



# Exploring the Feasibility and Acceptance of a Digital Platform for Surplus Produce: A Qualitative Study of Irish Farmers

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## Abstract

Food loss and waste (FLW) are a challenge with implications for the environment and economy. Previous evidence has primarily focused on consumer behaviour and the role of supply chains in addressing FLW. Little is known about food surplus at the farm level in high-income countries, and particularly in the Irish context. In this qualitative study, we aim to explore the feasibility and acceptance of a proposed digital platform, AgriLoop, to help Irish farmers manage and distribute surplus produce. Semi-structured interviews were conducted with ten Irish farmers from Dublin County and the surrounding regions. A thematic analysis of the transcripts was performed, which generated six main themes in our sample: (1) multi-faceted challenges of surplus produce, (2) desired platform features, (3) failures of past alternative sales routes, (4) conditions for trust and platform adoption, (5) current disposal practices, and (6) first impressions of AgriLoop. The findings of our analysis highlight the constraints and pressures faced by Irish farmers, which include operational constraints, a lack of infrastructure, and market friction. These challenges contribute to the on-farm FLW by making the operation to manage surplus costly and time-consuming. A universal desire was expressed for a digital platform that facilitates managing surplus through providing secure payment systems, a vetted buyers database, and logistical support. Trust was the single most prominent condition for adoption among farmers, which has two main parts: institutional legitimacy and peer-based reputation mechanisms, according to the themes observed in our sample. While farmers have shown cautious optimism about the concept of the platform, its success depends on aligning its features with farmers' expectations. This study provides new evidence about insights from the farmers' community in Ireland regarding FLW and a blueprint for designing scalable surplus redistribution platforms. These findings underscore that surplus produce is a multifactorial issue that requires a solution with a participatory design in order to solve it, and not merely a technological challenge, as well as answering the questions regarding the feasibility of the AgriLoop platform.

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# Declarations

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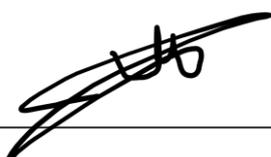
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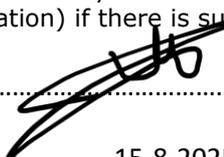
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## Introduction:

Food waste is considered a global challenge with significant environmental, social, and economic implications. The Food and Agriculture Organisation of the United Nations (FAO) estimates that nearly one-third of food production is lost or wasted annually, totalling approximately 1.3 billion tonnes globally (*The State of Food and Agriculture 2019*, 2019). In Europe, Ireland is a significant producer of food waste, amounting to 835,000 tonnes annually, with a high rate attributed to the agricultural, fishing, and aquaculture sectors, at 50,000 tonnes (Attard and O'Connor, 2022). Traditionally, attention has focused on post-consumer waste; however, recently, food loss at the farm level, particularly in the form of unsold or surplus produce, has been identified as a critical point of intervention (Xue *et al.*, 2017; O'Connor *et al.*, 2023).

Surplus produce represents both an operational burden and a missed opportunity, particularly for small- to medium-scale farmers. Surplus product is often a result of overproduction, unpredictable demand, or overly stringent buyer cosmetic standards; therefore, this product is frequently discarded due to failure to secure a viable buyer in time (Papargyropoulou *et al.*, 2014; De Hooge, Van Dulm and Van Trijp, 2018; O'Connor, Kleemann and Attard, 2022). This issue highlights a systematic inefficiency of food distribution and pricing. In Ireland, this issue is commonly faced by farmers due to tight labour, time, and financial constraints, where the short shelf life of fruits and vegetables leaves little to no room for alternative transactions (Evers *et al.*, 2016; Teagasc, 2020).

In Ireland, the agricultural sector is run mainly by family-operated farms that are small to medium-sized farms in economic terms. According to Teagasc, the national Agriculture and Food Development Authority, analysis reveals that there are over 48,000 small farms, averaging around 13 hectares, that work in the production of cattle and sheep (Dillon and Teagasc, 2022). The seasonal nature of labour demand and the underutilised role of hired labour are major contributors to labour shortages in Irish farms, according to research by Teagasc and NUI Galway (Garcia-Covarrubias *et al.*, 2024). These pressures are most prominent when managing unplanned surplus produce, particularly when the product is highly perishable, such as fruits and vegetables. In Ireland, the adoption of digital tools has been limited due to limited IT access, resource constraints, and low digital literacy (Das V., Sharma and Kaushik, 2019; Fox *et al.*, 2021).

There has been a growing interest in utilising digital tools to optimise food systems and reduce farm-level waste in response to the challenges mentioned previously. The idea of establishing platforms to connect buyers and food suppliers has been proposed as a method to minimise food loss and support farmer income (Borrello *et al.*, 2017). These strategies aim to contribute to United Nations Sustainable Development Goal 12.3, which seeks to halve per capita global food waste by 2030 (Lee *et al.*, 2016).

Platforms with the concept of digital food redistribution aim to bridge the gap between excess supply and latent demand through providing real-time connectivity, logistical support, and better pricing mechanisms (Alexander and Smaje, 2008). Despite the positive purpose of these platforms, their success is not guaranteed. Existing evidence on the integration of technology with agriculture suggests that multiple factors, including perceived utility, ease of use, existing infrastructure, and trust determine engagement and acceptance (Fielke, Taylor and Jakku, 2020; Klerkx and Rose, 2020). Platforms that do not take into consideration the daily challenges faced by farmers, such as time and financial constraints, are often deemed underutilised or abandoned.

The focus of this study is the AgriLoop platform, a proposed digital solution designed to help Irish farmers conveniently and easily sell their surplus products to local buyers and restaurants. The intention of the design is to be intuitive, user-friendly, and provide a responsive market that can accommodate the sale of fresh products quickly. Features such as instant listing, buyer verifications, and real-time communication will enable AgriLoop to assist farmers in reducing waste at the source. The platform aims to address issues faced by farmers in the previous pilots, including platform complexity, lack of buyer follow-through, and logistical bottlenecks (Glaros *et al.*, 2023; Masi *et al.*, 2025).

Despite having similar ideas to AgriLoop proposed multiple times, little is known about the perspective of Irish farmers on such solutions, and whether they are willing to consider them feasible and able to integrate them into their daily workflow. The importance of perceived ease of use and usefulness in adopting new tools has been highlighted in technology acceptance models (TAM) (Davis, 1989). Previous qualitative research has highlighted deeper barriers to adoption and acceptance, including cultural preference, prior negative experiences, and low digital literacy among some farming populations (Eastwood *et al.*, 2019). This evidence highlights the importance of exploratory, farmer-centred research in

ensuring that technological tools are developed based on actual needs and contexts, rather than a top-down approach or assumptions.

The cornerstone of a successful platform design is trust. Recent evidence has shown that farmers are often doubtful when it comes to novel digital tools, particularly ones that involve financial transactions or unfamiliar buyers ('Issue Information - TOC', 2017). Features that would help build trust include customer support, payment security, clear terms of service, and customer ratings. The platform's trust is further backed by recognition from institutions such as agricultural companies, public sector agencies, or trusted non-profits (Pertiwi *et al.*, 2025).

Based on the information provided above, this study aims to conduct a qualitative exploration of Irish farmers' perspectives on and accessibility to the AgriLoop platform as a concept, with a focus on feasibility, addressing current challenges, and responding to their needs. A semi-structured interview with a thematic analysis was conducted to investigate the barriers faced by farmers in dealing with surplus produce, as well as the current coping strategies and alternative sale routes they utilise. Farmers' expectations regarding the features and functionalities needed for them to actively use the platform were explored.

The goal of this research is to address the evident gap in the literature regarding digital interventions. Few studies have taken a bottom-up approach centred on the producer perspective when exploring food surplus. This research will also help shape the design of a practical tool that could enhance the resilience and profitability of small to medium businesses. This study will also ensure the social acceptance of the AgriLoop platform, in addition to its technological feasibility. In the end, reducing food waste is a challenge that not only requires technical solutions but also a participatory approach that could be integrated into day-to-day operations.

The importance of this study comes directly from the ongoing debate in Ireland about food waste reduction and sustainability. It aims to address challenges in the Irish agricultural community through innovative technological solutions. Current strategies in Ireland, such as the Climate Action Plan and the Food Waste Charter, highlight the importance of such tools, yet there is little to no evidence on the perspectives and insights from primary producers.

This thesis addresses the research question and its objectives following a structured approach. Starting with a comprehensive review of the literature to help understand the current context of on-farm food surplus and technology adoption principles. A methodology

section follows outlining the qualitative design, semi-structured interview process, and the data analysis protocol. Following this, the results and findings section highlights the key findings and the emerging themes identified from our thematic analysis. These results are discussed in detail in the discussion section, which interprets the findings in light of relevant literature while examining the policy and practical implications for the emergence of a digital solution like AgriLoop as well as discussing the limitations of our study. Finally, the thesis is condensed in a summary within the conclusion section with further directions for future research.

## Literature review:

Global food losses and waste (FLW) are considered a significant challenge for achieving food security and ensuring environmental sustainability. Estimates by the Food and Agriculture Organisation (FAO) suggest that approximately one-third (1.3 billion tonnes) of all food produced by humans is wasted across the supply chain annually (Gustavsson *et al.*, 2011; Ishangulyyev, Kim and Lee, 2019; Vesković Moračanin *et al.*, 2023). An increase of 25% in FLW was observed in a recent analysis between the years 2004 and 2014, which was more notable in sub-Saharan Africa and Southeast Asia. Interestingly, these areas suffer from food insecurity, as a loss of 550 calories per capita per day can have significant implications for the general population (Gatto and Chepeliev, 2023). In 2017, a study reported FLW of 1,498 million tons, with the most considerable portion of the waste coming from countries suffering from food insecurity (Durán-Sandoval, Durán-Romero and Uleri, 2023).

