Open innovation in the food industry: trends and barriers — a case of the Jordanian food industry

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Abstract
This paper aims to provide an overview of open innovation (OI) and the food industry, examine the main drivers of this model in the food industry, and consider the impact of applying open innovation strategies by companies. A single case study method was conducted with expert interviews with one of the largest food manufacturers in Jordan. Even though the food industry is considered a somewhat mature industry and low-tech, there are a lot of trends and unexplored potential that could permit the application of OI. This is the first study examining OI in the food industry in Jordan and one of the first in the MENA region. It is meaningful for the application of open innovation in countries with a lack of resources and small market size, especially SMEs that lack awareness of the importance of open innovation strategies and their applications. The findings also indicated that small and limited markets could be a huge barrier that hinders the application of open innovation and also indicated that Jordanian culture plays a major role as well.

Keywords Innovation · Food innovation · Open innovation · Case study · Jordan

Introduction

We are living in a time of constant change and technological breakthroughs, and seeking innovation is becoming very complex and costlier to pursue individually as a business to introduce unique products. The concept of open innovation has been introduced by Chesbrough (2003); this concept promoted the idea of using internal and external ideas and sharing them to find solutions for mutual implications and work in sync with even competitors. The beauty of the concept is that collaboration does not only make us more efficient but also helps in finding new solutions. The more diverse people you have trying to find solutions, the more likely you are going to find something incredible; scarcity breeds innovation but more importantly, different perspectives breed innovation as well (Wolpert, 2002). We tend to think of breakthroughs as lone geniuses but it is never true that innovation is usually additive.

Nowadays, organizations that use the traditional innovation (funnel Fig. 1) develop ideas then turn them into concepts as well as find solutions to develop prototypes internally without external help, spend a lot in the R&D department, then measure the ratio of their spending with their innovation, but they usually run into a lot of problems like the following:

(1) Incomplete information: since they tend to rely heavily on internally gathered ideas, concepts, and solutions as shown in Fig. 1, this will not be enough especially when the technology is evolving fast and the product life cycle is getting shorter by the day.

(2) Innovation is slow: with the technological breakthroughs that are happening every day, slow innovations and knowledge do not make it into the market simply because the knowledge becomes obsolete or the business plan changes completely as we witnessed from recent events especially COVID-19; many organizations went out of business faster than they could come up with a solution to keep up with the change.

(3) Prioritizing keeping the same resources with minimal budget changes is not as effective as it used to be, since
globalization allowed new competitors to compete internationally with their new innovative products.

External innovation was viewed as collaboration with the competitor, but the introduction of the open innovation model allows businesses to leverage current external expertise instead of rediscovering the wheel, in this fashion allowing organizations to build collaborations between them and other companies, universities, and other external information sources improving their innovation success rate and boosting their productivity.

Over the past few years, this traditional innovation practice has stalled as organizations have steadily realized that not every innovation should originate from inside organizations (Alawamleh et al. 2019; Chesbrough et al. 2006).

The external ideas gathered through the external sources are enhanced and related closely to the market and the customer, and the solutions are firmly aligned with the technological advancements which in turn allows faster innovation, lower risk, and provides a superior understanding of the challenges to evaluate the solutions (Fig. 2).

Till now, open innovation has been widely connected with rapidly growing, technically demanding sectors such as knowledge and communication industries as they require more innovation in comparison with other industries (Alawamleh et al., 2018; Pellizzoni et al., 2019; Sarkar & Costa, 2008); the question remains whether the open innovation concept welcomes more industries which are less technologically intensive (Chesbrough 2006). On the other hand, Sarkar and Costa (2008) and Franceschelli et al. (2018) point out that in the light of constant changes in the demand and supply of the food industry and the escalating competition between companies in the food industry, these have made innovation not only inevitable but profoundly crucial to the overall growth and profitability of the food industry.

