

A bibliometric analysis on packaging research: towards sustainable and healthy packages

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Abstract

Purpose – The basis of this paper is to carry on a bibliometric analysis to investigate how “marketing” decisions have affected “packaging” success in different disciplines. This analysis covers from the first paper published on this topic (in 1956) to the last papers published in 2019.

Design/methodology/approach – A total of 1,170 scientific papers (including 14,177 citations within those papers) were retrieved from the Web of Science (WOS) and Scopus, dated from 1956 to 2019. Scimat software was used to analyse the data.

Findings – The results of this paper show that two main sectors constitute the focus of packaging studies from a marketing approach: food and tobacco. Recently, the main topics of research have evolved towards sustainable and health packaging, concerning different agents involved in packaging decisions: retailers, marketers, consumers and producers. So, both lines of research represent promising lines of research.

Originality/value – Three different investigating profiles (i.e. engineers, marketers-psychologists and doctors-scientists) have examined how packaging should be prepared to succeed. However, a holistic bibliometric analysis about “packaging” and “marketing” is missing from those three branches of knowledge. This study is important to guide future lines of research to fill the identified gaps.

Keywords Packaging, Bibliometric, Sustainable, Health

Paper type General review

Introduction

Some theoretical revisions have been made about the relevance of the packaging, pursuant to the consumers’ point of view. For example, Nemat, Razzaghi, Bolton and Rousta (2019) recently reviewed, from a theoretical approach, the role of food packaging design in consumer recycling behaviour (waste sorting). In addition, from a supply approach and following a much more technical approach, Rojas, Ospina, Vélez and Flãrez (2019) developed a bibliometric analysis on packaging materials from 1996 to 2016.

Joining both approaches, it is possible to conclude that packaging design requires a dialogue and engagement among different stakeholders: producers, retailers and consumers (Gustavo, Pereira, Bond, Viegas and Borchardt, 2018). Maybe for this reason, different streams of research have investigated how a package should be prepared to succeed: (i) engineers and chemists have paid attention to the best packaging materials that could be used to keep the product and the environment optimal; (ii) marketers and psychologists in the fields of psychology, communication and marketing have focused on

the best claims and extrinsic product cues to convince retailers and seduce consumers at the point of sales; (iii) doctors and scientists in health departments have concentrated on the role of the packaging to stimulate healthy or unhealthy habits.

In this framework, a holistic bibliometric analysis on ‘packaging’ and ‘marketing’ is missing from those three branches of knowledge. Previous works have raised this point (Rundh, 2005, 2013), but ‘although packaging has become a recognised marketing tool, relatively few studies have been devoted towards the theoretical work in marketing literature . . . little is known about packaging and its relation to marketing strategy’ (Rundh, 2013, p. 1549). For this reason, the basis of this paper is to carry on a bibliometric analysis that covers from the first paper published on this topic (in 1956) to the last papers published in 2019 to investigate how ‘marketing’ decisions have affected ‘packaging’ success in different disciplines. This interdisciplinary stream of research is now gaining importance due to the new environmental restrictions that companies face when governments’ and consumers’ commitments to sustainability and health become a priority. Not in vain, environmental concerns has raised packaging decisions to be a research priority (Gustavo, Pereira, Bond, Viegas and Borchardt, 2018).

To that end, bibliometric resources will be used in this paper because they allow us to evaluate and analyse academic production in all scientific disciplines, quantifying bibliographic production at different levels and considering diverse agents, such as: researchers, institutions or journals (Montero-Díaz et al., 2018).

Based on Cobo et al., (2012) this research follows two main objectives. First, to measure the visibility and impact of the scientific production in the analysed topic. To reach this objective, a performance analysis will be done using the scientific impact (h-index) and the citations obtained by the different agents, such as journals or researchers.

Second, to identify the scientific structure by themes of research in the main topic under study, as well as its evolution in different periods of time. To get this objective, a scientific maps analysis will be obtained to identify the most prolific themes of research based on productivity (number of papers referring to each theme in each period). These maps will be generated after a co-word analysis that measures word co-occurrence by following a longitudinal approach that permits the identification of emerging and dying themes of research.

Based on previous bibliometric analyses (Kim and McMillan, 2008; Díaz et al., 2018), these two objectives will be concretised in four research questions. The first three questions addressed the first objective of measuring the visibility and impact of the scientific production in our topic (i.e. packaging research from a marketing focus), and the last question addressed the second objective of identifying the scientific structure and evolution of the principal themes (i.e. the evolution of packaging research towards sustainability and health).

- **RQ1:** Which authors have obtained the highest visibility and impact in the field of packing, from a marketing focus? That is, who are the most cited authors?
- **RQ2:** Which journals have obtained the highest visibility and impact in the field of packing, from a marketing focus? That is, which are the most cited journals?
- **RQ3:** Which themes have obtained the highest visibility and impact in the field of packing, from a marketing focus? That is, what are the most cited product marketing packing themes?
- **RQ4:** What are the underlying themes among the most cited works in the field of packaging from a marketing focus? Have they evolved?

Solving these questions will add value to the status of product packaging investigation, an important field as shown by the exponential increase in this topic. Public and private managers should be aware of research tendencies to promote acceptable and successful packaging in the future.

1. Materials and Methods

1.1. Software

Our bibliometric analysis allowed a quantitative analysis of all scientific publications indexed in the Web of Science (WOS) and Scopus, containing the key words ‘packaging’ and ‘marketing’. To this end, **SciMAT** software was used (Cobo et al., 2012). As Muñoz-Leiva, Porcu and Barrio-García (2015) have explained, the **SciMAT** software uses co-work analysis to identify the interests and aspirations of academic researchers; thus, ‘[t]his technique reduces a large set of descriptors (or keywords) to a set of network graphs that effectively illustrate the strongest associations between descriptors’ (p. 682).

