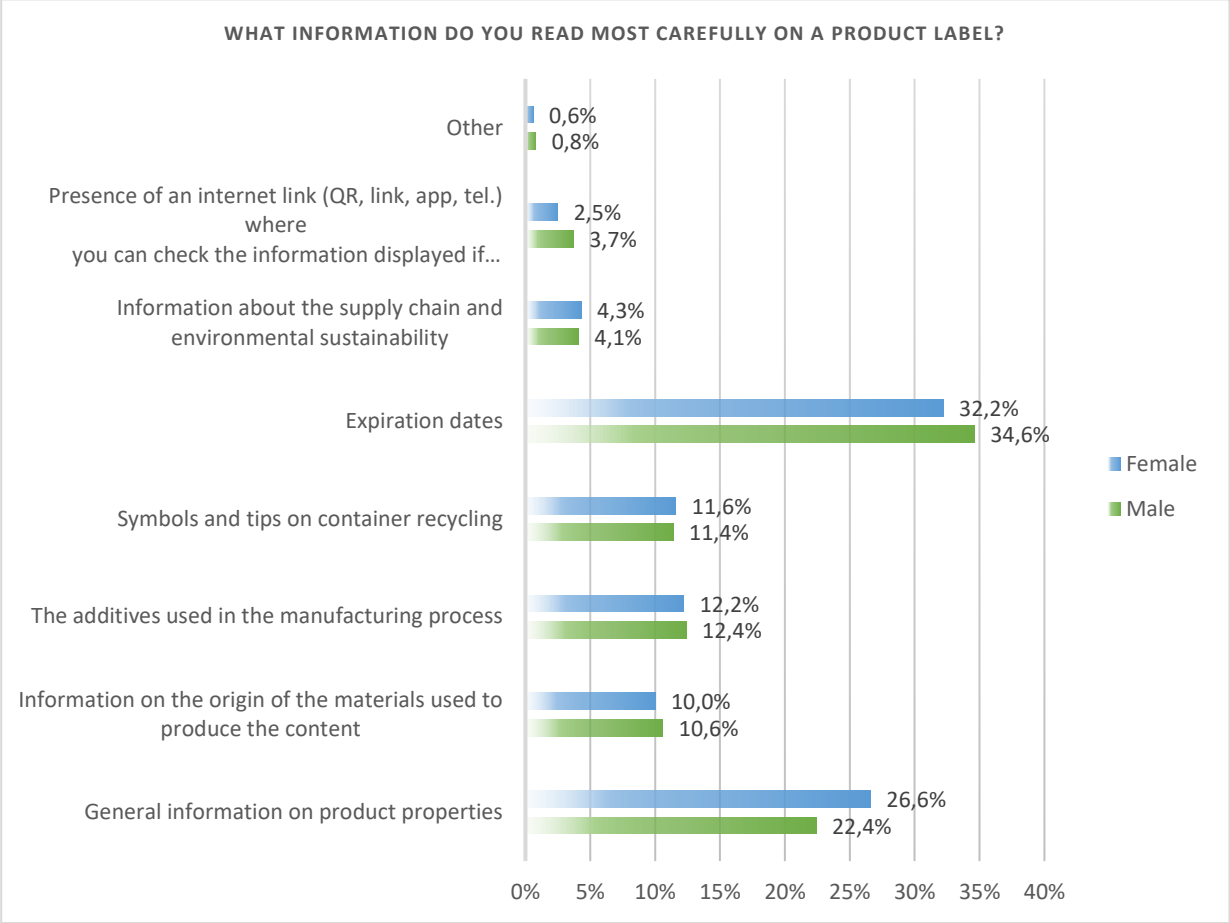
Annex 51 - Replies (%) per each age group (Series of opposite terms)



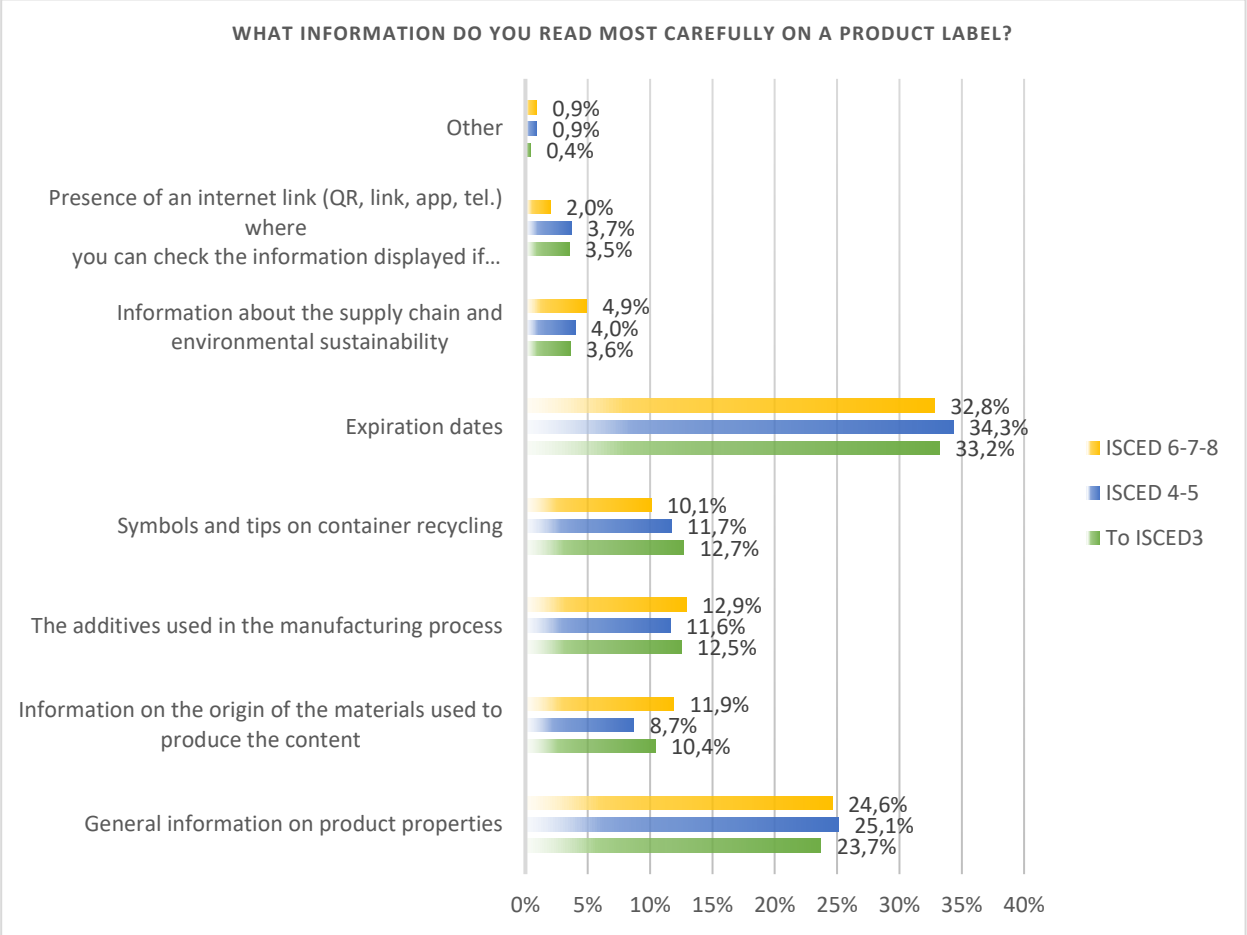
Annex 52 - Replies (%) per each willingness to pay (Series of opposite terms)

What information do you read most carefully on a product label?	N° Replies	% Replies
General information on product properties	764	24,3%
Information on the origin of the materials used to produce the content	320	10,2%
The additives used in the manufacturing process	385	12,2%
Symbols and tips on container recycling	366	11,6%
Expiration dates	1.057	33,6%
Information about the supply chain and environmental sustainability	134	4,3%
Presence of an internet link (QR, link, app, tel.) where you can check the information displayed if necessary	98	3,1%
Other	25	0,8%
Total	3.149	100%

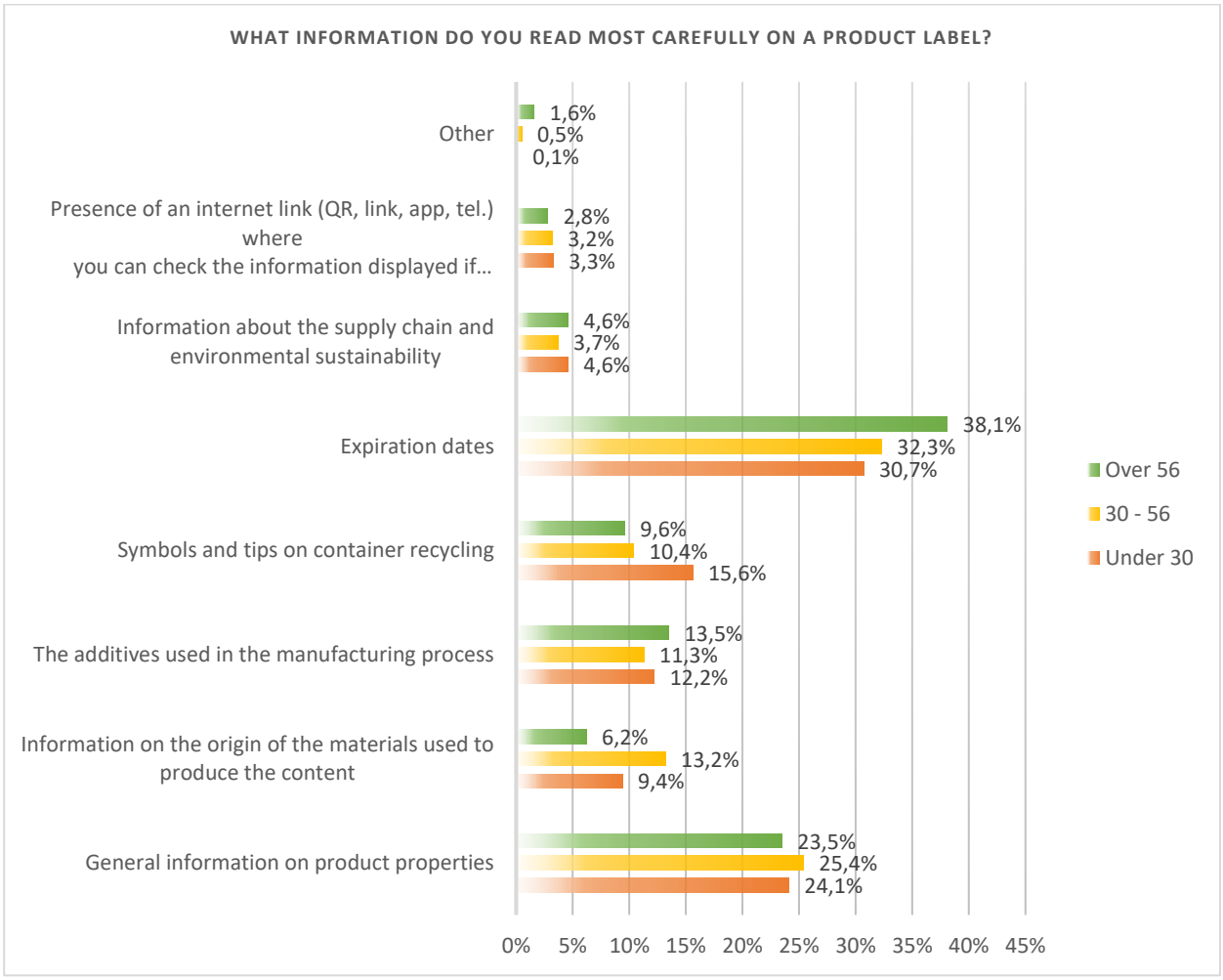
Annex 53 - Number and percentage of respondents (What information do you read most carefully on a product label?)



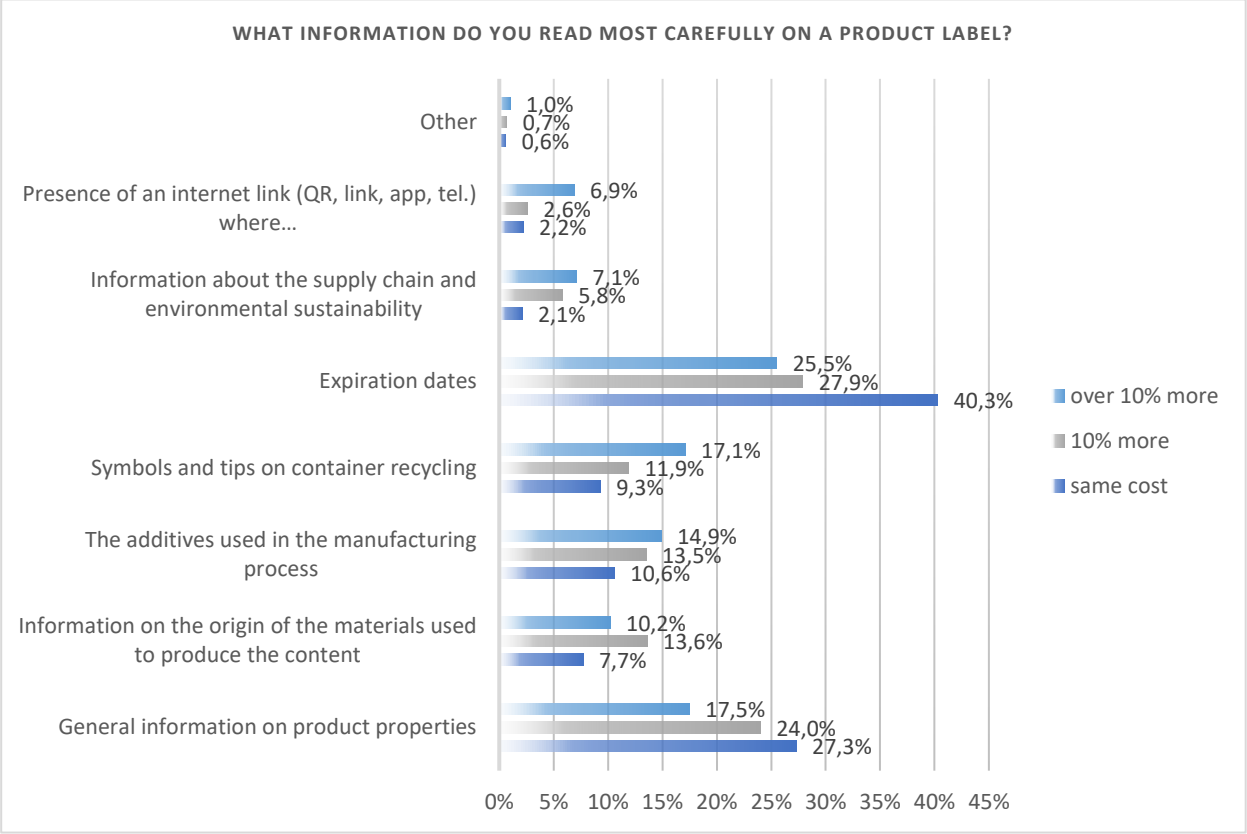
Annex 54 - Replies (%) per gender (What information do you read most carefully on a product label?)



Annex 55 - Replies (%) per each education group (What information do you read most carefully on a product label?)



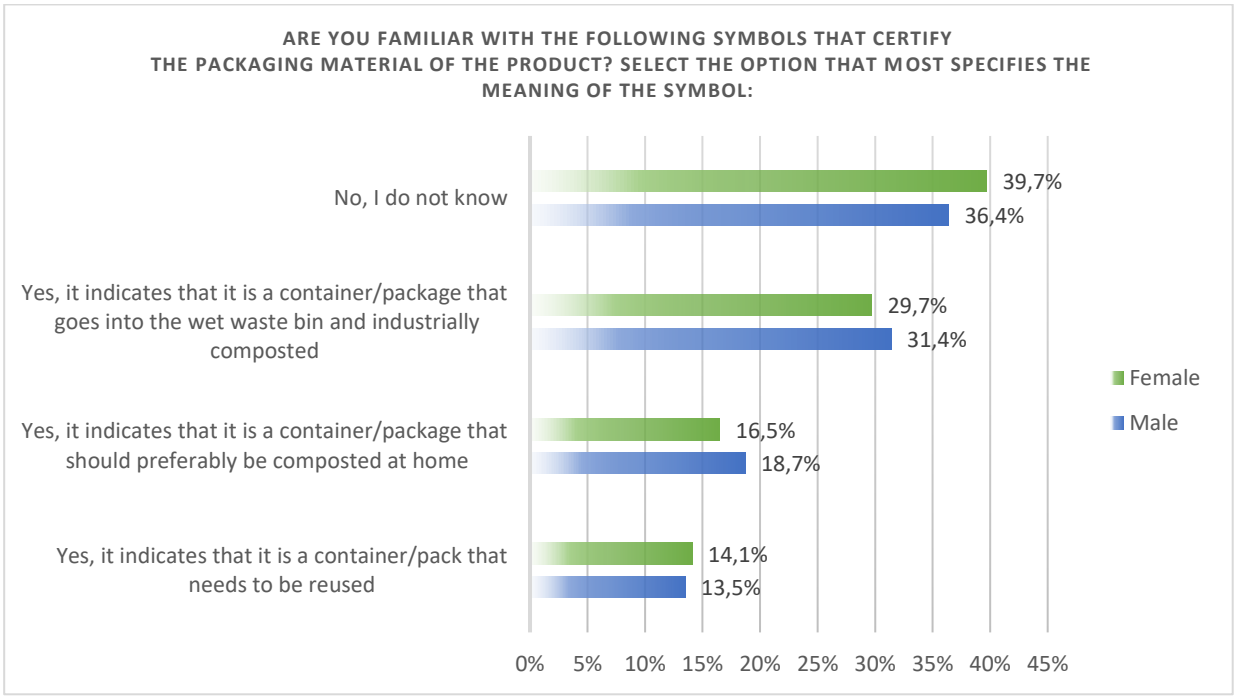
Annex 56 - Replies (%) per each age group (What information do you read most carefully on a product label?)



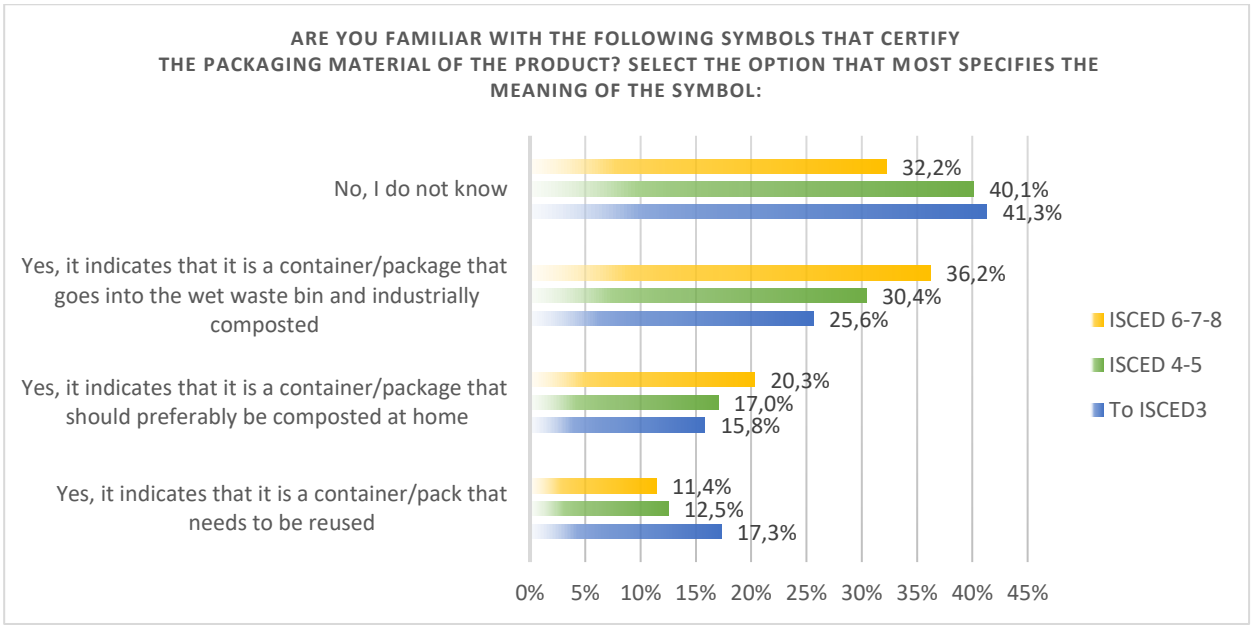
Annex 57 - Replies (%) per each willingness to pay (What information do you read most carefully on a product label?)

Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol:		
OK compost / TÜV AUSTRIA / INDUSTRIAL	N° Replies	% Replies
Yes, it indicates that it is a container/pack that needs to be reused	424	13,6%
Yes, it indicates that it is a container/package that should preferably be composted at home	543	17,4%
Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted	970	31,0%
No, I do not know	1.190	38,1%
Total	3.127	100%

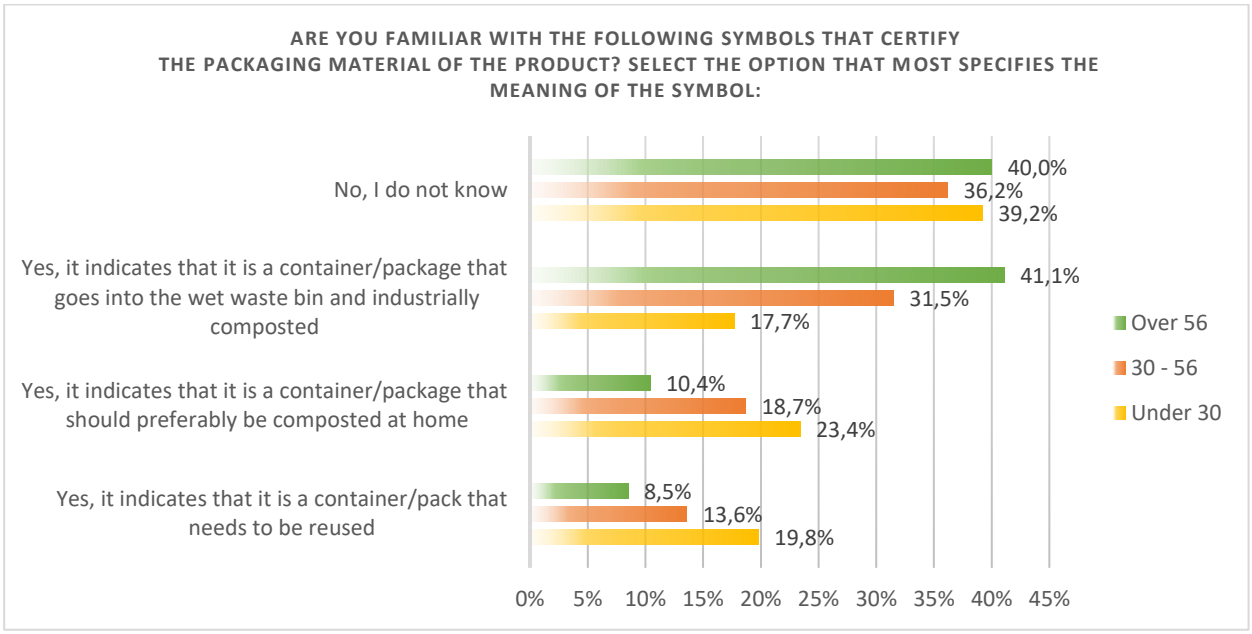
Annex 58 - Number and percentage of respondents (TUV Industrial)



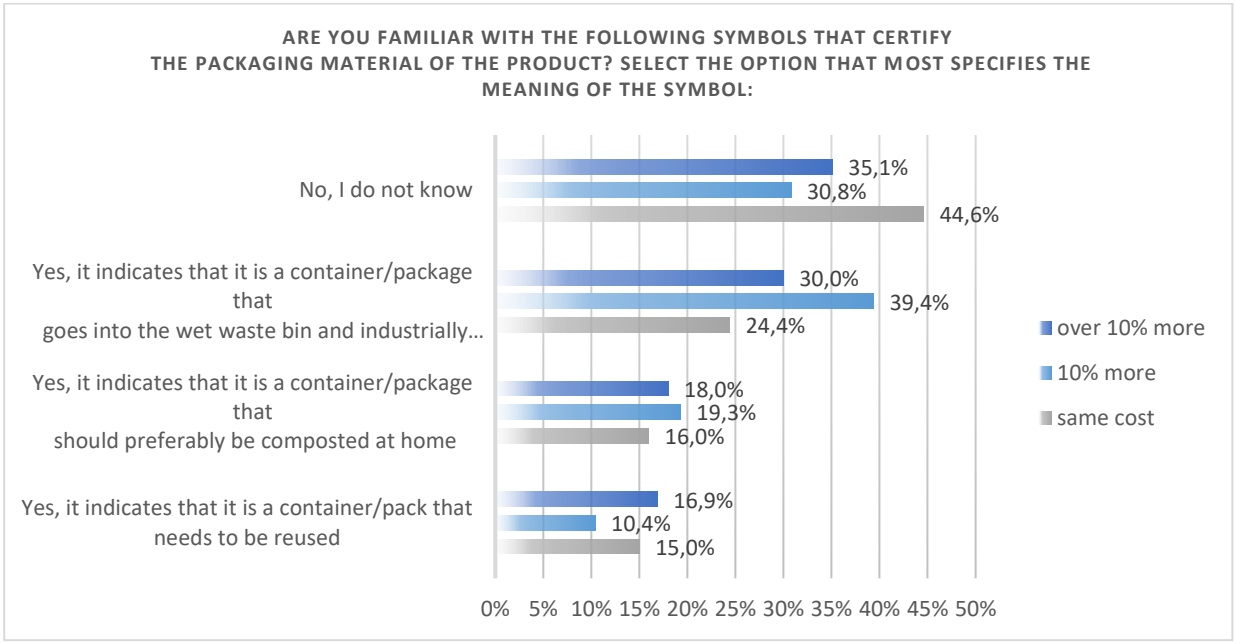
Annex 59 - Replies (%) per gender (TUV Industrial)



Annex 60 - Replies (%) per each education group (TUV Industrial)



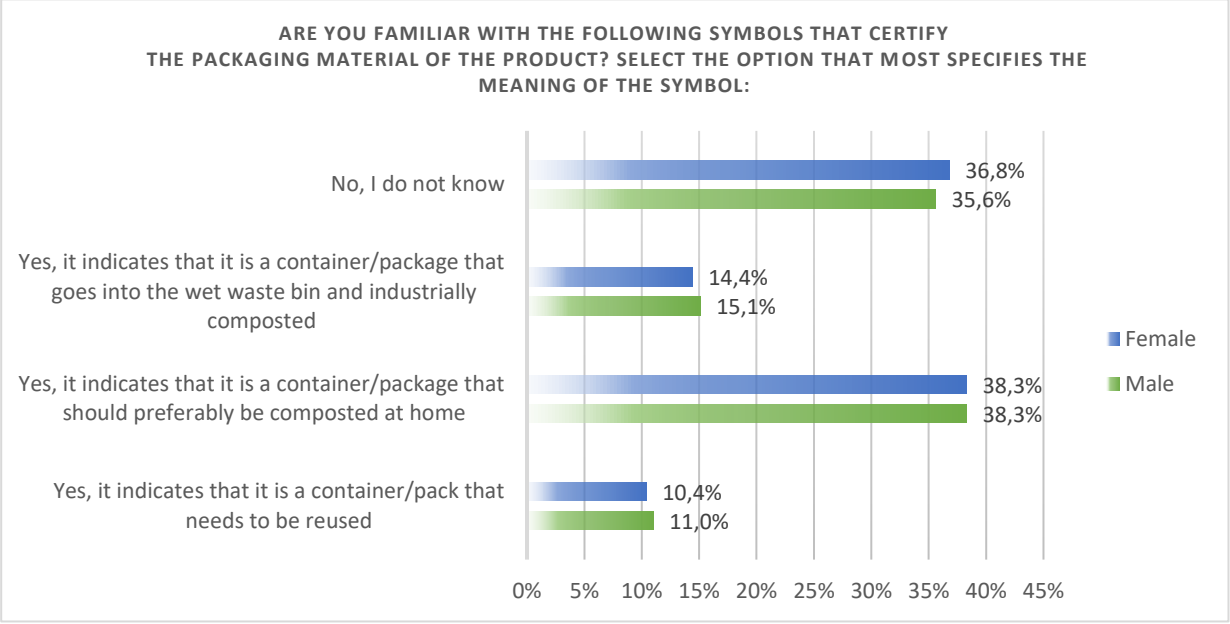
Annex 61 - Replies (%) per each age group (TUV Industrial)



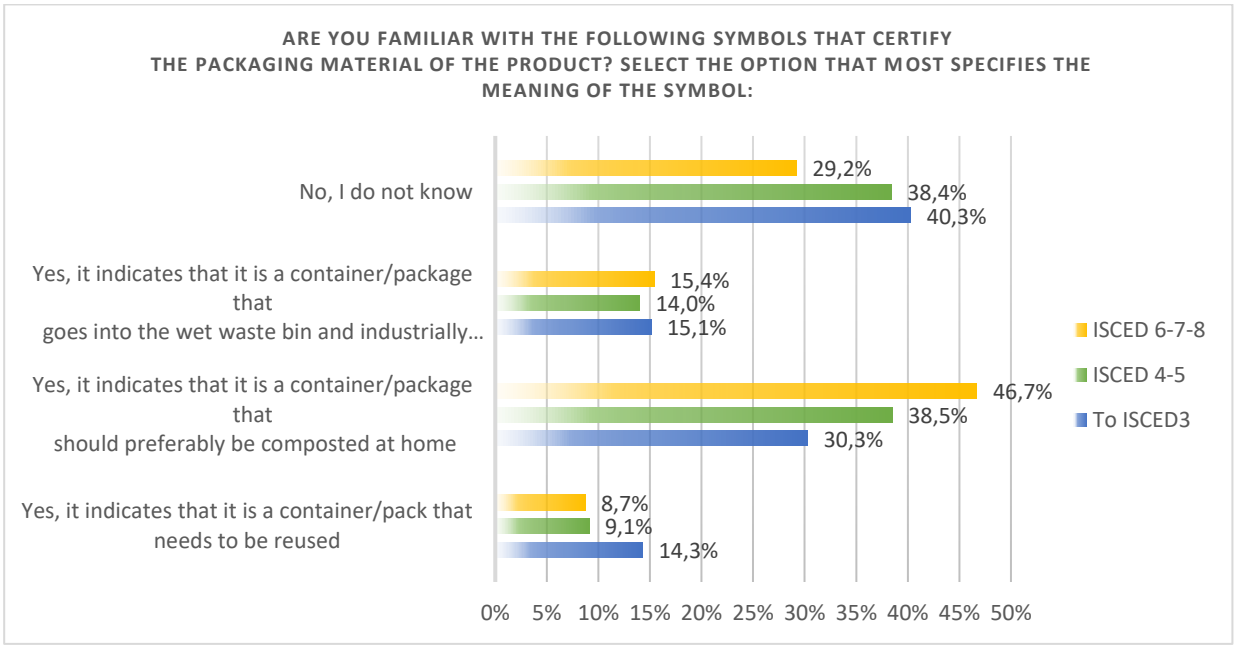
Annex 62 - Replies (%) per each willingness to pay (TUV Industrial)

Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol:		
HOME OK compost TÜV AUSTRIA HOME	N° Replies	% Replies
Yes, it indicates that it is a container/pack that needs to be reused	329	10,6%
Yes, it indicates that it is a container/package that should preferably be composted at home	1.188	38,4%
Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted	458	14,8%
No, I do not know	1.120	36,2%
Total	3.095	100%

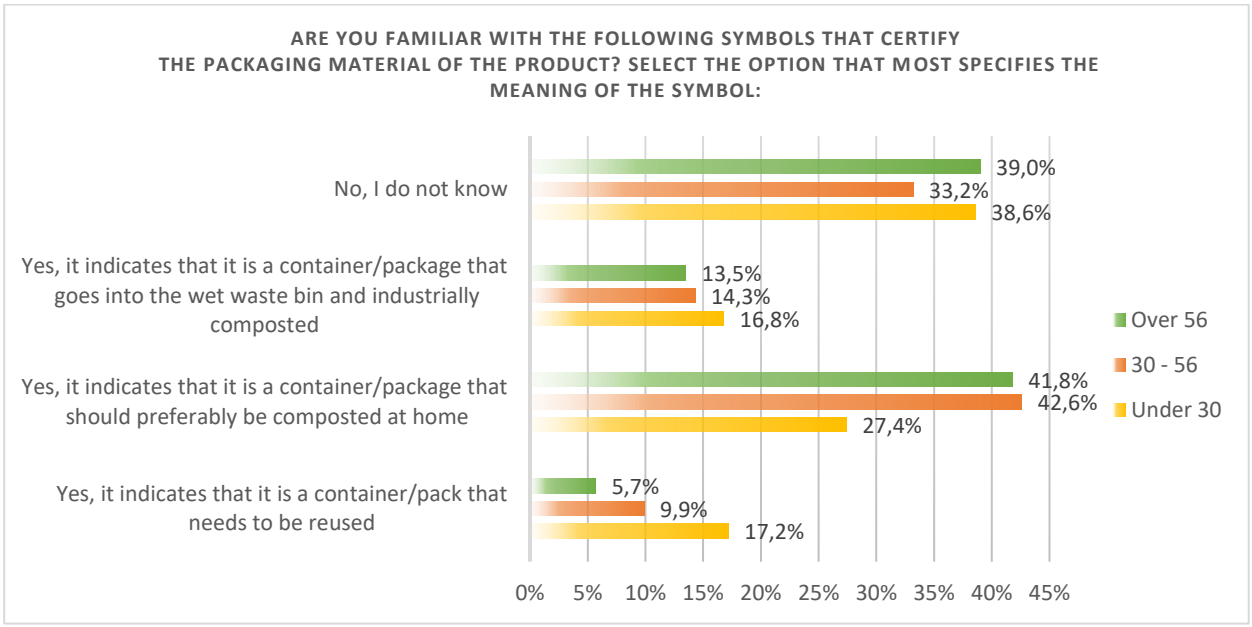
Annex 63 - Number and percentage of respondents (TUV Home)



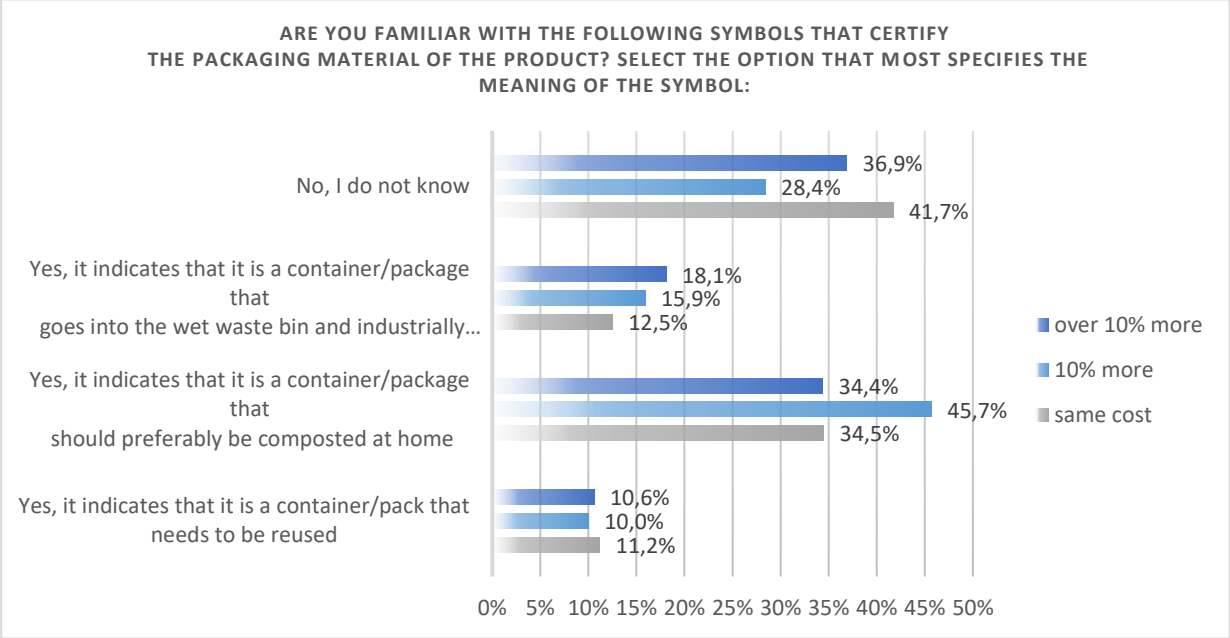
Annex 64 - Replies (%) per gender (TUV Home)



Annex 65 - Replies (%) per each education group (TUV Home)



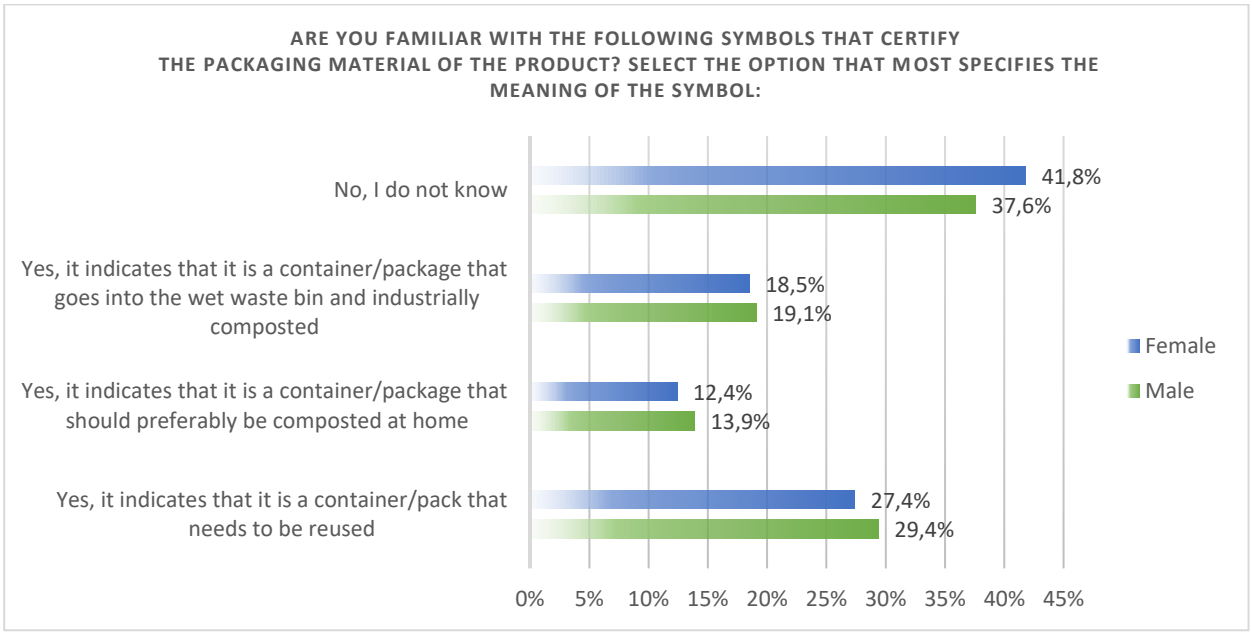
Annex 66 - Replies (%) per each age group (TUV Home)



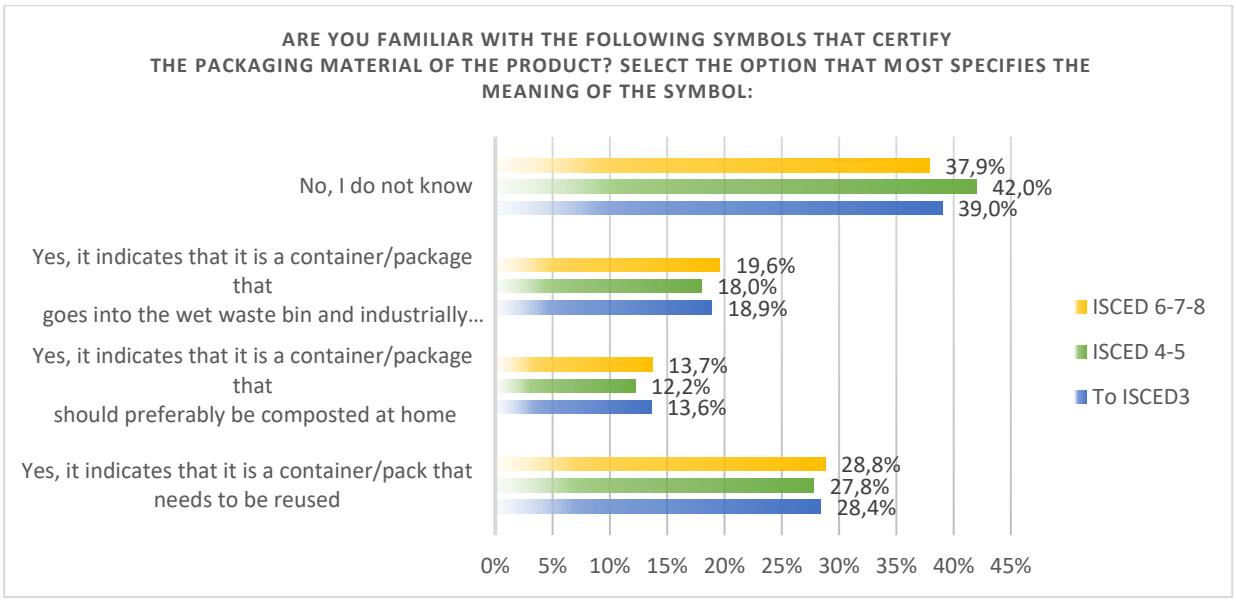
Annex 67 - Replies (%) per each willingness to pay (TUV Home)

Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol:		
OK biobased / TÜV AUSTRIA	N° Replies	% Replies
Yes, it indicates that it is a container/pack that needs to be reused	875	28,3%
Yes, it indicates that it is a container/package that should preferably be composted at home	400	12,9%
Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted	584	18,9%
No, I do not know	1.235	39,9%
Total	3.094	100%

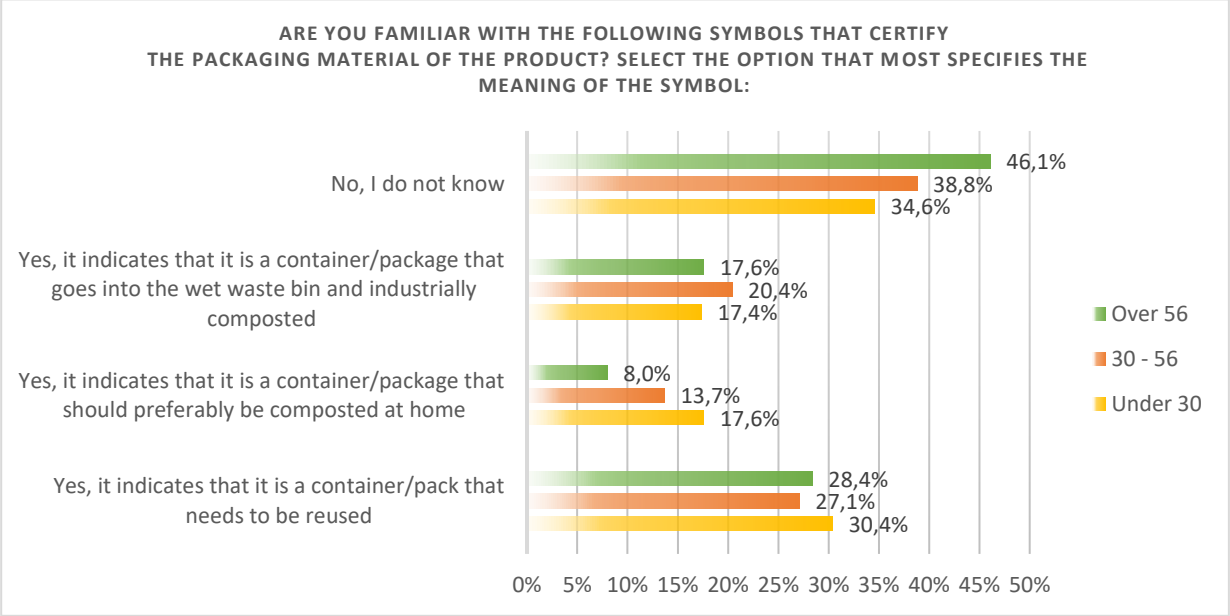
Annex 68 - Number and percentage of respondents (TUV OK biobased)



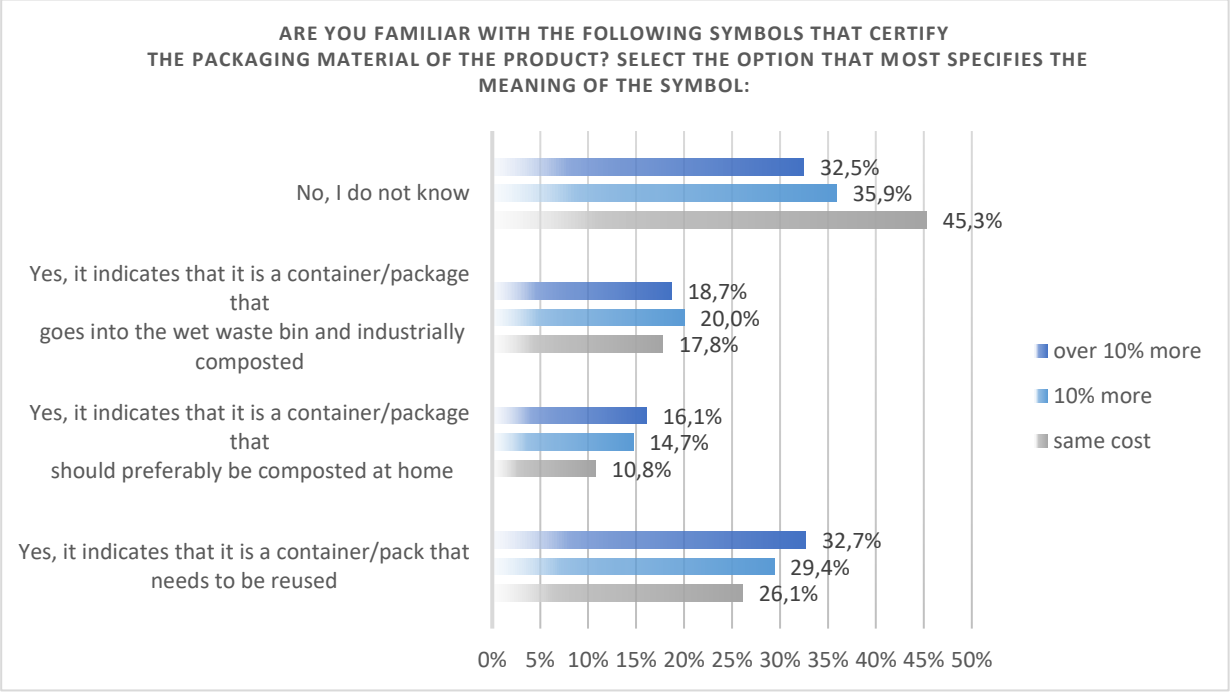
Annex 69 - Replies (%) per gender (TUV OK biobased)



Annex 70 - Replies (%) per each education group (TUV OK biobased)



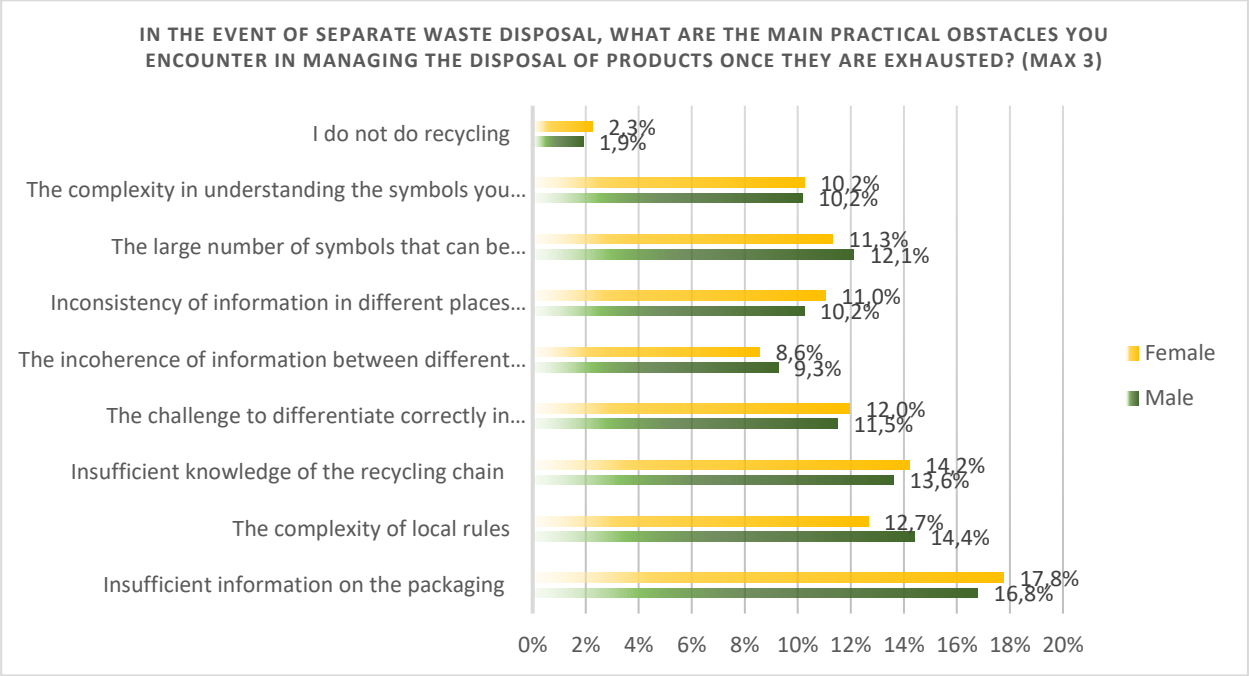
Annex 71 - Replies (%) per each age group (TUV OK biobased)



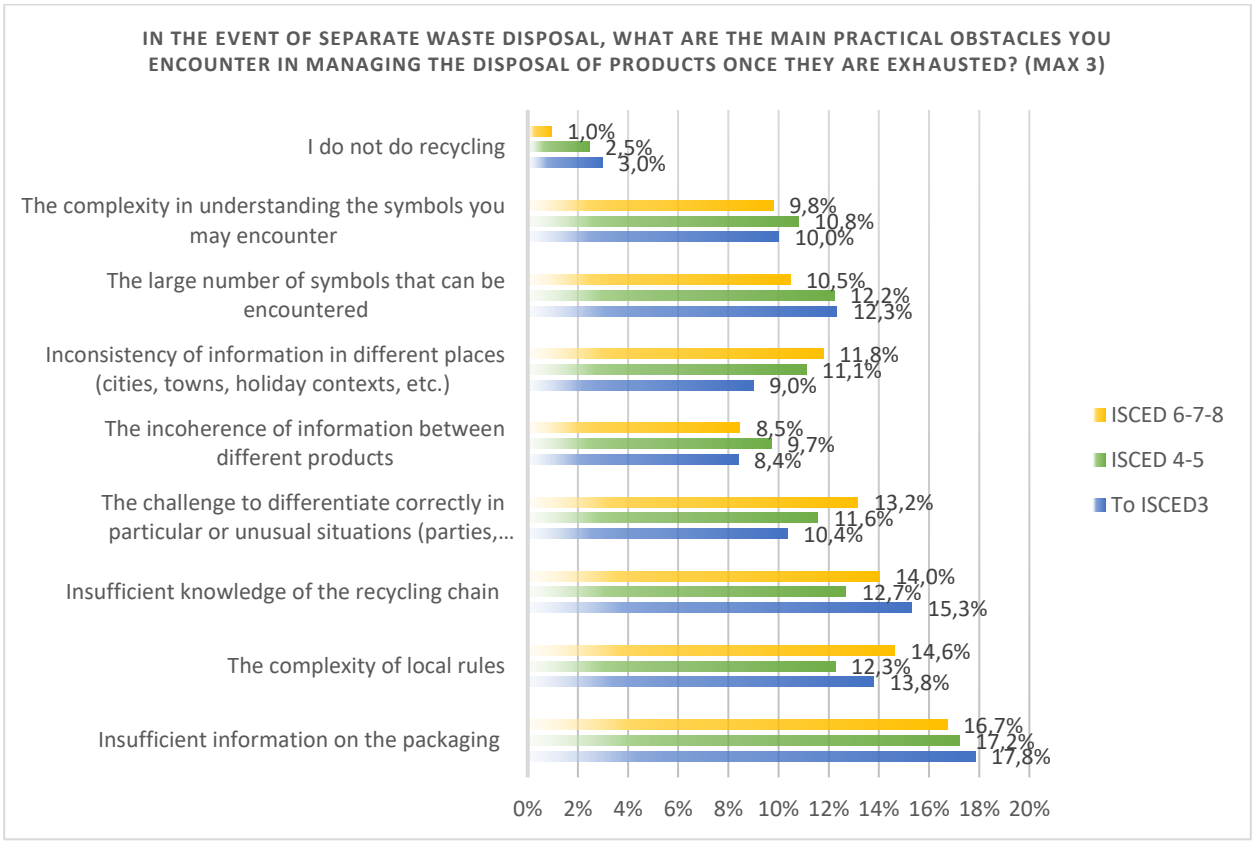
Annex 72 - Replies (%) per each willingness to pay (TUV OK biobased)

In the event of separate waste disposal, what are the main practical obstacles you encounter in managing the disposal of products once they are exhausted? (MAX 3)	N° Replies	% Replies
Insufficient information on the packaging	1.125	17,2%
The complexity of local rules	880	13,5%
Insufficient knowledge of the recycling chain	913	14,0%
The challenge to differentiate correctly in particular or unusual situations (parties, meetings, etc.)	766	11,7%
The incoherence of information between different products	580	8,9%
Inconsistency of information in different places (cities, towns, holiday contexts, etc.)	702	10,8%
The large number of symbols that can be encountered	758	11,6%
The complexity in understanding the symbols you may encounter	662	10,1%
I do not do recycling	138	2,1%

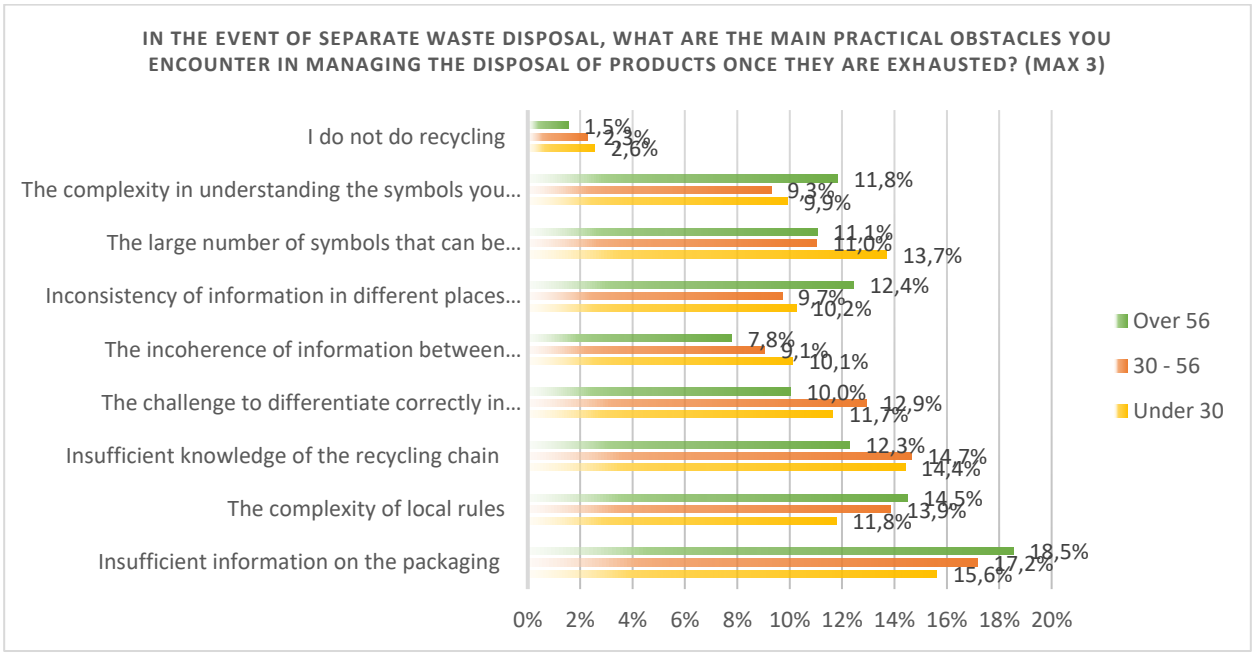
Annex 73 - Number and percentage of respondents (obstacles in managing the disposal of products once exhausted)



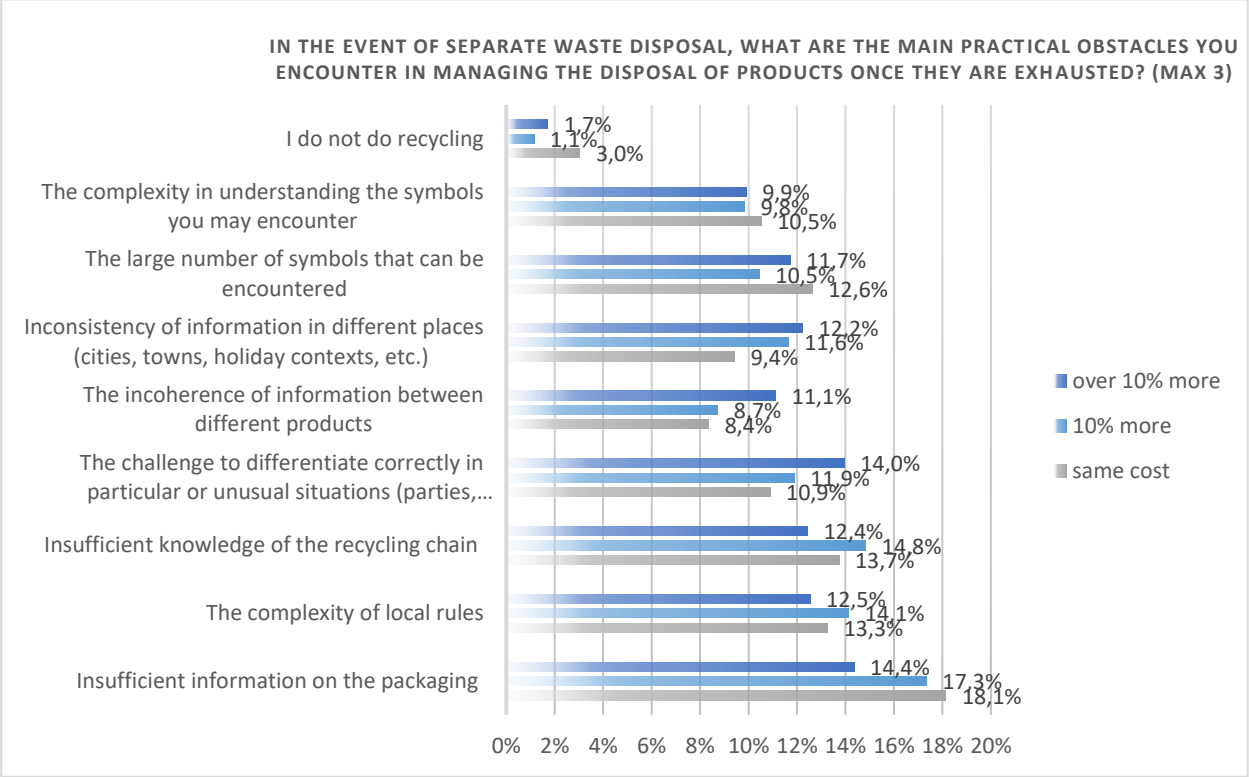
Annex 74 - Replies (%) per gender (obstacles in managing the disposal of products once exhausted)



Annex 75 - Replies (%) per each education group (obstacles in managing the disposal of products once exhausted)



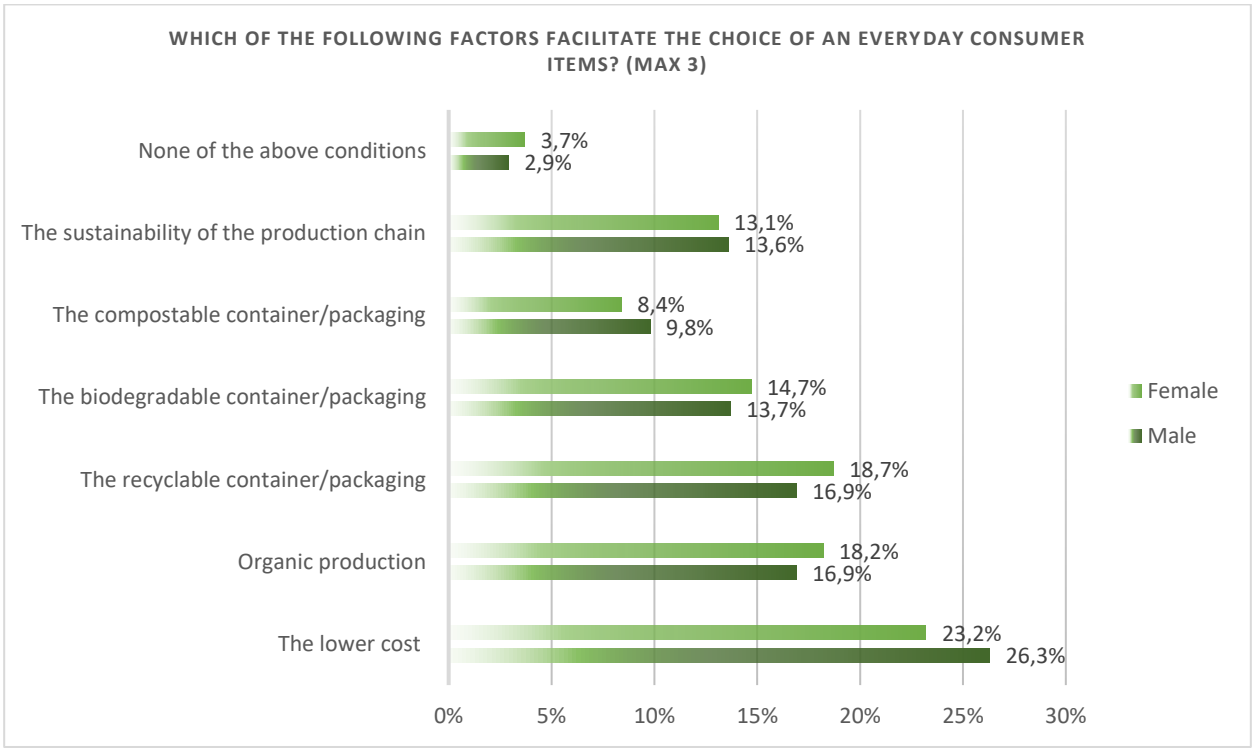
Annex 76 - Replies (%) per each age group (obstacles in managing the disposal of products once exhausted)



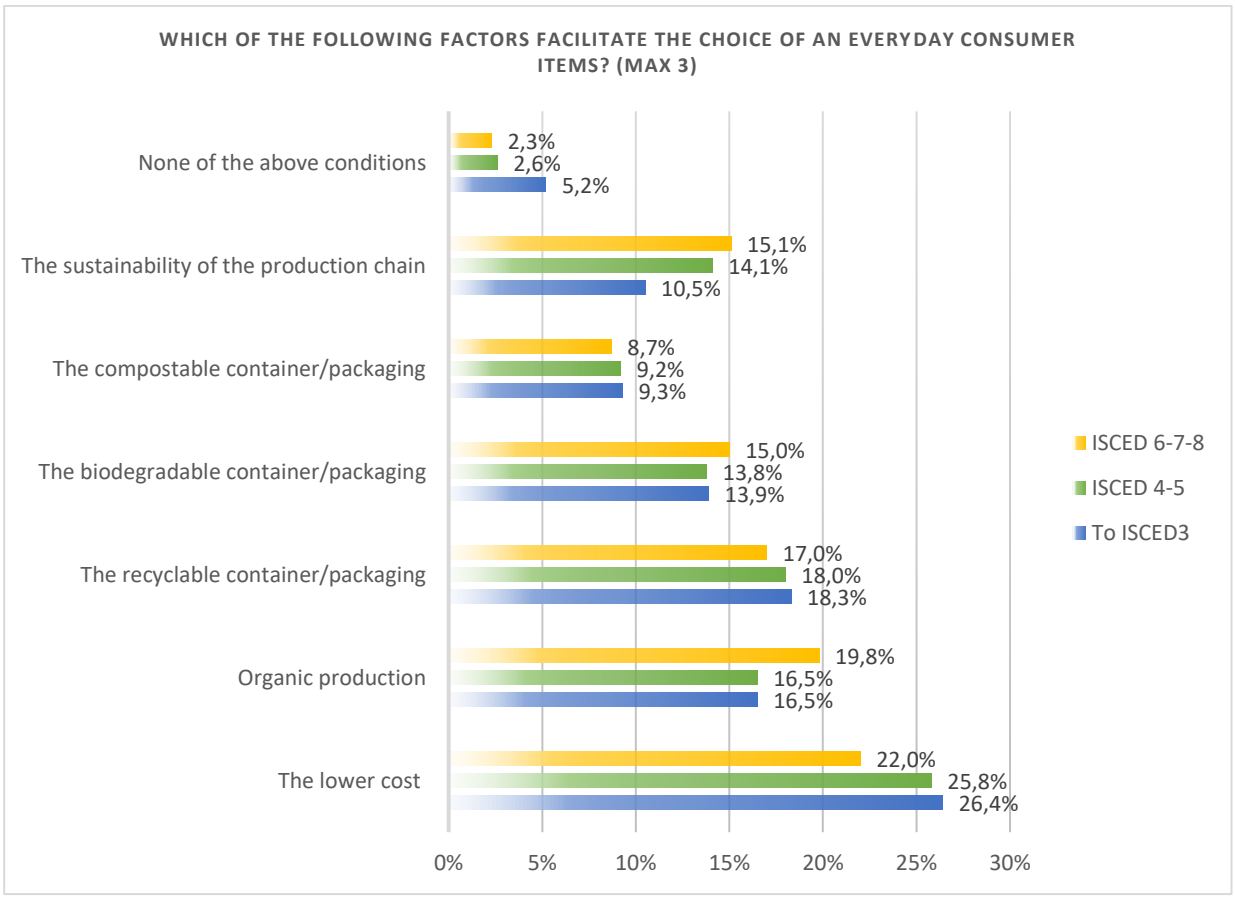
Annex 77 - Replies (%) per each willingness to pay (obstacles in managing the disposal of products once exhausted)

Which of the following factors facilitate the choice of an everyday consumer items? (max 3)	N° Replies	% Replies
The lower cost	1.473	24,8%
Organic production	1.050	17,7%
The recyclable container/packaging	1.055	17,7%
The biodegradable container/packaging	847	14,2%
The compostable container/packaging	540	9,1%
The sustainability of the production chain	787	13,2%
None of the above conditions	197	3,3%

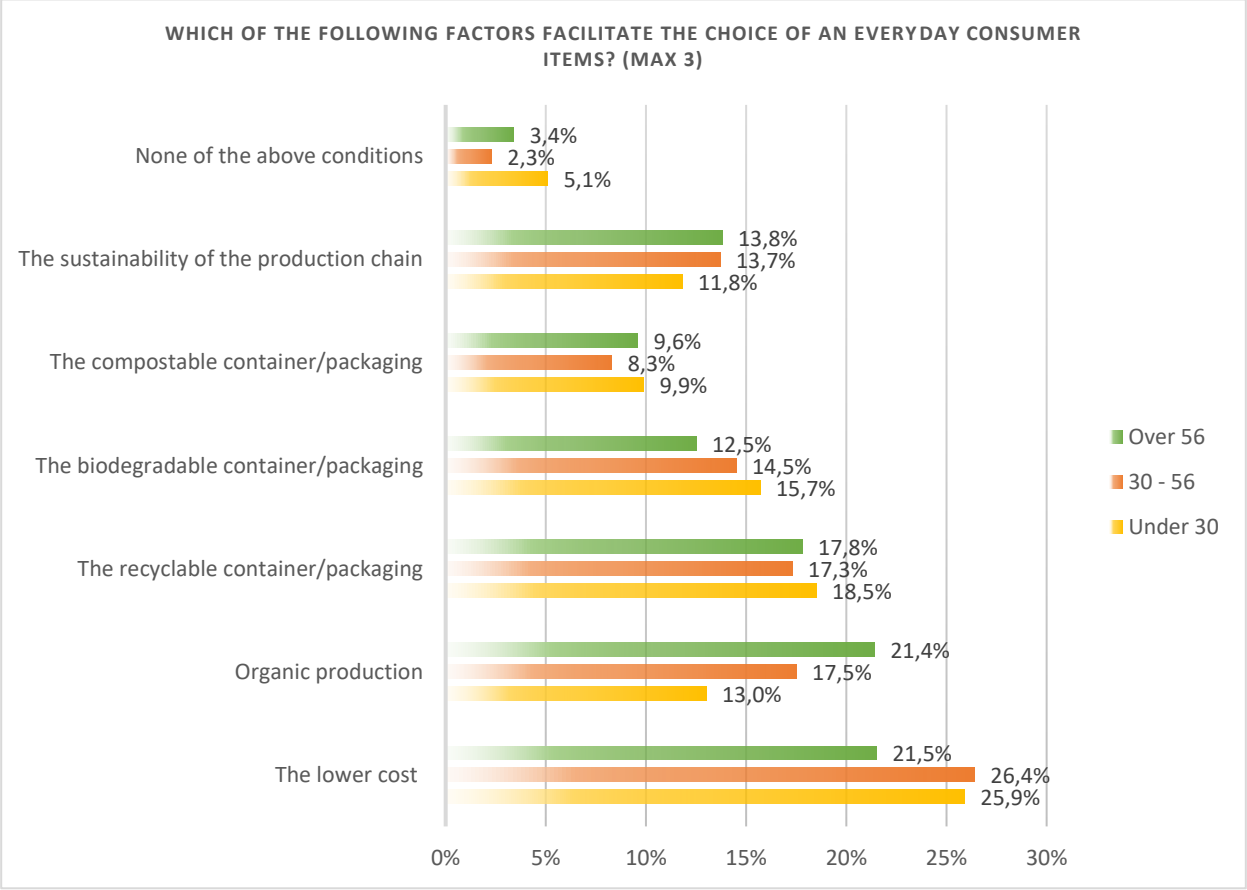
Annex 78 - Number and percentage of respondents (factors that facilitate consumer's choice)



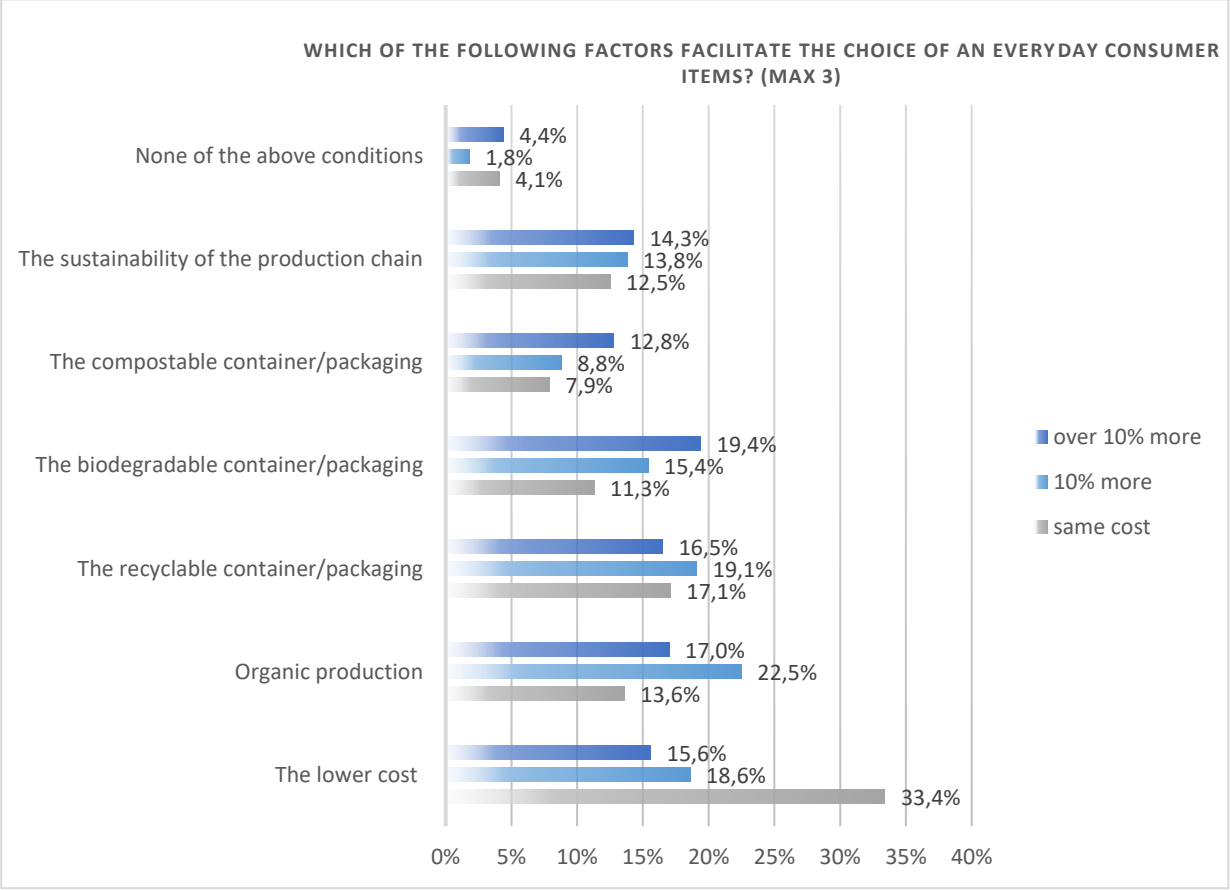
Annex 79 - Replies (%) per gender (factors that facilitate consumer's choice)



Annex 80 - Replies (%) per each education group (factors that facilitate consumer's choice)



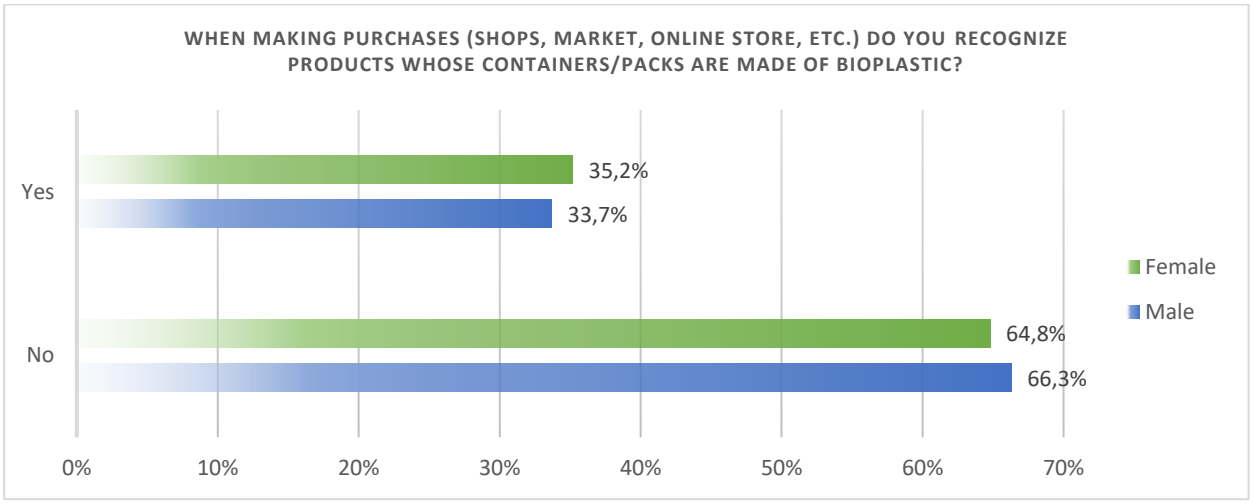
Annex 81 - Replies (%) per each age group (factors that facilitate consumer's choice)



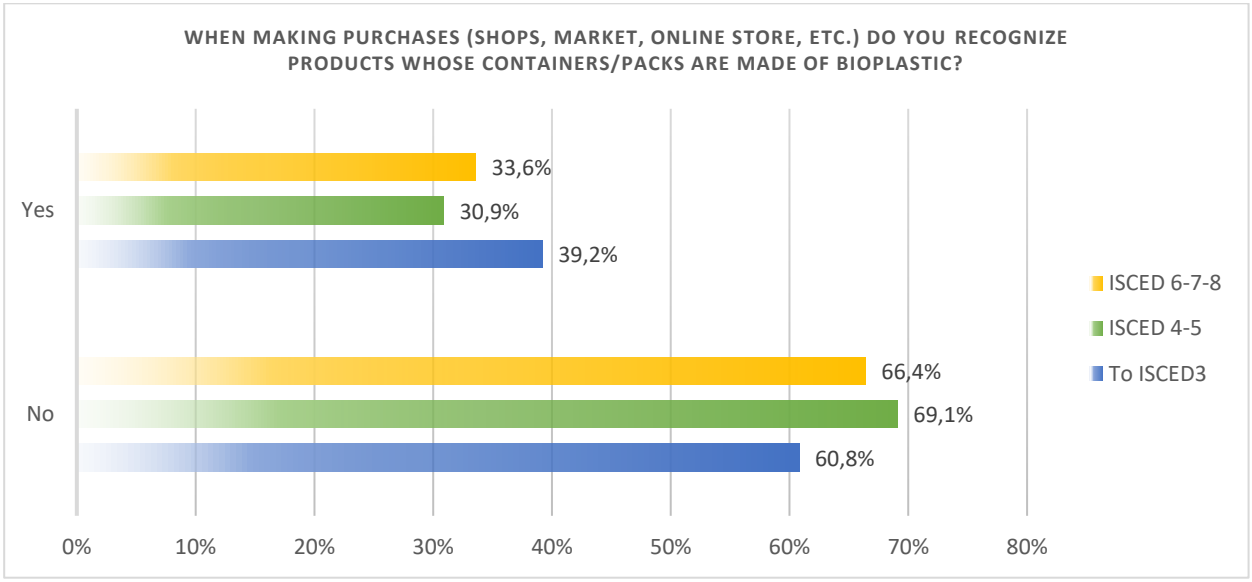
Annex 82 - Replies (%) per each willingness to pay (factors that facilitate consumer's choice)

When making purchases (shops, market, online store, etc.) do you recognize products whose containers/packs are made of Bioplastic?	N° Replies	% Replies
No	2.013	65,8%
Yes	1.048	34,2%
Total	3.061	100%

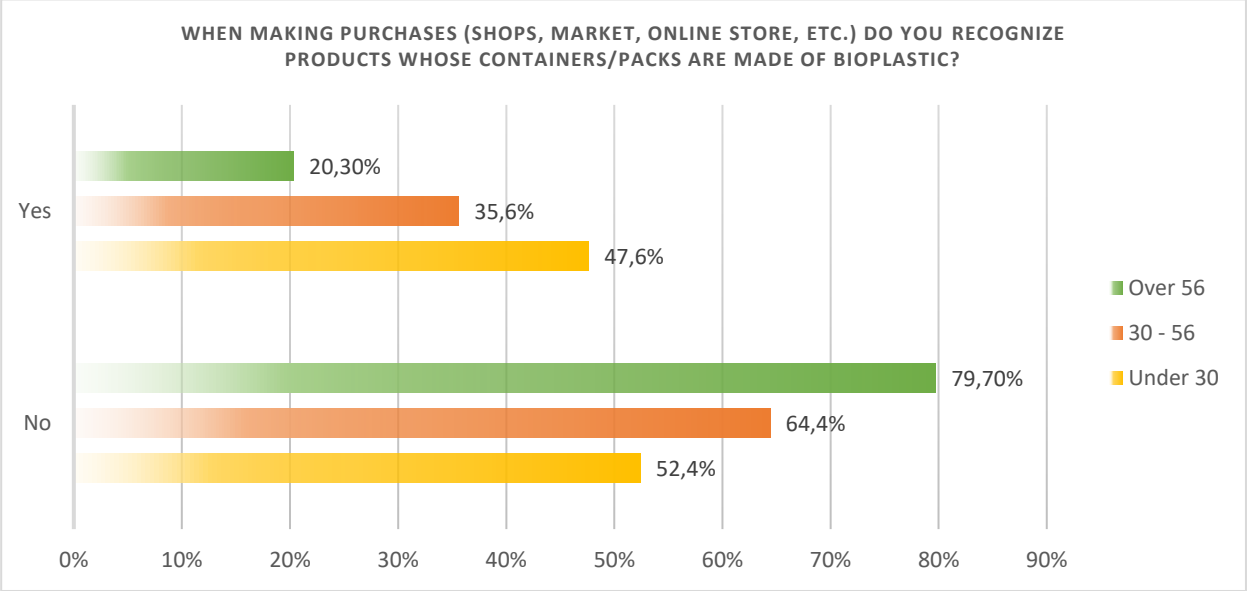
Annex 83 - Number and percentage of respondents (Do you recognize products whose containers/packs are made of Bioplastic?)



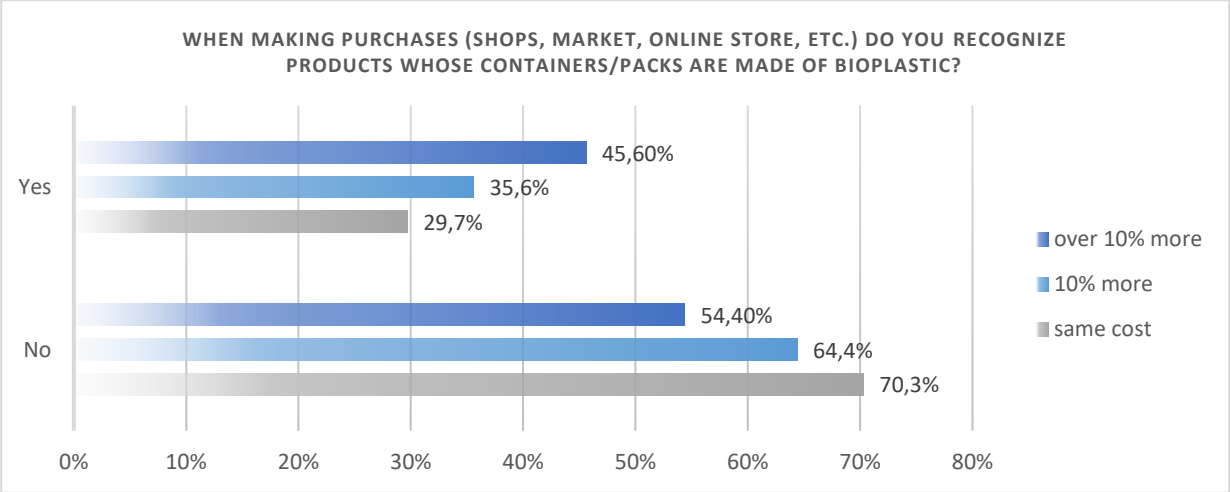
Annex 84 - Replies (%) per gender (Do you recognize products whose containers/packs are made of Bioplastic?)



