



National School Feeding Program (PNAE): a conceptual model of barriers to acquiring family farming food items

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ABSTRACT: The National School Feeding Program (PNAE) is the oldest and most extensive food and nutrition program in Brazil. Art. 14 of Law 11.947 stipulate that at least 30% of its operational resources need be used to purchase family farming products. However, there are important barriers that hinder the application of this law. The present article developed a conceptual model that described and analyzed the barriers to this requirement. A systematic literature review identified twelve barriers, divided into three constructs political administrative infrastructure and human capital, which enables PNAE management to develop mitigation strategies, including a larger number of farmers in the program, thereby increasing its efficiency.

Key words: school feeding, rural producer, difficulty.

Programa Nacional de Alimentação Escolar (PNAE): um modelo conceitual das barreiras à aquisição de alimentos da agricultura familiar

RESUMO: O Programa Nacional de Alimentação Escolar (PNAE) é considerado o programa de alimentação e nutrição mais antigo e de maior abrangência do Brasil. O art. 14 da Lei n. 11.947 determina que um percentual mínimo de 30% dos seus recursos operacionais deva ser empregado na compra de produtos da agricultura familiar. Contudo, existem barreiras importantes que dificultam a aplicação dessa Lei. Este artigo tem como objetivo desenvolver um modelo conceitual que permita descrever e analisar as barreiras impeditivas à esta exigência. Uma revisão sistemática da literatura permitiu identificar doze barreiras que se agrupam em três constructos: político-administrativo, infraestrutura e capital humano, que possibilita aos gestores do PNAE o desenvolvimento de estratégias de mitigação, inserindo um maior quantitativo de agricultores no programa, aumentando sua eficiência.

Palavras-chave: merenda escolar, produtor rural, dificuldade.

INTRODUCTION

The Brazilian Federal Government has extensive experience in formulating and implementing public school feeding programs (OLIVEIRA et al., 2017), including the National School Feeding Program (PNAE), the oldest Brazilian feeding and nutrition program in the country (ROCHA et al., 2018). It guarantees food availability and promotes nutrition education measures for elementary school students from the public school system.

Law 11.947, of June 16, 2009, stated that at least 30% of the National Education Development Fund (FNDE) resources for the PNAE must be used to acquire family farming (FF) foods (BRASIL, 2009). According to some authors, this law was important in

preserving eating habits and combating rural poverty. The Federal Government began to combine food safety policies and rural development instruments to implement commercial channels aimed at FF (SOUZA & VILLAR, 2019).

Despite its worthwhile goals, the law to include family products in the PNAE faces barriers to its operationalization. An FNDE report state that 1,852 (33.27%) of the 5,566 Brazilian municipalities do not apply at least 30% of resources to purchase FF products (FNDE, 2022). It is important to underscore that in paragraph 2 of article 14, law 11.947/2009 stipulates only three situations that exempt applying the 30%: (i) being unable to issue the fiscal document; (ii) being unable to regularly provide food stuffs; and (iii) inadequate hygiene-sanitary conditions (BRASIL, 2009).

With a view to mitigate these obstacles, this article developed a theoretical-conceptual model that addresses the barriers that prevent PNAE management from applying at least 30% of its resources to purchase FF products. This article considered barriers as any political-administrative, infrastructure and human capital factors that hamper the enforcement of Law no. 11.947/2009.

MATERIALS AND METHODS

A systematic literature review was conducted based on the five-stage approach of DENYER & TRANFIELD (2009), as follows:

Stage 1) Research question: this stage sought to answer the following question: “What are the barriers that hinder enforcement of Law 11.947/2009?”

Stage 2) Study sources: the articles were extracted from the Web of Science, Scopus and SciELO databases. The searches were conducted using a combination of the terms (“Programa Nacional de Alimentação Escolar” or PNAE) and (“agricultura familiar”), which were translated into English for the Web of Science and Scopus databases.

