Apps as a tool against food loss and waste. Technical implications and implementation complications

Las apps como herramienta contra el desperdicio y la pérdida de los alimentos. Implicaciones técnicas y limitaciones de implementación

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ABSTRACT

The study of environmental crisis that affects the world in contemporary times involves the analysis of different factors which contribute to a bigger problem. One of these factors is food loss and waste. This issue originates as well from different factors that can be approached from different strategies. This article analyses the use of smartphone apps as a tool to fight food loss and waste. Theoretical bases that support the use of these tools as a viable option to mitigate environmental problems and the different implications of food loss and waste. It is then analyzed the technical requirements of apps and considered their economic viability from the software developer and entrepreneur respectively. Finally, it is exemplified with a case study of a failed anti-food waste app launch in Guadalajara. Results show that these apps design is a development that requires of many resources compared to a slow return on investment that will hardly ensure the app sustainability. Potential reaches of the app are high, but hard to accomplish without a solid structure behind and, ideally, support from government or private institutions that are more interested in environmental impact than financial profit.

RESUMEN

El estudio de la crisis medioambiental que afecta al mundo en la época contemporánea involucra el análisis de diferentes factores que abonan al problema. Uno de ellos es el desperdicio y la pérdida de alimentos, originado en distintos fenómenos y cuya solución puede estudiarse desde de diferentes estrategias. Este artículo analiza el uso de las apps para teléfonos inteligentes como una herramienta para luchar contra el problema del desperdicio de los alimentos. Se revisaron las bases teóricas que apoyan el uso de estas herramientas digitales como una opción viable para combatir la problemática medioambiental y sus implicaciones ligadas desperdicio de alimentos. Además, se analizaron los requerimientos técnicos de las apps y se consideró su viabilidad económica desde la perspectiva del desarrollador de software y del empresario, respectivamente. Finalmente, se ejemplifica un estudio de caso del lanzamiento fallido de una app contra el desperdicio de los alimentos en Guadalajara, Jalisco, México. Los resultados muestran que el diseño de estas apps es un desarrollo que requiere de muchos recursos en comparación con un retorno de inversión lento que difícilmente asegura la sustentabilidad de la aplicación. Los alcances potenciales de las apps contra el desperdicio de alimentos son altos, pero difíciles de lograr sin una estructura sólida detrás e, idealmente, el apoyo de instituciones gubernamentales o privadas interesadas en las repercusiones ambientales más que en la ganancia económica.

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Introduction

Human beings are closely related to the environment which goes beyond mere interaction: it is a reliance. From the environment we obtain the resources to meet the basic physiological needs of the species, but this point is quickly transcended: we have an ecological, biophysical, psychological and spiritual dependence on it (Washington, 2013). For these reasons it can be argued that one of the most serious problems man currently faces is that of the environmental crisis, the consequences of which affect and put at risk the entire natural environment and the species that coexist therein (Myers & Knoll, 2001; Kotzé, 2019).

There are many factors related to the overall problem of the environmental crisis, and some are attributable to the relationship humans have with the environment. This article focuses on food waste and the scope of software applications as a potential tool to combat it. Its development implications and the difficulties inherent in its acceptance and use among users are discussed.

Food waste is not an easy problem to combat. The phenomenon can be defined as "the edible quantity of post-harvest food that is available for human consumption, but is not consumed for whatever reason" (United States Department of Agriculture, 2019). The Food and Agriculture Organization of the United Nations (FAO) (2014) has estimated annual food waste at 1.3 billion tons of food, which represents one-third of all production for human consumption worldwide.

The problem involves different areas: the food distribution system on a local and global scale, the ethical implications of waste, and the energy, nutritional and cultural dimensions of food. Within the food distribution system that governs the commercialization of food worldwide, food waste is tolerated, permitted and even promoted in a paradigm in which food is assessed and valued for its capacity to generate wealth or for its political value rather than for its capacity to nourish and provide energy to those who consume it (Ochoa, 2020).

The relationship of this problem with phenomena such as the emission of greenhouse gases and global warming has been proven, in addition to the social effects linked to the increase in human population and the consequent increase in the demand for food (Al-Rumaihi *et al*., 2020). The positive impacts, in environmental terms, of directly combating food waste have also been analyzed, even when compared to other strategies with similar purpose (Dilkes-Hoffman *et al*., 2018).

