



# **Digital food markets of the Association of Artisanal Cheese Producers of Southwestern Paraná (APROSUD): dynamics, challenges and innovations<sup>1</sup>**

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## **Abstract**

This research aimed to understand how family farmers use digital markets, by analyzing the initiative of the Association of Artisanal Cheese Producers of Southwestern Paraná (APROSUD). The analysis sought to identify the dynamics, challenges and innovations involved in Family Agri-processing Units associated with APROSUD. Methodologically, the sociotechnical tools used for sales by seven farmer members of the association were assessed, by means of a quantitative questionnaire applied through the Alimentario Digital Research application. Findings show that the dynamics of physical markets are still predominant in marketing, though digital markets have grown significantly and serve, above all, to meet specific demands and needs of consumers. In terms of challenges, it seems that the family nucleus' lack of time for operating digital marketing tools and the individualized logistics of deliveries to consumers predominate in terms of obstacles that farmers need to overcome. As for innovations, the use of WhatsApp stands out because it is used by all

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farmers as a means of marketing and loyalty, in addition to social networks that allow consumers to find out information about agri-processing and get in touch with the farmer.

**Keywords:** Family farming. Digital food markets. APROSUD. Artisanal cheeses. Rural and regional development.

### **Mercados alimentares digitais da Associação dos Produtores de Queijos Artesanais do Sudoeste do Paraná (APROSUD): dinâmicas, desafios e inovações**

#### **Resumo**

O presente trabalho teve por objetivo analisar como os agricultores familiares utilizam os mercados digitais, tomando por base a iniciativa da Associação dos Produtores de Queijos Artesanais do Sudoeste do Paraná (APROSUD). A análise foi conduzida de forma a evidenciar as dinâmicas, desafios e inovações construídas pelas AGFs associadas a APROSUD. Metodologicamente, avaliou-se as ferramentas sociotécnicas utilizadas para realizar as vendas de sete (7) agricultores da associação, através de questionário quantitativo, aplicado através do Aplicativo de Pesquisas Digitais Alimentário. Os resultados evidenciam que a dinâmica dos mercados físicos é ainda predominante na comercialização, mas que os digitais têm crescido bastante e servem, sobretudo, para atender as demandas e necessidades específicas dos consumidores. Em termos de desafios, parece que a falta de tempo do núcleo familiar para atuar nas ferramentas digitais de comercialização e a logística individualizada de entregas para os consumidores predominam em termos de entraves que os agricultores precisam superar. Já as inovações, o uso do WhatsApp se destacam por ser utilizado por todos os agricultores como meio de comercialização e fidelização, além das redes sociais que permite o consumidor conhecer informações da agroindústria e entrar em contato com o agricultor.

**Palavras-chave:** Agricultura familiar. Mercados alimentares digitais. APROSUD. Queijos artesanais. Desenvolvimento rural e regional.

### **Mercados alimentarios digitales de la Asociación de Productores de Quesos Artesanales del Sudoeste de Paraná (APROSUD): dinámicas, desafíos e innovaciones.**

#### **Resumen**

El presente trabajo tuvo como objetivo analizar cómo los agricultores familiares utilizan los mercados digitales, tomando como base la iniciativa de la Asociación de Productores de Quesos Artesanales del Sudoeste de Paraná (APROSUD). El análisis se realizó para destacar las dinámicas, desafíos e innovaciones construidas por las AGFs asociadas a APROSUD. Metodológicamente, se evaluaron las herramientas sociotécnicas utilizadas para realizar las ventas de siete (7) agricultores de la asociación, a través de un cuestionario cuantitativo aplicado mediante la Aplicación de Investigación Digital de Alimentos. Los resultados muestran que la dinámica de los mercados físicos sigue siendo predominante en la comercialización, pero que los mercados digitales han crecido considerablemente y sirven principalmente para satisfacer las demandas y necesidades específicas de los consumidores. En cuanto a los desafíos, parece que la falta de tiempo del núcleo familiar para utilizar herramientas digitales de comercialización y la logística individualizada de entregas para los consumidores son los principales obstáculos que los agricultores deben superar. En cuanto a las innovaciones, se destaca el uso de WhatsApp, que es utilizado por todos los agricultores como medio de comercialización y fidelización, además de las redes sociales que permiten al consumidor conocer información sobre la agroindustria y ponerse en contacto con el agricultor.

**Palabras clave:** Agricultura familiar. Mercados Alimentarios Digitales. APROSUD. Quesos artesanales. Desarrollo rural y regional.

## 1 Introduction

The advent of the Internet in the mid-1990s made an important contribution to globalization by narrowing social, economic, cultural and communicational distances, and also the commercialization of goods, products and services (Prause et al., 2020; Santos, 2011; Castel, 2000). As regards the food sector, several production-consumption networks have been conceived and strengthened over the last few decades, although imperial and corporate food markets still dominate food circulation, technological advances and the gauge of high rates of added value (Prause, 2021; Ploeg, 2008).

In the case of marketing digitalization, this was already a growing reality in the so-called hegemonic markets and in large delivery platforms and corporate sectors. Since the Covid-19 health crisis, the situation of family farmers and consumers in local and regional markets regarding digitalization began to change. Due to social distancing, food markets had to reinvent themselves, both in Brazil and worldwide, and several small and medium-scale sales and territorial initiatives were built (Gazolla et al., 2023; Brunori, 2022; Nierdele; Schneider; Cassol, 2021).

Meanwhile, in the case of family farmers, those whose produce were sold through public policies such as the National School Feeding Program (PNAE) saw schools' closure and were no longer able to sell their produce. Others were prevented from selling their produce at local farmers' markets and faced obstacles in selling to retail centers due to uncertainty surrounding the opening of supermarkets, grocery stores and other retail outlets.

These and other obstacles have led farmers and consumers to seek ways to connect, use the internet and various sociotechnical tools for marketing. For example, research carried out by Gazolla and Aquino (2021) found that, in the first year of the pandemic, some groups of farmers were selling through cooperative and/or association platforms, which corresponded to 52.63% (2020) through forms of social organization compared to 15.79% through companies or startups.

