

Technological Transfer Channels of Food and Beverage Processing Multinationals to Host Countries: An Empirical Analysis

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Abstract

This research examines the possibility of food and beverage (F&B)-processing multinational corporations serving as a viable conduit for the international diffusion of technology. It utilizes existing literature to analyse three potential avenues through which technology transfer occurs from these corporations to host sectors: contract farming, domestic collaboration for innovation, and spillover effects of Foreign Direct Investment (FDI). In specific instances, these firms might provide support to local innovators through financial assistance or complementary resources. Additionally, they may actively facilitate technology transfers to particular types of local partners and they may generate demonstration effects. Nevertheless, the prevailing evidence consistently indicates that the impact of FDI on the host sector is generally limited or selective.

The findings of this study cast doubt on the overly optimistic views held by international organizations and host governments regarding FDI in the food sector as a major source of cutting-edge technology for host countries. The incentives offered to food and beverage multinationals should be carefully calibrated to strike a balance between acknowledging potential benefits to the sector's innovation system and maintaining a realistic perspective on the actual outcomes. This study combines and analyses three separate empirical lines of research in parallel to offer factual elements for a policy debate. By integrating these different research approaches, the study aims to contribute to a well-informed discussion on relevant policy matters.

Keywords: innovation; internationalisation of R&D; FDI policy; food and beverage sector; contract farming, spillovers of knowledge; cooperation for innovation.

JEL Classification: L66; N5; O33; O36; F23; F63.

Introduction

Multinational enterprises (MNEs) innovate not only in their home country but also in their host countries, and often interact with the national innovation system (NIS). The internationalization of Research & Development (R&D) has shown a growing trend in recent decades (Papanastassiou et al., 2019) and has attracted the attention of academics, whereby the interest of inquiries goes beyond a mere academic question.

International organizations and policymakers often view MNEs as a possible source of up-to date technology for host countries (Guimón, 2011). The need for technology transfer is especially acute in countries that are not at the forefront of science and technology; this is the case in many developing countries and peripheral European countries. Consequently, competition between countries to attract R&D-intensive Foreign Direct investment (FDI) has increased markedly in recent years (Guimón, 2011). Given that this policy involves the allocation of potentially limited national resources and tax rebates, it is crucial to ascertain whether inward FDI is likely to meet the

aforementioned expectations. However, the existing empirical literature presents mixed and inconclusive findings in this regard (Crespo and Fountoura, 2007; Papanastassiou et al., 2019).

Therefore, further investigation and analysis are necessary to gain a clearer understanding of the potential outcomes. As noted by Javorcik and Spatareanu (2005, 45), “despite its importance to public policy choices, there is little conclusive evidence on whether domestic firms benefit from foreign presence in their country”. The scarcity of analyses conducted at the sectoral level is likely a contributing factor to the inconsistency observed in the existing literature regarding this matter. The lack of sector-specific studies may have limited the ability to draw definitive conclusions about the impact of inward FDI on particular sectors and, consequently, on the overall effectiveness of the policy. Conducting more sectoral-level analyses could help address this gap and provide more comprehensive insights into the potential outcomes of the policy.

This study contributes to filling this gap in the literature by investigating whether food and beverage (F&B) processing multinationals constitute a potential channel for international technology diffusion. Sectoral differences in innovation patterns (Lee and Malerba, 2017) suggest that fine-grained analyses may contribute to this debate. Our study is dedicated to examining F&B processing multinationals and their potential impact on technology transfer and innovation within the host sectors¹. We acknowledge the relevance of investigating this phenomenon not only in developed countries but also in developing countries. By considering both contexts, we aim to provide a comprehensive analysis that takes into account the distinct economic and social conditions present in different regions, which could shape the outcomes of technology diffusion and innovation facilitated by F&B processing multinationals (hereafter, F&B multinationals). This article represents an initial endeavour towards conducting a systematic analysis of potential technology transfer channels from the multinational F&B corporation to its host country. Our contribution is mainly empirical and focuses on fact-finding.

Overall, empirical research in unexplored fields is a crucial step in the advancement of knowledge since, empirical findings, in the absence of strong theoretical frameworks, can serve as the basis for further exploration and hypothesis generation. The insights gained from empirical studies can spark new research questions and open up avenues for future theoretical development.

Several reasons justify the selection of this topic for analysis. The F&B industry is one of the largest sectors globally, contributing significantly to the Gross Domestic Product (GDP) of many countries, and is a major source of employment². Food and beverage companies exert a significant influence on the entire food chain. The influence of these companies on agriculture can range from sourcing raw materials to providing inputs, technological support, and market access for farmers. As a result, their activities can play a crucial role in shaping the socioeconomic dynamics of rural communities, affecting livelihoods, and influencing agricultural practices and development. Although this industry is often depicted as “traditional,” nowadays it utilises a broad spectrum of sciences and techniques (e.g., biotechnology, informatics, scientific instruments); hence, its potential for becoming a “carrier” industry that can induce the development of vital upstream industries (Christensen *et al.* 1996). Major MNEs are the most important innovators in the F&B field, including the technology employed in agriculture, F&B processing, and the aforementioned auxiliary industries (Alfranca et al., 2005, Patel and Vega, 1999).

¹ Multinational retailers, multinational traders of agricultural commodities, and foreign companies that invest exclusively in land are not considered in the analysis. It is essential to clarify that our analysis does not encompass FDI in agriculture. Note, however, that retailers, for instance, may induce innovation in farms and other segments of the value-chain (Reardon *et al.*, 2019).

² <https://www.fooddrinkEurope.eu/wp-content/uploads/2021/02/FoodDrinkEurope-Data-Trends-2020-digital.pdf>, <https://stat.unido.org/database/INDSTAT%20202021,%20ISIC%20Revision%203> 2018-2019 data, April 2022.

Literature reviews have indicated that MNEs can positively impact the upgrading of the NIS when they establish local linkages, as opposed to remaining isolated (Rama, 2009; UNCTAD, 2001). Thus, in this study, we draw upon existing literature to examine whether F&B multinationals form linkages with local actors. Our analysis focuses on three potential channels for technology transfer: contract farming, knowledge spillovers, and cooperation for innovation with local partners. Although various studies exist on different types of local linkages established by MNEs, no attempt has been made, to our knowledge, to combine these contributions in the context of a specific sector. Hence, we aim to analyse different types of linkages together within the framework of the F&B industry, providing valuable insights for the FDI policy debate. In this endeavour, we integrate relevant findings from the international business (IB) literature, innovation in agro-food studies, and development studies.

In Section 1, we present the conceptual and methodological framework, as well as the context setting. Sections 2 and 3 analyse the economic linkages implemented by these MNEs in the host sector. Finally, Section 4 concludes.

