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Exploring what motivates the development of upcycling practices. The making of values and principles

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Abstract. Faced with an aggressive production model with the use of resources, initiatives such as upcycling arise that seek to extend the life of products. This paper analyzes the role of individuals' principles and values as driving factors, something that has not been studied in depth to date. The study is based on a field work in which 830 subjects from 180 countries have participated in a survey, from September 2019 to September 2020. This large sample of participants at the international level is one of the key contributions of the work, since it allows us to contrast conclusions from the few previous works and issue new ones based on the sequence of analysis described below, which broadens the empirical base in this field of study. The data so collected was analysed using the statistical software Stata and estimating standard multiple linear regressions, ordered logit and logit regressions. The findings confirmed the chain of actions – doing, frequency, entrepreneurship – is decisively conditioned by personal values and principles. This sequence of analysis constitutes the main contribution of our work. With regards to entrepreneurship, this work provides evidence that having the intention to start up an upcycling business is more likely when individuals consider upcycling important for them and report themselves as having a high probability of upcycling; but it is less likely among women and the older age groups (more than 55 years old).

Key words: upcycling, entrepreneurship, principles, sustainability.

1. Introduction

Transformations in various manufacturing industries and the progressive transition to a circular economy are making the traditional process based on the dynamics of „take, make and dispose" increasingly unsustainable (Razminiene, 2019). The need to change the model is supported by several factors, some of which are described below. More and more global leader experts, policy makers and intellectuals point out that continued economic growth based on increasing resource consumption is unsustainable (de Castro et al., 2019; Balakrishnan et al., 2003; Pacheco et al., 2010). Waste management is a major concern for industrialized countries (Zaman, 2016). A feeling of rejection of planned and premature obsolescence has spread (Sung, 2017). Consumers increasingly recognize their responsibility to consume more responsibly and sustainably (Jaeger-Erben et al., 2015). Regulatory frameworks supporting more sustainable consumption-production models have started to be developed, such as EU Directive 2018/851. The 2030 Agenda and the 17 Sustainable Development Goals (in particular, number 12, Responsible Consumption and Production) highlight the importance of sustainable consumption and production modalities (Jayasinghe, 2021; Rodic & Wilson,

2017). Given the above, the need arises to explore different approaches to extend the useful life of products and reduce waste generation (Bell et al., 2019; Calvo et al., 2020; Charter & Keiller, 2014). Along these lines, the concept of upcycling arises, which is defined as the reuse (of discarded objects or materials) in such a way that a product of higher quality or value than the original is created (Oxford dictionary, 2019). An important nuance is associated with the fact that it is a reuse of products, attributing to them a different function (Nalewajek & Macik, 2013), not foreseen in advance, which updates them (Wilson & Webster, 2018). Upcycling can be distinguished from downcycling, in which materials are broken down into lower value raw materials (Wilson & Webster, 2018). Upcycling, unlike recycling, requires less energy, material, emissions and water expenditure than recycling and can be done multiple times, thus avoiding material degradation into lower value raw materials (Wilson & Webster, 2018).

The theoretical framework associated with this type of activity is still underdeveloped (Anderson et al., 2018) and has also received little attention from empirical research (Bhatt et al., 2019; Wilson, 2016), which has been identified as a research gap (Wilson, 2016; Sung, 2015; Bridgens et al., 2018; Steurer, 2013). Given the research gap detected around the lack of theoretical studies, this research is of an exploratory-empirical nature. The development of theoretical frameworks requires prior exploratory studies that help to characterize the object of analysis. Specifically, this work focuses on the study of the role that individual principles and values have in the process of adopting upcycling practices. This study has focused on the importance attributed to these practices as first step for their development. It has also evaluated the frequency of practice and the development of entrepreneurial activities. This has not been studied before and therefore defines a clear research gap. The approach to analyze this type of data – based on the sequence doing, frequency, entrepreneurship – as well as the data provided – obtained from an international field work– constitute the main contribution of this work to the academic literature.

The contribution is presented from the following research questions. RQ1: What role do principles/values play in the importance that individuals attribute to upcycling? RQ2: How important are the principles / values in the frequency of upcycling practices? and RQ3: How important are the principles / values in the decision to undertake an upcycling business? This research takes its data from an online survey conducted between September 2019 and September 2020 (12 months) to 830 individuals participating in an online business course. The survey participants are residents of a total of 180 countries. This large number of respondents and their geographic diversity give great value to this research.