Annex 85 - Replies (%) per each education group (Do you recognize products whose containers/packs are made of Bioplastic?)



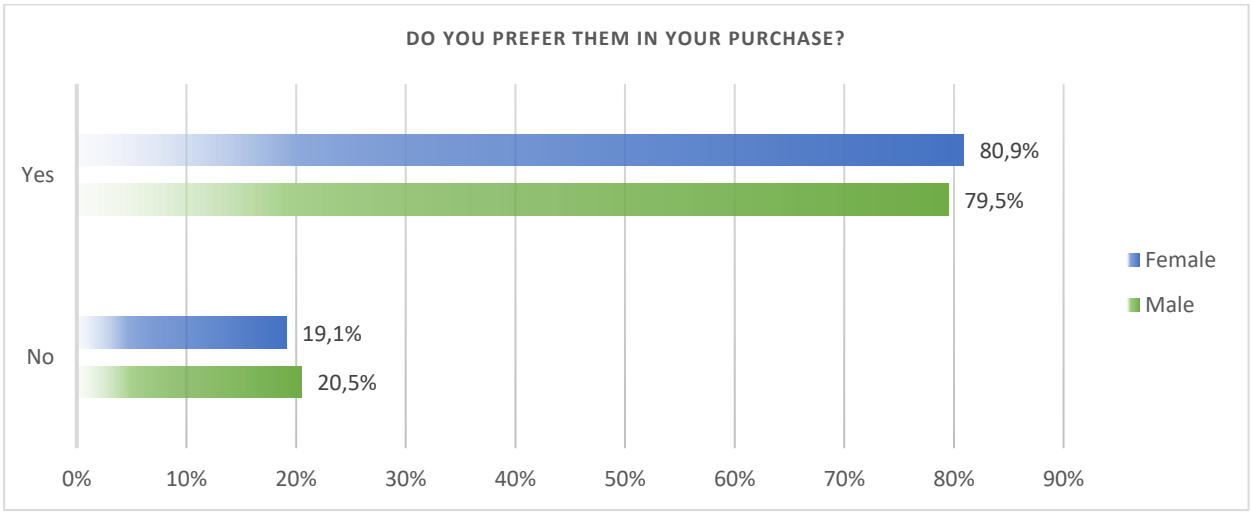
Annex 86 - Replies (%) per each age group (Do you recognize products whose containers/packs are made of Bioplastic?)



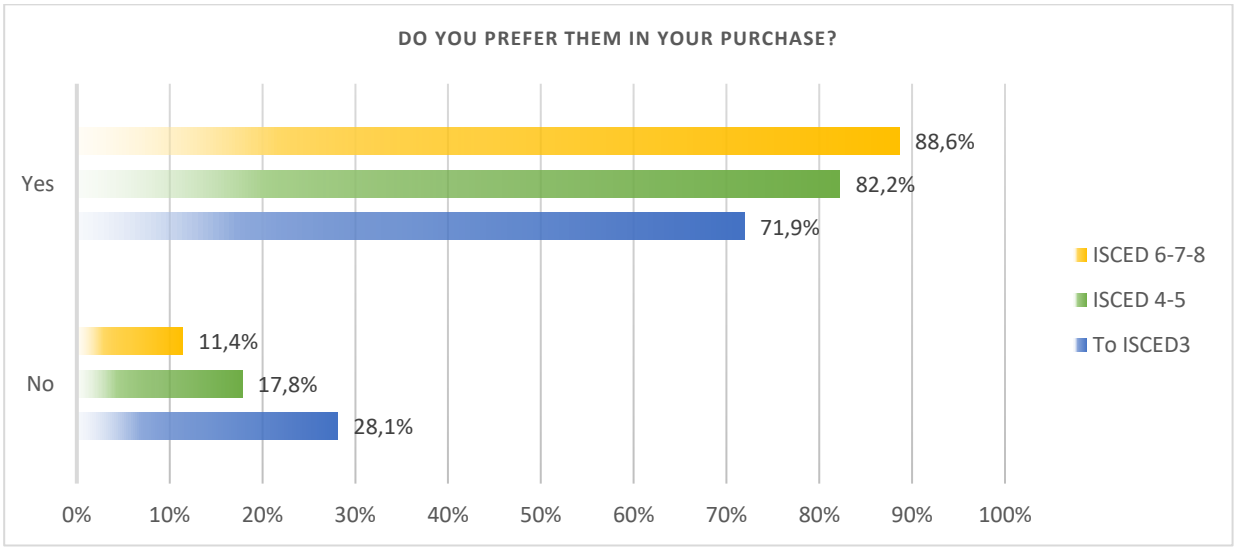
Annex 87 - Replies (%) per each willingness to pay (Do you recognize products whose containers/packs are made of Bioplastic?)

Do you prefer them in your purchase?	N° Replies	% Replies
No	208	19,9%
Yes	838	80,1%
Total	1.046	100%

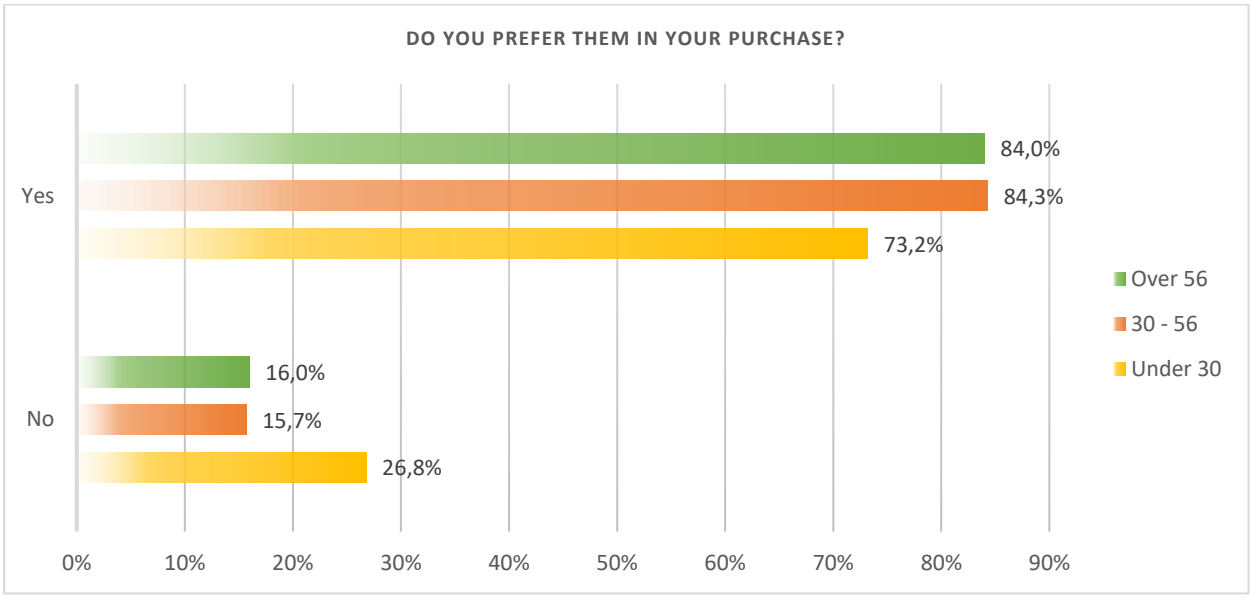
Annex 88 - Number and percentage of respondents (Do you prefer them in your purchase?)



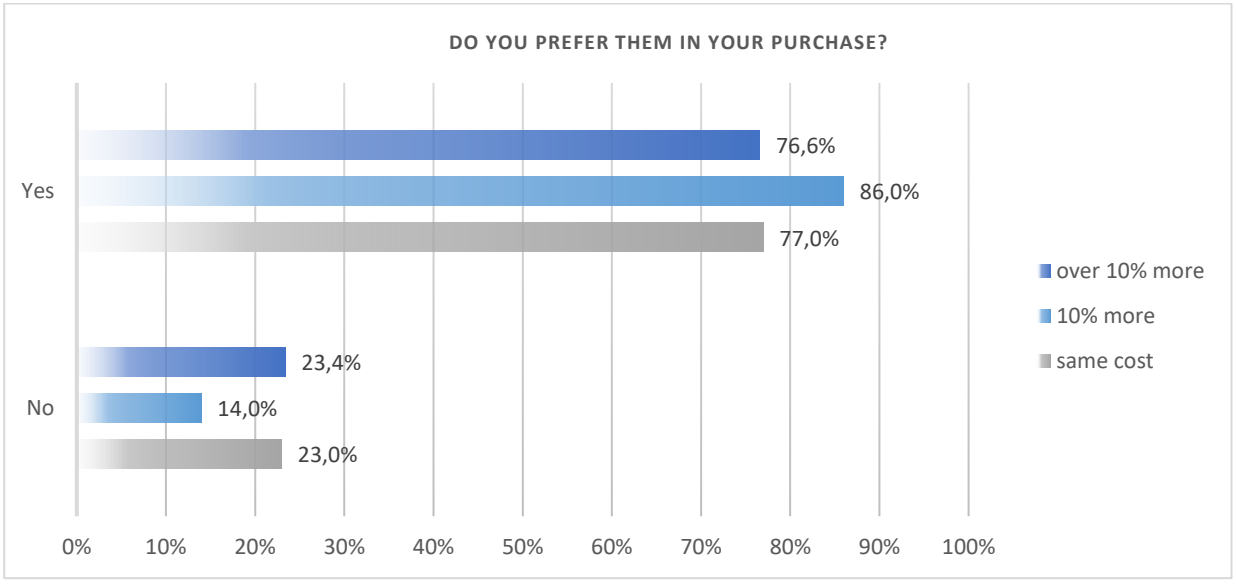
Annex 89 - Replies (%) per gender (Do you prefer them in your purchase?)



Annex 90 - Replies (%) per each education group (Do you prefer them in your purchase?)



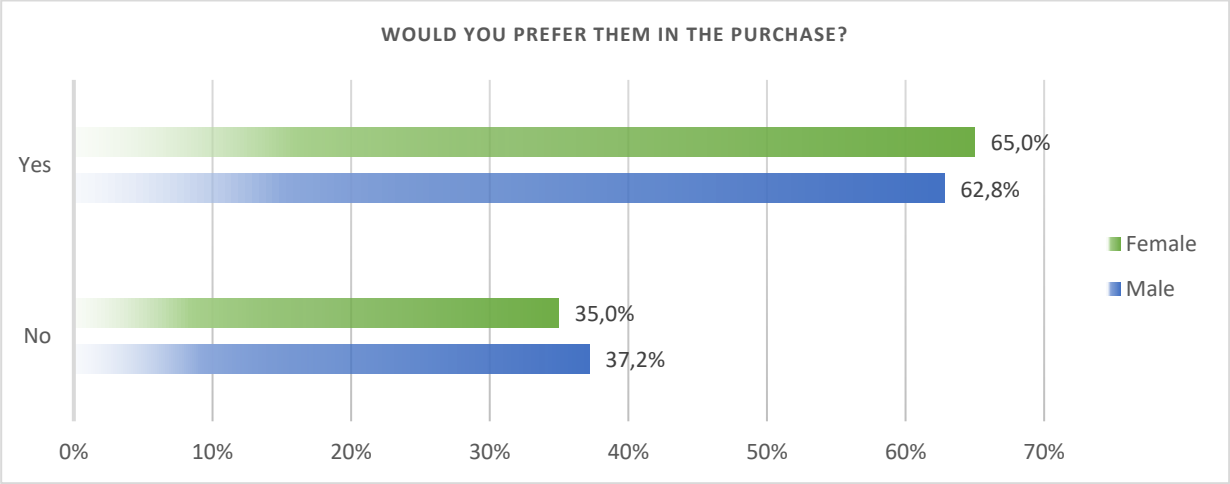
Annex 91 - Replies (%) per each age group (Do you prefer them in your purchase?)



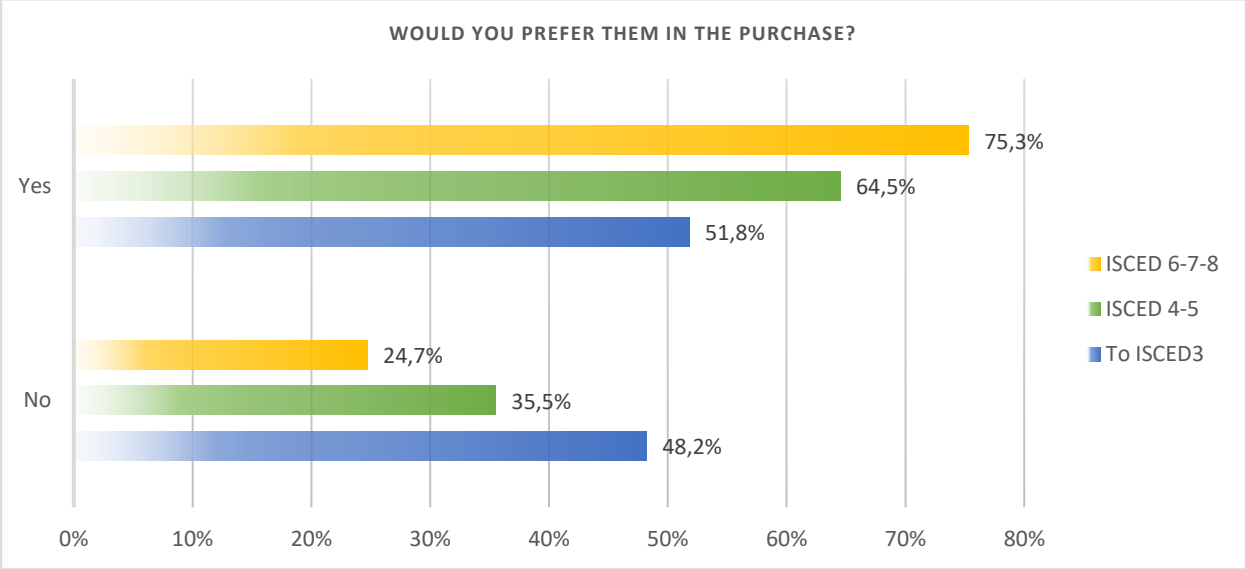
Annex 92 - Replies (%) per each willingness to pay (Do you prefer them in your purchase?)

Would you prefer them in the purchase?	N° Replies	% Replies
No	708	35,9%
Yes	1.264	64,1%
Total	1.972	100%

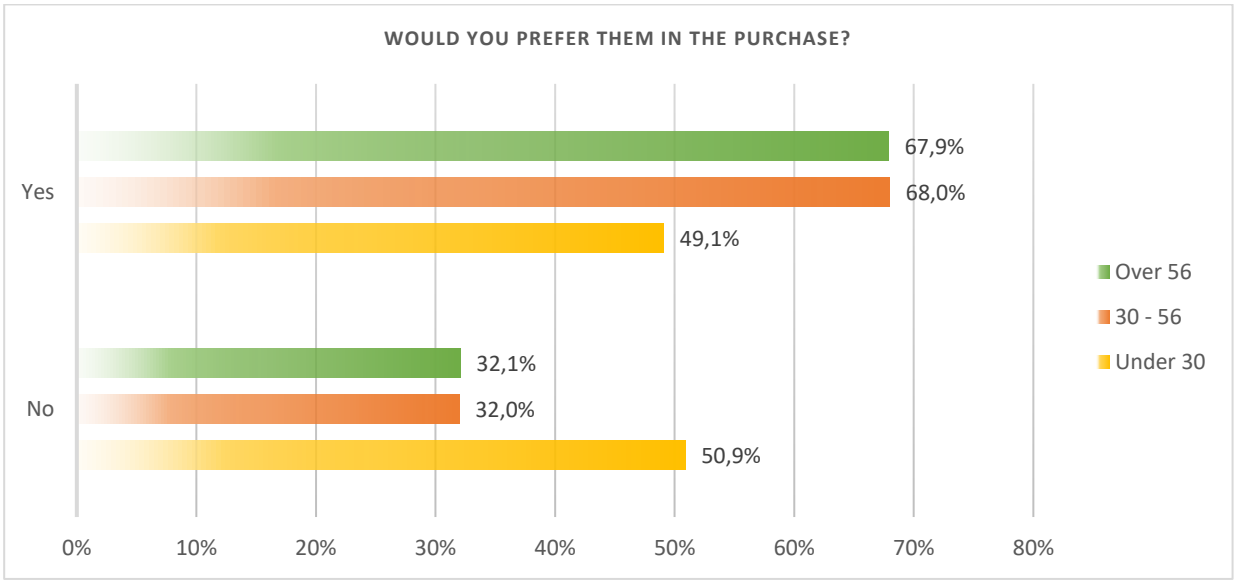
Annex 93 - Number and percentage of respondents (Would you prefer them in the purchase?)



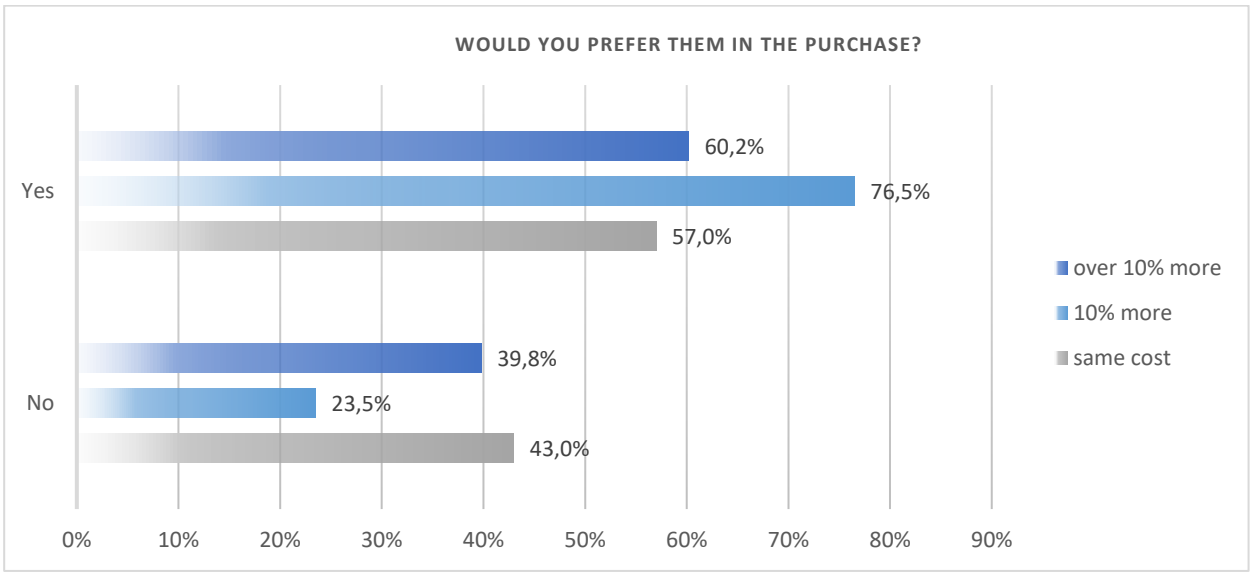
Annex 94 - Replies (%) per gender (Would you prefer them in the purchase?)



Annex 95 - Replies (%) per each education group (Would you prefer them in the purchase?)



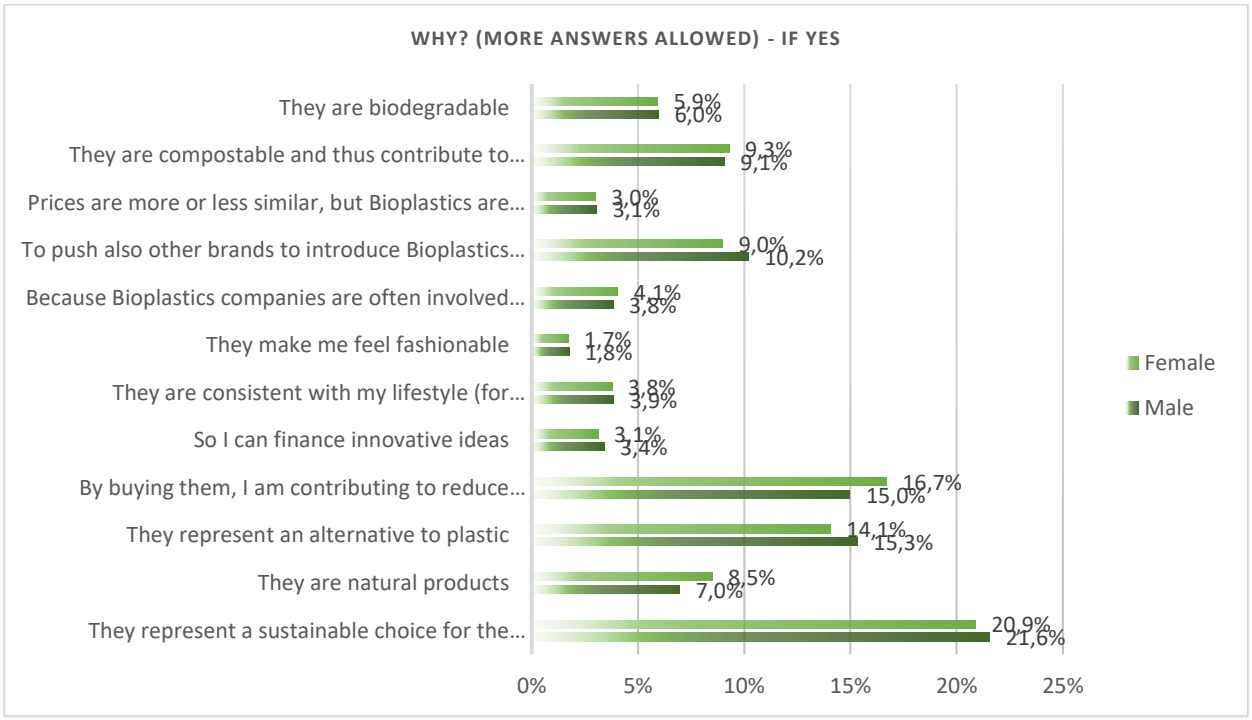
Annex 96 - Replies (%) per each age group (Would you prefer them in the purchase?)



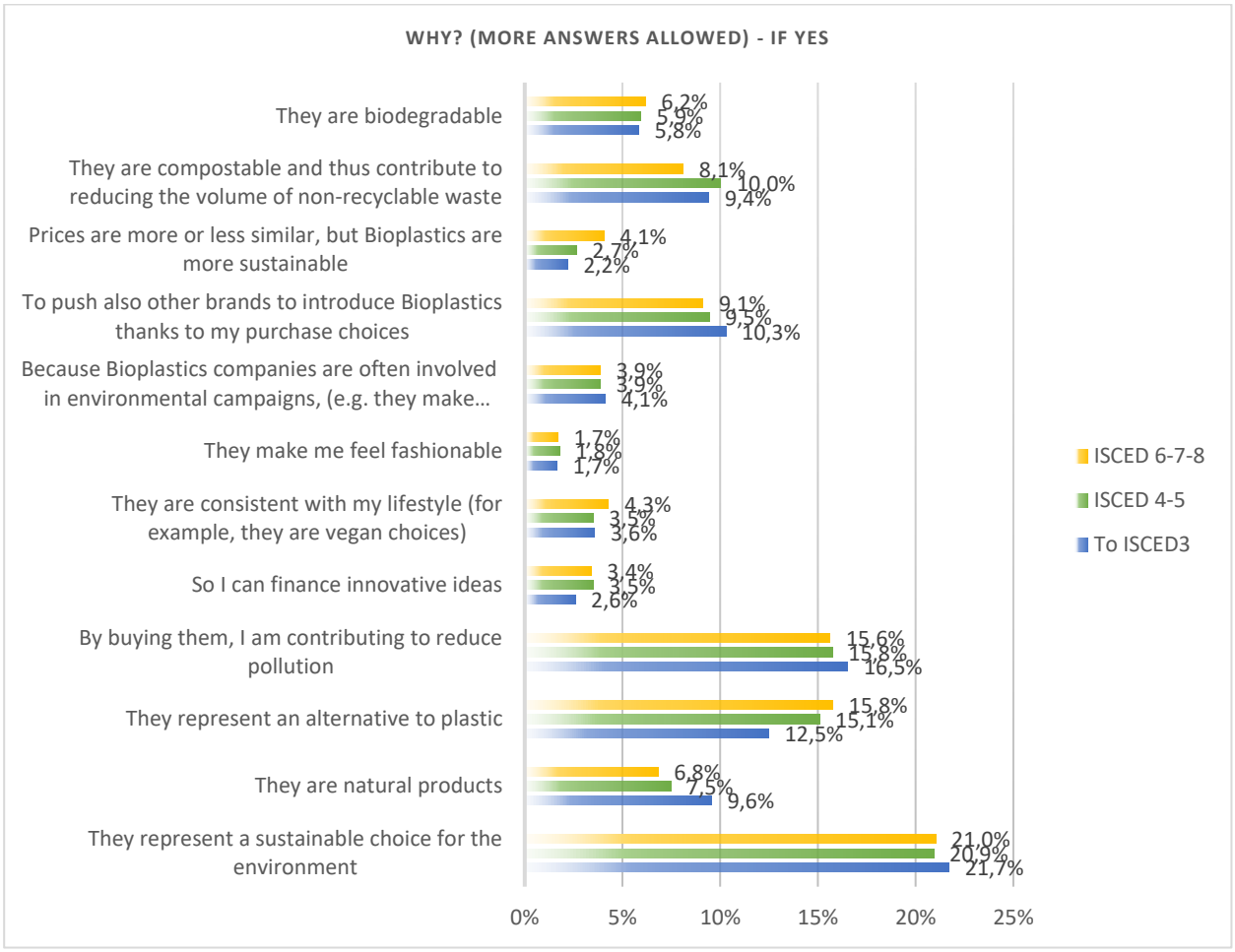
Annex 97 - Replies (%) per each willingness to pay (Would you prefer them in the purchase?)

Why? (more answers allowed) - If yes	N° Replies	% Replies
They represent a sustainable choice for the environment	1.264	21,1%
They are natural products	467	7,8%
They represent an alternative to plastic	876	14,6%
By buying them, I am contributing to reduce pollution	949	15,9%
So I can finance innovative ideas	195	3,3%
They are consistent with my lifestyle (for example, they are vegan choices)	228	3,8%
They make me feel fashionable	102	1,7%
Because Bioplastics companies are often involved in environmental campaigns, (e.g. they make donations for every product sold)	235	3,9%
To push also other brands to introduce Bioplastics thanks to my purchase choices	568	9,5%
Prices are more or less similar, but Bioplastics are more sustainable	183	3,1%
They are compostable and thus contribute to reducing the volume of non-recyclable waste	550	9,2%
They are biodegradable	363	6,1%

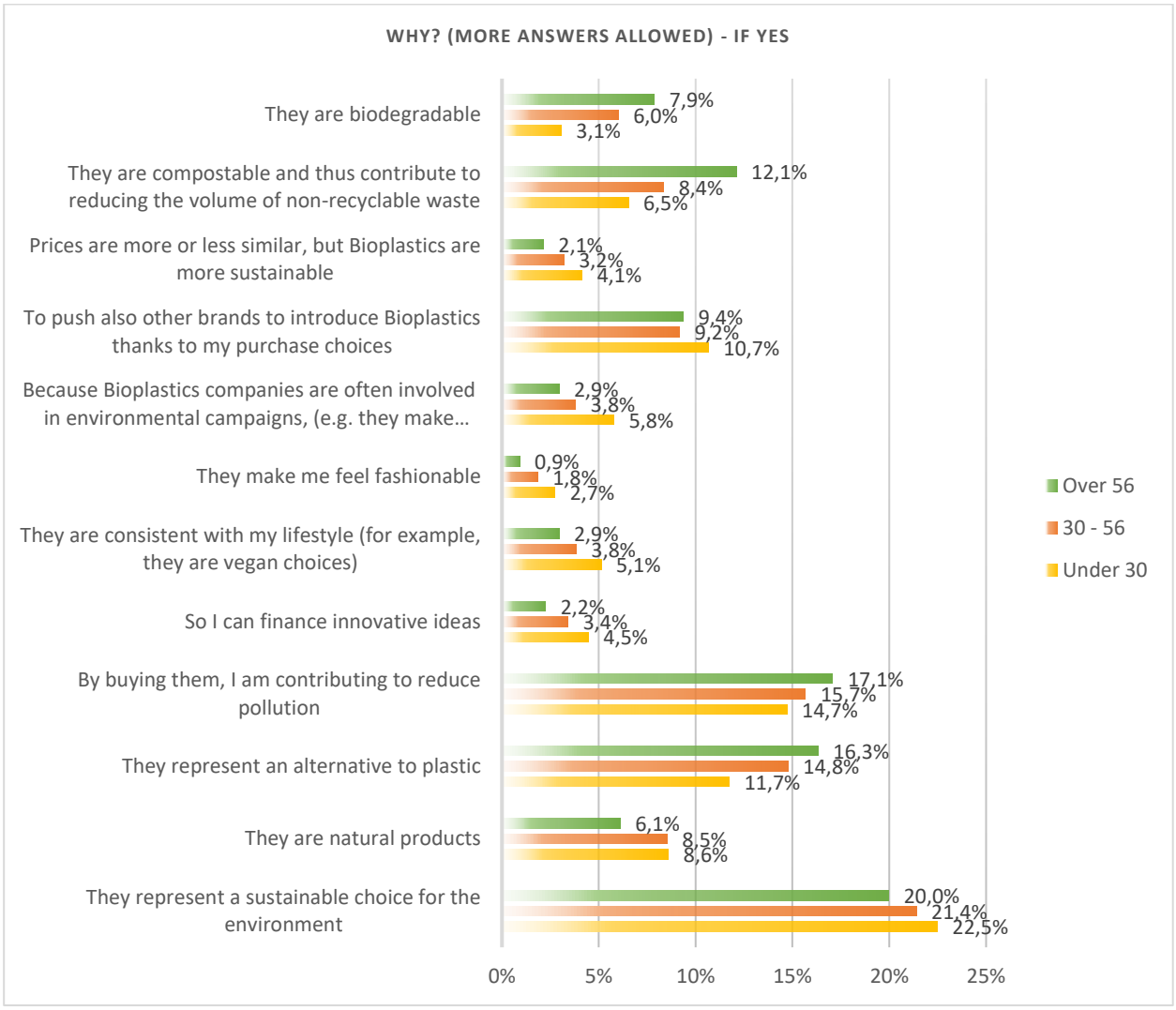
Annex 98 - Number and percentage of respondents (Why? / If yes)



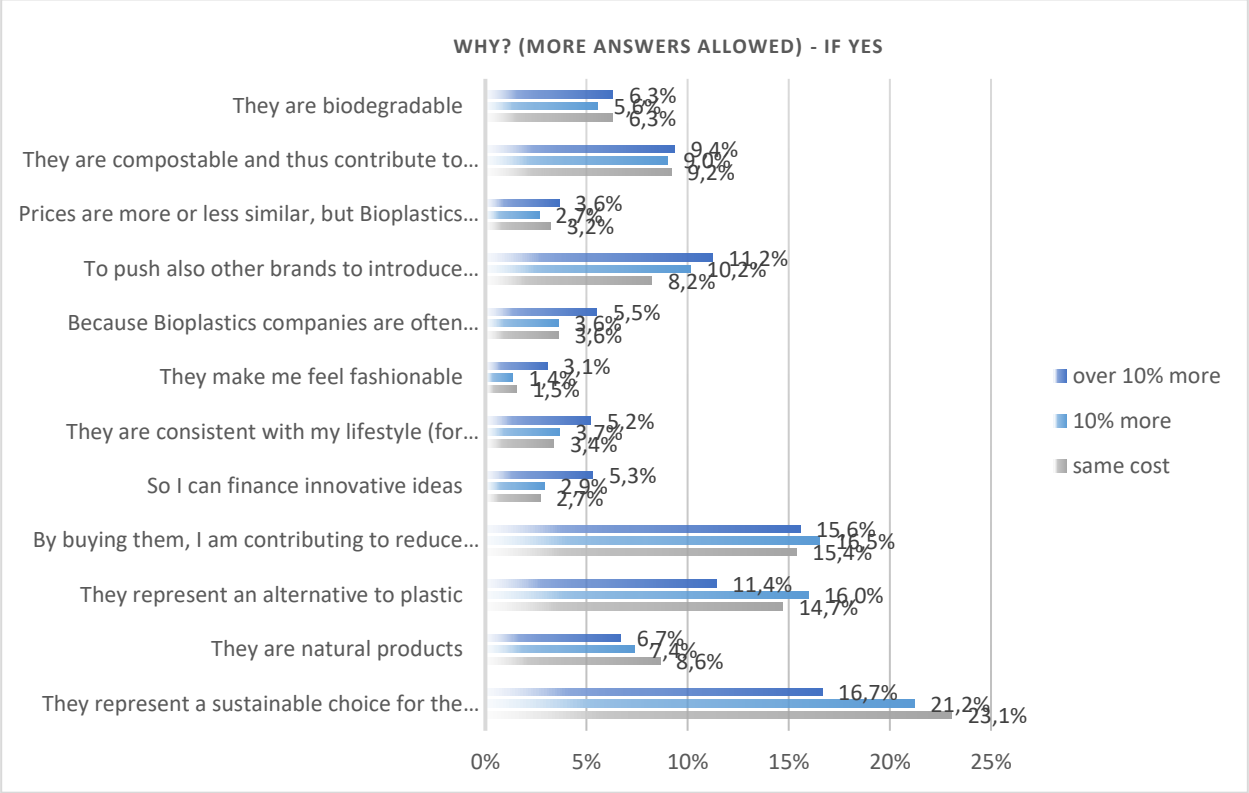
Annex 99 - Replies (%) per gender (Why? / If yes)



Annex 100 - Replies (%) per each education group (Why? / If yes)



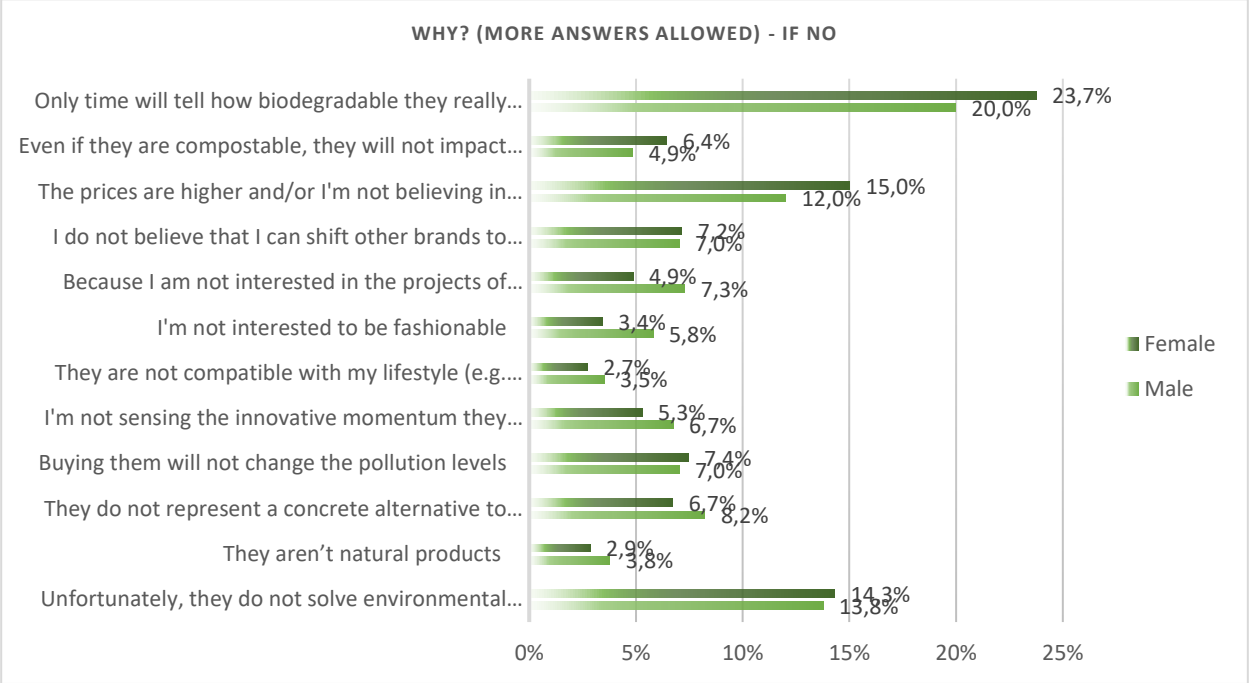
Annex 101 - Replies (%) per each age group (Why? / If yes)



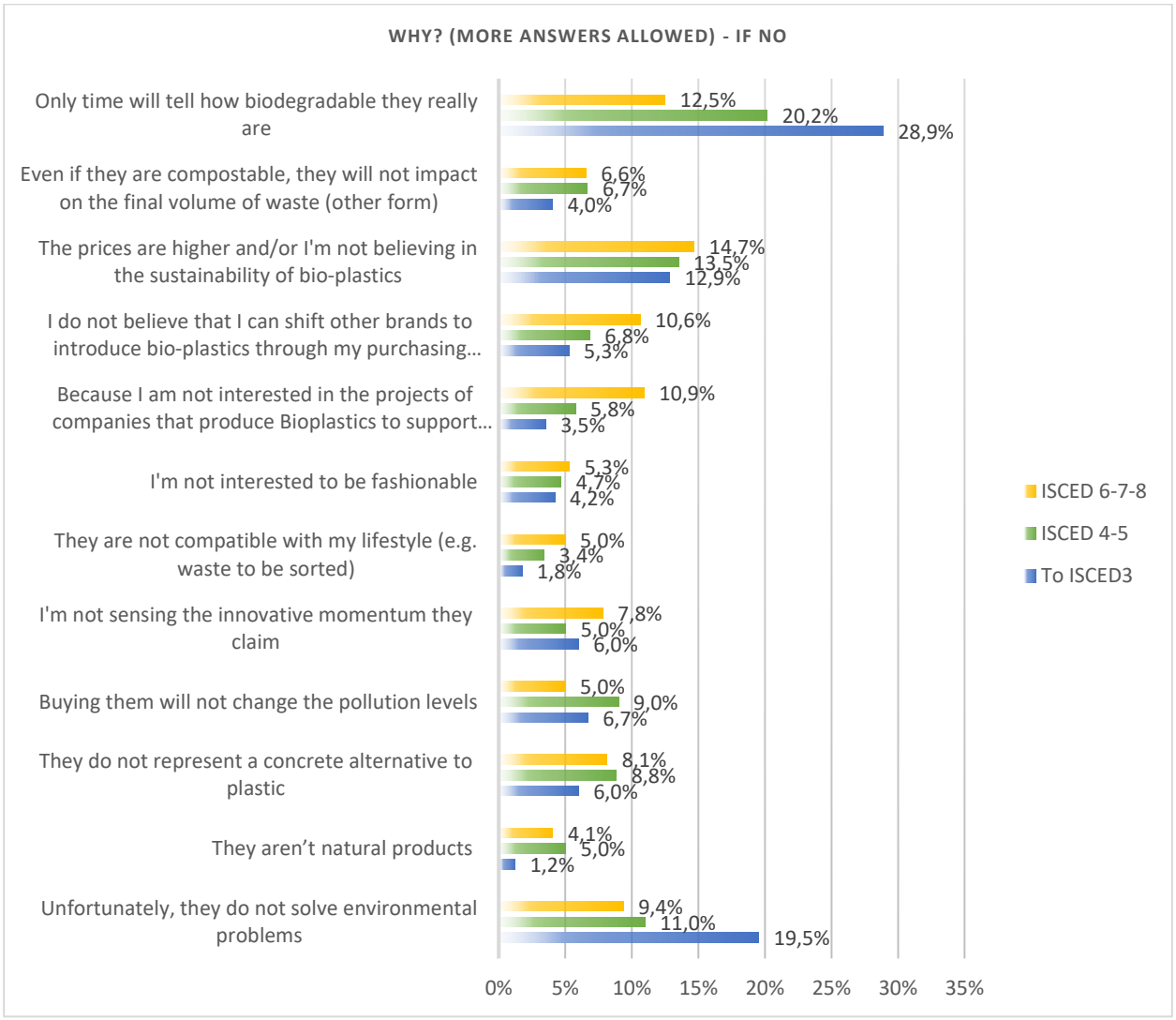
Annex 102 - Replies (%) per each willingness to pay (Why? / If yes)

