



Consumers are willing to participate in circular business models: A practice theory perspective to food provisioning

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ABSTRACT

Implementing circular business models in food supply chains is an organizational solution to tackle the issue of household food waste, converting it in feedstock to upcycle within industrial symbioses. Adopting literature on practices of food consumption as theoretical framework, this paper analyzes consumers' participation in circular business models. A conceptual model of the emergence of food provisioning practices in circular business models is designed and empirically tested, through a survey, in order to analyze consumers' willingness to participate in an innovative food provisioning mechanism with retailers. Respondents were asked to choose whether to participate or not in a proposed program, and their choices have been modelled in an ordered logit model. 88% of interviewees declared sorting organic food waste as a normal activity in his household. 78.9% of participants accepted to participate to the proposed programs independently of the type of agreement's attributes. 14.49% accepted only some programs depending on the program type, while 6.61% of respondents choose not to participate to any of the proposed program. Findings outline the expected participant as an individual already engaged in tasks to cope with risk in food provisioning and having already developed a long-lasting relation with a retailer. The study reveals also the opposite effect of concerns about tasks related to take-back system, such as food waste handling, and social desirability of recycling. Focusing on the business-to-consumers relationship, the paper suggests to practitioners interested in circular business models the possibility to adopt innovative 'food-product-as-a-service' approaches. Recommendations can be derived for future studies about the relevance of practice theory in the analysis of consumers' engagement in circular business models.

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1. Introduction

Literature suggests that circular business models (CBMs) offer an effective way to tackle societal challenges and contribute to sustainable development goals mostly by promoting a break-through approach to actualize the sustainability of industrial systems and rethink the organization of supply chains (Ghisellini et al., 2016).

Through the implementation of CBMs, in fact, critical resource

loops¹ are closed, slowed, intensified, dematerialised, or narrowed (Geissdoerfer et al., 2018), minimizing waste and reducing negative impacts for people and the planet. CBMs entail various sustainability strategies including (i) designing take-back systems connecting businesses to other businesses or to consumers aiming to reuse, remanufacturing, and recycling of resources, (ii) delivering functionality rather than ownership, for example through a produce-as-a-service approach and aiming at providing users with the required functionality without transfer of the owning of the

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¹ According to the EU, technological innovation and the rapid growth of emerging economies has led to increased demand of different raw materials with global resource use expected to double between 2010 and 2030 (European Commission, 2018). Particularly, a list of critical raw materials, namely materials which reach or exceed thresholds for both economic importance and supply risk, is published by the European Commission every three years (European Commission, 2017).

Notation list

CBM	Circular Business Model
CE	Circular Economy
CFPP	Circular Food Provisioning Practice
EU	European Union
HFW	Household Food Waste
SP	System of Provision
UK	United Kingdom

product that delivers the service (Geissdoerfer et al., 2018). Thus circular economy (CE) principles applied to business models support the exchange of materials among supply chain actors (Bocken et al., 2014) while delivering enhanced functionalities (Bocken et al., 2016).

Along this line, CBMs have been recently considered as effective organizational solutions to tackle societal issues such as food waste (Lüdeke-Freund et al., 2019). It is widely accepted that food waste is an inefficiency of current food systems (FAO, 2011), with a third of all edible food that goes uneaten (EMF, 2019). CE approaches to reduce food waste emphasise that, besides ordinary practices of food waste management, designing industrial routes, transforming food waste into feedstock to produce, for instance, bio-chemicals, bio-materials and energy, is the way to maximize the value of agri-food productions and reduce wastages (Giroto et al., 2015). Research in the CE domain has been particularly focused on business to business relations, for example in designing CBMs and industrial symbioses (Leipold and Petit-Boix, 2018) looking at CE as an “industrial economy that is restorative by intention and design” (EMF, 2012: 14). Instead, business to consumer relationship in these business models is still neglected, although key to tackle food waste issues (Hebrok and Boks, 2017). Particularly, what seems to be lacking is an inquiry in the role of the relations between consumers and retailers in both aspects of CBMs and namely when it comes to close critical loops of resources (i.e. those related to food) and to move from ownership (of food products) to functionality. In fact, research on CBMs and related strategies have been mostly developed in the context of technological materials and metabolisms and similarly application of product-as-a-service business models have largely focused on electronics, clothing, furniture and durable goods rather than food products (Lüdeke-Freund et al., 2019).

Given this background, this paper is focused on consumers' participation in CBMs entailing innovative food provisioning mechanisms with retailers. Particularly, aiming to contribute to the understanding of the role of consumers in CBMs, this paper takes the perspective of studies on practices related to consumption and more specifically in the field of *food provisioning* (Spaargaren and Van Vliet, 2000). Following recent accounts highlighting the relevance for CE to reconnect consumers' analysis to household practices (Mylan et al., 2016), this paper is informed by studies that investigate consumption as a practice (Warde, 2005). Since in CBMs food provisioning becomes a key set of practices that might call for redefining consumption strategies at household level, taking into account these practices is paramount to develop a wider understanding of CBMs based on business to consumer relations, new systems of provision (SP) and oriented to tackle food waste. Key to the success of these models, in fact, is understanding how to trigger consumers' participation and, then, widening to different target groups and segments. As opposed to business to business settings, the customer relation component of a business to consumer CBM becomes a critical aspect to consider (Lewandowski, 2016).

Based on a practice-oriented conceptual background

(Spaargaren and Van Vliet, 2000), an empirical analysis — in which *circular food provisioning* is defined as set of household-level practices (circular food provisioning practice, CFPP), starting from enacting food purchasing and ending with the act of recycling food waste — was developed. Current analysis tackles two main research questions: (a) would consumers be willing to participate in a CBM based on novel food provisioning practices? and (b) what would be the drivers shaping their participation?

To answer these questions, consumers' willingness to participate in a CBM with a food retailer was empirically explored, testing whether specific features concerning consumers' lifestyle and food provisioning strategies affect this decision. Particularly a theory-testing, combined with a quantitative methodological approach, was developed. A survey aiming at a large scale data collection process was designed and implemented. An opportunity to implement the empirical strategy was identified in the context of a research project aiming at mapping the raising interests of Italian large food retailers for CBMs, as well as the increase of public-private initiatives to tackle food waste in that country (such as *Last Minute Market* and *Il Pane in attesa*²) (Vittuari et al., 2017). Italy also represented an ideal setting for the field work of this study, since it has been reported as the second largest country (after UK) in terms of household food waste (HFW) generated per capita (Jørisen et al., 2015).

Current paper aims to address the gap of current literature on CBMs as concerns consumer-retailer relationships in the domain of food. To the best of our knowledge, no previous study has been focused on this topic by implementing a product-as-a-service approach to food, as well as being assisted by a nationally representative consumer sample (1270 Italian households). As for business-to-consumers relationships, the paper is expected to provide insights to practitioners in food retailing interested in the design and implementation of CBMs. Furthermore, it provides a conceptual framework based on a practice-oriented theoretical background fit for being applied to other CBMs related to food and food waste recycling.