Food losses can occur at a farm level during the production or immediate post-harvest stages. Evidence suggests that around 15% of food waste globally occurs before the food leaves the farm (McBreen, 2024). Up to 44% of dry crops are believed to be lost before human consumption, with most losses occurring before harvest (Alexander *et al.*, 2017). A report by FAO in 2011 revealed that food losses in low - and middle-income countries occur mainly at the post-harvest stage due to underdeveloped infrastructure, lack of storage and limited access to technological solutions (Gustavsson *et al.*, 2011; Ishangulyyev, Kim and Lee, 2019; Vesković Moračanin *et al.*, 2023). On the other hand, market standards, overproduction, and contractual or cosmetic rejections are often the main drivers of food waste in high-income countries (Ishangulyyev, Kim and Lee, 2019).

Unpredictable weather, pests, diseases, labour shortages, market fluctuations and strict standards are all factors for on-farm losses (O'Connor *et al.*, 2023). Surplus produce that might not be harvested or sold is often incentivised by market uncertainty or contractual obligations. The accurate on-farm losses are difficult to quantify due to a lack of standardised measurement tools and harmonised definitions, particularly in emerging economies (Xue *et al.*, 2017; Parfitt, Croker and Brockhaus, 2021; O'Connor *et al.*, 2023).

An estimated 88 million tonnes of food waste and losses occur every year in Europe, with a large portion of these losses coming from the fruit, vegetable, and dairy sectors. Household losses in Europe account for the highest portion of food waste, with a growing recognition of

farm losses increasing, resulting in targeting them for interventions and policy (Nicastro and Carillo, 2021; Jeremić *et al.*, 2024). About 16% of total agricultural-related greenhouse gas emissions globally is estimated to be from on-farm food losses and waste, highlighting the importance of targeting food waste at this stage (O'Connor *et al.*, 2023).

In Ireland, although there are limited comprehensive national statistics on farm-level food loss, the existing evidence suggests that similar factors to other European countries that contribute to food loss exist in Ireland, including weather variability, market standards, and logistical challenges (O'Connor *et al.*, 2023). Ongoing research and policy initiatives in Ireland are starting to focus on improving data collection to support farmers in loss prevention (Parfitt, Croker and Brockhaus, 2021).

### Causes of Surplus Produce on Farms:

Surplus produce at the farm level is driven by multiple factors, ranging from overproduction to logistical factors. Production quantities are often increased by farmers in anticipation of higher profit; however, market demands are often overestimated or fluctuate unexpectedly, resulting in a surplus of produce. Market uncertainty leads to overproduction, as farmers perceive it as a means to mitigate risks by increasing output. However, this results in food loss and waste when supply exceeds demand (Kumar, 2018; Poulomi, Banerjee and Banerjee, 2023). Agricultural transitions and efficiency improvements in France have resulted in the farm surplus quantity being quadrupled. This is a result of the system shifting towards a surplus-driven, export-oriented regime rather than a self-sufficiency one (Harchaoui and Chatzimpiros, 2019). This shift is observed in other European countries, where yields have increased, but also the risk of surplus produce due to policy and technology change.

Strict standards imposed by buyers, such as cosmetic standards, are a major contributor to on-farm loss. Many products get unharvested or discarded regardless of edibility or nutritional value if they do not meet a certain visual and size criteria. Buyers often demand perfect produce, which causes farmers to discard “imperfect” produce, according to interviews with farmers from California, contributing to food waste and loss at the farm level (Gillman, Campbell and Spang, 2019). Even though this study is based in the United States, it was observed that these practices and grading standards imposed by supermarkets, which result in substantial on-farm waste, are common in the European market, including Ireland.

Another important factor contributing to food waste at a farm level is labour shortages, which prevent farmers from harvesting all available produce, particularly impacting perishable crops. Previous studies observed a decrease of 4.2% of produce harvested for each 10% farm labour reduction (Rutledge and Mérel, 2022). Unharvested crops and increased surplus can be attributed to seasonal labour shortages in Europe, which are primarily due to policy changes or migration issues. Similarly, lack of storage is another major contributor to food loss, impacting fruits and vegetables due to their highly perishable nature. Harvest loss and surplus in India are attributed to inadequate storage and transportation facilities. Interestingly, these challenges are also common in Europe, with limited availability of modern cold storage or processing capacity (Sharma, 2022; Poulomi, Banerjee and Banerjee, 2023). As a result, any delay in marketing or processing can cause food waste and surplus, particularly for products with high perishability.

A case study of dairy farms in Norway revealed that an increased use of fertilisers in order to increase production resulted in an increase in nitrogen surplus, which can leak into the environment, causing water pollution and soil degradation (Hansen *et al.*, 2016; Koesling, Hansen and Bleken, 2017). Trends have shown that a higher input, whether from organic farms or conventional farms, results in higher yield and increased surplus. This is also observed in a case from France, where a shift towards synthetic fertilisers, machinery, and chemicals resulted in a higher surplus, indicating a systematic issue (Harchaoui and Chatzimpiros, 2019).

The causes of surplus production in low and middle-income countries are well documented, yet few studies exist about the perspective of Irish farmers regarding this issue. This is a crucial point to address, as any future policies or technological interventions can draw from the evidence by considering Irish small- to medium-scale farms and help navigate the systematic causes of surplus and farmers' operational realities.

## Current Disposal and Redistribution Practices

There are various existing strategies to manage surplus produce, including composting, using it as animal feed, and donating it to food banks or charities. Composting is a method of using surplus to feed animals and is a common on-farm practice, particularly when other channels to dispose of surplus are unavailable. This practice is observed mainly in California, where farmers use imperfect produce as a fertiliser or use it as animal feed, resulting in a less negative impact on the environment (Gillman, Campbell and Spang, 2019). Surplus produce

that doesn't meet the buyer's cosmetic or quality requirements is managed in a way to reduce financial risk (Gillman, Campbell and Spang, 2019). Composting does not address food insecurity or maximise the value of surplus products, despite being a practical solution for managing waste.

Another common method of managing surplus produce is donating it to food banks and charities in order to reduce waste and address food insecurity. It has been observed that many farmers are willing to donate surplus produce if the process is facilitated and made easy without requiring extra resources. While many farmers do not object to their surplus produce benefiting those in need, organising donations that require time and effort presents many challenges. Farmers' participation can be encouraged if food rescue agencies offer more donation options that are well communicated (Mount, Valentine and Gibson, 2019; Oroski, 2025).

The utilisation of community markets or direct community sharing as a channel for redistribution is a prevalent practice. This practice is widespread among Smallholder farmers in Assam, India, where they rely on periodic markets to dispose of their surplus. Such channels are considered crucial for the community redistribution; however, their effectiveness is limited by inadequate storage and transportation (Jyoti and Kalita, 2024). The emergence of digital platforms is helping farmers bypass middlemen and increase transparency to connect directly with consumers of NGOs to coordinate surplus redistribution (Vilas *et al.*, 2023).

Currently, the effectiveness of disposal or redistribution of surplus produce is impacted by multiple challenges: (1) lack of a clear definition of surplus and what differentiates it from waste, resulting in loss of edible food (Oroski, 2025); (2) limitations due to logistical barriers such as collection, transportation, labour, and storage (Poulomi, Banerjee and Banerjee, 2023); (3) Surplus is attached to market dynamics, which is a major contributor in determining whether the surplus is donated, sold, or discarded (Midgley, 2014; Weymes and Davies, 2019); (4) The volume of food that food banks and charities can recover depends on their operational capacity, which is often limited (Oroski, 2025); (5) The root cause of surplus remains the overproduction to meet market expectations, which needs to be addressed systematically to reduce food waste (Gillman, Campbell and Spang, 2019).

These patterns reveal that the surplus produce disposal methods are driven by economic factors rather than environmental priorities, creating room for a digital solution that could

alter the equation and transform the process of managing surplus produce into a profitable operation. The gaps in the current systems are explored in this study to examine the impact of integrating features such as logistical support or guaranteed payments on making managing surplus more profitable and sustainable.

## Technology Acceptance in Farming Communities:

The adoption of digital solutions in agriculture is shaped by multiple factors that are best explained using theoretical frameworks such as the Technology Acceptance Model (TAM). Perceived usefulness and perceived ease are significant determinants of technology adoption, according to TAM. These factors are considered central in the agricultural context as farmers are willing to adopt tools that would enhance their productivity, reduce workload, or improve decision-making, and when the tools are user-friendly (Gabriel and Gandorfer, 2022; Giua, Materia and Camanzi, 2022; Geng *et al.*, 2024).

One strong motivator for adoption is perceived usefulness; tools that would increase yields, reduce costs, or improve farm management are more likely to be integrated into daily farm operations. Automatic systems are a great example of this, such as automatic milking systems and digital field records, as they reduce labour and make these operations run smoothly (Groher, Heitkämper and Umstätter, 2020; Gabriel and Gandorfer, 2022). Another critical use of digital tools is decision-making support, such as smart sensors and support systems (Subeesh and Mehta, 2021; Ollerenshaw *et al.*, 2025; Petraki *et al.*, 2025). Technologies that require minimal training are also attractive due to their ease of use, which is equally essential, unlike complex tools that are often rejected or face resistance (Giua, Materia and Camanzi, 2022).

The adoption patterns are affected by cultural and educational factors such as digital literacy, technical knowledge, and training. These barriers are observed primarily in regions with small-scale or traditional farming systems (Giua, Materia and Camanzi, 2022; Dibbern, Romani and Massruhá, 2024). A recent study found that discomfort with new technologies or scepticism about their benefits reduces their adoption rates, particularly among older farmers (Groher, Heitkämper and Umstätter, 2020). On the other hand, younger and more educated farmers are more likely to adopt digital solutions, especially if they are managing large-scale operations (Yang *et al.*, 2024). Peer recommendations also play a role in shaping farmers' views regarding digital innovations (Giua, Materia and Camanzi, 2022).

Another adoption determinant is the existence of a well-developed infrastructure. Adoption is limited in remote areas due to poor digital infrastructure, unreliable internet connectivity, and high investment costs (Gizachew *et al.*, 2024; Ollerenshaw *et al.*, 2025). These barriers can be mitigated with the availability of technical support and governmental incentives. Concerns about data privacy, security and reliability can be a source of resistance to new digital tools. If the perceived risk outweighs the benefits, farmers tend to resist adoption, particularly if the new tool does not align with their farming needs (Cesco *et al.*, 2023; Bekee, Segovia and Valdivia, 2024). New digital tools could deepen the digital divide if access between large and small farms or between regions is not ensured equally (Balkrishna *et al.*, 2023).

