



Building value with packaging: Development and validation of a measurement scale

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ABSTRACT

In the absence of studies that include holistically all the current functionalities of packaging, this research develops and validates at confirmatory level a third-order scale for measuring the functional value of packaging. The measure accounts for protection, convenience, portability & storage, information, branding, engagement, sustainability and economy and considers active and intelligent functions. The psychometric properties of the scale are analysed in a total of 5 studies. Results indicates that protection, sustainability and information are the most relevant functions. This scale amounts to a useful tool that can serve as a framework for managers in numerous sectors.

1. Introduction

Packaging has become a crucial and complex matter, driven by government's introduction of packaging legislation and waste policies and consumer's awareness of its environmental performance. Moreover, consumers require solutions that meet their needs in a context of multifaceted lifestyles (Rundh, 2016). The packaging industry is meeting these demands by improving their traditional functions and including new ones to enhance value for consumers and to meet the economic, environmental, and legal requirements placed upon it (Niemelä-Nyrhinen and Uusitalo, 2013; Rundh, 2005; Seckin and Yener, 2015; Steenis et al., 2017).

From the marketing point of view, product packaging plays a fundamental role in marketing decisions. It is a source of competitive advantages thanks to its influence on consumers' multisensory experience (Niemelä-Nyrhinen and Uusitalo, 2013; Velasco and Spence, 2019) and purchasing behaviour (Gómez et al., 2015; Liao et al., 2015; Rundh, 2005; Velasco and Spence, 2019).

The academic literature on the functions of packaging is extensive but it has certain limitations in regard to their measurement. Most of the previous research has been done from a theoretical point of view, aiming to find the functions performed by packaging (Nordin and Selke, 2010;

Paine, 1991; Robertson, 1990; Yam et al., 2005). Empirical studies focus mainly on qualitative analysis of one or several functions (Ampuero and Vila, 2006; Draskovic, 2010; Liao et al., 2015; Niemelä-Nyrhinen and Uusitalo, 2013;; Pousette et al., 2014; Rokka and Uusitalo, 2008; Rundh, 2005, 2013; Silayoi and Speece, 2007; Steenis et al., 2017; Van Ooijen et al., 2017). The main limitation of these studies, however, is their lack of reliability and validity. The small number of quantitative studies performed include a larger number of functions (Lindh et al., 2016; Martinho et al., 2015; Wyrwa and Barska, 2017b) but the measurement scales for the variables are not fully validated. They only analyse reliability (Cronbach's alpha) and do not consider new types of packaging on the market, such as active and intelligent packaging.

Contributing to the literature on packaging and measurement, this research aims to understand consumer perceptions of the different packaging functions in the current context and to propose a valid measurement tool. This research makes three main contributions. First, we perform a thorough review of the literature on packaging and its functions from the point of view of consumer perception, including the functions offered by active and intelligent packaging. To our knowledge, no other studies to date include holistically all the current functionalities of packaging that can generate value. Second, we adopt a comprehensive scale development process, including an extensive literature review,

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scale refinement and validity analyses using 5 studies. Third, our research provides important managerial implications for firms facing challenges in managing aspects of packaging.

In what follows, the theoretical framework is put forward. We then present the development and validation of scales, discuss the main findings and mention the limitations and future research directions.

2. Theoretical framework

2.1. Packaging

Packaging is a “complex, dynamic, scientific, artistic and controversial segment of companies” (Paine and Paine, 1992, p.3). Coles et al. (2003) define it as a coordinated system that prepares goods for transport, distribution, storage, sale, and consumption. This system guarantees that the product is distributed from the factory to the end consumer in good condition and at optimum cost. Packaging also has a techno-commercial function, that of optimising the costs of distribution and maximising sales and profit.

Traditionally the functions of the package have been classified in four categories: protection, containment, communication and convenience (Paine, 1991; Robertson, 1990; Yam et al., 2005). This model has served as the basis for many studies. Packaging should fulfil the physical requirements to protect and contain the product during transportation (Lindh et al., 2016; Prendergast and Pitt, 1996; Rundh, 2013). It also serves as a method of communication, conveying messages about product attributes and brand to consumers at the point of sale (Ampuero and Vila, 2006; Gómez et al., 2015; Liao et al., 2015; Lindh et al., 2016; Prendergast and Pitt, 1996; Velasco and Spence, 2019; Wyrwa and Barska, 2017a). Packaging also provides customer convenience by making a product easy to obtain, use or consume, avoiding the need for consumers to perform unpleasant activities, providing ease or comfort and meeting specific user needs (Draskovic, 2010; Prendergast and Pitt, 1996; Rundh, 2005; Yale and Venkatesh, 1986).

However, this model does not consider certain key aspects for consumers today such as the environmental impact of packaging (Steenis et al., 2017) or how packaging meets social needs (Coles et al., 2003; Goodman-Deane et al., 2016). Nor does it consider the economic function of packaging or innovation and the development of active, intelligent packaging that can enhance protection and afford improved information, branding and engagement. Moreover, a package should not only meet all these functions but should also meet market criteria for performance and cost (Nordin and Selke, 2010).

We see packaging as an enclosure solution that can protect products from internal and external factors, guaranteeing their quality and safety, lengthening product life, offering convenience, facilitating transport, handling, and storage, functioning as a support for information and branding and improving the shopping and consumption experience. Moreover, all of this can be done at the lowest possible cost for consumers and in a sustainable way, complying with social and environmental responsibility (Fig. 1).

2.2. Functional value of packaging

In line with the review of the specific literature, in this research the functions of packaging in which value is reflected are protection, convenience, portability & storage, information, branding, engagement, sustainability and economy.

2.2.1. Protection

The primary function of packaging is to serve as a container for the product, allowing it to be efficiently and safely transported from the factory to its final destination (Lindh et al., 2016; Niemelä-Nyrhinen and Uusitalo, 2013; Paine, 1991; Paine and Paine, 1992; Robertson, 2013; Rundh, 2005).

