CONSUMER PERCEPTION OF NEAR-EXPIRY FOODS AND RETAILERS PRACTICES TOWARDS IMPROVING SUSTAINABILITY PERFORMANCE

DOI: 10.26341/issn.2241-4002-2024-2b-5-T02108

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Abstract
International studies on food waste highlight that it is critical to reduce or even eliminate food waste, towards meeting sustainability goals. In this direction, consumer behavior is essential as well as how businesses prevent generation and management of such a waste. Date labels are one of the main external indicators that have a decisive role in the purchase of near-expiry foods. In addition, food retailers are in a strong position to influence the reduction of food waste by producers, manufacturers and consumers, by managing dynamically products prices to increase 'last moment' demand and reduce thus food waste.

In this respect, the present paper aims to study consumer's perception of nearly-expired products. Moreover, it turns the focus to practical aspects of the subject, namely to retailers' pricing policy and practices towards reducing expired products and eventually waste.

A survey that has started at the end of summer of 2023 (211 participants till October 2023) revealed that indeed many consumers buy the products that offer them the highest benefit at the price offered, due to their expiration date. In addition, they believe that it is more sustainable to lower the price of a product so that it does not remain on the shelf. In this context, they need to be better informed about the expiry date of the products, as well as the dynamic pricing policy of the retailers and subsequent prices drop. These paper findings provide useful insights for retailers to improve their inventory management performance and reduce food waste.

Keywords: *Nearly-expired foods, food waste, sustainable consumption, consumers, sustainability, date labeling*

Introduction

Food waste is one of the main points of the scientific debate and is part of the countries' political agenda in the EU. In fact, with over 1 billion food items thrown away worldwide, amounting to 750 billion dollars, food waste has become topical and one of the priority issues of the European agenda (Marciante and Mezzacapo, 2016). It is estimated that over a third of

the food produced worldwide goes to waste (Gustavsson et al., 2011). The United Nations have recognized this challenge in Sustainable Development Goal (SDG) "Ensure sustainable consumption and production patterns" (Huang et al., 2021). Food that is intended for consumption but remains unsold and unused also has significant environmental impacts (Albizzati et al., 2019). This may also be reflected as a cost to retailers where landfill tax and other compliance duties are imposed (Huang et al., 2021).

Sustainable consumption has recently become a dominant issue in consumer decisions in which both personal needs and social responsibility are considered (Marciante and Mezzacapo, 2016). Food waste occurs at every step of the food chain. Therefore, mitigation should be a common goal and responsibility shared among actors in the food chain (Kasza et al., 2022).

According to Borda et al. (2020), ignorance of the expiry date of perishable products, inadequate handling of spoiled food and irresponsible handling of leftover meals in order to avoid food waste are among the most common food safety problems at the consumer level. Through research it has been pointed out how food waste arises as a result of the business practices of retailers (Huang et al., 2021), such as food safety, use of confusing date labeling, lack of staff training and available resources and/or marketing that encourages hyper marketing. Food waste causes excessive use of natural resources and produces emissions during disposal and decomposition (Bech-Larsen et al., 2019).

"Expired food" is defined as products that deviate from normal or optimal products based on their date labeling (e.g. near or beyond the best-before date) (Schmidt, 2019). Many studies report that there is enough evidence that household food waste is due to food having passed the best-before-date. It is not easily understood by most consumers that the stated expiration date is good to consume until then and not that it is forbidden to consume within a short time after it (Collart and Interis, 2018). Consumer misconceptions about the meaning of date labels cause food waste and also feed into the decisions of food vendors, who typically remove food from their shelves two to three days before the expiration date (Gunders and Bloom, 2017).

Best before date labels are not related to food safety, but are used by food manufacturers to indicate maximum quality (Collart and Interis, 2018). The Waste and Resources Action Programme (WRAP) in the United Kingdom, recommend several political actions in order to improve consumers' understanding and application of date labels (e.g., by further clarifying the meaning of the terms "best-before" and "use-by", by extending best before or use-by date time periods where possible (Schmidt, 2019). Date labels are one of the main external indicators that have a decisive role in the purchase of near-expiry foods.