2. A conceptual model of food provisioning practices in circular business models

The extant literature on CBMs has already acknowledged the role of consumers/users (Lüdeke-Freund et al., 2019), actively participating in the supply chain in order to valorize end-of-life products through reusing, cascading materials, refurbishing and upcycling (Tukker, 2015). Several CBMs are in fact based on the connection between consumers and upstream supply chain actors related to alternative activities concerning their purchasing and recycling habits (Borrello et al., 2017). To illustrate, consumers' engagement in these business models entails: entertain formalized relations with providers to organize the exchange of materials (Selvefors et al., 2019); store wastes, components and unused items (Borrello et al., 2016); devote time and space to recycling activities (Borrello et al., 2016); trust in the proper implementation of the circular supply chain (Graessley et al., 2019; Hollowell et al., 2019); restrict the supply of certain items to specific providers to which be affiliated (Rexfelt and Hiort af Ornäs, 2009). All these activities demand the implementation of novel organizational practices potentially conflicting with existing household routines (Mylan, 2015). As for this aspect, most of current knowledge about CBMs in consumption contexts, or focusing on business to consumer relations, comes from the literature on sustainable product service systems (Tukker, 2015). These studies highlight that since

² <https://www.facebook.com/paneinattesa>.

consumers have established ways of conducting their daily activities, the success of new SP based on CE (namely, CBMs) is conditioned by consumers' willingness to commit and re-organize their household strategies. In fact, consumers' participation in circular supply chains has been identified as a critical driver to facilitate transitioning into CE (Kirchherr et al., 2018). However, when looking at the literature on *practices related to consumption and food waste management* inspired by CE principles, the discussion on CBMs seems to lack an engagement with the idea of "rethinking consumption" (Moreau et al., 2017: 497), particularly by calling into question the role of consumers and final users in "circular practices" (Tukker, 2015).

A practice has been described as a set of human experience resulting from the interaction between us and the world around us, made of "bodily actions, mental activity, emotional meaning, materials 'things' and background knowledge or 'know-how'" (Paddock, 2017: 124) and of the interconnections of these elements. As such, interpreting life as constituted of practices (Warde, 2005), and each practice as a combination of elements, shifts the focus of consumer study away from single moments of individual rational decision making (Mylan, 2015). The current research will adopt the conceptual model of Spaargaren and Van Vliet (2000) which views practices as entities emerging from the combination of individuals' lifestyles and collective socio-technical SP. Grounding their model on structuration theory (Giddens, 1984), these authors argue that practices fostering environmental sustainability result from the reciprocal interaction of actor and structure. The actor is conditioned by SP which, in turn, are reinforced by the lifestyles of the actors. SP are made of rules and resources and falls in the institutional analysis of practices; actors' lifestyles represent coherent units of actions and meanings which eventually are manifested through behavioral patterns to analyze in the context of "micro-studies" (Spaargaren and Van Vliet, 2000: 54). Lifestyles thus break up human behavior in lifestyle sectors determining practices more or less integrated and not necessarily mutually consistent. "When high levels of environmental consciousness meet low levels of 'green innovation' of systems of provision, the result will be a lack of environmental friendly behavior. On the other hand, domestic agents will only accept more sustainable [options] under the condition that the devices 'fit' into the overall organization of their households and lifestyles" (Spaargaren and Van Vliet, 2000: 65). In a nutshell, the authors argue that environmental innovations may succeed to change practices of domestic consumption only when the SP that serves the innovation fits the lifestyle and the domestic organization/routine of human actors.

This notion seeing *consumption as a practice* resulting from lifestyles and SP requires a clear definition of the consumption practice itself. In the words of Warde (2005: 137): "consumption cannot be reduced to demand, requiring instead its examination as an integral part of most spheres of daily life". Even though it is prevalent in the scholarship on consumption not to define the term (Graeber, 2011), it is ordinary that the debate is focused on the shopping stage, while consumption concerns a sequence of actions ending with getting rid of things (Evans, 2018). Accordingly, the consumption concept has been referred to a very broad or very limited set of activities (Pepermans, 1984). Also, it may include the wide ecological element of consumer behavior (Woods, 1981), on the other hand it may refer only to "buy things" (Mason, 1981). Following the broadest possible meaning, Røpke (2009: 2495) proposes an ecological perspective in which "human society can be seen as a metabolic organism appropriating resources from the environment, transforming them for purposes useful for humans, and finally discarding them as waste". This perspective helps to understand consumption as postulated by the CE narrative, namely as a process occurring over a period longer than the moment of

shopping and involving new practices to meet usual needs (Mylan et al., 2016). During this process, different routine practices take place in the domestic sphere leading at the end to the disposal of waste. To contextualize in the sphere of food, Roodhuyzen et al. (2017) identify a set of practices which directly or indirectly influence the generation of food waste: planning and organizational, shopping, storing, preparation and serving, as well as consumption meant as the final act of eating. These practices occur in the framework of the currently established linear way of food provisioning and are generated from existent SP and lifestyles. In fact, one of the challenges of implementing CBMs concerning food provisioning is then to change the conventional and unsustainable way to perform these practices.

Given this background, current study has adopted Spaargaren and Van Vliet (2000) perspective to develop a conceptual model to analyze the potential emergence of a circular food provisioning practice. The conceptual model is structured, for the sake of illustration, in three main blocks (see Fig. 1):

- i. *Circular Food Provisioning Practices* (central block of Fig. 1): the conceptual contribution of this work is to advance a model of food provisioning as practice occurring not only in the moment of food purchase, but through a sequence of actions. Since the theoretical accounts of practice theory are abstract, the definition of a specific practice is not straightforward (Crivits and Paredis, 2013). Albeit the lack of guidelines on how to define the boundaries of a practice may be seen as a limit, this allows to the researcher to define analytical categories that fit best his purposes. As for food consumption, this article follows the indication of Røpke (2009) who suggests that certain practices may be broken up in sub-practices. More specifically, the conceptual model presents circular food provisioning as a practice that can be summarized in four consecutive steps: the commitment to programs of circular economy (i.e. subscription) embedded in new SP giving to consumers the possibility to actively participate in the recycling of food waste; the actual moment of food purchase; waste sorting; and return of food waste to food retailers. The empirical strategy adopted in the current study relates with consumers' participation in the CBMs to their willingness to enact such CFPP.
- ii. *Systems of Provision* (right side of Fig. 1): The current food SP is based on the linear economic model. The linear model is apparently grounded on the assumption that infinite upstream flows of virgin materials can be used to replace downstream flows of obsolescent technical products and decaying biological matter (McDonough and Braungart, 2002). The rising scarcity of natural resources (Nakamura and Sato, 2011) and high levels of waste production (Marshall and Farahbakhsh, 2013) are issues that highlight this assumption as weak and no longer sustainable. In order to counteract the effects of linear productions and to treat nature as a stakeholder (Lewandowski, 2016), an alternative food SP based on the principles of CE should approach the environmental sustainability of food supply chains aiming at transforming food waste into a resource. With this goal, the conceptual model envisions a new organizational structure (see Borrello et al., 2017), based on a CBM, aiming to connect consumers upstream with retailers beyond the moment of purchase in order to recycle the food waste produced by households. The features of the CBM are assumed to affect consumers' participation. Particularly, the participation program that consumers are asked to subscribe should be designed to fit households' lifestyles in order to succeed. To illustrate, the organization of the take-back system for the

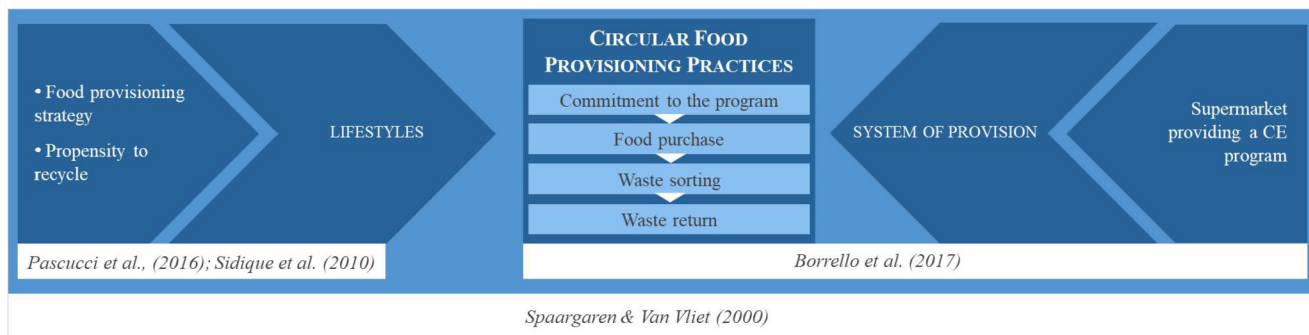


Fig. 1. Conceptual model of the circular food provisioning practices.