In the past, the food industry appeared to only focus on lowering both waste and production costs with a little or no attention to customer satisfaction; naturally, human beings are brilliant in terms of finding efficient ways to operate; hence, lately, we can observe that the industry shifted in emphasis towards the customer and it is oriented towards producing goods that are in line with customer demands.

Contemporary consumers want different flavors, and with the progressive concern over health and diet, consumers demand foods that align with their dietary guidelines; such increasing demands require a complete shift in production.
or at the very least tackle new innovative solutions and technologies that would help adapt and keep up with the competition. There are many examples of open innovation applications in the literature and their implications for a sustainable strategy. These applications are important for reducing cost and time to market and for a company’s impact on the environment and food security (Arcese et al., 2015).

**Literature review**

**Open innovation**

The classical approach to innovation by companies was carried out by investing heavily in their R&D departments; after that, they have started to realize that not all bright ideas come from the inside (Chesbrough 2006); Chesbrough (2006) defined open innovation as the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively.

With the introduction of globalization which increased the competition, companies started looking for ways that can support their R&D (Huston & Sakkab, 2006). Therefore, getting hold of outside knowledge to help with the internal innovation process is considered a must by many companies to keep up with the competition (Lichtenthaler, 2008); Desouza et al. (2005) suggest that without externally accrued knowledge, companies cannot compete effectively.

Gassmann et al. (2010) suggest that OI was originally based on the following nine perspectives in Table 1.

As mentioned in the previous section and according to Gassmann et al. (2010), open innovation started to emerge in the technology-intensive industries; however, there is a growing trend in less technologically based industries to exploit the benefits of open innovation. Bigliardi et al. (2021) suggest that future research requires greater investigation of the impact of technologies on the OI paradigm, considering not only the possibility to improve the inward flows of ideas but also the implications for people's behavior.
Open innovation in the food industry

The food industries are described as somewhat mature and displayed rather small investment in the R&D department and are very cautious when it comes to the type of innovations that it introduces to the market (Costa & Jongen, 2006); this sector’s end-consumers tend to be very cautious of the introduction of widely differing products that alters their consumption patterns along with the safety-related regulatory criteria and makes food goods and process invention highly complex and risky venture which should not be carried out lightly. Fortuin and Omta (2009) suggest that firms in the food industry are pursuing the demand approach rather than the supply approach.

Open innovation in the food industry is becoming crucial in the light of recent and drastic changes in the end-customer demands. The adoption of an “open sustainability innovation” approach could be a source of strategic advantage for food companies (Bigiardi & Filippelli, 2022; León-Bravo et al., 2019). According to Sarkar and Costa (2008) after the introduction of nutraceuticals and functional foods, the barriers that are preventing various industries from working together are vanishing rapidly for example food and cosmetics as well as pharmaceuticals to take advantage of this new segment. However, as we said, food industries tend to have limited investment in the R&D and have limited expertise when it comes to clinical trials to satisfy the health regulations while the pharmaceutical companies can provide those missing skills and expertise for example sports nutrition company collaborated with Dutch chemicals company to improve the utilization of their whey protein (Bröring, 2013). Therefore, it can be described as companies working together to take advantage of the knowledge and expertise in particular sectors that can help in the food industry (Chesbrough & Appleyard, 2007).

Functioning in an open innovation environment relies on participation from the network of stakeholders, starting from the raw materials suppliers, and R&D departments, to the end consumer.

Uttama (2021) suggests the health and wellness food business development through a consumer-driven open innovation strategy. Consumer-driven open innovation appears to be a novel opportunity for driving health and wellness food consumption. Consumers can play a major role in the innovation process and help in identifying what the customer demands (Vargo & Lusch, 2004); hence, new advancements in preservation tech and biotechnology present a huge opportunity that can be applied and used in the food industry to satisfy the customer demands (Juriaanse, 2006); therefore, companies which integrate customer demands quickly into their products gain competitive advantage and market share; Huston and Sakkab (2006) described the implementation of the innovative practices that procter and gamble (P&G) used to reduce the production time and cost by printing edible photographs on cakes and they were able to do that by applying their “Connect and Develop Strategy.”

