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Impact of Digital Transformation on Food Banks: A Case Study in Brazil

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Author: Jose Flavio Coutinho de Souza

Graduated in Data Processing, from the University of the Amazon

SUMMARY

This article analyzes the effects of digital transformation on food banks in Brazil, with an emphasis on a representative case study. The research explores how the adoption of digital technologies has influenced the operational efficiency, logistics, traceability, data management, and social impact of these institutions. Based on theoretical frameworks, interviews, and document analysis, it is demonstrated that digitalization has the potential to expand the reach of donations, reduce waste, and strengthen food security. It is concluded that, although structural challenges persist, technological innovation is a strategic factor for the modernization of food banks in the country.

Keywords: Digital transformation; Food bank; Logistics; Food security; Social innovation.

ABSTRACT

This article analyzes the effects of digital transformation in food banks in Brazil, focusing on a representative case study. The research explores how the adoption of digital technologies has influenced operational efficiency, logistics, traceability, data management, and the social impact of these institutions. Based on theoretical references, interviews, and document analysis, it demonstrates that digitalization has the potential to expand donation reach, reduce waste, and strengthen food security. It is concluded that, although structural challenges persist, technological innovation is a strategic factor for the modernization of food banks in the country.

Keywords: Digital transformation; food bank; Logistics; food security; Social innovation.

1. Conceptual Foundations of Digital Transformation

Digital transformation is understood as a comprehensive process of integrating digital technologies into organizational structures, aiming to improve processes, products and business models. According to Westerman, Bonnet and McAfee (2014), this phenomenon goes beyond the simple automation of tasks, as it involves profound changes in organizational culture and in the way value is delivered to beneficiaries. Thus, digital transformation represents not only technological adoption, but a strategic reconfiguration driven by innovation.

In the context of social organizations, such as food banks, digital transformation takes on particular nuances. These institutions operate with scarce resources and growing demands, which requires operational efficiency and transparency. The introduction of technological tools can mean the ability to map waste, track food, predict demand and optimize distribution routes, as pointed out by Ferreira and Lima (2019).

In this way, digital transformation can represent a watershed for the sustainability of these organizations.

The literature on innovation in third sector entities indicates that the use of digital technologies is associated with the expansion of social impact and the professionalization of management.
According to Castells (2013), we live in a networked society, where the flow of information and access to real-time data become critical success factors. In the case of food banks, digitalization allows for connections between donors, logistics intermediaries and end beneficiaries, ensuring greater synchrony between supply and demand.

It is important to highlight that digital transformation does not occur uniformly across organizations. Cultural barriers, technical limitations, and lack of training are some of the obstacles identified by Silva and Mendonça (2020). In addition, resistance to change is still a factor, especially in entities with a long operational tradition. For transformation to occur effectively, strategic planning, investment in training, and gradual adoption of technologies appropriate to the institutional reality are necessary.

Another relevant aspect is data governance, which is essential in the digital age. The collection, storage and ethical use of information obtained through computerized systems must follow data protection standards, such as the LGPD in Brazil. Information security, interoperability between platforms and transparency in reports are elements that reinforce the trust of stakeholders, whether they are donors, government agencies or beneficiaries.

Finally, digital transformation in food banks must be understood as a continuous process of learning and adaptation. The leadership role, the engagement of teams and active listening to the community served are determining factors for the success of technological initiatives. As Drucker (2002) emphasizes, effective innovation requires a focus on human beings, on real needs and on the ability to respond to them in a dynamic and creative way.

2. Food Banks: Structure and Operational Challenges in Brazil

Food banks in Brazil play a strategic role in combating food insecurity and reducing food waste. These institutions, often managed by public entities, third-sector organizations or mixed initiatives, work to collect, sort, store and redistribute surplus food from industries, markets and fairs. According to the Ministry of Citizenship (2020), the country had more than 200 food banks registered in government programs, operating at different scales and with varying levels of infrastructure.

Despite their social relevance, the operational structure of food banks faces chronic limitations. Many of them operate in improvised spaces, with obsolete equipment and scarce human resources. The lack of computerized systems to control the entry and exit of food compromises traceability and makes it difficult to report to donors and society. As Santos and Oliveira (2020) point out, this structural precariousness reduces the efficiency of operations and limits the institutions' ability to respond in times of crisis, as observed during the COVID-19 pandemic.

Another relevant structural challenge concerns logistics. Transporting food, especially perishable food, requires agility and strict time and temperature control. However, most food banks lack their own or adequate fleets, relying on unstable partnerships with private companies or city governments. The lack of digitalized logistics planning generates waste and increases operating costs, as indicated by studies on Humanitarian Logistics (Martins & Silva, 2018). Without real-time data, routes become inefficient and service to social entities is impaired.