1.2. Sampling

To define the sample, the key words ‘packaging’ and ‘marketing’ were used together. The search was only done in the English language. The robustness of this method can be seen in Cobo, Chiclana, Collop, de Ona and Herrera-Viedma (2014). As they recommend, a de-duplicating process was applied over the keywords. The author’s keywords and the Keywords Plus were considered to help group words that represent the same concept. The initial sample included 82 papers indexed in Scopus and 1130 indexed in the WOS. These 1212 articles were screened by removing duplicates and papers without year of publication, considering 1170 scientific papers in our final sample. Moreover, 14177 citations within those papers were recorded and analysed. The period embraced was from 1957 (when the first indexed paper was published) to 2019.

To answer RQ1, RQ2 and RQ3, citation analysis was used. This is a method of tracking publishing patterns based on the assumption that a heavily cited author, paper, or book is considered important by a large number of scholars in a discipline (Kim and McMillan, 2008).

To answer RQ4, two scientific maps were obtained and compared for two consecutive periods of time: (i) from 1957 to 2014, with 699 documents; and (ii) from 2015 to 2019, with 472 documents. The generic terms ‘packaging’ and ‘marketing’ were eliminated to a better approach the most used words in this field of research. These two periods of time were identified because, as Figure 1 shows, the number of published papers increased exponentially in 2016, doubling over previous years. Not in vain, Nemat, Razzaghi, Bolton and Roustia (2019) pointed out that one of the reasons for the increasing number of publications about food packing design in consumer recycling behaviour ‘could be a larger awareness of the environment impact of food and food packaging waste’ (p. 4).

To better understand the usefulness of the SciMAT software to carry on longitudinal analysis, see Montero-Díaz, Cobo, Gutiérrez-Salcedo, Segado-Boj and Herrera-Viedma (2018).



Figure 1. Number of papers about "packaging" and "marketing"

Source(s): Own elaboration

4. Results and Discussion

4.1. 7 Authors with highest visibility and impact in packaging research: RQ1

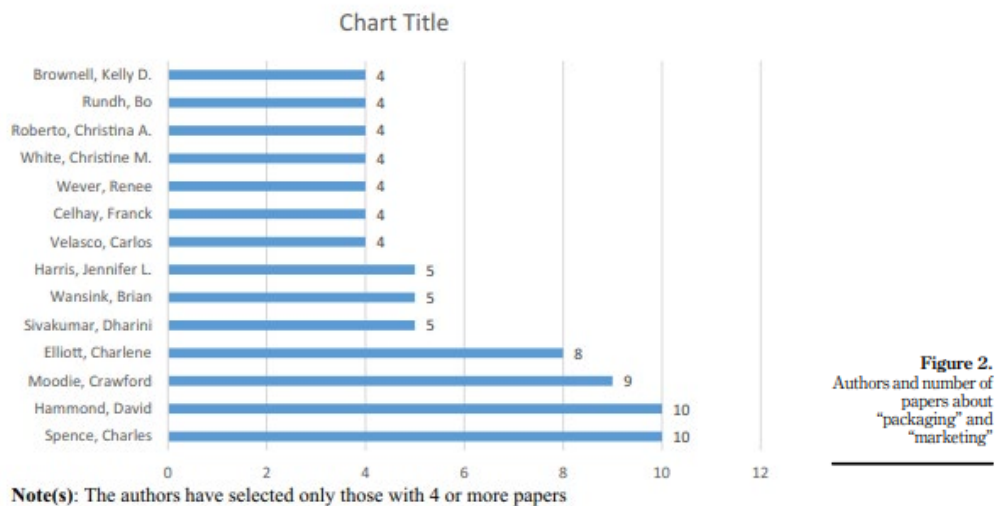
To identify the authors with the highest visibility (RQ1), the number of indexed published papers about this topic for each author was analysed. Although the analysis was carried out with all the authors (3191) and publications (1170) on "packaging" and "marketing", considering 14.177 references, for exhibition purposes, Figure 2 shows only the most outstanding works:

- Charles Spence (h-index = 115) has the highest number of indexed papers about packaging and marketing (10 papers). From the University of Oxford, he has investigated packaging proprieties from an Experimental Psychology approach, to analyse how diverse tastes, aromas and flavours can be combined to other sensory features, such as abstract shapes, names and speech sounds. The food industry has been a high priority for this researcher.
- David Hamando (h-index = 63) shares the first position, with 10 papers on this topic. He has developed his research in Canada at the Department of Health Studies and Gerontology, mainly to go deeper into the impact of health warning messages on tobacco packages.

- Crawford Moodie (h-index = 32) has followed the same line of research (i.e. the tobacco industry) in the Institute for Social Marketing & CRUK Centre for Tobacco Control Research (University of Stirling in UK). With 9 indexed papers on this topic, his priority has been plain tobacco packaging in the frame of the Public Health Research Consortium.
- Charlene Elliot (h-index = 19) has developed her research in Canada, following a communication perspective (School of Journalism and Communication). With 8 indexed papers on this topic, she has investigated how packaging affects the child market behaviour in the food industry.
- Dahirini Sivakumar's (h-index = 31) research is framed in South Africa (Department of Microbiology and Plant Pathology). Following a practical approach, she has investigated diverse technologies available to design packaging with the ability to maintain the overall quality of perishable food.
- Brian Wansink (h-index = 81), professor of Consumer Behaviour, was the head of the Cornell Food and Brand Lab in the USA. He has published 5 indexed papers on this topic. Some of his questioned work led to the introduction of mini-sized packaging and other surprising decisions related to food packages.
- Jennifer Harris (h-index = 34) frames her work in the Rudd Center for Food Policy & Obesity (University of Connecticut), concentrating on the marketing area. She has focused on food marketing to youth, and her research is widely used by the public health community and policymakers to improve the food marketing environment surrounding children and adolescents in the USA and worldwide

In summary, there is a group of prolific authors from Europe (United Kingdom), Canada, South Africa and EEUU (United States) who have investigated product

packaging and considered the influence of marketing decisions under an interdisciplinary umbrella of fields (i.e. psychology, communication, health and technology and chemistry). All of it focused on two main industries: food and tobacco.