HFW and the incentives provided by the CBM might significantly condition consumers' willingness to participate.

iii. *Lifestyles* (left side of Fig. 1): According to Spaargaren and Van Vliet (2000: 63), inside factors such as the "internal time-space organisation and the 'cultural' style of the household" affect the constitution of a practice. For example, the authors cite the case of pooling of equipment — one of the strategies to transform goods into services to reduce resource consumption — that might not be accepted by consumers since it negatively affects the idea of a flexible household time-space organisation. Current study posits that the inside factors more likely to influence the emergence of the CFPP designed in the model are the food provisioning strategy of consumers and their propensity to recycle. Food provisioning strategy concerns the resources invested by consumers in the sub-practice of food purchase; it involves activities such as planning purchases, selecting of products and retailers and investing time in getting information about products and prices (Pascucci et al., 2016). Consumers' propensity to recycle is a construct that capture the dependency of the behavioural pattern of recycling from factors such as attitudes, convenience, familiarity and social pressure (Sidique et al., 2010).

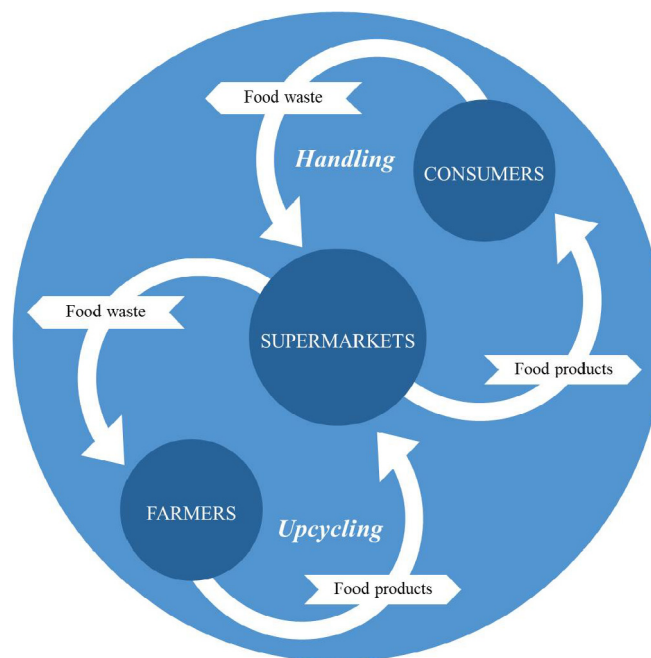


Fig. 2. Circular business model to upcycle and handle household food waste.

3. Materials and methods

The conceptual model of practices of circular food provisioning has been used to develop the field work and empirical strategy. The empirical strategy has been built around the idea of testing whether the likelihood to participate in a SP entailing circular food practices is affected by consumers' lifestyles and namely their food provisioning strategies, on one hand, and their propensity to recycle, on the other hand. The SP has been framed and presented to consumers as a CBM based on their collaboration with a food retailer like a supermarket (Fig. 2).

More specifically the SP in the CBM designed assumes that the food waste will be used as a substrate to upcycle (i.e. composted or directly transformed into feed) for the production of animal products (upcycling component). These products are then sold at the same retailing shop where consumers return their food waste (handling food waste component). In the empirical approach consumers' willingness to participate in this CBM was explored, particularly testing whether specific features concerning their lifestyles and food provisioning strategies might affect this decision. As indicated in the introduction, the methodological approach adopted also aimed at engage with an extended data collection process leading to the identification of a representative sample of Italian consumers (1270 participants, responsible of food purchase)

able to provide answers to the research questions. GfK, an international market research institute, was employed to collect data in 2016. In the survey the lifestyle concept was operationalized by adopting two scales that best summarize the lifestyle-domain of the household, focusing on consumers' food provisioning strategy (Pascucci et al., 2016) and propensity to recycle (Sidique et al., 2010). Therefore, standardized measurements of consumers' food provisioning strategies and propensity to recycle were collected and their influence on consumers' willingness to participate in the CBM tested through econometric modeling. Following the broad literature on dependencies between psychological/social constructs and the purchasing behaviour of economic actors (Cembalo et al., 2015), the mentioned measures were modelled as predictors of consumers' willingness to participate in the CBM entailing new food provisioning practices. Influence of lifestyles measures, taking into account alternative activities required by CBM as regards purchasing and recycling habits, were tested (Ghisellini et al., 2016). More specifically, interviewees were involved in choice tasks assuming activities such as: entertain formalized relations with retailers (De Coster, 2011); store and handle HFWs (Borrello et al., 2016); devote time and space to recycling (Borrello et al., 2016); trust in the proper implementation of the circular supply

Table 1
Operationalization of food provisioning strategies.

Item	Food provisioning strategy	Mean	S.D.
Strategic dimension A: coping with risks of food provisioning (uncertainty)		3.73	0.72
Do not have information about product prices before buying them	Dealing with food price uncertainty	3.49	1.24
The price of the product you choose is not clearly indicated		4.03	1.17
To find easily the level of quality that you desire for your food (for example in terms of taste, healthiness, origin, variety)	Managing product information availability	4.11	0.96
To control the quality of products that you wish to buy (for example label visibility, information in the place where you buy them, nutritional information)		4.24	0.94
How long does it take your family to collect information about the quality of food that you want to buy (hrs/week)		3.39	1.10
How long does it take your family to collect information about price of foods that you buy (hrs/week)	Managing price information availability	3.13	1.14
How long does it take your family to collect information about food sales promotions (hrs/week)		3.35	1.10
To compare prices of products in different markets before buying them	Coping with risks using terms of reference	3.89	1.07
To compare quality of products in different markets before buying them		3.88	1.09
Strategic dimension B: planning food sourcing and waste management		4.48	0.69
To find fresh food near to the place where you live	Planning food sourcing activities	4.29	0.93
To plan food supplies (in advance) for the week in your family		4.05	1.00
How many times a week does your family buy food		5.47	1.68
To control the expiry date of products before buying them	Managing food waste	4.43	0.91
To manage with attention all the expiry dates of the products that you have at home		4.29	0.94
Pay attention to expiry dates of products to avoid any waste		4.34	0.93
Strategic dimension C: managing dependencies in food provisioning		3.47	0.61
Do not find the food that you are looking for (for example because they are difficult to find)	Dealing with food availability and proximity	3.67	1.10
To transport food from the place where you buy it to the place where you live in time to ensure quality preservation (for example think about frozen food)		4.33	0.95
How long does it take your family to buy food in the supermarket/large-scale retail trade (hrs/week)	Managing complexity of food sourcing	3.49	1.03
How long does it take your family to buy food in the local market or in small food shops (hrs/week)		3.19	1.17
Rate the ability of the supermarket/large-scale retail outlet where you usually buy food, to guarantee a good price	Managing bargaining relations with food providers	3.88	0.93
Rate the ability of small food shops, where you buy food, to guarantee a good price		3.75	1.00
Rate the ability of the supermarket/large-scale retail outlet where you usually buy food to guarantee the quality that you desire		3.89	0.92
Rate the ability of small food shops, where you buy food to guarantee the quality that you desire		3.85	0.94
Do you think there are enough food suppliers to ensure a good price for your product?		1.15	0.36

chain (Fibírová and Petera, 2013); limit the purchase of food products to specific retailers (Rexfelt and Hiort af Ornäs, 2009).

