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## **Open Sustainability Innovation in the Food Sector**

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**Abstract:** The food sector is facing a constant increase of competitiveness. In order to address the high competition that involves the food industry, sustainability and innovation practices can be strategically effective, especially an open sustainability innovation approach. The main objective of this study is to assess the open sustainability innovation approach adoption rate, and how it could be strategically meaningful in the business practices of a company in the food sector. We observed that the adoption of an “open sustainability innovation approach in business practices could represent a strategic advantage to reach, at the same time, sustainability and business goals such as, for example: the costs and time to market reduction as well as company’s environmental impact and an increment of the food security. Evidences of this work emerged starting from an overview of the state of art of the food sector from a sustainability and Open Innovation perspective. Afterward we collected some food companies’ case studies that, on our perspective, have adopted and/or are adopting an open sustainability innovation approach in their business practices. By the analysis of these cases, we could gain a better awareness on the effectiveness of this approach on some companies that operate in the food sector. In conclusion an analysis of the evidences emerged in the paper are discussed.

**Keywords:** sustainability; food sector; open innovation; innovation.

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## 1. Introduction

The food sector is a key sector of the global economy that generates more than four trillion US dollars as annual retail sales [1]. It includes elements, like: the food industry, retail, agriculture and the consumer society [2].

In the food sector a larger variety of consumers' needs and a shorter lifecycle products, tend to increase competitiveness. The need of a wider network of distribution is getting more and more importance [3]; and a strategic aspect that adds a plus to competition is sustainability.

The increased attention towards social economic and environmental issues aiming to create sustainable development patterns offer a more credible and valid image of a company with its customers and business partners [4]. In fact, as [5] reported the green product innovation has been recognized as a strategic marker for several components among which there are: profit growth, environmental sustainability and a better life quality. The problem is that the food industry "is seen as a low-tech industry with a dominance of incremental rather than radical innovation and a relatively low innovation rate. However, Open Innovation is widely adopted" [3]. In support of that there is a series of contingences such as: the growing number of the supply chain actors, the variety in the demand of the customers, end-users, legislators and higher quality standards required; these contingences are pushing the food sector to open up to new sources of innovation in order to get new profitable and successful offers for the market [6].

In this work, starting from the concept of open sustainability innovation, that namely consists in the generation of sustainable ideas, services and products exploiting the open innovation paradigm [7]; we mean that open innovation practices merge with the sustainability concept. In fact the main objective of this study is to assess the open sustainability innovation approach adoption rate, and how it could be strategically meaningful in the business practices of a company in the food sector.

Evidences of this work emerged starting from an overview of the state of art of the food sector from a sustainability and Open Innovation perspective. Afterward we collected some food sector companies case studies that, on our perspective, have adopted and/or are adopting an open sustainability innovation approach in their business practices. By the analysis of these cases, we could gain a better awareness on the effectiveness of this approach on some companies that operate in the food sector.

## 2. State of art of the food sector

The food sector, as mentioned above, has a strategic importance in the global economy and it encompasses many heterogeneous actors that have to interrelate constantly with the variety of the demands from customers, end-users and legislators, but also with shorter lifecycles products, higher quality standards, food safety and competitiveness.

In Europe the food sector is extremely important [8] in terms of turnover, value added and employment and represents one of the main manufacturing sector. In fact the food and drink industry has a turnover estimated of €1,048 billion (2012), a value added of € 206 billion (2011) and EU companies employed directly 4.24 million people (2012) [9].

In the food sector actors build a wide and complex structure (Figure 1.); they need to cooperate if they want to meet higher standards of competitiveness, sustainability and social responsibility [10].

Indeed, in order to react to the numerous food scandals and therefore guarantee the product's quality and safety, the food supply chain fulfilled systems and made transparency as a key [11].

**Figure 1.** Food sector structure. (authors' elaboration based on [10; 2])



From the above figure (Figure 1.) it is possible to realize how globally the food industry forms a complex structure, that includes a large variety of structures, like: production farms, small and medium enterprises and multinationals [12; 13]. This sector is characterized by a high level of heterogeneity on the kind of enterprises, on the variety in the production, retail and distribution organization [14; 2].