In a new study carried out in 2022 by the same authors, after the pandemic, there was a considerable increase in the number of platforms and cooperatives, as well as in the amount of products and food sold (Gazolla; Aquino; Gaieveski, 2024). They found that the form of social organization through enterprises and startups now represents 20.45% while platforms of cooperatives and/or associations (47.73%) did not change significantly. However, considering all organizational forms analyzed, there was a 15.79% increase in the use of platforms and websites.

This increase in digital marketing reinforces the need for understanding how family farmers are using information and communication technologies (ICTs), especially for selling their produce. In this sense, this study aims to analyze how family farmers use digital markets, by studying the initiative of the Association of Artisanal Cheese Producers of Southwestern Paraná (APROSUD). The study sought to identify the dynamics, challenges and innovations built by family agri-processing units (FAUs) associated with APROSUD. To this end, methodologically, the sociotechnical tools

used for sales by seven farmer members of the association were assessed, by means of a quantitative questionnaire, applied through Alimento Digital Research application.

APROSUD, established in 2019, is an association of family farmers producers of artisanal cheeses. After a course on cheese manufacturing best practices, participants decided to organize themselves to get representation and strength in the agendas focused on the area. This means that each member sells their products and the organization works towards opening paths for them all, such as the regulation of the State Health Unified System (SUSAF), which despite being provided for in law still lacks regulation to be implemented. This makes the association eligible for research, since marketing is decentralized, individual, while the collective organization represents members, seeking to solve problems that are common to them all, including supporting farmers to access and build their food markets (physical and digital).

This work is structured in three main sections, in addition to this introduction and the final remarks. The next section presents the theoretical framework on sustainable development, digitalization and (digital) food markets. The second section briefly discusses the research methodology and the third section analyzes the outcomes of digital markets among APROSUD farmers.

## **2 Agriculture digitalization, food markets and sustainable development**

Digitalization in agriculture began with the introduction of technologies into agricultural processes, aiming to increase efficiency, productivity and sustainability. Initially, it involved the automation of tasks, such as the use of GPS to guide agricultural machinery, crop and animal monitoring systems and data collection for analysis and decision-making (Alarcón-Ferrari; Corrado; Fama, 2021).

The incorporation of digital technologies into agriculture has been driven by a combination of factors, including technological advances, market demands, and public policies. These transformations have generated new forms of agricultural management, new interactions between actors in the sector, and the emergence of new rules that shape the social structure of agri-food production (Prause, 2020). However, it is important to take into account that digitalization is not a homogeneous process, but rather marked by contradictions and challenges. While digitalization can bring benefits such as increased efficiency and productivity, it also carries obstacles such as inequalities in technology adoption and unequal socioeconomic impacts (Klerkx et al., 2019; Kenney; Serhan; Trystram, 2020; Ajena et al., 2020; McGrath et al., 2023).

Digitalization in agriculture and food also seems to be an expanding reality in Brazil, especially in the areas of agribusiness, such as biotechnology, natural resources and climate change, phytosanitary security, technology transfer and use of digital technologies in family farming (Bos; Owen, 2016; Massruhá; Leite, 2016; Deponti; Kirst; Machado, 2017). This paper addresses the digitalization of food marketing in the context of family farming, which recent literature has called digital food markets, a key link in food systems, holding strategic potential for strengthening family farmers (FFs) (Niederle; Schneider; Cassol, 2021; Gazolla; Aquino, 2021).

For Polanyi (2000), markets are socially constructed and depend on social institutions to function, such as legislation, regulation and state intervention. He argues that markets function within a social framework and require social relationships to build mutual trust between buyers and sellers, which is fundamental for the proper functioning of markets. In this sense, the author criticizes the idea of an autonomous market, de-rooted from society and that operates according to laws of supply and demand guiding production, consumption and distribution of goods and services.

Markets, thus, are understood as being multiple and playing fundamental roles, since they are not only spaces where exchanges of goods and services occur, but also places for socialization, exchange of experiences and cultural interaction. In this context, markets go beyond mere commercial transactions, involving social, cultural and political aspects. Thus, markets have functions such as allocation of scarce resources, price formation, economic coordination between producers and consumers, creation of value through exchange of goods and services, and social regulation by establishing norms and standards for economic behavior (Beckert, 2003).

Therefore, markets are widely present in societies, exerting influence on the daily lives of their members and on the social structure as a whole. Schneider (2016) states that markets can be considered as physical spaces for exchange, as organizing principles of society and as social constructions resulting from economic, social and cultural interactions. Therefore, food markets are fundamental spaces for promoting food security and sovereignty in societies and for the social reproduction of farming families.

According to the typology proposed by Schneider (2016), which is the most accepted and current for the Brazilian case, food markets can be classified as: public, conventional, of social proximity or territorial. Public markets are those operated by government policies and by the State at various levels and are intended to buy food from family farmers and offer good quality food to vulnerable groups or schools. Conventional markets, on the other hand, trade commodities, such as grains and livestock products, limiting farmers' autonomy and making them highly dependent on these markets and their market rules (Schneider, 2016).

In the case of social proximity and territorial markets, they comprise short chains, nested markets and regional markets. These markets are alternatives to the conventional marketing flows characterized by having intermediaries, covering long distances and offering highly processed food. In proximity markets, the importance of social relations, food identity, family farming and principles such as valuing local culture and environmental preservation are restored (Wilkinson, 2008; Gazolla; Schneider, 2017).

For Gazolla and Aquino (2021), digital food markets would rather be embedded in, although not exclusively, social proximity and/or territorial markets, as new marketing channels that are reconfigured by inclusion of a sociotechnical interface to mediate transactions between producers and consumers. This new food short circuit was fostered by the Covid-19 health crisis, which required social distancing and made it difficult for farming families to access food markets, leading to shortages and a drop in income. Thus, digitalization of sales channels was a

response to the health crisis and a novelty created by the social actors involved in food markets (Wiskerke; Ploeg, 2004).

