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Research Paper

How Digital Media can help fight food waste[1]

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ABSTRACT

Purpose: This study intends to understand how digital media can help raise consumer awareness of the importance of combating food waste. For this, two issues were investigated: if individuals are aware of this problem food; and if are willing to learn about digital tools that promote combat this type of waste.

Methodology: To assess the willingness of individuals to join digital media to combat food waste, an online questionnaire was administered to 211 individuals. The data collected were analysed thought of multivariate statistical techniques.

Findings: Most consumers proved to be aware of what food waste consists of using various strategies to reduce it. However, a consumer segment with little knowledge about this topic emerged. This segment said they didn't know any brands or applications to combat food waste, but when confronted with their names, they said they knew or at least had heard of them, and subsequently demonstrated the desire to deepen or acquire their services.

Originality: Understanding how digital media contribute to consumer awareness of the importance of combating food waste can help marketers design marketing strategies on this topic. Furthermore, the present research contributes to current literature on fighting food waste.

Keywords: Food waste, digital channels, marketing, food, strategy.

1. Introduction

Nowadays, the world and people are in constant change, whether by habits, behaviours, or thoughts. Globalization was one of the factors that most contributed to this change, and consequently more ideas come forward that could improve the world we live in.

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Globalization stems mainly from the evolution of technology, where an inhabitant can be informed to the second about situations that may be happening on the other side of the world, and this is a key issue to be addressed throughout the article (Ammi, 2007).

Food waste is one of the main problems in the world, and according to Reynolds et al. (2019) FAO reports one-third of the food produced in the world is wasted every year without being consumed. The main objective of this article is to understand how people know what food waste is, how they combat it, and especially how digital channels and technologies affect or help their behavior.

Increasingly, there is more literature that observes and studies how digital devices and platforms are being used to incorporate new sustainable consumption practices. For example, how QR codes can promote sustainable shopping (Atkinson, 2013), how blogs become intermediaries that assist consumers in interpreting complex sustainability issues and convert them into practical advice on how to consume sustainably (Joosse & Brydges, 2018) or still the potential of online communities in promoting sustainable consumption, showing how these online spaces enable the dissemination of environmental knowledge and environmental dialogue (Rokka & Moisander, 2009). The literature also provided an understanding that critics and advocates that digitization station of sustainable consumption assumes a similar position that presumes that technologies will be successful in promoting more sustainable forms of consumption (Fuentes et al., 2021). However, there is still very little research regarding the quantification of food waste management by commercial food services (Martin-Rios, et al., 2021).

In this sense, a literature review was conducted to understand the most relevant issues on the theme under study and some authors' ideas and conclusions that would later be or not verified by the methodology applied. The methodology used in this study was composed by the of reparation and application of a questionnaire, and the data collected was processed in ordtor some of the assumptions illustrated in the literature review, such as: (i) what is the cause of greater food waste by consumers; (ii) what is the relationship between the cause of waste and the area of residence; (iii) how do people adhere to digital media to reduce waste and support these causes, and (iv) how do they consider digital media really important awareness in society.

Finally, it was possible to draw conclusions about the applied methodology and reconcile it with the hypotheses and theories, to agree with or corroborate the conclusions of those studies already carried out. It was also possible to present the main difficulties encountered in the research process.

2. Literature Review

2.1. Waste in the world and Portugal

According to the first report of UNEP - United Nations Environment Programme (2021) on the food waste index, this issue is one of the causes that contributes to the planetary crisis of climate change, thus being an issue that countries must urgently address, through the implementation of measures to reduce this same waste.

Also in this study, it was possible to verify that, in 2019, waste from households, retail establishments, and food service industries was proximity 931 million tonnes, of which 570 million tonnes, about 61%, of this same waste, occurs at the household level, i.e., at the level of the final consumer. In this sense, about 17% of all food produced in the world

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is wasted, 11% of this at the household level, which means that each person (per capita) wastes about 74kg of food per year (Forbes et al., 2021).