According to the number of citations (Figure 3), the top two papers are framed in the marketing discipline, indexed in the Social Sciences Citation Index. First, the work of Brakus, Schmitt and Zarantonello (2009), published in the *Journal of Marketing*, about how brand experiences can be encouraged with brand-related stimuli (i.e. the packaging), but without focusing on any specific sector. Second, work from Wansink and Chandon (2006), also published in the *Journal of Marketing Research*, about how 'low-fat' nutrition claims may influence food consumption.

The third and the fourth most cited papers are recorded in the Science Citation Index. The third position belongs to the paper published by Mattila-Sandholm, Myllärinen, Crittenden, Mogensen, Fondén and Saarela (2002) in the *International Dairy Journal*. Those micro-biologists, from Northern Europe, were worried about probiotic foods and, more specifically, the packaging materials that store and maintain the quality of products containing probiotic bacteria. In the same vein, the fourth most cited paper (Silvestre,

Duraccio and Cimmino, 2011) was developed by Italian chemists, who identified how nanotechnologies advances could be used in food packaging to improve food quality and safety.



4.2. Journals with the highest visibility and impact in product placement research: RQ2

Figure 4 shows which journals have been the most prolific publishers. Our results indicate that the top journals on packaging research are framed in the tobacco industry, with *Tobacco Control* as the leading journal.

The second most relevant industry to investigate packaging is the food industry, with *Food Quality and Preference* representing the second journal with more published articles on the present research topic. Other relevant journals are: *Journal of Food Product Marketing*, *Journal of Food Science and Technology-Mysore* and *Appetite*.

The third outstanding research area on packaging research is the health industry, with *Public Health and Nutrition* as the top journal in the field.

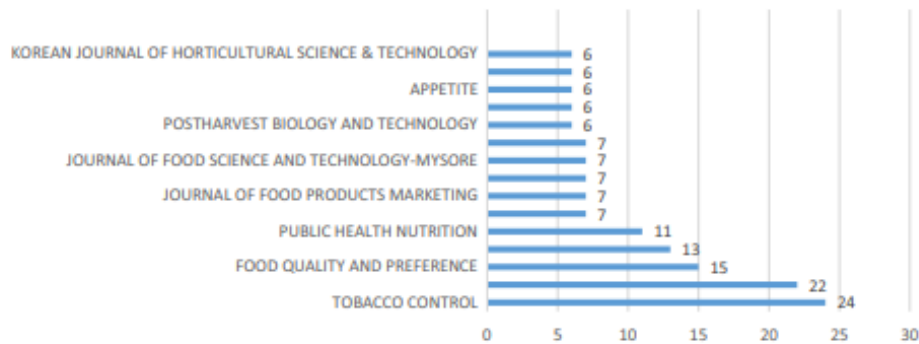


Figure 4. Journals and number of papers containing "packaging" and "marketing"

Note(s): Only the journals with more than 6 papers were selected

4.3. Themes with highest visibility and impact in packaging research and evolution:

RQ3

Following Cobo, Chiclana, Collop, de Ona and Herrera-Viedma (2014), the performance analysis of research themes—compared to the entire research field—were measured using three kinds of bibliometric indicators: (i) number of published documents, (ii) number of received citations and (iii) h-index. Table 1 shows the values for these three bibliometric indicators for the two analysed periods of time to help identify the most relevant themes and solve RQ3.

First, **based on the number of published documents** (Table 1), some themes have remained stable over time: SMOKE/TOBACCO and STRATEGY/MANAGEMENT. One theme has doubled its relevance: CONSUMERS (from 51 papers in period 1 to 110 papers in period 2). On the contrary, some themes have diminished (i.e. STORAGE, ENVIROMENT AND ACTIVE PACKAGING), while others have strongly emerged (i.e. CHILD-ADOLESCENT, NEURO-SENSO, SUSTAINABLE and FRUIT-VEGETABLES). That is, in the second period, a greater concern exists for a specific target (that of child-adolescent), for the development of novel methodologies to investigate packaging decisions (neuroscience and sensory analysis), for the relevance of

real foods (fruit and vegetables) and for packaging sustainability to attend environmental worries. These themes represent research opportunities in the coming years.

Second, **based on the maximum number of citations per theme**, our findings show that, in both periods, the most cited papers are those that talk about CONSUMER in the SMOKE-TOBACCO industry. In period 1 papers in the FOOD-NUTRITION industry are also outstanding in terms of cites, while CHILD-ADOLESCENTS, NEURO-SENSO and ATTITUDES stand out the most in period 2.

	Documents count	H index	Sum. citation
<i>Period 1 themes</i>			
CONSUMER	51	23	2.703
SMOKE-TOBACCO	30	21	1.335
STORAGE	50	14	586
FOOD_NUTRITION	36	19	1.492
RISK_SAFETY	16	9	434
SHELF_LIFE	23	10	517
ENVIRONMENT	7	7	540
STRATEGY_MANAGEMENT	13	6	483
ACTIVE-PACKAGING	5	5	479
<i>Period 2 themes</i>			
CONSUMER	110	12	409
CHILD_ADOLESCENT	73	8	242
SMOKE-TOBACCO	33	8	258
ATTITUDE	16	7	140
NEURO_SENSO	28	4	77
STRATEGY_MANAGEMENT	12	4	45
SUSTAINABLE	27	6	85
FRUIT_VEGETABLES	19	4	52

Table 1.
Performance measures
(bibliometric
indicators) for both
periods of time

Third, **focusing on the h-index**, Table 1, Figure 5 and Figure 6 show the evolution of themes. Four main conclusions are supported by our research:

- In period 1, there are four outstanding themes related to packaging and marketing: CONSUMER (h-index = 23), SMOKE-TOBACCO (h-index = 21), FOOD-NUTRITION (h-index = 19) and STORAGE (h-index = 14).
- Some themes in period 1 are consolidated in period 2 (Figure 6): CONSUMER and SMOKE-TOBACCO. More specifically, CONSUMER shares strong links in period 2 with CONSUMERS and other new themes, such as ATTITUDES. In the same vein,

SMOKE-TOBACCO shares strong links in period 2 with SMOKE-TOBACCO and a new theme, CHILD-ADOLESCENT.