2. Change Factors in the Upcycling Drive

Although the importance of the practice of upcycling is growing, the academic literature on upcycling remains fragmented (Paras & Curteza, 2018). As a preliminary step to exposing the methodology used in this study, a review of the literature on drivers of upcycling practices is presented. This review is divided into three blocks: references associated with consumers, traditional companies and entrepreneurs that promote projects of this type. The last two blocks are developed to a lesser extent in the academic literature, so to offer the most approximate information possible, the analysis of the drivers associated with circular economy practices has been used. It is precisely this lack of studies that leads the authors of this work to focus the analysis on the proposed research questions.

There are differences in how upcycling is understood in industrial terms (Cassidy & Han, 2017), depending on whether it is carried out by SMEs and creative entrepreneurs (Fletcher & Grose, 2012), or by individuals – households (Bridgens et al., 2018). From a product perspective, upcycling focuses on the creative modification of goods at the business, professional or individual level (Sung et al., 2014). Consumers commit to fixing broken products or applying reuse practices (Charter & Keiller, 2014). The increase in connectivity has favored co-creation processes between consumers (Labrecque et al., 2013; Yuksel et al., 2016). For citizens, the motivations or drivers linked to the development of upcycling activities are varied. Various studies have highlighted the value of environmental concerns (Wilson, 2016; Sung et al., 2014), but also of money or time saved (Nalewajek & Macik, 2013; Sung et al., 2014)]. Factors such as joy, the feeling of accomplishment or the relaxation associated with the process also appear to be determining factors (Wilson, 2016; Fletcher & Grose, 2012). Likewise, value is attributed to the aesthetic appeal of the final product (Wilson, 2016) and the uniqueness associated with it (Tian et al., 2001). In impoverished contexts, consumers are more likely to turn waste into useful items due to limited resources (Prahalad, 2006). The importance of principles / values in habits change processes, as proposed in this work, has not been analyzed in depth to date.

With regards to traditional industries, there are also practices that tend to implement, at least partially or occasionally, the philosophy of upcycling or promote it associated with their products. Likewise, a series of drivers that promote such actions can be highlighted, although as has been pointed out, research in this regard is scarce. In general, upcycling has been understood mainly as a sustainable practice or approach in engineering and technology (Zhuo & Levendis, 2014), design (Janigo & Wu, 2015) or business (Todeschini et al., 2018). In traditional companies, upcycling

has been used frequently as a form of reverse engineering, piracy, tuning or a form of social activism (Busch, 2008). Scholars, particularly in the field of strategic management, still struggle with the lack of a framework that describes how companies can go circular and adapt circularity to their existing business model or create a new business model (Urbinati et al., 2017). The introduction of these practices provides clear value for the company, even if only from the point of view of the perception that society has of it (Antikainen & Valkokari, 2016). Therefore, this could be identified as a driver of the impulse of these activities. However, scientific research has not yet defined a framework that describes how organizations that want to go circular could implement a circular business model in their existing business (Antikainen & Valkokari, 2016; Korhonen et al., 2018; Jesus & Mendonça, 2018). Various authors have pointed out the importance of increasing research on the circular economy at the company level (Murray et al., 2017). Even though there are some studies on the drivers of circular economy practices in companies (Jesus & Mendonça, 2018; Rizos et al, 2016), the connection between drivers and limiting factors in circular business models is not clear (Kurkela, 2020).

Some drivers or impulse factors associated with the circular economy – which would therefore include upcycling activities – have been described, such as legislation and political support, supportive infrastructure, development of greater social awareness, collaborative business models, external recognition, financial attractiveness, environmental culture of the company, the extension of information and communication technologies, improvements in product design and optimization of the supply chain (Rizos et al., 2016; Lieder & Rashid, 2016; Levänen, 2015), among others. Furthermore, Jesús and Mendonça divided the drivers as well as the challenges into the following categories: technical, economic and financial, institutional and regulatory, and social and cultural (Jesus & Mendonça, 2018). The increase in the cost of some resources is indicated as a driver of more sustainable circular models (Jesus & Mendonça, 2018) so that the economic benefits associated with the reduction of inputs can become first-level drivers (Korhonen et al., 2018). Political momentum gains strength as a driver, while great potential is expected in job creation, economic growth, and the definition of competitive advantages (Bocken et al., 2014; Mathews & Tan, 2011). Finally, one of the great drivers is technological development (Mathews & Tan, 2011; Martín & Salinas, 2022), as it facilitates the optimization and reuse of resources (Jesus & Mendonça, 2018; Ghisellini et al., 2016). Innovations in information exchange, associated for example with online platforms, can facilitate improved management of the life cycle of products (Lieder & Rashid, 2016; Benítez-Aurioles, 2021; Martín et al., 2020). In relation to the above, there are no studies on the factors that drive upcycling entrepreneurship, even less that analyze the role of personal principles and values.