Considering these issues, the present study investigates the problem of how to manage the stock of perishable products and food in general. In addition, ecological awareness in food retailing and the use of dynamic pricing with the help of new technologies are studied. Generally, consumers' intention to purchase dynamically priced foods close to their expiration date is investigated.

Sustainable consumption in cities and nearly-expired foods

Circular economy systems aim to improve efficiency, reduce waste in production processes and extend product life (Camilleri, 2021).Several theories have stated that effective monitoring and control procedures can be applied at all stages of production, distribution and consumption in turn, to minimize the costs of externalities, including pollution and emissions. Greenhouse gas emissions could be eliminated if food waste were reduced to zero (Camilleri, 2021). Food waste reduction strategies could potentially contribute to sustainable development by aiding food recovery and redistribution efforts, conserving natural resources and saving businesses and consumers money (Collart and Interis, 2018).

While the poverty rate in Europe is increasing due to the economic crisis and more and more people have to use Food Banks to collect products to meet their daily needs, at the same time millions of tons of food are thrown into landfills in European countries every week (Adenso-Díaz et al., 2017). The EU produces around 88 million tons of food waste, at a cost of around €143 billion. An estimated 20% of all food produced is lost, while at the same time 33 million citizens cannot afford a quality meal every other day (Camilleri, 2021).

Even more difficult is compliance in business. According to the U.S. Food and Drug Administration, between thirty and forty percent of the nation's food supply goes to waste every year (HOTREC, 2017). In some cases, up to 15% of perishable products are discarded due to spoilage or damage. Many retail companies have included waste reduction as one of their operational goals and performance indicators (Adenso-Díaz et al., 2017).

In terms of food consumption, the effects of social norms are often more pronounced on food choices than perceived risks of compromising food safety, as socially "correct behavior" acts as a dampener. For example, people may fear being judged for throwing away food, so they prefer to consume an expired product if they believe it would be more acceptable to their social environment. Other examples include confusion about food labeling and the ban on selling food after the expiry date in some Member States (Kasza et al., 2022).

Minimizing the amount of waste and unnecessary use of resources are among the principles of sustainable consumption. Preventing food waste is essential as food waste incorporates uneaten food and all the inputs used to produce it (e.g. arable land, fertilizers and pesticides, water, animal feed, energy, human resources. Apart from environmental impacts, ethical aspects (e.g. fighting hunger) and economic (e.g. production costs, household budget) are not negligible (Kasza et al., 2022)

As an example are some countries, which have already designed and are implementing policies for the management of the waste of each country. Bulgaria introduced the National Waste Management Plan 2021–2028, the Greek Ministry of the Environment set a strategic goal for the period 2021–2030 (Perkoulidis et al., 2022), Hungary aims to reduce food waste and losses through the National Management Plan Waste 2021–2027, and Romania ordered "Government Decision 92/2021" on its waste regime (Dobre-Baron et al., 2022). Incentives such as tax credits for companies that save donated food also exist in some EU countries (Kasza et al., 2022). The Horizon 2020 research and innovation program challenges food waste and aims to reduce it by 50% by 2030 (Marciante and Mezzacapo, 2016).

Through research by Schmidt (2019) it is reported that consumers have a positive intention to prevent the immediate disposal of expired food. At the same time, they have a negative attitude towards immediate consumption of expired food, as well as high subjective norms. The habits of the participants in this research, and therefore consumers, to immediately discard expired foods as well as the perceived health risks of consuming expired foods proved to be strong barriers to their performance.

In a study conducted by Wansink and Wright in 2006, they found that labels indicating freshness (ie, "best before…") influenced consumer perceptions of food freshness and "healthiness" but not the safety or danger of consuming them. In 2005, Tsiros and Heilman conducted a hypothetical survey with an open-ended willingness-to-pay question, examining how willingness-to-pay changes as a product's expiration date approaches, and found that willingness-to-pay decreases over time (at varying rates depending with the product). The main reason for consumers to buy almost expired food in 2020 is that they buy the goods they need at low prices, which means high price preference (Song et al., 2021). Liu et al. (2018) define dynamic pricing as assigning different prices to items of the same category, taking into account their individual characteristics and changes in their condition.

