

Zero-waste IT solutions in Poland

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Abstract— The article discusses various IT to avoid food waste solutions available in Poland, including mobile phone applications, websites, and discussion forums. The research thesis put forward in the paper says that Poles only use solutions that directly generate financial benefits. Other applications are little known or unknown, which shows that zero-waste solutions must take economic aspects into account. Saving food must pay off both for the person donating the food and for the person receiving or buying the food. The second aspect is undoubtedly the cost of access to a given solution, Poles knew almost only free applications

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I. INTRODUCTION

The recent report for the UN’s Food and Agriculture Organization FAO), in particular, „Global Food Losses and Food Waste” (Gustavsson et al., 2011), estimates that a third of the food produced globally is lost or wasted. According to the report, every year, we waste 1.3 billion tons of food produced for human consumption, almost equally: in developed (670 million tons) and developing countries (630 million tons).

In Europe (Gustavsson et al., 2011), food loss per capita is 280 kg per person per year; this includes 180 kg lost during production and retailing and 100 kilograms per capita of consumer waste. In North America and Oceania, it is almost 300 kg per capita of wasted food consisting of 180 kg of production and retailing waste and 120 kg of consumer waste. In industrialized Asia, food waste is 220 kg per capita per year, of which 160 kilograms goes for production and retaining waste

and 60 kg for consumer waste.

Despite alarming data, food waste is not a front-page news topic or distraction for world leaders. Data on this subject is given as a description of reality as if this reality could not be changed. Fortunately, many people take this matter seriously, and there is a certain amount of studies dedicated to avoiding food waste by households (Cappellini, 2009, p.365–375), (Cappellini & Parsons 2012, p. 119-128), (Cappellini & Parsons, 2012, p.109–128), (Evans, 2012, p. 1123-1137), (Evans, 2011, p.429-440), (Evans et al. (eds.) 2013, p. 517-522), (Gregson et al., 2007, p. 187–200), (Hetherington & Secondhandedness, 2004, p. 157–173), (Alexander et al., 2013, p. 471–84). A modern trend in this area is the archeology of rubbish, where researchers analyze the composition of garbage in various human agglomerations (Hetherington & Secondhandedness, 2004, p. 157–173), (Alexander et al., 2013, p. 471–84).

The problem of the modern world is that wasted food disposal is often cheaper than using it or re-using it (Gustavsson et al., 2011), (Somsen, 2004). The same situation is with the prevention, which is sometimes more expensive than food disposal - wholesale and retail markets are often unsanitary and lack costly cooling equipment. In a world ruled by economic efficiency, it is difficult to force the resignation of profits if the only effect of fighting waste is a sense of satisfaction and implementing moral values. This is where IT technologies come in to make food waste prevention profitable and attractive. This publication aims to present financially effective IT solutions based on information technology, which effectively fight food waste while bringing financial benefits to all parties.



II. APPLICATIONS AGAINST FOOD WASTE

To investigate the popularity of various IT solutions to prevent food waste, the authors of the publication asked users of multiple solutions for opinions on them and whether they recommend these solutions to others. The research was carried out on a sample of 400 people from the Małopolskie Voivodeship in Poland.

The first solution tested was the Too Good To Go application. The application currently works in most major European cities and North America. According to the authors of the publication, it saved 139 million meals in over 154,000 establishments, and 57.7 million users downloaded the application. The company was founded in 2015 in Denmark. The application connects shops, restaurants, cafes, and other entities with customers, proposing to buy products close to their use-by date at a price usually around 30% of the initial retail price. In most offers, users do not know precisely what they will receive in the package; it is mainly defined very generally - food, ready meals, sometimes more specifically: dairy products, bread, pastries, fruit, etc. The institution offers a certain number of packages at a given price through the application and provides the range of hours of receipt of parcels and the pickup address. The application user declares how many boxes he wants to buy, pay by electronic transfer, and then has to collect the package within a specific hourly period.

The application allows you to assess the quality of products, the behavior of the store service, and the price-value ratio. In Poland, where the research was conducted, most offers disappear within 15 minutes of their appearance in the application, and some disappear within five minutes. About 2 million people use the application in Poland. Application users bought not only food products or ready meals but also production surpluses of dairy products (Danone), dried fruit (Bakalland), syrups and coffee (Costa Cafe, Starbucks, etc.), and cookies (cafes). Every food offered was bought, so sellers did not have to dispose of unsold products, and buyers purchased food at a reduced price.