Why? (more answers allowed) - If no	N° Replies	% Replies
Unfortunately, they do not solve environmental problems	202	13,9%
They aren't natural products	49	3,4%
They do not represent a concrete alternative to plastic	109	7,5%
Buying them will not change the pollution levels	104	7,2%
I'm not sensing the innovative momentum they claim	88	6,1%
They are not compatible with my lifestyle (e.g. waste to be sorted)	46	3,2%
I'm not interested to be fashionable	68	4,7%
Because I am not interested in the projects of companies that produce Bioplastics to support environmental campaigns (for example through donations for each product sold - greenwashing)	89	6,1%
I do not believe that I can shift other brands to introduce bio-plastics through my purchasing choices	102	7,0%
The prices are higher and/or I'm not believing in the sustainability of bio-plastics	196	13,5%
Even if they are compostable, they will not impact on the final volume of waste (other form)	83	5,7%
Only time will tell how biodegradable they really are	316	21,8%

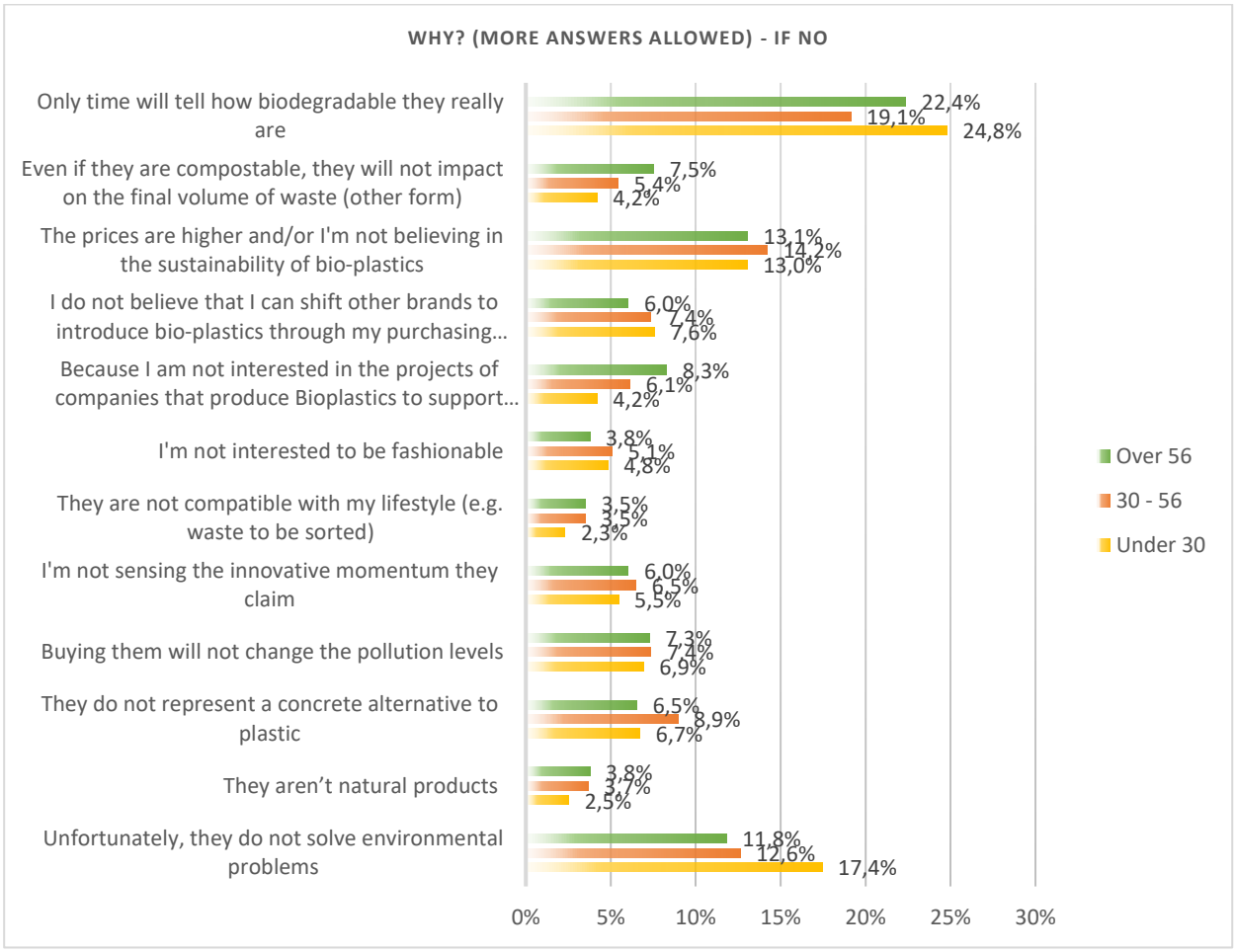
Annex 103 - Number and percentage of respondents (Why? / If no)



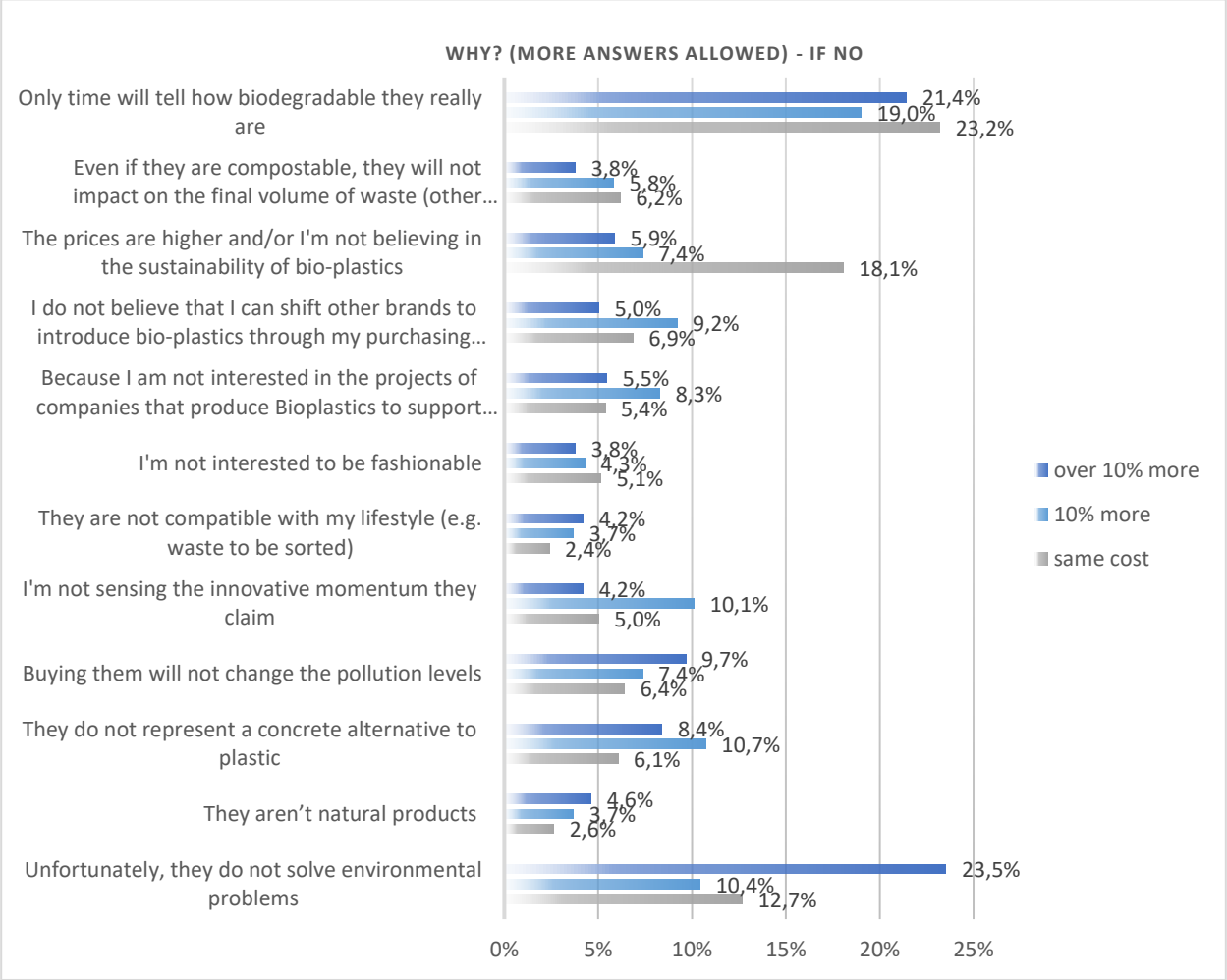
Annex 104 - Replies (%) per gender (Why? / If no)



Annex 105 - Replies (%) per each education group (Why? / If no)



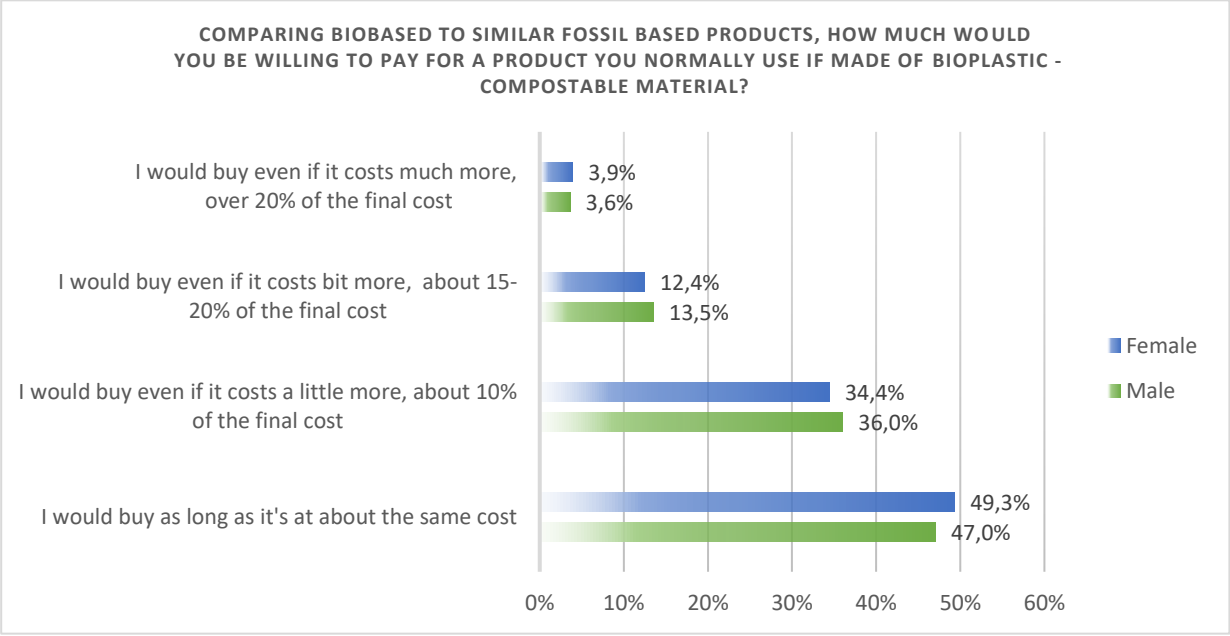
Annex 106 - Replies (%) per each age group (Why? / If no)



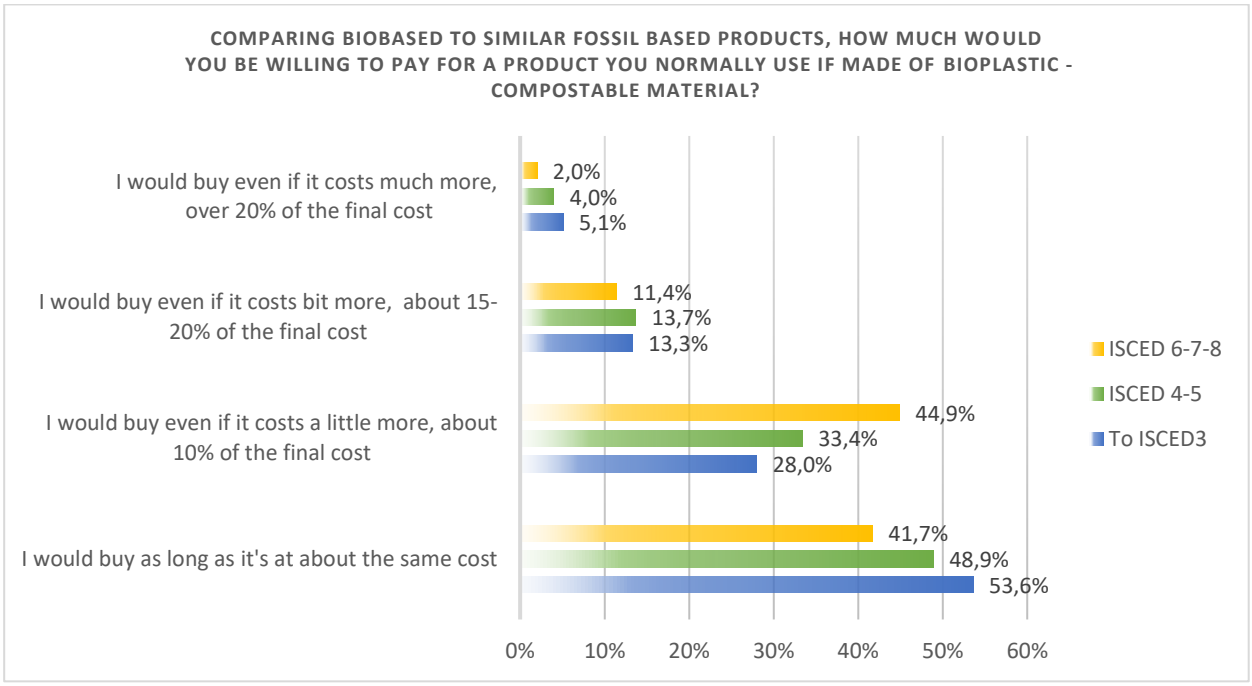
Annex 107 - Replies (%) per each willingness to pay (Why? / If no)

Comparing Biobased to similar fossil based products, how much would you be willing to pay for a product you normally use if made of Bioplastic - compostable material?	N° Replies	% Replies
I would buy as long as it's at about the same cost	1.478	48,2%
I would buy even if it costs a little more, about 10% of the final cost	1.077	35,1%
I would buy even if it costs bit more, about 15-20% of the final cost	395	12,9%
I would buy even if it costs much more, over 20% of the final cost	115	3,8%
Total	3.065	100%

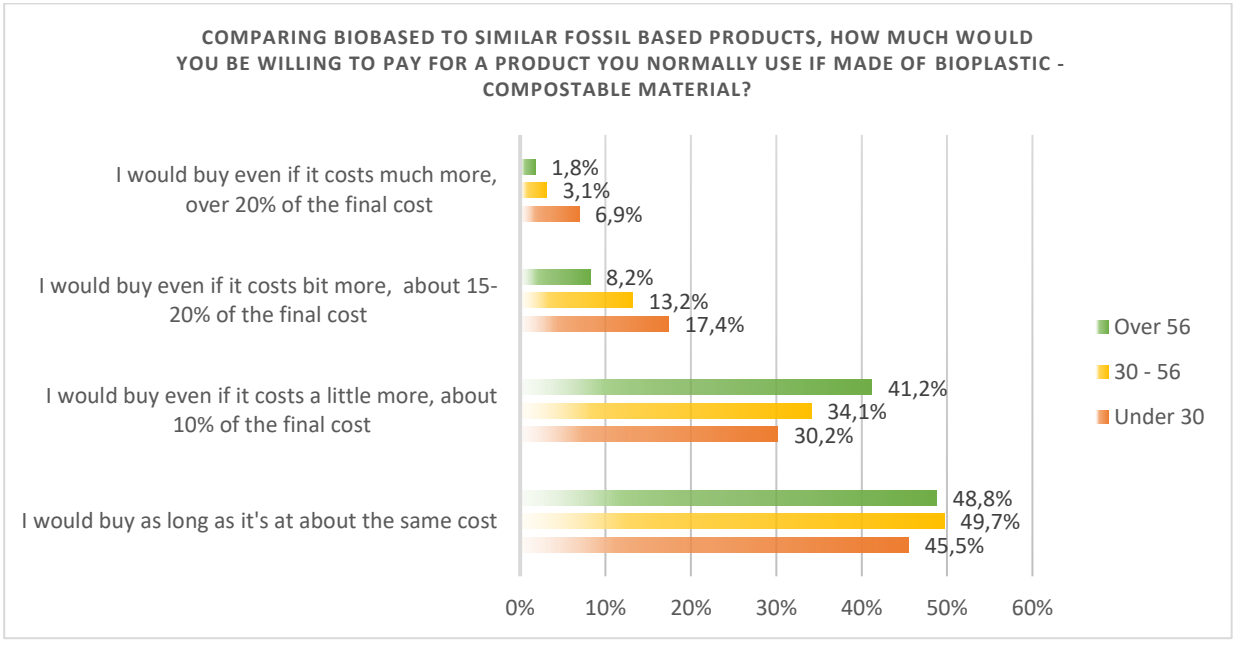
Annex 108 - Number and percentage of respondents (How much would you be willing to pay)



Annex 109 - Replies (%) per gender (How much would you be willing to pay)



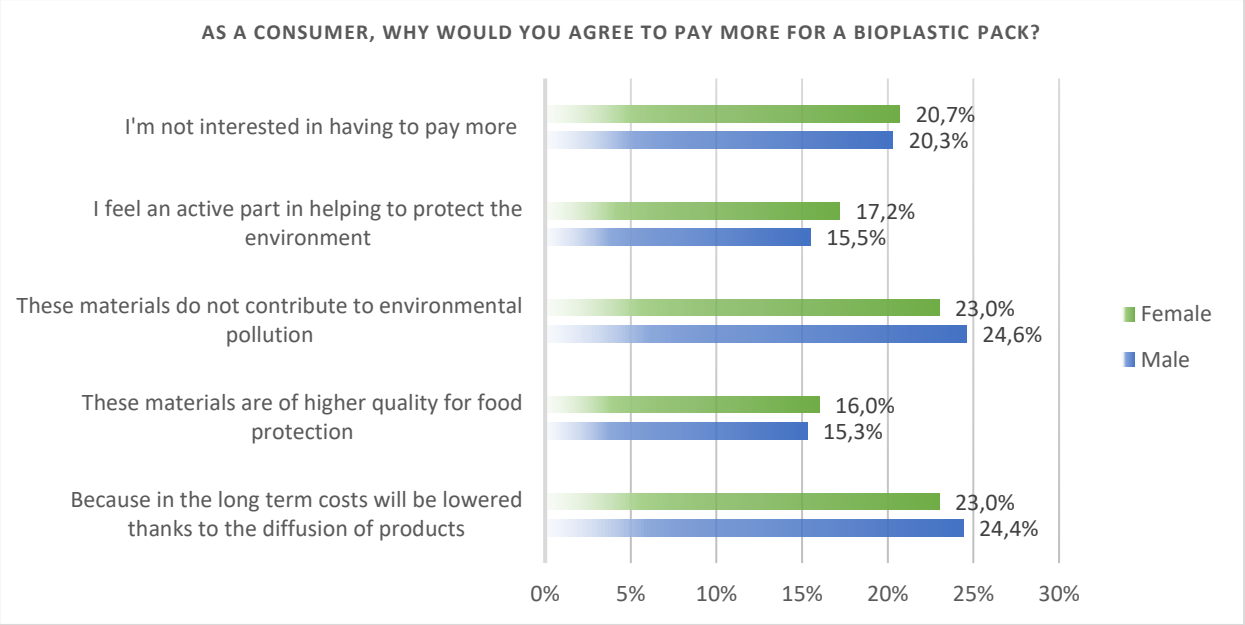
Annex 110 - Replies (%) per each education group (How much would you be willing to pay)



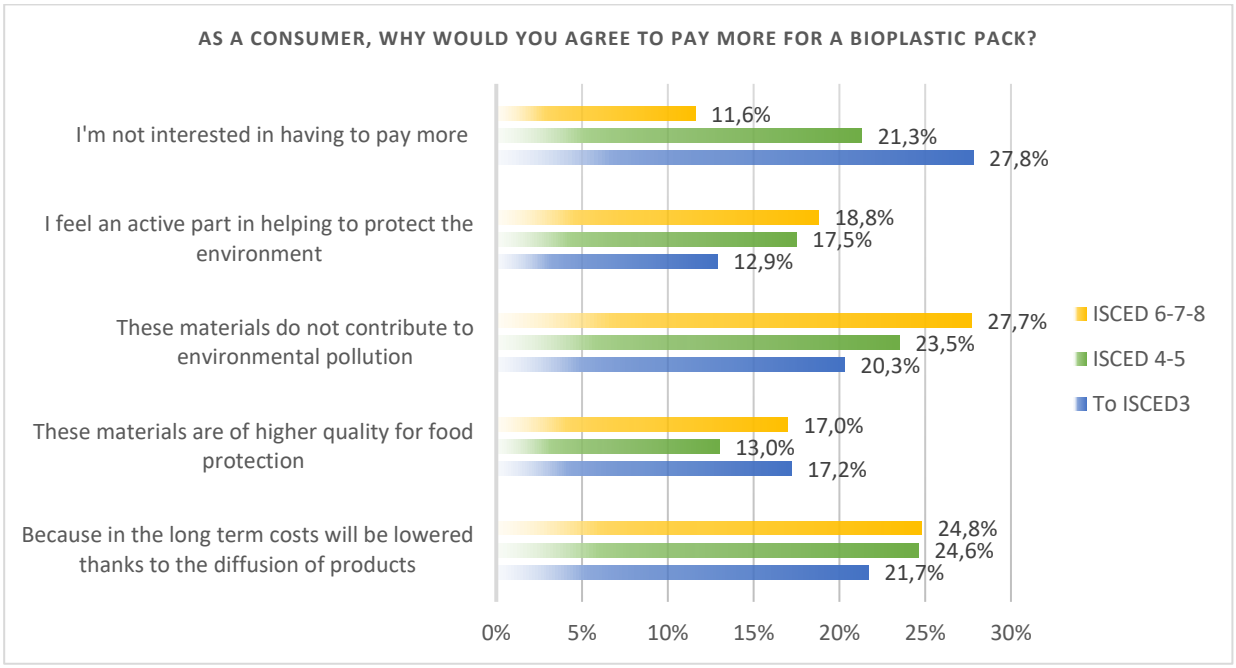
Annex 111 - Replies (%) per each age group (How much would you be willing to pay)

As a consumer, why would you agree to pay more for a Bioplastic pack?	N° Replies	% Replies
Because in the long term costs will be lowered thanks to the diffusion of products	724	23,7%
These materials are of higher quality for food protection	476	15,6%
These materials do not contribute to environmental pollution	724	23,7%
I feel an active part in helping to protect the environment	505	16,5%
I'm not interested in having to pay more	629	20,6%
Total	3.058	100%

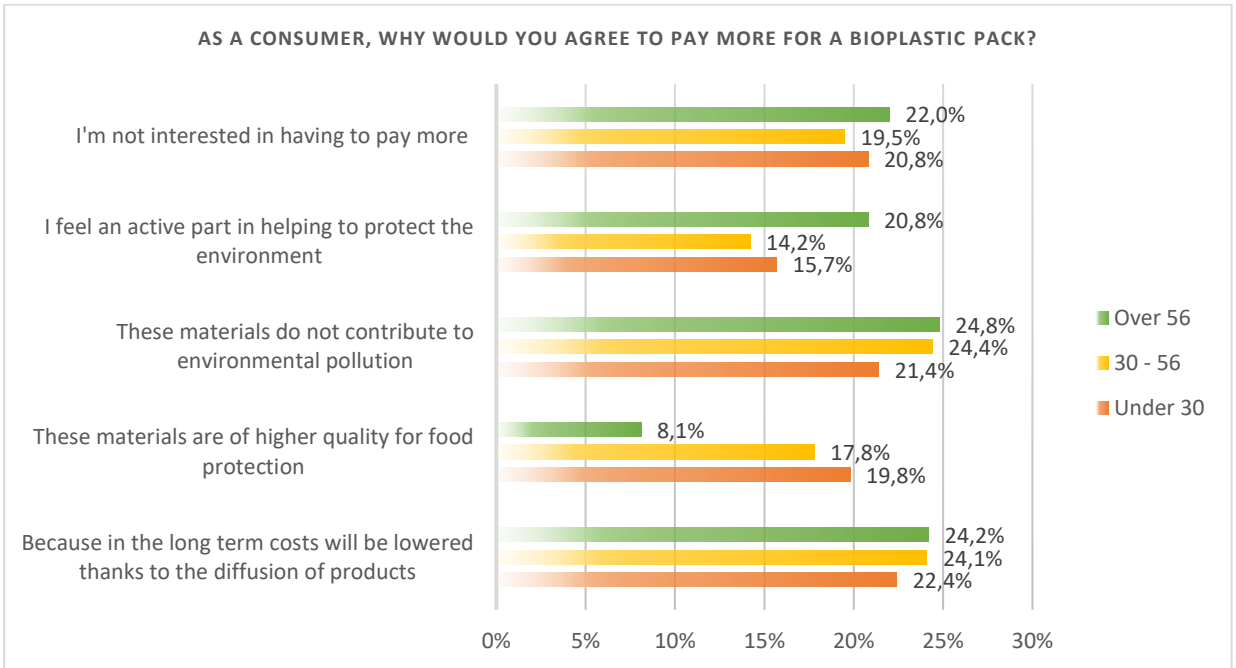
Annex 112 - Number and percentage of respondents (Why would you agree to pay more for a Bioplastic pack?)



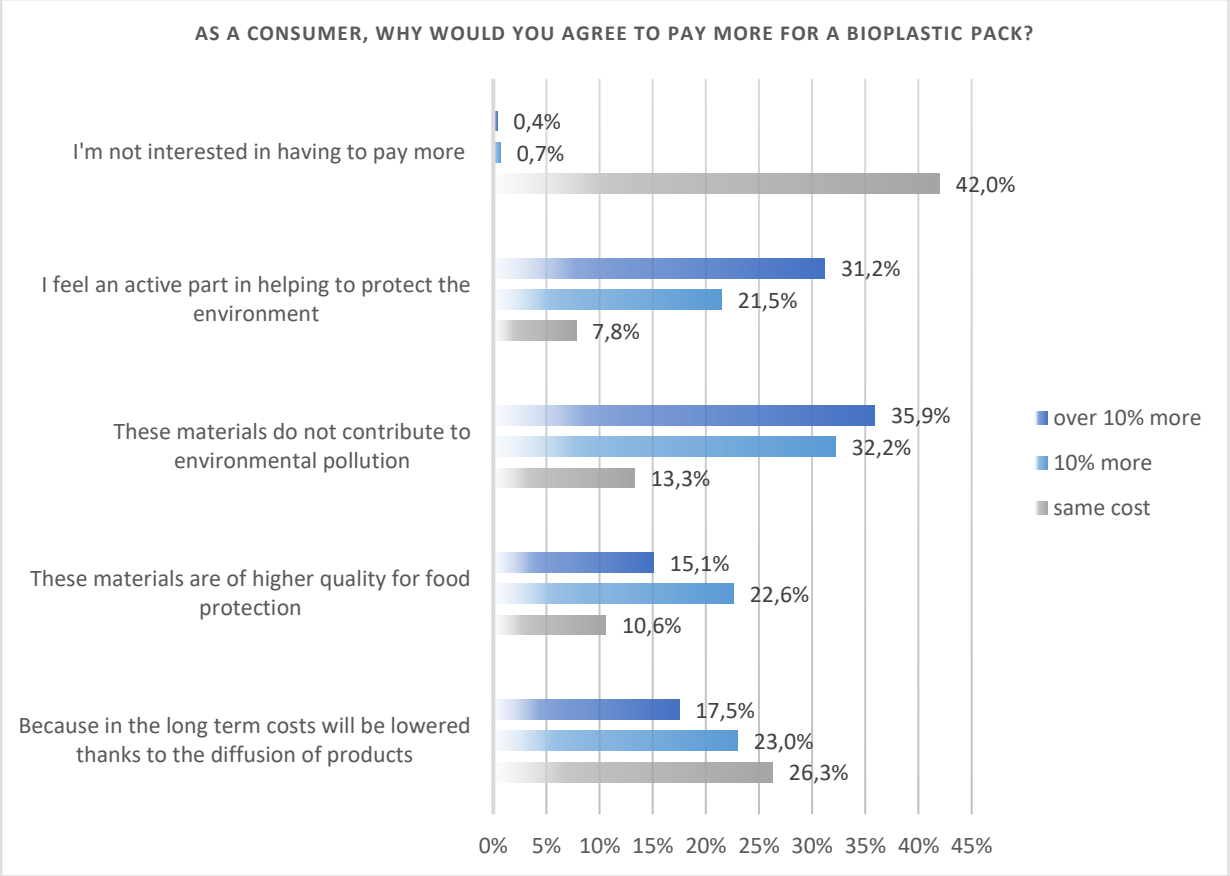
Annex 113 - Replies (%) per gender (Why would you agree to pay more for a Bioplastic pack?)



Annex 114 - Replies (%) per each education group (Why would you agree to pay more for a Bioplastic pack?)



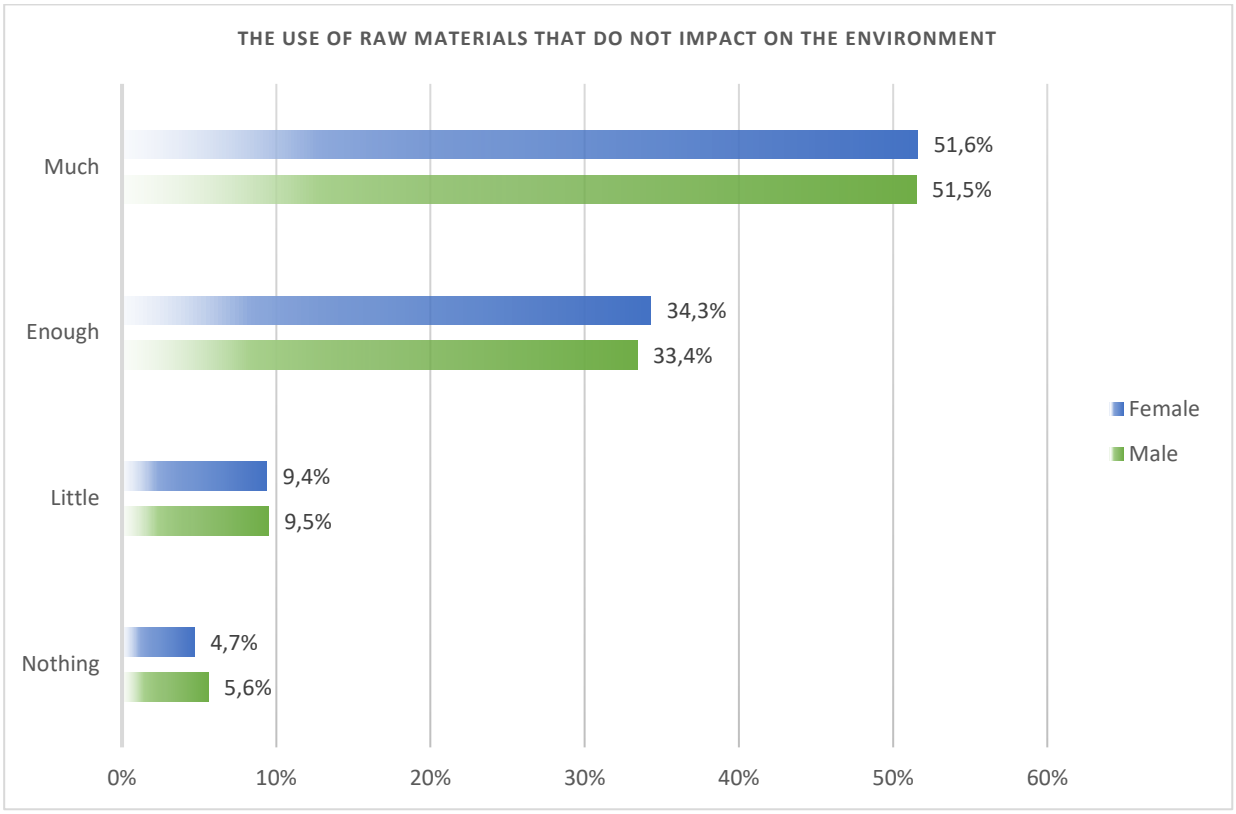
Annex 115 - Replies (%) per each age group (Why would you agree to pay more for a Bioplastic pack?)



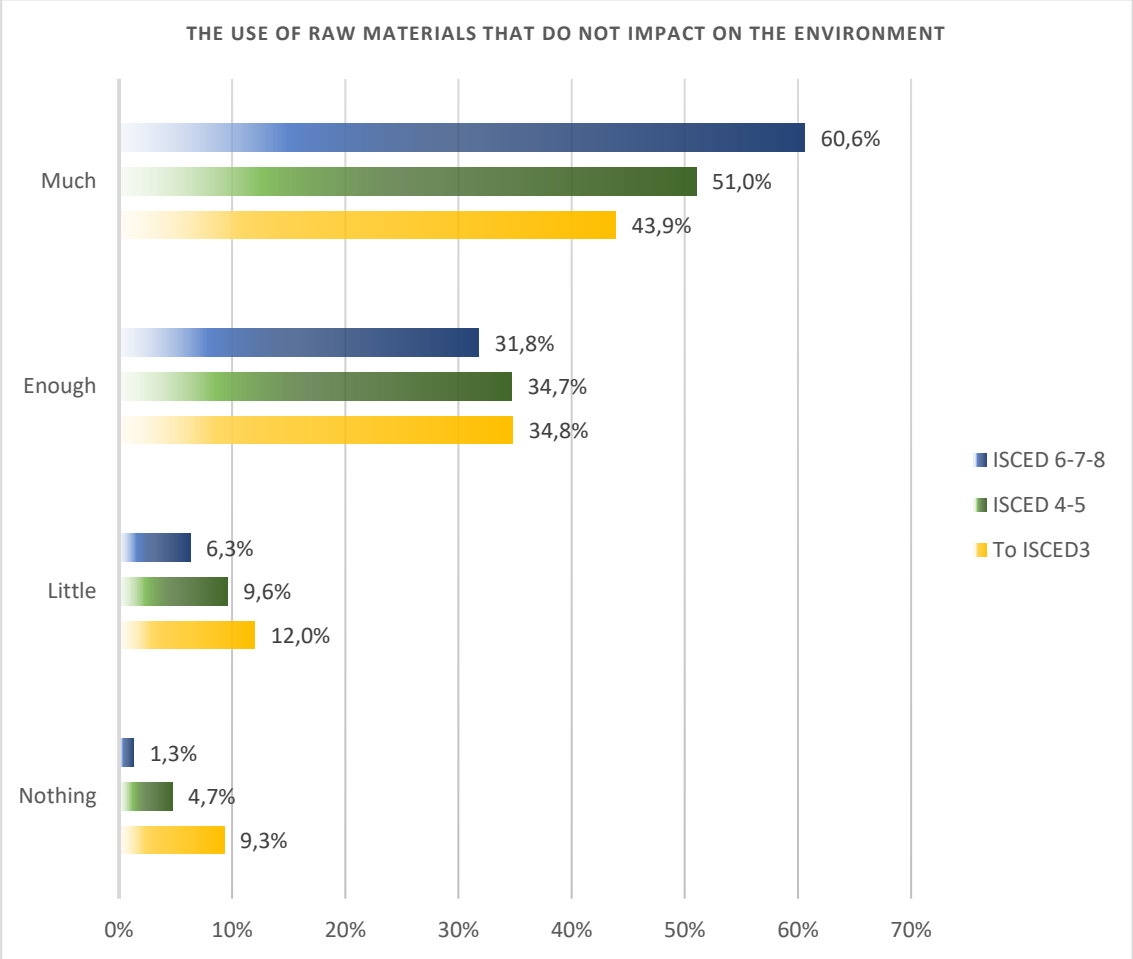
Annex 117 - Replies (%) per each willingness to pay (Why would you agree to pay more for a Bioplastic pack?)