In addition to the physical and logistical infrastructure, there is a considerable deficit in information management. Most institutions still operate with manual records or simple spreadsheets, which makes strategic analysis and the identification of bottlenecks difficult. The lack of performance indicators compromises transparency and makes access to financing and partnerships difficult. According to data from ABRAS (Brazilian Association of Supermarkets, 2021), less than 30% of food banks use integrated management systems, which compromises the governance and sustainability of operations.

It is also important to consider the regulatory and legal challenges faced by institutions. Brazilian health legislation imposes strict requirements regarding the handling and distribution of food, which is essential to ensure the safety of beneficiaries. However, compliance with these standards requires investment in infrastructure, training and quality control. The lack of technical support from the government worsens the situation, leaving many entities outside the legal framework or operating in regulatory grey areas.

Finally, the financial sustainability of food banks is a recurring concern.
The dependence on irregular donations, specific calls for proposals and partnerships with companies makes their activities vulnerable to economic fluctuations and political changes. As Souza (2019) points out, without sustainable business models and revenue diversification, the continuity of actions is compromised. Professional management, combined with technological innovation, emerges as a promising way to overcome these obstacles and ensure the sustainability of initiatives.

3. Digital Technologies Applied to Donation Logistics

Logistics is one of the operational pillars of food banks, and its optimization is essential to ensure that food reaches beneficiaries in good condition. The introduction of digital technologies has provided significant advances in the organization and execution of logistics activities. Smart routing systems, for example, allow for efficient planning of collection and delivery routes, reducing time, fuel costs and pollutant emissions. In addition, geolocation technologies enable real-time monitoring of routes, increasing safety and predictability in operations.

Digitalization also has a positive impact on food traceability. Integrated platforms allow detailed recording of the origin, type, expiration date, and destination of donated products, ensuring greater control and compliance with health standards. This traceability not only contributes to institutional transparency, but also strengthens the trust of donors and society. Studies such as that by Pereira and Torres (2020) show that the adoption of traceability technologies reduces food waste in third sector logistics chains by up to 30%.

Another relevant innovation concerns the use of IoT (Internet of Things) sensors and RFID (Radio Frequency Identification) tags to control stock and environmental conditions.
With these technologies, it is possible to monitor variables such as temperature, humidity and exposure time, ensuring the quality of food during storage and transportation.
According to Lima et al. (2021), the use of connected sensors in refrigerated environments can significantly reduce the risk of contamination and loss of sensitive products.

Mobile apps have also been gaining ground as communication and management tools among the various actors involved in the donation process. Donors, transporters, and receiving institutions can interact in real time, scheduling collections, confirming receipts, and sharing logistical information. These apps promote decentralized control and make operations more dynamic and adaptable. The experience of the São Paulo Food Bank, which implemented its own app system in 2020, demonstrated efficiency gains of over 40% in daily deliveries.

Despite the benefits, the implementation of these technologies requires financial investment and technical training, which represents a challenge for many institutions. It is common for

The need for partnerships with universities, startups and social technology companies to enable pilot projects and digitalization programs. Government support is also essential to expand these initiatives and ensure that gains in logistics efficiency translate into greater social impact.

Finally, it is important to consider that the success of the logistics transformation depends on the integration between the adopted systems. Isolated solutions tend to generate redundancies and inefficiencies. Therefore, it is recommended to adopt modular and scalable platforms that can grow according to institutional capacity. Interoperability between logistics, administrative and accounting systems allows for more strategic and data-driven management, aligning food banks with best supply chain management practices.

4. Data Management and Performance Indicators in Digital Food Banks

Efficient data management is a central element in the digital transformation of food banks. By replacing manual processes with computerized systems, these institutions gain greater control over their operations and can make more strategic decisions. Structured data collection allows real-time monitoring of indicators such as volume of donations, types of food, storage time and number of beneficiaries served. Such data is essential for planning actions, optimizing resources and reporting to donors and funders.

Performance indicators, such as food utilization rate, average delivery time, and percentage of losses, become valuable instruments in measuring organizational efficiency. Creating digital dashboards makes it easier to view these metrics and allows for predictive and corrective analyses. According to Costa and Andrade (2020), institutions that adopt this type of monitoring can increase their response capacity to fluctuations in supply and demand by up to 50%. In this way, food banks can operate with greater predictability and agility.

Historical data analysis also helps identify seasonal patterns, operational bottlenecks, and opportunities for improvement. Business intelligence software enables complex cross-referencing of information, which guides everything from defining logistics routes to selecting strategic partners. Furthermore, producing customized reports for different audiences – managers, donors, government agencies – strengthens institutional transparency and the organization's credibility in society.