To increase the adoption of any new digital intervention, these barriers must be addressed. Training and development of user-centric technologies are successful strategies to increase adoption, as well as policies that address infrastructure gaps and provide financial incentives, which can help promote equitable and sustainable adoption (Dibbern, Romani and Massruhá, 2024; Hardy and Palmer, 2025).

### Critical Success Factors for Digital Platform Adoption:

There is a large volume of published studies describing the role of technological features, effective logistics, and trust-building mechanisms in the success of digital platforms for surplus produce. Trust building is critical, as it is widely known that platforms that enforce identity verification or partners with trusted organisations foster user confidence and reduce fraud. Mechanisms that would increase the trust factor and project a feeling of safety and security in transactions, both for the buyer and seller, include transparent product traceability, interactive feedback systems, and ethical farming certifications (Cao *et al.*, 2022; Li and Park, 2024; Ahamed, 2025). The use of blockchain-based platforms, which are decentralised and store information across multiple centres, helps enhance trust by keeping the data secure and resistant to modification, thanks to their secure records (Cao *et al.*, 2022).

Having a secure payment gateway is obligatory for a successful platform as it ensures safe and reliable transactions with minimum fraud risk both for the buyer and seller. Farmers and buyers are more likely to adopt a digital platform that includes features that guarantee that funds are only released when both parties are satisfied, by offering real-time payment processing and integrating escrow services (Deekshitha *et al.*, 2025).

The logistical aspect of a deal is crucial, particularly for perishable goods. The digital platform needs to provide collaborative logistics models, including live tracking and a shipping vehicle fleet that can handle customer requests. Previous case studies have demonstrated that effective logistical collaboration can enhance carbon emissions, reduce food waste, and increase farmers' profits simultaneously. The lack of effective logistics results in user attrition due to delayed deliveries and spoilage of produce (Matkovskiy, Sas and Shelenko, 2021; Zhou, Hou and Rao, 2024).

Real-time notifications, such as order status, delivery updates, and payment confirmations, greatly enhance the user experience. This feature is significant in the farming context, as mobile devices are the primary means of internet access (Chaudhari and Anute, 2022; Varghese *et al.*, 2024). Higher engagement and satisfaction rates are observed with accessible and intuitive designs of digital platforms.

Evidence suggests that partnerships with trusted organisations improve credibility and user trust (Luo, Wang and Liu, 2024). The platform adoption could be improved with direct and indirect subsidies through governmental incentives (Gomathy and Kumar, 2025). For long-term sustainability and to increase trust, a digital platform must seek to establish partnerships with credible organisations. Platforms that lack a user-centred design or fail to establish trust are more prone to fail due to user dissatisfaction. Various studies have assessed the efficacy of perceived playfulness on user engagement, revealing that it significantly influences purchase intentions among users from a younger age group or lower income class (Hua *et al.*, 2023). Another feature that is of interest to farmers is information sharing, such as market prices, demand forecasts, and product availability, which allows farmers to make informed decisions, helping reduce market inefficiencies (Chaudhari and Anute, 2022; Tripathi *et al.*, 2022).

These success factors were tested and reported by case studies other than the Irish context, particularly small to medium-sized farms. Additionally, the existing body of research has always focused on the consumer perspective of large-scale agribusinesses. As a result, a gap in the relevant evidence exists, which this study is attempting to address by gathering feedback and insights from Irish farmers regarding the proposed concept platform AgriLoop.

## Economic and Environmental Benefits of Surplus Produce

### Redistribution Platforms:

Digital platforms, such as OLIO and FarmDrop, aim to connect farmers with buyers to sell surplus produce and reduce food waste, thereby addressing both economic and environmental challenges in the food system. Smallholder and commercial farmers can improve their access to the market by utilising these platforms to sell their surplus produce. These platforms enable farmers to secure better prices on their surplus produce and enhance their financial resilience (Morepje *et al.*, 2024). One study found that farmers who connected with the digital supply chain experienced increased profits by 36% and reduced expenses by 19% (Durmanov *et al.*, 2024).

Platforms like FarmDrop not only increase farmers' income but also help farmers diversify their market channels and reduce dependency on single buyers through providing a direct-to-consumer marketplace (Principato *et al.*, 2023). While OLIO, a platform based in the UK, helps individuals to share surplus produce with households, it does not focus on a farmer-to-consumer relationship and is not designed for farmers, which might misalign with their workflow. On the other hand, FarmDrop platforms provide farmers with a direct-to-consumer marketplace, thereby bypassing traditional middlemen and offering more flexibility in disposing of surplus produce (Harvey *et al.*, 2020; Morepje *et al.*, 2024). Both platforms highlight how digital tools can help generate value for producers and consumers while aligning with sustainability goals.

Food redistribution platforms can have positive environmental outcomes, such as lowering greenhouse emissions that result from food decomposition and the overall agricultural carbon footprint (Benyam, Soma and Fraser, 2021; Papadopoulos *et al.*, 2024). These platforms facilitate a transition to a circular economy, enabling the reuse and redistribution of resources, which in turn helps minimise waste and mitigate adverse environmental impacts (Padthar *et al.*, 2024).

### Consumer Behaviour and Willingness to Pay for “Surplus” or “Imperfect” Produce:

A significant driver of food waste globally is consumer behaviour and their willingness to purchase surplus or ‘ugly’ produce, fruits, and vegetables that are perfectly safe to consume

but do not meet cosmetic standards. Emerging evidence suggests that consumers tend to value cosmetically attractive products more due to pre-imposed stereotypes that “ugly = bad”, which links these visual imperfections with safety and health concerns (Grewal *et al.*, 2018; Spielmann, Gomez and Minton, 2023). These false perceptions can be addressed through targeted marketing campaigns to increase consumer acceptance of visually imperfect products.

Psychological and cultural factors contribute to shaping consumers' willingness to pay (WTP) for ugly produce. One of the most important factors is self-perception, in which the consumer links eating unattractive produce with lower self-esteem, thereby reducing WTP (Spielmann, Gomez and Minton, 2023). This perception can be mitigated by introducing positive messages that reaffirm purchasing this product as a positive act that contributes to reducing food waste and promotes environmental sustainability. These marketing campaigns may target the cultural attitude by linking the purchase of a surplus product with food waste reduction, naturalness, and emphasising the environmental benefit (Li, 2020; Qi *et al.*, 2022). Previous research has found that consumers are more accepting of surplus produce if it is sold in venues associated with sustainability (Yuan *et al.*, 2019).

Other significant factors that influence buyers' behaviour include age, education, and income. Previous research has established that women and older adults with higher income or environmental awareness are more likely to accept paying for visually imperfect produce (Li and Kallas, 2021; Alsubhi *et al.*, 2022). On the other hand, consumers who have a negative perspective or view about ‘ugly’ produce tend to require discounts and are more hesitant to pay for these products. Sustainability campaigns and a change in the cultural norms in the past years have been gradually changing consumers' attitudes towards ‘ugly’ produce positively (Li, 2020; Qi *et al.*, 2022).

In Ireland, there is limited peer-reviewed research about the behaviour of the Irish consumer towards ‘ugly’ produce. Multiple innovative platforms have emerged, such as FoodCloud and Too Good To Go, that connect producers with consumers for surplus redistribution. Also, national campaigns such as Stop Food Waste and initiatives by Bord Bia play a role in promoting the acceptance of imperfect produce. These examples demonstrate that promoting the acceptance of surplus produce can be effectively achieved through educational campaigns and creative marketing strategies, ultimately helping to reduce food waste and promote sustainability.

## Gaps in Existing Research & the Case for Farmer-Centric Design:

There has been a gap in the evidence around a farmer-centred design and participatory involvement, although there is a growing interest in surplus produce reduction platforms. The lived experiences of farmers and their motivations have not been explored, as most existing solutions focus on technical efficiency and market access. These gaps limited the effectiveness and adoption of sustainability-centred platforms (Hackfort, 2021).

One of the shortcomings is the neglect of a participatory methodology that involves farmers in the design and implementation of surplus management. Although a participatory approach is used in some cases, its application is limited and superficial, failing to express genuine co-creation. This highlights the need for frameworks that enable farmers to be involved in the design and decision-making process for the platform to meet their actual needs and aspirations. A case study from the Ethiopian Highlands shows that a participatory approach and farmer research groups lead to higher uptake and adoption rates of technological interventions (Álvarez-Mingote and McNamara, 2018; Sikwebu, Zwane and Ramashala, 2021; Mekonnen *et al.*, 2023).

The large body of existing evidence has focused on the features of existing platforms instead of farmers' experience and how it aligns with on-farm contexts. Diversity among farmers, including gender, farm scale, and region, is often overlooked even when considering an approach of involving farmers in the process (McCaig, Dara and Rezanía, 2023; Roscher *et al.*, 2023).

Another critical gap that exists is the lack of research that explores the factors that influence how farmers perceive a platform to facilitate selling surplus produce. There have been few studies that examine how farmers trust or perceive the usefulness or ease of use of such platforms (Venkatesh *et al.*, 2003; Fishbein and Ajzen, 2011). In addition, there has been a lack of farmers' previous experiences with digital platforms for these purposes (Prokopy *et al.*, 2019; Ruiz-Rosa, Gutiérrez-Taño and García-Rodríguez, 2020). It is critical to understand these dimensions to help develop future technological solutions that answer farmers' needs and meet their expectations while having a positive impact on food waste and the environment. For that reason, our study aims to fill this gap through a qualitative approach to explore Irish farmers' perceptions and attitudes towards a surplus produce platform.

## Conclusion:

Food waste represents a critical challenge globally and is associated with a significant impact on food security and the environment. The evidence highlights that the reasons for on-farm losses differ between high-income countries and low-middle-income countries. In high-income countries, cosmetic standards and a shortage of labour represent the most significant contributors to on-farm food waste. In contrast, in low- and middle-income countries, food waste is mainly attributed to infrastructure deficiencies such as transportation and storage. A systemic solution is needed to address these complex factors that contribute to on-farm food waste. The development of a digital platform that answers to farmers' needs and problems can help improve food redistribution and market access. Still, the success of such a platform depends on the adoption rate by farmers. Insights from farmers on the development process of such a platform could facilitate the success and increase the effectiveness of the proposed solution to reduce food loss and waste.