A high potential of upcycling is assumed as a base element for entrepreneurship, as is the conceptually close activity of recycling (Khan & Tandon, 2018). The academic literature has highlighted the value of sustainable entrepreneurship (Martín & Guaita, 2020), since on the one hand it contributes to the creation of wealth based on the detection of market opportunities and on the other it addresses ecological and social challenges (Cohen & Winn, 2007; Shepherd & Patzelt, 2011). Entrepreneurs who promote projects with a strong environmental and sustainability component show a series of largely common characteristics that act as drivers of their vocation (McEwen, 2013; Dean & McMullen, 2007). They act as entrepreneurs with a strong internal motivation related to environmental problems, which they consciously try to address (Jayasinghe et al., 2021). Obviously without losing sight of financial sustainability (Wilson & Webster, 2018). Among these entrepreneurs, innovation is very present, being necessary to propose innovative and sustainable solutions (Bymolt et al., 2015; Storey et al., 2015). Therefore, they are considered as agents of change (Hall et al., 2010; Hockerts & Wüstenhagen, 2010). In fact, several authors argue that sustainable entrepreneurs create and change institutions and social norms to positively influence ecological and social impact (Pacheco et al., 2010; Meek et al., 2010). It is found that the founders of green or social companies or both, imprint in their decisions and in the choice of priorities their own values of sustainability (Di Vito & Bohnsack, 2017). Furthermore, the attitudes, beliefs and convictions of the founders shape the company's orientation in a lasting way (Fauchart & Gruber, 2011; Schaltegger & Wagner, 2011). Eco-entrepreneurs have the conviction to grow their business in the most ecological and socially responsible way possible (Di Vito & Bohnsack, 2017). Therefore, they place social interest on the same level as private personal interest (Freeman et al., 2004; Porter & Kramer, 2011). These entrepreneurs are more open to using more sustainable practices, such as alternative technologies, use of recycled materials, waste conservation policies, etc. (Hall et al, 2010; Hockerts & Wüstenhagen, 2010).

Considering the academic literature on upcycling, this work makes several contributions. First, it delves into the role of principles and values as drivers of upcycling. This has been studied in the case of consumers, but not with a sample as large and international as the one proposed in this study. Second, a complementary contribution is made focused on the role of these principles and values in the frequency of practice of this activity. And finally, a new contribution is made focused on entrepreneurship. The latter has not been analyzed previously, since as it has been explained, has only

been possible to refer to academic studies focused on the more generic concept of circular economy. Thus, sound empirical evidence is provided in a field where it is scarce. It is the first time that a study has been proposed with such a broad fieldwork focused on upcycling and that provides a complete analysis of the role of principles and values in the sequence – practice, frequency, entrepreneurship.

3. Methodology

Data. The survey was completed online by 830 individuals. There were 643 females and 170 males (17 individuals selected the "Other" option in the gender question), and the average age of participants was in the range 25–45 years old. The survey included 17 questions, addressing sociodemographic issues such as gender, age, nationality and job position; as well as questions attempting to disentangle their drivers and upcycling behaviour (see Table 1).

Table 2 summarises the survey questions, their specific wording in the survey, the corresponding variable name in the data analysis further on, their answer type and codification. The answers to the majority of the questions used in the analysis have a Likert scale in the form of: "Strongly Agree", "Agree", "Neither agree nor disagree", "Disagree" and "Strongly Disagree"; subsequently coded, respectively, as: 2, 1, 0, -1, -2. For the analyses, we have not used those questions that had a long text answer. Answers to questions 2, 3 and 4 (Likert scale) are treated as continuous because their categories can be considered equally spaced (Williams, 2000). Question 7 (*business*) and question 12 (*age*) are treated as categorical variables; and question 10 (*female*) and question 15 (*furtherinterest*) as dummy variables. In any of these questions, "Other" type answers have been considered missing data.

Table 1. Characteristics of the survey sample

Characteristics	N	Percentage
Gender		
Male	170	20.8%
Female	643	78.8%
Other	17	0.4%
Age		
0–25	148	17.9%
25–45	353	42.5%
45–65	279	33.6%
+65	50	6%
Job Position		
Unemployed	127	16.1%
Entrepreneurship	102	12.9%
Student	29	3.7%
Retired	35	4.4%
Teacher	30	23.6%
Engineer	6	0.8%
Other	501	60%
Nationality		
British	277	33%
Mexican	10	1.2%
American	10	1.2%
Spain	13	1.5%
Nigerian	48	5.7%
Brazilian	21	2.5%
Indian	49	6%
French	20	2.4%
Australia	29	3.5%
Canada	17	2%
Italian	27	3.2%
Other	309	37.8%

Table 3 below summarizes the descriptive statistics of the variables used in the estimated models. One can see that the median respondent strongly agrees that "taking part in upcycling is important" (*importance*); reports to have upcycled in the past 5 years about once every three months (*frequency*); strongly agrees that upcycling strongly reflects his/her principles about using resources responsibly (*principles*), that it would be unacceptable not to upcycle (*unacceptable*) and that his/her likelihood of upcycling is high (*highprobab*). Moreover, the median respondent intents to start up an upcycling business (*business*); would be interested in doing sustainable business courses (*furtherinterest*); and is a female between 35–45 years old.