Foodsii is the Polish equivalent of the Too Good To Go application. Foodsii works mainly for restaurants and allows customers to purchase meals with a large discount, usually over 50%. Foodsii checks the user's location and shows the location of available offers on the map. An attractive option of the system is that if someone fails to collect the package they previously purchased, they can report this fact on Facebook, which allows you to "release" the offer. If there is a person who will take over the order, the application will refund the money to the original buyer. Otherwise, the amount paid will be forfeited.

Taste & Share is an application that enables the transfer of food products between users via the Internet. The application uses a geolocation system. By looking at the map, the user can see where someone offers products, usually with a short shelf life. The application was created on the initiative of Electrolux. Anyone can submit products, and anyone may want to buy or get them for free. The application locates the user on the map and shows the locations of individual active offers on the same

map. The application also allows you to search for products by description and composition (e.g., meat content).

A similar application is Olio, which connects neighbors and local businesses to exchange local surplus products: locally grown vegetables, home-baked bread, or unnecessary supplies from the refrigerator. Olio allows you to exchange both food and non-food items. The proximity in the application means the distance up to about 24 kilometers, but the user himself can change this radius. After pressing the "request this" button, users specify the place and time of pickup. A person who does not come to pick up the food within such an agreed time may be reported and even banned. The shops from which the products are picked up and distributed by volunteers called Food Waste Heroes also participate in the application. If the offer is popular, the offeror can receive more than one request and decide to whom to give the food. In addition to the surplus for free, the application also allows people to sell homemade

food and craft such as homemade pasta kits, cakes, and even paintings. When talking about meal planning and shopping, it is also worth mentioning the OurGroceries application, which allows 12 family members to share a shopping list that is constantly updated. Purchased products disappear from the list, and there are more for someone to buy. Similar applications include "ListEase", "Out of Milk", "Kroger", "Mealime".

The NoWaste or Save to Date applications allow one to read barcodes of products and enter their expiry dates in the calendar. The application warns a few days in advance that the product is approaching its expiry date and must be used. Other similar applications include Fridgely and Cozzo. Among other things, the Cozzo application allows up to 10 people to cooperate, alerting when food products are approaching their use-by date. When many people watch these products together, they can make better use of them before their use-by date. Many such applications offer recipes that use these expiring ingredients (Kitche); some even use Artificial Intelligence to find the best recipes. Another functionality is warning which products are no longer suitable for consumption and may be harmful to health (Nosh).

A slightly different solution is the "food-sharing fridges" system, which boils down to refrigerators usually standing in various locations in large cities where people voluntarily carry unnecessary surplus food. The rule is simple - one should share the food one would like to eat. Although the supervision of the mentioned refrigerators is minimal so far (August 2022), there has not been a case of someone poisoning themselves with the food offered in these refrigerators. Anyone can come to the fridge and take any products. It is allowed to share meals prepared by ourselves, but one should describe precisely what ingredients they were prepared from and their expiry date. Raw meat, products containing raw eggs, spoiled items, open cans, and alcohol are prohibited. The current locations of refrigerators are provided on an ongoing basis on the Internet. Unfortunately, the Foodsharing Polska organization does not provide statistics on how much food was saved thanks to it, but the maternal organization in Germany (Morrow, 2019, p. 202-212) already provides such data: by April 2020 (from 2012), over 32,000 tons of food were saved, and they benefited from

the program over 73 thousand consumers, over 7 thousand stores participated in the campaign.

A different idea for avoiding food waste is offered by the website LokalnyRolnik.pl, which offers the purchase of products directly from farmers via depo points. At the depot, all the order elements are picked up in one box and can be picked up. By offering products directly to consumers, agricultural products do not become shop waste because the application eliminates intermediaries between the producer and the final consumer. In addition to typical products, the application offers many rare and unusual products and many organic products at moderate prices.