Through the research cited in Collart and Interis (2018), it was found that in stores, if consumers are indifferent when choosing between non-expired and expired food items

(probably at discounted prices as the experiment showed), retailers can to leave food on the shelves (if allowed by law) rather than remove and possibly throw it away. Compared to other foods, near-expiry foods have the characteristic of having a shorter shelf life, so the date label information is the most important product indication in the purchasing process (Song et al., 2021).

Nearly-expired foods

The problem of how to manage the inventory of perishable products has been extensively researched since the 1970s (Adenso-Díaz et al., 2017). Consumers are most willing to consume foods past their “use by” date and least willing to eat beyond their “sell by” date (Song et al., 2021). Some researchers have also pointed out that consumers are more likely to consume foods if they exceed the "best by" rather than the "use by". The reason is that consumers intuitively believe that "best by" represents quality, while "use by" represents safety (Wilson et al., 2018). There is an opinion that a date label should be set to represent the safety and not the taste of the product in order to extend the selling time of the food and consequently increase the purchase by consumers (Wilson et al., 2018).

Shelf-life information is a way to describe the quality, health and other utility characteristics of food (Newsome et al., 2014). When it comes to unhealthy foods, consumers pay less attention to the usability of the food and are indifferent to information related to expiration time (Wilson et al., 2018). In contrast, when it comes to healthy food, consumers will pay attention to the utilitarian properties of the food, so it is more sensitive to expiration time information. Many foods have date labels that indicate when the quality is expected to deteriorate. Consumers often misunderstand these labels, resulting in excessive discards. The “sell by” date precedes the date when freshness is expected to begin to decline and is not intended to address food safety (Neff et al., 2015).

In the case of fresh food, the value of the item decreases significantly over time, so the retailer must lower prices, sometimes significantly, to sell more of these products (Lee and Tongarlak, 2017). The longer time period gives consumers more choice about when to consume and reduces the chance that the product will spoil before use. Consumers' willingness to pay for perishable items decreases as they approach the “sell by” (Chung, 2019). Some stores may be reluctant to sell low-quality fresh produce because not only do they have a low profit margin, but their discount policy doesn't fit with the store's image (Lee and Tongarlak, 2017). In some cases, however, in addition to reputational risk, there is also the risk of selling already obsolete or damaged products that may endanger lives and would require further compensation (Adenso-Díaz et al., 2017).

Through research (Lee and Tongarlak, 2017) it was observed that some stores can reduce food waste by implementing by-product synergy, i.e. they focus on using the remaining fresh products to prepare ready-to-eat foods (Gustavo Jr et al., 2021). As an example, Whole Foods removes products from its fresh produce department for use in its prepared foods department. That is, the can of cabbage is used to make coleslaw, the avocado to make guacamole, the apples to make apple pie, etc. (Whole Food’s Market, 2004). In addition, Tesco makes smoothies using excess fruit. An advantage, beyond simply reducing the price of fresh produce, is that prepared food can be positioned as a high quality product with a high price (Lee and Tongarlak, 2017).

Development of marketing policies and strategies for products that have already passed the expiry date may also be necessary, as long as the food is still fit for human consumption (Gustavo Jr et al., 2021). Green Marketing (GM) deals with all marketing activities that have helped to cause environmental problems and that can serve as a remedy for environmental problems. Over the years, GM has evolved and structured into a broader concept, sustainable

marketing (Gustavo Jr et al., 2021). GM can also help leverage the sustainability of supply chains, enhancing the performance and competitiveness of organizations.

Through research by Chung (2019) "popular" perishable foods are sold with their full shelf life remaining and do not generate waste regardless of the chosen pricing and display shelf management strategy and shelf life. For less popular perishable food products, in which the target amount of inventory exceeds average demand, displaying all available units and discounting the price of units as days pass could help retailers reduce inventory obsolescence.

In other countries

Cultures vary in promoting proactive approaches to food waste, versus stigmatizing overly wasteful moves (Neff et al., 2015). It is reported that, in addition to the reasons for rejecting food, which may be disgust or habit, cultural perceptions of "when it ceases to be food" also play an important role.