The article reviews the operation mode and the implications of the most popular anti-food waste apps based on the number of users and downloads visible in the Android Play Store. It analyzes the specific case of the Tenedor-es app and why these types of apps cannot be guaranteed success despite the attractiveness and novelty of their concept.

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Apps as an ecological tool

Cell phone software applications, also known simply as apps, are computer programs specially designed to accomplish one or multiple tasks from a mobile device. Since their conception and rapid expansion in contemporary societies, these applications have been used for an increasing number of tasks. This paper will not delve into the scope of these tools – which are known to be enormous–, but will analyze the impact they may have in the context of the environmental crisis.

It is useful to understand apps as shortcuts that allow tasks to be carried out quickly that would otherwise take time and other resources to complete. Their scope goes beyond the IT area: there is a real potential for their use as tools in social and economic areas; however, there may be a misinterpretation of the possibilities provided by these technological tools and take for granted that their use translates into sound ecological development, which is not necessarily correct (Grunwald, 2016).

When analyzing the positive aspects that the development of apps has brought about, Jepson and Ladle (2015) talk about the "unprecedented" potential scopes that can be conceived for them. The authors highlight their ability to transform the way society interacts with the environment, and highlight: 1) their potential to revolutionize natural conservation and environmental science, 2) the fact that the transformative power of apps has not yet been fully exploited, and 3) the reality that, to achieve this, both scientists and environmental conservationists must improve their avenues of interaction with engineers and software developers, but also with potential users (pp. 827-828).

It is not only a matter of establishing communication because these actors are the ones who will ultimately design and use the applications to be developed, but also to establish a dialogue between knowledge that can create a know-how that transcends the scope of each of these disciplines by themselves (Sotolongo & Delgado, 2006). This is essential for the effective and efficient development of applications that have an impact on man's relationship with the environment.

Likewise, these applications have a strong social and cultural component. In addition to contributing to the non-waste of food, they also contribute directly to the second Sustainable Development Goal of the United Nations, "Zero Hunger", which deals with food security, and indirectly to other goals related to the reduction of inequality, as well as health, well-being and sustainability (United Nations, 2019).

Software engineers and developers know the implications of performing any software development, but are often unfamiliar with the elements behind the issue that originated the need for them. However, they must design mechanisms and strategies that allow them to achieve the objectives set at the time the application is conceived. At this point, consideration should be given to those who will use the applications, since they have

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first-hand knowledge of the problems to be addressed with the few tools at their disposal, which, moreover, are far from optimal (Sandler & Pezzulo, 2007).

Several attempts at dialogue between academic institutions and conservation organizations have been documented and evaluated quantitatively and qualitatively, highlighting the value of transdisciplinary dialogue in this approach (Galán-Díaz *et al*. 2015; Wickson *et al*. 2006). The results show how the dialogue between academia and managers of new technologies contributes to the achievement of the conservationist objectives sought by the actors involved in the dialogue.

Apps against food waste around the world

The idea of using apps as a tool to address environmental issues has been implemented in different ways in different parts of the world. With regard to food waste, a large number of apps can be found that propose different methodologies to combat and prevent it. It is noteworthy that, among the data that are shown as justification for its conception and development, the figures provided by the FAO in recent years on the subject are often mentioned, which have served as a starting point for countless proposals and initiatives that seek to reduce the problem (FAO, 2013; FAO, 2014; FAO, 2016).

One of the most important apps in this area is Karma. Its homepage is headed by a very particular phrase: "Slackers will save the world", which can be translated as "freeloaders will save the world", followed by the subtitle "you can save the world by doing the simplest thing in the world. Eating." (Karma, 2021). This is an application that makes surplus food from restaurants, grocery stores, cafes, bakeries and wholesalers available to its users.

The foods that are marketed within the app are available in the morning or in the evening, which is the time when the establishments attached to the application usually make the cuts, either breakfast or lunch and dinner. The main attraction for users is that the food on sale comes at a significant reduction from the original price, although the app misses no opportunity to remind of the ecological benefits that buying food through this tool brings.

It is possible to buy food from a number of available restaurants and then pick it up directly at the chosen establishment. All you have to do is show the purchase receipt that is generated by the system at the end of the process. The application uses gamification elements to make it more enjoyable. For example, a "rewards" system has been developed that rewards the user for making purchases through the app: when users make a fifth purchase within thirty days, they can select from one of the enabled rewards. So far, the app is only available in Sweden –where it was created–, France and the United Kingdom.