To date, the findings of existing surveys have shown that the adaptation of Chesbrough’s innovation model remains...
low (Van de Vrande et al., 2009), the barrier of entry for new firms in the food industry is low, and achieving product differentiation is not simple. Hence, the innovation process is more typical in the food industry than product innovation (Capitanio et al., 2010).

The stakeholders involved in the food industry are many and scattered across different sectors and opening channels and collaborations with them are needed to achieve successful innovation in the food industry (Faems, 2008; Ferraris et al., 2021).

There is an increasing growth in the open innovation projects in the food industry that can be explained and linked to the fact that 90% of the sector includes small and medium enterprises which are commonly known to be extremely versatile and creative. Because they tend to allocate minimal resources to the R&D department, therefore, they cannot compete in the global market, as they find it difficult to allocate the resources required to hire experienced professionals; therefore, they should establish a vast network of collaborators to provide them with science and technical feedback since they lack time and knowledge (Knudsen, 2007).

The SMEs have taken advantage of OI and share the cost of innovation rather than incurring the expenses on their R&D; lowering the overall cost, Sarkar and Costa (2008) empirically proved that innovative ideas in the food industry often do not have to pay off, specifically when businesses do not introduce recognized original product advancement to the field. More precisely, for food manufacturers to be able to compete globally, new, customized, and differentiated commodities should be brought and introduced into the extremely crowded food market constantly, and to achieve this would be by collaborating with users, retailers, distributors, and other participants in the food industry. Also, Costa and Jongen (2006) suggest that including firms, final consumers, and policymakers closely in the innovation process will complement the likelihood of consumer adoption of innovations and thus ensure the success of that product.

Bigliardi and Galati (2013a) stressed and highlighted the value of collaborations between players in and beyond the food industry, i.e., academia and R&D centers, rivals, customers/consumers, innovation intermediaries (Fig. 3).
Bigliardi and Galati (2013b) argued that the integration of this model carries risks but also presents a tremendous opportunity for improvements. Benefits that could occur involve cooperation with professional consultants, as well as speeding innovation and time to market process. Furthermore, they added that the open innovation model is not for everyone as not every organization is ready to share its innovations with others as risks are coming along with sharing their knowledge, and ensuring their intellectual rights require agreements with their partners. As mentioned before and with the success of Procter and Gamble’s (P&G) open innovation strategy “Connect and develop” as Huston and Sakkab (2006) described its success and pointed out that it reduced the time to market for Pringles brand successfully, many companies started to follow their steps implementing OI into their strategies for example (Table 2):

Therefore, it can be inferred that businesses in the food industry are commonly engaged in open innovation strategies, but there are many hurdles and complications for this sector to engage this model effectively. On the other hand, Sarkar and Costa (2008) argued that the introduction of innovation into the food industry has become quite an inevitable organizational practice to keep competing in the market and gain an advantage in the light of recent changes in the supply and demand related to the food industry rendering innovation crucial despite the risks.

To maintain stability and competitiveness in the global economy, companies have started to weigh a range of aspects. The key reasons that may contribute to an open invention according to Sarkar and Costa (2008) are the following:

- Consumers expect distinct flavors which ultimately change the demand in the food industry
- Increasing demand for healthy food
- More distinct market demand in terms of consistency, choice, and simplicity

These aspects encourage companies to search for creative technological concepts, strategies, and innovative technologies.

### Methodology

Pre-understanding scholars are mainly constructed through knowledge from others and numerous intermediaries, such as books, academic papers, and discussions. The synthesis of one’s understanding and the knowledge of others form a store of wisdom that reflects pre-understanding.

### Methods

This paper aims to identify how the opportunities open innovation offers may help in redesigning the food industry in the future; develop an understanding and identify the challenges facing managers when adopting the OI model and discuss how SMEs can benefit from this concept. Second is to develop an understanding and identify the challenges facing managers when adopting the OI model, and finally, to discuss how SMEs can benefit from this concept.