Danish food retailers implement expiration date pricing and implement direct promotion-communication about such food waste activities (Bech-Larsen et al., 2019). All stores based on research by Bech-Larsen et al. (2019) apply some kind of price reduction based on the expiration date. Some stores apply this policy horizontally to all perishable foods, while others apply it only to sensitive products, such as dairy, meat, etc. Note, moreover, that the size of the price reduction on such products varies, per store and per product.

According to the report by Neff et al. (2015) one in four US consumers say they always throw away food after the "sell by" date because of food safety concerns for their own health.

In France, a law was passed that prohibits supermarkets from throwing away unsold food. A food waste bill with similar provisions to the French law was also proposed in the UK in September 2015, and there is a move to extend the law to other countries in the European Union (Lee and Tongarlak, 2017).

Digital applications-platforms/ Start-ups

Digital technologies offer them the power of connection capable of connecting a multitude of people beyond spatial and temporal limitations. This favored the possibility for the consumer to implement practices oriented towards more sustainable lifestyles: aware and responsible consumers have the opportunity, through ICT, to ask more, to exchange opinions, to express opinions (positive or negative) concerning a product, a company or a specific type of consumer (Marciante and Mezzacapo, 2016).

Examples with companies

- ***Ifoodshare.org*** is a non-profit organization. Created by three young Sicilians in 2013, this platform allows excess or nearly expired food sharing at the national level. For access all you need is a free registration in the application. Once enrolled in a specific sector, donors and beneficiaries can access their private area and enter the surplus food or certain amount of food in terms of food baskets, indicating the expiration date of the products and the location of the donor (Marciante and Mezzacapo, 2016). Beneficiaries can message donors to arrange for product pledge. Directly in the system they appear unavailable for binding by other consumers. The transition is performed without any money. The users are mainly women (60%) between the ages of 24 and 44. This project was inspired by a similar German experience known as Foodsharing, which is one of the most established and organized in Europe.
- On December 12, 2012, the platform "***foodsharing.de***" went online. Some companies, restaurateurs and supermarkets have committed to reducing food waste, supply chains

have become more efficient and corresponding offers and discounts have been introduced on products close to the "sell by" date. The primary goal is to halve and then end food waste by 2030. The foodsharing.de exchange platform is free, non-commercial and ad-free. Activities are based on voluntary and charitable commitment. Food storage and sharing is free. Foodsharing is an environmental organization with the purpose of conserving resources by using edible food instead of wasting it. Food is distributed to everyone through the use of the platform.

- ***Ex-Change food*** is a web platform created in 2014 as a project of young coworkers in Bologna. The main goal of the Ex-Change platform is to connect and provide people with the opportunity to share food that is expiring or soon to be discarded, especially among local communities. A geolocation system encourages exchange between people living in nearby areas. The platform does not assume any specific responsibility for the exchange.
- ***Breading.foundation*** was created in 2014 as a start-up project and was financed with one hundred thousand euros by the international telephone company Vodafone. In particular, Breading focuses on connecting small-scale retailers, such as bakers and local shopkeepers, through a geo-location system, with a third sector of associations involved in redistributing surplus food to economically vulnerable people in order to exchange such food.
- ***NoWaste.gr*** is an evolution of ***kontoliχima.gr***. Kontoliχima.gr is the first Greek platform exclusively for products that are close to their expiration date. Through their services, consumers can easily, quickly and efficiently locate the short-selling products sold in the nearest supermarket and retail stores. Goal is to create a specialized platform that will be a point of reference at a nationwide level, for all perishable products, not just food. The price gradually decreases as the product approaches on its marking date, as additional discounts apply. The consumer can buy or locate the products directly through the application. Thus, there will be profit for buyers, sellers and the environment. Locating the products is very simple, as kontoliχima.gr can locate the location of each user and show them the nearest cooperating stores on the available map. In addition, the user has the possibility to apply search filters such as: (expiry date, distance, discount rate, price, offers, etc.) and locate the short-listed products he wants from the comfort of his computer. He can then receive directions to the stores he is interested in, create shopping lists to organize his shopping and share products with his friends who may be interested.
- ***Mystery Pot*** is a Greek platform and it has developed a free mobile app that enables consumers to get fresh food that runs out at the end of the day at food outlets for a third of the price. The "Mystery Pot" platform connects consumers with stores that have excess food. Unsold fresh meals are available at the end of the day at a lower price. Mystery Pot works like this: the consumer opens the app and searches for surprise packages of food from stores in their area, the composition of which has been taken care of by catering companies. He reserves the secret package from the store of his choice and goes there, an hour before it closes, to collect it. For each store there are one or two mystery pots. The consumer does not know the contents of the bag he receives - usually it is a complete meal - so the whole process takes on a game character.