3.1. Lifestyle measures

The first lifestyle was measured by means of a scale that identifies types of food provisioning strategies at household level (adapted by Pascucci et al., 2016). More specifically, the scale is composed by three dimensions referring to: (i) how practices deal with risks and uncertainties related to food provisioning (9 items; 5 point likert scale; Cronbach's alpha is 0.84³); (ii) the role of planning tasks and managing resources in food sourcing and waste (6 items; 5 point likert scale; Cronbach's alpha is 0.81); and (iii) how practices deal with dependency related to food provisioning (9 items; 5 point likert scale; Cronbach's alpha is 0.81) (Table 1). This scale, and the related three dimensions,⁴ have the scope to test whether and how the household organization (routinized activities shaping the relations with food retailers) affects the likelihood of consumers' engagement in the CBM. As argued by Crivits and Peredis (2013: 318), "the basic motivational agreement to both organize and plan one's food purchase is a necessary condition to ensure reproduction of the practice". Therefore, the general assumption is that a motivational attitude — e.g. in terms of effort invested in food search and selection, organized planning of food sourcing, shape steady and enduring relationships with food providers — might be a likely predictor of consumers' willingness to

adopt new food provisioning strategy in favor of the conceptualized practices of circular food provisioning (Fig. 3).

The first dimension takes into account the tensions consumers need to deal with in relation to the uncertainties and risks of food provisioning tasks. These mainly deal with quality and price uncertainties of the food products and related information. Typically, consumers rely on retailers as main source of information for both price and quality attributes of the products they intend to purchase. Consumers may also use terms of references between retailers and other typologies of food sourcing. However, this is a key dimension shaping the supplier-customer relationship and collaboration in a CBM concerning food (Lüdeke-Freund et al., 2019). Some consumers have less sensitiveness of risk elements and quality and price related uncertainties. For others, instead, coping with risks by developing long-term relationship with food providers is a key strategic dimension. The hypothesis tested in the study is that respondents more concerned and dedicating more time to tasks for coping with the risks of food provisioning (reflected by high score in Table 1) are more likely to be willing to actively participate in the CBM. The second dimension refers to planning food provisioning tasks as well as food waste handling. Planning is in fact recognised as a relevant dimension to understand purchasing habits and routines, particularly at household level (Roodhuyzen et al., 2017). Purchasing relations with retailers often assume the connotations of planned actions and constitute relevant routines for households.

Food waste handling tasks are also deeply connected and influenced by attitude to planning and related tasks related to user participation in CBMs (Lüdeke-Freund et al., 2019). Consumers have different planning attitude for both food purchasing and waste management. More planning-oriented consumers tend to develop long term relationships with a selected set of food providers. The hypothesis tested in the study is that respondents with high score for this dimension are more likely to be willing to actively

³ Cronbach's alpha is an internal consistency estimate of reliability of test scores. It indicates the degree to which a set of items measures a single unidimensional latent construct. The theoretical value of alpha varies from 0 to 1 showing increase as the intercorrelations among test items increase. A common rule is to consider internal consistency of a scale acceptable if Cronbach's alpha ≥ 0.7 .

⁴ The three dimensions are calculated using standardized (mean 0, variance 1) values of the corresponding items.

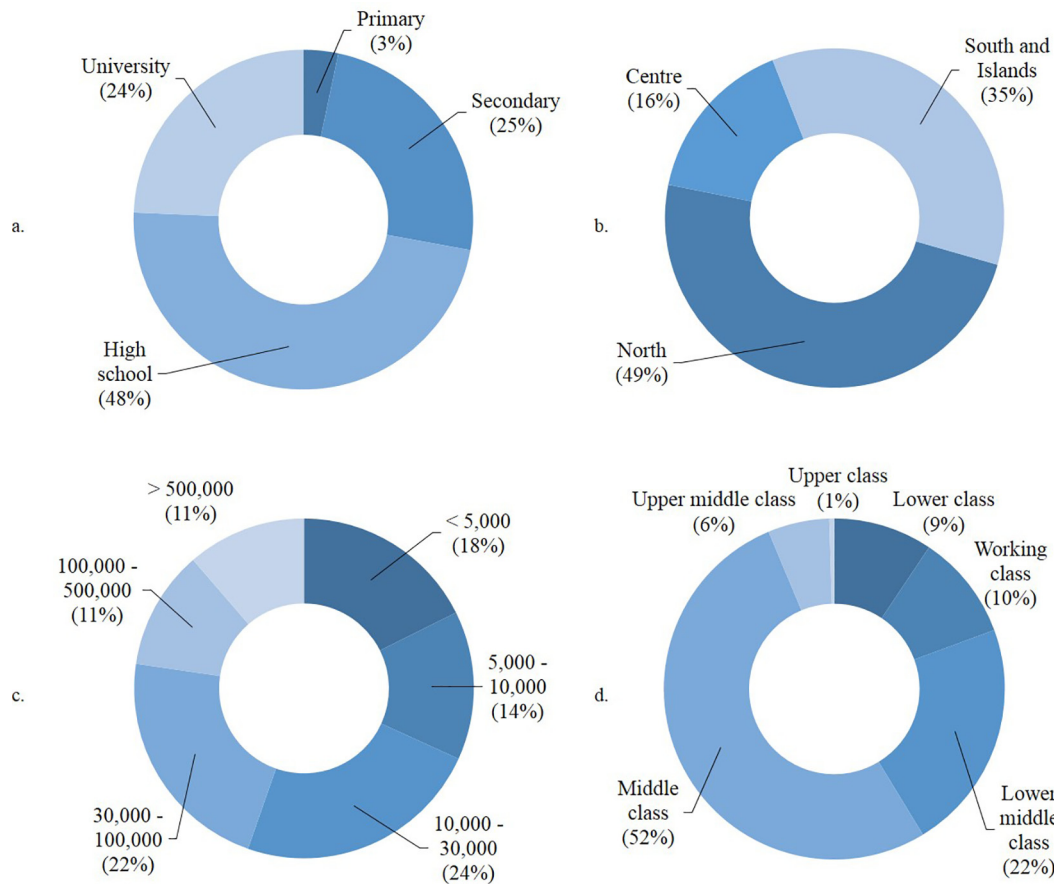


Fig. 3. Descriptive statistics of consumers interviewed: a. Education level; b. Geographic origin; c. City size (number of residents); d. Socio-economic classes.

participate in the CBM (Lewandowski, 2016). The third dimension looks at how food provisioning tasks depend on proximity of food providers, whether these tasks require relevant time investment for the household, and the capacity to management business relations with food providers. This dimension defines a set of key dependencies consumers may have developed with specific food providers and their ability to manage multiple sourcing streams and engage in bargaining relations with different food providers (Lüdeke-Freund et al., 2019). The hypothesis tested in the study is that respondents with higher ability to manage dependencies with food retailers are also more likely to be willing to actively participate in the CBM.

The second lifestyle measure identified is consumers' propensity to recycle (Sidique et al., 2010), a construct comprising 18 5-point Likert-scale items. Items were grouped by means of a factor analysis with principal component analysis into four dimensions of recycling, namely attitude, convenience, social pressure and familiarity, all likely to influence consumers' engagement in the CBM proposed in the study (Table 2). The four dimensions shape the way in which consumers approach their recycling activities based on their experience, knowledge and attitudes. These dimensions are related to both the practical and the psychological factors shaping consumers' lifestyle as concerns recycling. On the one hand, the practice of domestic food waste handling is conditioned by households "anxieties regarding having the appropriate skills, the right equipment, enough space, and, most of all, dealing with the material agency (smell, consistency) of food deemed inedible for human consumption" (Mylan et al., 2016: 10) (convenience). Recycling activities are also more likely to be implemented when

consumers are aware of recycling programs, materials and facilities (Babaei et al., 2015) (familiarity). On the other hand, the individualistic account of practice theory of Spaargaren and Van Vliet (2000) leaves space to consider in the construct dimensions borrowed from socio-psychological consumers approaches (see Ajzen, 1991) (attitude and social pressure). This is consistent with the approach of Shove et al. (2012), including meaning as component of practices, referring on how symbols and collective norms drive actions.