## Research Questions and Objectives

The primary goal of this study is to investigate the acceptance and feasibility of the concept of the AgriLoop digital platform among small to medium-scale farmers in Ireland. The purpose of the platform is the facilitation of the resale of surplus produce to local buyers, aiming in the process to reduce food waste and support sustainability. Farmers' needs, expectations, and concerns regarding such a tool will also be explored.

### Research Objectives:

The following objectives guide this study: (1) exploration of the current disposal or redistribution methods of surplus produce practiced by Irish farmers; (2) identifying existing challenges faced by Irish farmers regarding selling surplus produce through existing digital or informal channels; (3) to examine how AgriLoop will be perceived by Irish farmers with a focus on its trust, usability, and functionality; (4) to assess what conditions would influence the adoption of AgriLoop platform among Irish farmers; (5) to help the practical development of the platform through generating insights, ensuring its alignment with real world farming contexts.

## Research Question

This study was informed and guided by a core question: “What are the perceptions of Irish farmers regarding the acceptance and feasibility of the proposed AgriLoop platform for selling surplus produce?”. The study also aims to answer the following sub-questions: (1) What operational and logistical challenges do farmers face in managing surplus produce? (2) What prior experiences have they had with alternative sales or donation channels? (3) What features would they expect or require in a digital platform to support surplus sales? (4) What conditions would need to be in place to build trust and encourage adoption?

## Research Methodology:

### Research Methods:

A qualitative methods approach was used in this study, which is suitable to explore inquiries about subjective experiences and nuanced insights. This approach was selected instead of a quantitative approach to investigate the interpretation and perception of Irish farmers of the concept of the AgriLoop digital platform.

For data collection, semi-structured interviews were conducted to provide structure and flexibility. Comparison across interviews, while leaving room for emerging themes, was possible using this approach for data collection. Data analysis was conducted using reflexive thematic analysis, following a six-step process outlined by Braun and Clarke (2006), which enabled the generation of themes grounded in the data (Braun and Clarke, 2006).

### Research Approach:

The interpretivist epistemology guides this research, which assumes that reality is formed by social interactions and the interpretation of participants' lived experiences creates knowledge (Creswell and Poth, 2016). This approach is suitable for our research in order to understand the subjective realities of farmers and their relation to the use of digital tools and food systems.

Inductive reasoning was used in this study in order to develop a conclusion from the data itself rather than starting with a theory to test. This approach serves the exploratory nature of the research and its goal to generate ideas to build a future platform.

## Research Choice and Instrument

This study employs a mono-method qualitative design, which utilised semi-structured interviews as the sole data collection tool. The decision to choose this approach was due to the exploratory nature of the study and the need to understand farmers' needs and the feasibility of a technological solution.

A set of interview questions was developed to cover important areas such as farmers' prior experiences with surplus produce, former use of digital tools, and features they would like to be incorporated into the AgriLoop platform. The questions were open-ended to allow participants to respond freely, and probing was used to encourage engagement and elaboration from the participants.

Example questions included: (1) How often do you end up with extra or imperfect produce? What usually causes it? (2) What do you currently do with produce you can't sell? Why do you choose this approach? (3) What's the biggest challenge you face when it comes to managing surplus crops? (4) What are your first thoughts about the AgriLoop concept? (5) What would make a platform like AgriLoop most useful for you? (e.g., speed, price, type of buyers, reliability, transport, etc.).

There were no formal pilot studies conducted before the primary data collection process. The exploratory nature of our selected design of semi-structured interviews allows for flexibility in our approach, making early interviews effectively serve as 'natural pilots.' This practice is consistent with best practice in qualitative research, where it is recommended to refine questions during early interviews to improve clarity and relevance (Bryman, 2016).

## Data Collection Methods and Data Analysis

### Data Collection

Ten participants were recruited for this research study between May and July 2025 through purposive sampling. This sampling method was appropriate for our purposes, as we aimed to gather context-specific and deep knowledge (Palinkas *et al.*, 2015). Active farmers based in Ireland, from both urban and rural areas, such as Wicklow, who have experience with vegetable or horticultural farming and have dealt with food surplus before. Interviews were conducted via Zoom. Each interview lasted 25 to 35 minutes.

## Data Analysis

Thematic analysis of the data set was performed according to Braun and Clarke's (2006) framework in order to identify patterns of meaning across the data set. Initially, the transcripts were read multiple times to establish familiarity with the data set and gain a deep understanding of the content. Initial codes and patterns were identified through manual coding, utilising AI-assisted tools. The outcome from the coding process was reviewed and refined by the researcher to ensure accuracy in the final coding process and that it reflects the participants' perspectives. Border themes were created to group this code into similar categories, such as "Operational Constraints," "Platform Trust," and "Usability Expectations". Reviewing and checking the themes for internal consistency overlap was done before being defined, and this process was supported with illustrative participant quotes. In the end, each generated theme was linked with the study aims and existing literature in the final reporting. The selection of themes was based on their depth and relevance, and not only their frequency. Continuous engagement with the data and careful refinement of themes were done to ensure that the process was iterative and reflexive.

## A Semi-Structured Interview

The use of semi-structured interviews in this study helped create a balance between comparability and flexibility. The same formula was followed in each interview with slight adjustments based on participants' responses and interactions to allow for a deeper understanding of their perspectives. For that reason, we were able to cover key themes while allowing farmers enough space to raise any issues we may not have anticipated.

Interviews followed a conversational tone, which provided more comfort and openness for the participants. Technical language was avoided, and the use of storytelling was encouraged. This method allowed the participants to share details about their farming routines, challenges, and expectations.

## Participants

The inclusion criteria for this study were as follows: any person aged between 20 and 65 actively working in a farm of any size located in Ireland, with experience in dealing with food surplus in the past 18 months. Participants have to be fluent in English and consent to an interview in person or online. The exclusion criteria involved individuals not involved with the operational aspects of farming (e.g., administrative staff), farmers of produce that is not

perishable (e.g., grain or hay), individuals based outside of Ireland, and individuals with no experience of surplus produce.

## Ethical Considerations

Our study was conducted with adherence to the ethical guidelines of the National College of Ireland. An ethical approval was formally granted to the author of this paper before the commencement of data collection or recruitment. An information sheet outlining the purpose of our study, alongside a consent form, was provided to participants before conducting our interviews. After the interviews, the data were anonymised to ensure confidentiality and protect participants. All the audio recordings were deleted after the transcription process, following the General Data Protection Regulation (GDPR).

## Limitations:

This study has several limitations, including the sample size. Even though thematic saturation was achieved with ten interviews, the findings can't be generalised to all Irish farmers, including farmers in different categories such as dairy and livestock. Digital bias may have been introduced because farmers who may be more open to digital innovations agreed to participate in the study, potentially skewing perceptions towards optimism. Risk of self-reporting bias also exists as data perspectives were self-reported and may be prone to recall error or social desirability. Limited geographical scope, as most of the included farmers were from Dublin County, which might not be representative of the general Irish farming population. Finally, farmers' responses were based on a description of the concept rather than actual use, since AgriLoop is still a concept that could affect the accuracy of perceived feasibility.

## Results:

In this chapter, we will present the findings from our semi-structured interviews that were conducted with ten Irish farmers. A diverse group of participants was selected to ensure fair representation of the Irish agricultural community. The farm range of included participants ranges between (small, <15 acres; medium, 15-40 acres; large, >40 acres), and their primary crop types were (root/mixed vegetables, salad/greens, soft fruits) the age classification of included participants was (young, 25-44; mid-career, 45-54; senior, 55+) (Table 1, Appendix). Our research aimed to explore the challenges faced by Irish farmers

regarding surplus and cosmetically imperfect produce, as well as their perspectives and insights on existing and proposed technological solutions. We also aimed to identify factors that would influence their attitude and adoption of the newly proposed digital platform named ‘AgriLoop’.

Data analysis was done following a thematic analysis approach. This process involved comprehensive data familiarisation followed by the initial code generation, which was then used for thematic identification and refinement. In our analysis, six primary themes were identified as follows: 1) Challenges with Surplus Produce; 2) Desired Platform Features; 3) Experiences with Alternative Sales Routes; 4) Factors Influencing Trust; 5) Current Unsold Produce Disposal Methods; and 6) First Thoughts on the AgriLoop Concept. In the analysis, the demographic and firmographic profiles were included to explore how factors such as farm size, crop type, and age correlate with the findings of our thematic analysis and aid the interpretation process of these findings.

A thematic matrix of the analysis was generated to summarise and visualise the findings of our study (Figure 1). This provides insight into the prevalence of the observed sub-themes and their interaction across participants' profiles. A detailed narrative analysis of each theme was created, reinforced with direct quotations and demographic data to help provide a rich and contextualised understanding of the study findings. Factors such as farm size, crop type, and age influenced how challenges experienced by farmers are shaped.