1. Background Research

1.1. Conceptualization and Methodology

This subsection delineates the specific type of innovation under scrutiny in this study, the focal point or "locus" of innovation, and the primary mechanisms responsible for transmitting knowledge. In essence, our endeavour revolves around shedding light on the characteristics of transmitted knowledge and the food Sectoral Innovation System (SIS). We also aim to uncover the various ways through which knowledge is disseminated and shared among stakeholders within this sector. By doing so, we seek to gain a deeper understanding of the mechanisms driving innovation and knowledge transfer within the food SIS.

The term "internationalization of R&D" often encompasses various innovation-related concepts, extending beyond solely R&D activities. The broader concept of innovation encompasses a diverse range of aspects, such as the creation of new or significantly improved goods, services, manufacturing or production methods, logistics, distribution processes, and services (Singh and Aggarwal, 2021). An invention evolves into an innovation when it is introduced to the market or when an industrial process is implemented. Innovation does not necessarily require a patent, and it may or may not originate from a dedicated R&D department. Food and beverage companies have utilized brands, trademarks, and new distribution channels as important methods to gain competitive advantages (da Silva Lopes, 2007; Tozanli, 2005). However, it is important to note that this study's focus is primarily on technological innovation. While market innovation, which includes branding and distribution strategies, holds its significance, it falls beyond the scope of this particular research.

Each SIS possesses a distinctive knowledge base that shapes its patterns of innovation and technological advancement. The concept of a SIS refers to the network of organizations, institutions, and actors involved in generating, diffusing, and utilizing knowledge within a particular industry or sector (Lee and Malerba, 2017). The knowledge base of an SIS comprises the collective knowledge, expertise, and technological capabilities that are specific to that sector. This knowledge is often built upon historical experience, accumulated research, and development efforts, and specialized skills that are relevant to the sector's unique challenges and opportunities. The knowledge base influences the type of innovations that emerge, the direction of technological progress, and the ways in which different actors collaborate and interact within the sector. As defined by the United Nations, "food systems encompass the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption, and disposal of food products that originate from agriculture, forestry or fisheries, and food industries, and the broader economic, societal and natural environments

in which they are embedded". It also includes farmers, input industries, and science and technology actors³. The interconnection between food and non-food value chains holds significant importance in shaping the food SIS (Spendrup and Fernqvist, 2019). While most large F&B multinationals exhibit a consistent and enduring pattern of innovative activity (Alfranca et al., 2004), disruptive innovations predominantly emerge from auxiliary industries like biotechnology, significantly transforming the SIS. Nonetheless, auxiliary technological fields remain crucial components of the knowledge chain for large F&B multinationals. Even F&B multinationals focused on core activities (non-diversified into non-food products) engage in innovation within non-food technological domains, possibly driven by functional considerations (Alfranca et al., 2003). As per the aforementioned authors, F&B multinationals endeavour to stay abreast of food-related technological developments to effectively interact with their technology suppliers. In subsequent sections, we will revisit this topic and explore the role of technological diversification into non-food among F&B multinationals, as well as their interactions with auxiliary industries in specific countries.

The IB literature emphasizes the network-like characteristics of international R&D activities (Papanastassiou et al., 2019). Drawing from sociological perspectives, innovation research often revolves around diffusion studies, where new knowledge is transmitted through networks of production, cooperation, and imitation (Fernández Esquinas, 2021). As previously mentioned, MNEs that establish local linkages are more likely to contribute to the advancement of host industries compared to isolated MNEs. For our analysis, we have selected three types of local linkages: a) contract farming (CF), b) spillovers of knowledge, and c) domestic cooperation for innovation. The selection of these three channels for analysis is well justified based on their significant relevance and implications within the context of technology transfer and innovation in the F&B industry. Contract farming has been frequently regarded as a mechanism for technology transfer and the modernization of smallholder farmers. International aid organizations, such as the World Bank, and host governments have strongly advocated implementing this approach in developing countries (Echánove and Steffen, 2005; Oya, 2012; Martínez Godoy, 2016; Muñoz Morales, 2020; Singh, 2005; Surabi 2021).

Secondly, in measuring the impact of FDI on host countries, spillovers of knowledge are often used as an important criterion (Belitz and Mölders 2016, Crespo and Fontoura 2007). Finally, foreign firms adopt various strategies to access local technology, with cooperation for innovation appearing to hold greater potential for technology transfer to the host economy compared to subcontracting R&D services or purchasing R&D services through the market (Beneito 2006). This open innovation formula provides evidence for the relationship between foreign subsidiaries and local food manufacturers, auxiliary industries, and universities.

As stated, this article represents an initial endeavour towards conducting a systematic analysis of potential technology transfer channels from the F&B multinational to its host country. It is important to note that this study is not a bibliometric analysis employing statistical techniques to identify the most researched themes in the field. Instead, we rely on previous empirical research results to explore whether F&B multinationals can contribute to enhancing domestic innovation capabilities. To this end, we conducted an extensive search for primary research related to the three channels of technology transfer within the context of F&B multinationals.

The search was carried out on platforms such as Google Scholar and Scopus using various relevant keywords, including "multinational food enterprise," "R&D," "innovation," "technology," and "patents." To ensure comprehensiveness, equivalent terms in French, Portuguese, and Spanish languages were also included in the search. Additionally, we reviewed the general literature on the internationalization of innovative activities to identify cross-sectional studies that specifically focused on the F&B industry. While the literature on innovation in the agro-

³ https://www.un.org/sites/un2.un.org/files/scgroup_food_systems_paper_march-5-2021.pdf May 2022.

food sector was also examined, it is essential to note that the role of MNEs is seldom considered in this particular field (for a mapping of this literature, see Spendrup and Fernqvist 2019). The search criteria did not set a time limit, and we included some studies published in the 1980s if they were still relevant due to a lack of recent evidence on a specific region or because of their theoretical significance. The screening process yielded a total of 42 sources that specifically referred to the F&B industry, and 10 sources that provided cross-sectional evidence singularly focusing on the F&B industry for analysis. Given the available literature, the primary geographical focus of this article centres around Asia, Latin America and Europe.

1.2. Context Setting

In this subsection, we commence by introducing overarching trends of FDI in the sector. Subsequently, we explore the primary drivers behind the internationalization of R&D within this particular sector. Furthermore, we delve into an examination of the innovativeness displayed by F&B multinationals, as evidenced in the empirical literature.