The first factor (Attitude) represents consumers' attitude and belief that recycling activities are good for the environment. A high score for this factor indicates that respondents have a positive attitude and belief that recycling benefits the environment, for instance preserving natural resources and reducing pollution. Then, the hypothesis tested in the study is that respondents with high score for this factor are more likely to be willing to actively participate in the CBM. The second factor (Convenience) represents whether recycling is perceived as a convenient activity to undertake. A low score for this factor entails that recycling is perceived by respondents as something convenient, thus not causing them issues in terms of being difficult, attracting pests or time and space consuming. The hypothesis tested in the study is that respondents with low score for this factor are more likely to be willing to actively participate in the CBM. The third factor (Social pressure) concerns the social pressure perceived by respondents as concerns their recycling activities. A high score for this factor implies that consumers interviewed are likely to undertake recycling activities also influenced by neighbors, friends and family expectations. The hypothesis tested in the study is that respondents with high score for

Table 2

Descriptive statistics and factor loadings on consumers' experience, knowledge and attitude toward recycling.

Item	Mean	S.D.	Attitude	Convenience	Social pressure	Familiarity
For me, household recycling is a difficult task	2.13	1.30	-0.051	0.813	-0.062	-0.081
I do not have enough time to sort the materials for recycling	1.88	1.20	-0.132	0.853	-0.020	-0.019
I do not have enough space to store the materials for recycling	2.20	1.35	-0.070	0.829	-0.066	-0.059
The recyclables that I store attract pests	2.54	1.33	-0.096	0.669	0.016	-0.015
I am familiar with the recycling facilities in my area	3.44	1.46	0.127	-0.046	0.157	0.913
I am familiar with the materials accepted for recycling in the recycling facilities in my area	3.57	1.39	0.163	-0.059	0.185	0.897
My neighbors expect me to recycle household materials	2.95	1.49	0.055	-0.014	0.910	0.137
My friends expect me to recycle household materials	3.05	1.47	0.101	-0.003	0.927	0.130
My family expects me to recycle household materials	3.60	1.42	0.269	-0.144	0.755	0.169
I feel good about myself when I recycle	4.26	1.04	0.688	-0.153	0.276	0.105
Recycling is a major way to reduce pollution	4.56	0.87	0.857	-0.074	0.065	0.086
Recycling is a major way to reduce wasteful use of landfills	4.44	0.93	0.839	-0.016	0.080	0.075
Recycling is a major way to conserve natural resources	4.53	0.87	0.884	-0.070	0.051	0.064
Recycling will improve environmental quality	4.55	0.85	0.889	-0.055	0.045	0.072
I believe that my recycling activities will help reduce pollution	4.32	0.96	0.876	-0.056	0.118	0.112
I believe that my recycling activities will help reduce wasteful use of landfills	4.21	0.99	0.842	-0.054	0.100	0.100
I believe that my recycling activities will help conserve natural resources	4.30	0.96	0.882	-0.067	0.110	0.100
I believe that my recycling activities will help improve environmental quality	4.32	0.97	0.870	-0.093	0.081	0.085

Loadings greater than |0.4| are shown in bold.

this factor are more likely to be willing to actively participate in the CBM. The fourth factor (Familiarity) regards awareness and familiarity of recycling facilities. A high score for this factor indicates that the respondent is aware of the recycling services and the materials accepted in the recycling facilities in their area. The hypothesis tested in the study is that respondents with high score for this factor are more likely to be willing to actively participate in the CBM.

3.2. The survey and the experimental design

A discrete choice experiment approach was developed to analyze the willingness to be involved in the CBM through different types of engagement between consumers and the retailer. This CBM includes a take-back system based on handling and giving back their food waste (proportional to the number of the family members). Respondents were informed about the structure of the proposed business model: food waste returned by participants would be used to produce animal feed; the feed would then be used to produce animal products (eggs, pork, chicken, fresh farmed fish, selected based on the extent of their spread on the market). These products would be subsequently marketed at the same supermarket where participants return their food waste and to which participants could access with a discount (see Fig. 2). Interviewees were also informed that such a CBM entails the subscription of a hypothetical, though realistic, participation program. Respondents were, then, asked to choose whether to participate or not in the

proposed program. In order to achieve realistic answers, the program was combined with different intensity/modality of some characteristics, namely: 1. Monthly fixed discount; 2. Frequency of the delivery of organic waste; 3. Modality of the delivery of organic waste; 4. Duration of the participation to the program; 5. Penalization for the delivery of non-organic waste. As a result, respondents had to choose five times between two alternative types of engagement (programs), with the opportunity to choose none of them each time (see, for a full description of the choice exercise and of the programs, Borrello et al., 2017).

Any respondent could generate the following three, mutual exclusive, outcomes: (1) refusing five times to choose any type of program; (2) accepting five times to choose one type of program, (3) accepting at least one time to choose one type of program.

The questionnaire ended with two sections including: 1) participants' lifestyles, i.e. their food provisioning strategies and propensity to recycle; and 2) participants' social, economic and demographic characteristics.

3.3. Data analysis

As described above, the consumers underlying willingness to be involved in CBM can be analytically codified as three possible outcomes revealing an increasing propensity to participate: a minimum level of intensity (I) can be assigned to the i-th respondent that choose no program in all five tasks, irrespective of the programs' characteristics ($I_i = 1$); Comparing to them, respondents

that accepted some program but not in each choice task, then depending on the program characteristics showed a higher level of engagement ($I_i = 2$); and finally those respondents that accepted one of the programs in all tasks showed the highest level of willingness ($I_i = 3$). However, it can be reasonable hypothesize that the three possible outcomes reveal a latent unobserved continuous process identifying respondents' willingness to be actively involved in the circular business. This continuous process can thus be labelled as "willingness to be actively involved" (I_i^*) assuming infinite values in following range:

$$-\infty < I_i^* \leq \infty \quad (1)$$

A model for the latent variable I can be estimated as:

$$I_i^* = X_i' \beta + e_i \quad (2)$$

where X_i is a $1 \times m$ vector of explanatory variables and β is a $m \times 1$ vector of unknown parameters, while the latent variable is associated to the observed respondents' choice through the following conditions

$$I_i = \begin{cases} 1 & \text{if } -\infty < I_i^* \leq k_1 \\ 2 & \text{if } k_1 < I_i^* \leq k_2 \\ 3 & \text{if } k_2 < I_i^* \leq \infty \end{cases} \quad (3)$$

Where k_1 and k_2 are unknown threshold parameters to be estimated. Ordered Logit regression was applied to analyze the ordinal dependent variable. X_i vector of explanatory variables includes sociodemographic characteristics of the respondents as well as the lifestyle measures concerning the food provisioning strategies and the consumers' propensity to recycle, computed as in paragraph 3.1. Estimated coefficients (β parameters) indicate the direction and magnitude of the statistical associations between the explanatory variables and the probability of observing a higher consumers' willingness to be actively involved in the program.

In order to assess if the relationship between willingness to be actively involved in the CBM and consumers' lifestyles changes by varying the respondent characteristics, the empirical analysis was carried out for the whole sample as well as for homogeneous groups of consumers sharing similar demographic characteristics. Both Ward's hierarchical clustering method and non-hierarchical k-means clustering method have been used to set the optimal number of consumers segments and to refine the households' classification.

4. Descriptive statistics of the sample

The sample of 1270 Italian Households was geographically balanced according to the Italian population distribution (48.7% of respondents from the North, 35.4% from the South and the Islands and 15.9% from the Centre of the peninsula). It is made of 84% females with an age range 21–65, 47 ± 10 . Respondents monthly income belonged mainly to middle-class (52.4%) and lower-middle class (21.9%) with an average household composition of 3.13 (± 1.2) members. About a quarter of respondents held a university degree (24.33%). As for the city size, more than 45% of respondents belonged to medium size cities (between 10,000 and 100,000 residents). Lastly, 88% of interviewees declared sorting organic food waste as a normal activity in his household.