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In Denmark there is another popular app that combats food waste through a similar dynamic. It is Too Good To Go (which could be translated as "too good to be thrown away"), and claims to be the number one anti-food waste app (Too Good To Go, 2021). Here, the options are not limited to restaurants, but also to retailers with some product in their inventory that has not been sold at the planned time and is fit for consumption.

There are other applications that, although they have the same objective in ecological terms, work from a different approach. Farmdrop is an application from the United Kingdom that connects food producers directly with the consumer, taking care that production techniques generate the least possible environmental impact. This application is guided by ethical guidelines towards all the beings involved, by treating both animals, producers, consumers and the planet itself with kindness and consideration, "because it tastes so much better that way" (Farmdrop, n.d.a). In addition, delivery times to the consumer are highly competitive, although this has logistical implications by optimizing delivery times and reducing distribution costs.

It is taken as a starting point that, if food distribution is viewed as a supply chain, it is at the points of origin of food (harvest points) that the first major food losses occur (Gustavsson *et al*., 2011; Parfitt *et al*., 2010). Thus, the fact that Farmdrop markets meat products sourced exclusively from the United Kingdom gains further strength, as this makes it easier to ensure full utilization of the animals that are killed for further processing and sale, thereby, they claim, "reducing waste, maximizing the value of the product for producers, strengthening the local economy and honoring the life of the animal" (Farmdrop, n.d.b).

It is not impossible to acquire the type of food available in Farmdrop in conventional distribution systems; however, transnationals and the corporations behind the stores of these systems use the sale of these products as a marketing tool that supports their alleged transition towards sustainable and responsible trade, although in reality the results are far from this fact (Heying & Sanzero, 2009; Negi & Anand, 2014). It is because of these types of characteristics that apps such as Farmdrop would offer added value that would contribute to the improvement of food trade practices.

The problems of apps against food waste

After analyzing the main features and basic ways in which apps aimed at combating food waste operate, we will delve into the implications behind their development and the difficulties they face in their operation. The aim is to go beyond the mere notion of food waste and its consequences, and delve into the operation of an alienated food distribution system that not only tolerates but also promotes food waste and other economic and social problems that contribute, as a whole, to the major problem of the environmental crisis (Ochoa, 2020).

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The apps exemplified in this article are applications with a significant number (hundreds of thousands) of users who use them on a regular basis, and which have a team in charge of their maintenance and proper functioning. They are some success stories of a business model that, although it has tried to be replicated on several occasions and in different places, is difficult to consolidate. Not all apps of this type have had the same level of success.

The reasons for this are very diverse, both logistical and structural in nature. First of all, the development of these applications is not easy, even though their purpose is not similar to that of normal applications –for commercial purposes–. Mario Rodriguez, an entrepreneur, programmer and leader of the company SISDESA located in the Metropolitan Zone of Guadalajara (ZMG), with extensive experience in the development of applications and IT services, comments: "Just because you generate an application that is not going to have too much monetization, it is not going to be cheaper"[1]. His explanations have been the basis for developing the aspects behind the applications throughout this section.

Classic food delivery apps, such as UberEats or Didi Food, can be considered a digital restaurant. Although their approach is different, apps to avoid food waste are not so different from those, since they still have to make a digital menu available to users that, although it might be more rudimentary and with fewer options, has similar, even more complex, technical implications.

When an order is placed on a food delivery app, the action generates a record that has effects on the database of the establishment selling this product. For example, when a person orders a hamburger at a restaurant within an app, the action of buying the hamburger generates a record that makes the establishment aware that it has to prepare this hamburger for delivery minutes later. On the other hand, to make available to users the food left over at the end of a certain day, there must be at least two records: the original record of the burger from which the store made the preparation, and the new record that the burger is available in the inventory for resale through the app against food waste.

The mechanics developed in the previous paragraph are not the only way food apps can work, but they provide an idea of the technical implications behind their design. Obtaining a more efficient way would require a more extensive analysis that, of course, involves the participation and discussion of specialists in programming and in the subject of waste that can explain what is to be generated without losing the main objective: to avoid waste.