RQ1: What role do principles/values play in the importance that individuals attribute to upcycling?

This question is addressed by analyzing the determinants (independent variables) of the dependent variable *importance* (question 1). A regression model is estimated:

$$Y_i = \alpha + \beta_{1i}X_{1i} + \beta_{2i}X_{2i} + \beta_{3i}X_{3i} + \ldots + \varepsilon_i$$

where Y_i is the i^{th} observation of the dependent variable *importance*, X_{ji} is the i^{th} observation of the independent variable X_j; and ε_i is the i^{th} observation of the error term. The model is not completely specified until we select a probability distribution for Y or, equivalently, for the error term ε. If one can assume that the probability that Y* takes on successively higher values rises (or falls) constantly over the entire range of X_j, then the multiple linear regression (OLS) is appropriate. On the contrary, i.e., if the probability that Y* takes on successively higher values rises (or falls), respectively, slowly, more rapidly and more slowly at, respectively, small, medium and large values of X_j, then either the normal or logistic distribution is suitable for ε and, consequently, either the ordered probit or the ordered logit model is appropiate (Winship & Mare, 1984).

The answers to question 1 follow a Likert scale. Hence, *importance* can be treated as continuous, and a multiple

Table 2. Survey questions and codification

Order	Question text and *variable* in analysis:	Answers and Codification
1	To me taking part in upcycling is important: ***importance***	Likert scale (5 items) plus "Other"
2	Upclycling reflects my principles about using resources responsibly: ***principles***	Likert scale (5 items) plus "Other"
3	If would be unacceptable to me not to upcycle, especially when used materials are available and would become waste otherwise: ***unacceptable***	Likert scale (5 items) plus "Other"
4	My likelihood of upcycling is high: ***highprobab***	Likert scale (5 items) plus "Other"
5	Approximately, how often have you upcycled things in the past five years? ***frequency***	Never: 0 Less frequently than once a year: 1 About once a year: 2 About once every six months: 3 About once every three months: 4 About once a month: 5 About once a week: 6 More frequently than once a week: 7 Other: "-"
6	What are the type of products you have created with upcycling?	Short text answer
7	I intend to start up an upcycling business: ***business***	Yes: 1 No: 0 Im already un upcycling entrepreneur: 2 Other: "-"
8	If you have your upcycling company, describe your company and details	Long text answer
9	If you intend to start an upclycing business, what type of company and why?	Long text answer
10	Gender: ***female***	Female: 1 Male: 0 Other: "-"
11	Nationality	Short text answer
12	Age: ***age***	0-25: 1 25-35: 2 35-45: 3 45-55: 4 +55: 5 >65: 6 Other: "-"
13	Job Position	Arts and Design: 1 Unemployed: 2 Entrepreneur: 3 Other: "-"
14	Why did you take the Business Course in FutureLearn?	Long answer text
15	Would you be interested in doing sustainable business courses? ***furtherinterest***	Yes: 1 No: 0 Other: "-"
16	If you responded yes, which ones?	Short text answer
17	Are you willing to be contacted again for further details? Please provide your email	Short text answer

Table 3. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Median
importance	819	1.647	0.510	Neither agree nor disagree (0)	Strongly agree (2)	Strongly agree (2)
frequency	804	3.378	1.936	Never (0)	More than once a week (7)	About once every 3 months (4)
principles	819	1.637	0.550	Strongly disagree (-2)	Strongly agree (2)	Strongly agree (2)
unacceptable	810	1.315	0.761	Strongly disagree (-2)	Strongly agree (2)	Agree (1)
highprobab	811	1.274	0.733	Strongly disagree (-2)	Strongly agree (2)	Agree (1)
business	579	0.737	0.530	No (0)	I'm already an upcycling entrepreneur (2)	Yes (1)
furtherinterest	742	0.965	0.184	No (0)	Yes (1)	Yes (1)
female	813	0.791	0.410	Male (0)	Female (1)	Female (1)
age	814	3.060	1.514	0-25 years (1)	>65 years (6)	35– 45 years (3)