Stage 3) Selection and assessment: no filters were used to select the articles, with no restriction for specific areas, type of document, language or time period. The procedures resulted in seventy-three articles (seven from Web of Science, twenty-two from Scopus and forty-four from SciELO). Next, the inclusion (studies that discuss the barriers that hinder applying 30% of the resources for FF to supply the PNAE) and exclusion criteria (duplicate articles and those unavailable for download) were established (Table 1).

Table 1 - Selected studies.

Number	Authors	Publication
1	BORGES et al., 2022	Brazilian Journal of Development
2	MAIELLARO et al., 2022	Journal of International Food & Agribusiness Marketing
3	OLIVEIRA et al. 2021	Ciência rural
4	DIAS et al. 2020	Revista de Saúde Pública
5	FERREIRA et al. 2019	Revista de Saúde Pública
6	VILELA et al. 2019	Ciência Rural
7	TRICHES et al. 2019	Revista de Desenvolvimento Regional (Redes)
8	SOUZA & VILLAR, 2019	Revista de Nutrição
9	MACHADO et al. 2018	Ciência & Saúde Coletiva
10	ROCHA et al. 2018	Revista de Saúde Pública
11	SILVA et al. 2018a	Revista Brasileira de Gestão e Desenvolvimento Regional
12	MOSSMANN et al. 2017	Revista de Economia e Sociologia Rural
13	CASTELLANI et al. 2017	Revista de Nutrição
14	GREGOLIN et al. 2017	Revista Conexão UEPG
15	HIRATA, 2017	IFSULDEMINAS
16	BRASIL, 2017	MEC
17	TEO, 2017	Public Health Nutrition
18	SODRÉ & SALAMONI, 2016	Sociedade & Natureza
19	TEO et al. 2016	CAMPO-TERRITÓRIO: Revista de Geografia Agrária
20	DINIZ et al. 2016	GEO-UERJ
21	BARONE et al. 2016	Revista Visão em Debate: Sociedade, Ciência e Tecnologia
22	AMORIM et al. 2016	Revista de Nutrição
23	GONCALVES et al. 2015	Ciência Rural
24	COSTA et al. 2015	Revista de Economia e Sociologia Rural
25	SILVERIO & SOUSA, 2014	Revista de Nutrição
26	BRASIL, 2014	MEC
27	BEVILAQUA & TRICHES, 2014	Segurança Alimentar e Nutricional
28	MARQUES et al. 2014	Saúde e Sociedade
29	SARAIVA et al. 2013	Ciência & Saúde Coletiva
30	OLIVEIRA et al. 2013	Revista da Sociedade Brasileira de Alimentação e Nutrição
31	COSTA et al. 2012	Cadernos de Saúde Pública
32	REAL & SCHNEIDER, 2011	Estudo & Debate

Source: The authors.

Stage 4) Analysis and synthesis: the titles, abstracts, and keywords were read, excluding those irrelevant to the subject, followed by reading the introduction and conclusion in full. Included fourteen studies, whose references served as the theoretical framework to complement the articles, resulting in a final total of thirty-two studies (Figure 1).

Stage 5) Development of a report with results: a conceptual model of the barriers to FF food acquisition was developed.

RESULTS AND DISCUSSIONS

Twelve barriers were identified and grouped into constructs (political-administrative, infrastructure and human capital), which in a deductive logic, form the conceptual model of barriers that have hindered the implementation of article 14 of Law 11.947/2009 (Figure 2).