Traditionally, packaging should act as a physical barrier between the

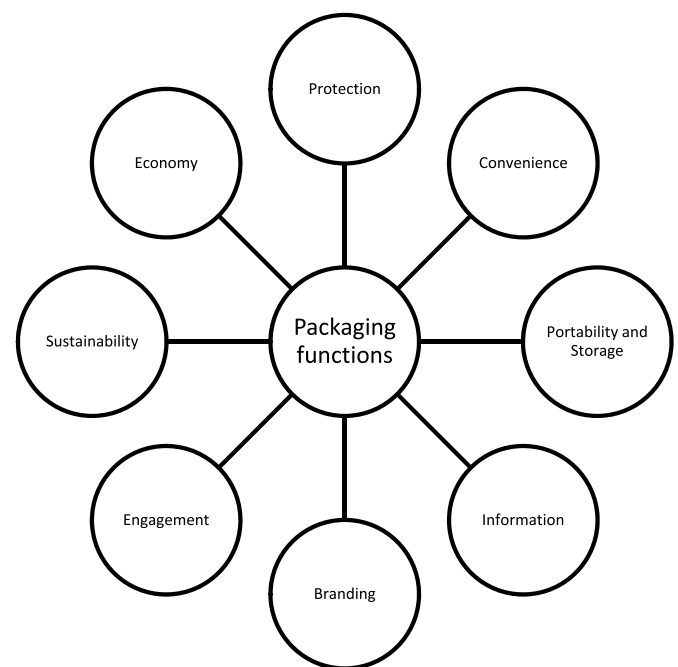


Fig. 1. Model of packaging functions.

product and external factors such as damage or compression or elements in the surrounding atmosphere such as temperature, humidity and others (Yam et al., 2005). Recently, packaging producers have been looking for innovative solutions called ‘active’ packaging systems. These new containers also protect products from their own, potentially damaging, biological activity (Realini and Marcos, 2014; Robertson, 2013; Seckin and Yener, 2015; Wyrwa and Barska, 2017a). Consequently, the function of packaging protection goes further, aiming to lengthen the product life cycle, reducing waste and facilitating access to large amounts of products from every part of the world while preserving their original organoleptic properties (Rooney, 1997; Wyrwa and Barska, 2017a).

There is extensive academic literature dealing with the protective function of packaging from a theoretical point of view (De Jong et al., 2005; Fang et al., 2017; Robertson, 1990; Pereira de Abreu et al., 2012; Wyrwa and Barska, 2017a). Empirically, most studies are qualitative and focus on analysis of cases or focus groups (Rundh, 2005). Regarding quantitative studies, although some authors measure this construct in their research (Seckin and Yener, 2015; Wyrwa and Barska, 2017b), no scales have been validated at confirmatory level to measure both active and passive packaging protection.

2.2.2. Convenience

Mortimer (1955) pointed to packaging convenience as one of the ten levels of convenience. Later, various researchers operationalised this idea with a wider meaning relating to time and energy savings (Candel, 2001; Douglas, 1976). Particularly, Morganosky (1986, p.37) defines convenience as “the ability to accomplish a task in the shortest time with the least expenditure of human energy”. From a theoretical perspective, some authors such as Robertson (1990) or, more recently, Niemelä-Nyrhinen and Uusitalo (2013) relate packaging convenience with product convenience, considering one of the primary functions of modern packaging. Today, convenience is considered one of the functions of packaging that is most closely linked to changes in consumer lifestyles (Rundh, 2005). Modern consumers, especially the young, often look for ways to reduce time spent on food shopping and preparation to the extent that convenience becomes an incentive to buy (Savelli et al., 2019; Silayoi and Speece, 2004, 2007). For example, Draskovic (2010),

in qualitative research on consumers and marketing managers, point out that, for food and beverage products, packaging convenience is a central purchasing motivator.

We consider here the convenience model by [Yale and Venkatesh \(1986\)](#): time utility, handiness, appropriateness and avoidance of unpleasantness. First, time utility implies a timesaving utility of increasing importance in the lifestyle of consumers today. Second, handiness makes the product consumption activity easier to perform. In this sense, several elements such as size, shape or design, ergonomics and package openability (open, takes out an intended quantity of the content and close) ([Pousette et al., 2014](#)) are related to consumer satisfaction. Third, appropriateness refers to packaging fittingness to specific needs, to products of various sizes and shapes and to specific products ([Yam et al., 2005](#)). Finally, avoidance of unpleasantness means that packaging may allow consumers to skip an activity that they previously had to perform but did not enjoy. For example, microwavable packaging enables consumers to cook an entire meal with virtually no preparation ([Marsh and Bugusu, 2007](#)).

The literature on convenience is mainly theoretical ([Morganosky, 1986](#); [Mortimer, 1955](#); [Robertson, 1990](#); [Yam et al., 2005](#)). There is also qualitative empirical literature analysing certain aspects of convenience ([Lindh et al., 2016](#); [Niemelä-Nyrhinen and Uusitalo, 2013](#); [Pousette et al., 2014](#)), but no studies analyse the multidimensional construct and no scales have been found to measure it.

2.2.3. Portability and storage

One of the most important functions of packaging is related to physical management. Although this functionality has been deeply studied by the literature, it has been almost exclusively applied to tertiary packaging where retailers' demands are considered ([Niemelä-Nyrhinen and Uusitalo, 2013](#)). Packaging should be considered as a source of value to final consumers when it is 'easy to carry', 'easy to store' and 'easy to consume' in any location. In fact, light products, individual packaging, special design, and technology to allow for better control of consumption and storage at home, are some of the concerns of the packaging industry today ([Prendergast and Pitt, 1996](#); [Van Birgelen et al., 2009](#); [Yale and Venkatesh, 1986](#)).

Studies on this function are limited to the theoretical level. Those that are empirical are qualitative ([Niemelä-Nyrhinen and Uusitalo, 2013](#); [Rundh, 2005](#)) or quantitative ([Prendergast and Pitt, 1996](#); [Van Birgelen et al., 2009](#)) but do not propose validated scales covering the aspects of portability and storage.

