Food and Beverage Collaboration Patterns:
A Systematic Literature Review

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Abstract

This paper provides a "state of the art" view of the literature about food and beverage collaboration and pinpoints to new research fields related to collaboration in the Food and Beverage industry. Using a systematic literature review methodology, we identify and summarize the published evidence on collaboration in the Food and Beverage industry and thus synthesize previous work to strengthen the topic of collaboration in the Food and Beverage industry. A total of 228 topic-related articles were retrieved from the databases Scopus and Web of Science. After validation, 46 articles were identified as relevant, accessed and reviewed to understand the significance and the critical role played by collaboration, interaction and partnership among the university, industry and the government. Results indicate that the challenges and problems experienced in the food industry can be addressed through innovation and technological advancement. To achieve open innovation there are key players who must come together and facilitate the entire process. The industry, the university, the government and the consumer need to collaborate to yield positive outcomes. This indicates the significance of collaboration to facilitate open innovation.

Keywords: food; beverage; industry; ecosystem; collaboration; open innovation

1. INTRODUCTION

The world is constantly evolving and transitioning from where it has been in the past (van Hilten & Wolfert, 2022). The food and beverage (F&B) industry has experienced several challenges e.g. lack of sustainable foods, waste culture, climate change, malnutrition, poverty, reluctance to innovate, among others. Such problems and challenges experienced in the food industry can be addressed through innovation and technological advancement (Bigliardi & Filippelli, 2022).

Open innovation is a process through which this industry may innovate and come up with products and services with greater value (Arvaniti et al., 2022). In certain circumstances, the industry, the university, and the government collaborate and yield positive outcomes (Saguy & Sirotinskaya, 2014).

The government uses science to address the problems and innovate economic well-being. It enacts favourable policies that facilitate the innovative process and encourage business to thrive. Besides, it provides funding to research centres located in various learning institutions and develops suitable policies that enable businesses, industries, and universities to thrive and compete favourably in the market (Bigliardi et al., 2015), in a similar manner to what industry does (Saguy & Sirotinskaya, 2014). Academia plays an important role in innovation by using the funding and providing ideas to other key players (Bigliardi et al., 2015).

So, collaboration between the different actors involved in F&B industry is key to open innovation, and this is where our research aims to contribute. Using a systematic literature review methodology performed on

Scopus and Web of Science, we look at collaboration between industry, higher education institutions and ecosystems, in the context of F&B industry.

To perform this study, we start with the methodology. Then we present the results and end with the final considerations.

2. METHODOLOGY

The research methodology follows the three steps designed by Tranfield et al. (2003) for a systematic literature review (SLR), namely: planning the review, conducting the review, and reporting and disseminating (Saur-Amaral et al., 2013).

2.1. STAGE 1: PLANNING THE REVIEW

According to Tranfield et al. (2003), stage one of the systematic literature review requires a review, preparation of the review proposal, and development of a review protocol. While executing the stage one process, the researcher was concerned with using past studies to understand the field and identify the alternative ways the topic has been addressed in the past.

The review protocol was developed (see Table 1). The databases chosen for the search were Scopus and Web of Science, as these are widely recognized by the academic community. The period was set between 2012 and 2023 (April) as a 10-year period was considered appropriate. The keywords identified for the search process includes industry, ecosystem, collaboration, university, and food.

Table 1: Review protocol

field	Food and beverage collaboration between industry, universities and ecosystem
keywords	Industry AND Ecosystem AND collaboration AND Food Industry AND Universit* AND collaboration AND Food
Boolean operators	AND
Sources	Scopus and Web of Science
Population	228
Analysis strategies	Conduct a comprehensive search, screen and select, access and paper reading, extract and synthesize data, interpret findings, paper writing
Language	English
Document type	Article
Search period	2012-2023
Last updated	13.04.2023

Source: own elaboration

Inclusion and exclusion criteria involved the year of publication, where the year was set to be from 2012 to April 2023 as a period of 10 years was considered adequate. Studies published outside the defined year of publication were excluded. The other criterium was accessibility, where only articles that were accessible were included. Any article that was not accessible was excluded. Only journal articles were included in the study while other literature material, such as books, conference proceedings and serials, were excluded.

Quality evaluation ensured that only high-quality articles providing evidence-based research were included. Therefore, the articles were subjected to quality evaluation based on the content and its relation to the study. The findings, the objectives, and the title of the study were assessed to filter and select suitable ones for use in the analysis and to make deductions. A relevance analysis was performed by abstracts to make sure, that only articles related to collaboration in the food and beverage sector are being used and all others are side lined.