To achieve the purpose of this research, single case study method was the most suitable (Yin, 2009); using a case study approach, questions of “how” and “why” can be answered (Eisenhardt & Graebner, 2007). It “uncovers areas for research and theory development” and uses in-depth field observation (Voss et al., 2002). The analysis of a single case might be a limitation, but at the same time, it is a strength of the research design, as it sacrifices generalizability in support of a more in-depth analysis than is possible to obtain from multiple case studies. It is equally well adapted to exploratory research and for theory building in new and emergent research areas (Voss et al., 2002). To circumvent the inconveniences of single-case research, the design of the study followed the components of case study research recommended by Yin (2009).

### Table 2  Open innovation implementation examples. Source: elaborated from IFF, Celgene website, (Bigliardi & Galati, 2013a, 2013b)

| Company | Way of implementation | Results |
|---------|-----------------------|---------|
| International Flavors Fragrances (IFF) | Acquire the knowledge of the customers thru their consumer insights program and specialized experts seeking to understand consumer patterns across the globe, investigate empirical demand statistics, and perform a couple hundred thousand customer interview sessions annually | Decreasing manufacturing costs, introducing new flavors, collecting knowledge on customer preferences, and increasing market share |
| Celgene | Develop relationships of links among customers, manufacturers, producers, and seed companies (Vanhaverbeke and Cloodt, 2006) | Use their unique advantages and bolster support for the introduction of modern genetically engineered tomatoes gaining a competitive edge in the fresh market |
| Mars | It uses external information technology through collaboration with customers, major companies, and small and medium enterprises, academic institutions | Increased the number of collaborative contracts (intensive collaborative agreements) |
The purpose of a case study is “to tell a big story through the lens of a small case” (Yin, 2009; Tan, 2004). Case studies are undertaken to focus on what is typical and this then leads to meaningful generalization and scientific abstraction, which would be prevented by uniqueness (Majumdar & Gupta, 2001). The case study method is suitable for those situations where the phenomena, as well as the context in which they occur, are difficult to prize apart.

Case studies are meant to shed light on a variety of approaches by describing why those decisions have been taken, how they have been applied, and what outcomes have been found.

Although case studies present disadvantages as they are hard to generalize when finding directly applicable companies, case studies are ideal for OI research. Chesbrough (2003) established his research on the foundation of case studies; Sakkab (2002) also conducted their research based on a case study.

Firstly, we investigated the cases arising from published studies, primarily academic articles, then collected data using online search such as annual reports of firms that have engaged in open innovation projects to clarify that adopting OI even in low-tech industries can lead to success.

To explore the issues further, the case of Nabil Foods was considered because it is one of the largest food companies in Jordan with more than 800 employees and their engagement with the international market as their foods are being distributed throughout local and 20 international markets as well as they are adopting the OI model with their adaptive strategies; therefore, they possess the knowledge and information that are applicable and useful for this paper; it will also assess the extent of accessibility for field research due to their location and willingness to schedule an interview; the decision was made by choosing Nabil Foods due to their engagement in OI and their enthusiasm to help in this paper.

Both qualitative and quantitative analyses can be conducted to address the research questions. While quantitative analysis requires a larger sample to provide a conclusion about OI and more generalizable findings, a qualitative analysis methodology allows for developing an insight into the mechanisms of open innovation and the possible obstacles to a specific implementation. In this case study, we collected data and information from the literature and expert interviews were performed to collect the knowledge required to address the study questions.

**Interviews**

Interviews can clearly overview the human perceptions and viewpoints on open innovation in general as well as reveal the barriers and trends of OI in the food industry from their point of view.

As both structured and unstructured interviews could provide us with answers to our questions, we have settled on a semi-structured interview style as structured interviews typically offer no space for originality and allow only a small range of feedback; as we want to understand the individual’s thoughts and perceptions, a semi-structured interview would be the most suitable.