Its innovative nature is mainly due to the adaptation of farming families that did not use, or were even averse to, digital marketing technologies. Digital marketing platforms are diverse; they can be formed by farmers and consumers only, or involve partners such as an association, cooperative or the government. Likewise, payment methods are also varied, and can be made online through the subsidiary platform or directly to farming families in cash (Gazolla; Aquino, 2021).

For Niederle, Schneider and Cassol (2021, p. 39), there are several forms of digital marketing, such as marketplaces, which sell products from different producers; websites or applications in which companies resell products from other companies (business to business to consumer); websites of farmers or cooperatives that sell their products directly to consumers or members; websites of farmers that offer directly to consumers, but the transaction takes place in other spaces; institutional platforms that offer food, but the sale takes place in other spaces; institutional platforms that gather the demand, but sale is done in physical spaces; and, social networks (Facebook, WhatsApp, etc.) of farmers, companies or cooperatives that offer food and carry out the sale in physical spaces or other virtual spaces.

Several of these markets have already been created and purchased by large corporations, which are part of conventional food markets, such as large supermarket chains, deliveries and marketplaces (for example, Alibaba, Amazon Foods). In the case of family farmers, studies have shown that they and their social organizations build food markets as collaborative platforms and/or use messaging and social media applications that are already available and free to put their food on the market and promote it (Niederle; Schneider; Cassol, 2021; Gazolla; Aquino; Gaieveski, 2024).

These markets are mainly characterized by direct connection between farming families and consumers, what provides a more intimate and trustworthy shopping experience. Through online platforms, farmers promote their food and products, highlighting their distinctive features, such as artisanal production, healthiness and environmental sustainability. Moreover, these markets operate through short supply chains, in which the farming families or the association/cooperative to which they are associated generally take on the logistics of orders and deliveries (Brunori, 2022; Gazolla; Aquino; Gaieveski, 2024).

Furthermore, digitalization in agriculture and food markets can contribute to achieving several Sustainable Development Goals, such as eradicating hunger (SDG 2), by providing another tool for access to healthy and nutritious food. Food markets digitalization can also boost sustainable agriculture (SDG 12) by promoting environmentally friendly agricultural practices and the consumption of organic food. These markets can also facilitate access to e-commerce platforms and digital technologies, contributing to reducing social inequalities and promoting sustainable development in all areas and sectors of society (Trentov; Varas; Zeng, 2019).

Finally, it is worth noting that the digitalization of family farming markets, in Brazil and other regions, provides opportunities for productive inclusion, strengthens ties between producers and consumers, and drives the sustainable development of food systems. However, it is imperative to overcome challenges such as lack of digital

infrastructure in rural areas, inequality in access to technologies, and the need for technical and managerial training to effectively use digital tools. Besides being designed and operated in accord with the principles of sustainable development, digitalization must consider the fundamental aspects and elements of what Amartya Sen called human development.

### 3 Research methodology

The research combined qualitative and quantitative methods. It was based on literature review and observation of social processes in the field, which comprised the qualitative part. The quantitative stage was based on the application of questionnaires to APROSUD's farmers in the Southwestern Region of Paraná, in the first half of 2024.

As a case study of digital food markets, the Association of Artisanal Cheese Producers of Southwestern Paraná (APROSUD) was researched in 2024. In this first phase of the investigation, quantitative questionnaires were applied to seven family farmers, including the president of the association, who agreed to participate. Five women and two men identified as responsible for production were interviewed between March and April 2024.

The seven production units (PUs) are identified with a trade name (used for marketing) under which cheese production is sold aiming to build customer loyalty. Table 1 shows the number of members working in the artisanal agri-processing, on average, four people per unit, and the area allocated for production, on average, 22 hectares/PU, therefore comprising small properties. Other relevant data are the products created and manufactured, in this case. colonial cheese, wine-soaked cheese, *coalho* cheese, mozzarella, provolone, yogurt, seasoned colonial cheese, sweets, lard, grains, raw milk and animals unfit for production.

Table 1 - Characteristics of the studied family agri-processing (FAP) units

Name of FAP	Municipality	Members	Types of products	Area (ha)
Sao Bento Queijaria	Chopininho/PR	4	Colonial Cheese, <i>Coalho</i> , Mozzarella, Provolone, Homemade Bread, Lard, Eggs, Homemade Biscuit	8.47
Martinazzo Queijaria	Itapejara D'Oeste	3	<i>Coalho</i> , Soy, Pumpkin paste, Grape paste, Papaya paste, Guava paste, Fig paste, Peach paste in 700g	21.78
Três Amores Queijaria Artesanal	São Jorge D'Oeste	4	Raw milk, Bovines, Colonial cheese, Truffle cheese, Breakfast basket, Caramelized milk	29
Latícinio Bach	Santa Isabel D'Oeste	7	Colonial cheese, Seasoned Colonial cheese, Prato cheese, Tia Paulina cheese, Raw Milk	33.88
Vidalat	Francisco Beltrão/ PR	6	Colonial Cheese, Wine-soaked cheese	28

Toca Queijos Artesanais	Francisco Beltrão	1	Colonial cheese, Fresh cheese, Aged cheese, Wine-soaked cheese, Ternura, Valeriano, Dão cheeses	10
Ladcorn Produtos Lácteos	Chopinzinho/PR	4	Raw milk, Cull cows, Coalho, Yogurt, Colonial cheese	26.62
<b>Sum</b>		<b>29</b>		<b>67</b>
<b>Average</b>		<b>4.14</b>		<b>22.33</b>

Source: Alimentario (2024).

Delving into the context of each cheese factory, specificities can be found that distinguish each production unit. For example, Queijaria São Bento and Queijaria Martinazzo are located on the highway, a feature that favors rural tourism and consumers' access. In these PUs, it is possible to introduce consumers to the charms of rural spaces, such as contact with animals, tasting cheeses and other foods produced by farmer families, such as cookies, breads and jams.