linear regression (OLS) is calculated to predict *importance* based on the various independent variables or predictors. But *importance* can also be treated as categorical, and for robustness, an ordered logit regression is calculated to predict *importance* on the various predictors – similar results with ordered probit regression. Results are consistent throughout estimation method. We have considered the following predictors of *importance*. The variable *frequency*, as a proxy for individuals' upcycling frequency, may be positively related with individuals' upcycling *importance*. Then, one may expect that individuals for whom "upcycling reflects their principles about using resources responsibly" do also consider that upcycling is important for them. The variable *unacceptable* attempts to capture whether individuals consider the upcycling action to be somehow imperative given that it can be done and otherwise the materials will become waste. One should expect a positive relationship between *unacceptable* and *importance*. The variable *highprobab* captures the answer to the survey question "My likelihood of upcycling is high"; one may expect that if the individual considers his likelihood of upcycling to be high, he will also consider upcycling important; hence *highprobab* and *importance* may be positively related. In addition, it seems plausible that individuals who report having the intention to start up an upcycling business will consider upcycling important; that is, *business* is expected to have a positive relationship with *importance*. Moreover, it seems likely that those individuals who report having interest in taking courses on sustainable businesses will also consider upcycling important; hence, a positive relationship between *further* and *importance* is expected. Finally, with respect to individuals' gender captured by the dummy variable *female* and with respect to individuals' *age*, there is no previous expectation about their relationship with importance. Hence the importance model to be estimated is as follows:

importance = f (frequency, importance, principles, unacceptable, highprobab, business, further, female, age)

RQ2: How important are the principles / values in the frequency of upcycling practices?

This question is addressed by analyzing the determinants of individuals' upcycling frequency (question 5). The answers to this question do not follow a Likert scale, thus, we have calculated an ordered logit regression to predict frequency based on various predictors. However, as *frequency* has seven categories, we have also calculated the standard multiple linear regression to predict it. Results are consistent throughout estimation method. The *frequency* model is as follows:

frequency = f (importance, principles, unacceptable, highprobab, business, further, female, age)

That is, it is assumed that individuals' upcycling *frequency* will be positively related with *importance* (upcycling is important for them), *principles* (upcycling reflects their principles), *unacceptable* (individuals consider that upcycling is somehow imperative since it can be done), *highprobab* (individual considers he/she has a high likelihood of upcycling), *business* (individuals have the intention of starting up an upcycling business) and *further* (individuals report interest in taking sustainability courses). With respect to the variables *female* and *age*, there is no previous expectation as to the sign, if significant, of their relationship with *frequency*.

RQ3: How important are the principles / values in the decision to undertake an upcycling business?

As there are only 25 observations in the *business* variable category "I'm already an upcycling entrepreneur", we have generated the dummy variable *entrepreneurship* with only two categories: "Yes", which includes both these 25 observations and those individuals who reported having the intention to start up an upcycling business; the category "No" contains those individuals who reported not having this intention. This mounts to the upcycling *entrepreneurship* logit model:

entrepreneurship = f (frequency, principles, unacceptable, highprobab, further, female, age)

In this model, it is expected: a positive relationship with individuals' upcycling *frequency*, *principles* (upcycling reflects their principles), *unacceptable* (individuals consider that upcycling is somehow imperative since it can be done), *highprobab* (individual considers he/she has a high likelihood of upcycling), *business* (individuals have the intention of starting up an upcycling business) and *further* (individuals report interest in taking sustainability courses). With respect to the variables *female* and *age*, there is no previous expectation as to the sign, if significant, of their relationship with *entrepreneurship*.

4. Results

4.1. Importance as dependent variable

Table 4 below captures the two *importance* models we have estimated. Model 1 estimates *importance* by means of a standard OLS multiple regression. We use the Stata software and apply the standard variance estimator for the ordinary least squares regression. A significant OLS multiple regression equation was found [$F(13, 498)=27.69$, $p<0.000$]. Model 2 estimates *importance* by an ordered logit model,

the model is significant [*LR* $\chi^2(13) = 247.78$, $p<0.000$]. Both models suggest consistent results with respect to the significance or not of the various predictors.

In these two models to predict *importance*, the independent variable *frequency* has been dealt with as a continuous variable, however, results do not vary if *frequency* were considered a categorical variable. Independently of the model and of how *frequency* is dealth with, *frequency* is not significant as a predictor of *importance*. Moreover, results suggest that *importance* increases with: *principles* (1% significance level); *unacceptable* (1% significance level); *highprobab* (1% significance level); *business* (more specifically, having the intention to start up an upcycling business, 1% significance level); and, *further* (5% significance level in OLS Model 1, and 10% significance level with ordered logit Model 2). Finally, *importance* seems to decrease for certain *age* groups: individuals between 25–35 years (5% significant independently of the model), individuals between 45–55 years old (1% significant with OLS Model 1- and 5% with ordered logit Model 2); and individuals older than 65 years (only 10% in OLS Model 1, 5% in ordered logit Model 2). Importance increases with principles, unacceptable, high probab and having the intention to start up an upcycling business.