Semi-organized interviews provide a significant level of learning while enabling insight in form of similarity due to their structured emphasis (Gillham, 2005).

This study is based on a personal interview conducted with the managers and head of departments in Nabil’s factory for food products.

Before the interview, the chosen respondents were informed of the purpose of this research by phone and handed them general questions to prepare them for the nature of the questions to follow up on the questions more freely; later on, the first step of the interview was to present a brief introduction about the research and explaining the aims and briefly discussing the similar literature.

**Discussion and results**

Throughout the whole research procedure and data collection from literature and individual interviews, we have concluded that the open innovation era in the food industry has just begun. A big change towards a modern model has started. After thorough investigations and discussions based on our interviews and literature, we have concluded the main the trends and future opportunities of this model as well as the barriers and challenges of large firms and SMEs.

Innovation in the food industry can occur at any stage across the food chain mainly at the following:

1. Unique ingredients
2. Natural food innovations
3. New production process
4. Food quality improvements
5. Packaging techniques and preservation technologies
6. Innovative ways of delivery or marketing

The data on the future and trends in the food industry OI applications can be obtained by the study of modern literature regarding the food industries and by building on our current research.

Throughout our research process, we conducted deep expert interviews with the R&D department in Nabil’s factory for food products regarding the trends of the application of the OI model; we concluded that there are main trends in the industry that lead to applying this model; we have summarized interviews’ data in Table 3.
Increased demand for specialized food

End consumers are developing food awareness regarding their health; they are requiring products closely tailored to their diet due to many reasons for example the increasing cost of health care, and the hope of old and young people for greater well-being later on the years of life has led people to demand functional food.

The term functional food definition based on Food and Nutrition Board (1994) is “Food that encompasses potentially helpful products, including any modified food or food ingredient that may provide a health benefit beyond that of the traditional nutrient it contains.” With that being said, more and more customers are becoming aware of functional foods and growing to accept them to fill missing nutrition’s in their strict diet. A good example would be that lactose-intolerant people can gain the missing calcium from calcium-fortified functional food. The research also identified some of the reasons that are linked to the success of functional foods which is linked to the positive image amends, the customers, and the extensive research on probiotics which lead to the introduction of new dairy products.

Dining at home

Since the outbreak of COVID-19 and while individuals keep working from home until 2021, the trend of dining at home instead of restaurants does not seem to be slowing down.

During the coronavirus lockdown, restaurants started operating as e-commerce sites; looking back 20 years ago, there were only a few delivery options available but nowadays, there are no limitations on the type of cuisine; all of that is made possible by third-party services such as Careem-Now and Talabat.

With that being said, the trend of innovation did not stop here; since these third-party services were successful, they created more demand; therefore, SMEs started to take advantage of such service; hence, the emergence of the term dark kitchens emerged, which meant that restaurants of even chefs can rent a small space offering no dining place inside the restaurant and only relying on delivery services, therefore, saving costs on renovations and staff.

Our research and discussion with small business owners in Jordan that were affected by the coronavirus lockdown and had to close down their main restaurant location clearly showed that they also took advantage of their services since Talabat allowed them to continue operating from home without the need for a formal kitchen.

With that being said, third-party delivery services and the food industry are finding opportunities to integrate innovative applications and contactless food-ordering advantages into their existing services.

Plant-based protein diet instead of meat-based

The trend in vegetarianism has steadily gained traction in recent years. Young people are becoming more health-conscious and environmentally aware. They are choosing a plant-based diet to reduce their carbon footprint and take better care of their health. They are demanding more vegetable-based recipes and ready meals with interesting tasty ingredients. And they are not satisfied with a few average vegan choices on the market and demanding quality and consistent improvements in the vegetarian-based food market. Hence, the food industry needs to innovate to satisfy the demand of the current customers and take advantage of this new market and attract new customers.

It all started with soy and almond milk and nowadays, the food industry is collaborating with different industries and experimenting with new concepts for example vegan ice cream.