The report also proves that the amount of food wasted per year is remarkably similar in low-middle-income and high-income families in a given country. This may be an indicator that income is not directly related to waste:

Hypothesis 1 (H1): The amount of food wasted is related to family income

In Portugal, even though in a very small percentage about the total of world, about 1 million tons of food is wasted every year. These figures have led to the publication of a set of measures by the Commission for the Fight against Food Waste, which include the physical and virtual world, such as publishing the statistics panel of food waste levels regularly as well as the creation in the portal of official statistics of an area dedicated to this topic; promoting the development of innovative processes (such as the opening of companies and applications that encourage the reduction of waste); facilitating and encouraging the food donation scheme; promoting specific places for the sale of products at risk of waste; among other measures (CNCDA, 2020).

2.2. Food waste

Food waste can be characterized in different ways since it depends on what is wasted and how it is done. This concept is sensitive in various cultures, since what may be considered waste in a given country may not be for another, therefore depending on the culture of each one of them (Gjerris & Gaiani, 2013).

In this sense, and to standardize the concept of food waste, the author's Quested et al. (2013) defined three central designations to categorize it, which can be an (i) non-avoidable, (ii) partially avoidable or (iii) avoidable waste.

Respectively, (i) non-avoidable food waste is characterized as portions of food that are no longer suitable for human consumption, examples being fish bones and bones; (ii) partially avoidable waste corresponds to food or its constituents, which even after cooking can be reused, such as the peel of a lemon to make tea. Finally, (iii) avoidable food waste corresponds to food that at some point before its disposal is considered edible and in good condition for human consumption.

We can also see that, generically, food waste occurs at various stages of the food value chain, and in developed countries about 24 million tonnes of the waste comes from food services and primary production (Stenmarck et al., 2016). Commercial food service, on the other hand, where the hospitality sector is included, is third in the food value chain in terms of the amount of food waste produced. Consumer food services include restaurants, fast food chains, cafés, café, as well as catering for events (Martin-Rios, et al., 2021).

There are also authors, who define food waste as food fit for human consumption but which is discarded or left to deteriorate at the consumer level, regardless of the cause, i.e. if the consumer lets the product past its expiry date, if the food gets some kind of fugus, if there is loss of product quality along the supply chain before reaching the final consumer or even by purposeful waste caused by the person (HLPE, 2014). In this perspective, it is possible to formulate the following hypothesis:

Hypothesis 2 (H2): The frequency of waste is related to its cause

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According to Parfitt et al. (2010), the stage of the supply chain that presents the greatest food waste is the consumption stage, because according to the authors it is at this stage that there are more causes for this phenomenon to happen, and the main ones being: the loss of product consumption by passing the expiry date; the storage of food in inappropriate preservation conditions; the acquisition and preparation of meals in exaggerated quantities; the ignorance of the information contained on the labels; the aesthetics of the products that subsequently affect the criteria of choice of consumers, all can lead them to reject the product and the lack of awareness and knowledge that lead to large amounts of food waste (Parfitt et al., 2010).

2.3. Digital Media

Digital media are becoming more and more widespread among consumers, even becoming part of the daily life of today's society due to the increasing rise that the digital world has had (Primo, 2000). This same increase and transformation occur, mainly, due to the changes that the world and people have undergone, since, with globalization, people have become more informed and demanding, thus, asking for continuous improvement and adaptation through digital media and means of communication, so that they do not become obsolete. According to Recuero (2011), one of the biggest changes for society was its possibility of expression and sociability through these communication tools mediated by a simple device (computer, tablet, mobile phone, among others).

The information does not focus only on written documents (paper) on radio and television but also started to be communicated through various platforms, mostly online (França, 2001). This is a consequence of digital adaptation to society's evolution and their new way of communicating new content.

This theme is also related to digital marketing that according to Kotler et al. (2017) is defined through communication actions that companies use, through the internet and other digital media to disseminate and market their products and services to customers and maintain relationships with them and with regular customers. Also, according to several studies, it was possible to verify that nowadays, many people invest a large part of their time in social networks for a wide panoply of purposes. As a response to this change, marketers are investing a significant part of their advertising budget in digital marketing. Thus, with the growing phenomenon of social media and the development of platform technologies and applications for mobile devices, communication has become easier and, in some cases, more effective (Khomenko et al., 2020). This type of marketing is thus an evolution of the traditional, where their strategies go online, with a significant change in the way to communicate and build loyalty among the public.