- In period 2 (Figure 6), some new themes hatch suddenly: CHILD-ADOLESCENT (73 documents; h-index = 8), ATTITUDES (16 documents; h-index = 7), SUSTAINABLE (27 documents; h-index = 6), NEURO-SENSO (28 documents; h-index = 4) and FRUIT AND VEGETABLES (19 documents; h-index = 4). These are relatively new and promising research topics.
- Some themes in period 1 decrease in period 2 (Figure 7): STORAGE, ENVIROMENT, ACTIVE PACKAGING and FOOD-NUTRITION. These topics seem to have lost their interest in academia.

To conclude, as the overlapping map included in last row of Figure 6 shows, the number of key works has diminished between both periods (from 2294 to 1877). This means that the research community has focused and strengthened its terminology. The shared key words between both periods is not too high, 423 (23%), in part because a big amount of key words disappeared from period 1 to period 2 (1871).

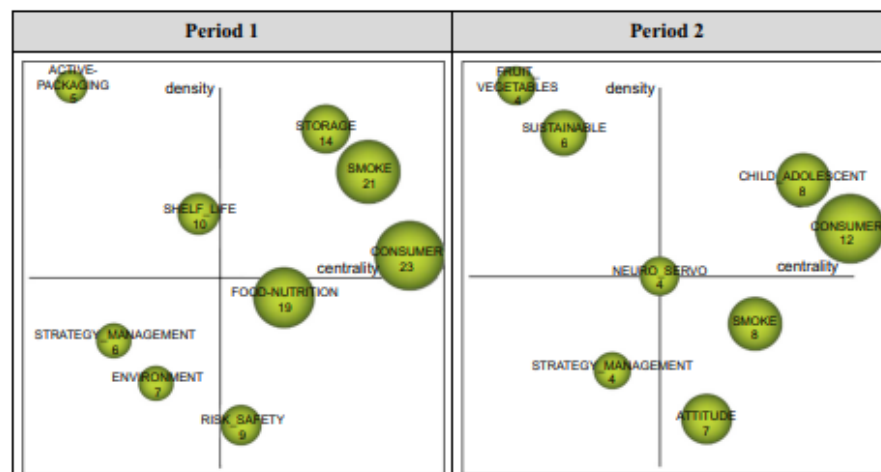


Figure 5. Themes with highest visibility/impact and evolution (*h*-index)

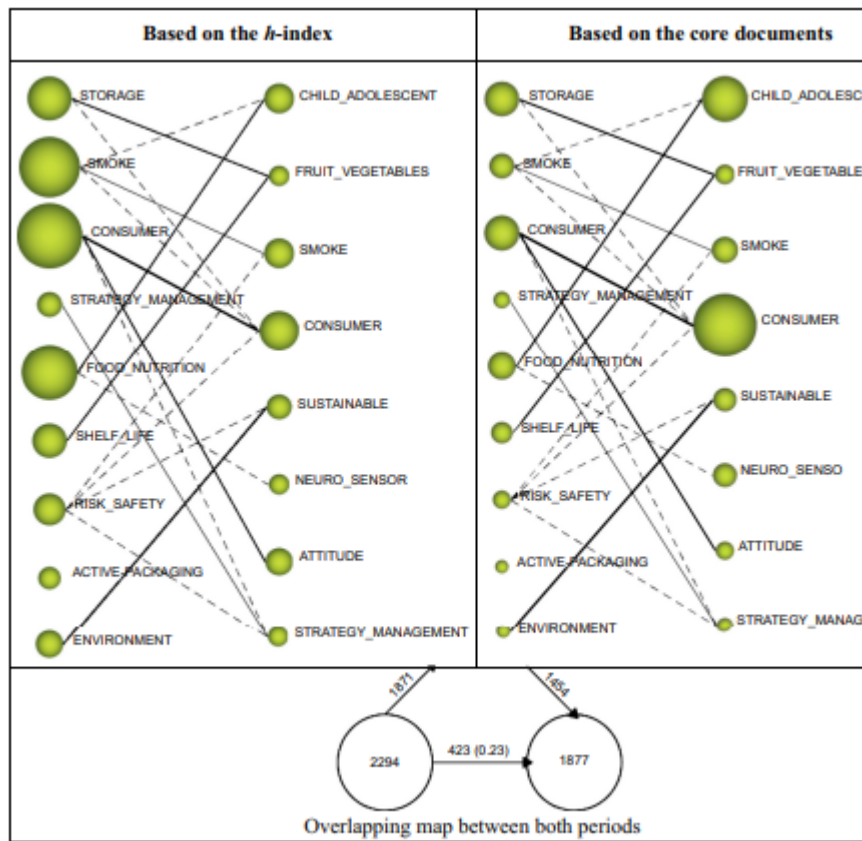


Figure 6.
Evolution of the topics
from period 1 to
period 2

4.4. Scientific structure (central themes and evolution): RQ4

Figures 7 and 8 visually show the strategic diagrams for the two periods, including the indicators used to analyse the centrality and density of each theme in both periods. Based on the ideas that ‘centrality’ measures the degree of interaction of a network with other networks and ‘density’ measures the internal strength of the network (Cobo et al., 2014), four groups of themes are identified to help answer RQ4: (i) motor themes, (ii) basic and transversal themes, (iii) emerging or declining themes and (iv) highly developed and isolated themes. Sphere size is proportional to the number of published documents associated with each research theme (Cobo et al., 2014). In addition, Figure 8 shows in parentheses the number of citations achieved by each theme and the number of core documents.