The total FDI flows of food, beverage, and tobacco increased from US\$ 16.1 billion in 2003 to US\$ 21.9 billion in 2014, after peaking in 2009, at US\$34.9 billion (FAO, 2016). This includes primary agricultural production in these sectors as well as their distribution. Since the 1980s, outward FDI flows in food, beverage, and tobacco manufacturing have rapidly increased owing to a range of new circumstances and policy measures, such as the liberalization of capital and trade, privatization of state-owned enterprises, the formation or enlargement of trading blocs, adoption of the market system in erstwhile state-managed economies, and increasing per capita GDP in emerging economies (Rama and Martínez, 2013; Reardon et al., 2019). FDI in F&B goes primarily to developed countries, whose importance appears to have increased, despite the incrementation in flows received by developing countries (UNCTAD, 2009, FAO, 2016).

The degree of corporate R&D internationalization refers to the share of a company's innovations produced outside the home country. While the average MNE produces only 19% of its patented inventions abroad, F&B multinationals generate 30% abroad. Specifically, British, French, Dutch, and Swiss F&B multinationals generate more than 50% (Le Bas and Sierra, 2002). Major F&B multinationals based in the European Union (EU) tend to concentrate on the production of food-related innovations in developed countries, but Brazil, and especially India, are currently gaining importance in this respect (Rama and Martínez, 2013). In another study, the aforementioned authors also observe that these MNEs tend to produce their non-core innovation, that is, auxiliary technological fields employed to manufacture F&B, in the US (Martínez and Rama, 2012). This is clearly a north–north flow of knowledge. Moreover, the Top 100 tend to keep their most important tools of R&D control and direction in their centralized laboratories within the Triad⁴, although China and India are acquiring a certain importance with regard to these superstructures of technology management (Filippaios et al., 2009). The discussion suggests that F&B MNEs concentrate on the generation and control of innovations mainly in industrialized countries and a few large emerging economies. To summarize, within the F&B sector, not all countries possess equal potential to attract FDI in R&D. This aspect will be further revisited and explored later in the article.

F&B multinationals engage in the internationalization of their innovative activities primarily for two significant reasons. Firstly, diet and cooking play a crucial role in cultural identity (Cavusgil et al., 2007). Local tastes, conviviality, and culinary habits differ substantially across countries, despite the presence of global trends. Consequently, MNEs feel compelled to adapt their products to suit local preferences and to gain insights from various gastronomic traditions. Secondly, F&B multinationals pursue international innovation to access diverse

⁴ Japan, Western Europe, and North America (excluding Mexico).

technologies that may not be readily available from research centres and universities in their home country. The production of processed food involves multiple technological fields, and some specialized technologies may be better sourced from foreign locations. While traditional IB studies have assumed that knowledge flows primarily from the MNE to the host country, recent research has shown that knowledge exchange is a two-way process (Papanastassiou et al., 2019). Moreover, F&B multinationals derive several benefits from the internationalization of their R&D activities. This includes gains in product diversification (Anastassopoulos, 2004; Arcese et al., 2015, Celikkol Geylani et al., 2019; Fernández Sastre, 2012; Giuliotti et al., 2004, Hashai et al., 2011; Tozanli, 2005). By expanding their R&D efforts across borders, these companies enhance their ability to develop a broader range of innovative products, contributing to their overall competitiveness and growth in the global market. In this framework, technological diversification plays a substantial role. Evidence provided by the world's 100 largest F&B multinationals (hereinafter, the Top 100)⁵ suggests that by the beginning of the 20th century, the rate of growth of these large multinationals decelerated, with the exception of relatively small MNEs that diversified into food-related technological activities, such as biotechnology and specialized knowledge-intensive services (Anastassopoulos and Rama, 2005).

Technological diversification benefits F&B multinationals in terms of faster growth, monopsony power vis-à-vis local farmers, and entry into new geographic markets (Anastassopoulos and Rama, 2005; Lavarello et al., 2011). Indeed, comprehending the innovativeness of F&B subsidiaries and identifying their limitations is crucial because the ability to transfer knowledge to the host country relies on their capacity for innovation. Without a culture of innovation within these subsidiaries, the potential for knowledge dissemination to the host country becomes hindered. Therefore, understanding the innovative capabilities and constraints of F&B subsidiaries is paramount to exploring the channels and mechanisms of technology transfer in this industry. Patel and Vega (1999), and Alfranca et al. (2005) agree that as early as the 1980s and the 1990s, major F&B multinationals already contributed approximately 50% of the sectoral patented inventions worldwide, intended for the F&B processing industry. However, it is worth noting that not all F&B multinationals are innovators, and patent analysis indicates that a small group of innovative F&B multinationals dominates food technology production worldwide (Alfranca et al., 2004).

Contrary to assumptions, foreign F&B subsidiaries are not automatically more innovative than domestic F&B firms, as evidenced by studies in the Netherlands and Thailand's F&B industries (Dhamvithee et al., 2005, Vancauteran, 2018). The discussion raises the possibility that, in certain instances, individual F&B subsidiaries may lack innovativeness and could be less innovative compared to domestic firms in specific host countries. This observation warrants a cautious approach when formulating policies to attract FDI in the F&B industry. Policymakers should consider the potential disparities in innovation capabilities between foreign subsidiaries and domestic companies before implementing strategies to encourage FDI in the sector. Adopting a more nuanced and context-specific approach will ensure that FDI policies align with the actual innovative contributions of foreign subsidiaries and do not inadvertently hinder the growth of domestic firms with higher innovation potential.

2. Contract Farming

In this section, we examine the possible contribution of F&B multinationals to the host country via contract farming. Otsuka *et al.* (2016, 354) observe that, under production contracts, “farmers typically provide land, labour, and equipment, whereas the contractor provides key inputs on credit and technical assistance in return for the delivery of an agreed upon quantity and quality of product, usually at a predetermined price”. Despite the existence of a substantial literature on contract farming (CF) with various reviews available (Bellemare and Bloem, 2018;

⁵ The information on the Top 100 is provided by the AGRODATA database (Institut Agronomique Méditerranéen, France).

Oya, 2012, Otsuka et al., 2016), there is often a lack of clarity regarding the identity of the contracting parties involved (e.g., MNEs, domestic private firms, or state-owned enterprises). Information concerning the specific arrangements of MNEs in CF is dispersed across multiple analyses, making it challenging to obtain a comprehensive understanding of their roles and contributions in this domain.