Thus, in recent years, due to the influence of new technologies and the development of the Internet, new business models have emerged focused on the use of sustainable strategies within their social identity (Minton et al., 2012). With the development of these new technologies, the concept of sustainability has acquired links not only with the environment but also with sustainable development, the types of resources used by companies, as well as the technologies and tools used by companies (Li et al., 2019)

It can then be observed that the internet and digital platforms have become a tool for sustainable growth for many companies that now have to adapt their business models. These new business models are based on how internet users behave on social media,

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which also presupposes the analysis of the content generated by the user as well as the tools they use (Saura et al., 2019).

To verify if the people who participated in the methodology applied in this article are aware of the existence of this theme, and in what way they became aware of it, depending on their age, it is possible to formulate the following hypothesis:

Hypothesis 3 (H3): Age is related to the source of knowledge of the food waste issue

These online tools are increasingly powerful and when used by companies they can be a tool to create value with their clients and consumers. With the emergence of these new technologies, communication barriers have disappeared, and as previously mentioned, people can access any information instantly. Therefore, they are becoming more informed about what is happening in the world globally, including the environmental problems it is going through, thus becoming aware of how to help the planet, and in this specific case, how to reduce food waste (Giurea, 2015).

It was based on this thought and on this technology evolution that some companies relied on, to create a digital and physical service at the same time, through applications or websites, aimed at reducing food waste, which will be referred to in the following topic. Many of these new digital platforms for food waste reduction try, above all, to promote a more sustainable food consumption and to develop new ways of acquiring food through equally sustainable purchasing modes. Despite all efforts, food procurement is not only related to food cooking, but also to a set everyday practice involving other activities such as childcare or social engagements (Dyen et al., 2018). For this reason, promoting sustainable food purchasing is not an easy task, not least because habits and daily routines related to food are particularly difficult to change (Fuentes et al., 2019).

2.4. Companies that combat food waste

More and more companies want to join the challenge of creating a better world with less waste. In this way, they create services and applications which facilitate and encourage people to reduce waste. Although these companies have the same objectives in terms of reducing food waste, they also have points of differentiation, and may be linked to waste in restaurants, to leftovers or even to food that do not represent the ideal standards for sale and therefore are not made available to consumers in establishments.

In this sense, presented below are some of the companies in Portugal that provide one of these types of service, and inevitably show that marketing and digital media are here to stay, either through mobile applications and websites that they own, or through the communication that is done online in order to raise awareness and show this topic to people, and through the initiatives that are created to generate word of mouth.

The “Share Waste” application is aimed at all people who want to recycle their organic surplus, through composting or donating it to other people who have farm animals to feed, be it leftovers from meals or even potato or banana peels (Waste, 2021).

“To Good to Go” has several partners in the most diverse branches, from pastry shops to restaurants, and marks its differentiation through the sale of magic boxes, i.e., the users of this application can choose some order parameters, such as type of food (vegan or meat-based) or type of service (pastry shop or restaurant), however, they never know what the real content of the box is until they have it. It has also created initiatives such as the "Observe, Smell, Taste" label, which aims to raise people's awareness about consuming

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the food even after its expiry date if it meets the requirements of the test of the senses (Goo, 2021).

"Phenix Portugal" tries to compensate those who have excess food for those who intend to buy it or who do not have enough. This company in addition to making donations to local charities and donations for animal feed has an application where it is possible to make the sale of products that are removed from supermarket shelves, but that can still be consumed, with great discounts. This also benefits traders, because instead of the product being thrown away, it is sold, and this recovers a little more than the cost price of the product so that consumers also get a good deal and at the same time help the planet (Phenix, 2021).