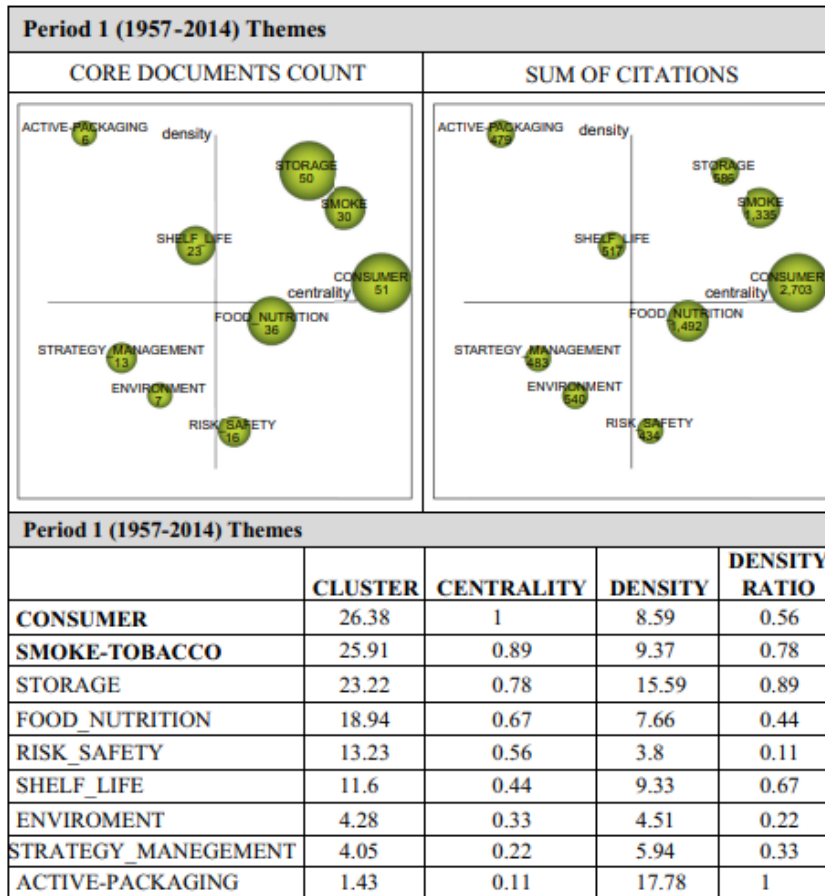


Figure 7. Strategic diagrams for period 1

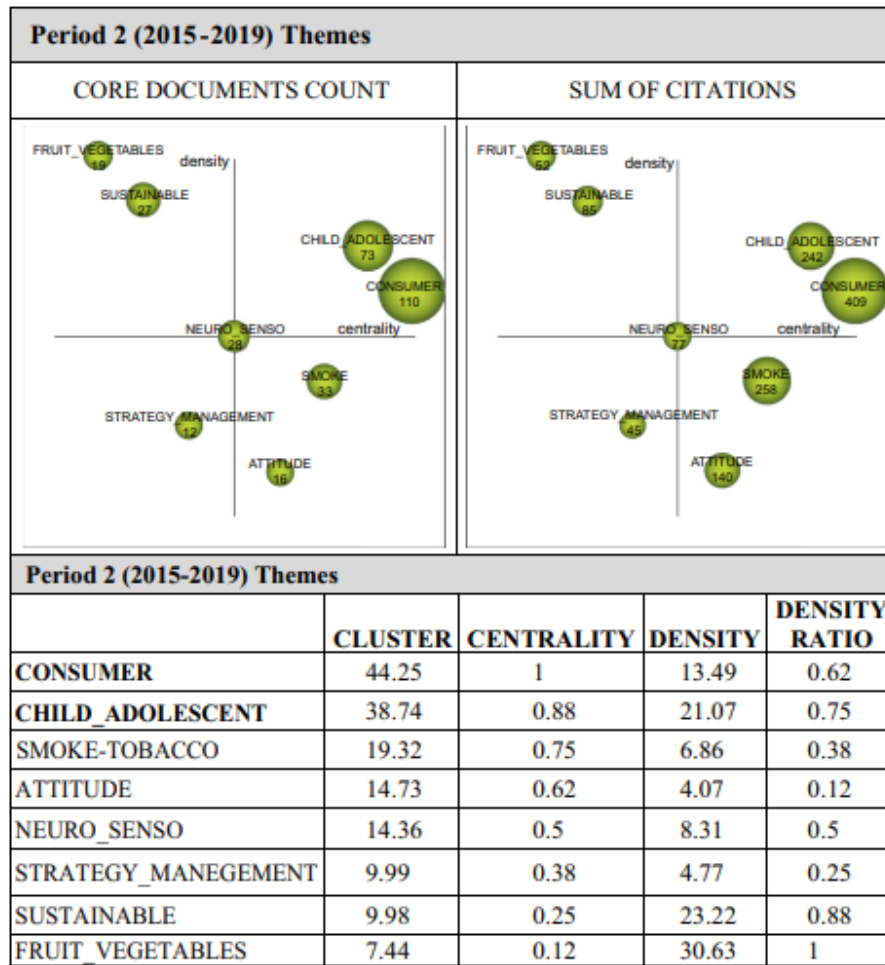


Figure 8.
Strategic diagrams for period 2

(i) Motor themes (high density and centrality): upper-right quadrant

As Figure 7 shows in the upper right quadrant of the map, there are three highly developed and indispensable themes for building the research field in period 1 (central nodes): CONSUMER (cluster = 26,38), SMOKE-TOBACCO (cluster = 25,91) and STORAGE (cluster = 23,22).

In period 2, Figure 8 shows that one of the motor themes persists: CONSUMER. This theme is even re-enforced over time (cluster = 44,25). In addition, a new motor theme appears: CHILD-ADOLESCENT (cluster = 19,32).