Farmer ID	Farm Size	Crop Type	Age Group	P1: Challenges with Surplus	P2: Desired Platform Features	P3: Alternative Sales Routes	P4: Factors Influencing Trust	P5: Unsold Produce Disposal	P6: First Thoughts on AgriLoop
Farmer 1	FS-M	CT-VEG	AGE-M	OP-CON / INFRA / MKT-FRIC	USABILITY / BUYERS / LOG-SUP	LOCAL-FAIL / AID-FAIL	LEGIT	FEED / WASTE	OPTIM / ALIGN
Farmer 2	FS-M	CT-SALAD	AGE-Y	MKT-FRIC	USABILITY / COMM / BUYERS	LOCAL-FAIL	REPUT	WASTE	OPTIM / ALIGN
Farmer 3	FS-L	CT-VEG	AGE-S	OP-CON	BUYERS / USABILITY	LOCAL-FAIL / DIGI-FAIL	LEGIT	DONATE / WASTE	OPTIM / ALIGN
Farmer 4	FS-S	CT-SALAD	AGE-Y	MKT-FRIC	COMM / USABILITY	LOCAL-FAIL	REPUT	DONATE / WASTE	OPTIM / ALIGN
Farmer 5	FS-L	CT-VEG	AGE-M	OP-CON / INFRA	LOG-SUP	AID-FAIL	LEGIT	FEED / WASTE	OPTIM / ALIGN
Farmer 6	FS-S	CT-FRUIT	AGE-Y	OP-CON / MKT-FRIC	USABILITY / COMM	LOCAL-FAIL	LEGIT	WASTE	OPTIM / ALIGN
Farmer 7	FS-M	CT-VEG	AGE-S	OP-CON / INFRA	USABILITY	LOCAL-FAIL	LEGIT	FEED / WASTE	OPTIM
Farmer 8	FS-S	CT-VEG	AGE-Y	INFRA / OP-CON	BUYERS / COMM	DIGI-FAIL	LEGIT	FEED / WASTE	OPTIM / ALIGN
Farmer 9	FS-S	CT-VEG	AGE-S	OP-CON	BUYERS / LOG-SUP	AID-FAIL	LEGIT	WASTE / DONATE	OPTIM / ALIGN
Farmer 10	FS-M	CT-VEG	AGE-M	OP-CON	USABILITY / LOG-SUP	LOCAL-FAIL	LEGIT / REPUT	WASTE / DONATE	OPTIM / ALIGN

Thematic Code Legend		
Code	Meaning	Theme Category
OP-CON	Operational Constraints (time, labor, transport)	Challenges with Surplus
INFRA	Infrastructural Deficits (lack of storage)	Challenges with Surplus
MKT-FRIC	Market Friction (difficulty finding buyers quickly)	Challenges with Surplus
USABILITY	Platform Usability & Speed (simple, fast interface)	Desired Platform Features
BUYERS	Buyer Networks & Reliability (vetted, reliable buyers)	Desired Platform Features
LOG-SUP	Logistics & Transaction Support (delivery, payment)	Desired Platform Features
COMM	Communication & Discovery (messaging, alerts, filters)	Desired Platform Features
DIGI-FAIL	Failure of Digital Platforms (e.g., Facebook)	Alternative Sales Routes
LOCAL-FAIL	Breakdown of Local Systems (co-ops, cafes)	Alternative Sales Routes
AID-FAIL	Logistical Failures with Aid (charity collections)	Alternative Sales Routes
LEGIT	Platform Legitimacy & Security (proper business, support)	Factors Influencing Trust
REPUT	Social Proof & Reputation (ratings, reviews)	Factors Influencing Trust
WASTE	Waste & Compost (tilling in, binning)	Unsold Produce Disposal
FEED	Animal Feed	Unsold Produce Disposal
DONATE	Donation Efforts (to charities, food banks)	Unsold Produce Disposal
OPTIM	Cautious Optimism (promising, depends on execution)	First Thoughts on AgriLoop
ALIGN	Alignment with Needs (solves a known core problem)	First Thoughts on AgriLoop

Participant Profile Legend		
Code	Meaning	Category
FS-S	Small Farm (<15 acres)	Farm Size
FS-M	Medium Farm (15-40 acres)	Farm Size
FS-L	Large Farm (>40 acres)	Farm Size
CT-VEG	Root/Mixed Vegetables	Crop Type
CT-SALAD	Salad/Greens/Herbs	Crop Type
CT-FRUIT	Soft Fruits	Crop Type
AGE-Y	Young (25-44)	Age Group
AGE-M	Mid-Career (45-54)	Age Group
AGE-S	Senior (55+)	Age Group

Figure 1 Thematic matrix summarising qualitative interview data from 10 farmers, detailing their challenges, desired platform features, sales routes, and thoughts on the AgriLoop platform.

## 4.1 Theme 1: The Multi-Faceted Challenges of Surplus Produce

The first theme in our analysis addresses the challenges faced by farmers when dealing with surplus produce. These challenges were divided into three critical subthemes

that include: overwhelming Operational Constraints, significant Infrastructural Deficits, and persistent Market Friction. Although these challenges may seem universal, our analysis revealed that their nature and intensity are different and are affected by the demographic profile of the farm and the farmer. It was also found that these factors are not isolated from each other, but instead they form a cycle in which lack of time is exacerbated by a lack of storage, which in turn is made critical by an inefficient market (Figure 2).

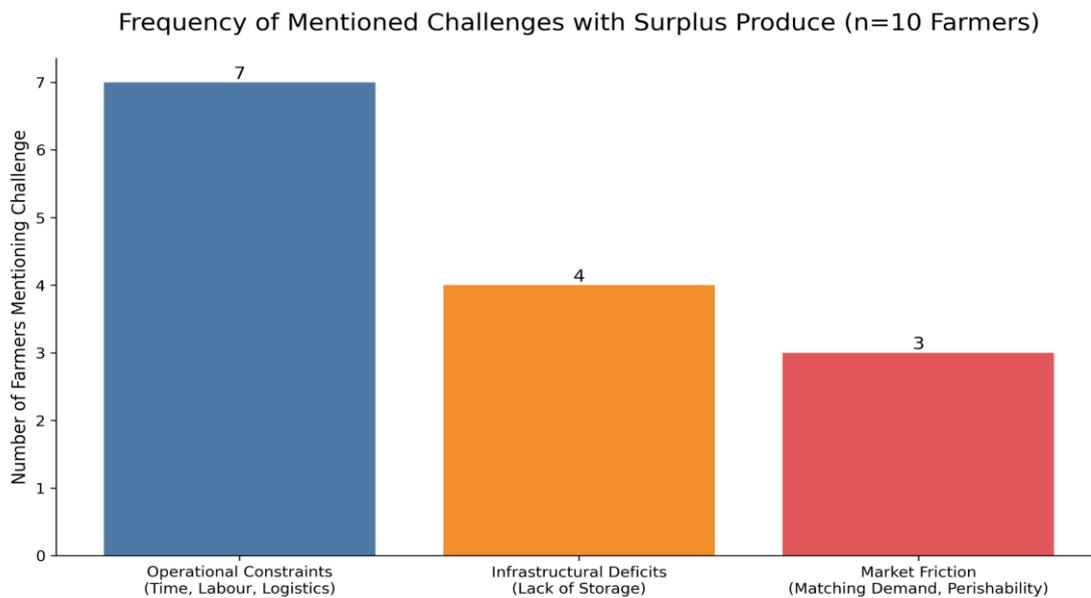


Figure 2 Challenges faced by farmers in managing surplus produce, with operational constraints being the most frequently reported.

#### 4.1.1 Operational Constraints

This severe pressure on the operational capacity of farmers' sub-theme was the most dominant among participants (8/10). This pressure was manifested as a shortage of time and labour, and was perceived by farmers from all farm sizes and types, which makes managing surplus produce as a secondary task a challenging process. All of the available manpower and time are consumed while fulfilling primary tasks of harvesting, leaving no room for additional consideration of surplus storage, transportation and redistribution.

Participants expressed a sentiment of being “stretched”. Farmer 1 (FS-M, AGE-M), a 30-acre potato and carrot grower, highlighted the impact of "labour shortages." Farmer 9 (FS-S, AGE-S), a 12-acre cabbage grower, bluntly stated the problem was "Labour and delivery. We don't have the staff or vans." These statements reflect that the issue of labour shortage is universal across farms regardless of size. It also demonstrates that the primary problem is not

a lack of will but rather a lack of resources and the high cost associated with managing surplus.

Additionally, the challenge of time pressure was expressed explicitly by Farmer 6 (FS-S, CT-FRUIT), the soft fruit grower. He explained, "June to September is the most intense. Fruits ripen fast, and if we don't sell or pick in time, they're gone." This statement suggests that a significant variable for surplus management is crop type, as the soft fruits are perishable within a very short window of time, measured in hours, unlike growers of root vegetables, who do not suffer from intense pressure when it comes to harvest. These findings highlight the need for a solution that minimises time and labour requirements for farmers, offering quick solutions to alleviate the time pressure faced by soft fruit growers.

#### 4.1.2 Infrastructural Deficits

Infrastructural deficits were identified by nearly half of the participants (4/10). A lack of on-farm infrastructure, most notably cold storage facilities, led to farmers making 'wasteful decisions' regarding surplus management. This issue seemed not to be influenced by farm size. Farmer 8 (FS-S, AGE-Y), with a 10-acre farm, stated simply, "We don't have cold storage for overflow," while Farmer 5 (FS-L, AGE-M), a large-scale 70-acre farmer, identified the same core challenge: "Transport and storage. If we can't shift it fast, it spoils or takes up space we don't have." these statements suggest issues with securing cold storage was more common across farms big and small and that investment in storage units for anticipated surplus seemed financially not effective for farmers.

The connection between sub-theme 1 and 2 was demonstrated by Farmer 1 (FS-M, AGE-M): "If we had a way to store produce short-term... it would change things." This information suggests that addressing the infrastructure problem would help secure more time for searching for a buyer. The lack of infrastructure contributes to labelling edible food as waste because there is no physical space to hold it, while looking for other alternatives for distribution.

#### 4.1.3 Market Friction

The third subtheme highlights the challenge of connecting the right buyer at the right moment, particularly when surplus produce that is unplanned is the product to sell. This challenge was felt most acutely by farmers of highly perishable produce and farmers dealing with high-end clients who are not easy to replace.

Farmer 2 (FS-M, CT-SALAD), a salad greens grower, pinpointed the core issue: "If one [restaurant] cancels last-minute, we're stuck." Similarly, Farmer 4 (FS-S, CT-SALAD), an urban farmer growing microgreens, noted, "One cancelled order can mean a lot of loss." Farmer 6 (CT-FRUIT) reinforced this: "There's no fast way to shift 15kg of ripe berries when your regular buyer cancels." This suggests that surplus was an issue for farmers supplying the hospitality sector, particularly when unplanned cancellations occur with little notice, making it difficult to secure an alternative buyer.