The cheese factories Três Amores, Bach and Vidalat are focused on production of cheese and raw milk, while Toca only produces cheese. For Ladcorn, in turn, which has raw milk as its main product, cheese production only became an option in food markets in 2023. For example, on certain occasions, Três Amores cheese factory sells breakfast baskets and *dulce de leite*.

Questionnaires were applied through the digital research application Alimentário,<sup>2</sup> developed by the project referred to in footnote 1, to facilitate collection, processing and analysis of statistical data. Primary data are essential for a better understanding and analysis of the empirical case, as they allow interactive circulation to the point of reaching a better understanding (Thiollent, 1980, p. 25). Descriptive statistical techniques were used to analyze the results.

APROSUD was chosen because it is a family farming organization from the southwestern region of Paraná that has been fighting for greater visibility and regulation of certification means for production and sale of artisanal cheeses. Among the 19 farmers associated with APROSUD, there are some who have won international awards for the distinguished quality of their food. Another interesting point about the organization is that it does not sell artisanal cheeses, but rather contributes to strengthening farmers' conditions. Farmers sell their cheeses on physical and digital markets on their own and have their own strategies and channels to sell them. Some make on-farm sales, others sell in consumer groups, through social networks (Facebook and Instagram), messaging apps (WhatsApp), municipal open-air markets and digital platforms.

The association gave farmers a voice and strength to make their products formal, as it led the negotiations to regulate the Municipal Inspection Service, performing political, technical and institutional compromises to enable these municipal services to join the State's Unified Public Health System on Artisanal, Small-Scale and Family Agri-processing (SUSAF) in Paraná and so its members' products to be marketed in the state when they hold this inspection certification. Still on APROSUD, it is worth noting that it is an associative organization that addresses

<sup>2</sup> Available at:

<https://pb.utfpr.edu.br/geppadem/alimentario/index.php/admin/authentication/sa/login>



several other demands and needs of its members, such as promotion of produced foods, political representation, organization of collective demands, relationship with entities, institutions and other social actors, participation in national and international fairs and competitions. What we want to make clear is that, although each FAU's marketing is individual, APROSUD facilitates access and supports the social construction of food markets for its members, as part of the literature has evidenced in Brazil.

#### 4 APROSUD's food markets: dynamics, challenges and innovations

This section presents the research results, in order to analyze data related to the distribution of production between physical and digital channels. The data are presented in both absolute values and percentages to provide a clear view of products distribution through these different channels, thus allowing us to observe the commercial practices adopted by participants. The data demonstrate preferences and adoption of marketing channels by farmers, revealing patterns that reflect the dynamics, challenges and innovations surrounding the constructed markets.

Table 2 shows the percentage of production that is sold through physical and digital channels. Four (4) participants indicated that over 76% of their production is sold through physical channels, while one (1) participant reported the same percentage of sales through digital channels. No participant pointed production through physical channels in the range of 51 to 75%, and one (1) participant reported production sales through digital channels to be within this range. Two (2) participants indicated that between 26 and 50% of their production is sold through physical channels, and one (1) participant reported this same range for digital channels. Finally, one (1) participant reported that less than 25% of production sales were made through physical channels, while four (4) participants indicated the same range for their digital channels.

Table 2. Absolute value and percentage of production distributed through physical and digital channels

Percentage of production (%)	Physical N <sup>o</sup>	%	Digital N <sup>o</sup> .	%
More than 76%	4	58	1	14
Between 51 and 75%	0	0	1	14
Between 26 and 50%	2	28	1	14
Less than 25%	1	14	4	58
<b>Total</b>	<b>7</b>	<b>100</b>	<b>7</b>	<b>100</b>

Source: Alimentario (2024).

The data show that most participants still use physical channels to sell their production, due to excessive workload and scarce time to dedicate to digital tools. However, a considerable part of them uses digital channels, indicating a growing adoption of digital technologies to build markets in family farming, as mentioned by Niederle, Schneider and Cassol (2021). The predominance of physical channels reflects obstacles such as lack of internet access and training in handling digital tools for farmers, and scarce time available to them for digital activities.

Charatsati et al. (2024) found the same situation in their work in Italy and Greece, where farmers had difficulty accessing marketing digital channels because they did not know how to use sociotechnical tools or how to carry out digital sales of their produce. However, they found that there were investments in training in the use of technological tools aimed at production, but that there was no interest from public agencies in training Technical Assistance and Rural Extension (TARE) agents to help family farmers use ICTs aimed at marketing.

In turn, Byomire et al. (2016) found that 89% of farmers used digital channels to sell products; even though that research was conducted with urban agriculture, the investigation replicates the characteristics of Brazilian rural, namely precarious access to internet, lack of training to advance ICTs use, and lack of network models for family farming. On the other hand, the growing adoption of digital channels indicates an innovative response to the demands of food markets and an opportunity to expand the reach and visibility of family farming food (Gazolla; Aquino, 2021).

Table 3 presents the main difficulties encountered by the interviewed farming families in participating in digital markets. The data reveal that the two main difficulties reported are lack of knowledge to operate platforms or websites (43%) and difficulties in managing digital information related to the purchase and sale of products (43%). These results corroborate Bert's (2021) assertion that training and technical support are necessary to help farmers navigate effectively in digital marketing environments.

This is in line with the above-mentioned claim by Charatsati et al. (2024) about the need for investment in TARE training. In addition, the difficulty of reconciling the various tasks related to agricultural production and the administrative management of online businesses was also highlighted, with 29% of participants reporting an excess of tasks to be performed. Other difficulties mentioned (43%) included issues related to internet infrastructure, delivery difficulties, and social media marketing costs.