This means that packaging research has been mainly approached from a CONSUMER perspective, gaining importance in recent years the CHILD-

ADOLESCENT market due to its greater vulnerability to marketing stimuli. In addition, although the SMOKE-TOBACCO industry was trendy in period 1, the investigations spread to other relevant industries in period 2.

(ii) Declining or emerging themes (low density and low centrality): lower-left quadrant

In period 1 and period 2, the same declining theme (STRATEGY-MANGEMENT) was found (see lower left quadrants of the maps in Figures 7 and 8). That theme has a very low-density ratio in both periods (0.33 in period 1 and 0.25 in period 2). This means that it is a generic theme that addresses the study of the package from a basic approach, giving way to more specific themes.

In period 1, another declining theme can be observed in the lower-left quadrant in Figure 8: ENVIROMENT. That is because generic environmental concerns crystallise in concrete research problems, such as sustainability or health in period 2.

(iii) Highly developed but isolated themes (high density but low centrality): upper-left quadrant

The themes located in the upper-left quadrant of the maps in Figures 7 and 8 have strong internal ties (high density) but weak external links (low centrality). They are peripheral themes (low centrality).

In period 1, there are two themes (upper left quadrant in Figure 7): SHELF-LIFE and ACTIVE-PACKAGING. Both themes were investigated mainly in the food industry to connect advances in packaging, material science, biotechnology and new consumer demands, with the needs to extend the shelf-life of foods, maintain nutritional quality and ensure safety (Labuza and Breene, 1989).

In period 2, there are two isolated themes (low centrality) that many papers paid attention to (high density) (upper left quadrant in Figure 8): SUSTAINABILITY and

FRUIT-VEGETABLES. That is, the food industry remains a high dense theme in period 2, but it seems that research was re-directed towards real-food packaging (FRUITS-VEGETABLES) and sustainable packaging (SUSTAINABILITY).

(iv) Basic-transversal themes (high centrality but low density): lower-right quadrant.

This group of themes was investigated with other relevant ones, but its weight is low because it lacks development. Themes in this group, have been named as transversal, basic and general topics. In period 1, Figure 7 shows two themes belonging to this group (lower-right quadrant): FOOD-NUTRITION and RISK-SAFETY. In period 2, Figure 8 shows two other transversal themes (lower-right quadrant): ATTITUDES and SMOKE-TOBACCO.

To conclude, in period 1, there are several themes with a lot of connections with other themes (i.e. they act as central nodes of the nets). Two of them are the most relevant ones: CONSUMER and SMOKE-TOBACCO. Four additional central nodes were found: FOOD-NUTRITION, STRATEGY-MANAGEMENT, STORAGE and SELF-LIFE. These themes were investigated in conjunction with those that are shown in their respective nets:

- CONSUMER connects with brand, information, price, attitudes and behaviour.
- SMOKE-TOBACCO connects with perception, health, cross-country and youth.
- FOOD-NUTRITION connects with low, child-adolescent, taste, and distributor.
- STRATEGY-MANAGEMENT connects with supply-chain, integration, framework and value-creation.
- SELF-LIFE connects with active packaging, atmosphere and transpiration.
- STORAGE connects with fruit-vegetables, quality and temperature.

In period 2, there are also several themes with a lot of connections with other themes in this period. Two of them are key: CONSUMER and CHILD-ADOLESCENT. Four additional central nodes were identified: FRUIT-VEGETABLES, SMOKE-TOBACCO, SUSTAINABILITY and NEURO-SENSORY. Such themes were investigated with those that are shown in their respective nets:

- CONSUMER connects with quality, perceptions, brand, design and behaviour.
- CHILD-ADOLESCENT connects with food-nutrition and health-obesity.
- FRUIT-VEGETABLES connects with storage, active-packaging and self-life.
- SMOKE-TOBACCO connects with label, USA, impact and plain packaging.
- SUSTAINABILITY connects with green, fair-trade or environment, among others.
- NEURO-SENSORY connects with taste, visual attributes and colour, among others.

5. Conclusions

The study of product packaging has been approached from multiple disciplines. Based on our results, the evolution of the main research topics can be summarised in the following points.

First, the relevance of the **store function of a package** was deeply investigated in the past. Following a supply approach, engineers, biologists and chemists have tried to find the best packaging materials to keep the product in the right form for a long time, thus, seducing consumers to buy them. This topic is currently in disuse.

Second, together with the **food industry**, packaging decisions in the **tobacco industry** have been deeply investigated from a marketing approach since the beginning. This has been a trending research topic for the general population since the first decade of the

present century, with greater prominence of the **young market** during the last years. Therefore, the key product-markets for packaging research in recent years are: food and tobacco (product) among youth (market).

Third, the potential influence of a packaging on consumption has been deeply investigated in the food industry, frequently connected to **nutritional aspects**: 216 papers of the present sample focused on the topic ‘food and/or nutrition’, and 122 encompassed any term related to ‘fruit and/or vegetables’. For this reason, the study of product packaging in the food industry—connected to nutritional aspects—has been a research priority for the entire studied period. So, it is not surprising that most of the papers about food claims have been published in the frame of ‘**Nutrition**’ and ‘**Health**’ disciplines. Similar to what happened with the tobacco industry, recent research in food-nutrition has moved from generic works on packaging to more specific works focused on the **child–adolescent market**.

Fourth, traditionally, **chemists and technologists** have investigated **packaging innovations** and, more specifically, how to improve packaging materials to protect the environment. Therefore, packaging innovation is still a research priority.

Fifth, nowadays, research on **environmentally friendly** packaging has evolved towards **sustainability**. A similar evolution has been observed for **active packaging** research, which now has also evolved towards ‘sustainable packaging’ research. The result is that the study of sustainable packaging is gaining momentum.

