Mismatch between food sustainability and consumer acceptance toward innovation technologies among Millennial students: The case of Shelf Life Extension

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**ABSTRACT**

The academic interest towards food products produced with innovative technologies has increased and a specific attention has been paid on the factors that could explain consumer acceptance or skepticism with regard to these new technologies. In this frame, the aim of this work is to analyze the factors that affect consumer acceptance towards new technologies in food with a special focus on Shelf Life Extension, which is considered to be one of the most sustainability-driving food innovations. The target group for the analysis is represented by the Millennial Generation (MG) students (n = 1027), recruited through a face to face survey.

The results evidenced that higher levels of food knowledge led to an increase in acceptance whereas, in contrast, a greater interest in sustainability led to technology rejection. As the main scope of these technologies is to increase the overall sustainability of food products by reducing food loss and chain fails, the mismatch evidenced by the rejection of Shelf Life Extension technology by eco-friendly individuals outlines that the innovation technologies in food products is perceived by consumers as risky per se, regardless of the specific technology. In a nutshell, individuals characterized by high sustainability concerns fail to recognize, in science and technology, a possible contribution for a more sustainable world.

1. Introduction

In the last decades, modern food systems have been faced with a challenge to accelerate the shift towards sustainable development and production; identifying solutions that are able to enhance productivity and sustainability along the supply chain while helping the sector cope with climate change issues (OECD, 2012). The transition towards new models of food production and consumption will depend on the sector’s capacity to introduce innovative approaches and strategies at any level of the supply chain (Schiefer and Deiters, 2016).

Nonetheless, compared to other manufacturing sectors, the food and drink sector in Europe is less innovative and only the 1.9% of the EU patent applications were related to such products (Eurostat, 2012). In the food sectors, ready-made meals are the most innovative, with 8% of the total European food innovation, followed by dairy products (7.5%), soft drinks (6.3%) and savory frozen products (6.2%) (FoodDrinkEurope, 2016). Moreover, in addition to patent data, research and development (R&D) expenditures can also be used as a measure of innovation. Data revealed that the low levels of R&D expenditures at an aggregate level and the low propensity for the development of new knowledge led to considering the European food and drink sectors as low-tech industries (Costa et al., 2016).

The capacity to innovate represents a strategic tool for firms to maintain a competitive position in the marketplace (de Jong and Marsili, 2006; Laforet and Tann, 2006). This is particularly relevant in the Italian market, where small and medium enterprises (SMEs) represent a greater part of the food industry (Spillan and Parnell, 2006; Banterle et al., 2016): the introduction of new
ideas, processes and products allows SMEs to survive alongside big enterprises and to face the growth of competition due to globalization processes (Tralli and Grunert, 1997). On the demand side, consumers are increasingly careful about what they eat, as a consequence of problems related to food intolerance, allergies and episodes of food poisoning and scares (McEachern and Schroeder, 2004; Grunert, 2005; European Commission, 2007), along with the increased awareness of the existence of a direct link between diet and health (Banterle and Cavaliere, 2014; Bui and Fazio, 2016; Cavaliere et al., 2016, 2017). In this context, despite the fact that technological innovation in the food chain can play a strategic role in coping with the evolution of the consumers’ needs and choices, evidence suggests that consumers tend to appreciate technology applications in general and, conversely, find food technologies risky (Lusk et al., 2014).

As a consequence, the academic interest towards food products produced with innovative technologies has increased and a specific attention has been paid on the factors that could explain consumer acceptance or skepticism with regard to these new technologies (Magnusson and Hursti, 2002; Biltekkoff, 2010; Verneau et al., 2014; Ferrazzi et al., 2017). Moreover, for the specific case of Italy, Eurobarometer data showed the lowest percentage of respondents who think that both science and technological innovation as well as people’s actions and behavior will have a positive impact on the availability and quality of food (European Commission, 2014). In addition, the highest proportion of respondents who consider food origin as important can be found in Italy. Indeed, almost 70% of the respondents were aware and interested in the Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI) logos (European Commission, 2012). This is the peculiarity of the Italian population, which translates to a great preference for high quality, typical, and niche food productions and a high adherence to ‘Made in Italy’ products (European Commission, 2012).