Table 3. Main difficulties encountered in participating in digital markets

Main difficulties encountered in participating in digital markets	No.	%
Lack of knowledge to operate the platform/website	3	43
Difficulties in managing digital information (purchasing and selling products)	3	43
Others (internet quality; delivery difficulties; paid marketing on social media)	3	43
Too many tasks to be performed (planting, harvesting, dialogue with consumers, administrative management, deliveries, etc.)	2	29
Tax and health requirements for marketing	0	0
Low consumer loyalty	0	0
High website/platform maintenance costs	0	0
Low income of the family group	0	0
<b>Total</b>	<b>11</b>	<b>158</b>

Source: Alimentário (2024). Note: Percentage exceeds 100% because question allowed multiple choices by interviewee.

Some of the challenges investigated by the research were not listed by farmers interviewed, such as tax and health requirements, low customer loyalty, high costs for maintaining the platform/website and low family income. This can be

explained by the fact that they are already regularized as to health inspection systems, have high customer loyalty because they sell through short supply chains and do not use platforms/websites.

However, it is important to emphasize that the absence of mention of these specific difficulties does not necessarily mean that they are not relevant or that they are not present in other contexts. For example, Gazolla and Aquino (2021), Klein, Klein and Schultz (2022) and Charatsati et al. (2024) identified that the cost of maintaining platforms is an obstacle to farming families' access to digital markets, especially when they do not have collaborative digital platforms, such as those managed by cooperatives and/or associations. An individual platform, for example, would be economically unfeasible in terms of the costs of creation, maintenance and the frequent updates it would require.

Table 4 presents the main factors that influence food marketing on digital markets. The results show that specific consumer demand is the most significant factor, mentioned by 86% of the interviewees. This suggests that farmers are attentive to consumer preferences and needs when deciding which products to offer through digital markets. This factor is in line with the discussions by Klein, Klein and Schultz (2022) regarding the need to observe unexplored spaces in marketing. Gazolla and Aquino (2021) also highlight the importance of customizing products offer in digital markets.

But it goes beyond that; it shows that the construction of food markets is rather driven by demand than by supply. This empirical finding is quite relevant, as it relates to a key current discussion on transformation of food systems, which have highlighted the role of consumers (their habits, needs, where they want to spend their resources, the sustainability of food, among other factors), as evidenced in research and literature (Goodman, 2003; Barbosa, 2009; Portilho, 2009; Byomire et al., 2016; Prause et al., 2020; Klein; Klein; Schultz, 2022; Samoggia et al., 2021).

Table 4. Main factors influencing product offer in digital markets

Factors influencing product offer	N °	%
Quality foods demanded by consumers	7	100
Specific consumer demands	6	86
Competition with physical markets	2	29
Variety and diversity of food and products offered	1	14
Logistics	1	14
Others (lacking health inspection)	1	14
Seasonality of production	0	0
<b>Total</b>	<b>18</b>	<b>257</b>

Source: Alimentário (2024). Note: Multiple choice question, leading to percentage higher than 100%.

In this context, the importance of the variety of offered foods and products (14%) was highlighted, along with quality attributes demanded by consumers (10%). This indicates that the supply in digital markets is influenced not only by consumer demands, but also by the variety and quality of available products, corroborating the suggestion by Niederle, Schneider and Cassol (2021) that farmers must meet these demands to keep their consumers loyal and their food markets operating and scaling up in the future.

This finding also confirms Bert's (2021) analysis that consumers value food with quality attributes, such as organic or sustainably and ecologically produced food, and that such demand is an opportunity to differentiate their products and attract customers. Migliore (2015) also confirms this trend of sustainable and social view and calls attention to the need for family farmers to keep an entrepreneurial attitude, in the sense of being attentive to the demands of consumers and the markets they access. Other factors mentioned that influence market supply to a lesser extent include logistics (14%), competition with physical markets (29%) and issues related to health inspection (14%).

Table 5 below shows the groups of sold food and their respective quantities. All participants (100%) indicated that artisanal agri-processed foods are the main group of foods sold on digital markets, in this case, artisanal cheeses. There were no reports on sales of other food groups, such as fresh foods, organic foods, organic drinks, beverages, crafts, or other products. This differs from findings by Klein, Klein and Schultz (2022) that most foods sold on digital channels are fresh. Gazolla and Aquino (2021) also identified a diversity of food groups sold on digital platforms, with fresh foods being predominant (30.27%) and, in second place, artisanal agri-processed foods (29.99%).

Table 5. Food groups offered and their quantity (annual).

Food group	Quantity (kg)	%
agri-processed products (Kg)*	43,128	100
Fresh (kg)	0	0
Organic fresh (Kg)	0	0
Ecological agri-processed products	0	0
Ecological drinks	0	0
Drinks	0	0
Craftsmanship	0	0
Other products	0	0
<b>Total</b>	<b>43,138</b>	<b>100</b>

Source: Alimentário (2024). Note: cheese production by family-owned enterprises was considered, but only for the main product sold.

The annual agri-processing production based on 13 types of cheese (Colonial, wine-soaked colonial, matured, mozzarella, curd-type, yogurt, fresh, *prato*, truffle, *Tia Paulina*, *Ternura*, *Valeriano*, *Dão*) is 43.128 kilos/year, with an average per FAU of 3.594 kilos produced and marketed per month. Considering the approximate average value of R\$ 35,00 per kilo of the product, it is possible to infer the average gross income of the production units at R\$ 17.970,00 per month and R\$ 215.640,00/year, which demonstrates the economic importance of this activity for the farming families that participated in the research, which generates an average annual gross income exceeding R\$200,000 per FAU.

Table 6 below shows the selling price of food marketed through digital markets compared to other physical channels accessed. Most participants (86%) reported that the selling price of products does not vary between digital and physical markets. A small number (14%) indicated selling for a higher price on digital markets because the price must cover the costs for transportation of the food. Other farming

families indicated that they deliver orders when they go to the city and, thus, they can maintain the price charged in physical markets without incurring transportation costs. There were no reports on sales for a lower price in digital markets compared to other markets accessed, nor on price variation between different marketing channels.