Market friction was also experienced by root vegetable growers and was described as a lack of a "quick mechanism for that last-minute connection" (Farmer 1, CT-VEG). Farmer 5 (FS-L, CT-VEG) further lamented, "It's not like there's a list of people looking for half a ton of carrots on a Tuesday afternoon." These inputs suggest that all farmers are affected by market friction, but it was felt more by farmers of highly perishable produce. The issue with the current market is that it was built for large volume orders and lacks the flexibility to absorb sudden, smaller quantities of produce.

In the end, the challenges faced by farmers are universal in most cases. Lack of labour and storage contribute to creating an environment where things have to be rushed. The rigidity of the market also contributes to this issue by adding pressure to try to connect with potential sellers at the last minute. This combination of pressure factors prevents farmers from managing surplus in a sustainable manner, leading them to waste produce to avoid the high cost of managing excess, despite the economic impact on the farmers. These findings help answer research question 1 by illustrating the challenges faced by farmers in managing surplus produce and how these challenges vary across crop types.

## 4.2 Theme 2: Blueprint for a Solution - Desired Platform Features

The farmers have helped deliver their insights and perspective about what a desired solution should look like. These insights were born from the challenges they experienced. Our analysis revealed four sub-themes when we asked the farmers about the desired platform features and utilities, which include: Platform Usability & Speed, a robust Buyer Network & Reliability, integrated Logistics & Transaction Support, and effective Communication & Discovery tools. The participants emphasised the importance of these features and considered them to be a core prerequisite for them to adopt the new solution. It was also noted that the emphasis on each of the features was influenced by the demographic factors of our participants (Figure 3).

Farmer Participants	Desired Feature Themes			
	Platform Usability & Speed	Buyer Network & Reliability	Logistics & Transaction Support	Communication & Discovery
Farmer 1	X	X	X	
Farmer 2	X	X		X
Farmer 3		X	X	
Farmer 4	X			X
Farmer 5			X	
Farmer 6	X			
Farmer 7	X			
Farmer 8		X		X
Farmer 9		X	X	
Farmer 10	X		X	X

Figure 3 Farmer participants' preferred digital platform features, highlighting usability, buyer reliability, logistics, and communication needs.

#### 4.2.1 Platform Usability & Speed

The most common theme that was observed (6/10) was the need for a fast and straightforward user interface for the digital platform. Farmers described their idea of a solution that must be a tool to save time, not waste it. This desire was born from the existing operational constraints and time shortage suffered by farmers. The best term to describe what the farmers were trying to articulate is the "five-minute rule."

Farmer 3 (FS-L, AGE-S), a large-scale farmer in the senior age bracket, established a clear benchmark: "If I can post in under five minutes, I'll use it." This "five-minute rule" was echoed by Farmer 6 (FS-S, AGE-Y), a young soft fruit grower, who desired a process so fast he could have an interested party "within an hour." These quotes underscore the need for a straightforward and user-friendly platform that streamlines surplus management without requiring excessive time.

A senior farmer highlighted in explicit terms the need for simplicity. Farmer 7 (AGE-S) cautioned that the platform must be "very simple to use... not into apps with too many steps," and even suggested "phone support for those not comfortable with tech." while most users value speed the most, it has to be taken into consideration that the platform needs to be accessible and uncluttered to ensure engagement and adoption from older demographic of

farmers who might have lower digital literacy. In the end, it became clear that the complexity is a direct barrier to adoption.

#### 4.2.2 Buyer Network & Reliability

Another important theme that was seen in half of the participants (5/10) is the need to be able to access a database of vetted and reliable buyers. This desire was observed across all demographics, highlighting the need for a professional, closed-loop system rather than an unmonitored open marketplace. This preference stems from previous negative experiences with other channels.

Farmers of all sizes and ages expressed a need for "a clear list of reliable buyers" (Farmer 9, FS-S, AGE-S) and a system that connects them with buyers who "actually turn up and pay" (Farmer 1, FS-M, AGE-M). The desire for a "proper database of buyers" (Farmer 8, FS-S, AGE-Y) highlights a shared frustration with the time wasted on non-serious inquiries on platforms like Facebook Marketplace. Therefore, the platform needs to act as a trustworthy intermediary between farmers and vetted buyers to increase its legitimacy and protect farmers from the risk of dealing with unserious buyers.

#### 4.2.3 Logistics & Transaction Support

Interest in the platforms' support for financial and physical aspects of the selling process was expressed by half of our participants (5/10). This feature was primarily desired by farmers operating on large farms or handling large quantities of produce, such as bulk root vegetables.

Farmer 5 (FS-L, AGE-M), managing a 70-acre operation, described integrated logistics as a potential "game-changer," specifically mentioning "Pickup or shared delivery." This request is entirely logical in light of the complexity of moving large quantities of produce. Farmer 1 (FS-M, AGE-M), another grower of bulk vegetables, also highlighted the need for "built-in logistics support." This indicates that the importance of an integrated logistical support increases as the farm size increases. As our analysis suggests, for large farms, this is considered a core feature, while for small farms, it would be convenient to have this feature available.

#### 4.2.4 Communication & Discovery

Four participants highlighted this final sub-theme in this category (4/10). There was a demand for tools for real-time communications, such as "instant messaging, and location filters," according to (Farmer 8, AGE-Y). Participants within the age group of AGE-Y mainly drove this demand.

Farmer 2 (AGE-Y) wanted "real-time posting, filters for location, and instant messaging," and Farmer 4 (AGE-Y) desired "local buyer filters [and] immediate notifications." This indicates that farmers from the younger age group who are more likely to be accustomed to using instant message apps in their daily lives are more likely to adopt the platform if it supported such feature. While younger farmers focused on speed and efficacy in communication, older farmers focused more on simplicity.

To conclude the second theme, the farmers' perception of a viable solution is one that is easy to use, provides access to trusted buyers, helps with logistics, and provides instant communication features. These features are considered pillars for our participants, and the lack of any of them would render the platform ineffective in their eyes.

### 4.3 Theme 3: The Landscape of Failure - Past Experiences with Alternative Sales Routes

To learn from past experiences and failures, it was important to explore the farmers' previous attempts at managing surplus produce. A consistent pattern of good intentions that was deemed to be unsustainable was observed. These experiences can be categorised into three sub-themes: Breakdown of Interpersonal & Local Systems, the Failure of Digital Self-Service Platforms, and Logistical Failures with Formalised Aid (Figure 4).

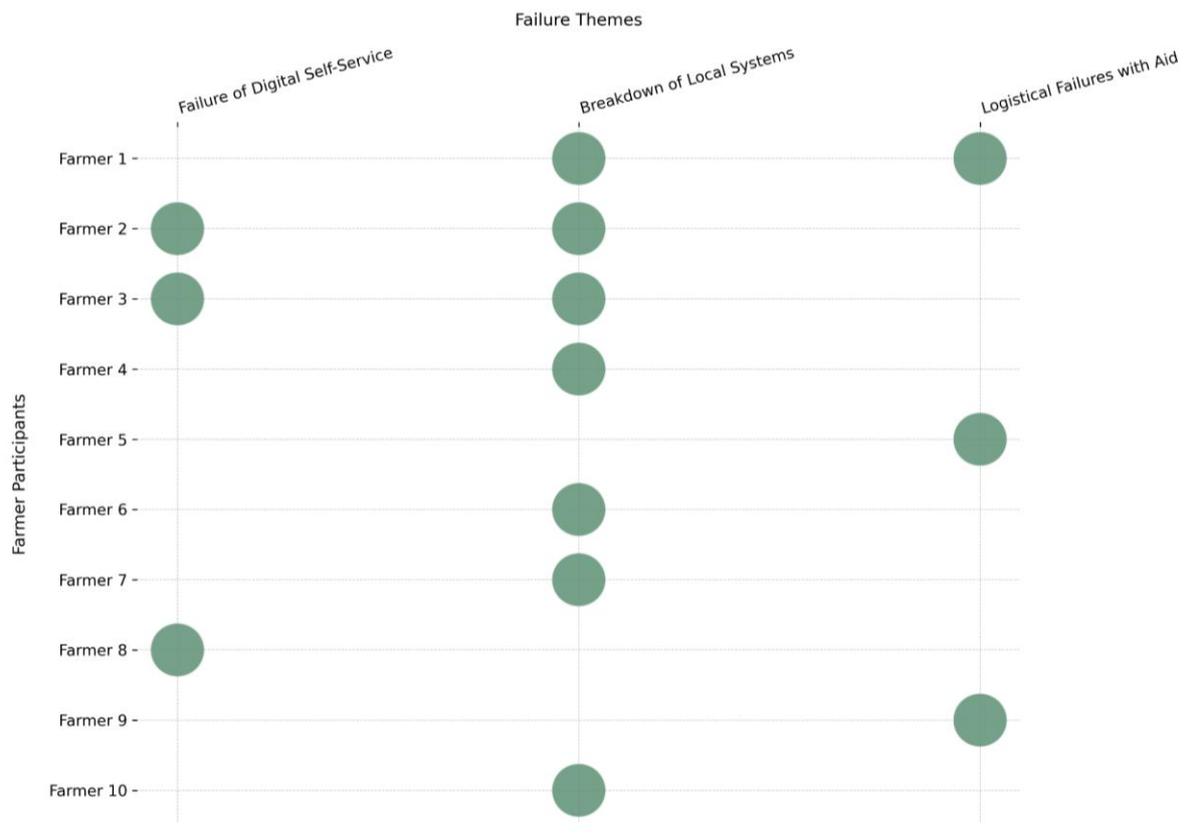


Figure 4 This matrix visualises the past experiences of ten farmers with alternative sales routes, categorising their reported failures into three themes: "Failure of Digital Self-Service," "Breakdown of Local Systems," and "Logistical Failures with Aid."

### 4.3.1 Breakdown of Interpersonal & Local Systems

Failure of local systems to manage surplus was the most observed theme (7/10) among our participants. Farmer 10 (AGE-M), who tried a local veg box scheme, found it involved "too much admin." At the same time, Farmer 3 (AGE-S) saw a co-op "folded" because "The coordination just didn't last." This suggests that the systems used by farmers relied on the goodwill and spare time of a few individuals. As Farmer 2, AGE-Y, noted, the "admin side" becomes increasingly challenging to manage over time, ultimately leading to the system's collapse.