Political-administrative barriers Farmer documentation

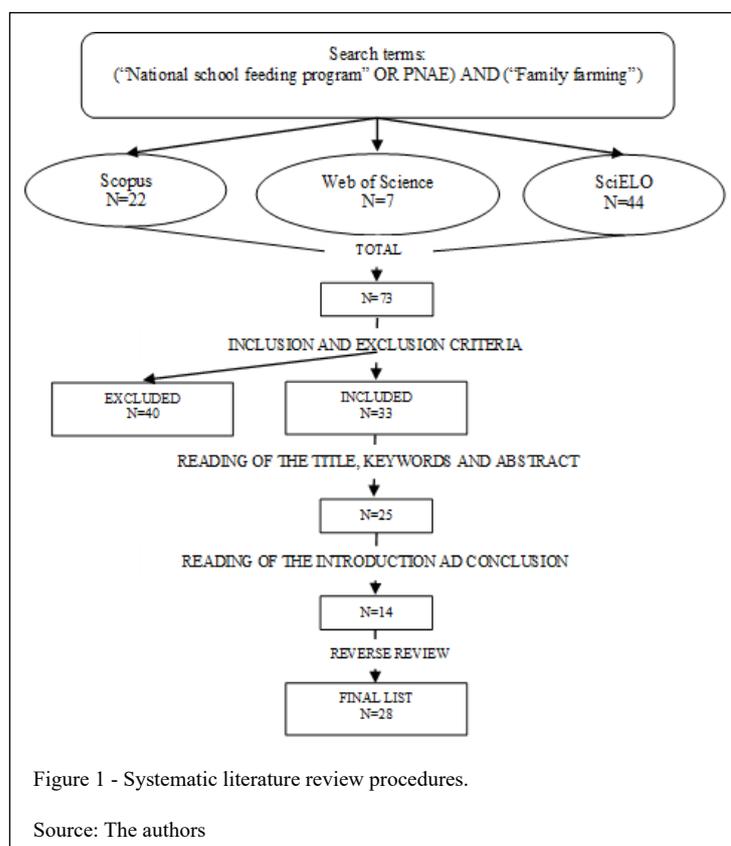
In order to access public rural productivity support policies, farmers must have been issued the

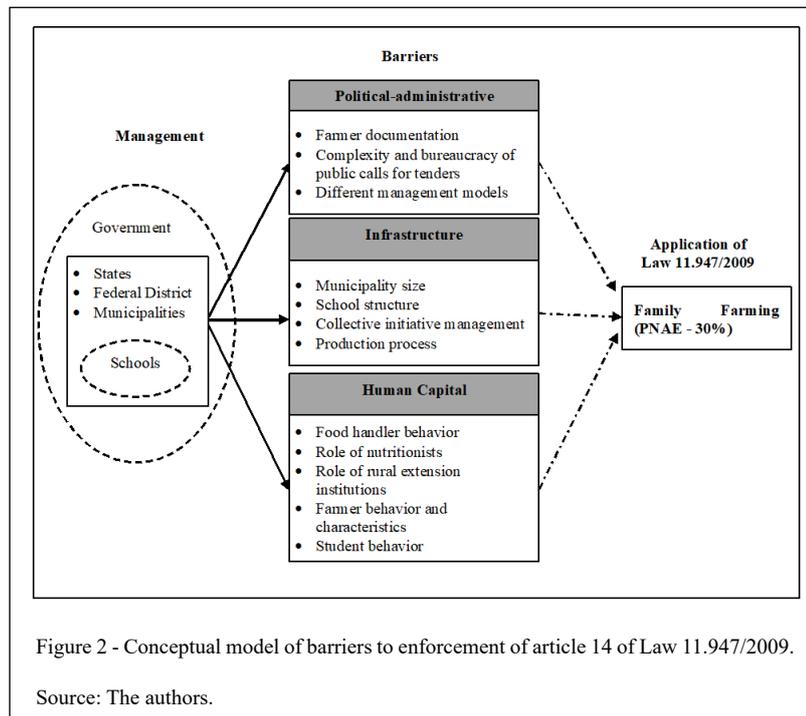
document entitled Declaration of Eligibility for the National Family Farming Strengthening Program (DAP) (BRASIL, 2022), which certifies that they meet the legal criteria of a family farmer (BARONE et al., 2016). Although, this document is issued free of charge, the PNAE often does not purchase FF products from farmers because they do not have the DAP (VILELA et al., 2019).