Table 6. Prices of food and products on digital markets compared to other channels

<b>Food prices</b>	<b>N °</b>	<b>%</b>
The selling price does not vary between the digital and physical market	6	86
Selling for a higher price on the digital market	1	14
Selling for a lower price on the digital market	0	0
It's a lower price than some channels and higher on others	0	0
I don't know how to answer	0	0
<b>Total</b>	<b>7</b>	<b>100</b>

Source: Alimentário (2024).

These data show that the prices charged are, in most cases, the same as those in physical markets. This confirms what was stated by Izecksohn and Bühler (2023) about farming families' concern with offering food at an affordable and fair price, carrying out a transparent marketing practice that is close to the social reality of their customers. In the study developed by Klein, Klein and Schultz (2022), however, they observed that transportation was charged, but at a low cost, since short marketing chains were promoted. This is also possible because farmers are directly responsible for marketing, what results in lower costs for maintaining the platforms, for example. In other cases, as evidenced by Niederle, Schneider and Cassol (2021), an increase of, on average, 30% of the total price proposed is common to cover the costs of managing the platforms/websites and logistics.

Furthermore, literature addressing digital markets shows that these are an extension of physical markets and many emerged from these latter during and after the Covid-19 pandemic, being complementing to each other. Thus, what we want to affirm is that most digital markets emerge from pre-existing physical markets, for example, a farmers' market or a consumer group and are a reinvention of these markets, as the literature has addressed. Therefore, as they are connected, integrated and work together and collaboratively in the experiences of family farmers, prices do not vary between the two types of marketing (Niederle; Schneider; Cassol, 2021; Gazolla; Tonin; Iale, 2024, in this dossier).

Data on logistics responsibility are presented in Table 7. In terms of logistics, all participants (100%) indicated that they are responsible for delivering the products and food sold through digital markets. There were no reports of other actors involved in delivery, such as producers' organizations, associations, cooperatives, intermediaries, government agencies, or business partners. Lack of mention of third-party services to deliver food sold on digital channels is due to the absence of such service, as these are artisanal cheeses, foods that require refrigerated transport to maintain their quality standards.

Two examples of logistics can be cited. The first is Queijaria São Bento, which has set days to go to certain cities in the PU's surroundings and customers are informed of the days and times to pick up their food. However, there are cases in

which the customer cannot wait, so a transportation fee is charged or an appointment is arranged with travel to the city. The second case is Queijaria Bach that produces a large quantity of cheese and had to adapt its vehicle with a refrigerator to ship it, since its cheeses are sent to emporiums in large centers of Paraná, such as the cities of Curitiba, the furthest destination (518 km), Londrina (509 km) and Ponta Grossa (429 km), also distant destinations.

Table 7. Person responsible for food logistics

Responsible for logistics	N °	%
The farmer family themselves	7	100
End consumers	0	0
Organization of a group of producers	0	0
Association/cooperative/cooperative center	0	0
Intermediate buyers	0	0
City Hall or other public body	0	0
Third party services are used	0	0
The business partner	0	0
Other	0	0
<b>Total</b>	<b>7</b>	<b>100</b>

Source: Alimentário (2024).

The fact that deliveries are carried out by the owners of the FAUs, despite some difficulties, is an important finding as evidenced by data in Table 8. This is due to the full autonomy of farmers regarding their enterprises, who distribute their products in their small refrigerated vans; a job done by members of the family group, which keeps the logistics under the direct management of the family. This empirical finding differs from other studies that found that deliveries were either carried out by drivers hired through delivery apps (Cunha; Conceição; Schneider, 2022) or, more commonly, by the cooperatives to which the farming families belonged (Niederle; Schneider; Cassol, 2021). This is also due to the fact that deliveries are local and regional, since the physical and digital markets of these artisanal cheese agri-processors can mostly be defined as short supply chains (Gazolla, Schneider, 2017).

Table 8 shows the main logistical difficulties faced by farmers. The results show several logistical difficulties, the most mentioned being the means of transport available to make deliveries, reported by 43% of respondents. Next, food delivery times were mentioned by 28% of participants as a logistical difficulty. Other logistical difficulties reported include the small scale of orders (28%), the lack of equipment to store or refrigerate products (28%), and the difficulty in accessing and managing digital tools (14%). There were no reports of problems related to road traffic conditions, packaging, labeling, and quality food delivery, or other unspecified difficulties.

Table 8. Main logistical difficulties faced in accessing digital markets

Logistical difficulties	N °	%
The means of transport available to make deliveries/collections	3	43

Food delivery or collection times	2	28
Lack of equipment to store/or refrigerate the product (e.g. cold rooms)	2	28
The small scale of requests	2	28
The difficulty of accessing and managing digital tools	1	14
No problem	1	14
The distance traveled between producer and consumer	1	14
The trafficability conditions of the roads	0	0
Difficulty in appropriately packaging, labeling and delivering food	0	0
Other	0	0
<b>Total</b>	<b>12</b>	<b>169</b>

Source: Alimentário (2024). Note: Multiple choice question, leading to percentage higher than 100%.

This research findings corroborate the analyses by Gazolla and Aquino (2021) and by Niederle, Schneider and Cassol (2021) on the logistical difficulties faced by farmers in the digitalization of food marketing. The shortage of adequate transportation for deliveries and limitation in distribution times reflects the challenges mentioned in the literature on logistics in digital food systems. In addition, the lack of storage equipment and refrigerators, together with the difficulty in using digital tools, highlights the barriers faced by family farmers when adopting new technologies to meet the demands of online markets, something that is also noted by Cunha, Conceição and Schneider (2022). This convergence between empirical data and theoretical analyses highlights the relevance of these studies to understand the obstacles and opportunities in digitalization of family farming marketing.

Table 9 presents the main social actors responsible for the governance of digital food markets. According to the data, 100% of the governance of digital markets is carried out by the farmers themselves. There is no participation of a board elected by the cooperative/association, public managers, private initiative, social movements and rural and urban unions, consumers or any form of outsourcing or professionalization. Furthermore, there are no reports of collaborative governance among the various actors involved, such as farmers, consumers and organizations. The results indicate that farmers are the main ones responsible for the management of these digital markets.