2.2. STAGE 2: CONDUCTING THE REVIEW

Stage 2 of the SLR developed by Tranfield et al. (2003) involved collecting the articles, assessing their quality and extracting and synthesizing data.

A total of 228 articles were collected from the two databases. All articles were exported to EndNote 20. A search routine "Find Duplicates" was performed on EndNote 20 accompanied by a manual search to ensure

that there were no duplicate records in the final sample. 46 articles were removed as duplicates. From Endnote 20, a subject bibliography was created with all 182 abstracts organized by publication year. The final set of selected articles had 46 records (see Figure 1 for an overview of the data collection and selection process).
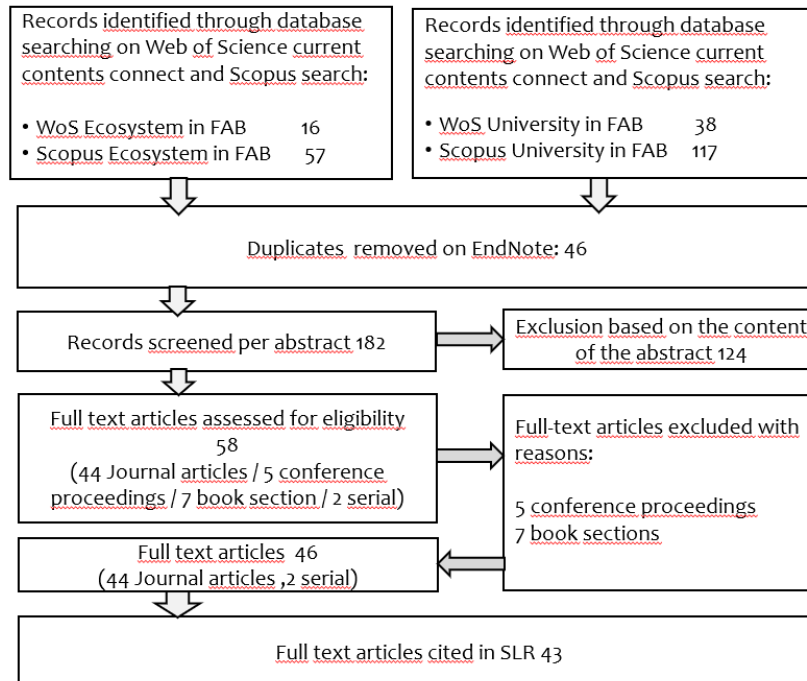

Figure 1: Flowchart selection process

Source: own elaboration

2.3. STAGE 3: REPORTING

Stage three involved two steps, namely, a descriptive statistical analysis and a thematical analysis. Tranfield et al. (2003) argued that descriptive analysis entailed identifying the most relevant journals and authors, while thematic analysis implied identifying the themes that emerge from the studies.

3. SYSTEMATIC LITERATURE REVIEW

3.1. DESCRIPTIVE STATISTICS

No journal emerged as a clear frontrunner in terms of publishing the most on the topic. The data did not reveal a significant concentration of articles on collaboration in any specific journal. Publications in this field are relatively dispersed across various journals (see Table 2).

Table 2: Top 10 journals per number of papers published (2012-2023/04)

Journal	Number of papers published
Sustainability	7
Sustainability Science	2
Food Policy	2
British Food Journal	2
Current Development in Nutrition	2
Sustainable Entrepreneurship and Ecosystems	1
International Entrepreneurship and Management Journal	1

Journal	Number of papers published
European Journal of Innovation Management	1
European Journal of Technology Management	1
Academic Journal of Interdisciplinary Studies	1