2.1. Background

The nationalisation of plantations triggered a reorganisation of local procurement methods and Western-based F&B multinationals have tended, since the 1980s, to divest from land and, instead, outsource production from local farmers (Echánove and Steffen, 2005; Oman et al., 1989; Surabi, 2021; Zimny, 2009; UNCTAD, 2009). However, as noted by Prowse (2012), CF is no longer a north-south affair, because certain F&B multinationals based in emerging economies also rely on CF in Africa, Asia, and Latin America (Orozco Suárez, 2022; Prowse, 2012, Martínez Godoy, 2016; Zimny, 2009). Contract farming is a multifaceted phenomenon with wide-ranging effects on various aspects, including farmers' incomes, agricultural yields, and rural welfare. However, our focus in this study is to comprehend the potential technological contributions of F&B multinationals. Thus, we narrow our investigation exclusively to three fundamental questions:

- whether MNEs offer technological support to local farmers;
- identifying the beneficiaries of such support;
- assessing the extent to which such CF initiatives are backed by local resources.

Through this narrowed scope of inquiry, we aim to gain insights into the role of F&B multinationals in facilitating technology transfer and sustainable development within local farming communities.

2.2. Technical Assistance

According to available evidence, particularly in Latin America, the majority of CF schemes involve the provision of technical assistance by food and beverage (F&B) multinationals (Table 1, column 4). This assistance typically encompasses extension services, veterinary support, training, and quality control services. These schemes are often regarded as new forms of international investment rather than traditional foreign direct investment (FDI). In this context, F&B multinationals engaging in CF tend to focus on the financial, organizational, and technological aspects of local agricultural production, without directly owning the land (Oman et al., 1989). A study by (Surabi, 2021) confirms the current engagement of numerous F&B multinationals in this type of CF in Latin America and highlights similar arrangements being observed in India. This reflects the growing trend of F&B companies actively participating in the development and management of agricultural production in these regions while collaborating with local farmers through technical support and expertise.

However, technology transfer may benefit certain farmers and not others. According to von Tunzelmann and Yoruk (2004), F&B multinationals failed to transfer technology to rural Poland, but the companies blamed the insufficient skills of local farmers, their scepticism towards cooperation, and the preference of the young for urban employment.

Table 1. Food and beverage multinationals and contract farming. Latin America

Article	Evidence	Size of farms	Technical Assistance	Institutional Support
Barril and Schamis (1981)	Nestlé (Sw)/ milk producers, Cayambe (Ecuador)	Mainly 20-50 ha farms	Yes	No
Echanove and Steffen (2005)	Birds Eye (US), Green Giant (US) and other US vegetable processors/ vegetable producers, Guanajuato (Mexico)	Mainly medium and large farms (100-200 ha)	Yes	No
Fonseca Sánchez and Gutiérrez (2017)	PepsiCo (US)/potato producers, Mérida (Venezuela)	Minimum size: 2 ha.	Yes	No
Fredericq (2009)	Nestlé (Sw)/milk producers, Minas Gerais (Brazil)	Mainly large farms	Yes	Yes (cooperatives)
Lajo Lazo (1981)	Carnation (US)/ milk producers, Southern Peru	Small farms	Yes	No
Orozco Suárez (2022)	Grupo Gloria (multilatinas)/milk producers, Pichincha (Ecuador)	Average size: 3 ha	Yes	Yes (farmer associations, government and NGO)
Martínez Godoy (2016)	Nestlé (Sw), Coca Cola (US), two multilatinas and two domestic firms/milk producers, Olmedo parish (Ecuadorian Andes)	Small farms (3-5 ha)	Yes	Yes (farmer association and government)
Medrano (1981)	Ralston Purina (US)/sorghum and corn producers, Cauca Valley (Colombia)	Large farms	No	Yes (cooperatives)
Muñoz Morales (2020)	AB Inbev (Bel)/barley producers, Zacatecas (Mexico)	< 20 ha: relationship with MNE through intermediaries > 20 ha: direct contractual relationship with MNE	Yes	Yes (regional and federal governments)
Reyes Posada (1981)	Nestlé (Sw)/milk producers, Northern Coast of Colombia	Average size: 200 ha	Yes	No

In their investigation of dairy supply chains in Albania, Bulgaria, Poland, Russia, and Slovakia, Dries *et al.* (2009) observe a prevalent pattern of vertical coordination between domestic firms and multinational enterprises (MNEs) with small farmers. Nevertheless, they also highlight that more substantial support and assistance are extended to larger farms. This pattern of favouring larger farms over smaller ones is similarly reported in studies examining CF led by MNEs in Latin America (Fredericq, 2009; Martínez Godoy, 2016) and India (Singh, 2002).

In different geographical contexts, the support offered by MNEs to farmers proved to be temporary. Notably, in certain regions, MNEs exerted significant efforts to promote the adoption of new technologies through CF. This trend was particularly evident in Latin American regions that were previously focused on producing "traditional" agricultural goods. Studies by (Fredericq, 2009; Martínez Godoy, 2016; and Muñoz Morales, 2020) illustrate instances where MNEs actively encouraged a reconversion in these areas. However, the technological assistance provided by certain F&B multinationals in both Latin America and Thailand was short-lived. These companies

subsequently shifted their operations to "new" regions characterized by lower land costs, less exhausted resources, and more promising prospects for obtaining monopsony positions. This behaviour is discussed in research by Fredericq (2009), Reyes Posada (1981), and Singh (2005).

Many F&B multinationals possess expertise in upstream technology and maintain strong ties with international suppliers of agricultural inputs (as discussed in Subsection 1.2). As a result, they may hold a unique position as the exclusive buyers in certain producing regions, capable of accessing cutting-edge agricultural inputs at cost prices (Rama, 2017). This advantage enables F&B multinationals to leverage their technological capabilities and procurement networks to obtain state-of-the-art inputs for agricultural production, giving them a competitive edge in the marketplace. Many of these MNEs coordinate specialized agricultural and veterinary research across countries to diffuse the up-to-date technology generated in any of their laboratories across the entire multinational network (Filippaios et al., 2009). These are powerful deterrents for potential domestic rivals, especially in least developing countries. Indeed, the environmental conditions and factors in different regions can lead to significant variations in the likelihood of monopsonic conditions. Monopsony refers to a market situation where there is only one buyer (in this case, the F&B multinational) for a particular product or service. The existence of monopsony can affect the dynamics of the agricultural input market and influence the bargaining power of local farmers. For instance, in Central and Eastern European (CEE) countries, Dries et al. (2009) find a "supplier market" and substantial competition for the obtaining of milk between dairy processors since cooperatives, former state-owned enterprises, and other domestic processors were not crowded out by MNEs. Therefore, the extent of monopsony in a specific region is influenced by various environmental factors and the competitive landscape within the agricultural input market.