Sixth, **consumers’ attitudes** towards packaging materials has become a trendy topic this last decade, promoting the use of new tools such as **neuroimaging techniques**. That is, of the different agents involved in the exchange process, the consumer is crowned as the most relevant agent in recent and forthcoming literature.

In sum, two main sectors constitute the focus of packaging and marketing studies: food and tobacco industries. Recently, the main topics of research have evolved towards sustainable and health packaging, not forgetting that different agents are involved in packaging decisions (producers, demand, distributors etc.), being the consumer the most important one.

6. Future research lines

As a result of the bibliometric analysis carried out, the following lines of future research should be noted. These future lines are important to be able to develop packaging that better suits the requirements of the different agents involved: consumers, manufacturers, distributors and society in general.

Future research line 1: from studies focused on ‘storage’ to studies focused on ‘fruit and vegetables’

Following a demand and consumers’ approach, marketers have investigated the storage function of a package in the past, comparing private brand and store brands in the process (Richardson, Jain, & Dick, 1996). Store brands are defined as products owned and branded by retailers, and their study was launched in the last century. Compared to private brands, consumers rely more on extrinsic cues (e.g. price and packaging) to judge product quality in a store brand. In spite of this, previous literature found that consumers perceive store brands to be inferior to national brands but superior to generic grocery items on attributes, such as overall quality, taste, aroma and reliability. As this stream of literature concludes, extrinsic cues (such as packaging) play a much more important role



in determining consumers' evaluations than did actual product ingredients (Richardson, Jain, & Dick, 1996).

At the beginning of this century, a boom of unprocessed products occurred, becoming fruits and vegetables of the great rival of storage products. In spite of this, Elliot's (2008) study revealed that less than 1% of the foods specifically targeted at children in a Canadian supermarket were fruits and vegetables and that 89% of 'fun food' products were low healthy storage aliments (with high levels of fat, sugar or sodium). From a communication perspective, this school of thought investigated the relationship between food product images, appeals and nutrition claims in packaging, concluding that 'fun foods' ('fun' to children) was a rapidly growing category of foods not covering the nutritional needs of children and should be investigated deeply.

Recently, this trend was reversed and packaging researchers stopped focusing on the storage function to boost research on real products (i.e. non-processed or packaged foods), such as fresh fruit and vegetables. The problem is that, as Chandon and Wansink (2012) remarked, the food industry is among the top advertisers in the USA media market, which is dominated by processed food manufactures. The common message communicated in their ads is 'that eating these foods is normal, fun, and socially rewarding' (Chandon and Wansink, 2012, p. 575).

So, to combat them and enhance real products, a future research line is to investigate the role of color-coded traffic lights in a packaging to stimulate the consumption of natural products (Chandon and Wansink, 2012).

Future research line 2: from studies focused on 'tobacco' to studies focused on 'child-adolescent risky consumption'.

The revision by Moodie, Stead, Bauld, McNeill, Angus, Hinds and O'Mara-Eves (2012) compared 37 studies that provide evidence of the impacts of plain tobacco packaging (compared to branded ones). Due to the introduction of powerful legal restrictions in the tobacco industry, the weight of other traditional channels (i.e. television, radio, billboards and print) led tobacco companies to heighten their focus on the cigarette pack as the primary marketing vehicle (Kotnowski and Hammond, 2013; Mutti, Hammond, Reid, White and Thrasher, 2016, p. 650).

This means that the study of tobacco packages has not declined, but its core research has been refocused. That is, although the study of plain packaging has continued during the last years, the focus has moved towards the young population because of its greater vulnerability (Kotnowski and Hammond, 2013; Mutti, Hammond, Reid, White and Thrasher, 2016, p. 650).

From this approach, interest in studying tobacco packaging, following a public health perspective, has grown (Wakefield, Morley Horan and Cummings, 2002) because, as these authors remark: 'in contrast to the small amount of public health attention on packaging, tobacco companies have conducted a vast amount of consumer research on this subject in their efforts to design packs that might promote cigarette sale' (p. 74).

In sum, because of the greater awareness about the potential damaging influence of tobacco packaging among children and adolescents, academic research has evolved to help them improve their healthy habits and avoid unhealthy consumption.

Future research line 3: from studies focused on 'food-nutrition' to studies focused on 'child-adolescent risky consumption'.

In the food and beverage market, about one-third of products is consumed directly from its packaging (Spence, 2016).

The increasing overweight and obesity issues among the world's children justify the need for a deeper research to improve their health and wellbeing (Robinson, Borzekowski, Matheson and Kraemer, 2007).

To solve this problem, a growing research priority in the food industry is the study of packaging ability to transmit healthiness. As André, Chandon and Haws (2019) underline, 'when shopping for packaged food, it has become difficult to find products that do not claim to be healthy for one reason or another' (p. 172).

Moreover, the growing problem of obesity among the youth has led marketing researchers to focus on certain claims and pictures that could incentivise unhealthy consumption, mainly in the child-adolescent market (Wansink and Chandon, 2006). Aspects such as low-fat claims, nutritional labels and healthy promises are a growing concern in this industry. In addition, guilty and pleasurable feelings worry the academy more and more. The study of Robinson, Borzekowski, Matheson and Kraemer (2007) highlights how a good packaging from a well-built brand can incentivise the consumption of high calories and low-nutrient foods and beverages among children, affecting their tasting perceptions. Thus, they claim for more generic marketing research and more specific research on branding or packaging to promote more healthful taste preferences and food and beverage choices in children and adolescents.

In sum, as Mattila-Sandholm, Myllärinen, Crittenden, Mogensen, Fondén and Saarela (2002) conclude, 'modern consumers are increasingly interested in their personal health, and expect the food that they eat to be healthy or even capable of preventing illness' (p. 173). The review by Chandon and Wansink (2012) provides some useful

recommendations about multiple ways in which marketing communication (including packaging branding and food claims) could help consumers eat better.