Table 4. Importance as Dependent Variable. OLS and Ordered Logistic Regression Coefficients

Importance	(1) OLS Model	(2) Ologit Model
frequency	0.0117	0.103
	(0.00919)	(0.0745)
principles	0.203***	1.133***
	(0.0346)	(0.235)
unacceptable	0.123***	0.883***
	(0.0235)	(0.171)
highprobab	0.206***	1.388***
	(0.0265)	(0.211)
1.*business* (Yes)	0.113***	0.775***
	(0.0403)	(0.283)
2.*business* (entrepreneur)	0.0962	0.684
	(0.0858)	(0.751)
furthercourses	0.189**	1.123*
	(0.0878)	(0.608)
female	0.0168	0.0421
	(0.0397)	(0.314)
2.*age* (25-35)	-0.122**	-0.927**
	(0.0482)	(0.368)
3.*age* (35-45)	-0.0692	-0.455
	(0.0532)	(0.419)
4.*age* (45-55)	-0.155***	-1.075**
	(0.0555)	(0.437)
5.*age* (+55)	-0.119*	-0.709
	(0.0625)	(0.521)
6.*age* (+65)	-0.154*	-1.125**
	(0.0783)	(0.570)
Constant	0.719***	-
	(0.107)	-
Observations	512	512
R-squared	0.420	0.370†
Model Significance	F(13, 498)= 27.69***	LR chi2(13)= 242.78***

Note: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1, †Pseudo R-squared

4.2. Frequency as dependent variable

Table 5 below summarizes the estimation results taking individuals' upcycling *frequency* as the dependent variable. The correlation analysis shows a 1% significant Spearman correlation coefficient between *importance*, on the one hand, versus *morality* ($r = 0.482$; $p<0.000$), *unacceptable* ($r = 0.454$, $p<0.000$) and *highprobab* ($r = 0.492$, $p < 0.000$). For this reason, Models 2 and 5 exclude *importance* and include *morality*, *unacceptable* and *highprobab*; while Models 3 and 6 include *importance* and exclude *morality*, *unacceptable* and *highprobab*. All of the regression equations estimated are significant at the 1% level, moreover, results are consistent across estimation models.

More concretely, either *importance* or the threesome conformed by *morality*, *unacceptable* and *highprobab* seem to very significantly increase upcycling *frequency*. The variable *importance* increases *frequency* at 1% significance level (Models 3 and 6); *principles* increases *frequency* significantly between 5% and 1% levels; *unacceptable* and *highprobab* do accordingly at 1% significance level (Models 2 and 5). The variable *business*, and more specifically the category "I'm already an upcycling entrepreneur", significantly increases *frequency* at 5% significance level. Being a *female* increases *frequency* at 1% significance level. With respect to *age*: *frequency* increases, significantly at 1% level, when individuals belong to the categories older than 55 and older than 65 years old. The variable *further* is not significant as predictor of *frequency*, independently of the model.

4.3. Entrepreneurship as dependent variable

As stated above, with the dummy variable *entrepreneurship*, the 25 observations in the category "Im already an upcycling entrepreneur" have been included in the category "Yes". As a dummy dependent variable, an ordered logit estimation method has been applied in the three models below, which differ with respect to whether *importance* versus *principles*, *unacceptable* and *higprobab* have been included. All of the logit equations estimated are significant at the 1% level.

Table 5. Frequency as Dependent Variable. OLS and Ordered Logistic Regression Coefficients