“The food and drink industry maintains the characteristics of a stable, non-cyclical and robust sector against the backdrop of the present economic downturn” [15]. In fact, the food and drink production in the European manufacturing industry has been one of the most stable, from 2008 to 2013, right after the pharmaceutical production [9].

Compared to the heterogeneity global structure of the food industry, the dimension of the Europe's food sector infrastructure is made up of about 286.000 companies of which the 99.1% (283.000) are micro, small and medium enterprises (SME) [9; 16]. In spite of the numerous companies, the majority are SMEs and only a limited number of them, along with the European multinationals, can compete on the global market although the European food market is one of the most important sectors in Europe itself [15].

At this point of our analysis seems relevant to underline some specific issues in the food sector such as in the table below (Table 1.) [10; 17]:

**Table 1.** Specific issues in the food sector. (authors' elaboration based on [10])

Issue	Explanation
<i>Rapid adaptation to different scenarios</i>	A rapid adaptation to new scenarios is needed [18] in which the process of coordination and communication between the main actors of the food sector requires abilities to face constantly new difficult issues.
<i>Innovative problem solving</i>	It is the need to overcome the structural problem that comes from the numerous SMEs in the European food sector [12; 19]. To do so those companies need to cooperate and look for a possible external support.
<i>Attention to the consumer needs</i>	Special attention to the consumer needs; this means that enterprises in this sector are willing to reach the consumers and take into the right consideration their needs. In this way enterprises could develop technologies, management and communication strategies between enterprises and consumers with the aim of building a trust worth relationship [20;21].

In this context even if innovation and sustainability are considered key strategic factors to overcome the issues of the sector and to achieve worldwide competitiveness goals [22; 23; 24; 25; 26; 27], the data have revealed a low research and development (R&D) intensity that, in Europe it is estimated around 0.27% [9; 26; 27; 28].

In the agri-food literature several authors state that the food sector is characterized by the predominance of incremental innovations instead of radical [23; 27; 29]. According to Capitanio et al. [26] the predominance of incremental innovation is caused by the demand and the consumer resilience to change.

Nowadays the food business sector is becoming a more consumer-oriented market that requires constant development in order to face customers' expectations. Other critical aspects that have to be dealt with, at the same time are: the shortening products lifecycle, the heterogeneity of the customers' need and their request for variety and quality of the products [30; 31; 32]. As many studies have shown food sector companies, that successfully innovate, are those which are mostly market oriented [27; 33; 34]. From this approach we can see that, along with the new available technologies the food sector can strongly refer also to those innovations that come not only from inside the company but also from the outside, as it is conceptualized in the paradigm of Open Innovation [35].

In this scenario, in order to face the customers' demand for higher quality products and more safety, sustainability becomes a key factor in the food sector competitiveness [36]. In fact, it is a strategic marker for a company in terms of image and credibility with customers and, in general, with all the stakeholders [4].

### 3. Open sustainability innovation: sustainability and open innovation in the food sector

#### 3.1 Sustainability in the food sector

In the last couple of decades the role of sustainability in company business strategies has increased both in terms of brand image and added value. In these decades, many measures that analyze enterprises contributions to sustainability have been suggested, like, for example, those ones that state that companies contribute to sustainability when the value created overtake the external damage done, another measure is reported by those studies that suggest the eco-efficiency. Namely sustainability takes place when companies “create as much value per environmental impact as possible”. [37; 38].

A third measure, known as the Sustainable Value Added “takes into account both, the efficiency and the absolute level (effectiveness) of resource use. Sustainable Value Added is the extra value created when the overall level of environmental and social impacts is kept constant” [38].

The central concept of sustainability has been defined by Brundtland as the “[...] development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [39]. In the literature the discussion about sustainable development could also take place through the capital theory approach to sustainability [38; 40; 41; 42]. The capital theory approach comprehends: “man-made capital (such as produced goods), human capital (such as knowledge and skills), natural capital (such as natural resources), and social capital (relationships between individuals and institutions). It follows, according to the constant capital rule, that development can be called sustainable, if it ensures constant capital stocks or at least constant capital services over time” [38; 43; 44; 45; 46; 47].