Other disciplines, such as ‘Chemistry’ and ‘Technology’, also focused on investigating the power of packaging to transmit healthiness, mainly toward the younger segment. Certain food components, such as probiotics, are currently gaining importance among literatures, in which the final proposal remains the same: to improve food quality and safety (Silvestre, Duraccio and Cimmino, 2011). Following an eclectic approach, Chandon and Wansink (2012) integrate both perspectives (i.e. marketing and chemistry perspectives), with the final proposal of providing useful recommendations to stimulate healthy consumption from a nutritional point of view.

Future research line 4: from studies focused on ‘environment’ and ‘active packaging’ to studies focused on ‘sustainable packaging’.

From a technological approach, Silvestre, Duraccio and Cimmino (2011) examined how the use of polymers—as food packaging materials—increased enormously during the last years, although polymer nanotechnology for food packaging is still in a development stage. Such material is ‘stirring up environment and health safety concerns’, and maybe for this reason, biodegradable bioplastics (frequently made with plant-based materials) is becoming a powerful research focus for nanotechnologists.

Also, Kale, Kijchavengkul, Auras, Rubino, Selke and Singn (2007) investigated in the past how companies can develop sustainable packaging, using new biomaterials that are obtained from renewable resources and biodegraded in biological environments, such as soil and compost. As they explain, packaging materials can be grouped into four

blocks: paper or paperboard, plastic, metal and glass packages. Only paper or paperboard, and some plastic packages, are biodegradable and, hence, compostable.

Recent papers support the notion that sustainability benefits are possible through redesign of product packages, and that economic and environmental gains can go together (Gustavo, Pereira, Bond, Viegas and Borchardt, 2018). This stream of research, based on the postulates from the Sustainable Packaging Coalition (SPC), states that a sustainable packaging “is beneficial, safe and healthy for individuals and communities throughout its life cycle” (p. 18). For this reason, they conclude that packaging decisions require dialogue and engagement among producers, retailers and consumers. Actors in the supply chain must collaborate to achieve environmental improvements, such as better distribution packaging to reduce damage in transport and handling, as well as better optimisation of the life cycle that impacts the packaging materials.

The same occurs for the theme “active packaging”. It was a trendy topic some years ago. For example, Vermeiren, Devlieghere, van Beest, Kruijf and Debevere (1999) conceptualised “active packaging” as ‘an innovative concept that can be defined as a type of packaging that changes the condition of the packaging to extend shelf-life or improve safety or sensory properties while maintaining the quality of the food’ (p. 77). As those authors reviewed, active packaging was a widely disseminated research topic in USA, Japan and Australia, being the priority to investigate chemical, microbiological and physiological effects of various active concepts on the packaged food (i.e. quality and safety). This stream of research grew during the last millennium, due to changes in retail and distribution practices (e.g. internet-shopping) and internationalisation of markets, resulting in increased distribution distances and longer storage times of a set of different

products with different temperature (Vermeiren, Devlieghere, van Beest, Kruijf and Debevere, 1999).

The stream of research on active packaging evolved to incorporate packaging environmental impacts, moving research from ‘active packaging’ to ‘sustainable packaging’ (Vermeiren, Devlieghere, van Beest, Kruijf and Debevere, 1999). From this approach, the study of active packaging has focused on the investigation of proper packaging materials and methods to minimise food losses and provide safe and wholesome packaging for food products (Ozdemir and Floros, 2004). However, as Rundth (2012) remarked, the possibilities for innovative packaging solutions must be analysed in relation to increased costs for packaging and the influence they can have on the environment. As he further reviewed, large quantities of food are now wasted due to poor logistics and packaging processes, and environmental damage is increasing due to poor packaging (Rundth, 2012). To solve these problems and assess sustainability, Steven van Passel (2013) provides a profound analysis of the concept of ‘food miles’, suggesting that a straightforward strategy towards sustainability is to reduce the distance food travels, from where it is grown or raised to where it is consumed. Although this new research concept was developed to calculate sustainability, it contravenes traditional active packaging research (aimed at enhancing the performance of the package to maintain or prolong the shelf-life of food products).

Future research line 5: a growth of studies about ‘consumer attitudes’ and ‘neuro-imaging and sensorial analysis’

Since the beginning, packaging decisions have been influenced by consumers’ reactions (mainly buying behaviour, satisfaction and loyalty). A further step has been made to

consider also consumer experiences (i.e. sensory experience, affective experience, intellectual experience and behavioural experience), which can be encouraged with the help of the packaging to improve the overall brand evaluation (Brakus, Schmitt and Zrantonello, 2009). As Chandon and Wansink (2012) suggest, in some industries (such as the food industry), the packaging could be a source of hedonic pleasure and stimulation.

In this new field of research, the application of neuroimaging techniques has been developed, mainly in the context of food marketing to detect changes in brain activity towards different packaging cues (such as pictures, colour, shape, texture or sound) (Petit, Velasco, Cheek and Spence, 2015). In this vein, Spence (2016) complemented the study of food packages, considering other variables, such as the noises, aromas or textures, among others. As the author concludes, a multisensory packaging design cannot be obviated to fully understand the consumption experience (Spence, 2016).

From this approach, an interdisciplinary review demonstrates that the various ways in which what we hear can influence what we taste (Spence, Reinoso-Carvalho, Velasco and Wang, 2019). A deeper revision on the evolution of neuromarketing studies on consumer behaviour can be shown in Yağci, Kuhzady, Balik and Öztürk (2018), seeing the full potential of this line of research in the future.

Global trend

In sum, the best packaging seems to be the one that covers diverse functions, on one side, and promoting healthy consumption, on another side, with positive impacts in regard to sustainability. Therefore, future research should follow both ways. In addition,



when the food industry is considered, both objectives are reached by promoting healthy products. This represents a promising research topic.

Limitations

In the present study, only two databases were used: WOS and Scopus. Therefore, future studies could include additional sources of information. In addition, more key words could be used in future revisions to enrich these results.

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