As concerns participation rate to the proposed program: 6.61% of respondents choose no program in all five tasks; 14.49% accepted some program but not in each choice task, then depending on the program type; 78.9% of participants accepted one of the programs

in all tasks.

Table 3 reports the mean values of the lifestyle measures conditioned on the socio-demographic characteristics of the households. Different (statistically significant) lifestyle measures mean values among diverse groups of households may highlight the possible existence of an association between the lifestyle measure and the specific characteristics of the households. As for the strategic dimensions of food provisioning only managing dependencies in food provisioning has shown statistically significant differences within the sample, particularly revealing citizens of Southern Italian regions and Island having established more key dependencies with their food providers. The recycling dimensions analyzed, instead, have all displayed statistically significant differences according to at least one socio-demographic characteristic. Upper class respondents showed a more negative attitude toward the benefits of recycling on the environment than other respondents. Participants with a university degree and participants living in the North of the peninsula revealed to consider recycling a convenient activity, and this opinion displayed to grow as the city size of respondents increases. More educated participants and participants belonging to Northern regions are also those more influenced by the social desirability of recycling. Lastly, living in the North has also a positive influence on being familiar with recycling services and facilities.

4.1. Econometric results

The relationship between consumers' willingness to be actively involved in the CBM and consumers' lifestyles and socio-demographic characteristics is formally investigated using ordered Logit regression (results are shown in Table 4). Covariates not statistically significant at the $p < .05$ level in predicting consumers' willingness were: as for lifestyle measures, Planning food sourcing and waste management, Attitude and Familiarity; as for socio-demographic characteristics, Income classes, Gender, Education level classes, number of Household members and the Geographic origin of respondents.

As concerns the statistically significant covariates, four of the hypotheses formulated regarding the effects of certain lifestyles on the intensity of consumers' willingness to be involved were confirmed. First, outcomes show that the strategic dimensions of food provisioning Managing dependencies in food provisioning and Coping with risks of food provisioning (uncertainty) have both a positive effect on consumers' willingness to be involved (Fig. 4), being also those covariates influencing the most the intensity of the response. This result is consistent with the assumption that consumers who perceive a higher level of risk in the transactions with their food providers, as well as those who have developed key dependencies with the latter, would be more likely to entertain formalized relationships through the proposed participation program. Second, as hypothesized, perceiving recycling as a not convenient activity to undertake (high score for the factor Convenience) has a negative impact on consumers' willingness, while the effect of the perceived social desirability of recycling activities (Social pressure) is positive (Fig. 5). This finding confirms the assumption about the opposite effect that, on the one hand effort, time and space required by recycling activities and on the other hand social influence have on the likelihood to participate in the program.

When it comes to the effect of socio-demographic characteristics — for which no hypothesis was formulated — only the explanatory variable City size of respondents was significant in predicting consumers' willingness to participate, with respondents of bigger cities (in terms of number of residents) showing higher propensity levels. This result might be explained considering that

Table 3

Descriptive statistics of strategic dimensions of food provisioning and recycling dimensions according to socio-demographic characteristics.

	Coping	Planning	Managing	Attitude	Convenience	Social Pressure	Familiarity
Education level							
Primary	−0.06	0.10	−0.06	0.06	0.19^a	−0.16^a	−0.03
Secondary	−0.05	−0.09	−0.06	−0.11	0.20^a	−0.06^a	0.03
High School	−0.04	−0.02	−0.05	−0.08	−0.05^a	−0.02^a	−0.03
University	0.09	0.03	0.01	0.11	−0.13^b	0.12^b	0.02
Geographic origin							
North	−0.04	−0.06	−0.06^a	−0.05	−0.08^a	0.12^a	0.12^a
Center	−0.04	−0.03	−0.09^a	−0.19	0.11^b	−0.14^b	−0.11^b
South and Islands	0.02	0.01	0.01^b	0.05	0.12^b	−0.10^b	−0.11^b
City size (number of residents)							
<5,000	−0.03	0.00	−0.06	−0.02	−0.15^a	−0.09^a	−0.05^a
5,000–10,000	0.08	0.03	0.01	−0.10	−0.05^b	−0.06^a	0.12^b
10,000–30,000	−0.03	−0.05	0.00	0.03	−0.01^b	0.17^b	0.13^b
30,000–100,000	−0.05	−0.02	−0.07	−0.09	0.12^c	0.01^a	−0.05^a
100,000–500,000	0.02	−0.07	−0.02	0.00	0.13^c	−0.10^a	0.02^a
>500,000	−0.11	−0.13	−0.10	−0.11	0.12^c	−0.02^a	−0.21^a
Socio-economic classes							
Lower class	0.09	0.02	0.00	0.08^a	0.10	−0.34	−0.18
Working class	0.01	−0.14	−0.05	−0.25^a	0.09	−0.04	0.09
Lower middle class	−0.04	−0.04	−0.04	−0.09^a	0.14	−0.01	−0.05
Middle class	−0.04	−0.03	−0.05	0.01^a	−0.06	0.06	0.03
Upper middle class	−0.05	0.09	0.03	−0.04^a	−0.04	0.21	0.06
Upper Class	−0.44	−0.33	−0.42	−1.19^b	0.11	−0.07	0.08

Means in the same block with different letters are significantly different according to ANOVA ($p \leq 0.05$).**Table 4**

Results of the ordered logit regression and odds ratio.

Variable	Coef.	S.D.	p-value	Odds ratio
Coping with risks of food provisioning	0.358	0.177	0.043	1.431
Planning food sourcing and waste management	−0.225	0.149	0.132	0.799
Managing dependencies in food provisioning	0.378	0.197	0.055	1.460
Attitude	0.122	0.083	0.140	1.130
Convenience	−0.240	0.084	0.005	0.787
Social pressure	0.163	0.085	0.054	1.178
Familiarity	0.052	0.082	0.529	1.053
Income ^a	−0.052	0.076	0.494	0.950
Gender ^b	0.097	0.218	0.655	1.102
Education level ^c	−0.026	0.034	0.456	0.975
Households members	0.087	0.067	0.194	1.090
City size ^d	0.099	0.052	0.058	1.105
North ^e	−0.023	0.232	0.922	0.978
Center ^f	−0.008	0.247	0.974	0.992
South and Islands ^g	−0.099	0.206	0.631	0.906
k_1	−2.364			0.592
k_2	−1.009			0.587
H0: $k_1 = k_2$ p-value < 0.001				
Wald $\chi^2(15) = 41.23$ p-value < 0.001				

^a classes: ranges from 1 (lower class) to 6 (upper class).^b dummy: 1 if female, 0 otherwise.^c classes: ranges from 1 (primary) to 4 (university).^d classes: ranges from 1 (<5,000) to 6 (>500,000).^e dummy: 1 if North, 0 otherwise.^f dummy: 1 if Center, 0 otherwise.^g dummy: 1 if South and Islands, 0 otherwise.

participants that belong to city at high number of residents might perceive the problem of food waste as more relevant.