In the food sector all actors in the chain affect the total sustainability of the chain itself [48]. Indeed the whole food system has a strong impact on the climate changing, starting from the agricultural processing to distribution, retail, home food preparation and waste [49]. For example, concerning food wastage, “FAO estimates that each year, approximately one-third of all food produced for human consumption in the world is lost or wasted” [50].

The some of the main issues on sustainability can be synthetized in three macro-areas (Table 2.): socio-economic, production consumption [49].

**Table 2.** Sustainability issues in the food sector. (authors’ elaboration based on [49])

Sustainability issues	Requirements
<i>Socio-economic</i>	The governance of the food sector needs to be constantly updated.
<i>Production</i>	The food production needs to be implemented by using more sustainable, technological and efficient systems.
<i>Consumption</i>	Changes in the daily dietary are needed based on how they can influence the food production.

*Socio-economic:* from a socio-economic perspective the latest institutional changes have made social and environmental sustainability key factors in the institutional legitimacy of corporations [4; 51]. In

light of that, in the last decade, the literature on corporate governance has widespread so much that also the concept itself has extended and now it has come to include aspects that in the past have been considered part of the corporate social responsibility (CSR). This because the concept of sustainability has achieved legitimacy among stakeholders. [4; 52].

The need to reach a general consensus has influenced companies in their ethical and social engagement so that CSR and Social Accountability Standards, such as SA8000 [53], have been modified [54] “Social impacts’ evaluation is one of the cornerstones of product sustainability. Models of indicators designed to assess the social sustainability are many and different in nature and composition, although some studies show that these are still incomplete and most of them are not objective” [4].

*Production:* nowadays production systems have to meet different crucial issues such as: supplying food to a worldwide population, supplying energies to all by respecting the constrains of the CO<sub>2</sub> emissions in secure and affordable ways, taking steps to control the impact of the climate change [55]. For example, agriculture and food production generate the 29% of worldwide emissions of greenhouse gases (GHG) [56; 57].

*Consumption:* “both traditional and modern supply chains offer risks and opportunities for achieving better nutrition and more sustainable food systems. Improvements in traditional supply chains can help reduce losses, lower prices and increase diversity of choice for lower-income households. The growth of modern retailing and food processing can facilitate the use of fortification to combat malnutrition, but the increased availability of highly-processed, packaged goods may contribute to overweight and obesity” [58].

In Europe food consumption is estimated about 30% of various environmental impacts [57; 59].

From the scenario we have sketched so far, we can say that consumers play a leading role in the sustainability of the food chain. The choices that consumers make when they buy food influence both the variety of types of food and the ways by which food can be produced. “While the way food is being produced can be changed by regulation, market forces are a major driver in the way food chains are developing. And here consumers have a crucial role” [48].

As a result of all the consideration discussed so far we can see that technological innovations and managerial changes can be considered as the key elements for a reduction of the environmental impacts and increasing resources [49]. In light of that it is possible to find several ways that companies can find to change their context with a more careful perspective on sustainability.

### 3.2 Open Innovation in the food sector

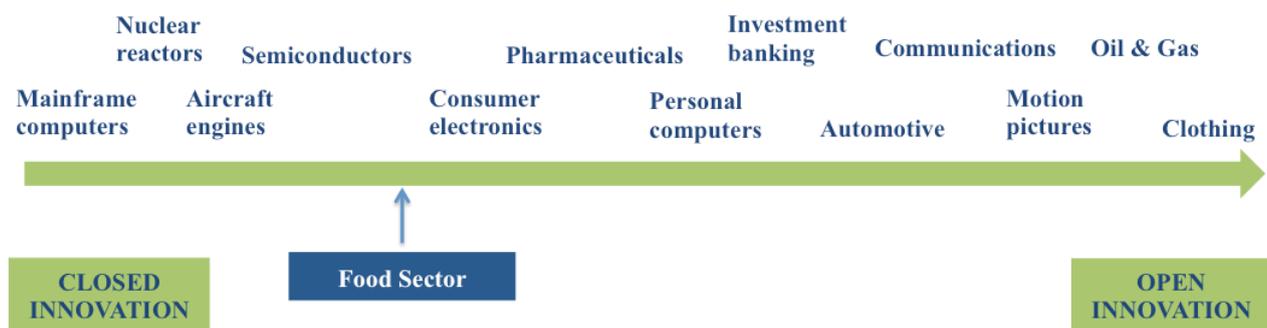
The spreading out of Internet had increased the competition among companies and the barriers to entry that had been placed by the larger corporations are reduced. Therefore the time to market has become one of the main objectives for all kinds of companies, because this reduction allows enterprises to gain competitive advantages both in terms of competition and turnover [60]. To face such strong competition companies from different sectors, have built a double strategy. On the one hand they started acquiring technologies from the outside environment [61; 62; 63; 64] and on the other one they started to externalize their own technology knowledge [65; 66; 67; 68].