Study's methodological framework

To conduct this research, a structured questionnaire was used to collect primary data. The questionnaire was conducted online through the application provided by Google, Google Forms. The final sample consisted of 211 people who answered the questionnaire thoroughly.

Main results

In the questionnaire, the respondents who participated were 32.70% men, while the majority with a percentage of 67.30% was women. The majority resided in Attica and belonged to the age group of 26-35 years, with most of them being graduates of higher education.

Figure 1. See the prices of the products

Figure 1 shows that most of the research participants, 93.36%, see the prices of the products they buy, while only 6.64% do not monitor them.

An attempt is made to capture the extent to which participants monitor the prices of the products they purchase. In the vast majority of them it seems that they monitor the prices from moderate to very much, as with 32.83% and 30.81% they monitor moderately and very much respectively. Very close to these percentages are the 27.27% of respondents who monitor product prices too much. Only 7.58% and 1.52% monitor the prices of the products they buy a little and not at all respectively.

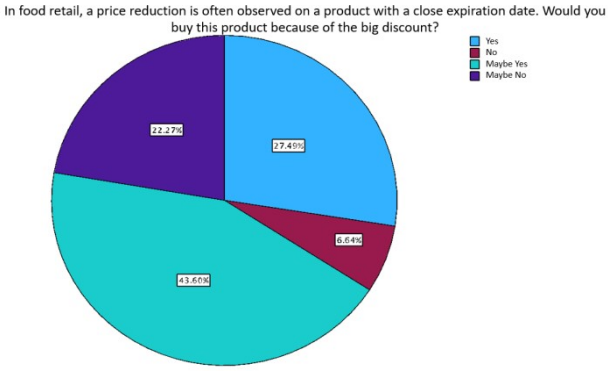

Figure 2. Probability of purchasing a product with near-expire

Figure 2 shows that 43.60% of the participants would probably buy a product with a close expiration date because of the big discount, and 27.49% would definitely buy it. 22.27% answered that they would probably not buy this product, while only 6.64% stated that they would definitely not buy such a product.

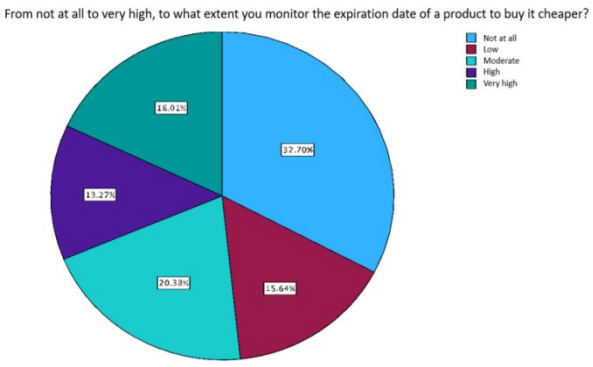

Figure 3. Degree of tracking a product's expiration date in order to buy it at a lower price

In figure 3 the respondents are asked to state the extent to which they monitor the expiry date of a product in order to buy it at the lowest price. 18.01% and 13.27% monitor product expiration dates very much and very much respectively. 20.38% attend to a moderate degree and 15.64% identify their degree of attendance as little. 32.70% declare zero degree of attendance.

As it was realized from the results of the questionnaire, 72.99% of the participants answered that they consider themselves ecologically conscientious citizens, while 27.01% disagree with this formulation.