2.2.4. Information

The informational function of packaging is becoming increasingly important because it influences consumer choice ([Silayoi and Speece, 2004, 2007](#); [Wyrwa and Barska, 2017b](#)). Traditional packaging information was about product content, characteristics, ingredients, nutritional value, terms of use, legal regulations, date of expiry and corporate values ([Lindh et al., 2016](#); [Niemela-Nyrhinen and Uusitalo, 2013](#); [Prendergast and Pitt, 1996](#); [Robertson, 1990, 2013](#); [Wyrwa and Barska, 2017b](#)). Today, new packaging technologies can monitor the conditions of the packed product or the environment surrounding the product ([European Commission, 2009](#)), providing important information not only about the product itself but also about its origin, authenticity, traceability, and storage conditions, and warning about possible problems using indicators or sensors of freshness or toxins, temperature indicators or RFID technologies ([Schaefer and Cheung, 2018](#); [Young et al., 2020](#)). This so-called "intelligent packaging" ([Yam et al., 2005](#)) is now the subject of growing interest among researchers, especially in the scientific and technical fields ([De Jong et al., 2005](#); [Fang et al., 2017](#);

[Pereira de Abreu et al., 2012](#); [Realini and Marcos, 2014](#)).

There is extensive literature on information and packaging. Among the empirical studies, there are qualitative studies ([Niemelä-Nyrhinen and Uusitalo, 2013](#); [Silayoi and Speece, 2004, 2007](#)) and quantitative ones ([Lee et al., 2019](#); [Prendergast and Pitt, 1996](#); [Seckin & Yener, 2014, 2015](#); [Wyrwa and Barska, 2017b](#)). But, again, no studies propose validated scales at confirmatory level to measure this construct.

2.2.5. Branding

As pointed by [Van Ooijen et al. \(2017, p. 71\)](#) "brands are able to reach consumers through product packaging when the iron is hot – at the point of sale". Nevertheless, the importance of marketing functions has only recently started to receive substantial attention. Certainly, packaging is the first contact point between consumers and is related to strategic decisions on the marketing mix ([Rundh, 2016](#); [Underwood, 2003](#)) and, specifically, packaging is closely related to branding ([Mohebbi, 2014](#); [Simms and Trott, 2014](#)). In fact, the package of the product can be seen as a manifestation of the brand itself ([Wyrwa and Barska, 2017a](#)), contribute to the development of brand equity ([Aaker, 2009](#)) and it is a vehicle to stand out the brand ([Rettie and Bewer, 2000](#)).

Packaging communicates branding aspects via product form, visual elements of package design (logo, colors, fonts, materials or shapes) and the positioning of its elements (labels, text) ([Bloch, 1995](#); [Draskovic, 2010](#); [Underwood, 2003](#)). It draws consumers' attention like a silent salesman, reinforcing the product image, helping its positioning strategy, and triggering purchase ([Ampuero and Vila, 2006](#); [Judd et al., 1989](#); [Lindh et al., 2016](#); [Prendergast and Pitt, 1996](#); [Rundh, 2005](#)). Besides, packaging helps to build and communicate the brand personality and it is a medium of differentiation and product attractiveness ([Draskovic, 2010](#); [Silayoi and Speece, 2004](#); [Underwood, 2003](#)). It could also highlight brand equity benefits for a firm ([Keller, 2003](#)) such as increased shelf impact and visibility or enhanced brand imagery ([Metcalfe et al., 2012](#); [Wyrwa and Barska, 2017a](#)).

From a quantitative point of view, some research has focused on finding the first aspect of packaging to draw consumers' attention and the most important claim information on packaging ([Favier et al., 2019](#); [Seckin and Yener, 2015](#)). Many studies use experiments to explore the communicative effects of product imagery or the effect of atypical packaging on product recall ([Liao et al., 2015](#); [Underwood, 2003](#); [Westerman et al., 2013](#)). Nevertheless, as far as we know, there have been no studies that completely validate at confirmatory level the psychometric properties of a construct with the above-mentioned conceptual spectrum. [Wang \(2013\)](#) proposed a scale validated to provide evidence of only reliability and discriminant validity to measure "attitude toward visual packaging design", but we are unaware of any other studies in this vein.

2.2.6. Engagement

Nowadays, the packaging also can constitute a powerful consumer's experience element ([Velasco and Spence, 2019](#)). These are called interactive packaging that incorporate new technologies to enable two-way communication between the user and the package and then, enhance consumers' experience, engagement or functionality of goods ([Joutsela et al., 2017](#); [Lydekaityte and Tambo, 2020](#)). Examples of these new technologies includes conductive ink, sensors, printed electronics, RFID tags, AR, VR, 3Ds, IoT, and so on, and they allow to develop multisensory experiences that improve a brand-consumer connection and sensory experiences (i.e., sight, hearing, smell, taste, touch) ([Velasco and Spence, 2019](#)) and to provide entertainment and leisure experiences ([Lydekaityte and Tambo, 2018, 2020](#)).

Most of empirical studies in this topic are qualitative and use

experiments to explore complex subjects such as consumers' sensorial responses as colour-flavour-taste associations in food packaging experience (Velasco and Spence, 2019). But, again, no studies propose validated scales at confirmatory level to measure this construct.

2.2.7. Sustainability

The impact of packaging on the environment as well as ethical awareness are gaining increasing recognition among consumers. They demand that manufacturers use socially and environmentally friendly packages (Prendergast and Pitt, 1996; Rundh, 2005). Packaging sustainability means integrating the broad objectives of sustainable development to its total life cycle throughout all stages of the supply chain, from raw materials to ultimate disposal. Consideration must be given to the 'triple bottom line' impacts of packaging: environmental, social and economic (Elkington, 1994).

Regarding environmental concerns, previous studies have analysed factors relating to the sustainability of packaging and its effect on consumers' attitudes (Van Birgelen et al., 2009) and purchase choice (Martinho et al., 2015; Prendergast and Pitt, 1996; Rokka and Uusitalo, 2008; Wyrwa and Barska, 2017b). They conclude that environment-friendly packaging is strongly preferred. Consumers are assumed to take an active part in solving environmental problems by recycling and choosing sustainable instead of regular packaging. In their perceptions of sustainable packaging, customers consider: 1) the type of packaging material selected, 2) the amount of packaging material used, 3) aspects relating to recycling, refills, reusability, etc. and 4) aspects relating to the reduction of product damage or food spoilage (Coles et al., 2003; Lindh et al., 2016; Young, 2008).

Concerning the second impact of packaging, studies reviewed do not deal with aspects of social awareness in packaging (Nordin and Selke, 2010). We believe that, in addition to the environmental benefits of packaging, the sustainability function should consider social concerns because the consumer experience of elderly users or of those with a visual or dexterity impairment can be greatly affected by packaging elements if they are hard to see, manipulate or understand (Goodman-Deane et al., 2016).