Understanding these nuances is crucial when examining the impact of F&B multinationals on local farmers and the agricultural sector as a whole. Although most farmers recognize that obtaining up-to-date technology is an important motive for engaging in CF (Echánove and Steffen, 2005; Fonseca Sánchez and Gutiérrez, 2017; Orozco Suárez, 2022), little is known about the quality of the transferred technology. Changes in consumption patterns, the quality turn, concerns about fair-trade and ethics influence the strategies of certain agro-food MNEs, at least in specific markets. In response to growing concerns from consumers, local governments, and non-governmental organizations (NGOs), some F&B multinationals are now collaborating with local farmers to enhance sustainable practices in the cultivation of coffee, palm oil, soybeans, and cacao (Adeoti and Olubamiwa, 2009; Ishak, 2021; Merola, 2015; Sorsa, 2016). This shift towards more sustainable practices reflects an increasing awareness of environmental and social issues associated with agricultural production. However, on the other side of the coin, case studies in Mexico and India have highlighted that the new techniques adopted by both native and foreign F&B multinationals, along with global value chains (GVCs), may have adverse effects on human health and the environment (González, 2020; Muñoz Morales, 2020; Singh, 2002). This dichotomy demonstrates the complex and multifaceted nature of the F&B multinational's impact on local economies, ecosystems, and societies. While some F&B multinationals are taking steps towards sustainability and responsible practices, challenges remain in ensuring that all practices align with environmental and social objectives. It underscores the importance of continuous scrutiny, informed policymaking, and collaborative efforts between stakeholders to promote sustainable and ethical practices within the F&B sector.

2.3. Beneficiaries

F&B multinationals rely on farms of almost all sizes (see Table 1, column 3). However, with a few exceptions (van Berkum 2006, White and Gorton 2006), they are unlikely to count on smallholders, that is, resource-scarce farmers with less than 2 ha of land (Vabi Vamuloh et al., 2019). A study on Moldova, Armenia, Georgia, Russia,

and Ukraine found that in 2003, both domestic and foreign contractors were likely to deal with large rather than small farms, and that contracts with the latter grew at a slower rhythm in 1997-2003 (White and Gorton, 2006). Another study noted that foreign investors active in the dairy industries of CEE countries tend to target large farms (Dries et al., 2009).

The primary determinant for supplier selection appears to be the farm size; however, F&B multinationals sometimes consider additional factors such as farm productivity, farmers' age, receptiveness to learning, ethical practices, prior experience, and regional reputation (Fonseca Sánchez and Gutiérrez, 2017; Fredericq, 2009, Martínez Godoy, 2016; White and Gorton, 2006). As noted by studies on Latin American and CEE countries, behind the decision of the MNE to rely on small farmers are often considerations such as government incentives, lower labour costs in labour-intensive activities, or the scarcity of large farms in the host region (Dries et al. 2009; Echánove and Steffen, 2005; Oman et al., 1989).

Small farmers face challenges when engaging in contracts that necessitate initial investments or substantial expenditures on wages, transportation, and insurances (Dries *et al.* 2009, Echánove and Steffen 2005). Additionally, for some small farmers, giving up self-consumption crops is not feasible as it serves as a safety net in times of need (Martínez Godoy 2016). Companies often argue that contracting with smallholders implies higher transaction costs (Dries et al., 2009; Echánove and Steffen, 2005, Otsuka et al., 2016, Surabi, 2021, Vabi Vamuloh et al., 2019). As a consequence, it becomes evident that very small farmers may not directly benefit from the CF arrangements pursued by MNEs unless they receive support from local governments and other organizations. Subsequent discussions will investigate whether domestic institutions assist multinationals in their CF arrangements.

2.4. Institutional Support

Zanfei (2012) questions the IB literature in that it often assumes that the beneficial effects of FDI presence are “not paid for.” Instead, he argues that some of these advantages are the result of costly efforts on the part of the host country. We investigate whether domestic institutions assist multinationals in their CF arrangements. As noted by (Oya 2012, 2), “much of the post-liberalization literature sees CF simply as a private-led arrangement.” However, in certain cases, CF is not a simple, uncomplicated partnership between an MNE and a farmer but an interlocked structure comprising public and private players. Analyses on Poland (Van Berkum and Bijman, 2006) and Moldova, Armenia, Georgia, Russia, and Ukraine (White and Gorton, 2006), suggest that the technical assistance provided to farmers by local and multinational contractors is insufficient. The aforementioned authors imply that public participation in the scheme is desirable, especially for small farmers. In half of the case studies on Latin America reported in column 5 of Table 1, CF is certainly not exclusively a private-led arrangement.

Surabi (2021) also reported on a multipartite arrangement involving the government in the Guatemalan frozen vegetable industry. He opines that the government's presence guarantees that stipulated prices are paid to farmers, whereas the MNE benefits from public finances. In other cases, support comes from a variety of local agents, such as cooperatives, farmer associations, NGO, local universities, and regional governments, and includes, in addition to technical assistance, public funding, free or subsidized fertilizers, and high-quality seeds (Fredericq, 2009, Orozco Suárez, 2022, Muñoz Morales, 2020, Surabi, 2021). At least in the initial stages, basic infrastructure such as irrigation and institutional development is essential for attracting foreign investors and promoting CF in poor regions (Surabi, 2021). Government support and public resources are also vital for reconverting areas that produce traditional crops into areas that produce industrial crops for an MNE (Martínez Godoy 2016, Muñoz Morales 2020). Certain authors believe that thanks to domestic institutional assistance, MNEs externalize certain costs (Orozco Suárez, 2022, Martínez Godoy, 2016).

Indeed, F&B multinationals' CF arrangements with medium and large farms have shown more favourable outcomes. These arrangements tend to be more successful in fostering technological advancements and promoting sustainable practices, particularly in relatively more developed countries. However, challenges arise when it comes to technology transfer to small farmers and less-developed regions. F&B multinationals often face difficulties in effectively disseminating knowledge and technology to these smaller and poorer farming communities without consistent support from governments and local institutions. As highlighted by Zanfei (2012), the positive impacts of FDI presence, particularly in the context of poor farming communities and underdeveloped regions, often come with associated costs borne by the host country.

3. Cooperation for Innovation and Spillover Effects

This section investigates whether F&B multinationals are able/willing to cooperate with domestic partners for innovation as well as their possible spillover effects on the host economy.