In this frame, the purpose of this paper is twofold: first, to analyze consumer acceptance towards new technologies in food and, second, a special focus on Shelf Life Extension, which is considered to be one of the most sustainability-driving food innovations. Plenty of studies have focused on new innovation technologies in the food sector, such as bio-fortified food, nanotechnology, and transgenic food, but, to our best knowledge, the acceptance of Shelf Life Extension technologies has been scarcely investigated (Magnusson and Hursti, 2002; Stevens and Winter-Nelson, 2008; González et al., 2009; Vandermoere et al., 2010; Bieberstein et al., 2013; McFadden and Lusk, 2014; Stranieri and Baldi, 2017).

The target group for the analysis is represented by the Millennial Generation (MG), in particular, the college student category of the MG, aged 20–25 years old. The MGs are considered more knowledgeable than others with respect to the environment, and they are more global and community oriented and less brand-loyal (Harris et al., 2011). They are also more concerned about the environment and the ethical attributes of products (Schubert et al., 2010; Lozano et al., 2013; Vicente-Molina et al., 2013; Zsóka et al., 2013; Gustin and Ha, 2014; Sloan, 2014).

This paper is structured as follows: the next section presents the main characteristic of Shelf Life Extension technology, and Section 2 describes the conceptual framework followed in this study. Moreover, the third section explains the details of data collection and the methodology applied; the fourth section provides the results and discussions. Finally, the study’s conclusions and limitations are presented in the fifth section.

1.1. New food technologies: why the Shelf Life Extension?

Shelf life is the period of time before a food product is considered unsuitable for consumption or sale. During the last several years, reliable methods have been developed to extend the shelf life of food products through formulation, processing or packaging innovations (Soliva-Fortuny and Martín-Belloso, 2003; Deegan et al., 2006; No et al., 2007; Banerjee et al., 2016; Odueke et al., 2016). Active packaging and modified atmosphere packaging are widely used as a supplement to refrigeration to delay spoilage and extend the shelf life of fresh products while maintaining a high-quality end-product. The most recent innovation in this sector introduced the adoption of ‘mild’ technologies that are able to preserve the nutritional and organoleptic characteristics of food products. In these recently developed innovations, antimicrobial compounds can be incorporated into the packaging films or coatings in order to maintain high concentrations of preservatives on the surface of foods for a longer storage time (Choulia et al., 2007; Yuan et al., 2016). Natural food preservatives can help in ensuring protection from both spoilage and pathogenic microorganisms by using low concentrations of essential oils in combination with other preservation technologies, such as low temperature (Scandamis and Nychas, 2001), low dose irradiation (Parkas, 1990; Choulia et al., 2007), high hydrostatic pressure (Devlieghere et al., 2004) and modified atmosphere packaging (Marino et al., 1999).

The extension of the shelf life of food products is considered to be one of the most strategic tool to improve the overall sustainability of a food product along its entire supply chain. Indeed, this technology can help in counteracting food waste, which is responsible for 17% of direct greenhouse gas emissions and 28% of material resource use (Priefert et al., 2013). A recent EU Resolution (European Commission, 2010) stated that food gets wasted in approximately 89 million tons per year throughout the entire food system from households (42%), manufacturers (39%), retail (5%), and catering (14%): there is a potential for the spoilage of food products at any stage of the supply chain when the products reach their ‘best before’ or ‘saleable date’. As a key strategy to tackle the problem of food waste, there is a trend towards developing Shelf Life Extension solutions that are intended to facilitate supply chain management by reducing the production and delivery lead times, thus increasing the low predictability and stability of the supply logistic strategies (Amani and Gadde, 2015). For consumers, the positive impact of Shelf Life extended products relies on improved convenience attributes in response to consumer demands for less time spent on shopping and cooking. Moreover, the longer shelf life period should increase the consumer’s ability to manage food provision, storage and preparation and, consequently, minimize domestic food waste.

2. Consumer acceptance of new food technologies

Consumer’s perception and acceptance of Shelf Life Extension is a quite new topic of investigation, although new food technologies have already been intensively investigated. Summarizing the main topics driving the controversies around new food technologies, trust represented one of the main important factors (Costa-Font et al., 2008; Vandermoere et al., 2010), indeed, food neophobia, described as the propensity to avoid new foods, can also be a consequence of the lack of social trust. Another factor that can influence the benefit-risk perception was media coverage (Fox et al., 2002; Roosen et al., 2011): food scares and worries are examples of how the media can sway the public’s perceptions of risk. Nevertheless, it would be erroneous to blame the media for the public’s unbalanced responses to such events, even though their influence is important and sometimes detrimental to the public’s understanding (Ventura et al., 2017). Also, cultural cognitions and worldviews, including food values (in particular, naturalness) have
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