Frequency	(1) OLS Model	(2) OLS Model	(3) OLS Model	(4) OLogit Model	(5) OLogit Model	(6) OLogit Model
importance	0.276	-	1.013***	0.255		0.964***
	(0.218)		(0.179)	(0.206)		(0.172)
principles	0.356**	0.421**	-	0.422**	0.487***	-
	(0.173)	(0.167)		(0.173)	(0.167)	
unacceptable	0.280**	0.316***	-	0.276**	0.304***	-
	(0.117)	(0.113)		(0.112)	(0.110)	
highprobab	0.440***	0.493***	-	0.493***	0.544***	-
	(0.135)	(0.127)		(0.132)	(0.123)	
1.*business intention*	0.0798	0.109	0.235	0.0700	0.0918	0.242
	(0.198)	(0.196)	(0.197)	(0.187)	(0.186)	(0.182)
2.*business intention*	0.818**	0.849**	1.090**	0.766*	0.788*	1.089**
	(0.416)	(0.416)	(0.422)	(0.457)	(0.455)	(0.462)
further courses	-0.0131	0.0354	0.0241	-0.0255	0.0362	-0.0268
	(0.429)	(0.427)	(0.429)	(0.410)	(0.407)	(0.401)
female	0.662***	0.666***	0.577***	0.658***	0.663***	0.529***
	(0.191)	(0.191)	(0.193)	(0.198)	(0.197)	(0.191)
2.*age* (25-35)	-0.0453	-0.0865	0.119	-0.00953	-0.0551	0.113
	(0.236)	(0.234)	(0.238)	(0.233)	(0.231)	(0.228)
3.*age* (35-45)	0.0616	0.0429	0.236	0.0366	0.0220	0.176
	(0.259)	(0.259)	(0.260)	(0.247)	(0.247)	(0.243)
4.*age* (45-55)	0.415	0.374	0.668**	0.397	0.356	0.633**
	(0.272)	(0.270)	(0.269)	(0.264)	(0.262)	(0.258)
5.*age* (+55)	0.839***	0.808***	1.168***	0.795***	0.762***	1.096***
	(0.303)	(0.302)	(0.304)	(0.294)	(0.292)	(0.288)
6.*age* (+65)	1.280***	1.240***	1.620***	1.334***	1.287***	1.669***
	(0.378)	(0.377)	(0.383)	(0.381)	(0.380)	(0.378)
Constant	0.524	0.725	0.532	-	-	-
	(0.546)	(0.522)	(0.537)			
Observations	512	513	523	512	513	523
R-squared	0.192	0.189	0.142	0.055†	0.054†	0.038†
Model Significance	F(13, 498) =9.10***	F(12, 500) =9.74***	F(10, 512) =8.49***	LRchi2(13) =114.16***	LRchi2(12) =112.84***	LRchi2(13) =79.47***

Note: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1 †Pseudo R-squared

Results on the *entrepreneurship* variable can be summarized as follows. Females are less likely to have the intention to start up an upcycling business (1% significance). Individuals older than 55 and older than 65 are less likely to have the intention to start up an upcycling business (1% significance level). Individuals for whom upcycling is important (*importance* variable) are more likely to have the intention to start up an upcycling business (1% significance level). Individuals who report themselves as having a high probability of upcycling (*highprobab*) are more likely to have the intention to start up an upcycling business (1% significance level).

5. Discussion and Conclusions

In this research, upcycling has been presented as an activity of great environmental and social value, capable of contributing to the evolution of the current obsolete production and consumption model. However, even when its potential is recognized (Sung, 2017; Wilson, 2016), research on this practice is scarce and remains fragmented (Paras & Curteza, 2018). This research is based on an international fieldwork that makes it possible to increase knowledge about the factors that contribute to promoting upcycling activities. The basic objective of the research is to expand

Table 6. Entrepreneurship as Dependent Variable. Logit Model Coefficients

Entrepreneurship	Model (1)	Model (2)	Model (3)
frequency	0.0335	0.0888	0.0437
	(0.0661)	(0.0600)	(0.0653)
importance	0.725***	1.312***	
	(0.278)	(0.223)	
principles	0.143		0.302
	(0.242)		(0.232)
unacceptable	-0.0136		0.0835
	(0.162)		(0.155)
highprobab	0.803***		0.956***
	(0.188)		(0.178)
furthercourses	0.151	-0.205	0.281
	(0.575)	(0.542)	(0.576)
female	-0.800***	-0.790***	-0.777***
	(0.295)	(0.283)	(0.291)
2.*age* (25-35)	0.351	0.557*	0.251
	(0.338)	(0.323)	(0.332)
3.*age* (35-45)	-0.0836	0.118	-0.124
	(0.356)	(0.342)	(0.355)
4.*age* (45-55)	-0.266	0.0413	-0.383
	(0.374)	(0.355)	(0.367)
5.*age* (+55)	-1.295***	-1.024***	-1.388***
	(0.393)	(0.371)	(0.390)
6.*age* (+65)	-2.451***	-2.191***	-2.564***
	(0.504)	(0.490)	(0.502)
Constant	-0.812	-0.607	-0.283
	(0.729)	(0.675)	(0.701)
Observations	512	523	513
Pseudo R^2	0.182	0.152	0.176
Model Significance	LR chi2(12) =115.20***	LR chi2(9) = 95.21***	LR chi2(11) =108.76***

Note: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

the information on the role of personal principles and values in behavior change related to upcycling. In this sense, a sequence of analysis has been defined that starts from the study of the importance attributed to these practices, as a first step for their development. The consolidation of the above is associated with the frequency of practice and culminates in the development of entrepreneurship initiatives.