Source: own elaboration

When examining the distribution of papers on collaboration in the food and beverage industry, it becomes apparent that there is an ascending trend over the years analysed in the SLR. This suggests a growing interest on collaboration within the food and beverage industry (see Figure 2).
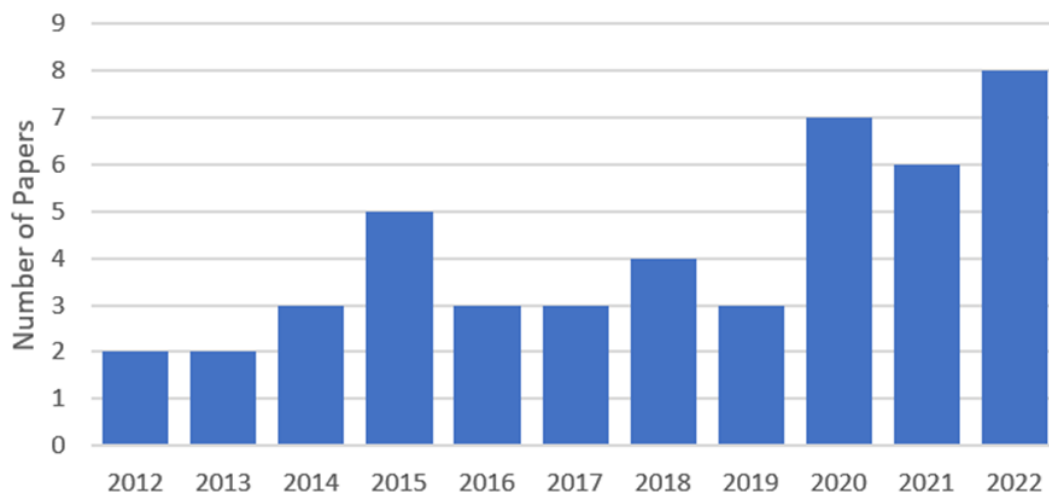

Figure 2: Article Distribution per Publication Year (Jan. 2012 – March 2023)

Source: own elaboration

Most of the articles had affiliations from Europe, particularly from countries like Italy, the UK, Norway, Germany, Austria, but also Finland, Denmark, the Netherlands, France, Portugal, and Greece. There were also a few papers from other regions, including Israel, the United States, Chile, Mexico, New Zealand, Thailand, Saudi Arabia, and Ethiopia (see Figure 3).

Europe appears to have a strong presence in research related to food and beverage collaboration, as indicated by the larger number of papers from European countries compared to other regions. The varying number of papers from different countries within Europe indicates differing levels of research interest and activity. For example, Italy had the highest number of papers (12), which suggests a relevant research focus on food and beverage collaboration within the country.

While Europe had the most papers, there were also contributions from other regions such as the United States, Chile, Mexico, New Zealand, Thailand, and Israel. This demonstrates that food and beverage collaboration research is not limited to a single region and is explored by researchers located worldwide. There were also some cooperative efforts between Europe, Saudi Arabia, Russia and Ethiopia. This suggests that there are collaborative research projects between different countries and regions, highlighting the global nature of food and beverage research.
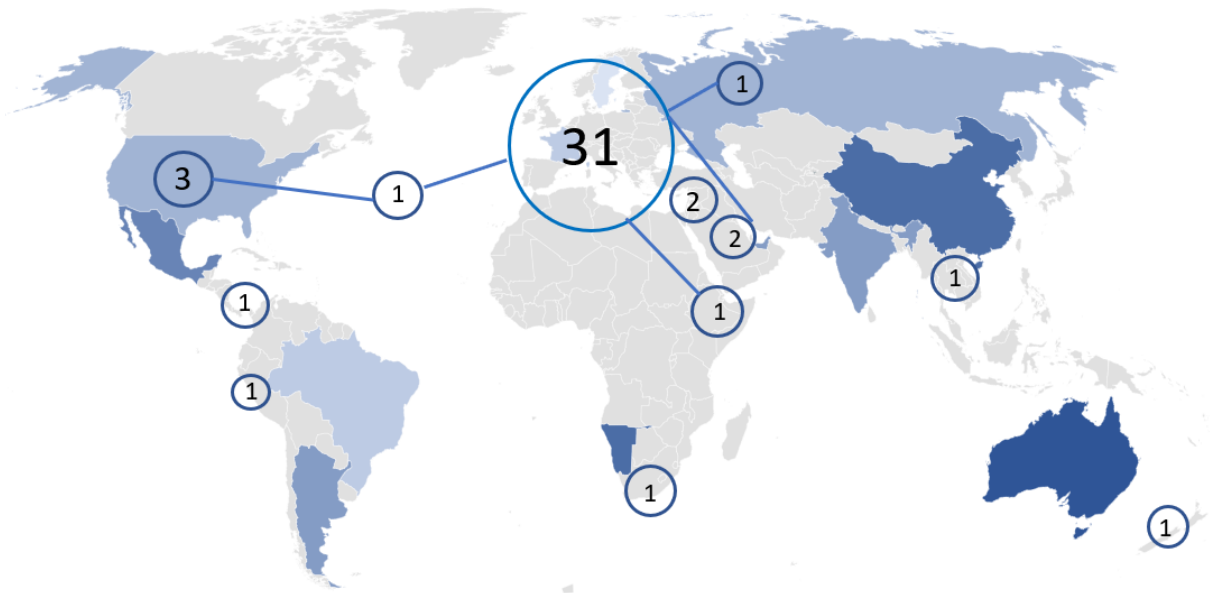
Figure 3: Distribution of articles by country