The third impact of packaging refers to the economic responsibility of the sector which this study does not cover because it considers the consumer perspective.

Research on sustainability has increased over recent years, on both theoretical (Marsh and Bugusu, 2007; Nordin and Selke, 2010; Robertson, 1990; Sumrin et al., 2020; Wei et al., 2018) and empirical levels (Lindh et al., 2016; Martinho et al., 2015; Petit et al., 2020; Prakash et al., 2019; Prendergast and Pitt, 1996; Steenis et al., 2017). For measuring the construct, the scales focus on the study of the environmental benefits of packaging. In these cases, the measurement scales are either not validated (Prendergast and Pitt, 1996) or validation is limited to exploratory analysis of reliability (Martinho et al., 2015; Van Birgelen

et al., 2009; Wyrwa and Barska, 2017b).

2.2.8. Economy

Consumers purchase products because they provide benefits that are related to their needs and desires. Although such benefits may be highly diverse and dependent on the product category, research in the field of packaging suggests that price is important to consumers and is a function of their response (Steenis et al., 2017; Wyrwa and Barska, 2017a). The literature on prices and packaging is very diverse. On the one hand, packaging characteristics yield significant market price differences (Joutsela et al., 2017). If consumers are convinced that the packaging gives them the benefits they expect, they will be prepared to pay a higher price for it, and vice versa (Lindh et al., 2016). For example, Lindh et al. (2016) find that consumers are willing to pay more for environmental-sustainable packaging, but it is not clear how many of them would be prepared to pay more, or how much. On the other hand, in some cases packaging is perceived to be somewhat superfluous, and at worst, a serious waste of resources, so that neither the consumer nor the distributor is willing to pay a premium for it (Robertson, 2013).

In order to measure this construct, we propose 'value consciousness' to denote the degree to which the consumer focuses exclusively on paying low prices (Lichtenstein et al., 1993). This construct has already been employed by various researchers but never in the field of packaging (McGowan and Sternquist, 1998)

3. Scale development and validation

We conducted five studies on consumers in 16 European countries in 4 sub-regions of Europe (Central and Eastern, Northern, Western, Southern) (EuroVoc Classification) to develop and validate a measurement scale for the functional value of packaging. We followed the recommendations made by Anderson and Gerbing (1982), Churchill (1979), Hair et al. (2019) and Wright et al. (2017). In the study 1, we identified a set of indicators for each function of packaging proposed, considering the conceptual content in each and ensuring that the vocabulary used was appropriate for the purpose of the research and for the respondents. Then, in study 2, with a sample of 125 individuals, we analysed: (1) the appropriateness of using factor analysis to study the data; and (2) the dimensionality of the scales. In study 3, with a sample of 488 individuals, we evaluated the psychometric properties of the scales for reliability and convergent and discriminant validity. In study 4, we analysed the third-order formative scale proposed on a theoretical level in a sample of 876 individuals. Finally, in study 5, we assess the nomological validity and we present the descriptors for the scales developed, using a sample of 1489 individuals. Table 1 summarises the methodological process followed.

Table 1
Methodological process for developing the measurement scales.

Study	Purpose	Approach	Sample size	Year	Technique(s)
Study 1	Generation of items	Qualitative	N = 5 experts	2017	Literature review Panel of experts
Study 2	Content validity Analysis of the appropriateness of using factor analysis Analysis of dimensionality	Quantitative	N = 125 individuals from Northern and Western Europe	2018–2019	Survey SPSS
Study 3	Analysis of reliability and convergent and discriminant validity	Quantitative	N = 488 individuals from Central and Eastern Europe	2018–2019	Survey AMOS PLS
Study 4	Estimation of the proposed measurement model	Quantitative	N = 876 individuals from Southern Europe	2018–2019	Survey PLS
Study 5	Nomological validity Descriptive analysis	Quantitative	N = 1489 individuals from Europe	2018–2019	Survey SPSS

Table 2
Proposed items for the scale.