Many IT solutions provide tips and recipes for using leftover food. Many such solutions are available in the Zero Waste discussion groups on Facebook. Often the advice concerns not only food but also used furniture and clothes. The most numerous groups are Zero Waste Polska, the Polish Zero Waste Association, and Zero Waste for Beginners. In addition to specific advice and recipes, the websites provide answers to specific questions, give addresses to various places where you can exchange food or clothes, and other websites on similar topics.

The inventors' ingenuity and new technological possibilities allowed for the creation of startups using food waste to produce the equivalent of coniferous wood (Kebony from Norway), electricity (BIO2CHP from Greece), biocomposites that allow the production of furniture and wall panels (Studio Ottana from Turkey) or bioplastic (TripleW from Israel). All these actions help to avoid the decomposition of food, which produces vast amounts of methane, which has a much stronger greenhouse effect.

The ShareWaste application informs the user of the bio-composting plant locations to which one can take their food scraps. Alternatively, one can set up your compost to get other people to bring their food scraps to it. The application allows it to browse a map to see where are the other hosts who recycle food scraps. An interesting solution to limiting food consumption is applications that allow one to schedule fasts. In many countries, obesity and excessive food consumption lead not only to unnecessary food consumption but also to many civilization diseases, ranging from diabetes to heart attacks and embolisms. Examples of such applications are: "Intermittent Fasting Tracker", "Window", "Fenometer Intermittent Fasting", "Fastic", "Zero", "Fastient", "BodyFast", "Vora", "DoFasting", "FastHabit", "LIFE Intermittent Fast Tracker", "Ate Food Diary", "Simple", and many others.

Another way of avoiding food waste is offered by applications that calculate portions of food that a given person should consume. Examples of such applications include: "Lifesum", "YAZIO", "MyPlate", "CarbManager", "Calorie Counter" by FatSecret, "Lose It", "My Diet Coach", "Kudofile", "Fooducate", "My Macros +", "MyFitnessPal". For people with insulin resistance or diabetes, specialized applications allow them to choose or prepare healthy meals that simultaneously inhibit the feeling of hunger for a long time - an example is Fooducate.

A different group of applications that help to avoid food

waste are meal planning applications. The user selects recipes for the whole week, plans meals, and then the application prepares shopping lists and sometimes allows to complete the order online, that is, place it in the store and then pick it up. Examples of such applications are: "Paprika", "Fork and Knives", "Yummly", "COZI", "PlateJoy", "Mealime", "Meal Prep Pro". Some of these applications also allow one to control water consumption, which is assumed to affect the amount of food consumed (drinking water relieves symptoms of hunger). MealPrepPro, Yummly, Mealime, and Paprika applications allow checking someone's pantry before they shop. The ShopOnline application will enable one to find stores where certain products are the cheapest (including delivery). Speaking of pantry control, it is necessary to mention the Internet of Things, under which many manufacturers already offer refrigerators that allow one to check the condition of products and inform what is missing in the refrigerator. Internet-connected refrigerators allow less organized people to avoid buying unnecessary products that they already have at home.

One more exciting solution is the possibility of buying fruit and vegetables that do not meet the requirements of stores, and farmers would have to throw them away. Applications that allow people to purchase such agricultural products include: "Imperfect Foods", "Misfits Market", "Hungry Harvest", "Food Rescue Us", "FlashFood" (the latter application shows discounted food in the user's area and allows you to buy these products using the application, payment, and the user has to collect them from the store).

In Poland and many other countries, there are food banks that, apart from public collections, accept surplus food from producers and then distribute it to those in need. These institutions run websites and social campaigns to prevent food waste.

"Falling Fruit" is an example of an application created and used by freegan, i.e., an application where, inter alia, trees bearing edible fruit from which lawfully harvested free fruit. Among other things, people can find places where sorrel or mirabelle plum grows. On social media websites, freegans also exchange information about garbage cans where shops or other people leave a lot of food scraps and where it is worth checking.