Source: own elaboration

3.1. THEMATIC ANALYSIS

Following the first steps of descriptive statistics, the 46 papers were analysed. To start the process, a Word Frequency Query was conducted to pinpoint emergent themes. As can be noted in Figure 4, in addition to the expected relevance of the words research, innovation and food and industry, the keywords stakeholders, needs, agri*, business, development, developing, collaboration and interdependencies, but at the same time methodology, design, ecosystem, drivers' models and pharmaceuticals emerged as relevant.

Figure 4: Word Frequency Query based on the 46 abstracts

Source: own elaboration

Next, the topics addressed by the authors were identified (see Figure 5). They were quite diverse, ranging from the triple helix and the roles of different actors to ~~food materials,~~ food engineering and food materials, including, as well, contemporary sustainability challenges.
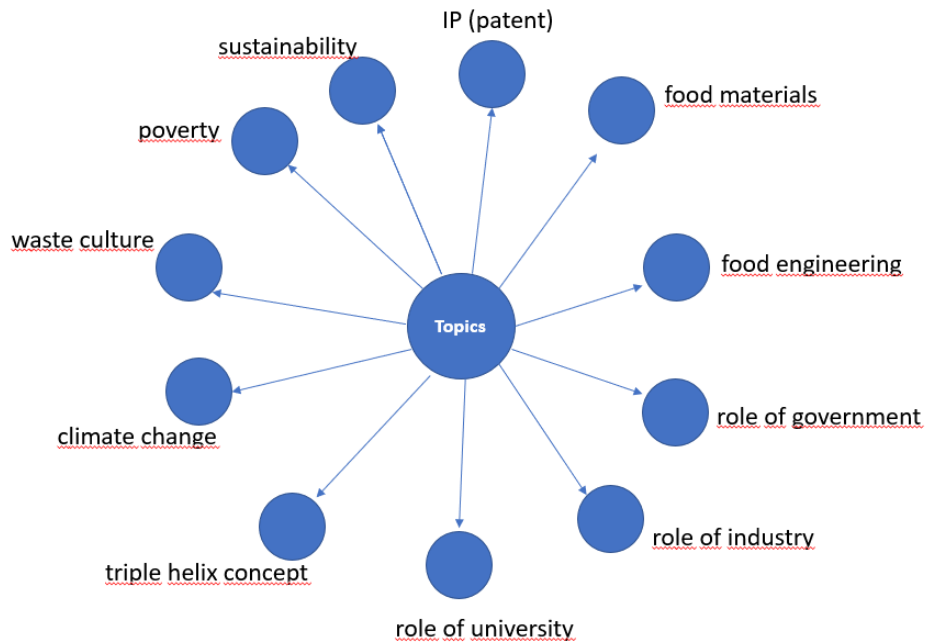

Figure 5: Key topics addressed in the articles

Source: own elaboration

A specific body of knowledge points out the increase of the adoption of innovative technologies such as gastronomic engineering (Aguilera, 2017; Engel et al., 2020) where food materials science and food engineering come together to compel consumers to use environmentally sustainable and technologically feasible food (Martinez et al., 2014). This may lead to innovation.

In the food industry, similarly to other industries, innovation is influenced by different factors. Ciliberti et al. (2016) points out that the external factors that drive innovation in the food industry are knowledge sources and R&D organization, equipment, machinery, and software acquisition. Food companies depend on acquiring external knowledge and technology from suppliers to support the high-tech sectors. The food sector is endowed with supplier-driven innovation that creates a spill-over of knowledge and consequently causes positive impacts on innovation. The internal driver is the desire and the need for absorptive capacity, which sparks knowledge transfer, collaboration, and product innovation (Ciliberti et al., 2016).