3.1. Cooperation for Innovation

Cooperation for innovation⁶ involves the active participation of a firm in innovative activities carried out with other companies or institutions, such as universities. It includes R&D collaborations, but excludes the outsourcing of R&D. Firms cooperate to reduce the risks and costs of R&D, shorten the product cycle life, expand their product range, access new knowledge, and enter new markets (Miotti and Sachwald 2003). Most cross-sectional studies find that foreign ownership has a negative or, at best, neutral influence on the probability that a MNE engages in domestic cooperation for innovation (Arvanitis and Bolli, 2013, Ebersberger et al., 2011, Guimón and Salazar-Elena, 2015; Srholec, 2015; Veugelers and Cassiman, 2004). In these studies, neutral means that foreign subsidiaries are not more likely to cooperate for innovation with domestic partners than a control group, usually domestic business groups. Domestic cooperation for innovation involves partnerships with external partners that are located in the host country and are not part of the same business group as the focal multinational enterprise (MNE). These external partners could be domestic companies, other foreign subsidiaries, research institutions, universities, suppliers, customers, or any other relevant stakeholders with whom the MNE collaborates to foster innovation. The propensity of MNEs to engage in domestic cooperation can vary across different sectors, as highlighted by Ebersberger et al., (2011). This observation underscores the relevance of conducting sectoral analyses in understanding the dynamics of technology transfer, innovation, and collaboration between MNEs and local actors within each industry.

Although certain case studies have reported collaboration between F&B multinationals and domestic partners (Pellegrini et al., 2014), the results of quantitative studies based on large samples of firms suggest that this is an exception. A pan-European study reports that, in low-tech manufacturing industries, such as the F&B industry, foreign ownership has a positive impact on the probability that a firm engages in international cooperation for innovation but a negative and, at best, a neutral impact on the probability that a firm engages in domestic cooperation for innovation (Ebersberger et al., 2011).

In the opinion of the aforementioned authors, the danger of a “branch plant syndrome” stemming from FDI is supported by their econometric analysis and requires policy awareness. The “branch plant syndrome” is characterized by the poor integration of foreign subsidiaries into the local milieu (Phelps, 1993). Poor embeddedness of MNEs is common in countries that are not at the forefront of science and techniques (Ebersberger et al., 2011). As shown in Table 2, evidence on, specifically, Eastern Europe and Spain also

⁶ Also termed in the literature and in this article as collaboration for innovation.

encounters a limited probability of technology transfers to the host F&B industry via domestic cooperation for innovation.

Table 2. Foreign ownership and domestic cooperation for innovation in the F&B industry. Selected studies

Study	Evidence	Results	Policy implications
Chobanova (2009)	Multiple case study on Nestlé, InBev, and Unilever in Bulgaria, Czech Republic, Hungary, and Romania, (Interviews with CEOE at the headquarters of companies and at the subsidiaries)	-None of the MNEs had a R&D centre in the host countries, nor did they have plans to create one; - Cooperation with local agro-food institutions and universities is weak; -The upgrading of local suppliers remains an infrequent strategy; -In the medium term, not even Hungary and the Czech Republic, which have the strongest innovation systems, have been able to embed the MNEs.	Policies adopted by host-governments, such as tax stimuli to attract foreign investors, programs that encouraged the establishment of linkages between FDI and local companies, and the strengthening of the NIS, have been unsuccessful in embedding the MNEs
Guimón and Salazar-Elena (2015)	Innovative firms located in Spain. PITEC * panel, 2005-2011 (subsample of food, beverage, and tobacco firms)	Foreign subsidiaries are not prone to cooperating for innovation with local universities (control group: domestic business groups).	FDI-oriented policies should include measures to encourage collaboration between MNEs and local universities
García Sánchez <i>et al.</i> (2016)	Innovative foreign subsidiaries operating in the Spanish F&B industry. PITEC * panel, 2004–2008	-Highly Innovative F&B subsidiaries remain unlikely to engage in local R&D cooperation; -F&B subsidiaries seem to provide economic and marketing resources to networks of local innovators, although not necessarily state-of-the-art technology.	- Reliance on the strengths of the host country for the technological upgrading of its F&B industry is recommended - Boost cooperation on basic research between F&B multinationals, national technological centres and domestic firms
Knell and Srholec (2005)	Third Community Innovation Survey (EU). Data for Czech food and tobacco firms	Foreign ownership has no effect on the probability of local cooperation for innovation	N.a.

Note: * PITEC (Technological Innovation Panel Database) is a CIS-type survey produced by the Spanish National Institute of Statistics (INE) and the Spanish Foundation for Science and Technology (FECYT).

Column 4 of Table 2 presents the policy implications of this research. In her study of major F&B multinationals in Eastern European countries, (Chobanova, 2009) questioned the “power” of the SIS to lock multinationals in host industries. The aforementioned author contends that, for F&B multinationals, the degree of embeddedness in the host country is influenced by a combination of factors. These factors encompass the global strategies adopted by the companies and the specific characteristics of the host country, including the size of its market.

Consequently, she expresses scepticism regarding the effectiveness of national pro-FDI policies. While pro-FDI policies can create an enabling environment for foreign investors, they may not guarantee automatic and deep-rooted embeddedness. The level of embeddedness is contingent upon multiple internal and external factors that may be beyond the control of policymakers.

However, F&B multinationals may exhibit a willingness to engage in cooperation for innovation, particularly with highly skilled domestic partners in certain host countries. While this may not be the norm in some other host countries, case studies on Argentina highlight the unique collaboration between F&B multinationals and local scientific and technological centres, possibly due to the excellence in agronomical research present in the country.

Chobanova (2009), Ebersberger et al. (2011), Guimón and Salazar-Elena (2015), and von Tunzelmann and Yoruk (2004) have noted that such collaborations with local universities are not widespread in other host countries. However, in the context of Argentina, case studies conducted by Lavarello (2004) and Lavarello et al. (2011) provide evidence of F&B multinationals actively cooperating with local scientific and technological centres. The reason behind this distinctive pattern of collaboration in Argentina is likely due to the country's recognized excellence in agronomical research. Given the significance of agriculture and related technologies in the F&B sector, multinationals may perceive Argentine scientific and technological centres as valuable sources of specialized knowledge and expertise.

The case analysis of the Italian subsidiary of Lindt and Sprüngli, a prominent player in the high-quality chocolate market, reveals that the multinational engages in an iterative two-way process of collaboration solely with machinery suppliers. This collaboration pattern is not extended to other types of suppliers (Manzini *et al.* 2017). It appears that Italian manufacturers have successfully positioned themselves in the international trade arena, supplying machinery to the global food and beverage (F&B) sector. These are especially skilled local patterners. The disparity between developed and developing countries' capabilities in supplying machinery for the F&B sector influences the potential for domestic cooperation and technological advancements within each context. According to Manzini *et al.* (2017), the reluctance of the MNE to cooperate with other types of Italian partners, such as suppliers of aromas, is attributable to a fear of spillovers of knowledge, especially when innovation is not protected by patents but by industrial secrecy.