Dimension	Item	Author
Protection	Prot_1: That it prevents deterioration of the product Prot_2: That it resists the bumps Prot_3: That it ensures the safety of ingredients and the product Prot_4: That it ensures the product quality preserving the taste of ingredients Prot_5: That it prevents them from coming out or penetrating by liquids, vapours, gases and/or external smells Prot_6: That it has antimicrobial properties that extend product life Prot_7: That it preserves hygiene by avoiding the chemical interaction of product with other elements Prot_8: That it provides greater freshness of the product	Fang et al. (2017); De Jong et al. (2005); Lindh et al. (2016); Niemelä-Nyrhinen and Uusitalo (2013); Paine (1991); Paine and Paine (1992); Pereira de Abreu et al. (2012); Robertson (1990, 2013); Rooney (1997); Rundh (2005); Realini and Marcos (2014); Seckin and Yener (2015); Wyrwa and Barska (2017a); Yam et al. (2005)
Convenience	Conve_1: That it facilitates the opening and closing of the product Conve_2: That it facilitates the handling of product (packaging and/or lid ergonomic) Conve_3: That it provides a good system of closing the product Conve_4: That it provides comfort and fast consume of product: cooling, heating, inclusion of utensils, etc. Conve_5: That its size suits the consumption needs	Draskovic (2010); Lindh et al. (2016); Marsh and Bugusu (2007); Niemelä-Nyrhinen and Uusitalo (2013); Pousette et al. (2014); Rundh (2005); Olsson and Györei (2002); Robertson (1990); Yale and Venkatesh (1986); Yam et al. (2005)
Portability & Storage	Port&Stor_1: That it facilitates the storage in the pantry reducing the need for space Port&Stor_2: That it makes the "best before date" very visible in your pantry or in your fridge Port&Stor_3: That it decreases in size after partial consumption of the product Port&Stor_4: That it makes the product easy to carry	Niemelä-Nyrhinen and Uusitalo (2013); Prendergast and Pitt (1996); Rundh (2005, Rundh, 2011) Van Birgelen et al. (2009); Yale and Venkatesh (1986)
Information	Info_1: That it reports rigorously on its content Info_2: That it indicates the benefits obtained after consumption of the product Info_3: That it contains information on prices Info_4: That it informs about the legal regulations Info_5: That it transmits the ethical values of brand (fair trade, social responsibility, sustainability, etc.) Info_6: That it reports information whether the cold chain has been maintained Info_7: That it reports about the origin of the product Info_8: That it guarantees the authenticity of the product Info_9: That it informs about the freshness of food	De Jong et al. (2005); Lindh et al. (2016); Fang et al. (2017); Niemelä-Nyrhinen and Uusitalo (2013); Prendergast and Pitt (1996); Pereira de Abreu et al. (2012); Realini and Marcos (2014); Robertson (1990, 2013); Schaefer and Cheung (2018); Seckin and Yener (2014, 2015); Silayoi and Speece (2004, 2007); Yam et al. (2005); Wyrwa and Barska (2017b)
Branding	Brand_1: That it makes suitable and in the consumer aesthetic line of this content Brand_2: That it contains information that helps to pick a product at the point of sale Brand_3: That it is innovative or different from other packaging Brand_4: That you want to keep it or to use it to collect	Ampuero and Vila (2006); Judd et al. (1989); Liao et al. (2015); Lindh et al. (2016); Lydekaityte and Tambo (2020); Prendergast and Pitt (1996); Rundh (2005, 2016); Seckin and Yener (2014, 2015); Silayoi and Speece (2004, 2007); Underwood (2003); Wang (2013); Westerman et al. (2013)
Engagement	Engag_1: That it stimulates the senses: emitting lights, sounds, voices, smells, etc. Engag_2: That it provides experiences of leisure (games, QR, 3Ds, virtual reality, etc.) Engag_3: That it provides entertainment and fun	Joutsela et al. (2017); Lydekaityte and Tambo (2018, 2020) Velasco and Spence (2019)
Sustainability	Sust_1: That it does not contaminate the environment in its manufacturing process Sust_2: That it does not waste resources in its manufacturing process Sust_3: That it makes the product accessible to people with visual impairment or in the handling objects (easy open, braille, reliefs, and textures) Sust_4: That it is biodegradable Sust_5: That it reusable, recyclable, or returnable Sust_6: That it is rational with the use of resources, avoiding waste	Coles et al. (2003); Goodman-Deane et al. (2016); Lindh et al. (2016); Nordin and Selke (2010); Martinho et al. (2015); Prendergast and Pitt (1996); Rokka and Uusitalo (2008); Rundh (2005); Van Birgelen et al. (2009); Wyrwa and Barska (2017b); Young (2008)
Economy	Econ_1: That it is economical Econ_2: That it offers good value Econ_3: That it does not increase too much the product price	Lichtenstein et al. (1993); McGowan and Sternquist (1998); Robertson (2013)

3.1. Study 1. Item generation

3.1.1. Purpose

The aim of this initial study is to generate the set of indicators for each function proposed for the functional value scale for packaging.

3.1.2. Procedure and results

The generation of items followed 2 procedures: (1) A thorough review of the specific literature allowed us to identify the initial set of items for each packaging function. All the variables were considered using 7-point Likert-type scales in which the endpoints were 1, not important, and 7, very important. (2) From this list of items, a group of five experts carried out a critical review in order to guarantee content validity and the simplicity and appropriateness of the items for the survey respondents (De Vellis, 1991; Vandecasteele and Geuens, 2010). The experts evaluated each item on a 7-point Likert scale and made comments which led to changes in the wording of some items (Table 2).

3.2. Study 2. Exploratory factor analysis (EFA)

3.2.1. Purpose

The aim of study 2 is exploratory, seeking to examine the factorial structure of the scales using EFA, with no restrictions on the number of components to be extracted (Hair et al., 1999).

3.2.2. Participants and procedure

The final sample in this study, after data cleansing – processing of missing values, analysis of outliers and normality tests – comprised 125 individuals from Northern and Western Europe. 42.40% were men and 57.60% women. About 37.6% were under 25 years old, 35.2% were between 25 and 34 years old and 27.2 were over 35 years old. 46.40% of the households were made up of 2 or less people, and 11.20% of more than 4. 23.20% had children.

3.2.3. Results

We first checked that factor analysis was appropriate for analysing the data. We checked that the determinant of the correlations matrix for each scale was close to 0 and that the result of the KMO test was close to 1 (Lévy and Varela, 2003). We then performed Exploratory Factor Analysis (EFA) using Principal Component analysis with Varimax rotation as the extraction method. Given the size of the sample, this required factor loadings in the rotated component matrix above or nearly 0.5, self-values above 1, explained variance of about 60% or more, and communality above 0.50 (Hair et al., 1999). As a result, items Prot6, Conv3, Info3 and Info9 were removed.

Table 3
Exploratory factor analysis.

Scale/dimension	Items	Determinant	KMO	Explained variance	Rotated factor load	Communality
Protection	7	.005	.867	69.27%		.582–.753
Convenience	4	.225	.769	64.71%		.519–.771
Portability & Storage	4	.383	.737	57.94%		.515–.644
Information	7	.112	.807	62.46%	.620–.862	.505–.783
Product information	4				.620–.789	.505–.623
Intelligent packaging	3				.741–.862	.610–.783
Branding	4	.307	.753	60.86%		.515–.765
Engagement	3	.155	.716	82.32%		.769–.880
Sustainability	6	.014	.865	68.83%		.486–.838
Economy	3	.268	.722	76.94%		.723–.802

The results (Table 3) indicate that the information scale is second-order multidimensional, while the others are unidimensional. The information scale is made up of basic information and “intelligent packaging” information.

3.3. Study 3. Reliability, convergent and discriminant validity

3.3.1. Purpose

Study 3 aims to check the psychometric properties of reliability and convergent and discriminant validity of the scales that resulted from the previous study.

3.3.2. Participants and procedure

After data cleansing, the sample for this study comprised 488 individuals from Central and Eastern Europe. 38.10% of the sample were men and 61.90% women. Considering age, 57% were under 25 years old, 34.7% were between 25 and 34 years old and 8.2% were over 35 years old. 24.80% of the households were made up of 2 or less people, and 15% had children.

3.3.3. Results

Reliability. To analyse reliability, two tests were used: (1) Cronbach’s alpha, and (2) Composite Reliability (CR) (Table 4). The values for Cronbach’s alpha fluctuated between 0.722 for the portability & storage scale and 0.912 for the protection scale, in both cases above 0.7 (Nunnally and Bernstein, 1994). Composite reliability also exceeded 0.7 (Hair et al., 1999) for all the scales. It could therefore be deduced that there was internal consistency and high reliability.