Another example is the application "Refood", whose purpose is to help the most deprived and people in need, this being an application more business-oriented, i.e., supermarkets or even catering companies provide nutritious food and in good condition, which through volunteers, will get this food to the most disadvantaged and/or vulnerable people (Refood, 2021).

The "Karma" application has also shown very positive results. It is a platform that aggregates surplus food from cafés and restaurants that can re-sell the food to final consumers at a reduced price. In this way, consumers can help reduce food waste and cafés and restaurants can earn revenue through food and meals that would otherwise be wasted. Also, the "Olio" app allows food sharing, and "Reko-Rings" allows finding the best deals from local food suppliers.

With the examples presented it is possible to understand how these companies work and how they communicate with customers, whether through social networks, campaigns, apps or other digital media, managing to improve their notoriety every day and reach increasingly more people, making them change their thinking and adopt positive behaviours in the fight against waste, which can lead to the last hypothesis of this study:

Hypothesis 4 (H4): Knowledge of applications that deal with food waste is related with willing to purchase food or meals in digital media

3. Methodology

In order to achieve the objective proposed an online questionnaire was applied. The questionnaire was comprised of scales validated in literature to investigate the perception and motivation of individuals. Additionally, the sociodemographic characteristics were collected. A pilot study was carried out by administering the questionnaire to a small group of individuals from the area, to improve and understand its quality, to be subsequently distributed to the individuals in this sample, ensuring their total anonymity. The questionnaire was conducted via the Google Forms platform and administered online during the month of May 2021. It was distributed through digital channels, such as Facebook, Whatsapp, and Messenger, thus constituting a non-probability sample by convenience and snowballing. The sample gathered was 211 individuals (responses) of different educational qualifications, age ranges, regions, and incomes. Data obtained were extracted into the Excel program, where they were adjusted, and subsequently exported SPSS software. Following, multivariate statistical analyses were carried out.

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4. Results and Discussion

4.1. Socio-demographic Characteristics

A total of 211 answers were collected, of which 66.4% were women, 33.2% were men, and 0.5% were “Other". Average age of the individuals is 33 years, with 16 years being the minimum age and 67 years the maximum age of the respondent. However, individuals aged between 21 and 23 years (young people) were those who most responded to this survey. Regarding to education level, 58.3% of individuals have higher education, where 56.9% of the individuals say their household has an average monthly income between 601 euros and 1700 euros. 64.5% of the individuals live in the North region, and 20.4% come from the Centre region Portugal.

4.2. Perception about Food wastage

The results found demonstrate that 98.6% of the individual say they know what food waste consists of, with only 1.4% of individuals affirm do not know what this subject is about and therefore, in the last few months, they have not heard, seen, or read anything about waste. Of the individuals who assume to know what food waste consists of 77 of them have not heard, seen, or read anything about this issue, 101 respondents obtained some information, and 30 individuals answered, "Don't Know", so these data can show that even if it is not a daily subject, this is present in the thinking of the population. It was also observed that the information obtained on the subject was mainly through television or radio (15.6%), and social networks (11.8%) which also include the information transmitted by digital influencers, as well as the dissemination of brands to combat this issue, being residual the number of respondents for newspapers, articles, petitions, among others.

Concerning individuals’ behaviour 3.8% of respondents never waste food, 45.5% almost never produce waste, 22.3% waste on average 1 time per week and 13.3%, 2 to 3 times per month, with the remaining percentage divided between "waste 3 times per week" and "1 time per month". Thus, one can perceive that the sample under study tries, whenever possible, not to produce waste, thus showing that sensitivity to this topic is quite high. The main causes for this waste are the expiry date of a certain product, that represent 62% of the individuals answering, and the purchase and preparation of meals in exaggerated quantities, that represent 49% of the answers. The remaining percentage is divided between the storage of food in inappropriate preservation conditions, the aesthetics of the product and the lack of knowledge of the information contained in the product labels. However, when there are leftovers from meals, they almost always try to reuse them by reheating them and using them in the next meal (154 respondents always or often do this process), use these foods to make a new meal by adding just a few more ingredients (121 individuals always or often do it) or freeze them to eat later (60 respondents often do it).