The evidence suggests that other F&B multinationals adopt strategies that allow them to access local knowledge while minimizing the risk of knowledge leakage. These strategies involve providing marketing and financial support to networks of local innovators, rather than directly transferring up-to-date technology. Several prominent F&B multinationals have implemented such approaches to foster innovation and collaboration with local innovators in various countries. For example, Coca-Cola supports start-ups of local innovators in cities like Buenos Aires and Istanbul, enabling them to tap into local expertise and ideas without directly sharing their latest technological advancements. Similarly, Procter & Gamble offers seed funding to small F&B firms, independent innovators, and auxiliary industries in China, India, and certain industrialized countries, facilitating innovation while maintaining control over sensitive technology (Dodgson et al., 2006; Huston and Sakkab, 2006; Miglietta et al., 2017).

Moreover, F&B multinationals active in the Spanish market have also embraced this approach of supporting local innovators (García Sánchez et al., 2016). These methods demonstrate a strategic balance between promoting innovation and safeguarding proprietary technology. By providing support to local innovators, F&B multinationals can benefit from a flow of new ideas and approaches without explicitly sharing their most advanced and proprietary technologies.

Certain scholars in the field of IB argue that MNEs proactively take measures to prevent horizontal leakages of knowledge, which could potentially reach local competitors and other MNEs (de Faria and Sofka, 2010, Otsuka

et al., 2016, Javorcik and Spatareanu, 2005; Veugelers and Cassiman, 2004). We believe that MNEs are more inclined to adopt this strategy when they perceive a higher risk of knowledge leakages, particularly in the context of unpatented innovations and products that are relatively easy to imitate. This situation is often observed in the F&B sector. The risk of knowledge spillovers for highly innovative F&B multinationals becomes more significant when other MNEs are active in the same host sector, and local prospective partners possess absorptive capacity. This scenario is common in host countries where the F&B industry is competitive and characterized by a pool of capable and knowledgeable domestic actors (García Sánchez et al., 2016). By proactively preventing horizontal leakages of knowledge, F&B multinationals create a barrier to the international transfer of knowledge. In conclusion, the strategy adopted by F&B multinationals to prevent knowledge spillovers contributes to safeguarding their intellectual property and market position. However, while this strategy serves the interests of individual companies, it can present challenges to the broader international transfer of knowledge and collaborative innovation.

In summary, the available evidence indicates that F&B multinationals are generally less inclined to engage in cooperation for innovation with local partners compared to domestic firms. However, there are specific cases where F&B multinationals do cooperate with local partners for innovation purposes. These instances include collaborating with advanced local upstream industries and research centres of excellence or providing financial support to local innovators to access local knowledge. This pattern of selective cooperation with local partners may have different implications for various economies. In developed countries and certain emerging economies, the presence of local upstream industries and research centres of excellence may create opportunities for more cooperative innovation activities with F&B multinationals. The existence of relevant expertise and capabilities in these regions could make them attractive partners for multinational corporations seeking to tap into local knowledge and resources. However, the situation may be different in the least developed countries, where the lack of local expertise and absorptive capacity may deter F&B multinationals from engaging in collaborative ventures.

3.2. Spillovers

Most studies assume that domestic firms' productivity may increase because of their forward and backward linkages with foreign subsidiaries (Belitz and Mölders, 2016; Crespo and Fontoura, 2007). Domestic firms, it is argued, may be encouraged to innovate by increased competition due to the entry of an MNE into a monopolistic local industry; the licencing of a technology; subcontracting relationships with an MNE, imitation, etc. (Javorcik and Spatareanu, 2005). However, cross-sectional evidence regarding spillovers from FDI is mixed and mostly negative in developing countries, one reason being the insufficient absorptive capacity of domestic firms (Belitz and Mölders, 2016, Crespo and Fontoura, 2007). Indeed, the impact of FDI can vary significantly across different host sectors. As highlighted by Javorcik and Spatareanu (2005), the effects of FDI are not uniform and can be sector-specific. Therefore, conducting sectoral studies becomes essential to gain a more nuanced and accurate understanding of the implications of FDI in each industry.

Cross-sectional studies suggest that FDI spillover effects are less likely in the F&B sector (Blanchard and Mathieu, 2016; Desli et al., 2012; Kokko, 1994, Suyanto and Salim, 2010; Vu and Noy, 2009). The evidence revised here for both developing and developed countries confirms the limited scope of the spillover effects in this sector (Table 3).

Table 3. Spillovers from inward FDI in the food and beverage industry. Selected studies

Article	Evidence	Results	Explanation	Policy implications
Amighini and Sanfilippo (2014)	-FDI_South (BRICS and certain African countries); -FDI_North (OECD countries) 2003-2010.	Spillover effects from FDI_South in African export agri business	Technological proximity between recipient African countries and FDI_South.	FDI_South offers a potential for accelerating African development
Blanchard and Mathieu (2016)	F&B firms with >20 employees, France 1990-2003, INSEE	No spillover effects	Domestic firms have not enough absorptive capacity.	Pro FDI policies are justified in intensive-research sectors, but not necessarily in F&B
Desli <i>et al.</i> (2012)	Panel of 971 F&B firms, Greece 2001-2007, National Statistical Service of Greece	Small and diminishing spillover effects	Small absorptive capacity of domestic firms.	N.a.
Kokko (1994)	Data on 156 Mexican industries. Mexican Census, 1971.	No spillover effects in: alcoholic beverages, instant coffee, and prepared food	Dual market or "enclave" effect. Foreign and domestic firms operate in different segments of the market	Efforts to attract FDI should focus on industries where local technological capability is already relatively strong, or where product differentiation and economies of scale are not so significant that foreign subsidiaries can easily take over the whole market.
Jensen (2004)	Amadeus database and Effect, 1993-2000. 649 Polish food, beverage and tobacco firms	-Very small spillover effects towards host economy; - The spillover effect operates within the multinational group due to technological and cultural proximity.	-The positive spillover effect from the presence of foreign firms is outweighed by the market-stealing effect; - Foreign firms and domestic firms operate in different regions, and spillover effects are likely to be localised.	-Tax rebates to attract F&B multinationals to poor regions have hindered rather than encouraged spillovers. In such regions, there is a negative effect of FDI policies on small Polish firms; -Foreign investors should be encouraged to embed in Polish manufacturing (e.g., joint ventures)
Kugler (2006)	Colombian Manufacturing Census 1974-1998 and FDI data from the Central Bank	No intra-industry spillovers but evidence of inter-industry positive spillovers	-MNEs prevent intra-industry spillovers; - Domestic F&B firms have limited access to machinery and equipment due to restrictions on finance and imports.	Improve absorptive capacity of domestic firms
Nandonde <i>et al.</i> (2019)	Case study comprising 5 South	Small spillover effects, except	N.a.	Encourage local entrepreneurship

Article	Evidence	Results	Explanation	Policy implications
	African F&B multinationals and 21 domestic partners, Botswana and Kenya, 2018-2019	provision of some technology and training to young domestic firms		
Suyanto <i>et al.</i> (2021)	Balanced panel of 6,617 F&B firms, Indonesia 1988-1995, Indonesian Board of Statistics	Significant negative spillover effects	-F&B MNEs tend to steal the market of domestic firms; - No transfer of technology due to a wide knowledge gap between MNEs and domestic firms.	In industries where the presence of FDI is negative, pro FDI policies need to be reconsidered
Vu and Noy (2009)	Data on the US and six EU countries, 1980-2003. OECD Structural Analysis	No spillover effects	Different impact of FDI across sectors	N.a.