In which way the following elements can encourage the purchase of a product in Bioplastics for everyday use?	Nothing	Little	Enough	Much	Nothing (%)	Little (%)	Enough (%)	Much (%)	Total
The use of raw materials that do not impact on the environment	159	286	1.032	1.575	5,2%	9,4%	33,8%	51,6%	3.052
Knowing that the production of raw materials does not have negative effects on the economy of the producing countries (e.g. monocultures, deforestation, etc.)	164	423	1.231	1.220	5,4%	13,9%	40,5%	40,2%	3.038
The presence of the words "Packaging made with 50% recycled plastic"	256	809	1.310	639	8,5%	26,8%	43,5%	21,2%	3.014
The awareness that it is a positive investment for health	183	466	1.227	1.156	6,0%	15,4%	40,5%	38,1%	3.032
Trademarks and tips on container disposal	201	535	1.329	940	6,7%	17,8%	44,2%	31,3%	3.005
The awareness that this helps the planet to save it for future generations	240	401	953	1.447	7,9%	13,2%	31,3%	47,6%	3.041

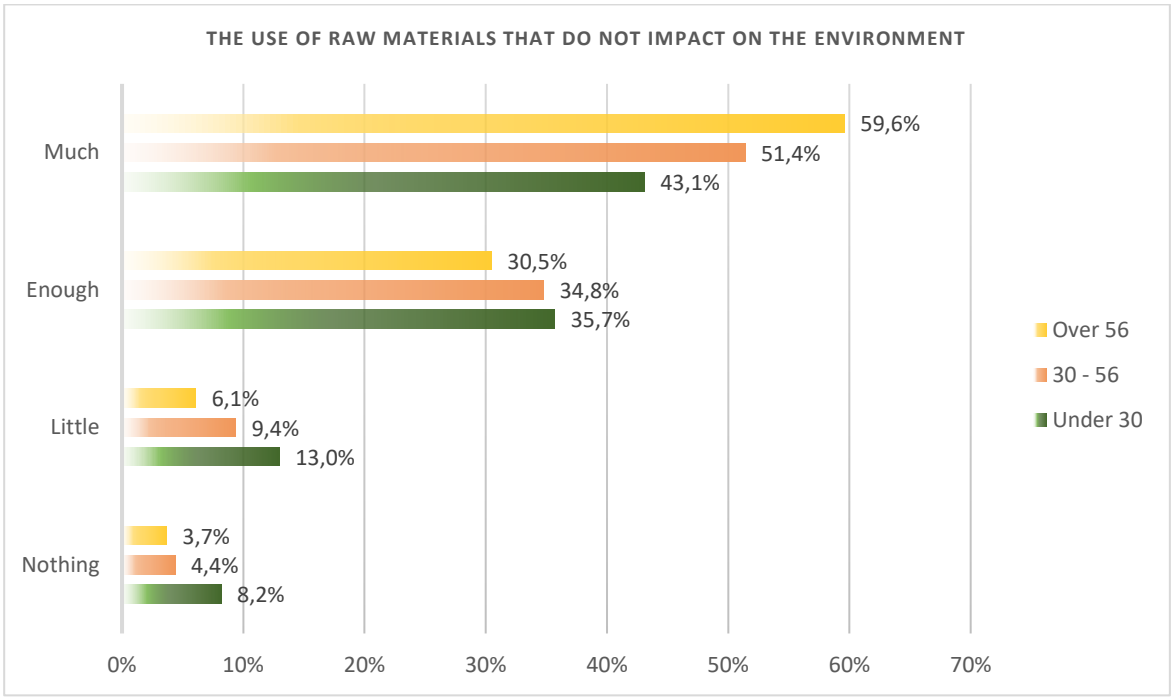
Annex 116 - Number and percentage of respondents (Elements that can encourage the purchase of a product in Bioplastics)



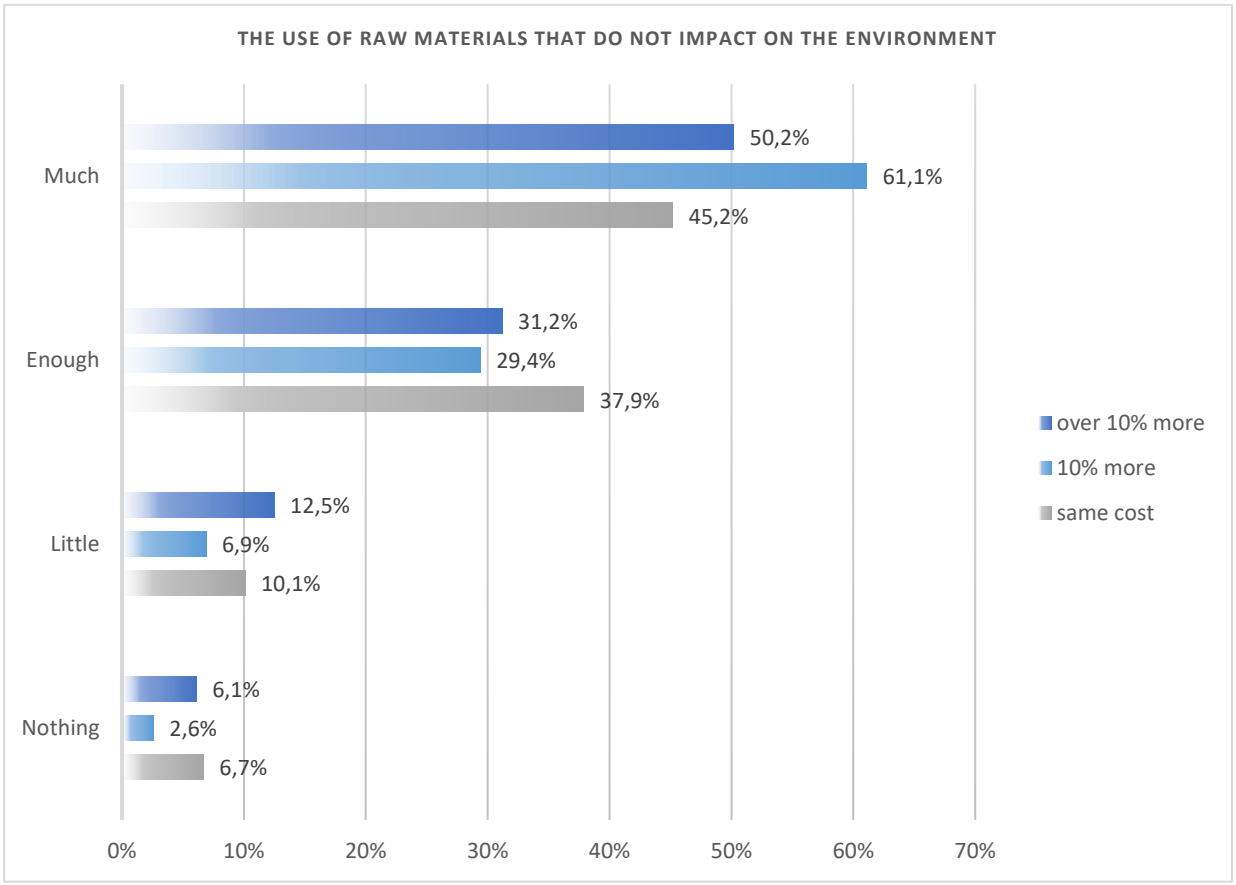
Annex 118 - Replies (%) per gender (The use of raw materials that do not impact on the environment)



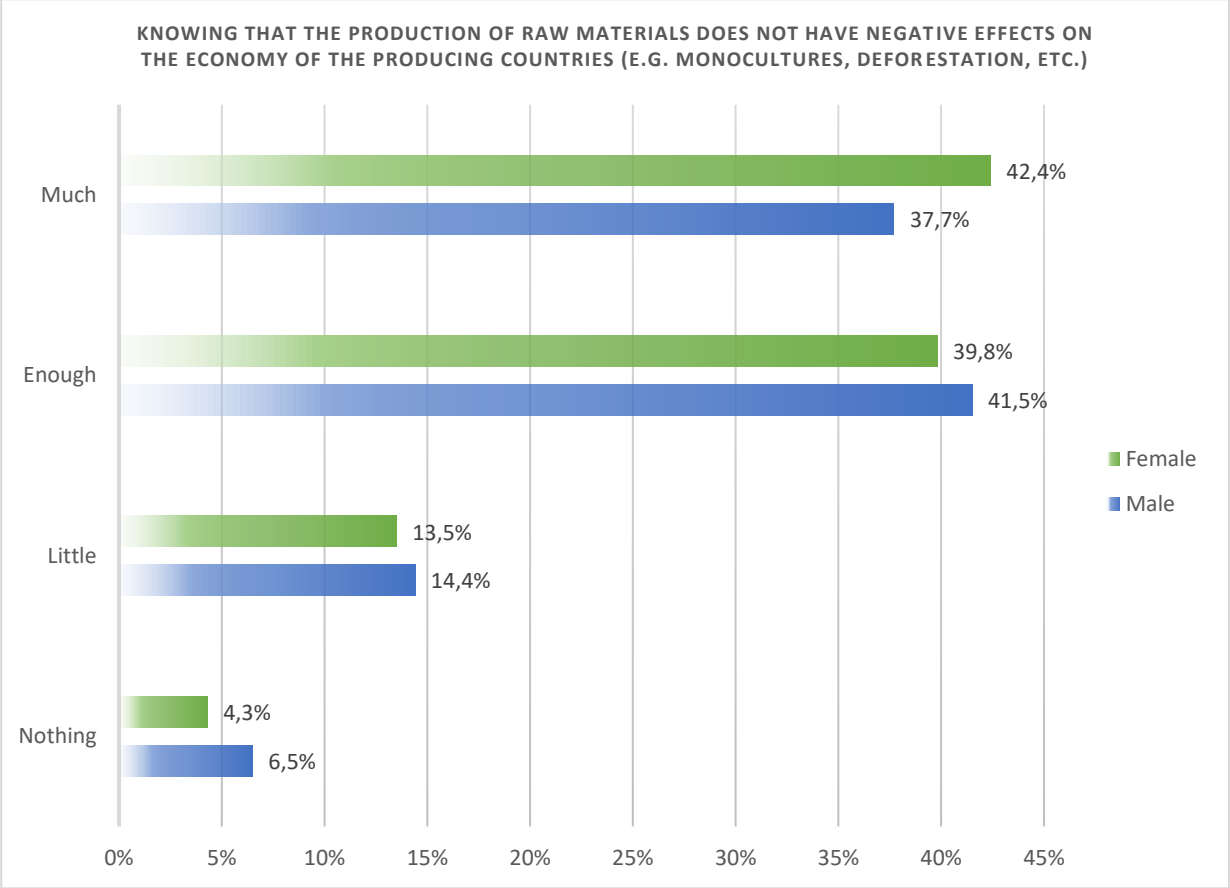
Annex 119 - Replies (%) per each education group (The use of raw materials that do not impact on the environment)



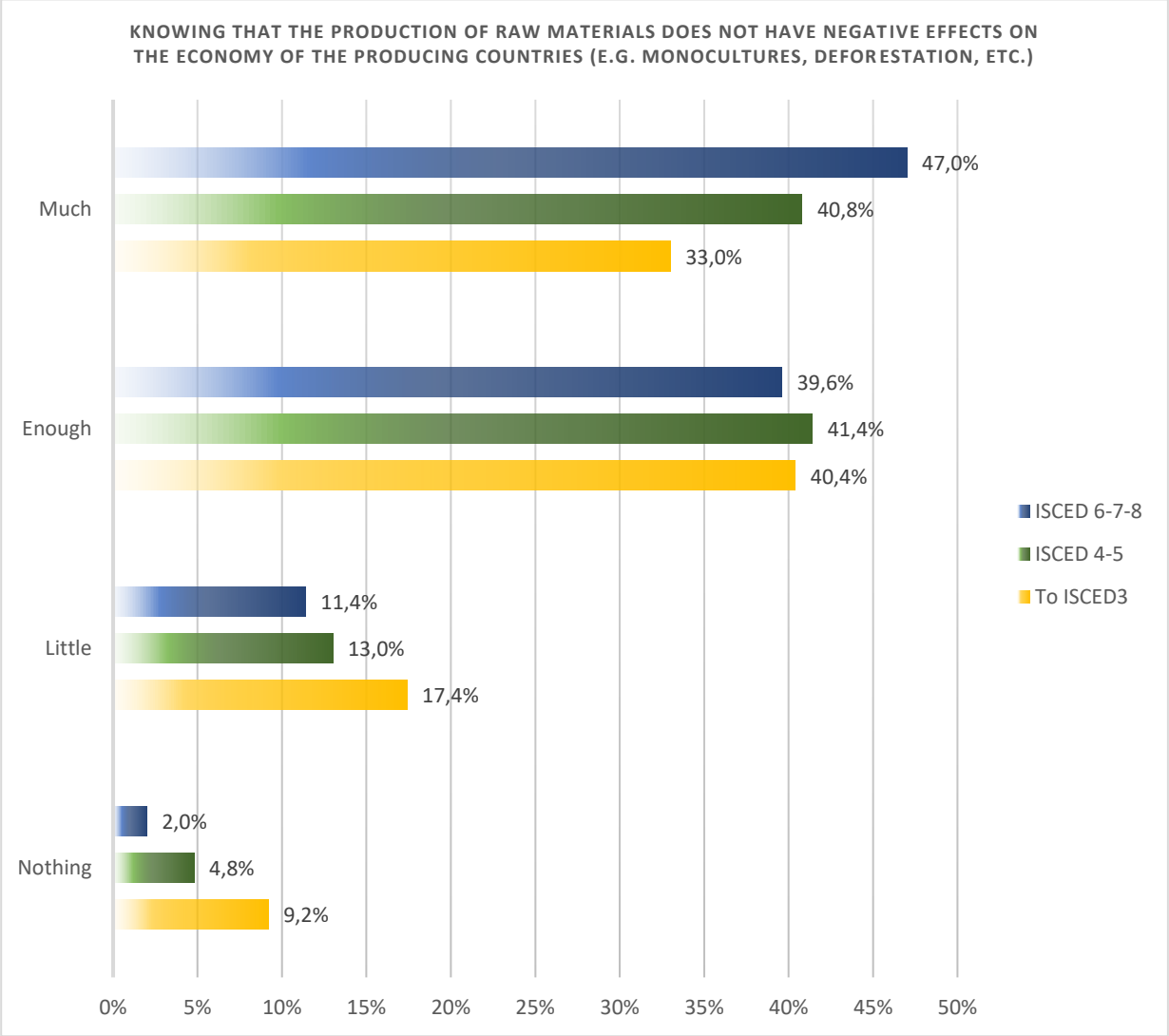
Annex 120 - Replies (%) per each age group (The use of raw materials that do not impact on the environment)



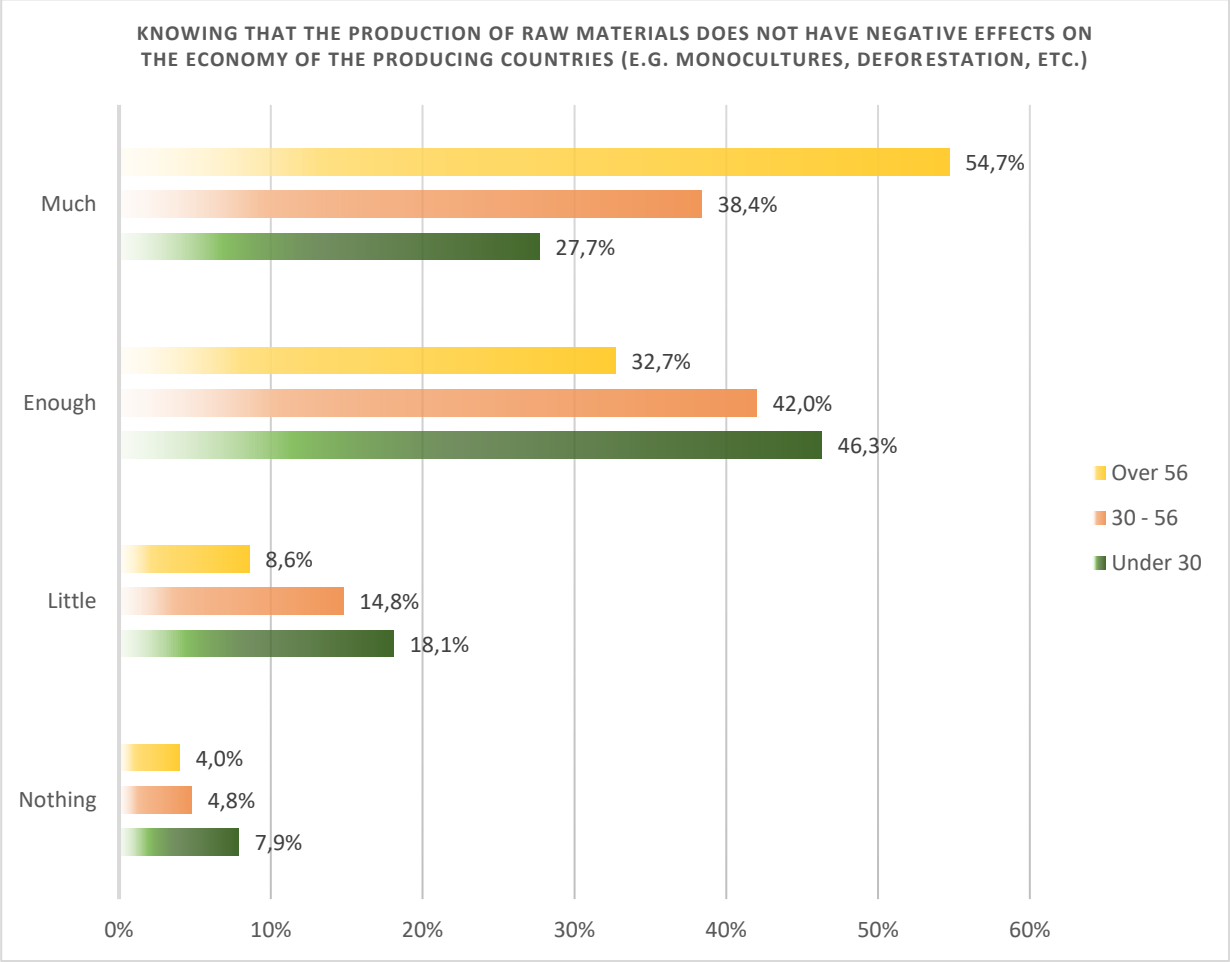
Annex 121 - Replies (%) per each willingness to pay (The use of raw materials that do not impact on the environment)



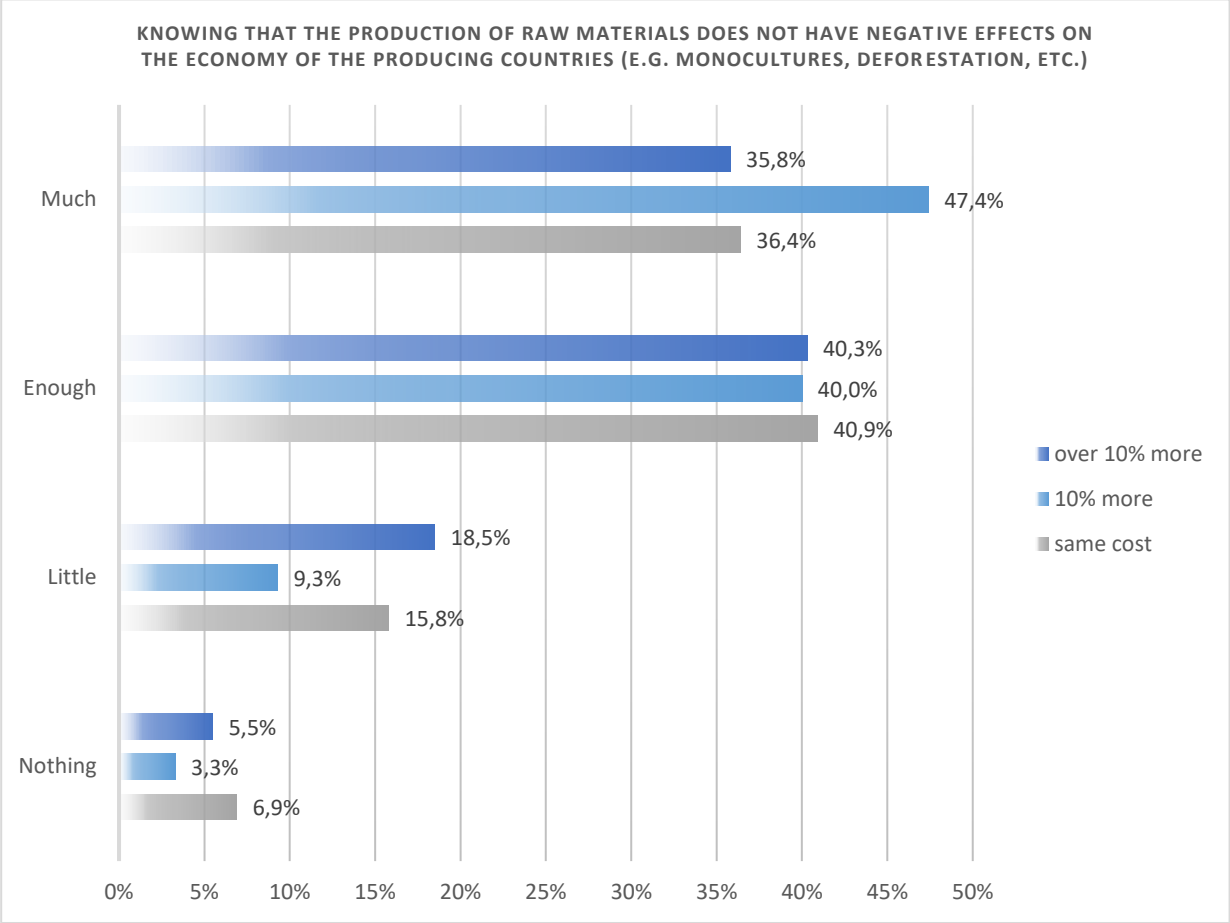
Annex 122 - Replies (%) per gender (Knowing that the production of raw materials does not have negative effects)



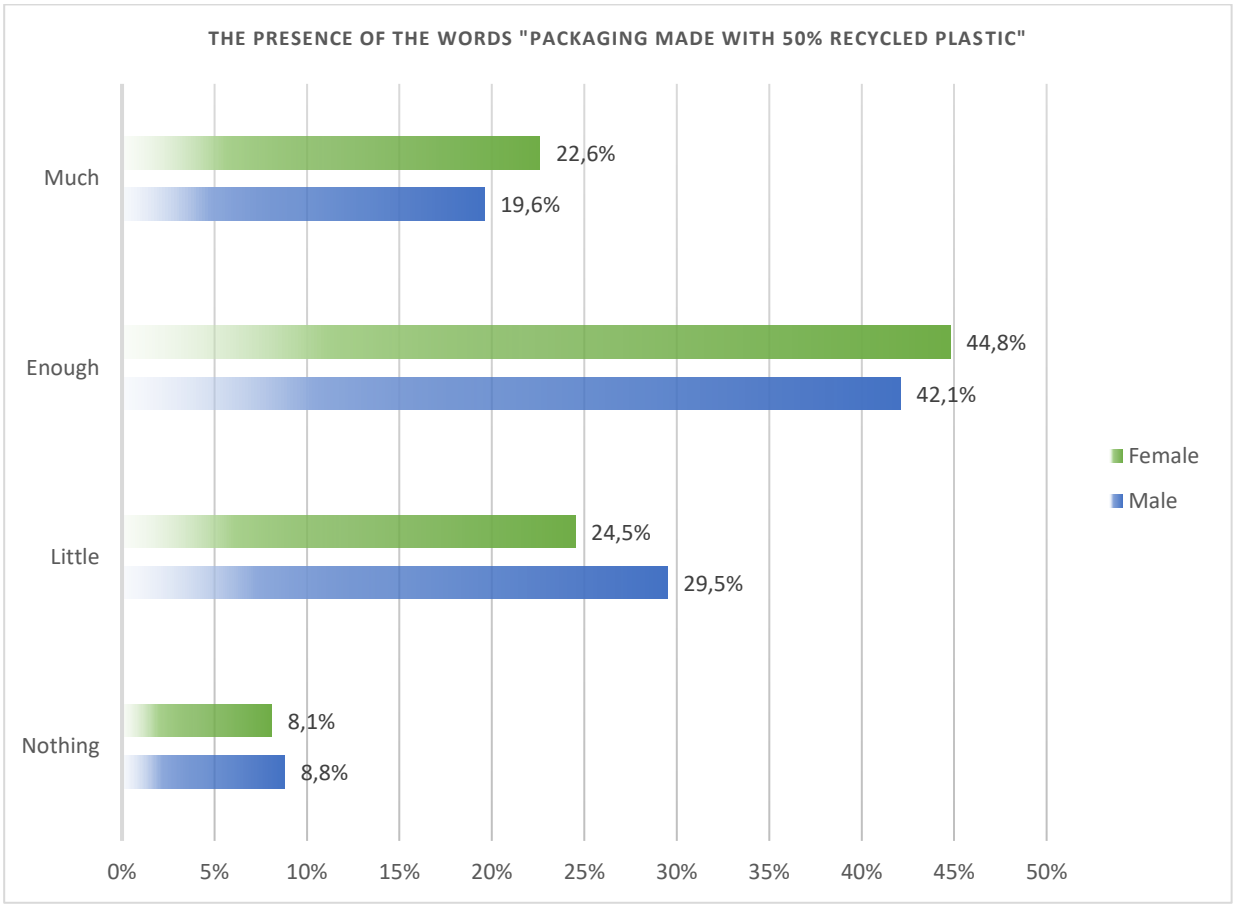
Annex 123 - Replies (%) per each education group (Knowing that the production of raw materials does not have negative effects)



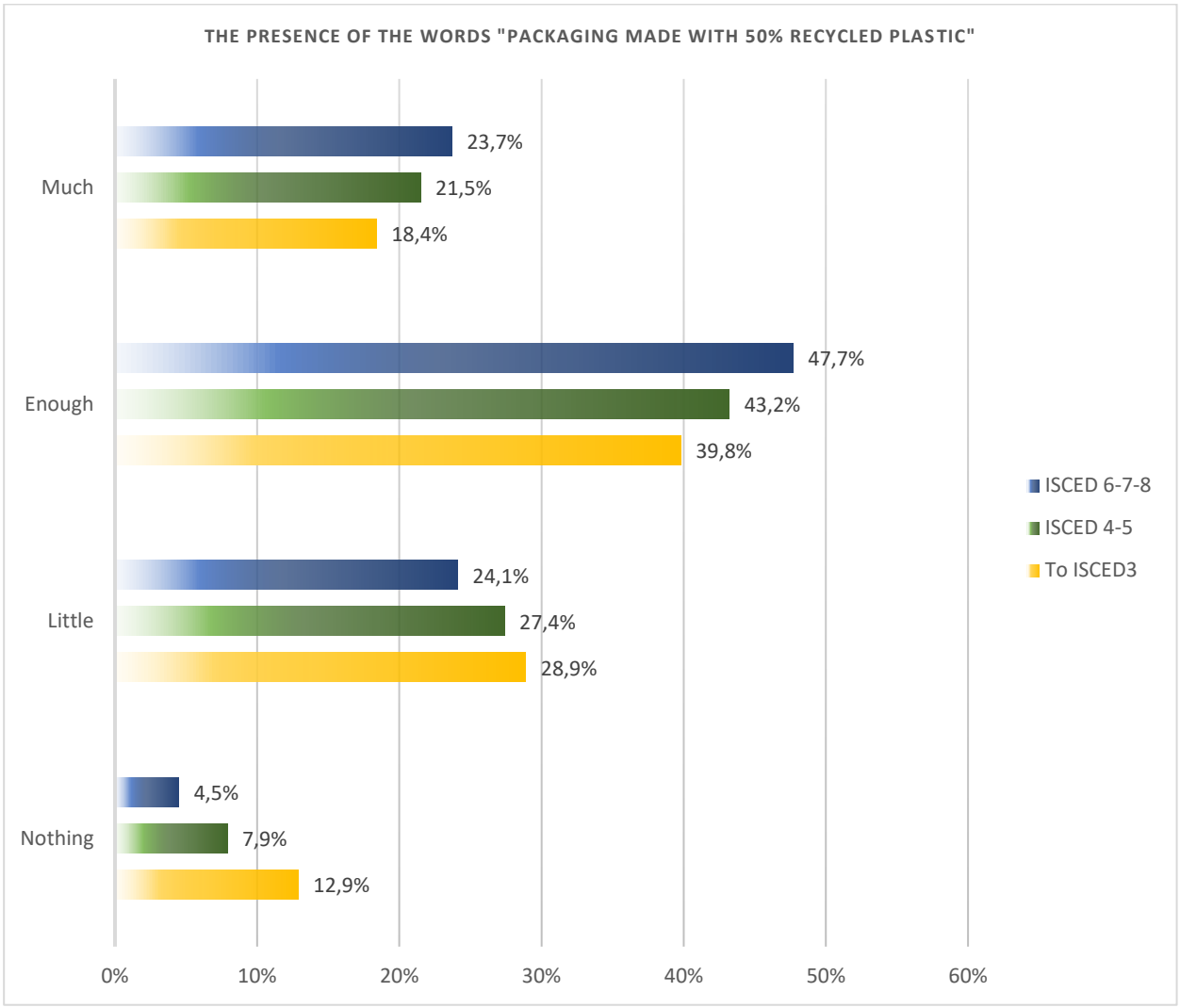
Annex 124 - Replies (%) per each age group (Knowing that the production of raw materials does not have negative effects)



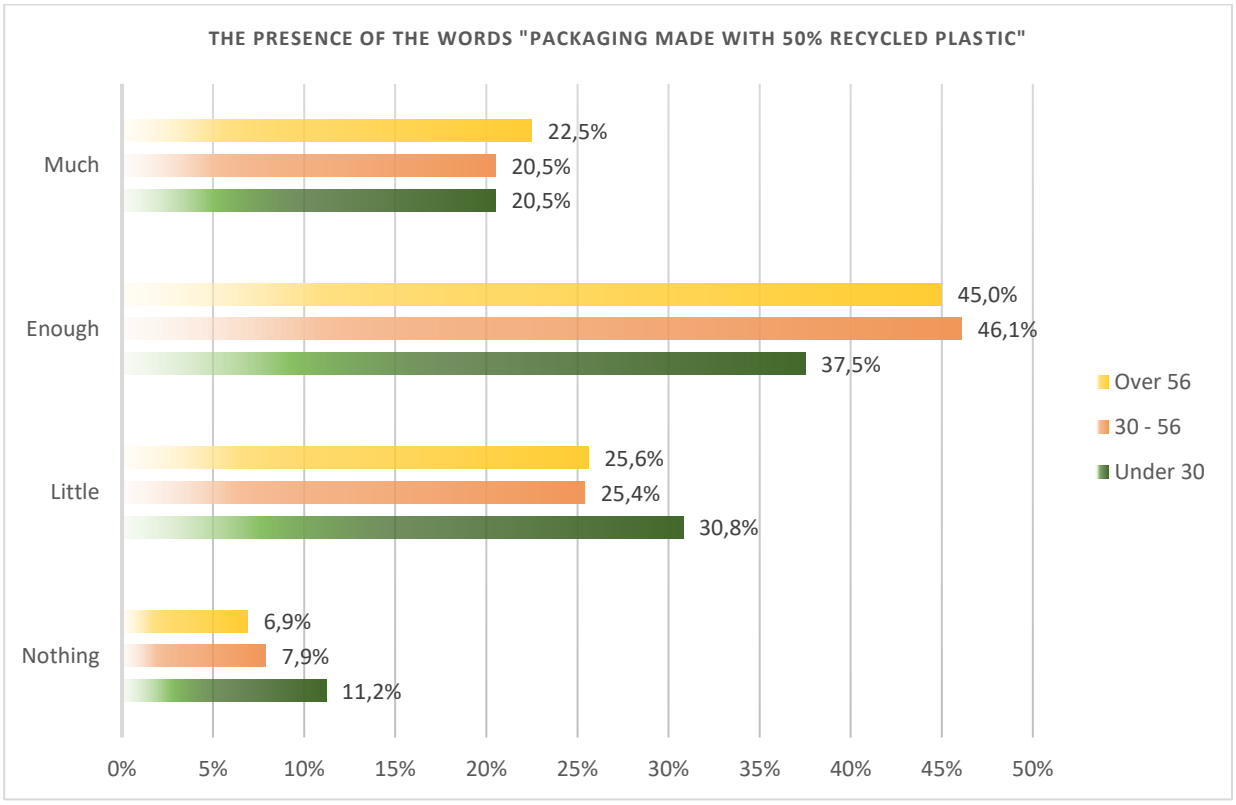
Annex 125 - Replies (%) per each willingness to pay (Knowing that the production of raw materials does not have negative effects)



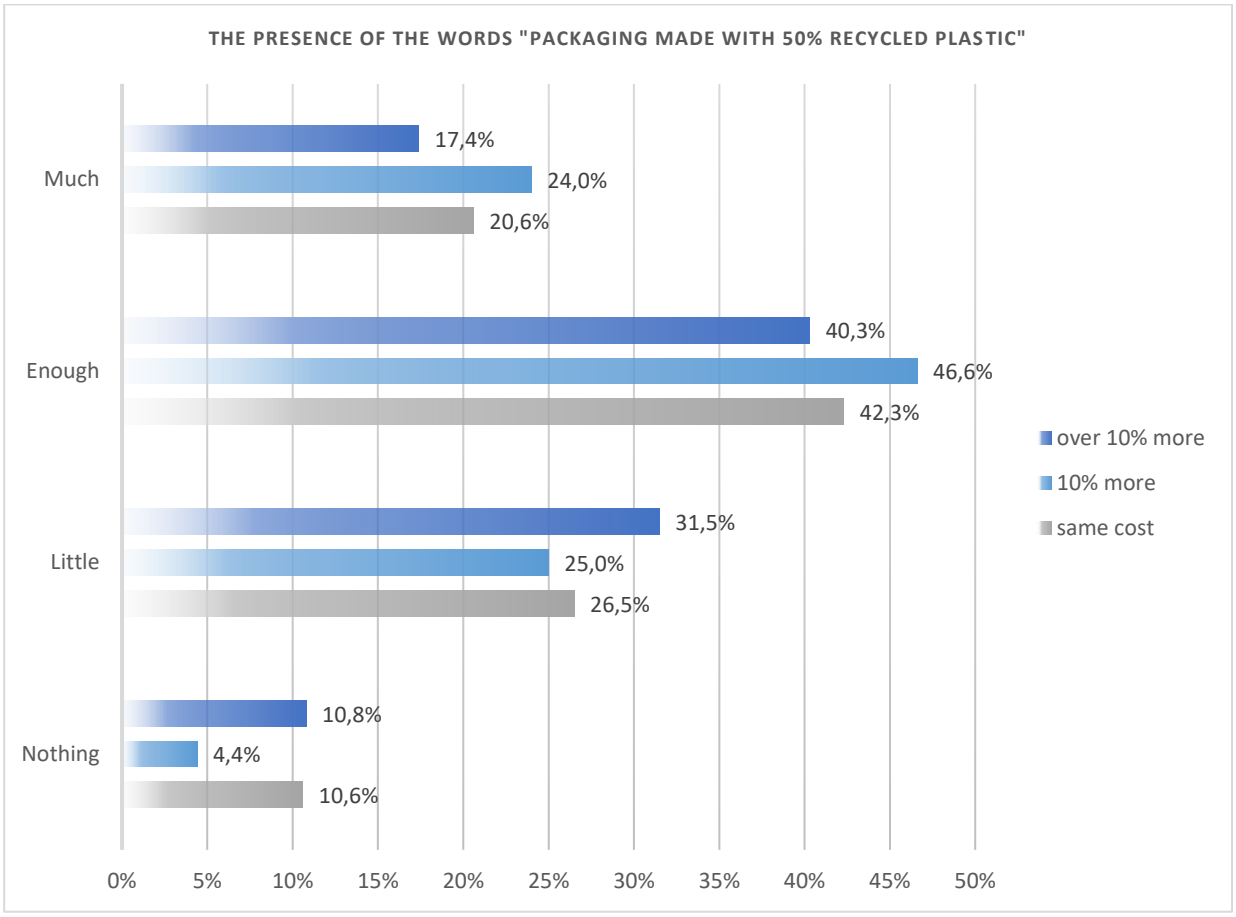
Annex 126 - Replies (%) per gender (Packaging made with 50% recycled plastic)



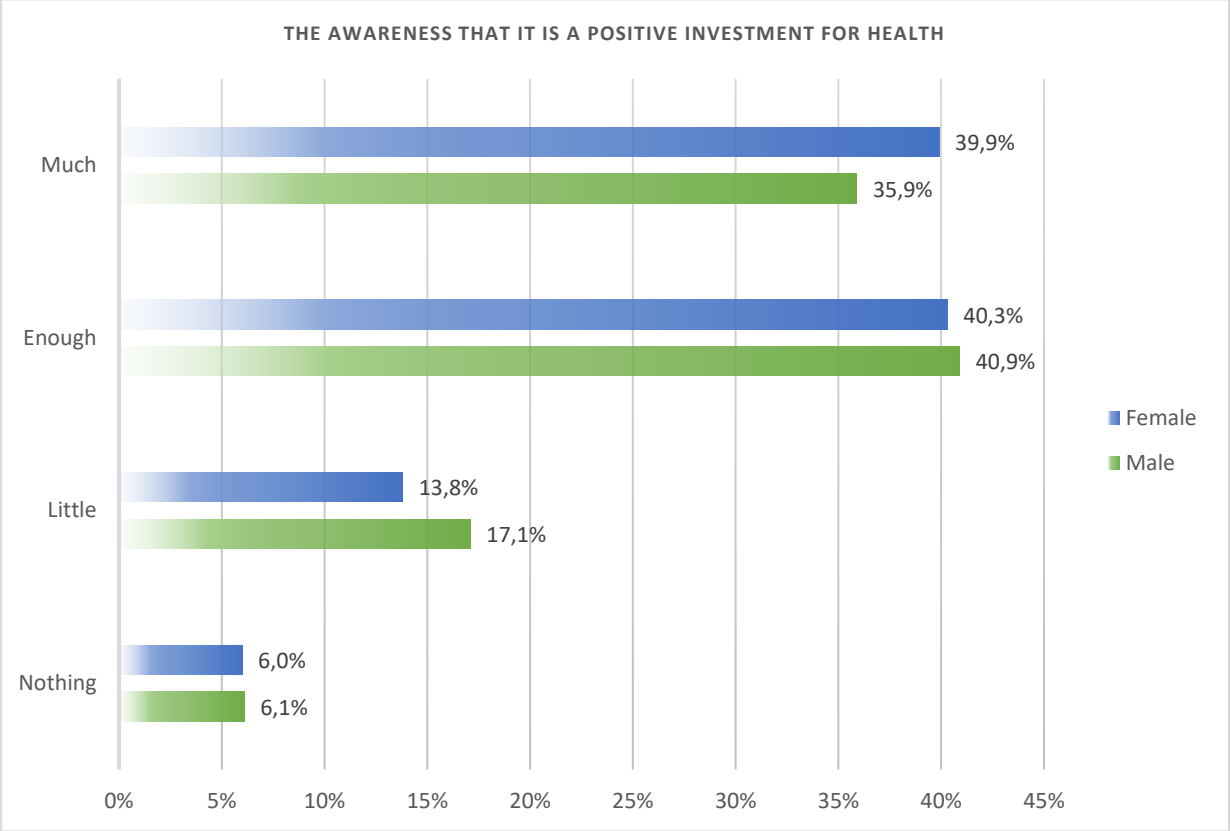
Annex 127 - Replies (%) per each education group (Packaging made with 50% recycled plastic)



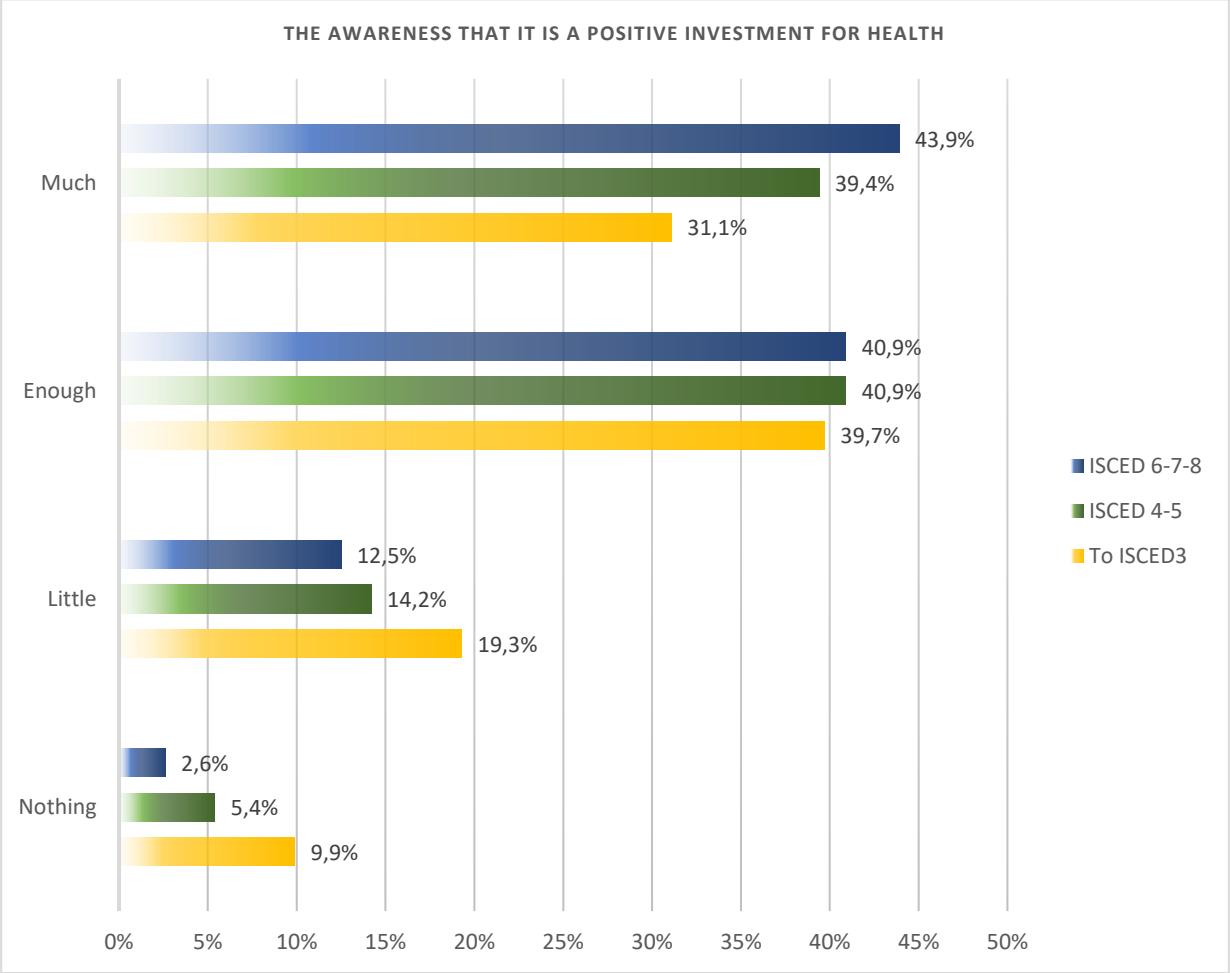
Annex 128 - Replies (%) per each age group (Packaging made with 50% recycled plastic)



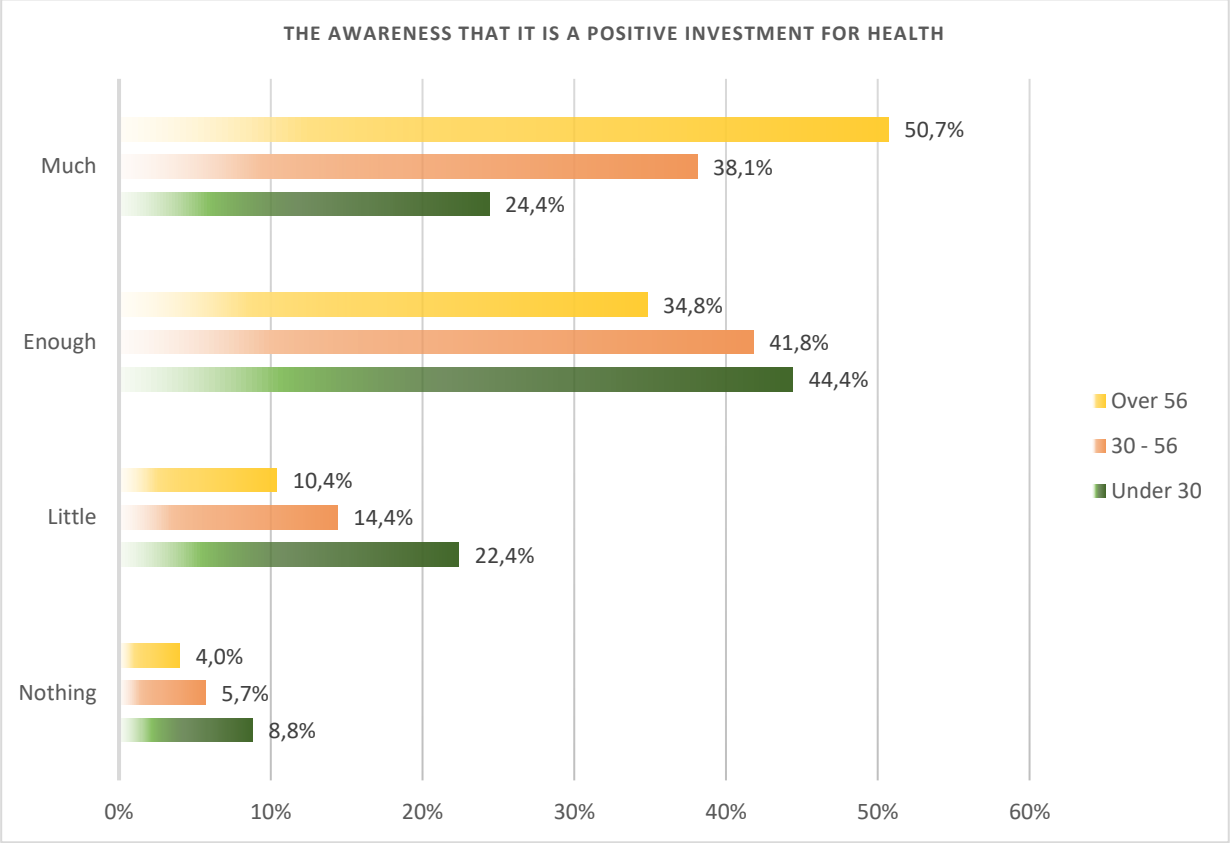
Annex 129 - Replies (%) per each willingness to pay (Packaging made with 50% recycled plastic)