### 4.3.2 Failure of Digital Self-Service Platforms

The second sub-theme focused on the use of existing services to manage surplus produce. Three participants mentioned the platform Facebook Marketplace, which proved to be ineffective for them. Farmer 8 (AGE-Y) perfectly summarised the issue: "Got more likes than buyers." The experience of these farmers taught them that a dedicated marketplace for surplus produce was needed. This desire was also expressed when farmers requested that the platform connect them with vetted buyers, as mentioned in theme 2.

### 4.3.3 Logistical Failures with Formalised Aid

Working with charities was cited by three farmers, and it was described as challenging. Farmer 9 (FS-S, AGE-S) noted that a charity stopped collecting due to their own "fuel costs," while Farmer 1 (FS-M, AGE-M) found the two-day process to organise a collection "isn't viable when we're busy harvesting." This shows that even when both parties are willing, logistics can be the deal breaker. Costs for both the farmers and charities present a barrier to managing surplus.

As a whole, these failures are essential to understanding the farmer's mindset and how to address these challenges in the new proposed solution. Any new viable platform must be able to address past failures in order to be efficient in real-world operations and meet farmers' expectations.

## 4.4 Theme 4: The Currency of Trust - Conditions for Platform Adoption

The single most important factor for the platform's success is the trust of the farmers. In this section, two main themes emerged as a core to establish trust: the non-negotiable need for Platform Legitimacy & Security and the strong demand for Social Proof & Reputation Systems (Figure 5).

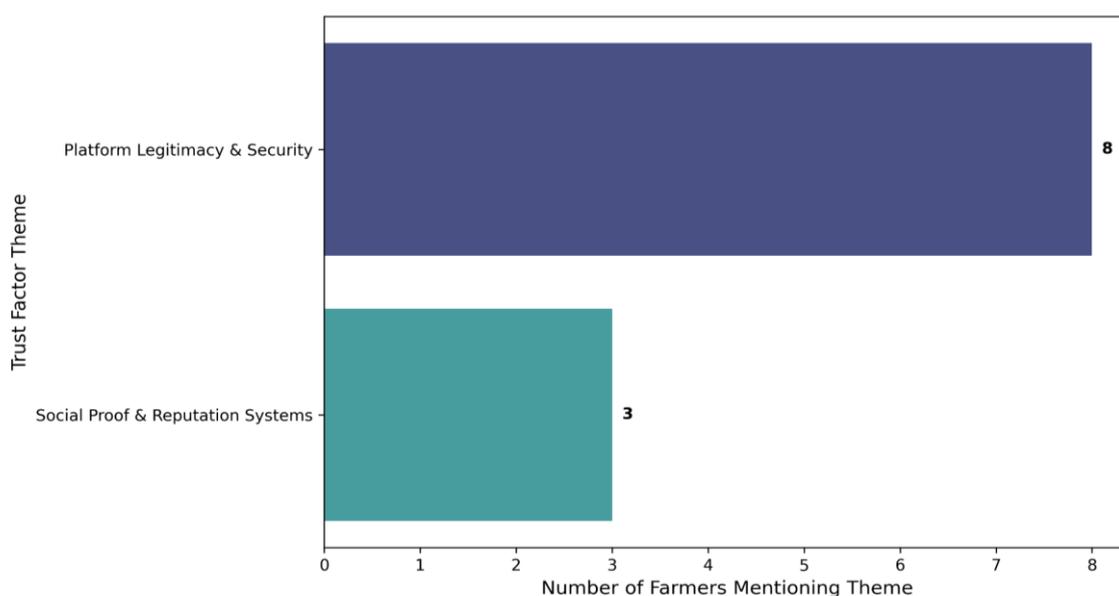


Figure 5 This bar chart illustrates how frequently different factors influence trust among ten farmers.

#### 4.4.1 Platform Legitimacy & Security

Platform legitimacy was the most prominent theme in the entire study, and it was mentioned by eight participants (8/10). This demand was universal, requested across all age groups and farm sizes. There was a need from the farmers for the platform to function as "proper business" with "secure payments" (Farmer 3, AGE-S), "clear terms of service," and "accessible customer support" (Farmer 4, AGE-Y), which was a point of complete consensus. Farmer 1 (AGE-M) described this demand best: "It can't just be a classifieds board. Needs structure and some accountability." The requirement of a professional, secure, and accountable service that mitigates risk was desired by all the farmers, regardless of their age or farm size.

#### 4.4.2 Social Proof & Reputation Systems

The reputation system theme was cited by three farmers (3/10), indicating the presence of a need for a trust mechanism that is community-driven. Features such as "a rating or review system" (Farmer 2, AGE-Y; Farmer 10, AGE-M) or "good moderation" (Farmer 4, AGE-Y) were mentioned by farmers in the young age group. On the other hand, senior farmers demanded institutional legitimacy. This contrast highlights how younger farmers have higher confidence in a peer-to-peer accountability system. Their experience with modern e-commerce platforms mainly shapes this desire, as value is seen through the experiences of their fellow users.

Trust for the platform could be summarised into two categories: institutional legitimacy and social proof. According to our findings, providing only one of the categories would be insufficient for the platform's success.

### 4.5 Theme 5: The End of the Line - Current Disposal Methods for Unsold Produce

In this theme, the current disposal methods of surplus produce are discussed. In our findings, it was surprising that the most wasteful options were the cheapest. There were three primary disposal methods in our sample: Waste & Compost, use as Animal Feed, and inconsistent Donation Efforts (Figure 6).

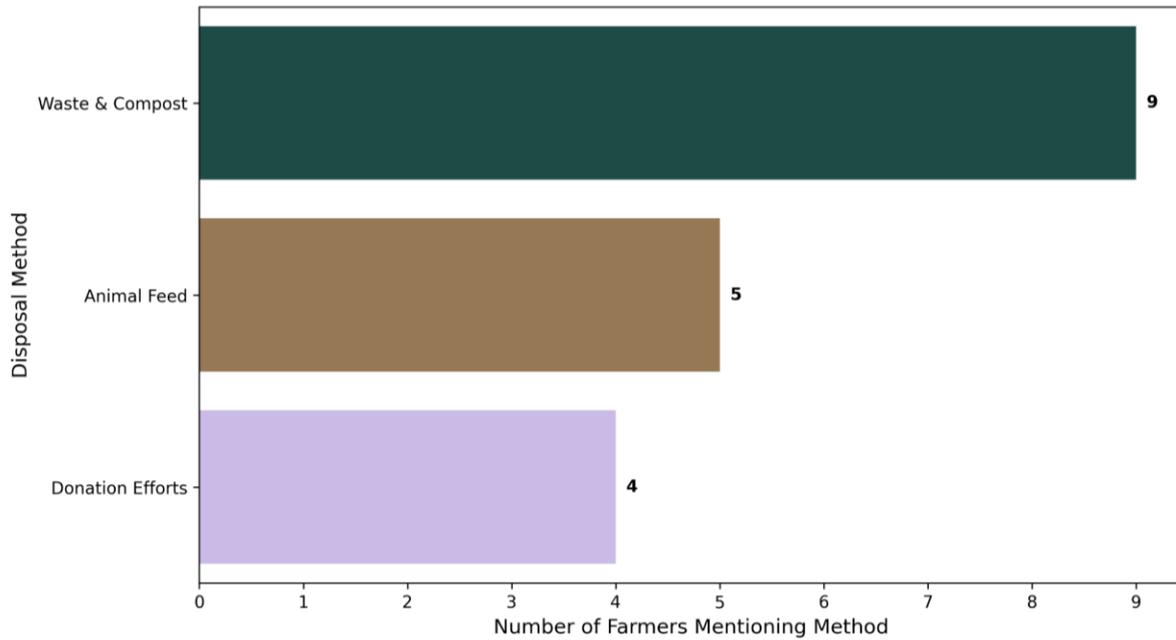


Figure 6 bar chart displays the frequency of different disposal methods for unsold produce among ten farmers.

#### 4.5.1 Waste & Compost

This theme was almost a universal practice, with 9 out of 10 farmers reporting it. This method was adopted by farmers of all sizes and was a "quicker and cheaper" option (Farmer 3, FS-L). Despite this practice being common, it held an emotional toll on the farmers. Farmer 1 found it "painful to see good food go to waste," while Farmer 10 described it as "frustrating, especially when you know it could feed people." The sheer scale of this waste varies significantly, ranging from "400-600 kg total" for a small salad grower (Farmer 2, FS-M) to "5 to 8 tonnes" for a medium-sized vegetable grower (Farmer 10, FS-M). These findings highlight the critical economic impact of the current system's inefficiencies.

#### 4.5.2 Animal Feed

The use of surplus as an animal feed was the second most common option among our sample, reported by five farmers (5/10). It's worth noting that the five farmers who expressed this theme were all growers of root/mixed vegetables (CT-VEG).

These findings suggest that the current system of surplus disposal is driven by convenience and a lack of alternatives. Farmers' frustration with the surplus produce from current management methods is an issue that a platform like AgriLoop aims to solve.

## 4.6 Theme 6: First Impressions - Initial Reactions to the AgriLoop Concept

The final theme represents farmers' initial thoughts about the concept of the proposed platform AgriLoop. The participants had an overwhelmingly positive response to the idea, and this can be classified into two main sub-themes: a uniform feeling of Cautious Optimism and a strong sense of Alignment with Needs (Figure 7).

Initial Reaction Themes

	Cautious Optimism	Alignment with Needs
Farmer 1	✓	✓
Farmer 2	✓	✓
Farmer 3	✓	✓
Farmer 4	✓	✓
Farmer 5	✓	
Farmer 6	✓	✓
Farmer 7	✓	
Farmer 8	✓	✓
Farmer 9	✓	
Farmer 10	✓	✓

Figure 7 The matrix visualises the initial reactions of ten farmers to AgriLoop

### 4.6.1 Cautious Optimism

Every single farmer had a positive response to the idea (10/10) using terms such as "promising" (Farmer 1, Farmer 5), "interesting" (Farmer 9), or "great" (Farmer 6, Farmer 10). This positive reaction is an indication of a need that is unmet. However, farmers expressed this feeling, hoping that the platform would meet their expectations and it would address past failures mentioned in theme 3.