A variety of explanations have been offered: F&B multinationals deliberately avoid intra-industry spillovers of knowledge; they steal the market of domestic food processors; foreign subsidiaries and domestic firms operate in different segments of the host F&B industry or different regions; and domestic firms enjoy insufficient absorptive capacity to process new knowledge, etc. (Table 3, column 4).

On analysing data for Colombia, (Kugler 2006) notes that although a growing trend in the productivity of F&B subsidiaries indicates that they are implementing improved techniques, domestic producers do not seem to benefit from sector-specific spillovers. However, he found that direct advantages from FDI are generated for suppliers of inputs, such as local packaging manufacturers, whereas indirect advantages are generated for domestic F&B companies through their purchases from local packaging suppliers. In this case, he argues that there are limited intra-industry externalities but widespread inter-industry spillovers. Doan *et al.* (2015) found similar indirect FDI effects in New Zealand's F&B sector. On the other hand, the nationality of FDI deserves consideration. Amighini and Sanfilippo (2014) reveal that FDI originating from other developing countries is more likely to have a positive effect on the export performance of low-tech African industries, including agro industries, when compared to FDI originating from developed countries. According to their findings, this difference in impact can be attributed to the smaller technological gap between the foreign investor from the South and the African host country. In other words, FDI from developing countries tends to be more conducive to improving the export capabilities of low-tech industries in Africa due to a relatively closer alignment in technological capabilities and economic development levels between the foreign investor and the host country. Column 5 of Table 3 presents the policy implications that the authors derived from their research work.

Crespo and Fontoura (2007) maintain that demonstration effects constitute the most evident spillover channel. Adoption of new technology may be risky and expensive but domestic firms, they claim, may feel disposed to adoption when the technology is successfully employed by foreign subsidiaries. F&B multinationals often act, in host countries, as early adopters of new technology, new quality standards, Corporate Social Responsibility, best practices and new forms of organisation, while domestic firms may subsequently follow their lead (Craviotti, 2019;

Dries et al., 2009; Gutman et al., 2006; Sorsa, 2016, von Tunzelmann and Yoruk, 2004; Zimny, 2009). With some exceptions, the evidence available on F&B multinationals fails to confirm the idea of spillover effects. However, in certain cases, these companies promote demonstration effects in the host-sector.

Conclusion

Our study sought to present empirical evidence regarding the technological impact of Foreign Direct Investment (FDI) in the food and beverage sectors of host countries. In pursuit of this objective, we conducted a comprehensive literature review focusing on three potential channels for technology transfer.

It was observed that while multinational corporations engage in a significant portion of their innovative endeavours overseas, these activities are predominantly concentrated in developed nations and a select few major emerging economies. As a result, numerous countries face challenges in attracting Research and Development (R&D) intensive FDI to their respective food and beverage industries. The evidence on contract farming, domestic cooperation for innovation, and FDI spillovers, the three possible channels of technology transfer analysed here, is almost unanimous regarding the limited or, at best, the selective effects of FDI on the host country's sectoral innovation system. Additional national resources are often needed to support FDI arrangements; for instance, to facilitate the involvement of small farmers and poor regions in contract farming promoted by MNEs.

However, in certain cases, F&B multinationals may contribute a non-negligible aspect to the local networks of innovators in the form of funding or complementary assets, especially if domestic firms and institutions already display absorptive capacity. These multinationals may also collaborate with specific types of local partners, such as suppliers of machinery and packaging, in addition to generating demonstration effects. The most favourable outcomes were observed in relatively more advanced countries, particularly when considering contract farming arrangements, where medium and large producers displayed clear benefits. Nevertheless, at least in this sector, the available evidence questions the excessive optimism of international bodies and host governments regarding MNEs as a potential source of up-to-date technology for host countries.

Based on our findings, formulating pro-FDI policies for the food and beverage sector should involve a careful consideration of the costs and benefits associated with attracting F&B multinationals. While such policies can potentially bring technological advancements and economic benefits, it is vital to assess the specific circumstances of each country, taking into account the varying capabilities and readiness to absorb foreign investment in this sector. A balanced approach should be adopted to ensure that the potential gains from FDI are maximized while addressing any potential challenges or risks. Policymakers should remain mindful of the sector's unique characteristics and tailor their strategies accordingly to foster a favourable environment for sustainable technology transfer and economic growth. Further research in this area would also be valuable to inform more nuanced policy decisions. Moreover, the internationalization of R&D does not guarantee the international transfer of technology, and the role of national policies is still vital.

Our research identifies certain aspects that deserve further attention:

- internationalization of R&D in smaller F&B multinationals and F&B multinationals from emerging economies;
- indirect effects of food FDI on local auxiliary industries;
- the possible effects of FDI technology transfers on health and the environment;
- the effects of F&B multinationals on the potential for technology transfer to host countries may vary depending on the home country of the multinational.

Our study was mainly centred on a specific group of countries and involved extensive analysis of major food and beverage multinationals. However, it is essential to acknowledge that in certain instances, our conclusions

were drawn from limited evidence due to the scarcity of published studies on the topic. The dearth of available research highlights the need for further investigation to enhance the understanding of technology transfer in this context and to achieve more robust and comprehensive findings. Indeed, some of the sources utilized in this study may be outdated, given the lack of recent publications on the subject. Consequently, there is a pressing need for new research to investigate potential changes and developments in the context of the early findings.

Conducting new studies can provide updated insights into the technological effects of FDI in the food and beverage sectors of host countries, shedding light on any evolving trends or shifts in technology transfer channels. Despite the limitations of our study, we believe that this analysis offers valuable insights that can serve as a foundation for future research in this area. By shedding light on the technological effects of F&B multinationals in host countries and identifying the various challenges and opportunities, our study contributes to the ongoing policy debate surrounding foreign direct investment in the food and beverage sector.

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The author performed all tasks involved in manuscript preparation, research, and writing.

Conflict of Interest Statement

The authors declare that there exists no conflict of interest since the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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