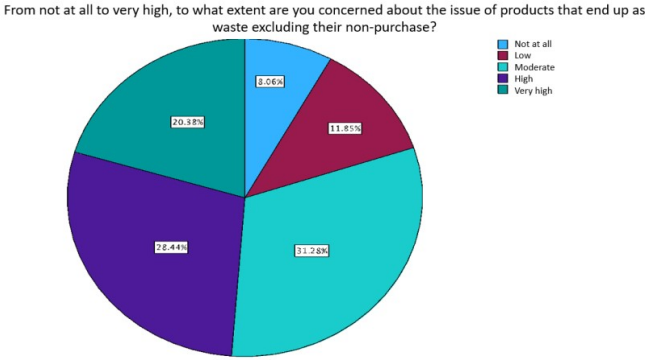

Figure 4. Environmental awareness in food retailing

20.38% and 28.44% are very and very interested respectively in the products that end up as waste in the food supply chain due to not buying them. 31.28% of the participants in the research state that the extent to which they are concerned about the specific issue is moderate, while only 8.06% and 11.85% are not interested at all and a little respectively (Figure 4).

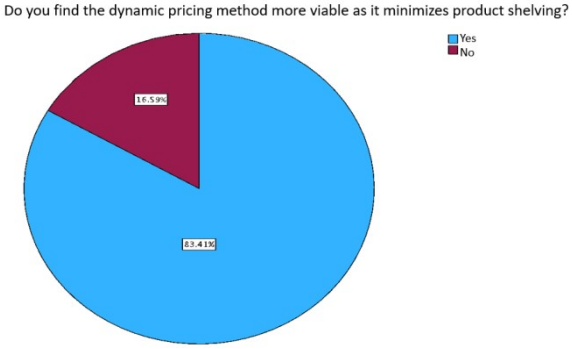

Figure 5. Assessing dynamic pricing for its viability

In figure 5, 83.41% of the survey participants consider it more sustainable to dynamically price a product so that it does not stay on the shelf, compared to 16.59% who disagree with this pricing method in terms of sustainability.

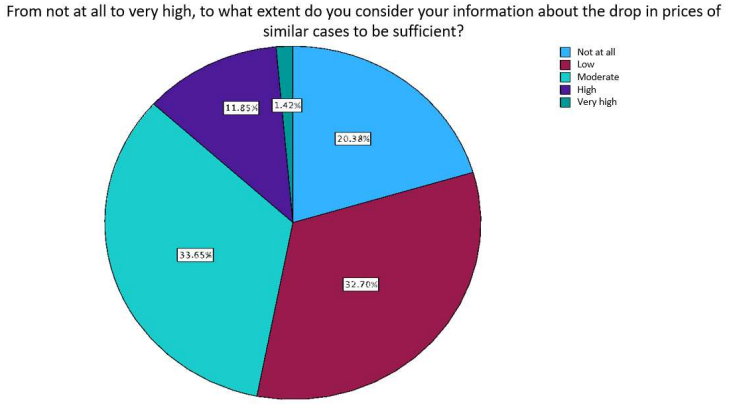

Figure 6. Price drop update rating

The respondents do not consider their information about the drop in prices of products with a short expiration date to be sufficient as 20.38% consider that they have no information, 32.70% consider that this information is little and 33.65% identify his level of awareness as moderate. Finally, only 11.85% and 1.42% consider the adequacy of their information as too much and too much respectively (Figure 6).

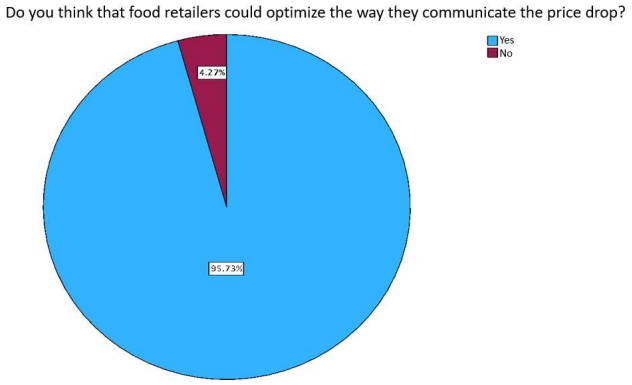

Figure 7. Optimizing ways to communicate price drops

Figure 7 show that 95.73% of those who responded to the questionnaire believe that food retailers could optimize the ways in which they communicate price drops on short-expiration products. Only 4.27% answered negatively to this question.