Any application that makes any dish or food from an establishment available to users first requires the generation of an inventory to know what products are available for sale. In technical terms, this translates into the need for a database containing information on which foods are available and perhaps some other additional data, depending on the nature of the app.

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According to Mario Rodríguez, it is possible that one of these apps could generate even more data than classic food apps, since information such as the time the dish was cooked, the different prices for the same product –depending, for example, on its special characteristics–, among other data, could be considered relevant. This information would have to be interpreted by the app and, if it is important for the user, registered by a person, which implies higher costs for an app that ends up generating less revenue for its sales model than traditional applications.

Among these types of apps available in the Google store for Android, common elements can be identified: 1) the number of downloads does not usually go beyond thousands of users, unlike large apps, such as Too Good To Go, with more than ten million downloads, or Geev or Olio, with more than one million downloads each; 2) they have very low user ratings; and 3) they have outdated information, suggesting that they are not consistently maintained and supported. These elements are symptomatic of the same problem: it is software that, either because of design or infrastructure problems behind the development team, simply cannot sustain itself in the app market, resulting in poor dissemination and downloads, bad reviews and soon abandonment.

While the ideas behind these types of apps are obviously timely due to the current environmental context, the economistic context in which they operate cannot be overlooked. The food delivery market via apps is dominated by large companies such as Didi and Uber, with a solid business model behind them. For an app to be attractive from a business point of view, it must have a clear path to monetize its services.[2] It is very unattractive for an entrepreneur to develop a project that requires a high investment for something that is going to make little money –and it is even difficult to know whether it will be self-sustaining.

The Tenedor-es app

The current food distribution system does not consider the social, cultural and energetic value and potential of food. This system prioritizes the maximization of profits for some of the actors involved in its distribution chain. The problem lies precisely in the commoditization of food, which, by definition, has more dimensions than a common item due to its biological importance for most species that thrive on the earth (Ochoa, 2020).

The problem with conventional food distribution systems lies in several factors. One of the most important is the intrinsic inability to take advantage of and reuse many of the wastes generated throughout the stages that make up the food distribution chain (Francis *et al*., 2003); and, even when considered as a purely logistical problem, the correct reuse and relocation in the distribution chain of those foods that have already become waste implies costs and complications that are difficult to solve.

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There are alternatives to this conventional food distribution system. If we compare alternative food systems –strategies such as short circuits and the economic stimulation of small regions in geographical terms– and conventional systems –globalized and involving the transportation of kilometers of goods as they progress from their points of origin to those of consumption–, it is easier to understand how the former promote a greater use of products than the latter, which has a positive impact among local producers and distributors involved with the sales process (Ayala & Castillo, 2018). We are not only talking about the waste that may be produced at the beginning of the distribution chain, but also about the waste that is produced along the distribution chain and that can be more easily taken advantage of.

From the concern to prevent these foods from being completely lost, Nela Monasterio's interest in creating an application that would contribute to this end was born: Tenedor-es. This app was designed so that users could select, from a list of available restaurants, food that had not been sold at the end of the day[3] at a price of a maximum of 50% of the original price. The objective of these parameters was to ensure that users had access to quality food at an affordable price, and to reduce the economic losses of the restaurant, which would recover some of the economic investment made in the food that was going to be discarded. The second advantage was the non-waste of food with its ecological implications: from the obvious reduction of food waste to the decrease of the carbon footprint linked to the use and consumption of food.

In 2018, the first conversation with Nela Monasterio took place, and she had practically finalized the design process of the app. Nela was surprised by the fact that in America there was no legal and juridical framework that specifically prohibited throwing away food, even though other anti-waste, anti-pollution or anti-plastic policies had become popular during that time.[4] Nela believed that all these features made her app's operating model something that could be consolidated in the country.

In parallel to the normal operation of the app, different ideas were contemplated to strengthen the dissemination of the sustainability message. Thus, Nela and her team planned to carry out donation exercises once or twice a month with the support of the restaurants that were allied with them. These exercises would be based on the donation of surpluses by the restaurants –with no financial gain in between– to be sent directly to needy groups.