MOSSMANN et al. (2017) showed that farmers deem the DAP a barrier to access public tenders and school food sales, due to the large number of requirements. In order to minimize this barrier, farmers need better government assistance to instruct them regarding the emission and organization of the documentation required to participate in the PNAE.

Complexity and bureaucracy of public calls for tenders

Even with the changes brought about by Law 11.957/2009, such as exemption from public calls for tenders, bureaucracy in the managed purchasing process persists, primarily by Brazilian municipalities (TRICHES et al., 2019). This is especially concerning because family farmers are





unfamiliar with government bureaucracy procedures, which may vary substantially according to the practices and administrative routines of purchasing organizations, generally municipalities.

The PNAE buying process includes 18 stages: Nominating the Special Commission for Family Farming Purchases (CECAF); Identifying family farmers and local producers; Establishing the menu; Basic project; Price quote; Process formalization; Public announcement; Estimate/authorization; Judicial analysis; Publication of the public call for tenders; Receiving sales proposals; Public judgment session; Publication of the sentence; Receiving samples; Ratification; Dissemination of exemption for calls for tenders on the Electronic Publication System for Purchases and Acquisitions (SIDECA) and Integrated System for General Services (SUASG); Note of commitment; and Contract emission (HIRATA, 2017).

These stages and the need to engage different public sectors to implement them are serious bureaucratic barriers to the PNAE purchasing process, making it highly complex (VILELA et al., 2019). This results in the delayed annual renewal of public calls for tenders and hinders the planning of program managers and family farmers (TRICHES et al., 2019).

According to HIRATA (2017), a public call for tenders to acquire food products is a public

policy that stimulates farmer production and contributes to developing FF in several Brazilian regions. However, this purchase model based on the lowest price negatively affects the investment power of local farmers, since a considerable part of the resources received are to cover production costs and related expenses, in addition to sustaining the family itself (BORGES et al., 2022). This may be mitigated with administrative measures that establish purchase criteria as important as price, which would reduce the number of public call stages, thereby minimizing the bureaucracy and time required in the process.

Different management models

In a large country such as Brazil, administrative and financial decentralization is important in improving managerial efficiency associated with public policies. For example, in the PNAE, the FNDE decentralized the responsibility of defining the food acquisition process to states and municipalities.

There are four types of management in the PNAE: centralized, decentralized, outsourced and mixed. Centralized management gives the municipality or state direct responsibility in purchasing food products; in decentralization, the schools themselves purchase these products; in outsourced management, the municipality or

state contracts meal supply services; and in mixed management, the municipality or state purchases nonperishable food items and schools their perishable counterparts (SOUZA & VILLAR, 2019).

This variety in management models used in the PNAE complicates the mandatory 30% minimum purchase of food products from FF and makes it difficult to standardize the formulation and management of measures undertaken by states and municipalities. Machado et al. (2018) demonstrated that centralized management was predominant in most municipalities, and the purchase of FF products was greater. By contrast, in mixed or outsourced management, the purchase of FF products varied between 10 and 30% less when compared to centralized management.

Conversely, SOUZA & VILLAR (2019) investigated the FF food acquisition process in a number of municipalities in Southeastern Brazil, reporting that all those using outsourced or mixed management achieved the 30% minimum and centralized management 35%.

Infrastructure barrier

Municipality size

The size of Brazilian municipalities may influence FF product purchases by the PNAE (SARAIVA et al., 2013). There is an inverse relationship between municipality size and the number of FF products acquired, whereby larger cities buy fewer (CASTELLANI et al., 2017). MACHADO et al. (2018) observed that municipality size is a determining factor in the percentage of FF products purchased. Large municipalities buy less from FF (10-20% less), especially in the states of Amapá, Roraima and São Paulo.

Amorim et al. (2016) analyzed the sale of FF food products to the PNAE in São Paulo state. According to the authors, one of the reasons why larger municipalities do not spend 30% of the resources made available by the FNDE is that family farmers are usually unable to achieve the larger production scales needed. In addition, low FF production may be linked to the use of rudimentary and obsolete farm equipment. The authors also indicated that the federal government could provide the farmers with technical assistance in order to increase access to rural credit, thereby improving their technological base and production.