Table 9. Main social actors responsible for the governance of digital markets

<b>Social actors</b>	<b>N °</b>	<b>%</b>
The farmers themselves	7	100
A council elected by the cooperative/association	0	0
In partnership with public managers	0	0
It is outsourced/professionalized	0	0
Social movements and rural and urban unionism	0	0
Private initiative (business, startups, etc.)	0	0
Consumers (groups, associations, individuals, etc.)	0	0
It is done collaboratively between the actors involved (farmers, consumers, organizations, etc.)	0	0
<b>Total</b>	<b>7</b>	<b>100</b>

Source: Alimentario (2024).

In the studied cases, farming families do not share management responsibilities with other social actors. This can be positive in terms of cost savings, since the existence of intermediaries could cost up to 30% of the total value of food sold. However, from the point of view of the work performed by farmers, centralizing governance in families can lead to work overload, since constant updating and contact with consumers is necessary. Therefore, it is necessary to carefully assess the cost-benefit of maintaining centralized governance, so that it does not hinder other activities related to the production of raw materials (raw milk), preparation of cheeses (processing) and the good management of the enterprises (Niederle; Schneider; Cassol, 2021).

However, farmers account that they are responsible for the entire governance of their markets, whether physical or digital, should be put into perspective, since fieldwork observations demonstrated that APROSUD is very active in representing these families and in the governance of markets built by the member farmers. For example, APROSUD usually negotiates spaces in local fairs and exhibitions of various types; intermediates relations with the state health surveillance agency (Agência de Defesa Agropecuária do Paraná - ADAPAR) and with the Municipal Health Inspection Services (SIM), for participation of its members in national, regional and even international cheese fairs and competitions, in which several member FAUs have had their artisanal cheeses awarded.<sup>3</sup> These examples show that APROSUD supports the governance processes and, in broader terms, the active construction of FAUs' food markets.

Table 10 shows the main advantages of marketing in digital markets, as identified by the survey participants. Most participants (86%) highlighted access to new consumers as one of the main advantages of marketing in digital markets. In addition, food promotion was mentioned by 57% of participants as another advantage of these markets. Other reported benefits include consumer loyalty and appreciation (86%), greater sales volume/quantity (28%), convenience (28%) and safer payment (14%).

Table 10. Main advantages of marketing through digital marketplaces

<b>Advantages of digital commerce</b>	<b>N °</b>	<b>%</b>
Access to new consumers	6	86
Customer loyalty and appreciation	6	86
Publicity of produced foods	4	57
Higher sales volume/quantity	2	28
Practicality	2	28
Higher prices	1	14
Safer payment	1	14
Flexibility for marketed products	1	14
Guarantee of sales	1	14
Other	0	0
<b>Total</b>	<b>24</b>	<b>341</b>

<sup>3</sup>Through APROSUD's social networks, it is possible to access the associated cheese factories individually and view the national and international awards received by some of the FAUs and award-winning cheeses. Facebook: aprosud and Instagram: aprosud.pr



Source: Alimentário (2024). Note: Multiple choice question, leading to percentage higher than 100%.

For Samoggia et al. (2021), digital platforms provide access to new markets, allowing farmers to reach new consumers in different regions. By selling directly through these platforms, farmers can reduce their dependence on intermediaries, which translates into a higher earning power. In addition, digital platforms provide greater autonomy to farmers in managing their businesses, allowing them to decide on prices, promotions, and marketing strategies, something that Byomire et al. (2016) also found in their research.

Online marketing enhances the value of family production, giving visibility to the origin of food and promoting sustainable and quality farming. Leaning on digital platforms, farmers can diversify their marketed products and facilitate their promotion, as commented by 57% of respondents. This process not only expands products' reach, but also generates an additional source of income for family farmers (Trendov; Varas; Zeng, 2019), contributing to increasing their income and improving their living conditions, as evidenced by Niederle, Schneider and Cassol (2021), who demonstrated that marketing through digital channels increases the income of farming families by around 15%.

Table 11 shows which points should be improved in digital markets, according to farmers' opinions. The majority (86%) indicated logistics and delivery of food and products as the main point to be improved in digital markets. Additionally, 43% mentioned that food delivered without meeting the quality standard offered on the platform or website is a point to be improved. Other points to be improved include instability in the supply of food and products (14%) and lack of information about food's origin and farmers (14%). Another response mentioned the need for health inspection as a point to be improved. No participant mentioned payment for ordered products as something to be improved.

Table 11. Areas for improvement in marketing through digital marketplaces

Improvements in digital commerce	N °	%
Logistics and delivery of food and products	6	86
Delivered foods below quality standard offered on the platform/website	3	43
Instability in the supply of food and products	1	14
Lack of information on food's origin and farmers	1	14
Other (health inspection)	1	14
Payment of ordered food	0	0
<b>Total</b>	<b>12</b>	<b>171</b>

Source: Alimentário (2024). Note: Multiple choice question, leading to percentage higher than 100%.

Data show that the main challenge for farming families is food delivery. This common point can be an opportunity for improvement for the association, since participants who face difficulties with delivery can work together and create a logistics that serves everyone. Thus, by developing collaborative actions, farmers can improve the efficiency of their deliveries and reduce their workload and individual costs, as demonstrated by Alvear et al. (2020) in their study on the integrated marketing system that was developed for the Landless Workers' Movement (MST). The system optimized the organization of demand, allowing farmers to share

information among themselves about what food and products they had available, in addition to centralizing orders and organizing deliveries.