Collaboration, partnerships, and associations between industry and other actors are critical in open innovation in the food and beverage industry (Aguilera, 2017; Saguy, 2016; Saguy & Sirotinskaya, 2014), with universities and governments playing an important role (Carayannis et al., 2018; Isiordia-Lachica et al., 2020; Ueasangkomsate & Jangkot, 2019). The triple helix concept is also mentioned, reinforcing the relevance of the triangle industry – academia – government.

The emergence of sustainability related topics is patent in the articles (Bigliardi et al., 2015; Geissler, 2015; George et al., 2022; Kleinschroth et al., 2021). F&B industry has been reluctant to embrace innovation, and problems exist that have not been addressed e.g. diseases, poverty, and malnutrition. Growth in the sector has been hastened by the uprising of biotechnology that has heaped competitive pressure on the market and industry players to enhance food security, standards, and quality, reduce waste, and for longevity (Isiordia-Lachica et al., 2020).

Through partnerships and collaborations, the industry benefits from the university innovation centers by combining business models and developing technologies that previously did not exist (Saguy & Sirotinskaya,

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2014). As a result, the industry can focus on specifically intended markets, bring back unexpected payoffs, and facilitate long-term relationships (Saguy & Sirotinskaya, 2014).

Other benefits include reduced time to market pressure, identification of highly skilled people, lifting sole burden or resources, and accelerating innovation. Besides, when the companies or institutions share a common business model, they can sustain their open innovation and thus enhance their overall ability to survive and thrive (Saguy & Sirotinskaya, 2014).

According to Isiordia-Lachica et al. (2020), the formation of links between the industry and the university is a complex process yet a very beneficial one. Each of the actors involved in the collaborative exercise, must diligently dispense the mandate for the food industry's success. Even as start-ups, companies can start forming collaborations, partnerships, and interactions with universities and other industries (Kohut et al., 2021).

However, collaboration is not trouble-free. Not only there are technical challenges (Saguy, 2016), but also challenges related to the way companies perceive the benefits of the collaboration and even of innovation and technological advance (Bertello et al., 2022; Saguy & Sirotinskaya, 2014). Financial hurdles may also constitute a barrier (Ueasangkomsate & Jangkot, 2019) and the lack of experience of collaboration between partners may hinder the success of the collaboration (Carayannis et al., 2018).

Further research could be conducted to explore various aspects of implementing collaborative efforts in the food and beverage industry. The following table shows some potential areas of future research.

Table 3: Future research directions

Source	*Title*	*Future research*
(Bezares et al., 2021)	The Role of Food and Beverage Companies in Transforming Food Systems: Building Resilience at Multiple Scales	Explore different models for open innovation
(Bigliardi et al., 2015)	Factors affecting technology transfer offices' performance in the Italian food context	Examine the role of government policies and technology transfer offices
(Bigliardi & Filippelli, 2022)	Sustainability and Open Innovation: Main Themes and Research Trajectories	Conduct case studies of successful collaborative projects
(Carayannis et al., 2018; Johnston, 2021)	Agri-science to agri-business: the technology transfer dimensions	Explore governance frameworks
(Johnston, 2021)	Open innovation and the formation of university–industry links in the food manufacturing and technology sector: Evidence from the UK	Strategies for fostering collaboration
(Mahdad et al., 2022)	A smart web of firms, farms and internet of things (IOT): enabling collaboration-based business models in the agri-food industry	The role of technology, digital platforms and IoT

Source: own elaboration

By conducting further research in these areas, valuable insights can be gained to inform and guide stakeholders in the food and beverage industry on how to effectively implement open innovation and collaborative practices for addressing the industry's challenges and driving positive change.

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4. FINAL CONSIDERATIONS

The F&B industry has been facing different challenges, e.g. lack of sustainable foods, a prevailing waste culture, climate change, malnutrition, poverty, and a reluctance to innovate. New technologies, processes and business models are required to face these challenges. – do we need sources?

The literature indicates that collaboration between F&B industry and other actors, especially the ones part of the Triple Helix (industry, academia and government) may be an effective manner to tackle the beforementioned challenges. However, barriers exist and more need to be done to understand how companies from F&B industry, depending of their size or maturity level, could effectively interact with the other actors. – do we need sources?

As this is a preliminary study, further analysis need to be performed on the methodologies used by the different articles and a dive into the different types of collaborations and their dynamic, especially at the level of specific ecosystems is required. – do we need sources?

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