The vegetarian trend has moved towards the frozen food market and now, the frozen food section in the supermarket has a section dedicated to it; Nabil foods took advantage of that and introduced a variety of products to satisfy the customers’ demand starting from vegetarian beef and chicken burger towards more culture-related foods in Jordan like vegetarian kubbeh and vegetarian eggplant stew to more international cuisine like samosa and spring rolls.
Environmentally friendly packaging

We are seeing nowadays that there is an incredible increase in the demand for packaging alternatives as a consequence of traditional plastic packaging’s negative impact, and companies are already starting implementing solutions and partnering with companies that provide “green Packaging.”

In that sense, bioengineering, nanotech, and looking for new innovative ways of preservation and fortifying food products with nutrition offer the path to meet modern customers’ demands. To fully exploit these current innovation cycles, the food industry, as a result, must enter into more or less formal relationships with other industries in the innovation system since many of the technologies, and solutions lie outside the food industry; therefore, the food industry sector should experience a notable increase in OI strategies extending from access to external knowledge and skills to external labor talent and services.

Food industry sector innovation challenges

Indeed, there are many successful and promising innovation categories for the food industry, agriculture Bio-Tec, biomaterials, and innovative foods just to name a few; nevertheless, they always experience high technical complexity and must conduct a structural research approach in animal nutrition, Bio-Tech, and biomaterials, to address a wide range a barrier to innovation that affects the food industry.

From our research and interviews with Nabil foods, we summarized some of the barriers that hinder the OI in the food industry as follows:

Culture

Particularly in big organizations, culture is very influential and incredibly difficult to reform. Even if management strategies of tackling innovation were exceptional, culture always takes the win, and to overcome this barrier, culture has to start supporting OI practices and strategies and think not with the ordinary way of competition and keep in mind that the rewards of the OI strategy would justify the risks.

Especially in Jordan, we asked the question during our interview whether the culture is considered a barrier to OI and the answer was yes because Jordanian culture is competitive by nature; Jordanian as well as the whole Middle East culture, in particular, is unforgiving; mistakes are remembered and there is no clean slate; therefore, managers hesitate to apply OI strategies.

Characteristics of the food industry as a whole

Firms are thinking about improving existing products and extending the line of an existing product is more favorable than dramatically changes; therefore, managers are not motivated to adopt a new strategy that allows the implementation of the OI model.

The elasticity of the industry

When huge companies are competing internationally in the food industry, they are categorized by their high sale volume and low margins; additionally, they face a challenge adopting OI due to the long food industry value chain which renders them inflexible; hence, revenues may be severely affected by any failed experiment.

With that being said, SMEs have a better chance of implementing radical changes due to their small sale volume; therefore, they can take advantage of experimenting.

Short product life cycle

As the customer needs and demands are changing regularly, companies are not focusing on the long run and are primarily interested in achieving a higher volume of sales with the same if not lower price; therefore, innovation only plays a small role in their strategy.

While large companies may see this as a barrier, SMEs can look at it as an opportunity to innovate and differentiate their products from major companies.

Cost of external knowledge

Hence, the profitability and margins in the food industry are low acquiring that external knowledge can be costly and managers will less likely to turn and look for external knowledge and they will only do so if they are positive that it is necessary due to the reason that externally acquired knowledge usually requires familiarity with the company internal environment which is not the case usually. In that sense, managers get hold of external ideas and technologies from suppliers since they are more familiar with the internal environment.

Open innovation for SMEs

While the food industry is categorized as a mature industry and research has barely touched the investigated OI in full, the adaptation of the model seems to offer a huge opportunity to SMEs; it can help them to overcome their poor sources of intelligence and information gathering expertise as well as help with their financial capital.

We concluded from our research that the engagement in the open innovation process for SMEs is closely linked to cost reduction and their low investment in the R&D department and their need to share the uncertainty of innovation and externalize it.
There are different ways that startups and SMEs can work with larger companies since larger companies are more hesitant about experimenting.