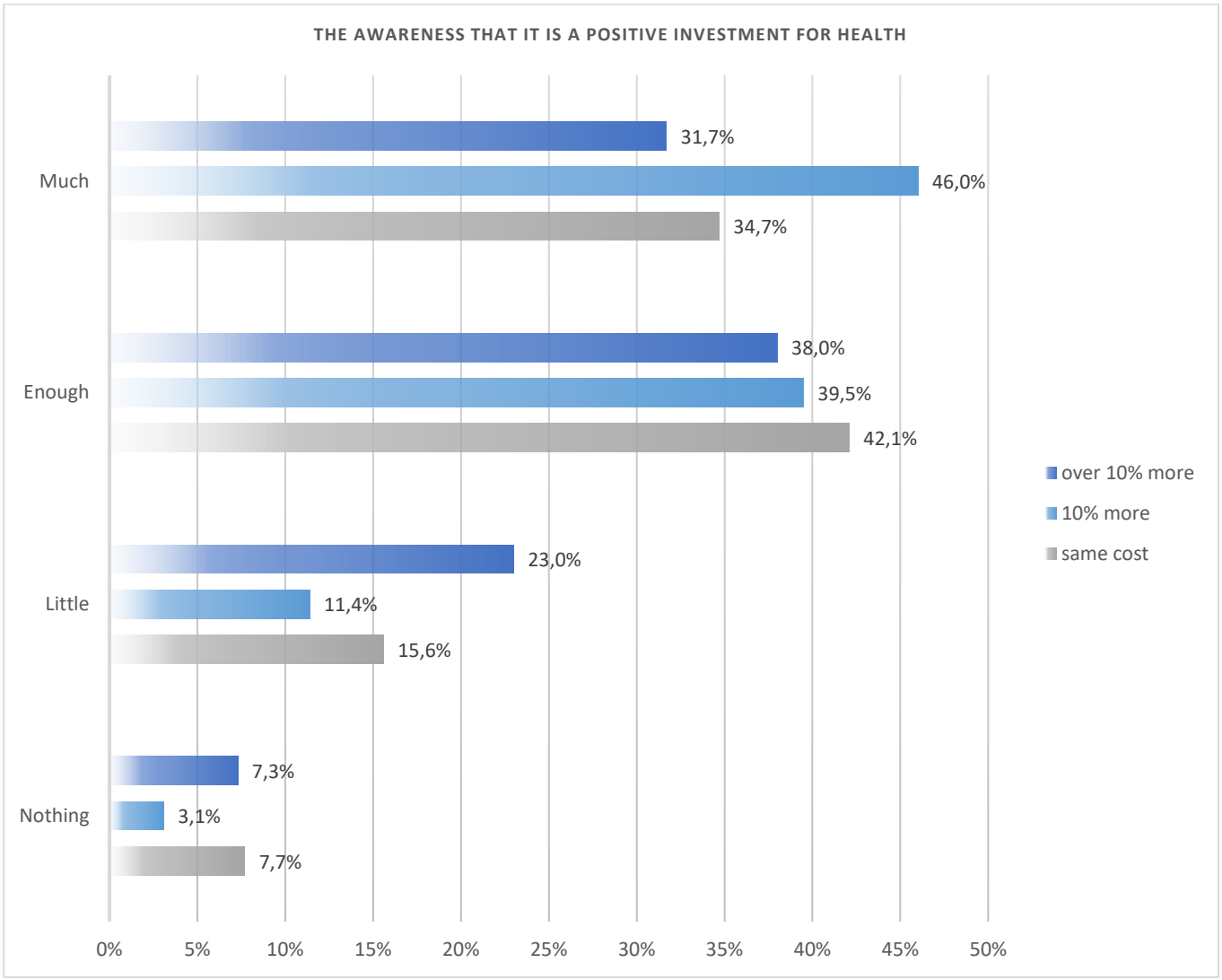
Annex 130 - Replies (%) per gender (The awareness that it is a positive investment for health)



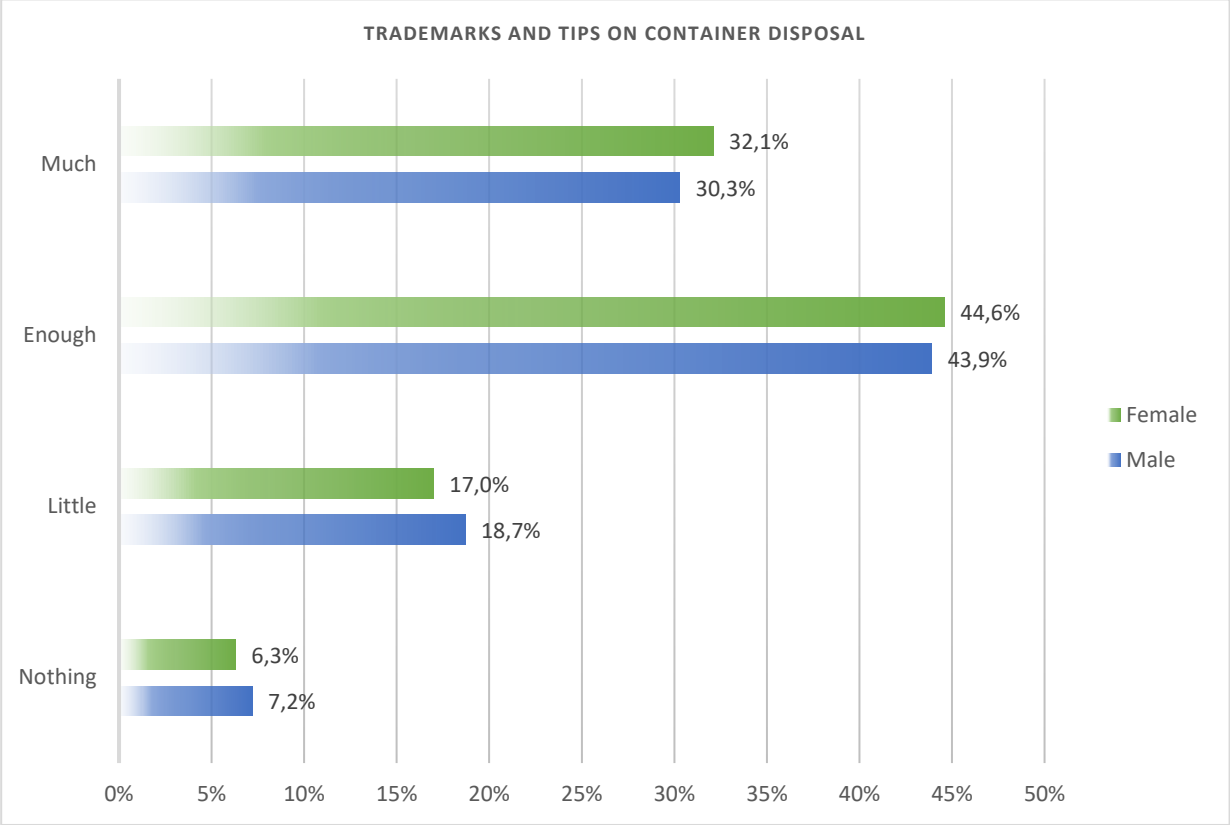
Annex 131 - Replies (%) per each education group (The awareness that it is a positive investment for health)



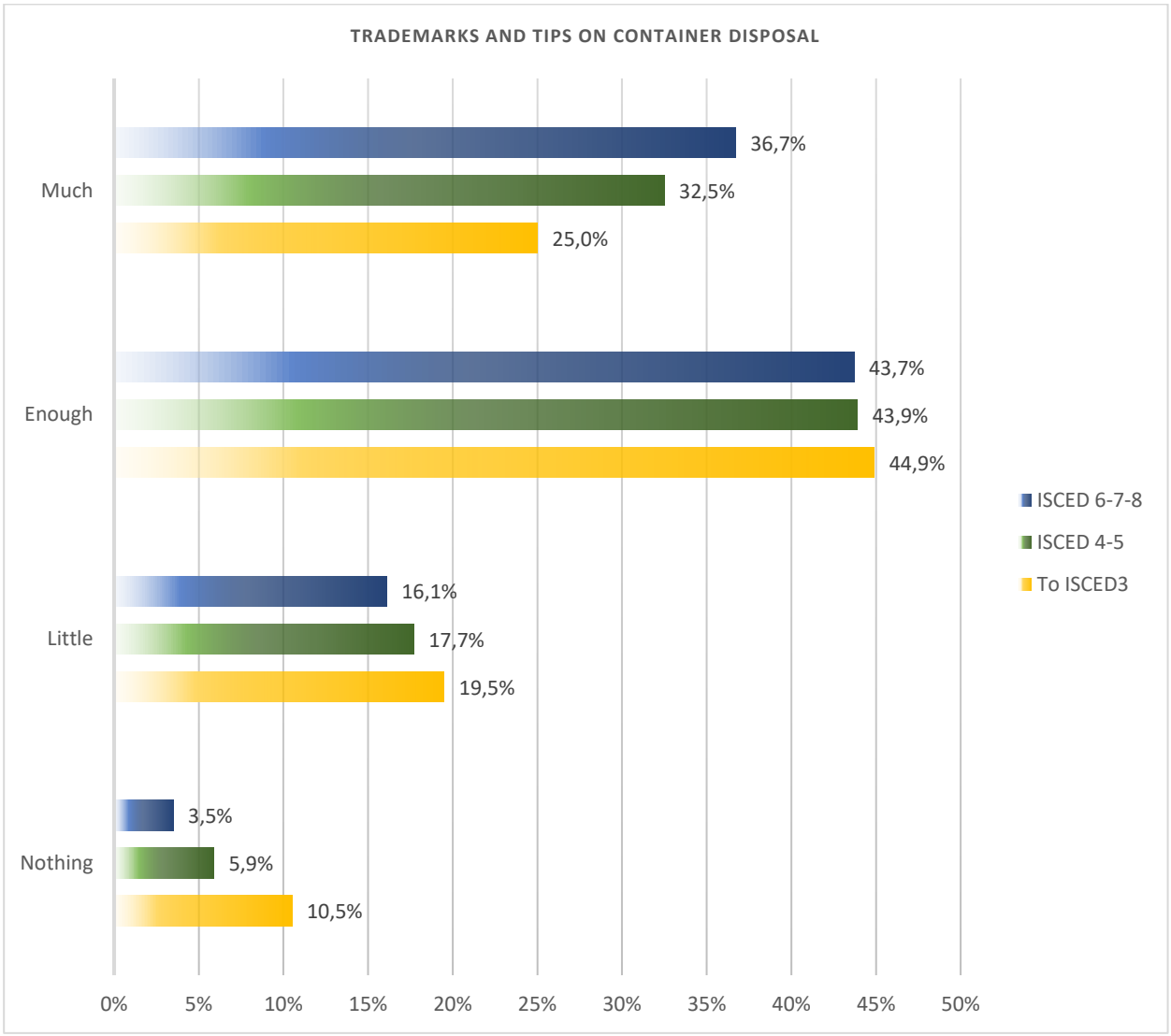
Annex 132 - Replies (%) per each age group (The awareness that it is a positive investment for health)



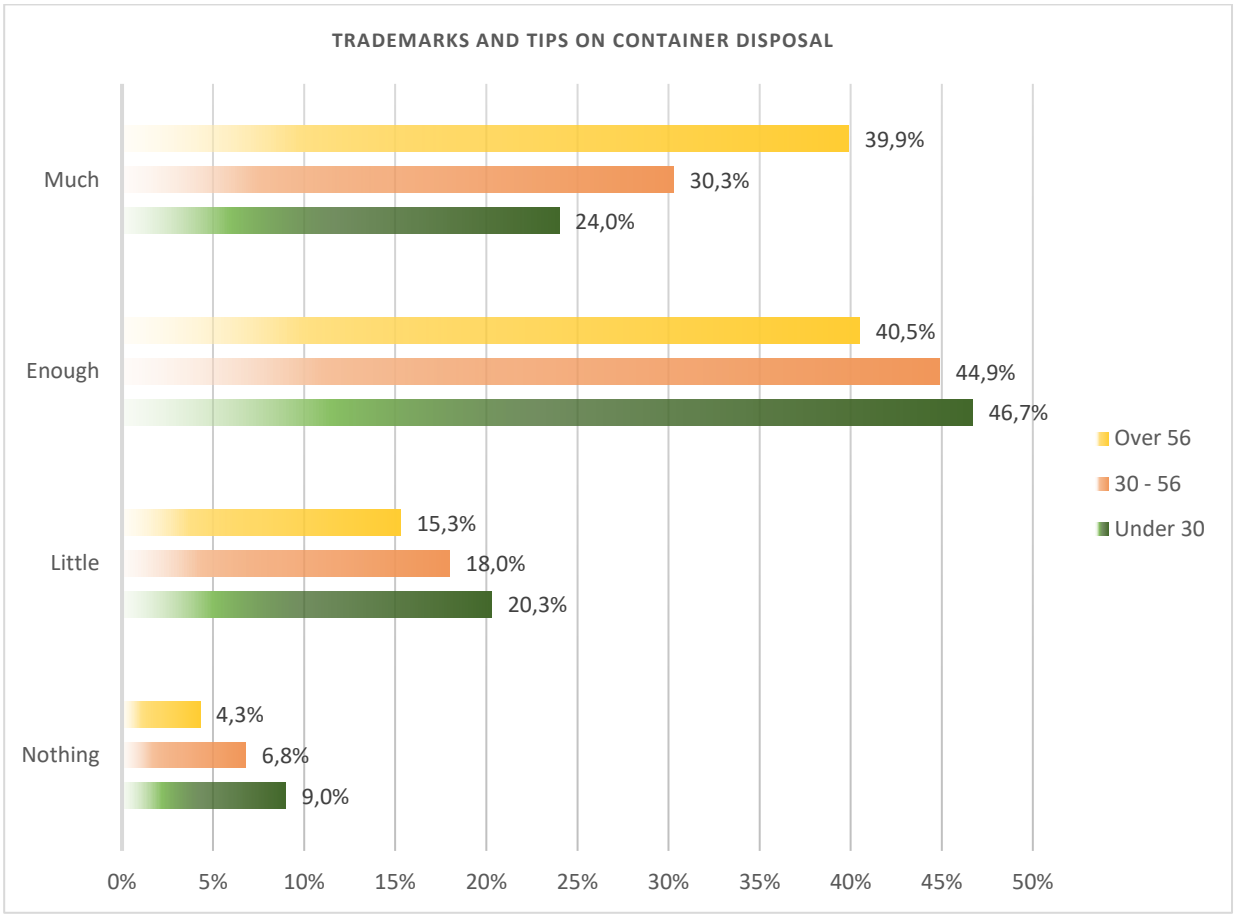
Annex 133 - Replies (%) per each willingness to pay (The awareness that it is a positive investment for health)



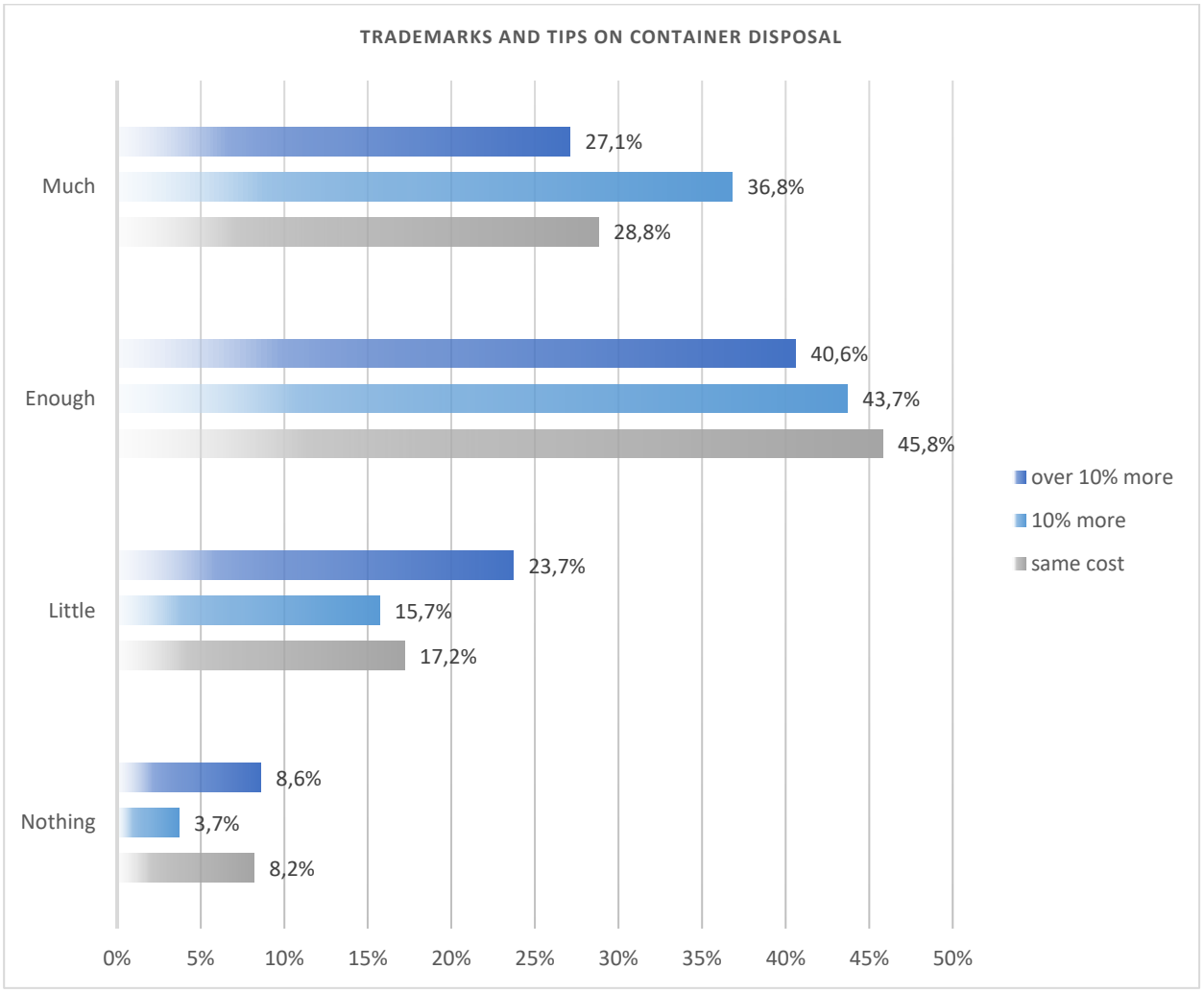
Annex 134 - Replies (%) per gender (Trademarks and tips on container disposal)



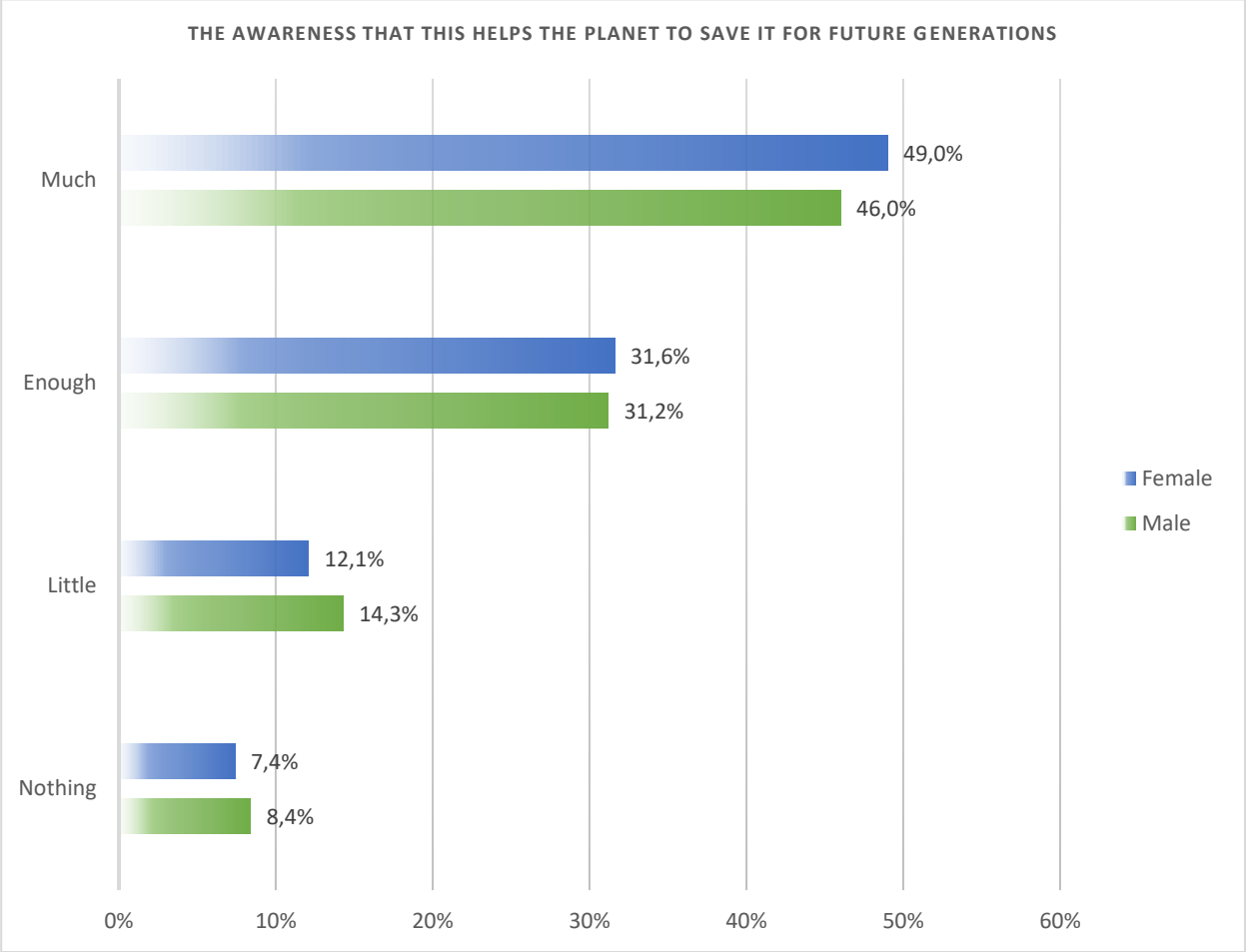
Annex 135 - Replies (%) per each education group (Trademarks and tips on container disposal)



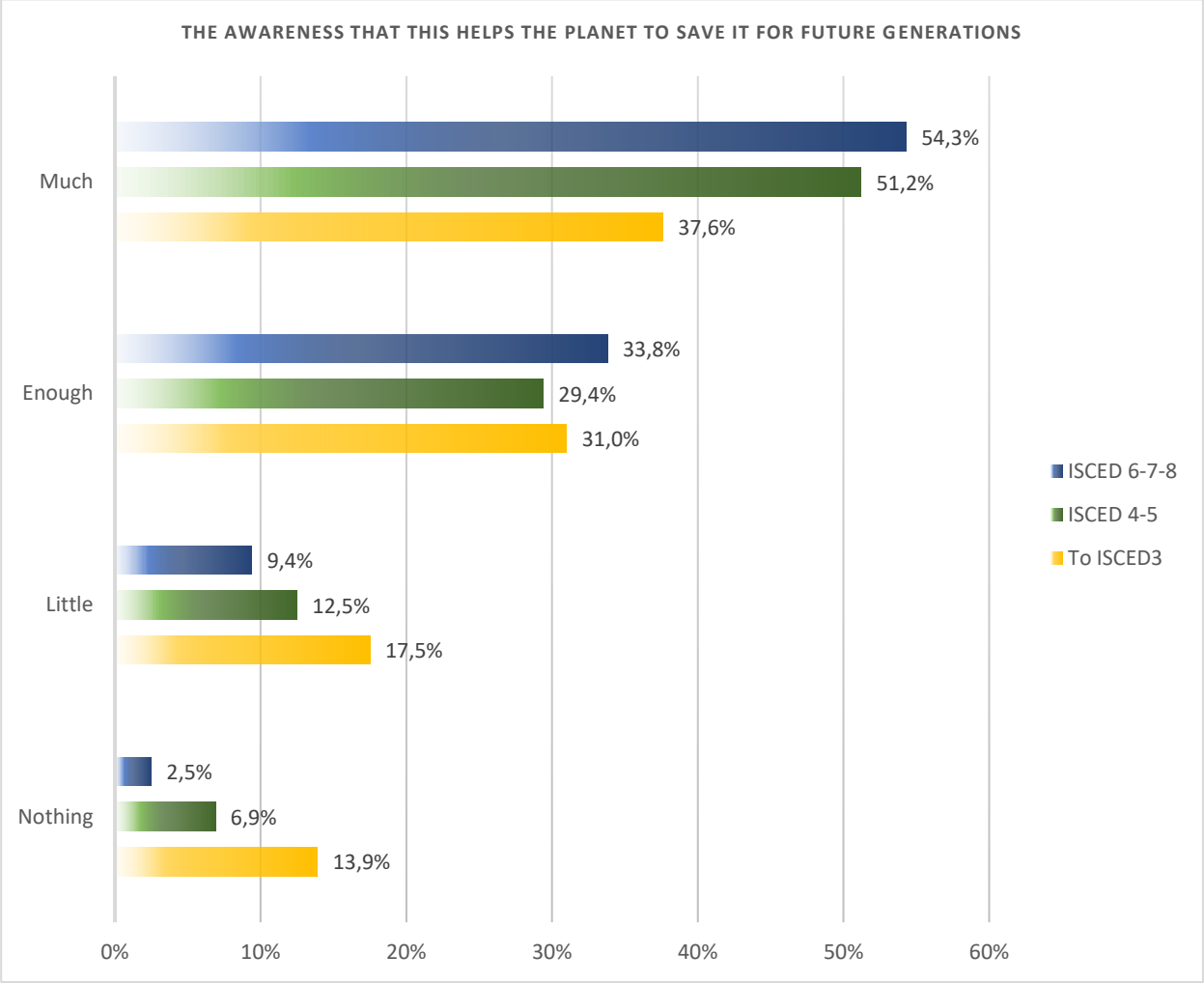
Annex 136 - Replies (%) per each age group (Trademarks and tips on container disposal)



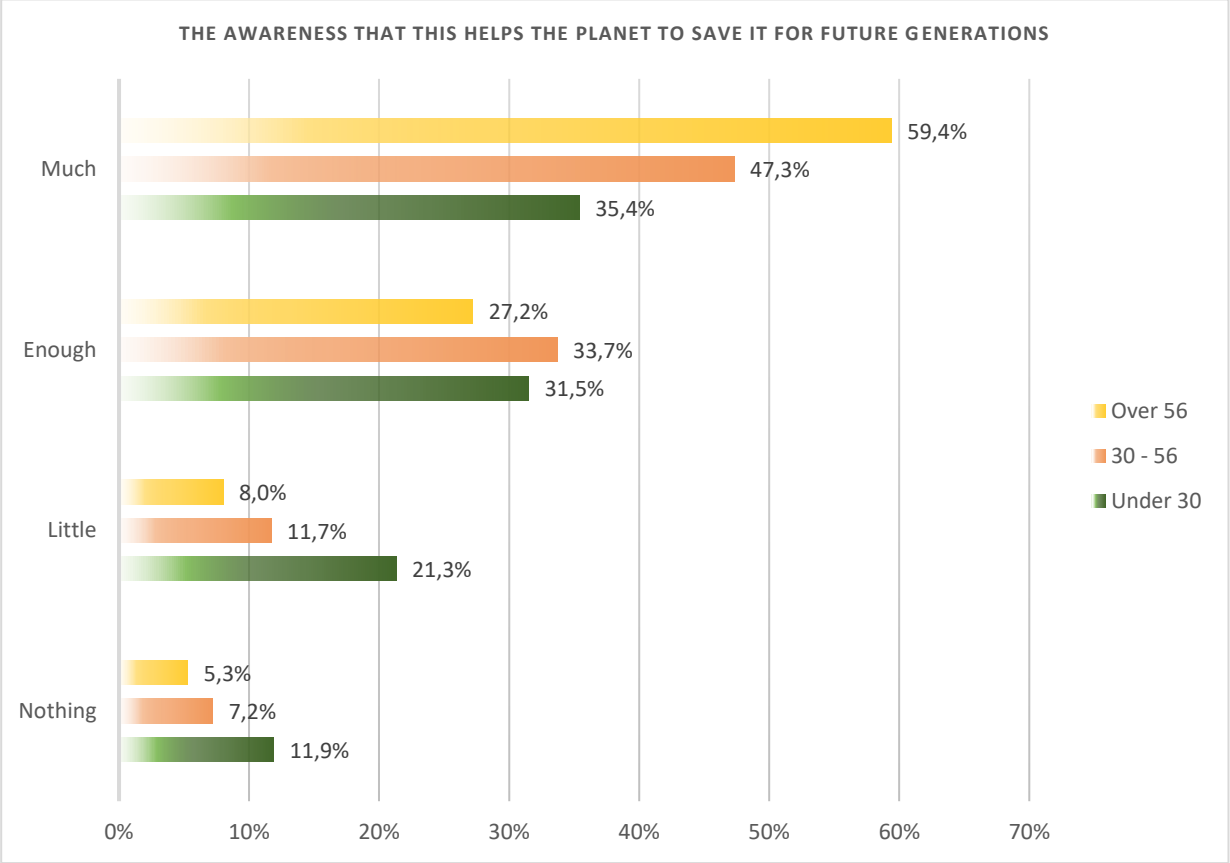
Annex 137 - Replies (%) per each willingness to pay (Trademarks and tips on container disposal)



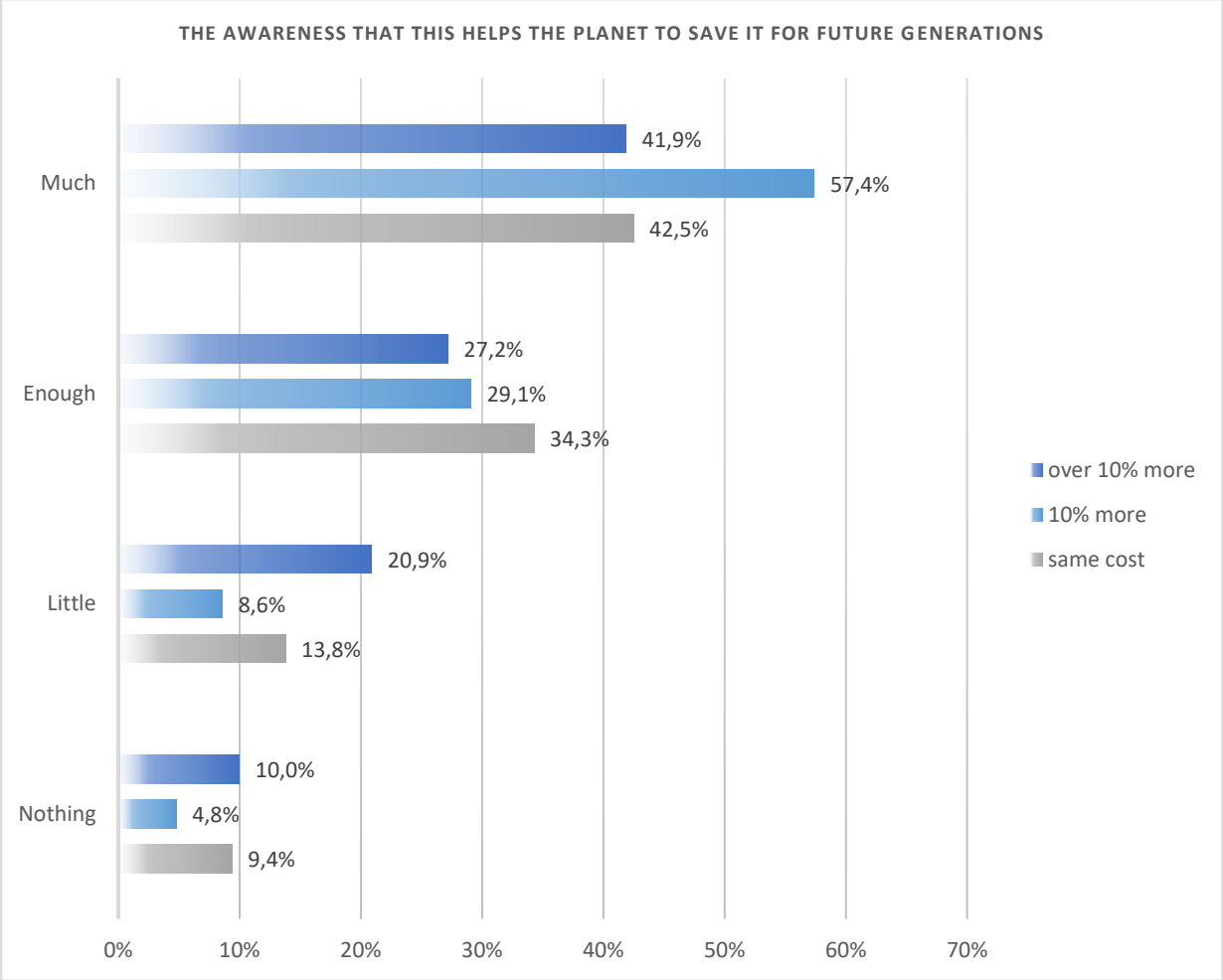
Annex 138 - Replies (%) per gender (The awareness that this helps the planet to save it for future generations)



Annex 139 - Replies (%) per each education group (The awareness that this helps the planet to save it for future generations)



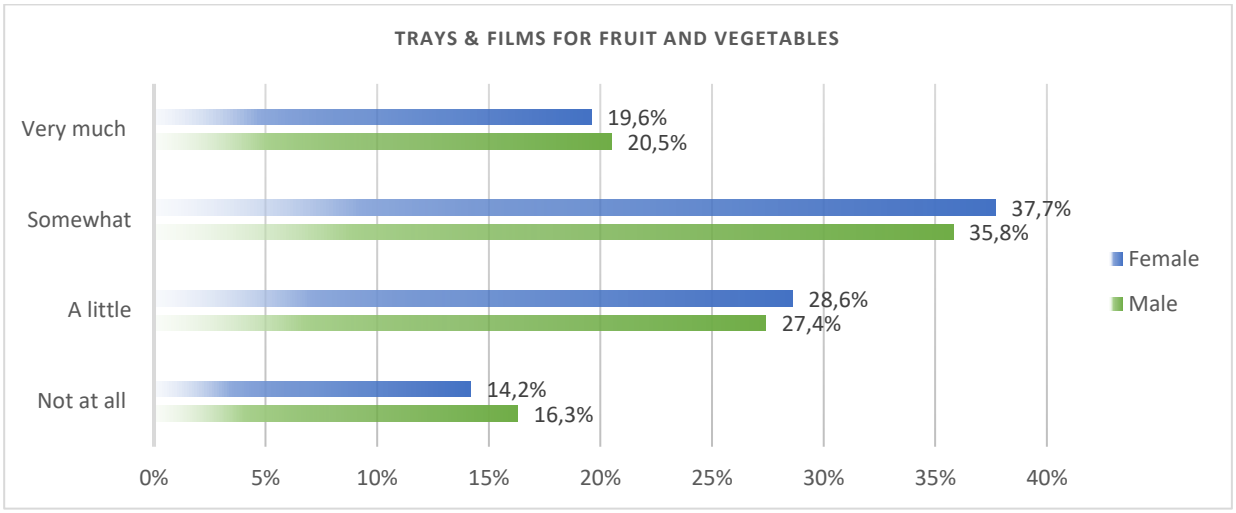
Annex 140 - Replies (%) per each age group (The awareness that this helps the planet to save it for future generations)



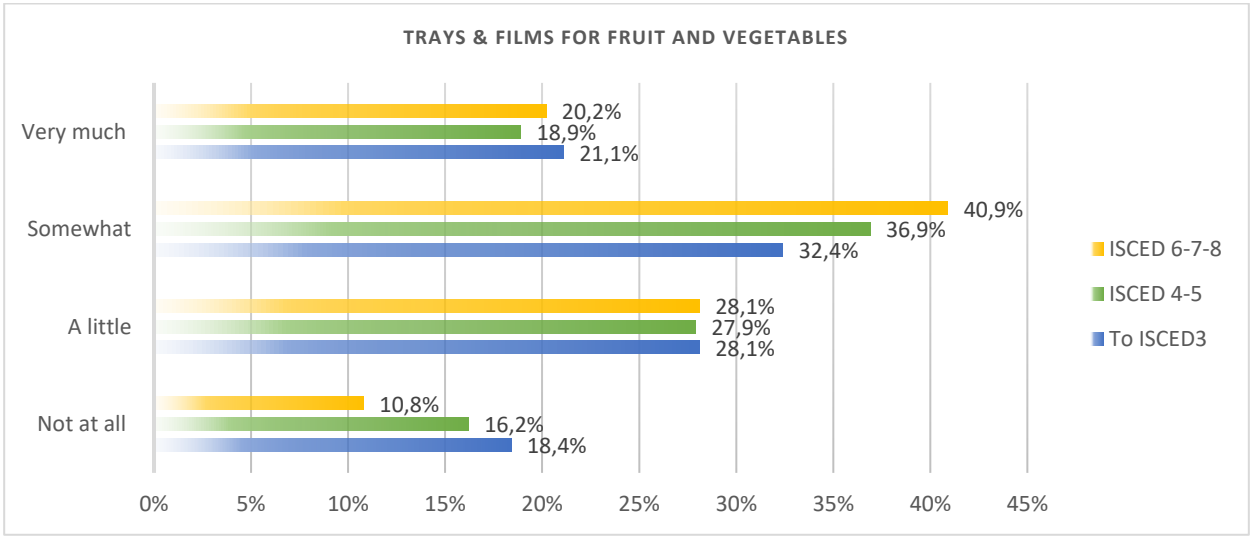
Annex 141 - Replies (%) per each willingness to pay (The awareness that this helps the planet to save it for future generations)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Trays & films for fruit and vegetables	N° Replies	% Replies
Not at all	469	15,3%
A little	858	28,0%
Somewhat	1.125	36,7%
Very much	614	20,0%
Total	3.066	100%

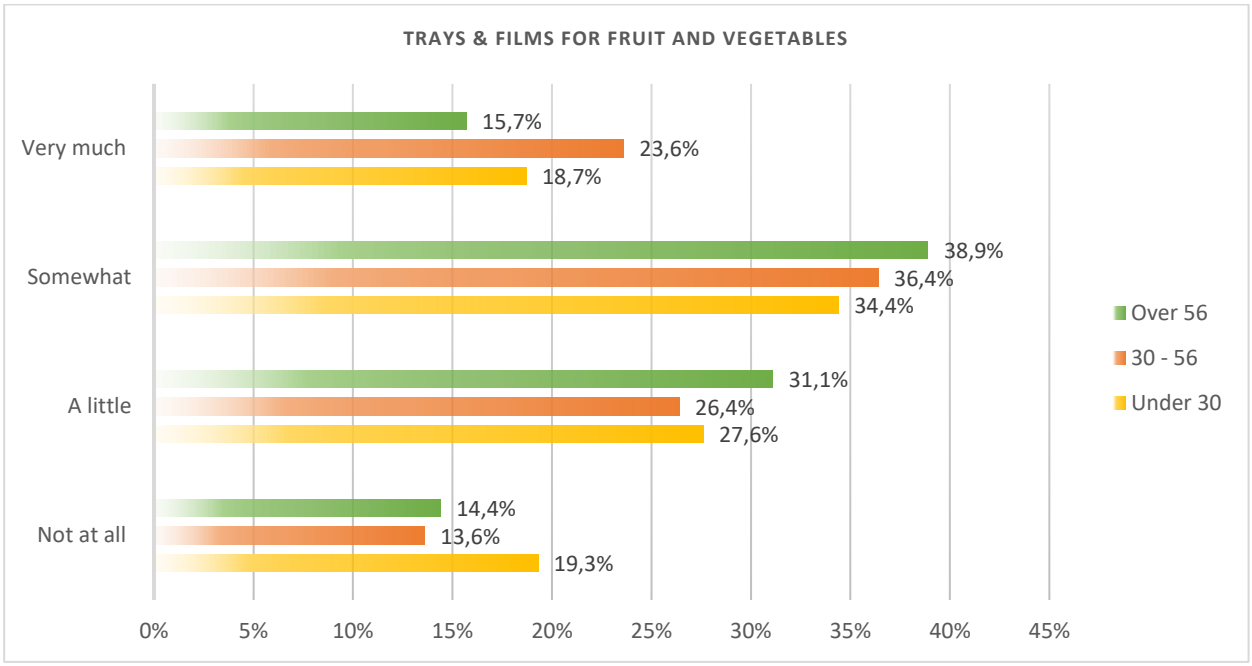
Annex 142 - Number and percentage of respondents (Trays & films for fruit and vegetables)