4.3. Digital media to combate food waste

In this second part of the questionnaire, the aim was to understand how the digital media affect the wasting decisions of the sample under analysis, and how receptive they are to digital media as a solution to this food waste. In this sense, it was found that 35.1% never

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purchased food or meals through digital means (mobile applications, Social Networks, websites, among others), 30.3% rarely do so, 25.6% answered "Sometimes", and only 9% do so always or often, showing that they prefer to prepare their food at home or eat in a restaurant.

Thus, and relating waste with the companies/applications that try to combat this problem daily, it was found that more than half of the sample (51.7%,) did not know any of these, and only 48.3% said they did. However, when confronted with the names of these types of applications or organisations, the percentage of answers "I don't know any of the above" was 39.3%, which corresponds to 83 individuals. This data ends up being incongruous with the information they provided in the previous question, with the answer "I don't know any of the above" adding up to around 109 individuals. This may show that some respondents have heard the name of certain brands, such as “Good To Go”, “Fruta Feia” or “Phenix” (the best known among the sample under study), but do not associate it with the type of causes they advocate, and that these companies should try to do another type of marketing and communication to get more people aware.

Even so, 22 of these individuals have already purchased some product or service from these applications or companies. Of this sample, 87.7% say they have not purchased any of these types of services or products; however, 43.8% of these say they are willing to get to know these companies and subscribe to their online service, and 44.3% may consider doing so.

Even though there is a large percentage of individuals who do not use this type of service or applications, 97.2% think it is very important, significantly important or important to have this type of companies in the country providing an online service, and 92.4% of respondents think it is important or very important that these companies make more marketing campaigns in order to make the service and its cause known, and to raise awareness of the need to reduce food waste.

In this sense, the results show that this type of brands should invest more in Marketing, mainly digital, to reach more people and for them to be known not only by their name, but also by the daily work they do and the causes they defend, showing that digital is here to stay and that it is possible to reduce food waste worldwide.

4.4. Hypothesis Validation

The Hypothesis 1 postulated whether family income interferes with the quantity of food wasted or whether it remains the same among the groups. Thus, the Kruskal-Wallis test was used with the purpose of comparing the means of the family income groups, these variables being represented by an ordinal scale.

The test revel a p-value=0.297 (see Table 1), meaning that for a significance level of 5% the null hypothesis is not rejected, and it is found that the average amount of food wasted is similar for individuals with a lower income as for people with a higher income, thus these two variables are not related, meeting the theory proven in the UNEP report (2021). Thus, the Hypothesis 1 is not corroborated.

In order to understand whether, regardless of the cause that leads an individual to waste food, the frequency of this wastage is the same, the Hypotheses 2 was formulated.

As show the Table 1, the results revel a statistically significance (for a significance level of 5%, a p-value= 0.001) relationship between the causes for waste food production and

frequency of this wastage. Based on this result the Hypothesis 2 is validated. In this context, the theory of HLPE (2014) is corroborated, that individuals will waste food, whether it is because of the passing of the product's shelf life, its aesthetics, or even the leftovers that are thrown away instead of being put to good use.

In the Hypothesis 3 intends to assess whether age has related with source of knowledge of issue of food waste. The results (Table 1) demonstrate a statistically significance between two variables (for a significance level of 5%, a p-value= 0.002), that is, individual's age influence the source of knowledge of this theme, even if it is done through newspapers, articles, social networks, or other means, thus corroborating the initial idea.

Regarding effect of applications' knowledge that deal with food waste on willing to purchase food or meals in digital media, the Hypothesis 4 was tested (Table 1). The findings show there is not statistically evidence to support this Hypothesis (for a significance level of 5%, a p-value= 0.538). Thus, the results indicate that knowledge of these applications does not influence the will to acquire them or not.

In sum, the results show that the individuals are willing to try this type of applications: (i) possibly to help the cause that these companies defend; and (ii) and conjugating the information mentioned by Giurea (2015), there is, increasingly, technology present in everyday life, and in this way people want to keep themselves updated and current, wanting to experience and be in this technological world and contributor of causes. The digital media came to facilitate this process.