The advantages of Open Innovation practices deriving from inter-firms cooperation are becoming more and more increasing. Analyzing Open Innovation from a company process perspective Gassmann

and Enkel have identified three base archetypes in the open innovation processes where each of them represents a different strategy: the outside-in process, the inside-out and the coupled process [69].

According to Chesbrough theories [35] open innovation can be seen at the baseline of the knowledge of a company through external and internal flows of innovation. Therefore the use of open innovation strategies could become a relevant structure for the growth of SMEs as well as big companies that by their participation in networks can have access to a wide range of knowledge that lead them to towards a successful innovation process (Figure 2.) [70; 71; 72].

**Figure 2.** Open innovation in different industries. (authors' elaboration based on [35; 73]).



In the last decade typical sectors associated to open innovation are those characterized by high-technology and speed growing trends [6], why on the contrary, there are less evidences on the application of open innovation paradigm to sector characterized by lower technology intensity [74].

In fact the food processing industry has been considered so far as quite conservative, slow growing with a low level of R&D investments and quite reluctant to introduce innovative ideas to the market [6; 75]. The slowness in changes could be attributed to the perception of its customers that to a large extent seem not to be willing to accept radical changes in their consumption patterns. Therefore the perceived customers slowness, the constraints of legal requirements needed to guarantee safety have had a strong impact on the innovation process and until recently have made it a complex time consuming, risky and not likely to be easily undertaken [6].

Nowadays as many studies have pointed out innovation could become an effective tool also for traditional and matures industries [6]. In support of that Chesbrough and Crowther [76] found evidences that open innovation strategies are being applied also to companies that operate in lower-tech sectors.

In order to ensure profitability and competitiveness on a global market firms have begun to take several factors into consideration. The main factors that can lead to open innovation are [34]:

- A different nature of food demand;
- A different organization of food supply.
- A more differentiated demand from consumers in terms of quality, variety and convenience.
- A different demand for healthy food with a low ecological impact.
- A different approach to food safety.

All these factors compel organization to look for innovative technical ideas, solutions and new business models [77]. Therefore because of the innovation above mentioned required different approaches, firms have changed their perspective that now has moved from a supplier-based approach to a consumer-based approach [34]

Therefore the combination of the above mentioned factors along with a further evolution in biotechnology have given origin to a new changing attitude in the food industry that now is taking into consideration how all the above-mentioned factors are strictly interrelated. These companies are now more aware of the great possibilities based on the technological and scientific knowledge, and if they are able to include knowledge in their processes could become more and more innovative and competitive in the sector.

In the New Food Economy several studies have explained that enterprises in the food sector depend on external sources of information for their innovation, and therefore they have to open their network in order to become part of innovation processes [78; 79].

From the consumers perspective is it possible to see that in the past they have been considered as the passive targets of the new products. Nowadays, consumers have become a significant element in the value chain. By the spreading out of web and social networks consumers have been able to contact directly companies and vice versa, so consumers and companies roles have become more and more unit, as result in co-creation. In this way is possible to build a win-win process of innovation, for both consumers and companies [80.]

“Co-creation offers a new way to innovate, in which prosumers work in mutually beneficial collaboration with companies to develop products, often through social networking”, where the term prosumers derives by combining the words producer or professional and consumer [80].

Therefore there are many tools linked to open innovation applicable in the food industry like, for example: crowdsourcing, crowdfunding, open data, toolkit and so on.