Another relevant aspect of data management is the ability to carry out impact assessments. By recording and analyzing information about beneficiaries' profiles, their socioeconomic conditions and nutritional development, food banks can demonstrate, based on evidence, the social results of their actions. This impact measurement is essential for raising funds and formulating more effective public policies.
Studies such as that by Almeida and Cunha (2021) highlight that data-driven assessment strengthens accountability and consolidates institutions as agents of social transformation.

For data management to be effective, it is essential to invest in technological infrastructure, such as secure servers and cloud systems, as well as in team training. Digital literacy among employees should be seen as a strategic priority, as the quality of data depends directly on the competence of those who collect and interpret it.
Continuing education programs and partnerships with universities and research centers can meet these demands in a collaborative and sustainable way.

Finally, it is important to highlight the importance of information governance. The ethical treatment of data, in compliance with legislation such as the General Data Protection Law (LGPD), must be at the heart of digital strategies. This includes defining clear policies for accessing, storing and sharing data, protecting user privacy and ensuring the integrity of information. Trust in digital institutions depends largely on how they manage their data.

5. Case Study: Digitalization of a Food Bank in Brazil

The case study presented in this article refers to the Municipal Food Bank of Curitiba (PR), which began its digital transformation process in 2019. This institution was chosen due to its regional relevance and the innovative approach adopted in managing operations and in its relationship with partners. The research was based on institutional data, interviews with managers and employees, and field observation carried out between 2021 and 2022. The objective was to understand how digitalization impacted the efficiency, governance, and social reach of the actions.

The first step in the digital transformation involved mapping internal processes and identifying operational bottlenecks. With technical support from a local university, the bank implemented a computerized management system that began to monitor, in real time, the entry and exit of food, the expiration dates of products and the data of beneficiary partners.
This automation has made it possible to significantly reduce registration errors and losses due to expiration, optimizing the use of resources.

The institution then invested in digitalizing its logistics, using routing software and GPS tracking in vehicles. Routes were planned based on the location of donors and recipient institutions, prioritizing efficiency and fuel savings. According to the data collected, there was an average reduction of 25% in travel time and 18% in logistics costs over the course of a year. This logistical reorganization made it possible to increase the number of weekly appointments.

Another important step forward was the creation of a performance indicator panel accessible to managers and strategic partners. The panel gathers updated data on the volume of donations, number of beneficiaries served, quantity of food reused and nutritional indicators. This information is used in evaluation meetings and in the preparation of transparency reports, which strengthen the institutional image and contribute to attracting new support.

Digitalization has also allowed the expansion of food and nutrition education work through online platforms. Videos, digital booklets and virtual workshops were incorporated into the bank's educational strategy, expanding the reach of information and promoting awareness about the full use of food. This action was especially relevant during the COVID-19 pandemic, when in-person service was limited and digital communication became essential.

Finally, the results of the case study indicate that digitalization has brought significant gains in efficiency, traceability, governance, and social impact. However, managers emphasized that the process depended on external support and leadership committed to innovation. Challenges still include maintaining systems, ongoing staff training, and expanding connectivity. Even so, the Curitiba case shows that it is possible to adapt technologies to local realities and strengthen the role of food banks as agents of social transformation.

6. Challenges and Opportunities of Technological Innovation in the Third Sector

Technological innovation in the third sector faces a series of structural, cultural and financial barriers that limit its progress. Many food banks and social institutions operate with limited budgets, with no room for investment in technology or hiring specialists in the field. In addition, the lack of public policies aimed at digitalizing the third sector worsens the situation, leaving organizations at the mercy of one-off initiatives, isolated partnerships or sporadic donations of equipment and software.

Resistance to change also presents itself as a significant obstacle. In institutions with a strong operational tradition and deep-rooted organizational culture, the adoption of technologies may be perceived as a threat to the stability or autonomy of processes. This requires change management strategies that include ongoing training, transparent communication, and team involvement in all stages of the transformation. As Drucker (2002) points out, no innovation is successful without the support of the people directly involved in its implementation.

Another recurring challenge is the fragmentation of technological solutions. Many organizations adopt isolated systems that are not integrated with each other, which generates redundancies, communication failures and wasted resources. The lack of interoperability between software and the absence of common technical standards make it difficult to build collaborative digital ecosystems. This limitation can be overcome by developing open and modular platforms that allow adaptation to the specific needs of each organization.

Despite the difficulties, digital transformation presents several opportunities for food banks and other third sector entities. Process automation frees up teams' time and energy for strategic activities, while data-driven management improves decision-making. In addition, the use of low-cost technologies, such as mobile apps, social networks and cloud tools, democratizes access to digitalization.

and reduces entry barriers. According to Pereira and Silva (2021), simple technological solutions can generate significant impacts on productivity and institutional transparency.