The subsequent analysis aims to explore if the above discussed relations are constant within the considered population or show some degree of heterogeneity among consumers sharing similar characteristics. The clustering procedure has classified households in two main subgroups: group a and group b. While the former include the majority of the respondents (77%) and therefore has

characteristics non dissimilar from those observed in the whole sample, the latter isolates those middle and middle upper classes respondents with the highest educational level (71% have a university degree), living in the bigger city areas (Table 5). By re-estimating for the two groups the relationship between consumers' willingness to be actively involved in the CBM and their lifestyles characteristics, some relevant differences occur in the importance of the lifestyle measures (Table 6). In particular, as for

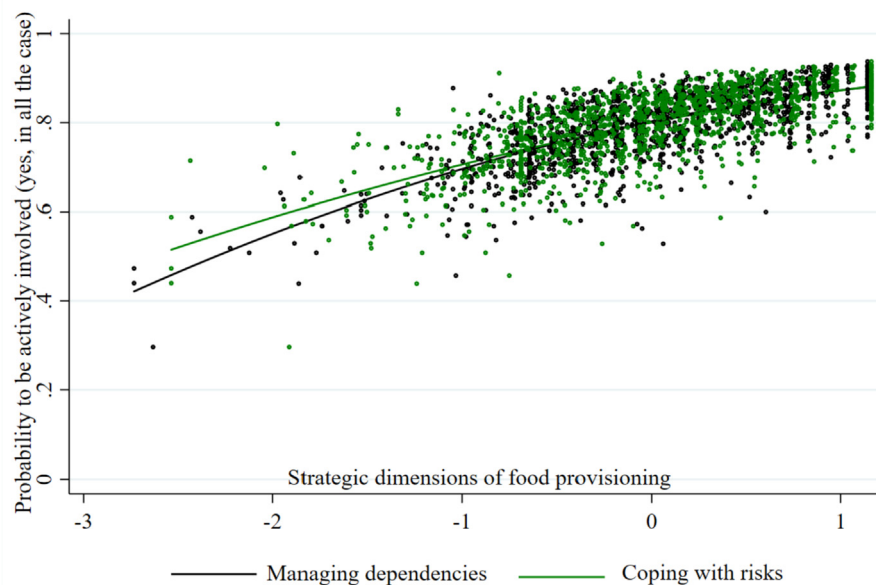


Fig. 4. Effect of the strategic dimensions of food provisioning Managing dependencies in food provisioning and Coping with risks of food provisioning on consumers' willingness to participate.

Values in x-axis are standardized with mean = 0 and variance = 1.

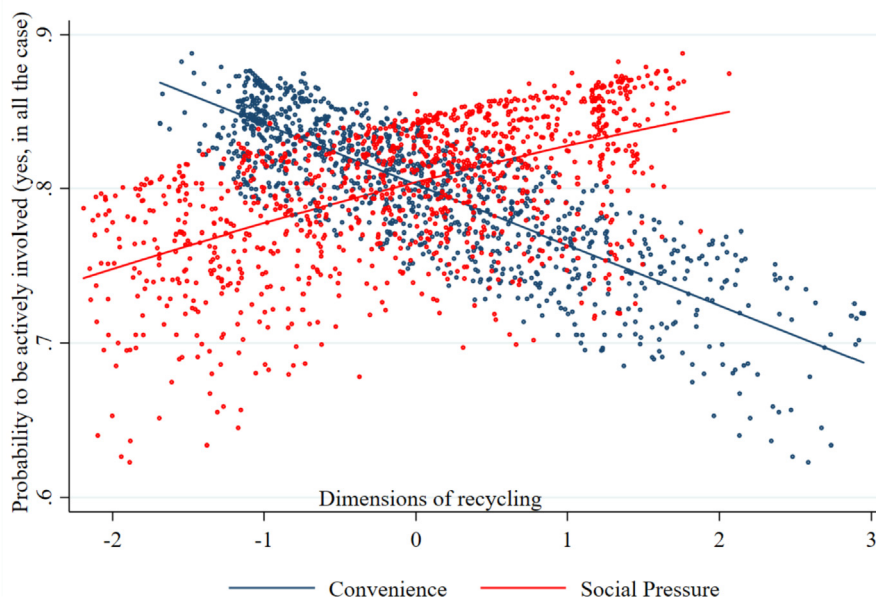


Fig. 5. Effect of the recycling propensity dimensions Convenience and Social Pressure on consumers' willingness to participate.

Values in x-axis are standardized with mean = 0 and variance = 1.

the strategic dimensions of food provisioning, while Coping with risks of food provisioning significantly explain the consumers' willingness to be actively involved in the CBM in the group a, in group b managing dependencies in food provisioning has shown to be particularly relevant in explaining consumers participation. As for the recycling dimensions analyzed, instead, while the group a show a behavior like those observed within the whole population, the group b, including the most educated respondents, seems prevalently influenced by their individual attitude toward the environmental benefits of recycling.

5. Discussion

Current paper is a contribution to current gaps in the CE literature on consumers' participation in CBMs entailing an active engagement in innovative food provisioning mechanisms with retailers. Informed by the work of authors who analyze consumption as a practice (Warde, 2005), the research follows the lead of recent studies underlining the need to include household practices in the analysis of consumers' engagement in circular economy initiatives (Mylan et al., 2016).

Table 5
Descriptive statistics of the two groups (% frequency).

	Group a	Group b	Whole Sample
Education level			
Primary ^a	4.29	0	3.31
Secondary ^a	42.74	0	32.99
High School ^a	52.97	28.87	47.4
University ^a	0	71.13	16.3
Geographic origin			
North	48.88	48.11	48.66
Center	15.64	16.84	15.91
South and Islands	35.48	35.05	35.43
City size (number of residents)			
<5,000	17.89	16.84	17.64
5,000–10,000 ^a	15.64	9.28	14.17
10,000–30,000 ^a	24.74	19.59	23.54
30,000–100,000	22.19	21.31	21.97
100,000–500,000 ^a	9.92	16.15	11.34
>500,000 ^a	9.61	16.84	11.34
Socio-economic classes			
Lower class ^a	10.74	4.81	9.38
Working class ^a	10.94	6.87	10.01
Lower middle class ^a	22.7	19.24	21.91
Middle class ^a	49.8	61.17	52.4
Upper middle class ^a	5.21	7.9	5.83
Upper Class	0.61	0	0.47

^a Relative frequency (%) significantly different in the two groups according to χ^2 ($p \leq 0.05$).

Our findings indicate that in general terms a large proportion of the sampled consumers would be willing to participate in CBMs connected to innovative food provisioning mechanisms with retailers. Particularly in a CBM in which food waste handling is combined with food provisioning few key drivers have been identified to explain and predict participation (Fig. 6). The first driver refers to the provider-customer relationship, and namely how food consumers engage with retailers. Consumers concerned

with risks associated to food provisioning and already engaged in tasks to cope with these risks are more likely to consider participating in a CBM with a food retailer. Similarly consumers who have already developed a long-lasting relation with a retailer and show a relatively high dependency on this source of food provisioning are more willing to participate in a CBM with them. On contrary consumers who have developed practices related to food planning provisioning tasks are not more likely to participate. These results are aligned with extant literature on sustainable product service systems (Tukker, 2015) and CBMs highlighting the relevance of the design of the value proposition offered in a CBM (Lüdeke-Freund et al., 2019) and how it fits the customer/user segments (Lewandowski, 2016). While this component of CBMs has been thoroughly understood in the context of sustainable service provisioning, and namely the sustainable product service systems framework (Edbring et al., 2016), current study highlights that this is relevant also for products that are not easily subject to 'servitization', such as food products. Instead, what current study seems to underline is the idea that food products can be successfully provided 'as a service' if the food provisioning is associated with food waste handling in an integrated and coordinated business model. This type of 'food-product-as-a-service' approach seems to be more likely considered by consumers already strongly engaged with retailers, aligning this result with extant literature on customer relationships in CBMs (see Lewandowski, 2016). The findings of the study, in fact, suggest that the adoption of a CBMs in this business to consumer setting can be framed as an 'extension' of existing relations by enacting 'circular practices'.

The second driver that seems to enhance participation relates to consumers' propensity to recycling. In the presented approach food products subject to provisioning are the outcomes of food waste upcycling processes, because food waste recycling (handling) is coupled with streams of feed products for food production. These results engage with the extant literature on the relevance of product design thinking and management of key resources in CBMs (Lewandowski, 2016). The analysis has showed that propensity to recycling as conducive attitude to engage in circular practices,

Table 6
Results of the ordered logit regression (whole sample and two groups).