Convergent validity. This was tested by analysing: (1) the factor loadings of all the items and their significance, and (2) Average Variance Extracted (AVE). In order to guarantee the results, bootstrap analysis at a confidence level of 95% was performed with 5000 subsamples, each of which had the same size as the original sample (Hair et al., 2011). The results (Table 4) show that all the loads were significant and exceeded 0.7 (Carmines and Zeller, 1979). AVE exceeded 0.5 in all cases (Fornell and Larcker, 1981), so convergent validity was confirmed.

Discriminant validity. Discriminant validity was analysed using 2 tests: (1) the ratio between the Heterotrait-Monotrait correlations (Henseler et al., 2015) did not exceed 0.85 (Clark and Watson, 1995; Kline, 2011); and (2) the AVE between each pair of factors exceeded the square of the correlation between the factors (Fornell and Larcker, 1981). The results (Table 5) show that there is discriminant validity.

Table 4
Reliability and convergent validity of the scales (Bootstrap results).

Scale/dimension	Items	Bootstrap		CA	CR	AVE
		Loads	Confidence intervals			
Protection	7	(.735-.854)***	(.685-.815)	.912	.930	.655
Convenience	4	(.774-.870)***	(.719-.894)	.830	.887	.663
Portability & Storage	4	(.712-.768)***	(.639-.808)	.722	.827	.545
Information	7	(.923-.947)***	(.908-.958)	.885	.910	.592
Product information	4	(.735-.840)***	(.680-.866)	.813	.877	.642
Intelligent packaging	3	(.838-.866)***	(.801-.879)	.809	.887	.723
Branding	4	(.738-.840)***	(.685-.869)	.810	.875	.637
Engagement	3	(.863-.907)***	(.835-.925)	.863	.916	.785
Sustainability	6	(.790-.861)***	(.754-.887)	.906	.928	.681
Economy	3	(.870-.904)***	(.836-.924)	.872	.921	.796

Note: CA: Cronbach's alpha; CR: Composite reliability; AVE: Average Variance Extracted.
***p < .01.

Table 5
Discriminant validity.

	1	2	3	4	5	6	7	8
1. Protection	.655	.747	.726	.706	.573	.329	.682	.713
2. Convenience	.428	.663	.831	.734	.753	.588	.620	.620
3. Portability & Storage	.354	.416	.545	.724	.759	.593	.661	.623
4. Information	.402	.398	.340	.592	.749	.539	.813	.660
5. Branding	.253	.382	.345	.407	.637	.836	.567	.544
6. Engagement	.087	.246	.220	.223	.487	.785	.303	.262
7. Sustainability	.386	.294	.289	.530	.243	.073	.681	.827
8. Economy	.406	.280	.248	.335	.214	.053	.542	.796

Note: Values on the diagonal: AVE; below the diagonal: square of the correlations between the factors; above the diagonal: Heterotrait-Monotrait (HTMT).

3.4. Study 4. Formative scale

3.4.1. Purpose

The purpose of study 4 is to validate the third-order formative scale for the functional value of packaging.

3.4.2. Participants and procedure

The sample used in this study comprised 876 individuals in Southern Europe, after data cleansing. 36.80% were men and 63.20% women. About 29.2% were under 25 years old, 36.4% were between 25 and 34 years old, 14.5% were between 35 and 44 years old and 19.9% were over 45 years old. 32% lived alone or with one other person, and 7.60% of households had more than 4 people. 25.50% had children.

3.4.3. Results

To study the validity of the formative scale for the functional value of packaging, we first performed a diagnosis of collinearity, checking that VIF did not exceed 5 (Table 6) (Hair et al., 2011). From the results, we deduced that there were no problems of multicollinearity. We then analysed the relative relevance of each formative dimension by studying the significance of its weight. In order to guarantee the results, bootstrap analysis with 5000 samples was performed at a confidence level of 95%. All the weights were significant (Table 6), so all the dimensions were retained.

Finally, we analysed the reliability and convergent and discriminant validity of the dimensions of the scale. The results confirm that they exist (Tables 6 and 7).

Table 6
Reliability and convergent validity of the formative scale (Bootstrap results).

Dimension	Bootstrap		VIF	CA	CR	AVE
	Loads	Confidence intervals				
Protection	.322***	.300-.344	1.769	.899	.921	.626
Convenience	.143***	.129-.160	1.718	.778	.857	.602
Portability & Storage	.130***	.114-.150	1.456	.773	.855	.596
Information	.257***	.238-.278	1.819	.843	.882	.518
Branding	.109***	.095-.127	1.820	.699	.812	.522
Engagement	.067***	.048-.089	1.466	.874	.923	.799
Sustainability	.295***	.266-.327	1.630	.930	.945	.742
Economy	.120***	.106-.133	1.394	.812	.888	.726

Note: CA: Cronbach's alpha; CR: Composite reliability; AVE: Average Variance Extracted.
***p < .01.

Table 7
Discriminant validity of the dimensions of the formative scale.

	1	2	3	4	5	6	7	8
1. Protection	.626	.603	.549	.591	.425	.187	.424	.447
2. Convenience	.255	.602	.610	.415	.628	.382	.309	.463
3. Portability & Storage	.210	.232	.596	.393	.433	.252	.365	.325
4. Information	.268	.118	.100	.518	.441	.141	.637	.461
5. Branding	.126	.217	.103	.130	.522	.737	.310	.411
6. Engagement	.026	.087	.043	.011	.296	.799	.053	.212
7. Sustainability	.154	.077	.096	.323	.068	.002	.742	.476
8. Economy	.151	.140	.067	.148	.104	.032	.175	.726

Note: Values on the diagonal: AVE; below the diagonal: square of the correlations between the factors; above the diagonal: Heterotrait-Monotrait (HTMT).

3.5. Study 5. Nomological validity and descriptive analysis

3.5.1. Purpose

The purpose of this study 5 is to assess the nomological validity of the previously developed and validated functional value of packaging scale from study 4 and provide a descriptive analysis of its dimensions.

3.5.2. Participants and procedure

The sample for this study was made up of the sub-samples from studies 1, 2 and 3 so, after data cleansing, it comprised 1489 individuals from Europe. Considering age, 20.4% were under 25 years old, 49.9% were between 25 and 34 years old, 15% were between 35 and 44 years old and 14.7% aged 45 or over. 30.80% lived alone or with one other person, and only 7.30% lived with 3 or more people. 21.80% had children.