## 4.6.2 Alignment with Needs

A majority of farmers (7/10) had initial thoughts that the platform could represent the solution they need. Farmer 8 (AGE-Y) stated simply, "Sounds like a solution we need," while Farmer 4 (AGE-Y) noted how it "fits the model of circular food systems and community resilience." A recognition of potential value was felt particularly among younger farmers who might be more environmentally conscious.

These themes show that the problem AgriLoop is trying to address is deeply felt within the farming community. They also show that farmers have the will to shift towards a more sustainable solution if it were realistic and aligned with their day-to-day operations.

## Discussion

The findings of our analysis show a complex connection between different factors that shape Irish farmers' response to surplus produce. The six identified themes highlight a universal pressure on farmers due to limited labour, insufficient storage, and unpredictable market connections, which made the management of surplus produce in a sustainable manner complex and financially non-viable. These findings are consistent with what was reported previously in the literature by farmers in high-income contexts, at the same time highlighting that the effect of these factors is combined and acute for small and medium farms (Gillman, Campbell and Spang, 2019; O'Connor *et al.*, 2023).

The themes explored in this study align with technology acceptance literature that identifies perceived usefulness and ease of use as central adoption factors (Davis, 1989; Gabriel and Gandorfer, 2022). It was worth noting that the older farmers referred to simplicity as a core desired feature of the platform, which echoes the previous findings in the literature regarding digital literacy as a barrier for adoption, particularly among senior farmers (Giua, Materia and Camanzi, 2022). Younger farmers expressed their desire for a real-time communications feature, which reflects the trends relating to age-based digital preferences (Groher, Heitkämper and Umstätter, 2020).

Security and reputation systems are identified in the literature as trust indicators that establish legitimacy for agricultural technology solutions (Sun *et al.*, 2025). This pattern identified in our analysis suggests that any future solution, and in this case AgriLoop, will need to be credible through combining robust governance structures with community-driven

feedback mechanisms. These requirements can be observed in similar platforms such as FarmDrop (De Vries *et al.*, 2023).

## Policy Implications

The findings of this study have a direct implication on Ireland's policy towards agricultural, environmental, and rural digitalisation. For example, the operational constraints expressed by the farmers regarding labour shortages are supported by previous evidence identifying labour shortage as a major contributor to on-farm losses (LOSS, 2019). Targeted policy interventions such as subsidising temporary labour for peak harvest periods and offering financial incentives for mechanisation, where appropriate, are critical to address these challenges.

Another clear target for policy support is the notable lack of accessible cold storage. Shared cold storage facilities co-funded by local authorities have proven to be effective in parts of Spain and Italy, with measurable reductions in post-harvest loss (Navarro-del Aguila and De Burgos-Jiménez, 2022; *Sustainable food cold chains: Opportunities, challenges and the way forward*, 2022). Similar models could be integrated in Ireland, which will provide the necessary window for redistribution through platforms like AgriLoop.

Another area for improvement is the government policy towards the redistribution of surplus. Redistribution and donation of surplus could become more economically appealing for farmers if they received tax credits or reduced rates. Linking redistribution metrics to agri-environmental payments could incentivise farmers to adopt more sustainable methods of surplus management (Franco and Cicatiello, 2021). Additionally, policies to improve digital literacy among senior farmers could contribute to increasing the uptake of digital solutions, as was proven in other contexts (Aung *et al.*, 2025).

## Implications for AgriLoop's Development and Scaling

A particular blueprint can be made from the insights provided by our themes for the platform's design and roll-out. A “five-minute rule”, which was expressed by our participants, should be a cornerstone in the design process, meaning it should allow farmers to list surplus produce without excessive data entry quickly. Trust building for the platform should be embedded from the start. The integration of secure payment gateways, user verification, and transparent transaction policies can help establish institutional trust. On the other hand, independent trust can be established through peer review systems, buyer/seller rating, and

user feedback, which have proved to be effective in different digital platforms (Li and Wang, 2020; Tadelis, 2023).

AgriLoop could partner with established logistics providers in Ireland to integrate their services within the platform, thereby facilitating deals for buyers lacking access to logistical support. For example, digital coordination with volunteer logistics and OLIO facilitated food redistribution remarkably, as 75% of all food listings are claimed within one day, and 43% within just one hour (Aziz *et al.*, 2022).

A phased rollout strategy could help mitigate challenges that appear with early launch. Limiting the platform in the beginning to high-waste, highly perishable produce locations will result in maximising the initial impact and generating early success to help build capacity and platform credibility. As the platform capacity grows, expansion to other products and locations across Ireland can begin. Sustainability certification schemes (e.g., Bord Bia's Origin Green) could help support AgriLoop's market legitimacy and appeal.

## Contribution to Existing Evidence

This study adds new qualitative evidence on the issue of surplus produce in Irish farms from the perspective of producers. Previous evidence has focused on consumer behaviour and supply chains to address food loss and waste (Borrello *et al.*, 2017; Klerkx and Rose, 2020). Our findings complement this literature by helping create a single conceptual framework by integrating operational, infrastructural, market, and trust-related adoption factors.

Our study offers an extension to the Technology Acceptance Model in agricultural settings, as the results demonstrate the influence of age and digital literacy on the desired interface and design of the platform (Davis, 1989). The study findings also highlight the importance of policy intervention regarding composting as a common practice among farmers due to its effect on greenhouse gases and the environment.

## Limitations and Future Research Directions

This study and its methodology present a set of limitations. The small sample size that is a geographically concentrated area (Dublin County and surrounding regions) may not be fully representative of the Irish farmers' community, particularly farmers in more remote areas or who work in a different agricultural sector, such as dairy. Future studies should

achieve more geographical and sectoral diversity to improve the representation of Irish farmers.

Self-bias may have been introduced due to the voluntary nature of our sampling strategy. Farmers who might be more digitally literate are more likely to participate in our study. An overestimation of the platform acceptance might have resulted from this limitation. Additionally, farmers' responses might represent aspirational preferences rather than grounded adoption behaviour, as AgriLoop is a conceptual design rather than a functional prototype. As a result, unforeseen barriers could arise when moving to the implementation and testing phase of the platform.

Future research with a mixed method approach, piloting the platform's initial design and quantitative measures of acceptance and adoption rates, could be conducted. Comparative studies between existing similar models could be performed to attempt design transfer or policy framework adoption for successful models. Longitudinal studies could be employed to track farmers' interaction and adoption of the digital platform, as well as the impact of using the platform on food waste and loss at the farm level.

## Conclusion

This study explores Irish farmers' acceptance and perspective of a concept design for a digital platform called AgriLoop. A thematic analysis was performed through an analysis of transcripts from semi-structured interviews with ten Irish farmers, which covered some of the systematic barriers faced in surplus management and the conditions necessary for platform adoption.

Farmers faced labour shortages, lack of cold storage, and market inflexibility, which contributed to the failure of sustainable management of surplus produce. Turning produce into animal feed or compost was one of the most common practices to manage surplus produce by farmers, despite their frustration with wasting perfectly edible produce. Farmers expressed desired features to be implemented in the design of future digital platforms, such as speed, trust, reliable buyers, and logistical support. While optimism was expressed towards the concept of the platform, negative past experiences led to caution in their expectations.

The insights from the study findings will have implications for the platform design, prioritising a user-friendly interface, verified buyers, and logistical support to increase adoption and platform legitimacy. Equally important is governmental support in logistical

operations, such as shared cold storage facilities and tax incentives for surplus redistribution to relief farmers, to help alleviate some of the financial burdens. Additionally, the government might help address labour shortages by supporting mechanisation.

This study contributes to the existing body of evidence by shedding light on farmers' lived experiences with food loss and waste management, building on previous studies exploring consumer or supply chain perspectives. Our findings are in line with the Technology Acceptance Model, which reveals that factors such as age, digital literacy, and trust mediate adoption in agricultural contexts.

The findings of our study have some limitations, such as a small sample size and a limited geographical location, which limit the generalizability of our results to the Irish context as a whole. Also, AgriLoop is still a concept of a platform, indicating that expressed enthusiasm by farmers might still not translate directly into adoption. Future studies with a mixed method approach should assess the real-life implementation of the platform to explore its impact and adoption rates among the Irish farming community.

In the end, food loss and waste require a participatory approach to address their barriers. The conceptual design of the AgriLoop platform holds a promising solution, but its success depends on the integration of farmers' feedback into its features. Inclusivity in the design process alongside supportive policies could contribute meaningfully to reducing food loss and waste in line with the UN Sustainable Development Goals.

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## Appendix

Participant ID	Location	Age Range	Farm Size (Acres)	Primary Crop Types	Growing Season	Estimated Annual Food Waste
Farmer 1	Fingal	45-54	30	Potatoes, Carrots, Cabbage	Year-round	500-700 kg per season
Farmer 2	North County Dublin	35-44	15	Salad Greens, Herbs, Tomatoes	Seasonally	400-600 kg total
Farmer 3	Meath	55-64	50	Mixed Vegetables	Seasonally	> 1 tonne
Farmer 4	South Dublin	25-34	5	Microgreens, Lettuce, Kale	Year-round	~500 kg (Extrapolated)
Farmer 5	Kildare	45-54	70	Carrots, Onions, Potatoes	Seasonally	~5 tonnes
Farmer 6	Fingal	25-34	8	Soft Fruits, Lettuce	Seasonally	10-20% of weekly harvest
Farmer 7	Wicklow	65+	40	Root vegetables, Cabbage	Seasonally	A good few tonnes
Farmer 8	Dublin Fringe	35-44	10	Peas, Beans, Sweetcorn	Seasonally	300-500 kg per season
Farmer 9	Meath	55-64	12	Cabbage, Parsnips, Turnips	Year-round	~1 tonne
Farmer 10	Westmeath	50-59	20	Mixed Vegetables (Cauliflower, Carrots)	Seasonally	5-8 tonnes

Table 1 Table 1: Baseline Characteristics of Interview Participants (n=10)