Table 1. Hypothesis Validation formulated

Variables	Frequency waste food *(p-value)*[a]	Source of knowledge about food waste *(p-value))*[a]	Willing to purchase food or meals in digital media *(p-value)*[b]
Family income	0.297	n.a	n.a
Causes for waste food production	0.001*	n.a	n.a
Age	n.a	0.002*	n.a
Applications' knowledge that deals with food waste	n.a	n.a	0.538
Legend: a) Kruskal-Wallis test; b) Mann-Whitney test. Significance: * significance level of 5%			

5. Conclusion

It is known that food waste occurs at all stages of the supply chain, and that it is neither a systemic problem nor the responsibility of just one entity. However, it is necessary to start combating it in some part of this chain, and this study is focused on the final consumers and the chain prior engagement to this cause, i.e., brands that provide services in order to raise awareness and reduce this waste.

In this sense, this study intends to contribute to the fight for this cause, through the study of theories and articles present in the literature review, and the application of a quantitative methodology, to confirm, corroborate or add information to these same studies. However, there were some difficulties in collecting secondary information, since for this theme, despite being quite developed in Portugal, there are no studies that relate the digital media or new technologies with food waste. This enhances the important of this type of articles, or even brands that have applications or websites to do so, since this

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area is constantly growing. Another difficulty was the low number of responses to the questionnaire survey, which can make it difficult to generalise the results, sometimes making it unrealistic.

Notwithstanding the above, with the literature review it was possible to gather some points to be proved or corroborated through the questionnaire survey. Firstly, and despite the fact that some individuals had not obtained any type of information on the subject recently, the sample shows awareness that this is an important issue to discuss and solve. It was observed that many respondents never or almost never wasted food, and that even if they had a waste destination, it would be used for another purpose.

Contrary to what many authors have previously stated, it was possible to verify in this study that, nowadays, there is no longer any distinction between food waste by lower-middle-income and upper-middle-income households, which converges with the UNEP theory which assessed the possibility of this difference. This result leads us to conclude, not only that it is increasingly necessary to implement serious measures to combat food waste in each country, but also seems to suggest that both developed and developing countries have an almost equal degree of waste.

Thus, it was possible, observing the study of Parfitt et al. (2010), to realise that the main causes for food waste are the passing of the expiry date of a product, the storage of food in inappropriate preservation conditions, and the purchase and preparation of meals in exaggerated quantities, and that these are not related to the frequency of food waste.

The results also revealed, in accordance with the theory of França (2001), that the information transmitted on food waste was not only centred on written documents, but also on television and radio, and mainly through digital platforms, i.e., social networks, Youtube, among others, and that the means by which information was obtained was not interconnected with the age of the respondents.

Finally, it was also possible to verify that many individuals said they did not know brands that helped fighting for this cause, however, when confronted with the names of these brands, they already knew them, thus showing that these brands are having a good marketing role, but not enough to be recognized by the type of service and cause that they stand up for. In this way, these companies should invest more in digital marketing, as the evolution of technology is increasingly growing, to publicize and market their services by conquering new customers, or at least make them better known and know what the brand represents. Even so, both the individuals who did not know of the existence of these applications and those who knew but had never used them, said they wanted to know more about them and in the future seek to subscribe to their online services, whether by “To Good To Go”, “Refood”, “Fruta Feia” or another company of this type.

Considering this, most respondents said that it is important to have this type of companies in the country and agree that if these companies made more digital marketing campaigns, there would be more people joining these services, and consequently, reducing food waste. This would lead to conclude that digital media are here to stay and that brands should communicate more through them, to reach these increasingly digital and informed consumers.

With the methodology applied and the results found, it was possible, in a certain way, to make the individuals in the sample aware that this is a current issue that urgently needs to be addressed, as well as to make companies that operate in digital media and that fight for this cause known. In the future, it would be opportune and interesting to apply an identical study to a larger population, to determine whether the results obtained could be globalized to the Portuguese population.

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