3.5.3. Results

Nomological validity is apparent if the scale correlates with the measures of different but theoretically related concepts. To determine the nomological validity of the functional value of packaging scale, a measure of purchase intention was included because, as suggested in the literature review, both variables are related (Ampuero and Vila, 2006; Silayoi and Speece, 2004, 2007; Wyrwa and Barska, 2007a). Literature suggests that the elements of packaging positively influence the consumer purchase intention in particular for packaged food products (Benachenhou et al., 2018; Silayoi and Speece, 2004; Tiekstra et al., 2021; Vilnai-Wavetz and Koren, 2013).

Purchase intention was measured through a seven-point Likert-type item (anchored by “I certainly wouldn’t buy it” and “I certainly would buy it”). Respondents were asked how likely they were to purchase a food product in an intelligent packaging (Yam et al., 2005). Results confirm the proposed relationship (Table 8), thereby establishing the nomological validity of the scale.

Therefore, the scale for the functional value of packaging is made up of the dimensions of protection, convenience, portability & storage, information, branding, engagement, sustainability, and economy (Fig. 2).

The descriptive analysis scores, on a scale of 7 points (Table 9), exceeded 5 points (5.271) for the functional value of packaging, as were the dimensions of protection (6.013), sustainability (5.860), economy (5.790), information (5.443) and convenience (5.175). The mean for portability & storage was close to 5 (4.788). The mean for engagement was the lowest (2.643).

Table 8
Nomological validity of the formative scale (Bootstrap results).

Relation	Bootstrap	
	Estimate	Confidence intervals
Functional value of packaging → purchase intention	.332 ***	(.288-.384)

***p < .01; R² = 11.00%.

4. Discussion

We found evidence of reliability, convergent, discriminant and nomological validity in the third-order formative scale, which included the functionalities of packaging that provide value to consumers: protection, convenience, portability & storage, information, branding, engagement, sustainability, and economy. Confirmatory analysis pointed to the existence of a formative, third-order construct that significantly explains the relations between, and importance of, the 7 first-order dimensions and the 1 s-order dimensions that it is made up of.

Regarding the importance of each function, the results show that the most important function of packaging is protection, including the extra-protection function offered by active packaging which was not considered in previous studies. The literature had already shown a clear consensus that the main function of sales packaging is essentially logistical in nature, that is, to contain and protect the product (Paine, 1991; Paine and Paine, 1992; Prendergast and Pitt, 1996). Our finding is in line with subsequent developments which also find that the protective function of packaging is a quality that is considered a ‘must’, especially for food products (Lindh et al., 2016; Niemelä-Nyrhinen and Uusitalo, 2013; Robertson, 2013; Seckin and Yener, 2015; Wyrwa and Barska, 2017a, b).

Our main finding in this study is that the second most important function of packaging for consumers is sustainability. We find that consumers place greater value on packaging that offers sustainable solutions with regard to rational use of resources, environmental impact and social demands such as accessibility. These results differ from those of other research which indicated that other aspects were valued by consumers more than sustainability. Rokka and Uusitalo (2008), in an empirical study with a sample of 330 consumers using functional drink products, found that brand, price or convenience seemed to override the importance of environment-friendly packaging. Along the same line, Van Birgelen et al. (2009), in an online research panel of 176 respondents, found that, in the beverages sector, price has to be fulfilled before a consumer takes environment-friendly beverage packaging characteristics into account. Wyrwa and Barska (2017b), in a study on a sample of 372 Polish consumers found that environment-friendly characteristics were the fourth most important function of food product packaging, after protection, information and utility. But these authors note that this order is different among young consumers who place greater importance on the environment-friendly function.

Consumers give third place to the informational function of packaging when information is provided on, amongst others, content, benefits, legal regulations, brand value and technical matters relating to intelligent packaging. According to Wyrwa and Barska (2017b, p.771), inclusion of this information is a “factor significantly influencing the opinion of consumers on buying or not buying a food product”. Similarly, Silayoi and Speece (2004) state that these informational elements are becoming more important and influential than visual and other communicational elements.

The following functions of packaging come next in order of importance but at a considerable distance from those already mentioned. Regarding convenience, studies such as that by Draskovic (2010)