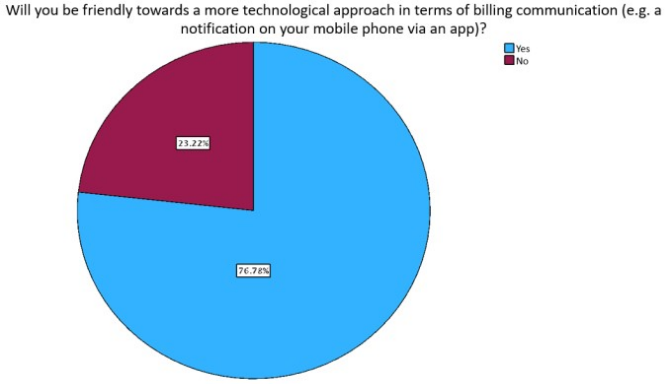

Figure 8. Predisposition of consumers towards a more technological approach to their information

Figure 8 shows that 76.78% of respondents would be friendly towards a more technological approach to communicating dynamic pricing such as a notification on their mobile phone via an app. However, 23.22% of them answered that they do not have a positive disposition towards this fact.

Discussion

According to the findings of the research, consumers make their purchase decision for products with a discount by weighing the benefits and costs of the product, as mentioned in a corresponding research by Lippman et al. (2003). More specifically, consumers buy the products that offer the highest benefit with the price offered.

Liu and Van Ryzin's (2008) research focuses on the use of radio frequency identification (RFID) technology to collect product quality data and subsequently implement dynamic pricing. The results show that applying dynamic pricing to perishable food based on RFID data leads to higher profit. Dynamic pricing is particularly advantageous when the rate of decay of a food is high, i.e. when the quality of the product decreases rapidly. Based on this, consumers seem to be ready to buy a product at a deep discount. Based on the research

conducted, consumers seek and would be positively willing to have an application that informs them about the quality and price of the products (Liu and Van Ryzin, 2008).

Perishable food management has a significant impact on the revenue of super markets in today's competitive markets. While many retailers implement a price reduction strategy as products approach their expiration dates, some use a flat price strategy on fresh produce. In addition, dynamic pricing also has an impact on food waste. In this research, the participants state that they closely monitor the drop in prices due to the expiration date, but also that they consider it more sustainable to dynamically price a product so that it does not stay on the shelf. Corresponding data is also reported in the research of Teller et al. (2018), who state that food waste at the retail stage imposes high costs on retail stores, as operating costs are usually high, while overall food margins are lower. In addition, Sanders (2020) states that consumers want to have more information about the expiration date of products and the possible drop in prices, as the majority of participants cited.

Yang et al. (2022) suggest that dynamic pricing based on quality is critical to the efficient sale of fresh produce and that the incorporation of information disclosure allows the retailer to maintain prices high during the selling season. In this survey, the vast majority of participants state that the communication of discounts is minimal and they would like more timely information from digital media, but also from store employees.

Limitations and Future research directions

This particular study, carried out on a small sample of consumers (n=211) for research conducted at a nationwide level, and consequently no generalized results can be obtained.

One suggestion is to study a corresponding survey to capture the opinion and behavior of consumers who will be studied at time intervals in the same places, so that the factors of food waste are understood. In addition, this paper can be further investigated by making correlations (x2) between the critical variables, drawing co-interval conclusions.

A future survey can delve deeper and with more targeted questions to both consumers about using or not using near-expiry foods, and companies about how they manage them. Finally, it is proposed and studied for future action, the construction of a mobile application to notify consumers who are in close proximity to a food store or that the consumer himself follows about the products that reach their expiration date and the reduction of the price they have with the passage of days.

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