The design, interface and programming of the Nela application were finalized by 2018, with some details to be refined. Among the commercial partners, 16 establishments had been confirmed. Nela and her team planned several events to spread the word about the app in the city. On September 2, 2018, for example, they were at a strategic location on the Via RecreActiva[5] to make the official announcement of Tenedor-es. They also scheduled a press conference and other social events. Nela and her team intended to extend

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the concept to Puerto Vallarta and Mexico City, where they had already begun to talk with potential establishments to launch the app.

In addition, Channel 44 in Guadalajara did a brief coverage of the launch of Tenedor-es, and a report was broadcast on television and uploaded to social networks on September 25, 2018. In it, Nela Monasterio recounts what the app consists of and the advantages it would bring. López Villalobos, the reporter, concludes by saying that "adhered restaurants will help to lessen food shortages and avoid their own surpluses", and reports that 25 restaurants had joined the app and that it was already available for download (López, 2018).

The app was planned to be downloaded by users free of charge; however, that ended when the application was installed, as user registration had a one-time cost of 20 pesos. The expected profits for the app would not come, naturally, from this one-time payment. The business model established that partner establishments would be charged a fraction of their profits for each completed transaction, since users would pay them directly for the food purchased. Nela also mentioned that by subscribing to the application they would be eligible to deduct taxes from a portion of their profits.

Nela had made the establishments attached to the app sign a contract in which they took responsibility for the food they sold, to ensure that it had the appropriate organoleptic conditions for human consumption. This should not be a breaking point for the users, who were aware that the food they would offer for sale would be produced during the day. The concerns expressed by these establishments were more related to the reception of this type of sales dynamic in a society with prejudices about food: would users be willing to eat "leftovers"? Nela was aware of this aspect, so her team was designing a marketing campaign aimed at creating awareness in a fun way.

A few days after the app was launched, in addition to the technical complications and everything involved in the design and development of the application, Nela and her partners were financially drained, since they had paid for the investment needed to launch the project. It had not been possible to obtain support from Mexican public resources.

The team was present at the Vía RecreActiva, and there was a presence in media such as Canal 44 and Notimex. Everything seemed to be going according to plan, and yet months went by and it was still not possible –nor is it now– to use the app. It can be downloaded, but it is impossible to register or make any purchase in "the first app in Mexico to avoid food waste", as they call it in their social networks.

The above is an example of how having the complete development for an app is not enough to operate and maintain itself in a market composed of thousands of other applications. From the moment of their conception, these apps face countless obstacles: the economic and development requirements, the time involved for those who conceive the

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idea of the application and the fact that these people usually have another primary professional activity, and the difficulty to access government support and even private investors, since they are not economically attractive proposals. All these elements create a panorama that is not encouraging for tools that seem condemned to unsustainability or inactivity even before they begin to operate.

Conclusions

Cell phone applications (apps) can be an exceptional tool in the fight against the different problems that, as a whole, make up the environmental crisis the world is currently facing. However, this does not imply that just because of their high potential in this objective, everything that is achieved through the development of an app is positive progress.

The development and planning of an application that can have a real impact must start from the transdisciplinary dialogue between experts in software development, scientists and environmentalists who have a deep knowledge of environmental issues, as well as all the people directly involved in the processes that trigger it, understanding food waste as one of the problems that cause the environmental crisis.

Despite representing a good option to address this problem, these apps are not always viable, since their development can present strong challenges in terms of IT (Joorabchi *et al.*, 2013) which, not being aimed at a "traditional" app with a business model that allows to think of a quick return on investment, makes them unattractive to investors in general.

The case of Tenedor-es in Guadalajara is a good example of these problems: a fully developed app, with an organized team that was in charge of making the necessary arrangements for a successful parallel launch in the ZMG, Puerto Vallarta and Mexico City. In spite of the preparation and all the efforts to get it off the ground, it is in an operational limbo that apparently it will not overcome.

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[1] M. Rodriguez, personal communication, April 11, 2021.

[2] "The idea sounds great, but not all ideas can be monetized by entrepreneurs, since not all are profitable" (M. Rodriguez, personal communication, April 11, 2021).

[3] This is a similar dynamic to that of apps such as Karma or Too Good To Go, which served as inspiration for the new design.

[4] N. Monasterio, personal communication, August 20, 2018.

[5] The Via RecreActiva is an initiative of the Government of Jalisco present in Guadalajara since September 2004. The roads are closed to vehicular traffic every Sunday and some holidays to be given over to pedestrians and bicycles (Montes, 2019).

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