Variable	Whole Sample (obs. 1269)		Group a (obs. 978)		Group b (obs. 291)	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
Coping with risks of food provisioning	0.358	0.043	0.503	0.009	−0.61	0.20
Planning food sourcing and waste management	−0.225	0.132	−0.217	0.171	−0.49	0.26
Managing dependencies in food provisioning	0.378	0.055	0.288	0.167	1.28	0.03
Attitude	0.122	0.14	0.079	0.365	0.43	0.04
Convenience	−0.24	0.005	−0.241	0.008	−0.28	0.26
Social pressure	0.163	0.054	0.156	0.093	0.19	0.40
Familiarity	0.052	0.529	0.022	0.799	0.16	0.49
Income ^a	−0.052	0.494	−0.068	0.400	0.11	0.56
Gender ^b	0.097	0.655	0.100	0.699	−0.09	0.81
Education level ^c	−0.026	0.456	−0.057	0.456	0.10	0.37
Households members	0.087	0.194	0.057	0.411	0.29	0.15
City size ^d	0.099	0.058	0.120	0.048	0.04	0.77
North ^e	−0.023	0.922	−0.150	0.559	0.77	0.25
Center ^f	−0.008	0.974	−0.218	0.431	1.17	0.05
South and Islands ^g	−0.099	0.631	−0.064	0.781	−0.38	0.49
	k1	−2.364	k1	−2.641	k1	−2.527
	k2	−1.009	k2	−1.411	k2	0.020
	H0: k1 = k2 p-value < 0.001		H0: k1 = k2 p-value < 0.001		H0: k1 = k2 p-value < 0.001	

^a classes: ranges from 1 (lower class) to 6 (upper class).

^b dummy: 1 if female, 0 otherwise.

^c classes: ranges from 1 (primary) to 4 (university).

^d classes: ranges from 1 (<5,000) to 6 (>500,000).

^e dummy: 1 if North, 0 otherwise.

^f dummy: 1 if Center, 0 otherwise.

^g dummy: 1 if South and Islands, 0 otherwise.



Fig. 6. Drivers of consumers participation in the circular business model.

where tasks of food waste handling and food provisioning need to be combined. However, findings clearly indicate that the willingness to participate in a CBM is shaped by the need to economize on food provisioning, on one hand, and conditioned by social pressure, on the other hand. Findings seem to suggest that when food waste is concerned with practices related to take-back systems (e.g. recycling and food waste handling) coupled with delivering new functionality rather than ownership, for example through a food-as-a-service approach for food provisioning, consumers are more likely participating if this set of practices is conducive to a cost reductions and at the same time if they diffuse in the social context they are embedded. However, education and income seems to significantly affect the relevance of the attitude towards recycling in predicting consumers' willingness to participate in the CBM. The choices of individuals belonging to group b of the study were not influenced by factors concerning convenience and social pressure towards recycling. Instead, these individuals seems to be more likely than the average of the sample to actualize their beliefs about the utility of recycling through the participation in the CBM.

Besides those explanatory variables whose influence on respondents' willingness to participate was not significant, outcomes of this research confirm the research hypothesis about the covariates effect direction. Particularly, the analysis of these results provide managerial implications — namely regarding elements to consider in business model design and customer segmentation — for businesses interested in implementing circular solutions analogue to the one proposed in the study. Particularly, business actors may consider as ideal customer an urban citizen located in social contexts where recycling activities are perceived as relevant. The CBM is expected to function if it is conveyed targeting customers who already seek information to cope with risk in food provisioning and entertain long-term relationships with their food providers. This customer would also be more likely to participate in the CBM if it is designed to reduce participants' undesired efforts.

Main limitation of current study resides in the fact that it is designed around a hypothetical CBM. However, we expect that its results may inform the design of CBM entailing the enactment of analogous activities such as those belonging to the CFPP designed.

Besides this consideration, the size of the sampled Italian respondents guarantees external validity to our findings. Furthermore, current analysis is consistent with the study on food consumption in the CE by Mylan and colleagues (2016: 9), who state that “both the quantity and quality of materials which enter domestic space, and how they are used, transformed, and ultimately leave the home are underpinned and shaped by the social relationships and material infrastructures available for provisioning and preparing food”. Furthermore, results about the relevance of the perceived convenience in performing recycling activities are aligned with Dewberry et al. (2013) who highlight how efficiency should be considered in the design of circular solutions. As for the

food provisioning strategies, outcomes are supported by Camacho-Otero and colleagues (2018: 15), who list among main features of consumption in the CE the role of connected consumption and “issues of trust, risk and control”.

6. Conclusions

Our analysis has provided some useful insights to the still nascent debate on business to consumer relations in the CBMs literature, particularly when food and bio-based products/materials are concerned. Findings suggest that consumers are willing to participate in a CBM based on novel food provisioning practices. The hypothesis that consumers' food provisioning strategies and propensity to recycle are drivers of consumers' willingness are partially confirmed. More specifically, the following lifestyle measures were confirmed to be relevant drivers: coping with risks of food provisioning, managing dependencies in food provisioning, convenience and social pressure towards recycling. Findings reveal also that the city size of origin influences consumers' willingness. From these outcomes some relevant insights useful for interdisciplinary research may be highlighted, particularly for scientists engaged in the domain of business models and consumer behavior.

As for business models research, future studies and implementations of business model design are expected to use our results to address the business to customer relation component of CBM, that is indeed a critical strategic dimension for a successful adoption and diffusion of the business model. More specifically, current study has indicated that engaging with consumers' practices is a key perspective to better understand this process, and even more importantly to design the business model through modularity, for example coupling food waste handling and recycling with food provisioning. Moreover, ensuring convenience associated to the participation is a key aspect emerged by the analysis. The cost-effectiveness of the business model, thus a careful consideration of both revenue and cost streams is likely to be the first step to make in the design process. In fact, without a clear economic advantage, participation can be jeopardized regardless how effective other aspects of the business model will be.

Finally, findings indicate that working in urban settings and likely targeting groups of consumers can enhance participation. In this respect it might make sense for retailers to consider to pilot the introduction of new CBMs by co-designing with consumers and by enacting circular practices at level of a given neighbourhood, or social group.

As for research in consumer behavior, albeit the exploratory nature of the study, considering food provisioning practices beyond the act of purchase has driven to extend the analysis to lifestyle dimensions potentially affecting consumers' participation that would have been otherwise neglected. Therefore, results suggest

the usefulness of an approach based on practice theory in the analysis of consumers' engagement in CBMs. Current paper brings forward the literature on practice theory implemented in the context of sustainable food consumption by extending the domain of the analysis of practices to food provider-consumers relationships in the context of CBMs.

Even though this study was undertaken in a specific geographical context, its results are of wide interest, since they highlight the potential feasibility of CBM in the food sector based on an ecological perspective of the practice of food, meant as process lasting from food purchase to the disposal of waste materials. Particularly, it finds in the proposed CBM a contextual opportunity to analyze food provisioning as a practice emerging from novel potential 'food-product-service-systems'.

Besides its relevance to inform future research, this paper also provides suggestions for policy actors involved in decision processes also outside the area of this case study. Particularly, considered the challenge to engage consumers in novel business models based on circular supply chains, policies should take care of supporting CBM in which the customer relation component is tailored to customers' needs. This study suggests also the potential success of incentives directed to food retailers willing to involve their customers in circular relationships; and provides indications about context in which such initiatives would have more probability to succeed.

Author contributions

Massimiliano Borrello contributed to conceptual and empirical design, data collection and writing. Stefano Pascucci contributed to conceptual and empirical design. Francesco Caracciolo contributed to empirical design, econometric modeling, data analyses and writing. Alessia Lombardi contributed to literature review and writing. Luigi Cembalo contribute to conceptual and empirical design, econometric modeling, writing and coordinated the work.

Declaration of competing interest

None.

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