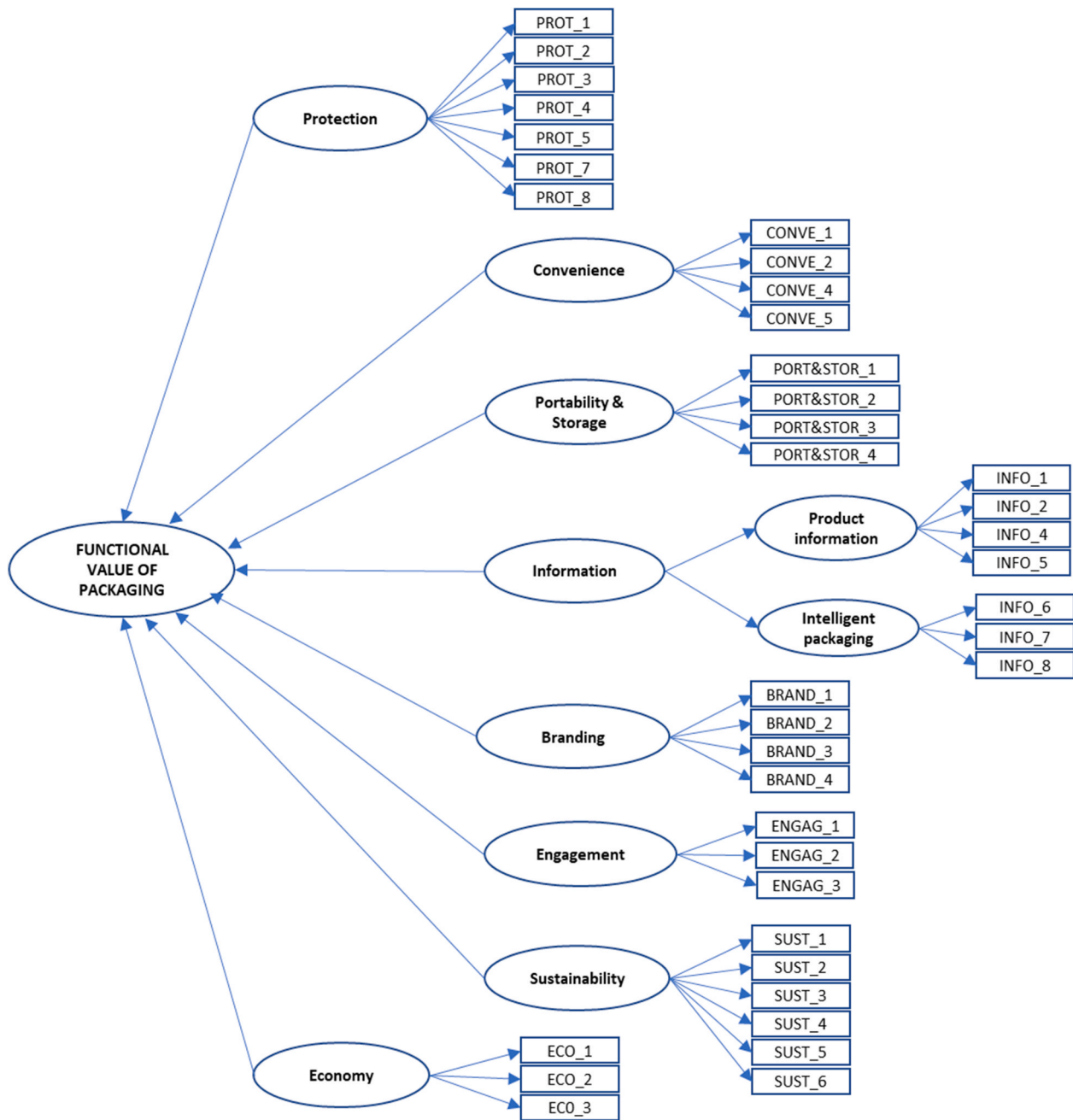


Fig. 2. Final items.

Table 9
Descriptive statistics of the scales studied (mean and standard deviation).

	Packaging	Protection	Convenience	Portability & Storage	Information	Brand	Engagement	Sustainability	Economy
M	5.271	6.013	5.175	4.788	5.443	3.808	2.643	5.860	5.790
SD	.875	1.043	1.208	1.302	1.18	1.880	1.767	1.236	1.161

indicate that soft drink consumers consider convenience to be an important modern feature of packaging due to changing lifestyles. Lindh et al. (2016) also noted, in a sample of 712 Swedish individuals, that handiness of packaging is crucial in consumer food packaging choices. Aspects of convenience such as ‘easy to re-seal’, ‘easy to open’, and ‘packaging size’ are even considered more important than protection and information. The differences in our results might be attributed to the

fact that the studies mentioned were not applied to products in general but to soft drinks, for which portability is highly-valued by consumers.

The results place the portability & storage function in fifth position in order of importance. This reflects that for packaging to facilitate consumption of the product anywhere and storage in the home is less important for consumers than the protection, sustainability and information functions. Along the same line, Young (2008), after a packaging

test, concluded that 'ease of transport', 'disposal' and 'storage in the home' were mentioned by consumers as important drivers of purchase.

In sixth position, consumers have valued the economic function of packaging. As stated by Nordin and Selke (2010), efforts to ensure that packaging fulfils its functions must be made in balance with consumer price sensitivity.

Finally, consumers value the branding and the engagement functions of packaging. The consideration of branding was reinforced in previous studies focusing on actors in the value chain. For example, marketing managers in the study by Rundh (2013) pointed to packaging as a key marketing tool within a highly competitive food industry. In addition, Wyrwa and Barska (2017b) indicated that packaging should also fulfil promotional functions to encourage buyers to purchase a product. Regarding engagement, previous research suggests the importance of new technologies in packaging to link brand with consumer (Joutsela et al., 2017; Lydekaityte and Tambo, 2020; Velasco and Spence, 2019). However, our results show that consumer attaches importance to branding and engagement but makes them subject to the fulfilment of the previous ones. It must be considered that marketing functions -branding and engagement- influence the emotional or irrational component of consumer behaviour and this cannot be captured in their conscious response.

5. Conclusions

In five comprehensive studies with different samples comprising consumers of 16 European nationalities, we define, develop and validate a scale to measure the functional value of packaging.

The main strengths of the scale proposed stem from its validity and test. Existing scales of packaging functions are limited and their validation is incomplete. The developed scale can be used to evaluate the functions of packaging in numerous sectors such as food, beverages, cosmetics, drugs and so on, because, although the items were tested in a food context, the scale could be easily adaptable to the specific aspects that might be different in other industries. The validation of the dimensions of packaging can be used (in isolation or in combination) to study the roles of packaging that are relevant in given situation and for a given category of product. Researchers could use the dimensions proposed as autonomous concepts or as concepts that are combined holistically in their research, depending on whether they aim to analyse one or several functions of packaging. Therefore, in addition to providing a generic, global scale, we provide more operational, shorter measures that are easy to apply to each of the dimensions of the scale. Finally, when developing this scale, we considered both active and intelligent packaging, that is, innovative packaging with enhanced functions resulting from scientific and technological developments.

This study extends knowledge on the relative importance of each of the functions of packaging, showing that they have an influence on consumers' evaluation of products and intention to purchase. Protection is shown to be the most relevant function of packaging, followed by sustainability, information on the packaging, convenience, portability & storage, economy, branding and, finally engagement. This development can undoubtedly be used by product managers to position each of these functions in their strategy.

6. Limitations and future research

Our research offers opportunities for future research to extend our findings. First, this study develops a scale that includes a large number of functions of packaging that provide value to consumers in today's markets. Bearing in mind that both consumers and packaging are dynamic elements that are constantly changing, to ensure the measurement tool maintains relevancy, it is recommended that in future research dialogues should be established with consumers to anticipate new demands that might lead to the inclusion of new elements completing our scale's categorization.

Second, this study analyses the data globally because its aim is to develop a measurement scale. However, a more specific analysis is proposed because the functional value of packaging might change across different scenarios. Segmentation based on variables such as geography, age or lifestyle would reveal the perceptions of different consumer groups.

Finally, we suggest that future research should be explored in detail the relationship between the functional value of packaging and other variables, such as consumers' intention to buy, level of involvement or willingness to pay more.

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