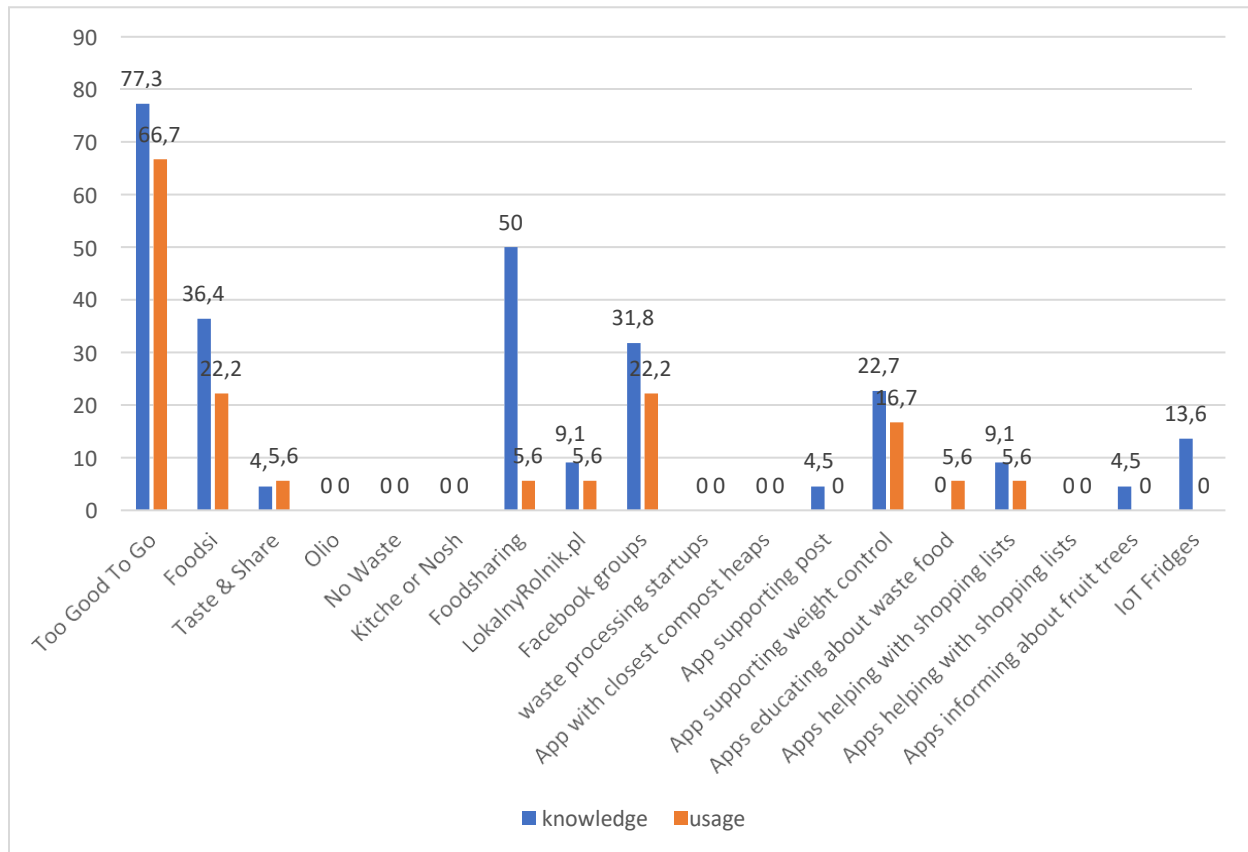
III. SUMMARY AND CONCLUSIONS

Research shows that there are many solutions available in Poland to avoid food waste. When comparing them with what is available in developed countries, their functionality is often limited. For instance, if they are connected with the online store, these stores in Poland may have a limited range of products offered online. Nevertheless, Poland is moving in the right direction, and it should be expected that each year the market for zero-waste solutions will grow larger and larger. Chart 1 below shows the popularity of individual applications among the inhabitants of the Małopolskie Voivodeship. Out of 300 people surveyed, most of them knew and used the Too Good To Go application; many also knew Jąłdzielnie (FoodSharing Poland) and the Polish Foodsi application. Surprisingly, the

knowledge of these applications was declared by people of all ages, including people over 60 years of age. As you can see,

good solutions quickly propagate among market participants.

CHART 1: KNOWLEDGE AND USAGE OF IT SOLUTIONS FOR WASTE FOOD MANAGEMENT, 300 RESPONDENTS FROM THE MALOPOLSKIE VOIVODSHIP, ONLINE SURVEY, 2022 [% OF TOTAL RESPONDENTS]



source: own research based on 300 inhabitants of the Malopolskie Voivodship

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