## **4 Open sustainability innovation: analysis of case studies**

### **4.1 Open sustainability innovation in the food sector**

An open sustainability innovation approach could be strategically meaningful for a company that operates in the food sector in order to gain, at the same time, sustainability and business goals such as, for example: the costs and time to market reduction as well as company's environmental impact and/or an increment of the food security. This could be possible in light of the open innovation paradigm and suitability themselves. In fact, on one hand, according to Chesbrough “Open innovation offers the prospect of lower costs for innovation, faster times to market, and the chance to share risks with others” [68; 81]. On the other hand, we already observed that customers behavior play a key strategic role for sustainability, because with their consumption and purchasing habits are able to influence the market [48]. Therefore companies are increasing their willingness both in the co-operation with customers and in the adoption of sustainability approach. Those are the reasons why open sustainability innovation could represent an effective approach in order of gaining competitive advantages and differentiation [7].

“The hope is that companies big and small can benefit from the cost savings and environmental benefits that come from sharing sustainability orientated innovations”[7].

There are many cases of open innovation related to sustainability, as we will see in the following paragraph. In fact, by the concept of open sustainability innovation, in this work, we mean an approach by which open innovation practices merge with the sustainability concept. Indeed to show the potential effectiveness of this approach we have collected some evidences on the adoption of an open sustainability innovation approach (Table 3.). By the analysis of the case studies we could gain a better awareness on the effectiveness of this approach on companies that operate in the food sector.

**Table 3.** Evidences from open sustainability innovation in the food sector. (authors’ elaboration based on [82; 83; 84; 85; 86; 87; 88])

<b>Company Name</b>	<b>Project</b>	<b>Open Innovation</b>	<b>Sustainability</b>	<b>Type of Innovation</b>	<b>Supporting Technology</b>	<b>Goals</b>
Starbucks	Betacup Project	Crowdsourcing	Reduce paper cups waste	Incremental	Karma cup a law-tech chalkboard solution	<ul style="list-style-type: none"> <li>- Reduce paper cups waste</li> <li>- Lower time to market</li> </ul>
BTTR	AquaFarm	Crowdfunding	Growing home food from waste	Incremental	Home Aquaponics Kits	<ul style="list-style-type: none"> <li>- Reduce waste</li> <li>- Grow at home food</li> <li>- Fund the production</li> <li>- Lower time to market</li> </ul>
Bubbly Dynamics LLC	The Plant	Food startups incubator	All food waste generated by these businesses will be processed in an onsite anaerobic digester to create	Incremental	Sustainable Food startup Business	<ul style="list-style-type: none"> <li>- Green jobs.</li> <li>- Food waste processed into The Plant</li> </ul>

			biogas for The Plant's renewable energy system"[87]		incubator	renewable energy system.  - Lower operating costs  - Startups become sustainable ventures.
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#### 4.2 Open sustainability innovation: case studies

Each company is unique, has its own structure, strategy, business model, needs, challenges and opportunities; therefore has also its own open innovation needs and way to face them. In light of that we can see that food companies are adopting different strategy to assess their open sustainability innovation needs. Some of them are more oriented on co-creation process launching crowdsourcing campaigns like Starbucks [7]; others used crowdfunding to starts the project production like Back to the Roots (BTTR) [85]; or also on an Omni-comprehensive open sustainability innovative organization project like The Plant [87]. Those cases are just some examples of companies that adopt an open sustainability innovation approach in the food sector.

*Starbucks:* in 2010 Starbucks decided to sponsor a campaign in order to reduce the paper cups waste. To pursue this objective the company decided to sponsor an external group of partners that had already started a project that was aiming to address the issue of disposable cups, the project was known as "Betacup Project" [82]. This project consisted in launching an online crowdsourcing public contest on Jovoto creative platform, providing a summary on the global problem of the paper coffee cups and a money prize of 10.000€ plus 2.000€ 1<sup>st</sup>- 5<sup>th</sup> place [83]. The task was: "Rethink the way we consume coffee and present solutions that strive to reduce paper cup waste [83]." After 2 months of running Betacup contest received 430 idea submissions, 1,500 ideas revisions, more than 5,000 comments, 13,000 ratings and a winner [82]. The winner was a low-tech solution known as "Karma Cup" a "chalkboard sitting by [each Starbucks] register. Every guest who uses a reusable mug marks the chalkboard. Every 10<sup>th</sup> guest receives a free item" [83].