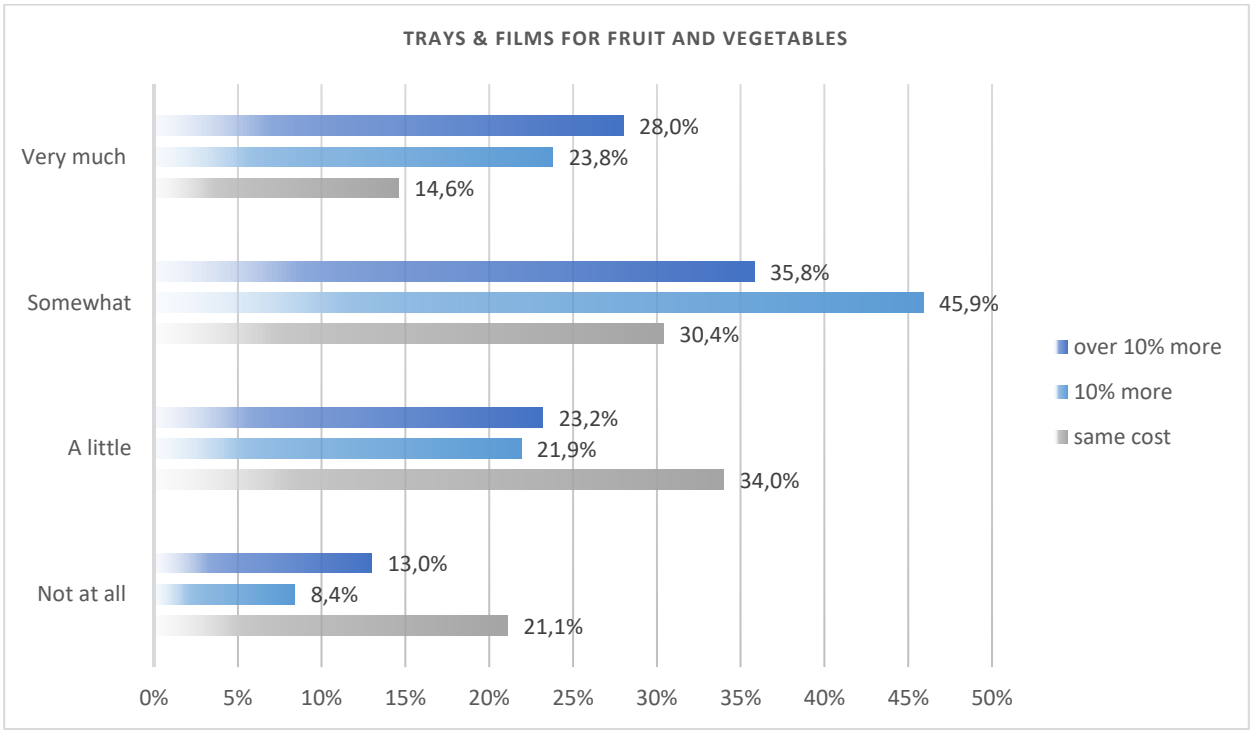
Annex 143 - Replies (%) per gender (Trays & films for fruit and vegetables)



Annex 144 - Replies (%) per each education group (Trays & films for fruit and vegetables)



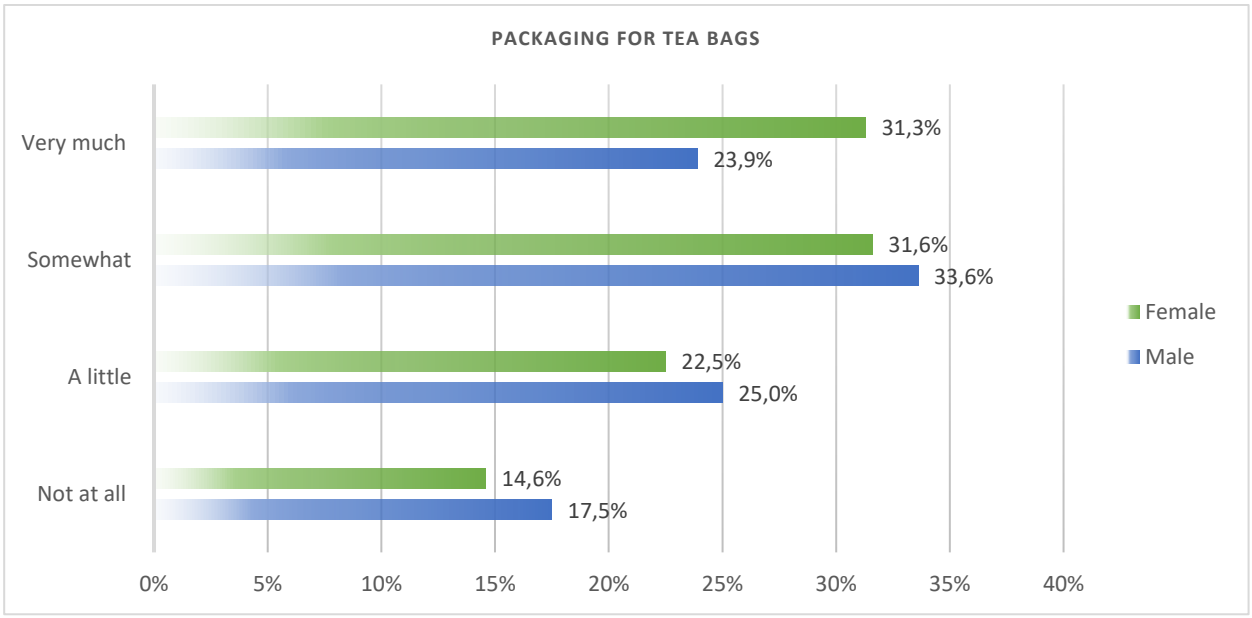
Annex 145 - Replies (%) per each age group (Trays & films for fruit and vegetables)



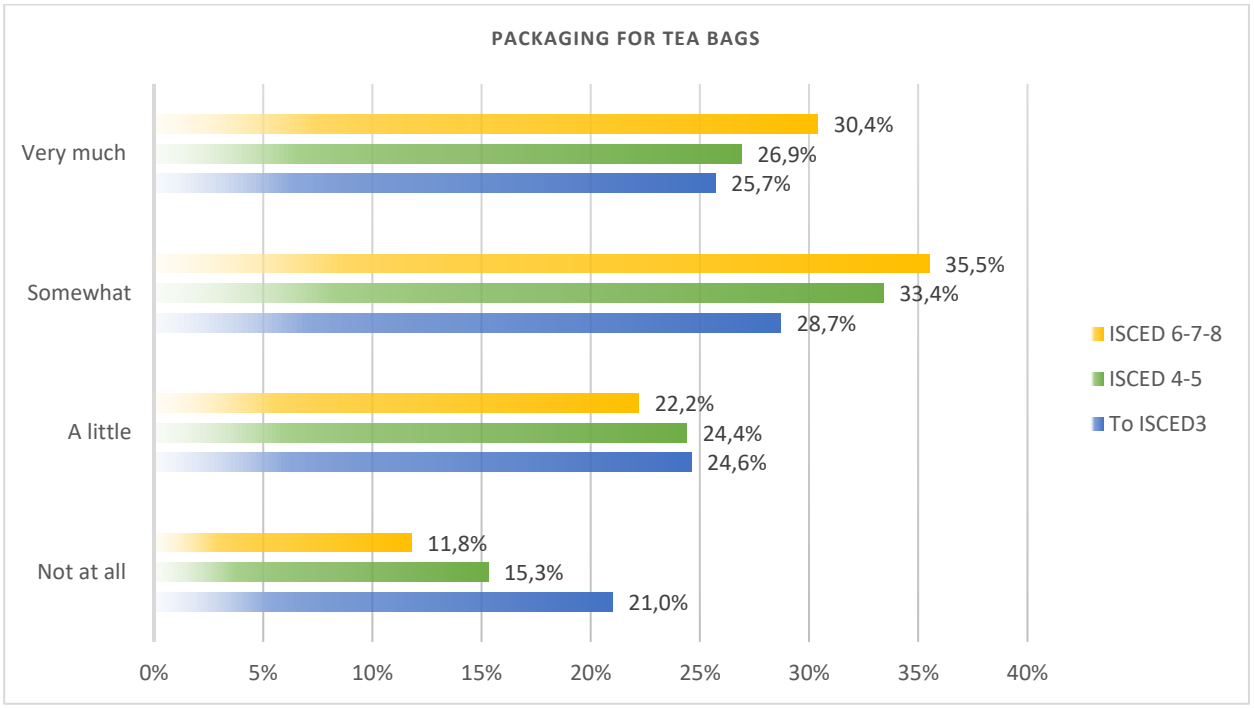
Annex 146 - Replies (%) per each willingness to pay (Trays & films for fruit and vegetables)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Packaging for tea bags	N° Replies	% Replies
Not at all	493	16,1%
A little	729	23,8%
Somewhat	995	32,5%
Very much	843	27,5%
Total	3.060	100%

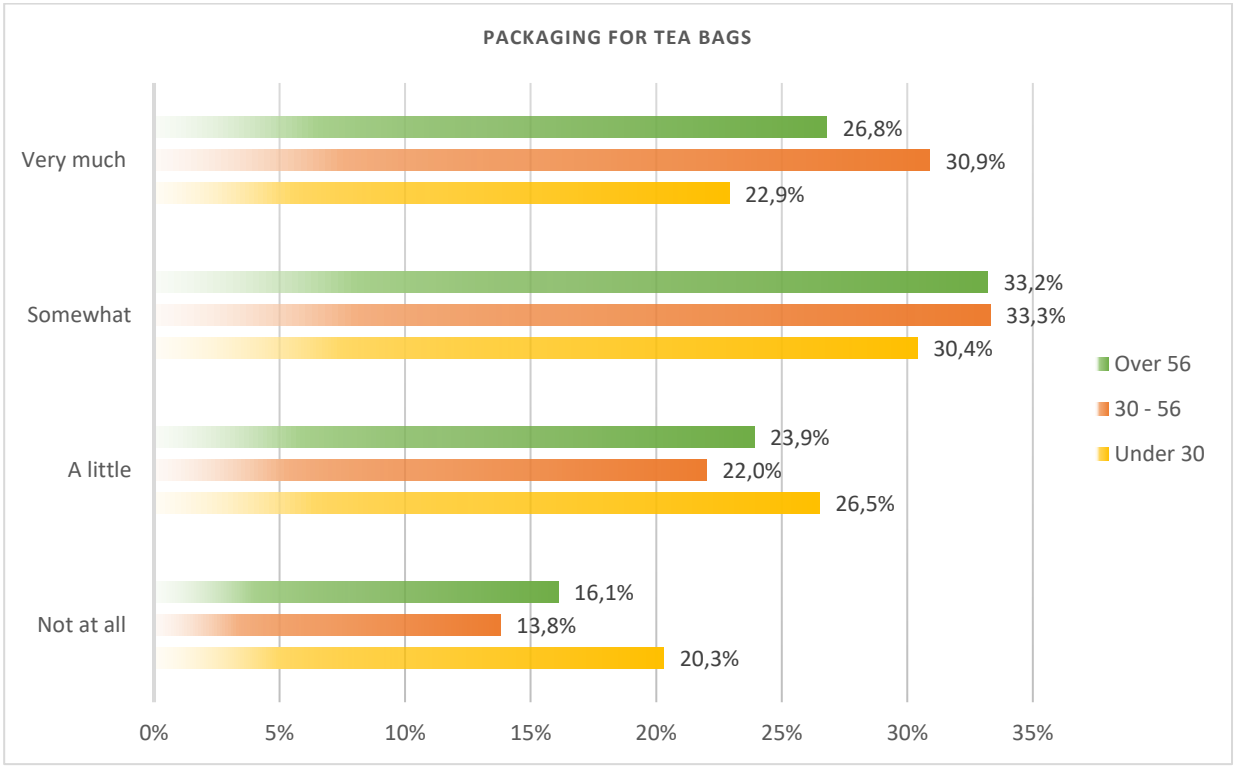
Annex 147 - Number and percentage of respondents (Packaging for tea bags)



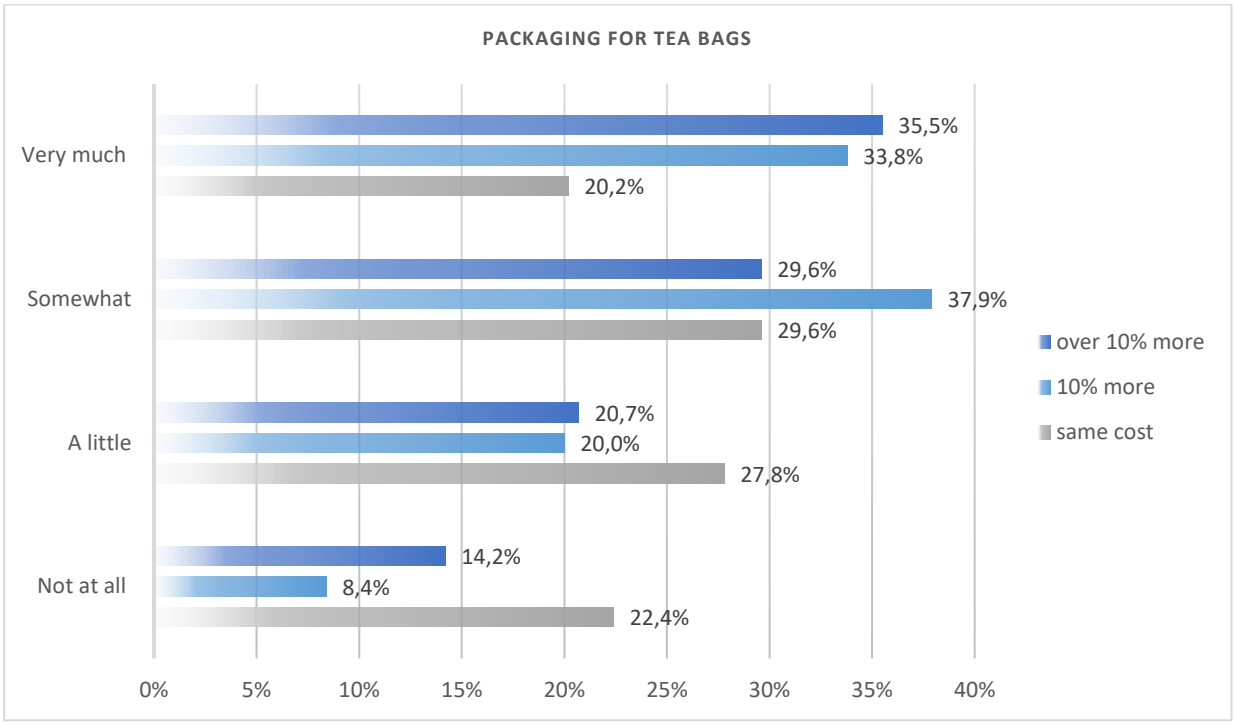
Annex 148 - Replies (%) per gender (Packaging for tea bags)



Annex 149 - Replies (%) per each education group (Packaging for tea bags)



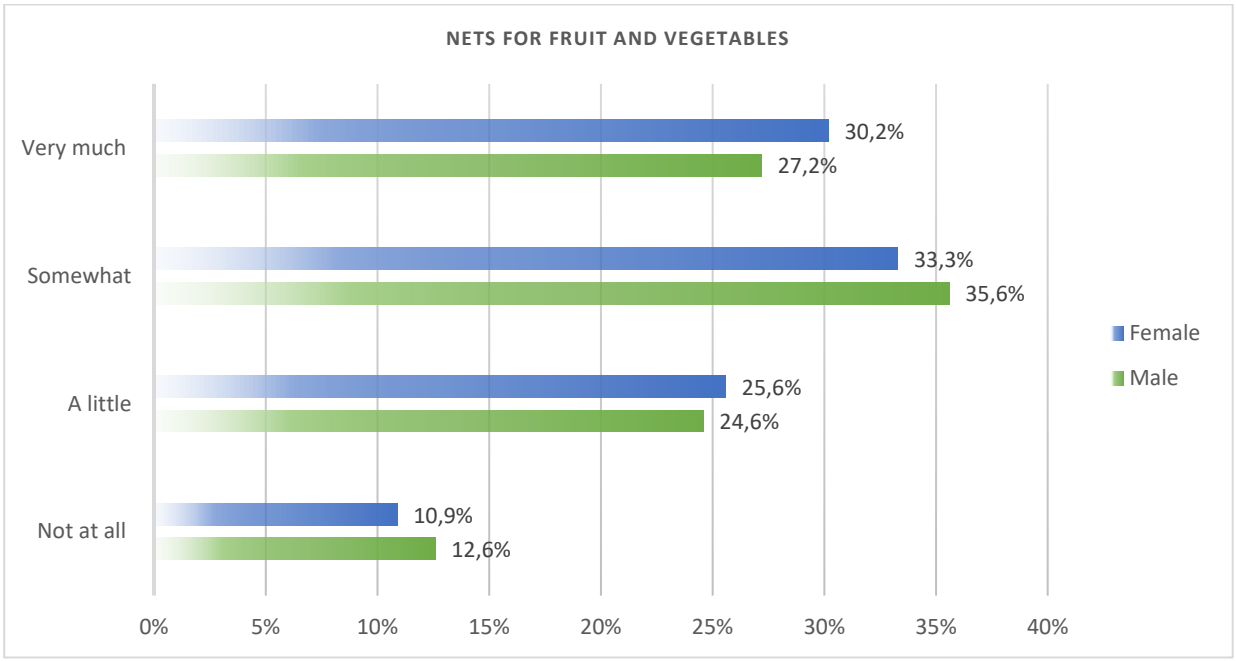
Annex 150 - Replies (%) per each age group (Packaging for tea bags)



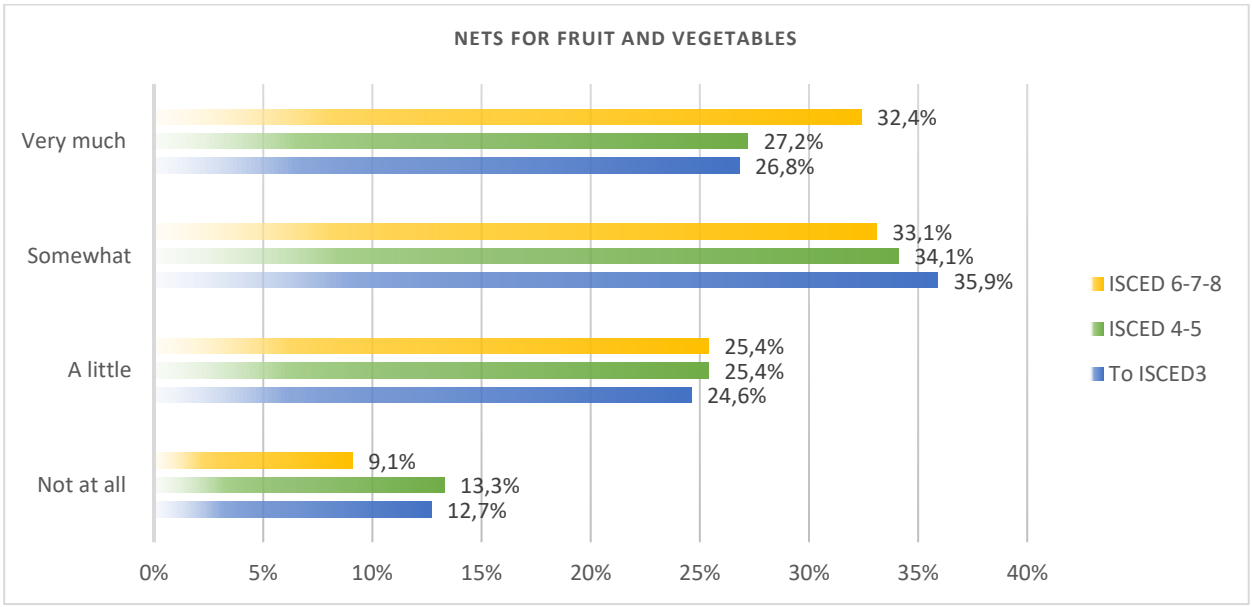
Annex 151 - Replies (%) per each willingness to pay (Packaging for tea bags)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Nets for fruit and vegetables	N° Replies	% Replies
Not at all	361	11,8%
A little	766	25,1%
Somewhat	1.052	34,4%
Very much	876	28,7%
Total	3.055	100%

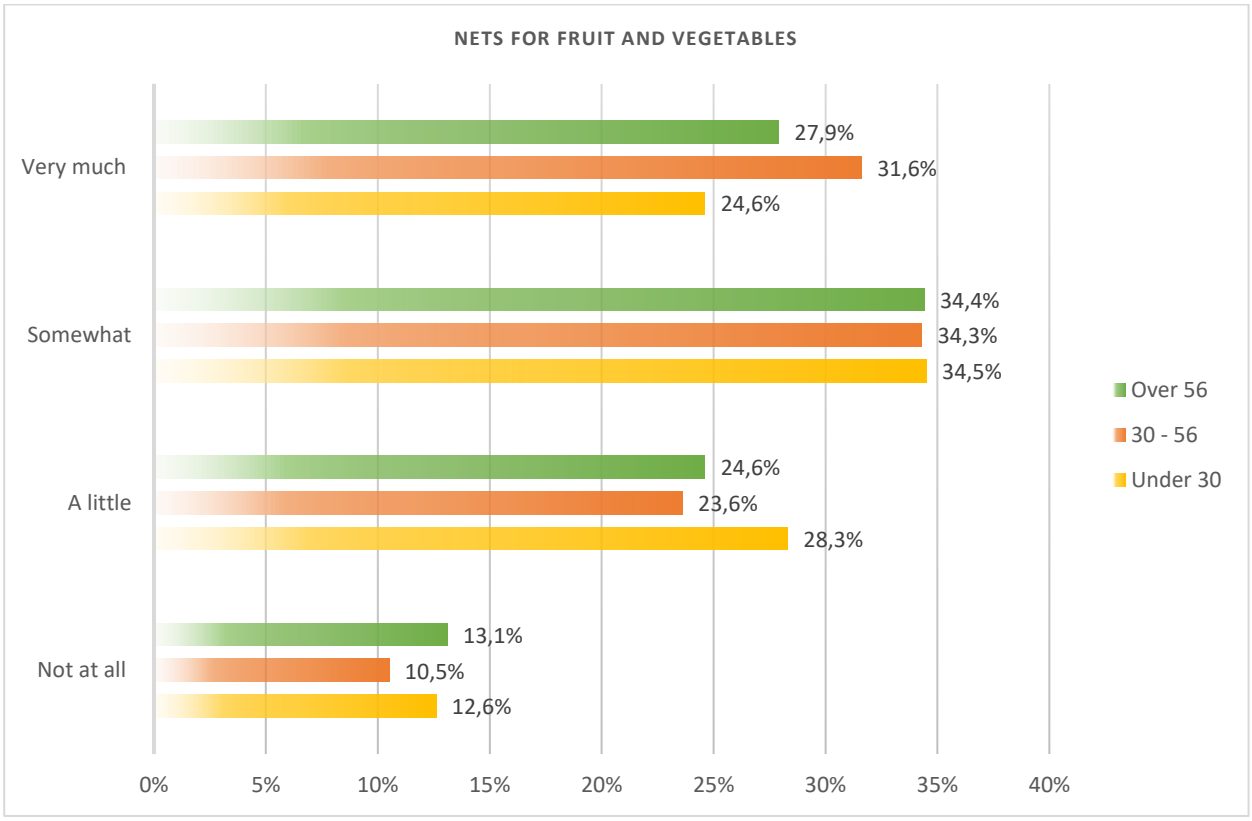
Annex 152 - Number and percentage of respondents (Nets for fruit and vegetables)



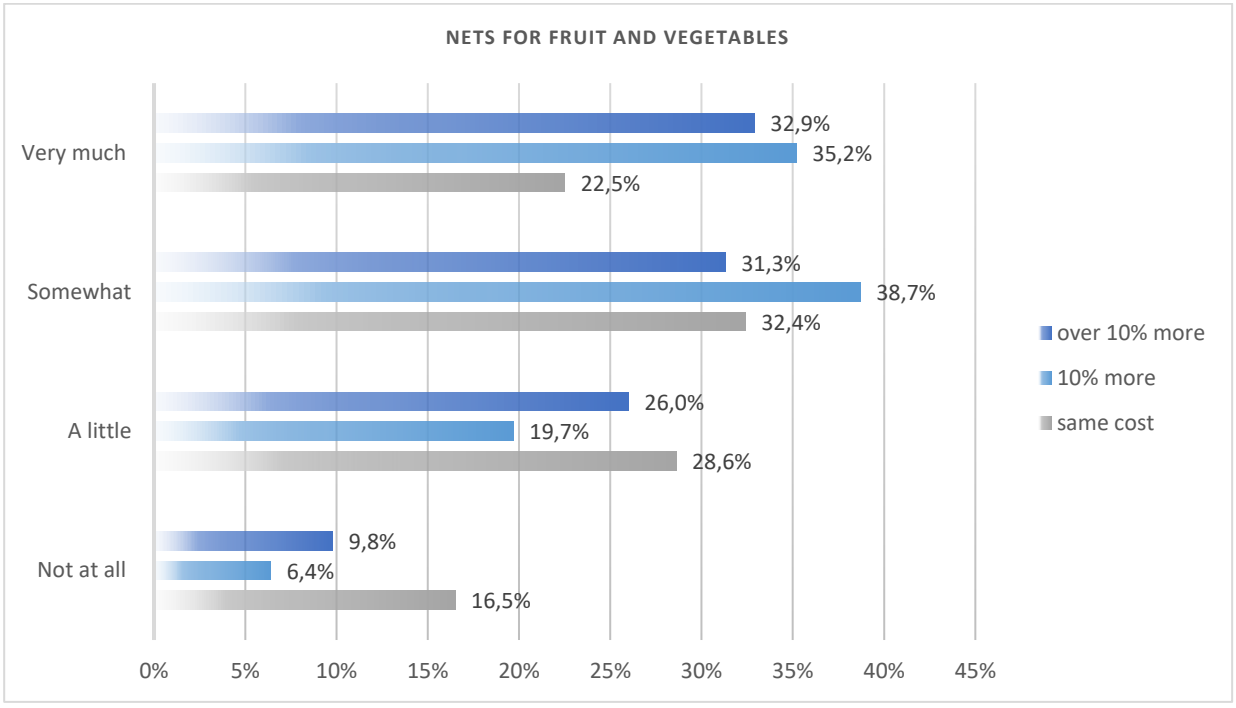
Annex 153 - Replies (%) per gender (Nets for fruit and vegetables)



Annex 154 - Replies (%) per each education group (Nets for fruit and vegetables)



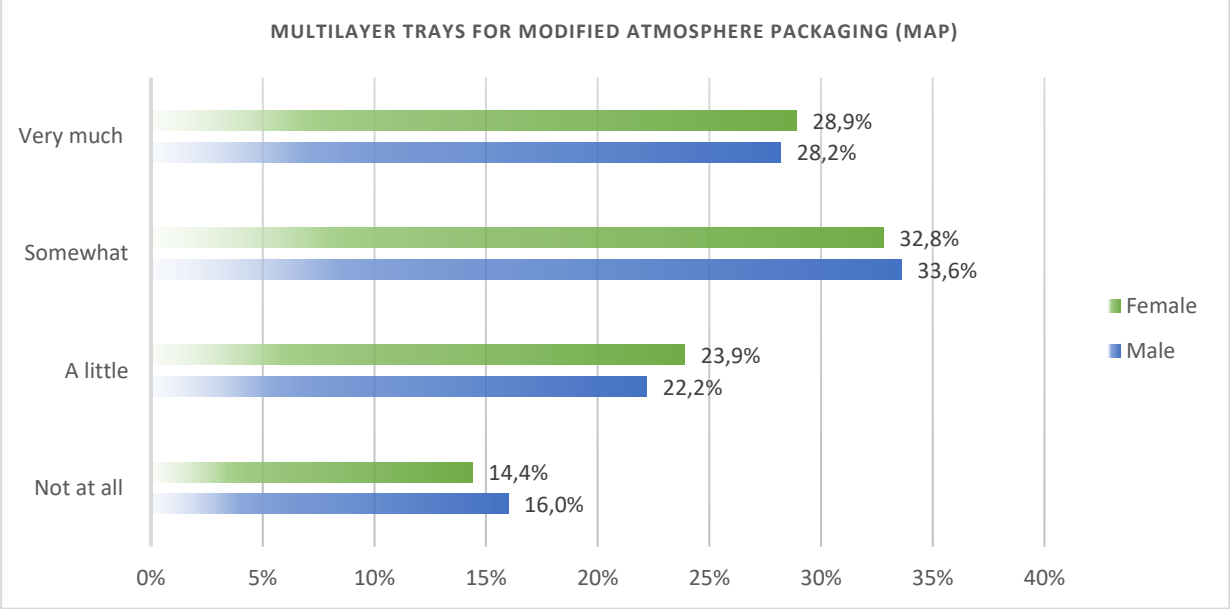
Annex 155 - Replies (%) per each age group (Nets for fruit and vegetables)



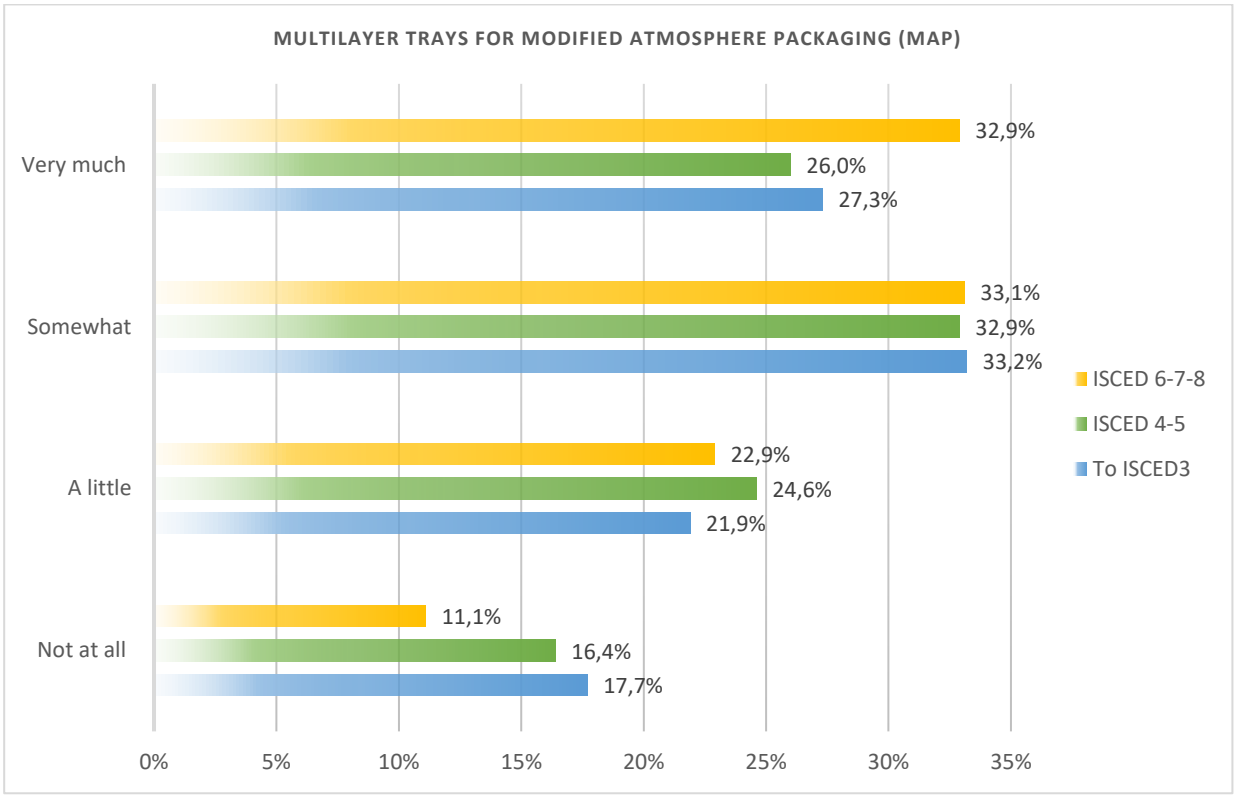
Annex 156 - Replies (%) per each willingness to pay (Nets for fruit and vegetables)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Multilayer trays for modified atmosphere packaging (MAP)	N° Replies	% Replies
Not at all	466	15,2%
A little	707	23,1%
Somewhat	1.014	33,1%
Very much	873	28,5%
Total	3.060	100%

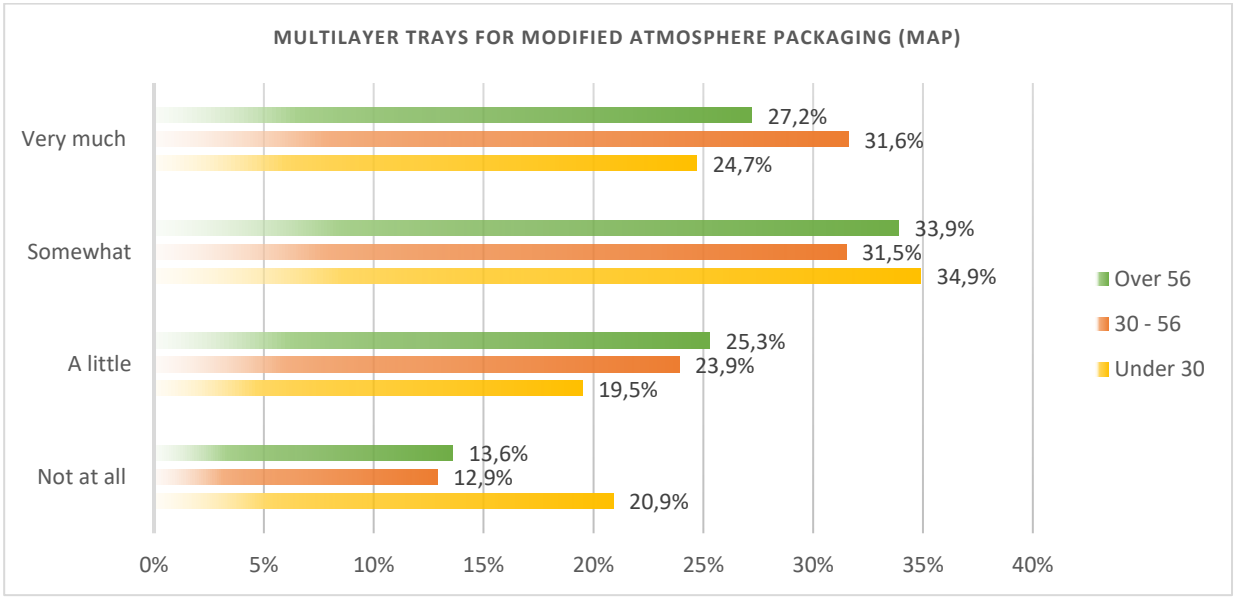
Annex 157 - Number and percentage of respondents (Multilayer trays for modified atmosphere packaging)



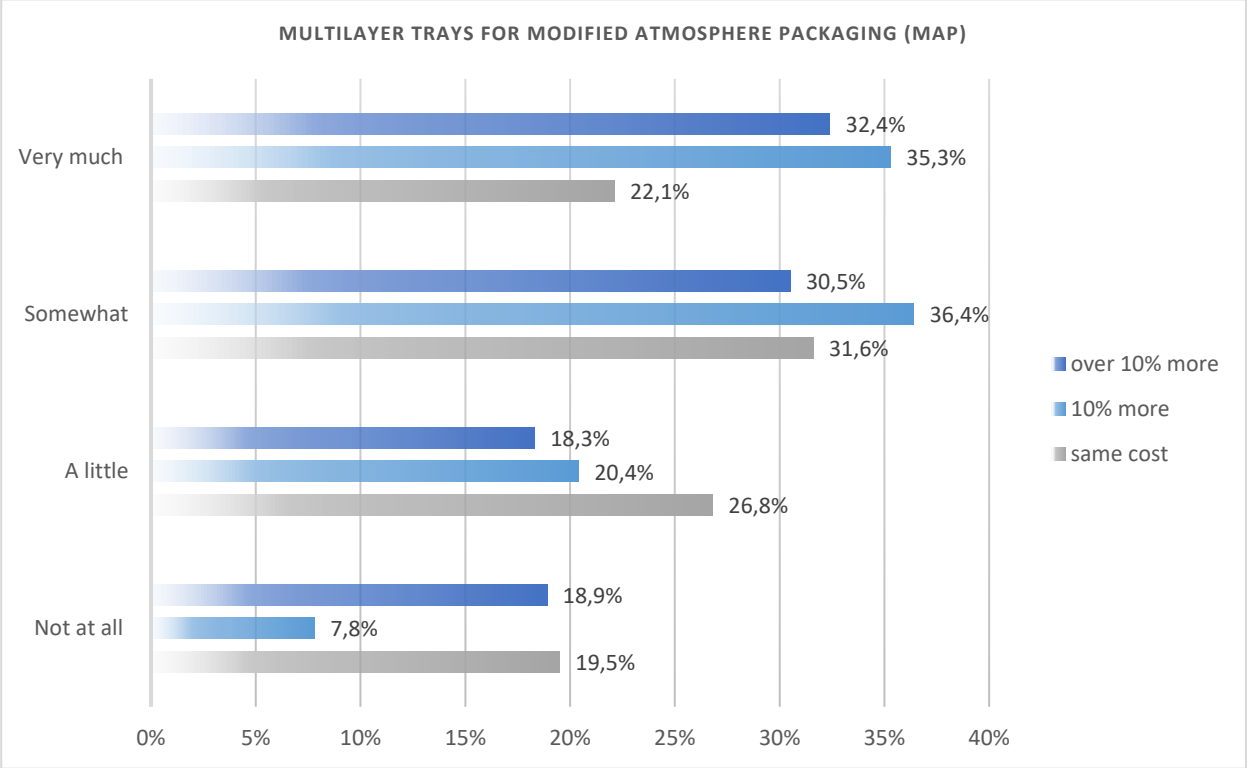
Annex 158 - Replies (%) per gender (Multilayer trays for modified atmosphere packaging)



Annex 159 - Replies (%) per each education group (Multilayer trays for modified atmosphere packaging)



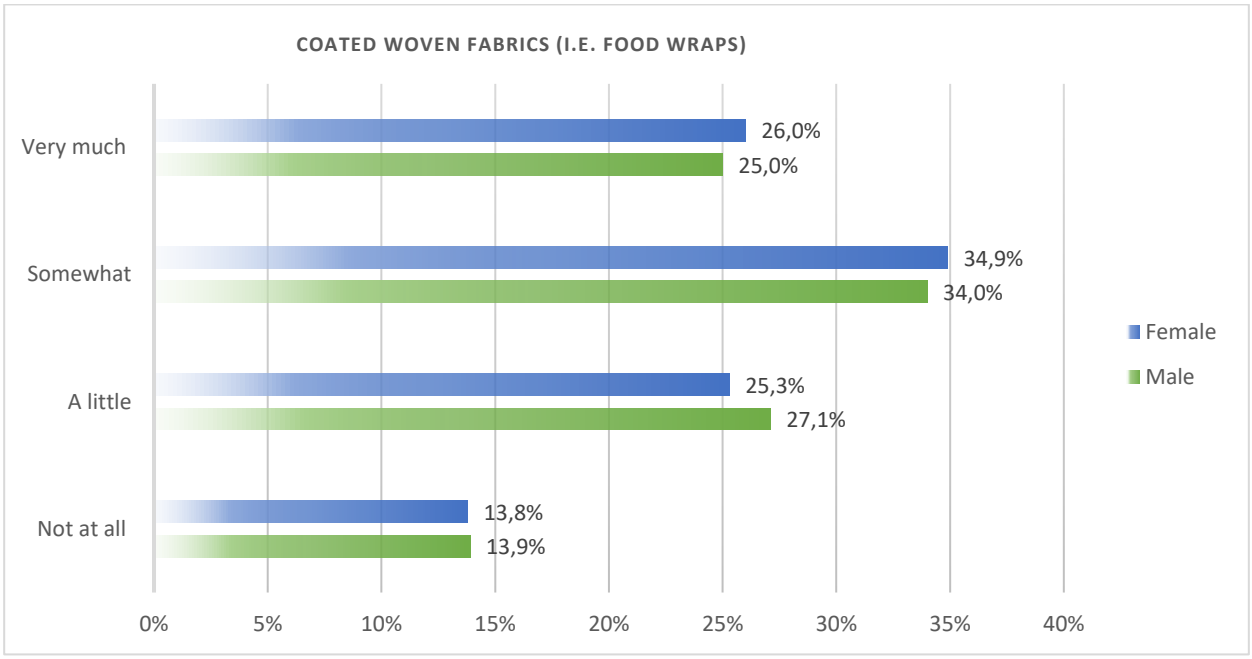
Annex 160 - Replies (%) per each age group (Multilayer trays for modified atmosphere packaging)