Regarding the importance attached to upcycling practices, the significant correlation between, on the one hand, the variable *importance* and, on the other hand, the variables *principles*, *unacceptable* and *highprobab*, suggests that upcycling is important for individuals because either it reflects their principles, they consider upcycling almost imperative or they report themselves as having a high probability of upcycling. As a complement to the above, on the predictors of individuals' upcycling *importance* [RQ1], results seem to suggest that *importance* increases with: *principles* (upcycling reflects their principles), *unacceptable* (individuals consider that upcycling is somehow imperative since it can be done), *highprobability* (individual considers he/she has a high likelihood of upcycling), *business* (category: individuals have the intention of starting up an upcycling business) and *further* (individual reports interest in taking sustainability courses). On the contrary, *importance* seems to decrease for certain *age* groups (25–35, 45–55, older than 65). Finally, being a *female* is not a significant predictor. Therefore, it is found that individual principles and values are decisive in the importance attached to upcycling. Moreover, those individuals who attach more importance to this practice consider its development imperative and have a high probability of developing these practices. This connects with what has been highlighted in previous studies on motivations for upcycling, which highlights environmental concerns (Wilson, 2016; Sung et al., 2014). This is undoubtedly related to personal principles. Therefore, certain common elements are found between motivations and the attribution of importance. Once the factors that influence the importance attributed to upcycling have been analyzed, the predictors of the frequency with which this practice is carried out have been studied.

Regarding the predictors of individuals' upcycling *frequency* [RQ2], our results seem to suggest that individuals upcycling frequency increases if either upcycling is important for them (*importance*), or if upcycling reflects their principles (*principles*), they consider it almost imperative (*unacceptable*) and report themselves as having a high probability of upcycling (*highprobab*). This is due to the significant correlation reported between the variable importance, on the one hand, and, on the other hand, each one of the variables principles, unacceptable and highprobab. Furthermore, when the individual is already an upcycling entrepreneur (*business*' category), the frequency of practice increases. Likewise, the frequency is higher among women, and when individuals belong to the older age groups (more than 55 and more than 65 years old). Therefore, the idea that individual principles are decisive not only in the attributed importance but also in the frequency of practice is reinforced. Principles that are reinforced with perceptions related to the imperative to carry out this practice.

On the predictors of individuals' upcycling entrepreneurship [RQ3], our results seem to suggest that individuals are more likely to have the intention of starting up an upcycling business if upcycling is important for them (*importance*) and if they report themselves as having a high probability of upcycling (*highprobab*). On the contrary, it is less likely that individuals have the intention of starting up an upcycling

business if they are females or belong to the older age groups (more than 55 and more than 65 years old). Since there are very few studies on upcycling entrepreneurship, these conclusions must be connected with studies on sustainable entrepreneurship or the circular economy. It has been found that these entrepreneurs decide to start these types of activities largely due to personal motivations to improve environmental and social problems (Jayasinghe et al., 2021). As has been stated, entrepreneurs link their values related to sustainability to their decision making (Di Vito & Bohnsack, 2017). Or as this study indicates, their principles, with regard specifically to upcycling.

This work confirms the results presented in previous studies that indicated the importance of principles in the development of circular economy practices, specifically upcycling, among citizens. Although the contribution of the study goes further and reveals new evidence. More concretely, it is necessary to highlight the aforementioned, since it is confirmed with a large international sample. Second, specific evidence is provided on the effect of age and gender on the role of principles in the development of upcycling practices and their frequency. Finally, this study makes a particular contribution to the analysis of the drivers of upcycling entrepreneurship, something scarcely studied in the entire branch of the circular economy and very specifically in upcycling. Thus, the chain of actions – doing, frequency, entrepreneurship – is decisively conditioned by personal values and principles, this being an original contribution of this work. With regards to entrepreneurship, this work provides evidence that having the intention to start up an upcycling business is more likely when individuals consider upcycling important for them and report themselves as having a high probability of upcycling.

Considering the above, some public policy recommendations are proposed. In the first place, given the importance of the principles, it would be necessary to develop training actions among children and young people that can transmit these principles. Even raise awareness actions that address the imperative of developing more sustainable practices given the environmental crisis that may arise from prolonging the current consumption/production model. This study offers a first piece to understand motivations for change in production and consumption practices related to upcycling. Once the value of the principles has been verified, the next step proposed as future research should focus on comparing the value of the principles with other elements studied in the literature on responsible production / consumption. These would be those related to cost savings, the role of legislation, social image, self-realization, etc. We also recommend conducting qualitative studies on what exactly are the intangible values associated with upcycling entrepreneurship and its link with factors such as maintaining the cultural heritage and identity of the territories expressed in disused products. The main limitation of this study lies precisely in the fact that it offers an incomplete picture of the driving factors, but the authors understand that this study on importance, frequency and entrepreneurial intention is a necessary step to initiate other comparative studies such as the one that has been proposed.

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