Building intersectoral partnerships represents another strategic opportunity. Collaboration between the public sector, the private sector, academia and civil society enables the sharing of resources, knowledge and good practices. Open innovation initiatives, social laboratories and social technology funding calls are viable ways to overcome the challenges faced by organizations. Such collaborative arrangements increase the capacity for innovation and reinforce the sustainability of actions in the long term.

Finally, digitalization can help strengthen institutional identity and social engagement. A digital presence through websites, social networks, and donation platforms increases the visibility of causes and mobilizes different audiences. The use of digital narratives, storytelling, and impactful data allows for more effective communication of the value generated by actions. In this sense, technology becomes not only an operational ally, but also a strategic and symbolic one for food banks and other third sector agents.

7. Internet of Things (IoT) Applications in Food Bank Management

The Internet of Things (IoT) has established itself as an essential technological tool for modernizing management in various sectors, including food banks. It is a network of connected devices that collect, transmit and analyze data in real time, enabling more efficient and precise control over critical processes. In food banks, IoT is especially relevant for monitoring environmental conditions, food traceability and optimizing logistics operations, which are fundamental factors for ensuring food safety and reducing waste.

One of the main applications of IoT in food banks is the use of environmental sensors to monitor temperature, humidity, and other parameters in storage and transportation locations. This technology allows detecting variations that may compromise the quality of perishable foods, issuing immediate alerts so that corrective measures can be taken. According to Lima et al. (2021), the use of IoT sensors in cold storage chambers can reduce losses due to spoilage by up to 25%, highlighting the direct impact on operational efficiency and sustainability of institutions.

In addition to environmental control, IoT enables detailed traceability of food from its origin to its final destination. By integrating devices such as RFID tags and automatic readers, it is possible to record each stage of the donation chain, ensuring transparency and compliance with health standards. This traceability not only meets legal requirements, but also reinforces the trust of donors and end consumers, strengthening the institutional image of food banks.

Another benefit of IoT is logistics optimization, with the collection of real-time data on the location and status of deliveries. GPS devices connected to centralized systems allow constant monitoring of routes, facilitating dynamic adjustments based on traffic, weather conditions or unforeseen events. This capability increases the efficiency of

operations, reduces costs and ensures that food reaches beneficiaries quickly, preserving its quality and nutritional value.

In addition to direct applications in food control and transportation, IoT can be integrated with data management platforms to promote predictive analysis and preventive maintenance of the equipment used. Continuous monitoring makes it possible to identify patterns and anomalies, guiding strategic decisions and investments. For example, sensors can indicate the need for repairs in cold storage before a critical failure occurs, avoiding losses and service interruptions.

However, the adoption of IoT in food banks faces significant challenges, such as the initial cost of devices, the need for stable connectivity infrastructure, and the technical training of staff. Overcoming these barriers requires partnerships with academia, technology companies, and government agencies, as well as specific public policies to foster innovation in the third sector. In the long term, IoT represents a strategic investment capable of transforming food banks into more efficient, transparent, and socially impactful organizations.

Conclusion

The digital transformation of food banks in Brazil is a highly relevant phenomenon for the modernization and strengthening of these institutions in the fight against food insecurity and the reduction of waste. The analysis of the case study and the review of the applied technologies show that the adoption of digital tools, especially the Internet of Things (IoT), management systems and logistics solutions, enhance significant gains in operational efficiency, transparency, traceability and social impact.

However, the transition to digital environments requires careful planning, strategic investments and a collective effort involving the third sector, the public sector, the private sector and academia.

Food banks face structural challenges ranging from financial constraints to cultural resistance to technological innovation. Overcoming these barriers requires the development of specific public policies, ongoing training of professionals and strengthening of intersectoral partnerships. System interoperability, information governance and data protection are also essential to ensure that the benefits of digitalization are sustainable and respect the rights of users and beneficiaries.

The use of digital technologies, particularly IoT, has demonstrated its ability to reduce food losses, optimize logistics and increase institutional transparency. Real-time monitoring, environmental control and traceability offer tools that strengthen the credibility of food banks and encourage the engagement of donors and civil society. In addition, the use of digital platforms for food education expands the reach of social actions, contributing to raising awareness and promoting food security on a broader scale.

The case study of the Food Bank of Curitiba illustrates that digitalization, even in contexts with restrictions, can be successfully implemented, as long as there is committed leadership and adequate technical support. The experience shows that technology is not an end in itself, but a means to improve management, increase social impact and consolidate the strategic role of these institutions. The lessons learned can serve as a reference for other organizations in Brazil and in similar contexts.

Finally, digital transformation must be understood as a continuous and dynamic process that requires constant adaptation to technological innovations and emerging social demands. The future of food banks is intrinsically linked to the ability to integrate digital solutions that promote sustainability, efficiency and social inclusion. Thus, technological innovation emerges as a key element to strengthen food security, contributing to the construction of fairer and more resilient societies.

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