TRICHES et al. (2019) corroborate the aforementioned authors. In their study to identify the conditions and limitations to acquiring FF products in the PNAE of Paraná State, they reported that large municipalities did not achieve the 30% minimum

required by Law 11.947/2009, while their medium-size and small counterparts purchased larger percentages of products. According to DIAS et al. (2020), the difficulty of large municipalities, such as Brazilian State capitals, in acquiring FF foodstuffs, is caused by the institutional procedures and bureaucracy that hamper collaboration between schools, departments and sectors responsible for complying with PNAE requirements.

In addition to municipal size, the presence of large food producing companies in the PNAE public purchasing process hinders the 30% application in FF foodstuffs (REAL & SCHNEIDER, 2011). The federal government's location of resources to public purchases (such as the PNAE) in Brazilian State capitals has attracted wholesale and retail companies involved in large-scale sale of different products. These companies are experienced with the bureaucratic commercialization procedures of the program and can provide structured food delivery logistics at a lower cost, which may represent certain resistance to FF entering this market (AMORIM et al., 2016; DIAS et al., 2020).

School structure

School infrastructure is a barrier that limits PNAE spending on FF foodstuffs. This often precludes storing fresh products (GREGOLIN et al., 2017; MAILERO et al., 2022), despite the robust PNAE guidelines, laws and requirements (ROCHA et al., 2018).

According to SOUZA & VILLAR (2019), the precarious school kitchens of Brazilian public schools is a barrier that needs to be overcome to favor the purchase of FF food products. In addition, the lack of adequate installations is an obstacle to storing a larger amount of FF foodstuffs, thereby reducing farmer deliveries (SODRÉ & SALAMONI, 2016). There is a need for fresh food processing equipment in order to provide healthy nourishment.

As a result, industrial food is favored over FF products due to its easy preparation and packaging. This occurs despite the poor nutritional value of school meals and damage to local development with the lack of investment (GREGOLIN et al., 2017). These shortcomings need to be identified and resolved in order to increase FF investment using FNDE resources and funding from federal entities (ROCHA et al., 2018). So, promoting healthy food in schools requires investments.

Collective initiative management (cooperatives and associations)

Farmers need to organize collectively to be included in the PNAE. This is why the internal

management difficulties of cooperatives or family farmer associations may result in barriers to FF participation in the PNAE (TEO et al., 2016). These difficulties are exacerbated as collectives expand and diversify their products (MARQUES et al., 2014), requiring administrative understanding by farmers who often have a very low educational level. Farmers' managerial skills must be developed in order for cooperatives to provide foodstuffs to the PNAE and other markets.

In small cooperatives, for example, lack of resources mean that management cannot be remunerated. In some cases, these institutions have insufficient working capital for basic logistic activities (VILELA et al., 2019). In addition, collective actions incur operationalization costs that are shared by all the farmers, thereby reducing funds transferred to associations or cooperatives (COSTA et al., 2015). Some studies, such as that by MARQUES et al. (2014), confirmed that operating costs such as rent, water, energy, and administration, among others, are equally shared among farmers belonging to rural production associations, thereby compromising their production. These operating costs should be included in the final price of the product, in order to make commercialization with the PNAE more attractive.

COSTA et al. (2015) reported that 19 family farmer cooperatives in Minas Gerais State experience difficulties in their storage and distribution logistics. Overcoming these challenges requires time and depends on the cooperation of managing institutions, increasing investments in FF and improving the collective organization of family farmers.

Production process

Aspects linked to the volume and quality of production can be barriers to including FF products in the PNAE. In order to supply the PNAE with foodstuffs, in addition to a commercialization scale commensurate with demand (SILVERIO&SOUSA, 2014; DINIZ et al., 2016; DIAS et al., 2020; MAIELLARO et al., 2022), foods need specific packaging, labeling, preparation and conservation (MOSSMANN et al., 2017). However, farmers often have difficulty meeting these demands due to their poor access to suitable technologies (OLIVEIRA et al., 2021) and high food perishability (MAILLERO et al., 2022).