"The creative collaboration contest not only produced a huge number of innovative ideas for Starbuck and provided it with insight about is product strategy, it raised awareness of an important issue that Starbucks was addressing and thus earned Starbucks valuable media" [82]. Along with those considerations the Betacup Project, thanks to the co-creation model, allowed to find a solution suitable, already positively prototyped, in relatively short time and with a less investments in R&D. This case study is an example of the effectiveness that open sustainability innovation can have from a marketing perspective.

*Back to the Roots (BTTR)*: it is a California based small company born in 2009, their “Our mission is to make food personal again through the passionate development of tools that educate and inspire, one family at a time” [85]. While the founders of BTTR were searching for product diversification and development, they noticed a business opportunity in the designing of an home aquaponic system. “Aquaponics is a centuries-old, closed-loop method of growing food that utilizes fish waste to fertilize the plants, which then clean and oxygenate the water for the fish.” [84] In order to fund the production of the home aquaponics kit in November 2012, BTTR, that at that time was still a startup company, launched a crowdfunding campaign on Kickstarter, a crowdfunding online platform [86]. From the campaign BTTR raised 248,873\$ out of a goal of 100,000\$, that means they raised more the double of what they initially asked. The campaign was a success for them not only in order to get the needed amount of money to fund the production, but also to get feedback from potentials customers that allowed them to add detail to the product in order to better fit the customer need and to validate the market demands for home aquaponics kit [84]. In this way this example of crowdfunding campaign is a successful example of co-creation that shows how much customers care about sustainable products and how strong is the co-creation approach in terms of lower time to market, costs and product validation.

*The Plant*: as it is described on the website “The Plant is a new kind of organization in a very old building. It’s part vertical farm, part food-business incubator, part research and education space” [87]. The Plant is a complex structured project rooted upon the concept of sustainability. Concerning the food-business incubator, it “The Plant is a center for start-up for existing food producing businesses to develop into viable, sustainable ventures. The Plant’s business incubator consists of permanent tenant spaces maintained by Bubbly Dynamics, LLC, and will offer food-producing businesses the advantage of reduced rent and energy costs. All food waste generated by these businesses will be processed in an onsite anaerobic digester to create biogas for The Plant’s renewable energy system. This self-sustaining, interconnected process helps the businesses housed in The Plant grow and prosper together, while creating new, green jobs in the community.” [87] As it is described the business incubator has a multiple functions to transform food businesses into sustainable companies, to reduce the costs, to create green jobs and at the same time reduce the environmental impact creating renewable energy from food startups waste. Therefore The Plan represent another example of successful open sustainability approach.

## 5. Conclusions

From the above-mentioned case studies we can see that some companies have completely included a consumer driven approach to innovation with a consumer centric culture, consumer led innovation by experimenting co-creation. Other companies prefer to linger on more traditional consumer based methods. Many companies did not want to take into consideration the benefits of including consumers as valid partners of the innovation process. In general the food sector is traditionally slow in taking up new approaches [80]. Therefore a paradigm shift is suggested in order to meet new challenging demands by making consumers part of the food sector innovation by creating cooperation, all these factors could build a possible route to success [80].

It is important also to consider that “The size of the European common market holds many opportunities for companies wishing to increase their productivity, by making effective use of

economies of scale. The EU's food industry must also look to stimulate innovation and develop new products in order to thrive. All this must be done in way that is respectful for the environment and that guarantees secure access to agricultural raw materials” [89].

The conclusion that can be drawn from our critical examination of the open sustainability innovation in the food sector and from the analysis of some case studies are manifold.

Although the food sector as been considered as a traditional and mature industry, the application of open sustainability innovation approach has proved that could be an incremental resource for the sector. Therefore more researches and evidences can be suggested in order to get a better understanding of “how” the use of open sustainability innovation approach could eventually have a positive influence on the food sector.

For the food sector the merging of open innovation and sustainability represents an important challenge. This because from the merging of these two elements could be possible to reach, for example, goals such as a reduction of environmental impact, healthier and safer food for an increasing number of population and at the same time, leveraging on open innovation strategies, and also a reduction of some of the company costs and time to market.

Anyway it is becoming clearer and clearer that food sector companies have to face an undeniable effort if they want to meet the future global challenges successfully [90].

### Conflict of Interest

The authors declare no conflict of interest.

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