SMEs possess a significant advantage when it comes to open innovation due to their flexibility as well as the means of meeting the consumer’s changing demand and market needs.

**Practical implications that face managers when adopting OI**

We raised the question during our interviews regarding the implications that face managers when implementing the OI model and we concluded that most SMEs in Jordan are not motivated enough to implement OI and adapt new strategies mainly because the market size and share for each company are relatively small in Jordan and it is even smaller for SMEs due to the introduction of new competitors daily and they are categorized by their sales volume and low margins; hence, they tend to overlook the potentials of OI and the possibilities that the model can introduce for them.

As for larger companies, the adaptation of this model is growing but companies still tend to rely mostly on their R&D and apply the model mostly to gain external information and ideas mainly from their supplier and marketing insight and on a lesser scale from their customers, and as for the implications that face them when adopting the model, this has been summarized in Table 4.

**Conclusions, limitations, and scope for future research**

This research aimed to identify trends and practices of open innovation that are currently applied within the food industry, as well as to provide a general idea of the barriers and difficulties that managers of the food industry face while applying open innovation strategies, and we have concluded from our interviews that the adaptation of this model within the industry is gaining popularity and this leads us to believe that the confusion-built concept is vanishing especially with the current pandemic situation; however, considering the food industry characteristic, many barriers need to be solved especially with large international companies mainly because as we mentioned before, it is a low-margin and high-sale industry.

However, the developments and the introduction of new and innovative foods and technologies do not appear to be slowing down with the constant changes in society and demand trends; therefore, the competition in the sector is becoming more intense, and to survive this competition, the industry needs to look at open innovation strategies more

Table 4: Managerial implication regarding OI implementation

| Implication | Explanation | Possible solution |
|-------------|-------------|------------------|
| Resistance to change | Due to the complex nature of OI, managers may face some major backlash from the partners whenever they try to implement or even introduce the idea of OI because there would always be some partners who are against opening the organization process. | Understanding why the partners may feel resistant to the idea of OI, preparing the internal resistance, and explaining every aspect of OI thoroughly might be the key to the success of OI in the organization. |
| No comparable benchmark | The firm will always feel endangered by a modification of process and protocol as not everyone is supportive of the idea because the firm is still relatively new, and there is no comparable benchmarking the management could conduct to compare the OI strategy with other already implemented ideas and models. In most cases, doubtful partners are not uncomfortable communicating their thoughts evaluating them outside their departments or concerned with confidentiality. | Strengthen the external lines of contact. Irrespective of whether it is your intranet, staff blog, or newsletter, they could use all those outlets to communicate the idea as well as suppliers and possible allies, only when employees and partners recognize the reason behind the company deciding to introduce a different and new strategy and will be more willing to accept the change. |
| Uncertain cost and high risk involved | It was an issue rising from the distrust among the partners and the risk associated with the cost from the unsuccessful open innovation activities; there is a continuing perception among companies that because they want to retain an upper hand, ideas should be built internally and implemented within the business. Without the help of external knowledge is difficult. | Yes, it is difficult to crack OI. But the easiest approach to implement this model is by learning it by partnering with companies that have experience with the OI tools, and learning how OI models carried them to success as well as the benefits of OI outweigh the risks, for the organization to start building their OI programs. |
seriously and change the traditional competition concept and start looking for more beneficial alliances.

Future research could apply different research approaches which can help generalize results. It is also advisable to repeat such studies periodically, to account for pedagogical, societal, economic, and technological developments affecting innovation in the food industry.

The present research is not free from limitations as the list of established OI activities is not a comprehensive list. Past reports have suggested other strategies and practices were not included in our study, since our findings are related to a specific country.

**Author contribution** All authors (MA, MA, and LBI) contributed equally to this work. All authors read and approved the final manuscript.

**Data availability** Not applicable.

**Code availability (software application or custom code)** Not applicable.

**Declarations**

**Conflict of interest** The authors declare no competing interests.

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