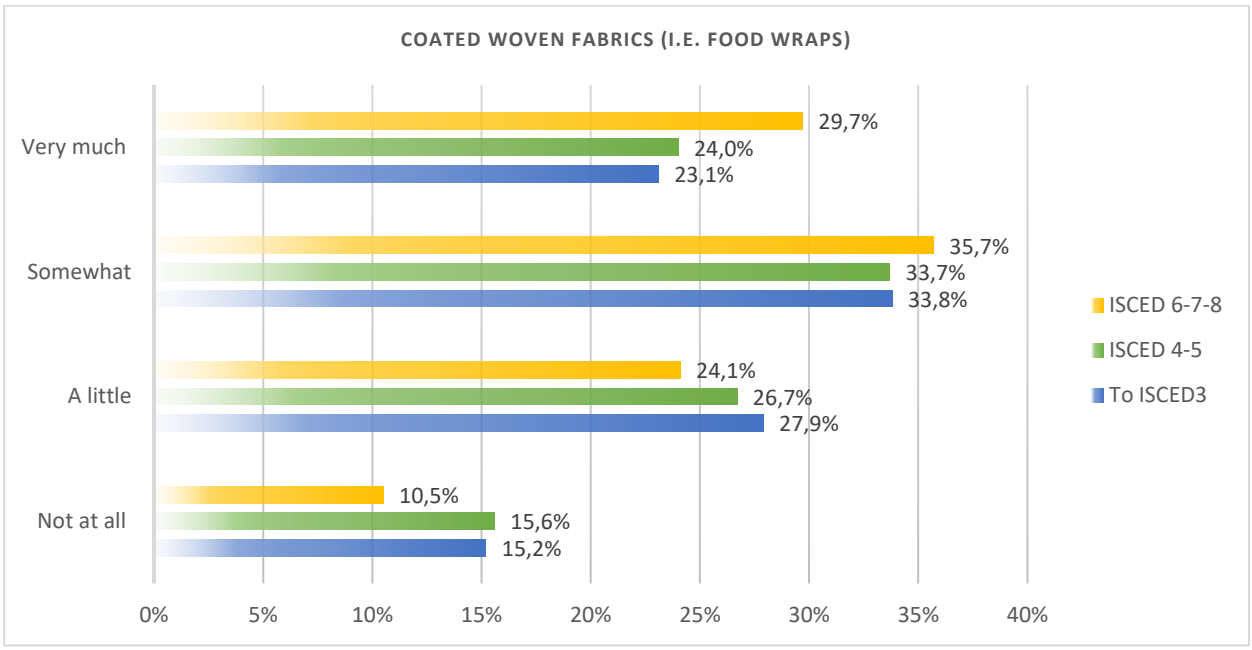
Annex 161 - Replies (%) per each willingness to pay (Multilayer trays for modified atmosphere packaging)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Coated woven fabrics (i.e. food wraps)	N° Replies	% Replies
Not at all	424	13,9%
A little	800	26,2%
Somewhat	1.049	34,4%
Very much	777	25,5%
Total	3.050	100%

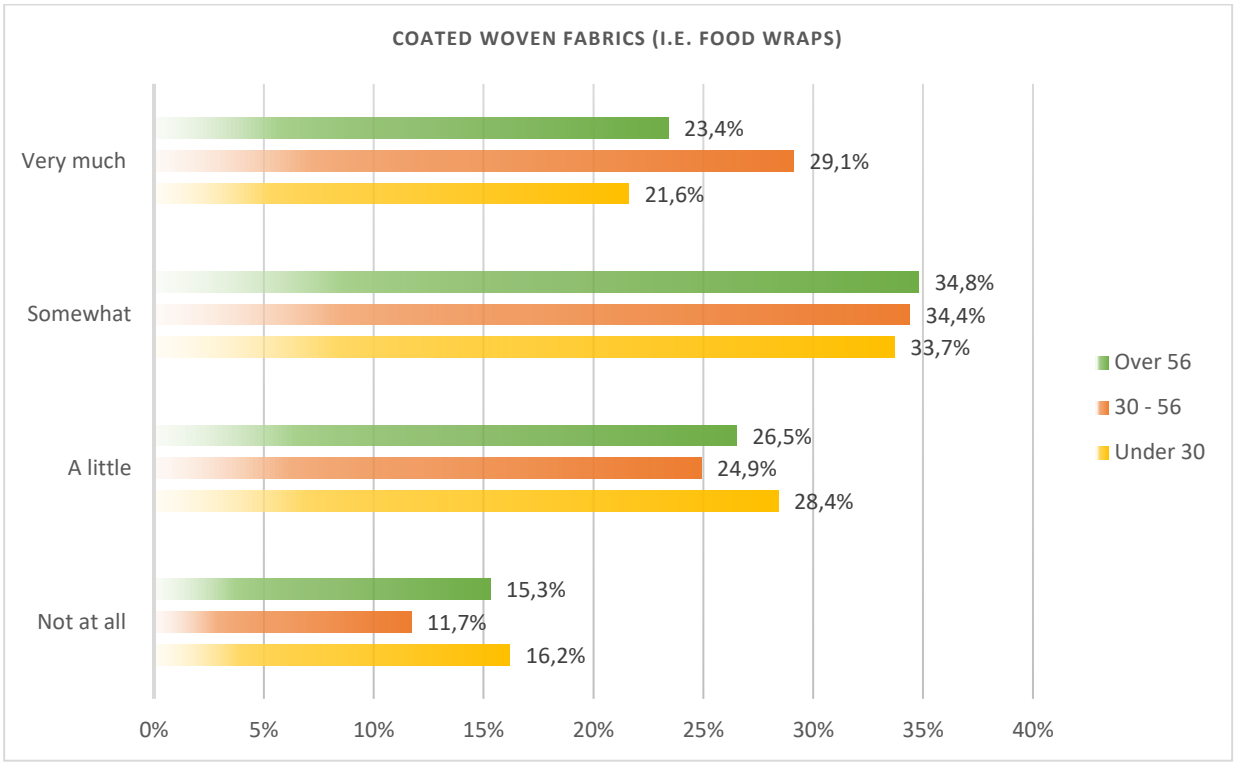
Annex 162 - Number and percentage of respondents (Coated woven fabrics)



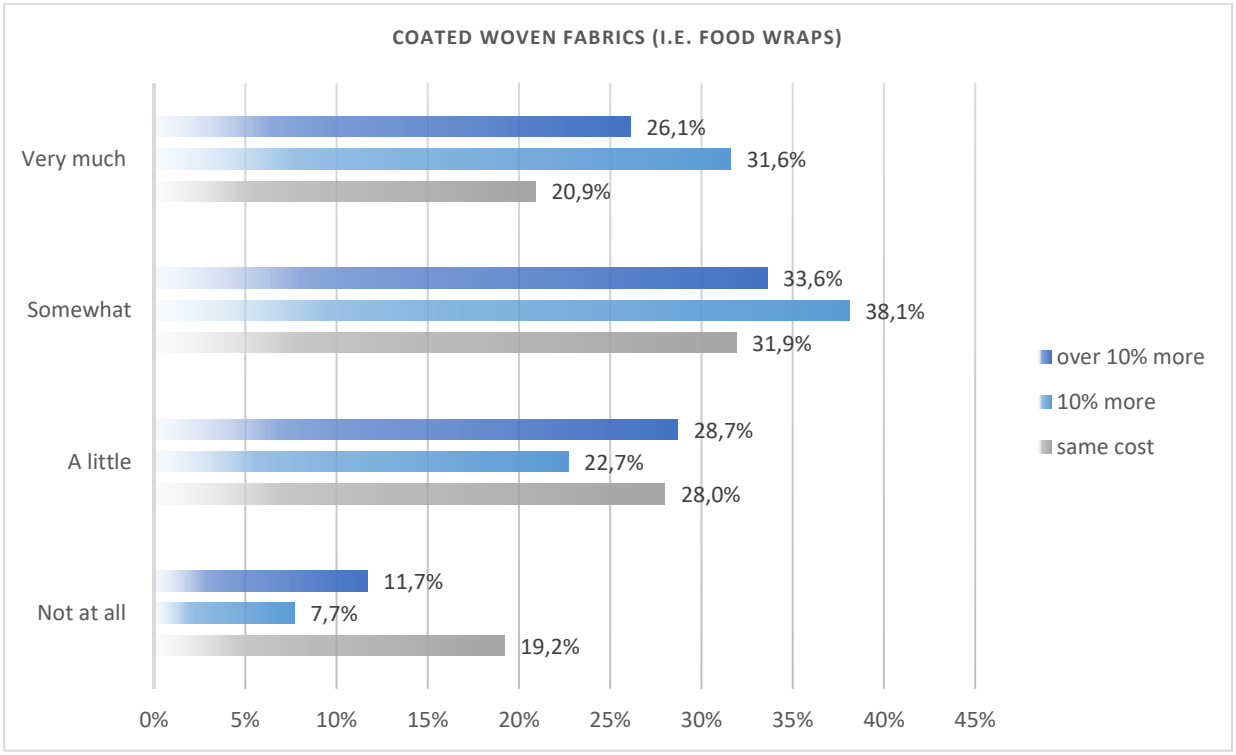
Annex 163 - Replies (%) per gender (Coated woven fabrics)



Annex 164 - Replies (%) per each education group (Coated woven fabrics)



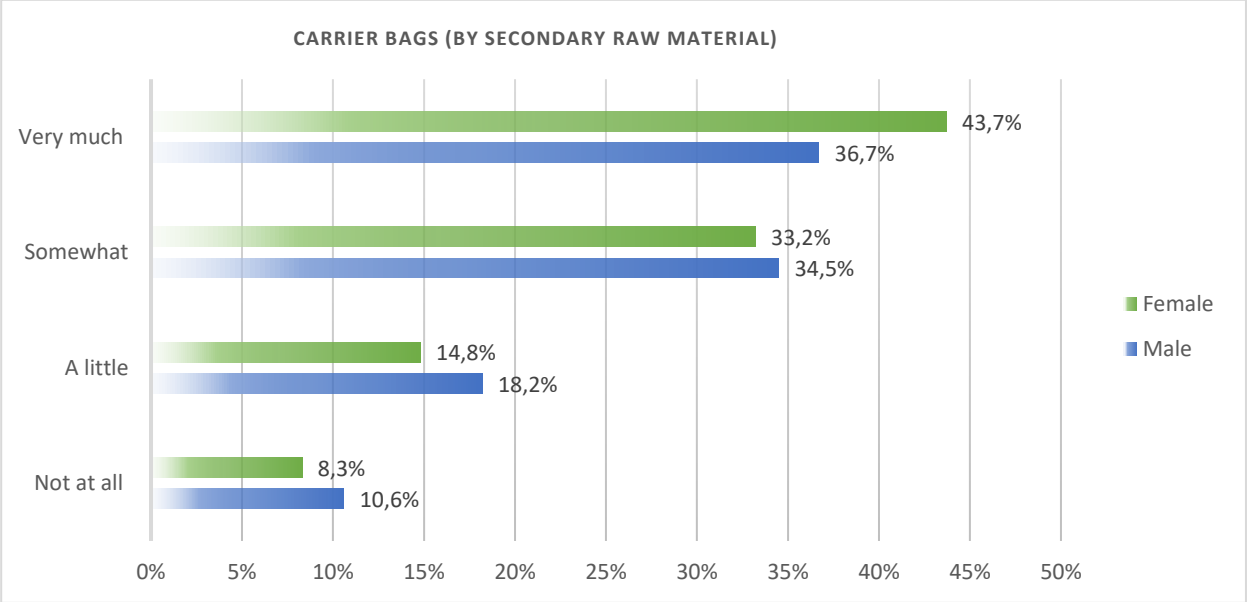
Annex 165 - Replies (%) per each age group (Coated woven fabrics)



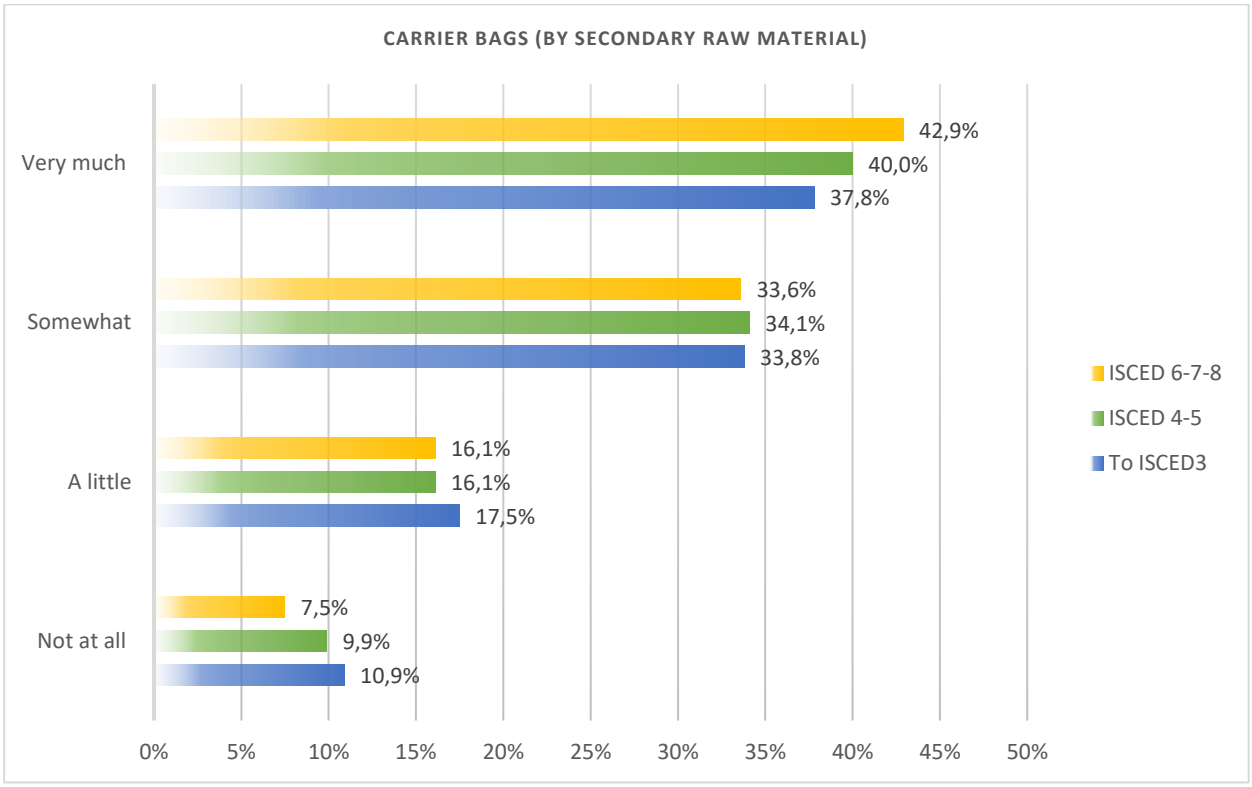
Annex 166 - Replies (%) per each willingness to pay (Coated woven fabrics)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Carrier bags (by secondary raw material)	N° Replies	% Replies
Not at all	292	9,5%
A little	505	16,5%
Somewhat	1.038	33,9%
Very much	1.228	40,1%
Total	3.063	100%

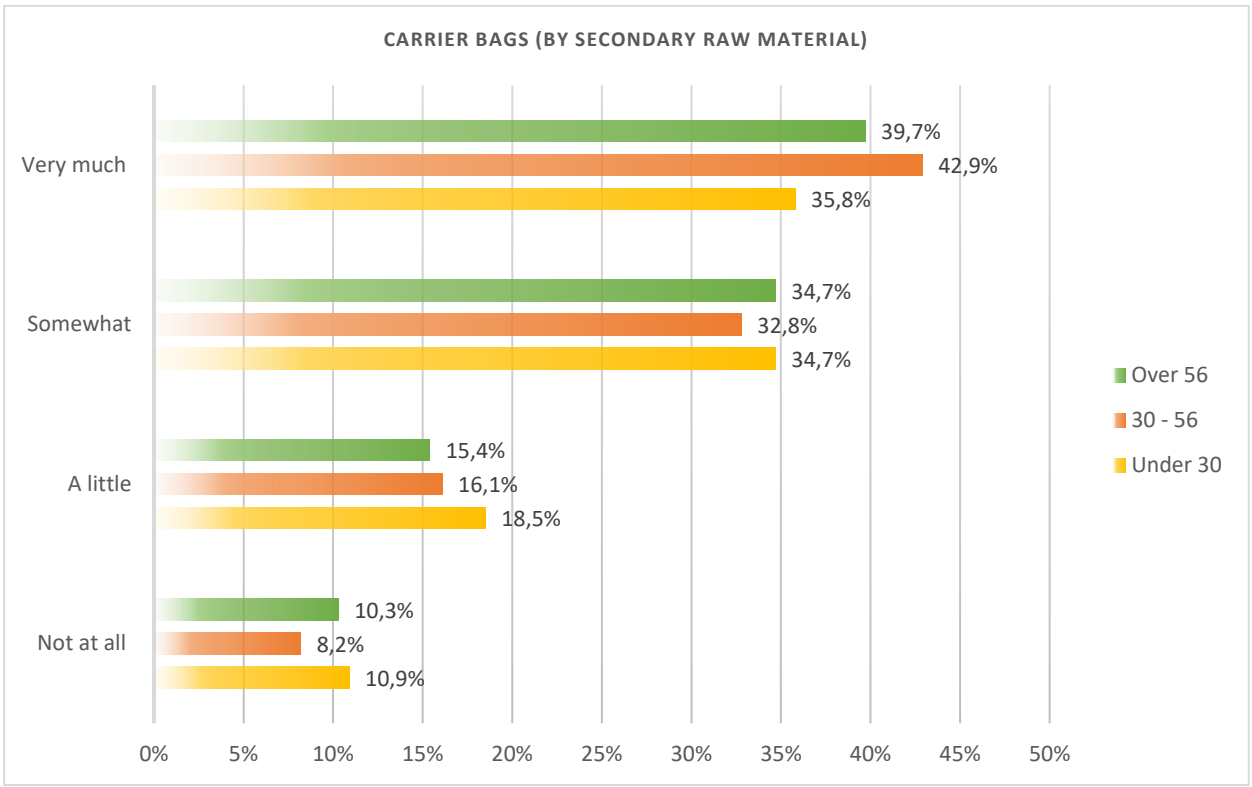
Annex 167 - Number and percentage of respondents (Carrier bags)



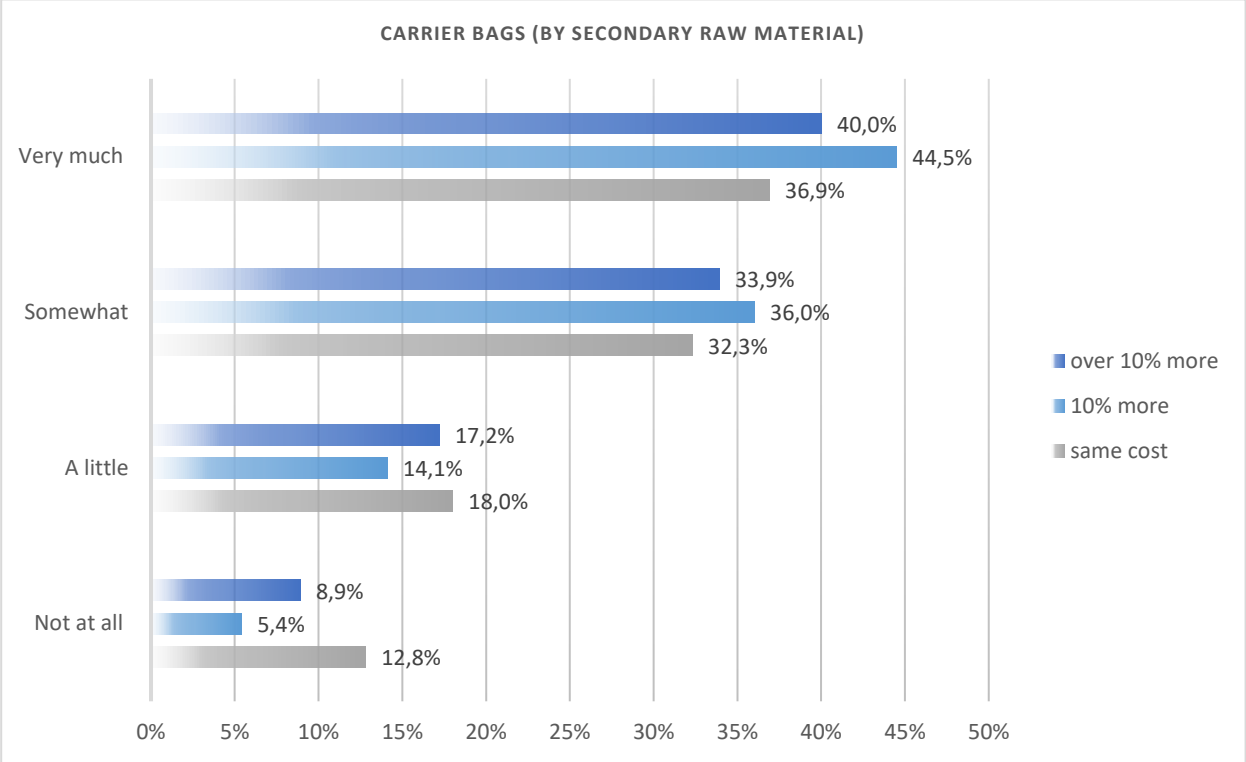
Annex 168 - Replies (%) per gender (Carrier bags)



Annex 169 - Replies (%) per each education group (Carrier bags)



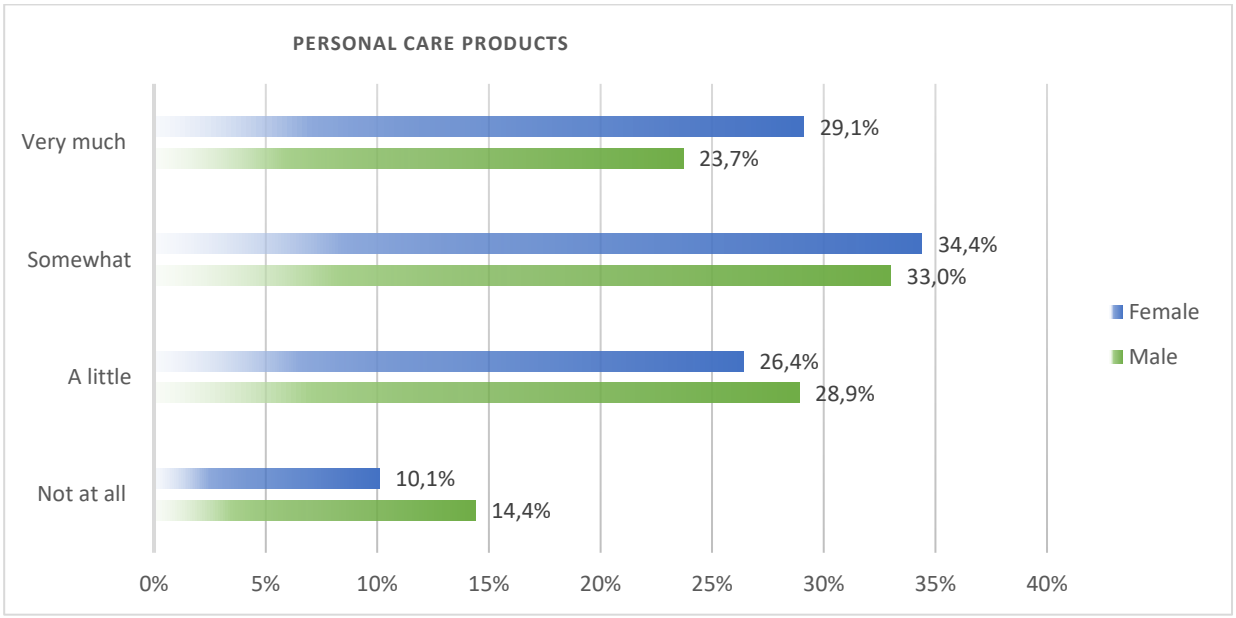
Annex 170 - Replies (%) per each age group (Carrier bags)



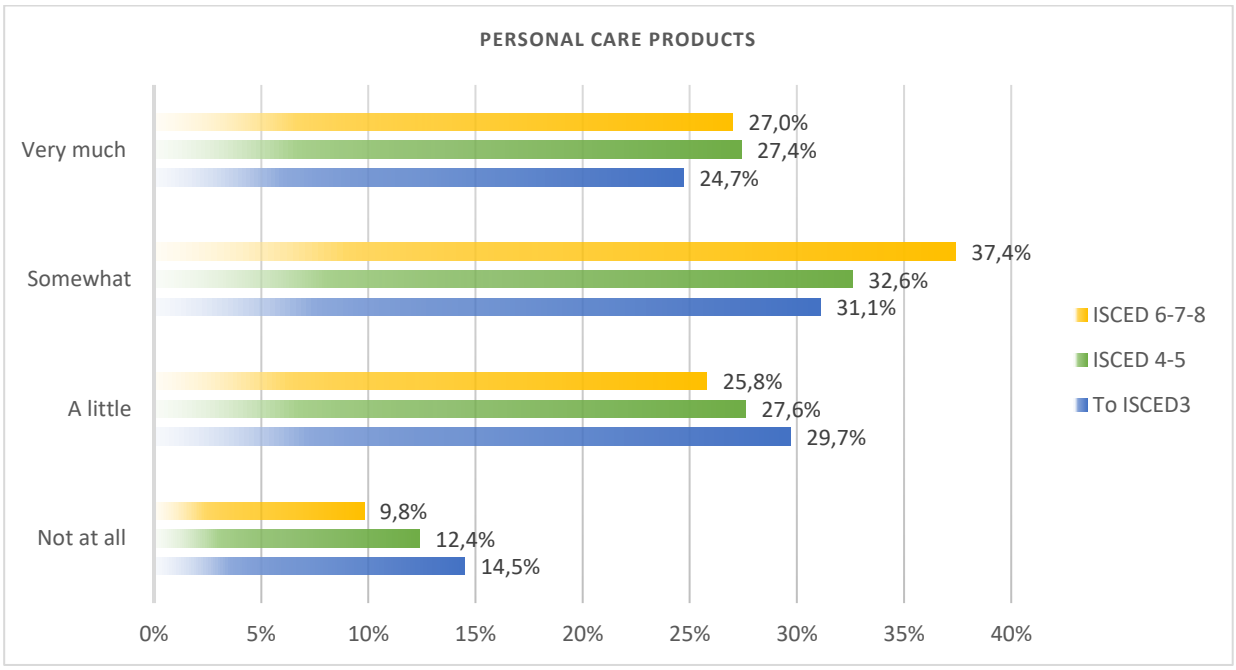
Annex 171 - Replies (%) per each willingness to pay (Carrier bags)

The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?		
Personal care products	N° Replies	% Replies
Not at all	377	12,3%
A little	847	27,7%
Somewhat	1.026	33,6%
Very much	808	26,4%
Total	3.058	100%

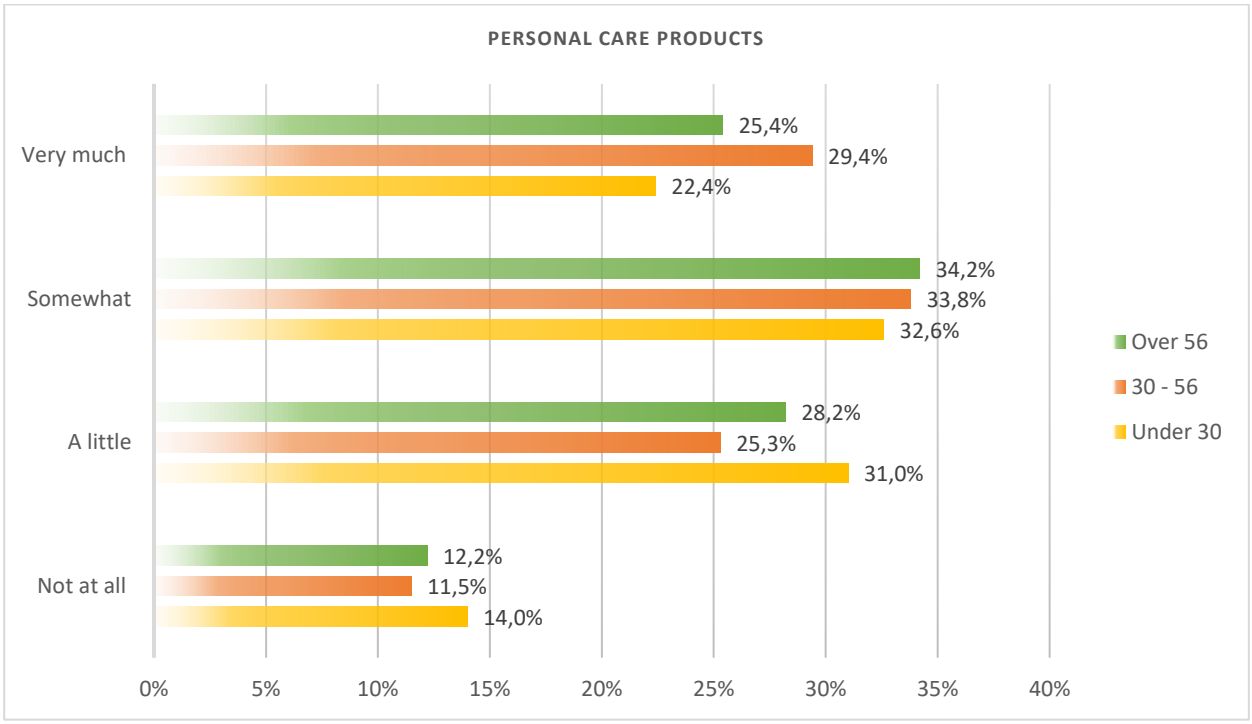
Annex 172 - Number and percentage of respondents (Personal care products)



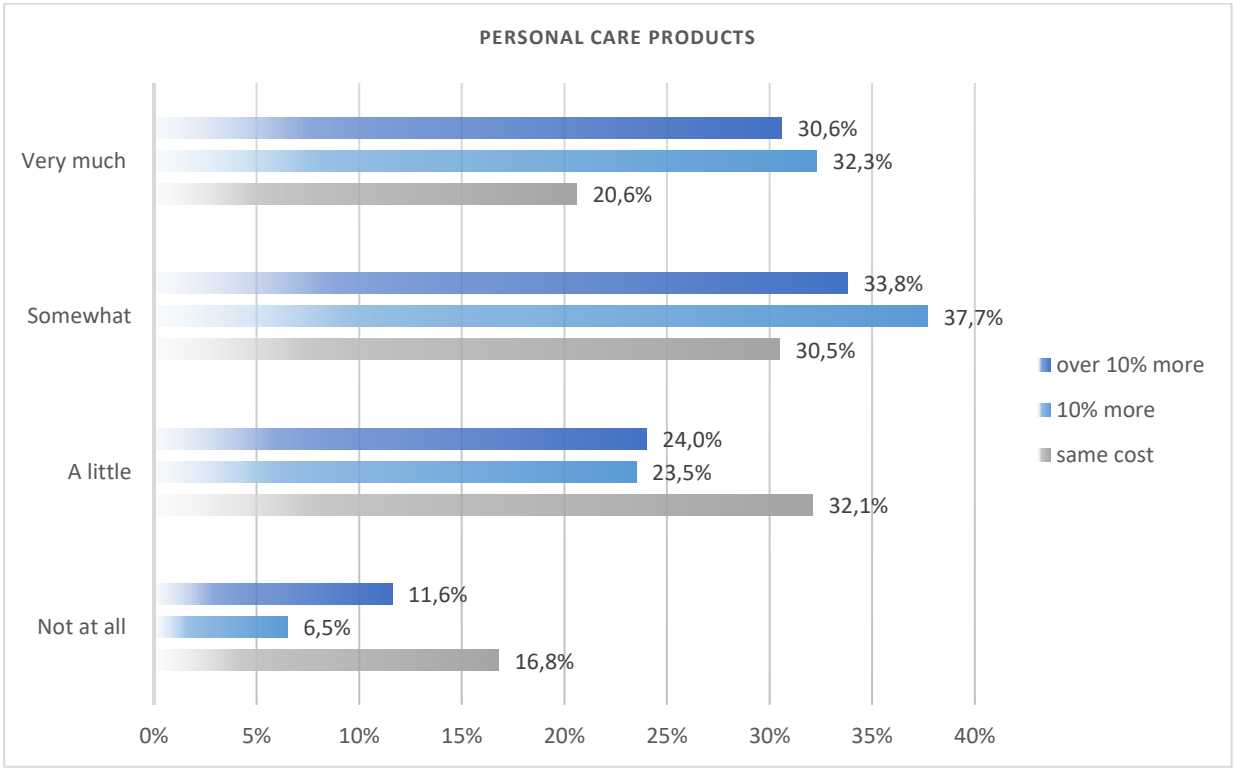
Annex 173 - Replies (%) per gender (Personal care products)



Annex 174 - Replies (%) per each education group (Personal care products)



Annex 175 - Replies (%) per each age group (Personal care products)



Annex 176 - Replies (%) per each willingness to pay (Personal care products)

6.2 Survey online form

Figure 7: BIOnTop – Survey cover page

A1. Have you ever heard about bio-based plastic?

- No, never → (DEFINITION*)
- Yes, but I am not sure what this is about→A2→DEFINITION
- Yes, and I know what it is →A2→ DEFINITION

(*DEFINITION)

Bioplastics comprise a large family of materials that differ in properties and applications. According to the definition of the European Bioplastic, Bioplastics refers to products made of either Bio-Based or biodegradable materials, or both.

Bio-based label refers to materials made from plant processing residues (biomass) such as corn, sugar cane and cellulose, thus distinguishing them from those produced with conventional plastics based on non-renewable fossil fuels such as oil (fossil based).

A2. What is a Bioplastic?

- A plastic that can be produced from recyclable resources
- A plastic that can be biodegradable
- A plastic that can be compostable
- A plastic that can be simultaneously compostable, recyclable, biodegradable
- A Plastic that can be produced from biomass or biodegradable material
- A plastic that can be produced with minimum shares of fossil-based, non-renewable (fossil-based) materials
- No answer

C1. Please state your degree of agreement/disagreement with the following statements. In the future, the product containers will be built in Bioplastic if:

	1. STRONGLY AGREE	2. AGREE	3. NEITHER AGREE, NOR DISAGREE	4. DISAGREE	5. STRONGLY DISAGREE
There will be mandatory laws addressed to the companies to do so [→IF THE ANSWER IS (1-2-3) →C2]					
There will be incentives and government investment					
There will be citizens' associations from below that put pressure on public opinion					
There will be many individuals from below who put pressure on public opinion					
The public authority will tax more the Oil companies					

C2. At what level should rules be enacted to encourage companies to produce packaging in Bioplastics?

- At a global level (i.e. UN)
- At European Union level
- At single state level
- No answer

D1. In your opinion what could be the ADVANTAGES in the use of Bioplastics? (MAX 3)

- It creates new jobs (including vocational training for those employees in current sectors which are due to disappear)
- It reduces waste management costs
- It reduces plastic pollution
- It uses biomass and other organic waste
- It increase the production of quality compost
- It can be recycled and used for the creation of new Bioplastics
- There are no advantages

D2. In your opinion what could be the DISADVANTAGES in the use of Bioplastics? (MAX 3)

- Currently, scientific evidence has not shown that products in Bioplastics are less polluting
- Bioplastics are more expensive than traditional (fossil-based) plastics
- Bioplastics lead those who produce traditional (fossil-based) plastics to lay off their employees

- It will increase the diffusion of monocultures for industrial purposes (for Bioplastics) by reducing the
- areas reserved for food use
- There is a risk that since they are compostable, many people throw them directly into the environment
- There are no disadvantages

E1. We propose you a series of opposite terms. Please, select a point in the line between them that you think indicates more the link with BIOPLASTIC (please click one of the dots between the two labels that best represents your proximity to the represented labels):

- Pollutant $$ Non Pollutant
- Compostable $$ Non-Compostable
- Infinitely reusable $$ Single use
- Sustainable $$ Not Sustainable
- Natural $$ Synthetic
- Expensive $$ Cheap
- Trust $$ Mistrust
- Safe $$ Unsafe
- Land Consumption $$ Limited Land Consumption

F1. What information do you read most carefully on a product label?

- General information on product properties
- Information on the origin of the materials used to produce the content
- The additives used in the manufacturing process
- Symbols and tips on container recycling
- Expiration dates
- Information about the supply chain and environmental sustainability
- Presence of an internet link (QR, link, app, tel.) where you can check the information displayed if necessary
- Other

G1. Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol:

- Yes, it indicates that it is a container/pack that needs to be reused
- Yes, it indicates that it is a container/package that should preferably be composted at home
- Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted
- No, I do not know

G2. Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol:

- Yes, it indicates that it is a container/pack that needs to be reused
- Yes, it indicates that it is a container/package that should preferably be composted at home
- Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted
- No, I do not know

G3. Are you familiar with the following symbols that certify the packaging material of the product? Select the option that most specifies the meaning of the symbol:

- Yes, it indicates that it is a container/pack that needs to be reused
- Yes, it indicates that it is a container/package that should preferably be composted at home
- Yes, it indicates that it is a container/package that goes into the wet waste bin and industrially composted
- No, I do not know

H2. In the event of separate waste disposal, what are the main practical obstacles you encounter in managing the disposal of products once they are exhausted? (MAX 3)

- Insufficient information on the packaging The complexity of local rules
- Insufficient knowledge of the recycling chain The challenge to differentiate correctly in particular or unusual situations (parties, meetings, etc.)
- The incoherence of information between different products Inconsistency of information in different places (cities, towns, holiday contexts, etc.)
- The large number of symbols that can be encountered
- The complexity in understanding the symbols you may encounter
- I do not do recycling
- Other

I2. Which of the following factors facilitate the choice of an everyday consumer items? (Max 3)

- The lower cost
- Organic production
- The recyclable container/packaging
- The biodegradable container/packaging
- The compostable container/packaging
- The sustainability of the production chain
- None of the above conditions

I4. When making purchases (shops, market, online store, etc.) do you recognize products whose containers/packs are made of Bioplastic?

- Yes→I5
- No→I6

I5. Do you prefer them in your purchase?

- Yes→I7
- No→I8

I6. Would you prefer them in the purchase?

- Yes→I7
- No→I8

I7. Why? (more answers allowed)

- They represent a sustainable choice for the environment
- They are natural products
- They represent an alternative to plastic
- By buying them, I am contributing to reduce pollution
- So I can finance innovative ideas
- They are consistent with my lifestyle (for example, they are vegan choices)

- They make me feel fashionable
- Because Bioplastics companies are often involved in environmental campaigns, (e.g. they make donations for every product sold)
- To push also other brands to introduce Bioplastics thanks to my purchase choices
- Prices are more or less similar, but Bioplastics are more sustainable
- They are compostable and thus contribute to reducing the volume of non-recyclable waste
- They are biodegradable

I8. Why? (more answers allowed)

- Unfortunately, they do not solve environmental problems
- They aren't natural products
- They do not represent a concrete alternative to plastic
- Buying them will not change the pollution levels
- I'm not sensing the innovative momentum they claim
- They are not compatible with my lifestyle (e.g. waste to be sorted)
- I'm not interested to be fashionable
- Because I am not interested in the projects of companies that produce Bioplastics to support environmental campaigns (for example through donations for each product sold - greenwashing)
- I do not believe that I can shift other brands to introduce bio-plastics through my purchasing choices
- The prices are higher and/or I'm not believing in the sustainability of bio-plastics
- Even if they are compostable, they will not impact on the final volume of waste (other form)
- Only time will tell how biodegradable they really are

J2. Comparing Biobased to similar fossil based products, how much would you be willing to pay for a product you normally use if made of Bioplastic - compostable material?

- I would buy as long as it's at about the same cost
- I would buy even if it costs a little more, about 10% of the final cost
- I would buy even if it costs bit more, about 15-20% of the final cost
- I would buy even if it costs much more, over 20% of the final cost

J4. As a consumer, why would you agree to pay more for a Bioplastic pack?

- Because in the long term costs will be lowered thanks to the diffusion of products
- These materials are of higher quality for food protection
- These materials do not contribute to environmental pollution
- I feel an active part in helping to protect the environment
- I'm not interested in having to pay more

J6. In which way the following elements can encourage the purchase of a product in Bioplastics for everyday use?

	Much	Enough	Little	Nothing
The use of raw materials that do not impact on the environment				
Knowing that the production of raw materials does not have negative effects on the economy of the producing countries (e.g. monocultures, deforestation, etc.)				
The presence of the words "Packaging made with 50% recycled plastic"				
The awareness that it is a positive investment for health				
Trademarks and tips on container disposal				
The awareness that this helps the planet to save it for future generations				

K. The following products are packed in Bioplastic and are very similar to other products packed with traditional plastic. If they will cost more, are you willing to buy them?

K1. Trays & films for fruit and vegetables
- Very much
- Somewhat
- A little
- Not at all

K2. Packaging for tea bags
- Very much
- Somewhat
- A little
- Not at all

K3. Nets for fruit and vegetables
- Very much
- Somewhat
- A little
- Not at all

K4. Multilayer trays for modified atmosphere packaging (MAP)
- Very much
- Somewhat
- A little
- Not at all

K5. Coated woven fabrics (i.e. food wraps)
- Very much
- Somewhat
- A little
- Not at all

K6. Carrier bags (by secondary raw material)
- Very much
- Somewhat
- A little
- Not at all

K7. Personal care products
- Very much
- Somewhat
- A little
- Not at all

L1. Sex:
- Female

- Male
- Other or prefer not to say

L2. Year of birth (YYYY)

L3. What state are you in?

L4. What is your education level?

- Lower secondary education (ISCED-2)
- Upper secondary education (ISCED-3)
- Post-secondary non-tertiary education (ISCED-4)
- Short-cycle Tertiary education (ISCED-5)
- Bachelor's or equivalent level (ISCED-6)
- Master's or equivalent level (ISCED-7)
- Doctorate or equivalent level (ISCED-8)
- No answer

L5. Please, select your current employment status?

- Employee or external collaborator
- Self-employed
- Unemployed
- Homemaker or housewife/house husband
- Retired
- Student
- No answer
- Other, specify

L7. Please, specify the composition of your household:

- Couple with children living together
- Couple with children not living together
- Couple without children
- Single without children
- Single with cohabiting children
- Single with not cohabiting children
- I live with my parents
- Other
- No answer

Figure 8: BIOnTop – Survey last page

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