Finally, as important novelties identified in the research on APROSUD and its family cheese processor associates, three aspects stand out, as announced in the objective of the work and in the subtitle of this section. The first novelty refers to the manufactured foods, which are artisanal cheeses. Artisanal cheeses are living and natural foods, as their production relies on the farmers' own know-how, their recipes and historical knowledge, sometimes intergenerational. Furthermore, although they use small processing equipment, the production processes are manual and based on the use of raw milk from pasture-fed herds (Dutch and Jersey cows), mostly using techniques and art of artisanal craftsmanship. Thus produced, artisanal cheeses become unique foods, peculiar to each family and each cheese agri-processor, and this is their great asset of quality that the FAUs associated with APROSUD have used to access, conquer and build new and better markets, whether physical or digital.<sup>4</sup>

The second novelty is related to the use of WhatsApp application, used by 100% of the interviewees. In their words, “we can talk directly and with that we become known”, what establishes bonds of trust and closeness in exchanges linked to short marketing chains (Brunori, 2022; Gazolla; Aquino; Gaieveski, 2024). Research carried out by Zuñiga, Zuñiga and Montilla (2020), during the Covid-19 pandemic, in 29 countries in Latin America, found similar data, noting that more than 75% of farmers' digital marketing was done via messaging application, because it is free, easy to use and runs with limited data traffic in relation to the internet.

The third novelty is that although the organization (APROSUD) does not carry out marketing, it provides space through its social networks to promote food produced by each member. This means that, if a consumer cannot locate the specific cheese processor, he/she can access Facebook (aprosud) or Instagram (aprosud.pr) and will find the FAU he/she is looking for to purchase artisanal cheeses. The use of social networks enhances the marketing of family agribusinesses, as shown by research in the West of the state of Santa Catarina, where 42.30% of production accessed digital markets through the social networks Instagram and Facebook, the same social networks found in the research with APROSUD farmers (Lauremann, 2023).

These two innovations, the use of WhatsApp and social media by APROSUD's cheese producers, highlight two interrelated and interesting processes for building digital food markets. The first is that it allows farmers to use their creativity and the technological tools that are already available and free of charge to promote and sell their food and products at no additional cost. The second element, which is also very important, is that, even in the countryside and rural regions – as southwestern Paraná where the investigated initiatives are located – whose infrastructure for access to internet and various ICTs is generally precarious, it is possible to build and access the so-called digital food markets in a proactive and innovative way.

A fourth innovation, which could be said to be incubated and having potential for future development, is related to fostering sustainable development processes. Among the researched FAUs, one is being adapted to produce zero carbon. Such

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<sup>4</sup> APROSUD is also in process to get Geographical Indication (GI) for artisanal cheeses made from raw milk, before the Ministry of Agriculture, Livestock and Supply (MAPA) and the National Institute of Intellectual Property (INPI) requesting.

examples are enabled by a combination of elements such as association with credit cooperatives, technical assistance and the interest of farmers – something that has been worked on intensively within APROSUD. This innovation in development is in line with the purposes of the SDGs, especially SDG 12, which aims to promote environmentally friendly agricultural practices and consumption of organic food, and SDG 13, which deals with combating climate change.

This potential future development is important, since food systems are major emitters of greenhouse gases (GHGs). Globally, research indicates that around 1/3 of such emissions are linked to food production (Cerutti *et al.*, 2023). In Brazil, data are more alarming, since food systems account for around 73.7% of the total GHG emitted in the country, mainly linked to changes in land use and forests and agricultural and food production, in which ruminant farming stands out as a major emitter (SEEG, 2023; Santos; Gazolla; Conterato, 2024). Thus, agri-processors can help the country reduce its carbon emissions, since they are one of the specific actors within the Brazilian food system.

## 5 Final remarks

This study aimed to analyze how farming families use digital markets, based on the initiative of the Association of Artisanal Cheese Producers of Southwest Paraná (APROSUD). The analysis sought to identify the dynamics, challenges and innovations built by the FAUs associated with APROSUD.

Among the main research findings in relation to the dynamics of food markets, it is worth noting that physical marketing channels are still more prominent than the digital channels. These latter are in the phase of scaling up. Digital marketing channels confirm what existing literature reports so far – that they arise from existing physical markets, as a creative response from farmers to marketing restrictions due to the Covid-19 pandemic and that they remain in place after the health crisis. In addition, there is a concern with the regularity of supply, good quality of the marketed artisanal cheeses and personal delivery, demonstrating that farmers seek to create close and trusting relationships with consumers, in order to keep them satisfied and loyal.

Another relevant aspect is the autonomy of farming families, which is maintained in these food markets, as they take on the entire logistics of digital marketing. By being responsible for delivering food, farmers are able to keep greater control over the distribution process, avoiding additional costs associated with intermediaries. This short-chain marketing approach not only reduces costs, but also strengthens the direct relationship between farmers and consumers, promoting transparency and trust.

Regarding the challenges for building digital food markets, research findings highlight logistics as a major obstacle, particularly due to lack of appropriate equipment for delivering perishable products that require refrigeration to maintain quality; the small scale of orders; and delivery times. Furthermore, it seems that another major challenge is lack of time to operate digital tools required to interact with consumers on social networks and messaging apps. This is because the agri-processing experiences require farmers to implement an entire production chain, which begins with raw materials (caring for cows and obtaining raw milk), making

cheese, general management of the production unit, and which ends with the marketing of production, either through physical or digital channels.

In terms of innovations developed in food markets, the research showed that APROSUD innovates on three main fronts: a) the use of WhatsApp as a major commercial tool to sell its artisanal and raw milk cheeses; b) the use of social networks, which are free, to promote and sell its foods; and c) the big innovation, which seems to be the innovation of manufacturing and marketing artisanal cheeses made from raw milk, providing a product with specific qualities that represents the great asset used by the FAUs associated with APROSUD to access, conquer and build new and better food markets, whether physical or digital.

Finally, it is important to highlight the active role of associations such as APROSUD in the governance (albeit indirectly) of markets built by farmers, what demonstrates a collaborative and collective way of facing the challenges of marketing. This partnership strengthens the representation of farming families as suppliers of healthy and sustainable food, in addition to helping farmers adapt to changes in food markets, which are increasingly connected digitally.

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