Indeed, a large number of farmers do not earn enough to invest in production and meet the sanitary conditions required by the PNAE (BEVILAQUA&TRICHES, 2014). TRICHES et al. (2019) showed the difficulties farmers experience in

complying with the sanitary measures demanded for commercializing animal-based products. Public calls for tenders stipulate amounts to be supplied annually (MARQUES et al., 2014). However, the seasonality of production and lack of storage facilities prevent these requirements from being fulfilled. More incisive action is needed from rural extension institutions to help farmers obtain rural credit, an important instrument for improving their production processes.

In this respect, diversification is an alternative to meet the dictates of Law 11.947/2009. However, not all family farmers have the technical skills, equipment and machinery needed for product diversification (SODRÉ& SALAMONI, 2016; CASTELLANI et al., 2017; VILELA et al., 2019; TRICHES et al., 2019; DIAS et al., 2020). Encouraging PNAE farmers to diversify production is one of the challenges between FF and institutional markets (TEO et al., 2016).

Given that some municipalities exhibit difficulties in achieving the legally stipulated 30% of resources, the PNAE has prioritized the sale of organic, agroecological and socio-biodiversity foods via Resolutions 26/2013 and 4/2015. In order to stimulate the purchase of locally processed organic food, the abovementioned resolution establishes that up to 30% more can be paid for these foods, when compared to their conventional counterparts (CASTELLANI et al., 2017). However, in addition to stipulate a higher price for organic and agroecological food products, farmers need to be provided with the means to produce them, through technical training courses, in order for the supply to be constant.

Despite the opportunities provided by the program, there are difficulties in acquiring these foods. According to SILVÉRIO & SOUSA (2014), the sanitary guidelines needed to produce organic, agroecological and community-based products are excessively bureaucratic for smallholder farmers, preventing them from obtaining the required certification to commercialize these products. TEO et al. (2016) also reported that the higher costs of these production systems are also an obstacle to overcome in order for FF to participate in the PNAE.

Human capital barrier

Food handler behavior

The Ministry of Education (MEC) recommends that school meals comply with technical guidelines, prioritizing nutritional and hygiene-sanitary aspects, in order to ensure that a food item not pose a risk to students' health. In this respect, the National Sanitary Surveillance Agency (ANVISA)

defines a food handler as any person in the food service industry that has direct or indirect contact with the food item” (BRASIL, 2014). ANVISA’s Collegiate Directorate Resolution 216/2004 requires good food storage, handling, preparation and distribution practices.

In the PNAE context, the behavior of food handlers responsible for meals that use FF products is a limitation cited in some studies. For these individuals, the use of FF products has significantly changed their work processes, since more elaborate meals require longer preparation time than processed foods (SODRÉ& SALAMONI, 2016). An alternative to this scenario is to hire more food handlers to prepare the meals.

In addition, it is difficult to meet MEC school meal best practices in terms of cleaning, since the food items are dirty when they reach the schools (TEO et al., 2016). Food should be cleaned first on the farms and PNAE management should hold workshops to teach correct cleaning and the importance of commercializing them in conditions suitable for subsequent handling.

Another question is the absence of uniform food preparation, which may result in dissatisfied students and significant waste (TRICHES et al., 2019). The MEC has produced training material for food handlers working in the PNAE (BRASIL, 2014), but it seems that only a small number of these individuals have access to this content. Moreover, in order for these measures to be effective, managers need to be engaged at the different execution levels of the program in the states and municipalities, which represents a significant challenge.

The role of the nutritionist

The PNAE consists of nutritionists, advisors and food handlers, who are indispensable for promoting school meals (BRASIL, 2014). Of these, the presence of nutritionists in the PNAE is an important variable in commercializing FF, since it is a dynamic agent in the purchase process and interlocutor between managers, schools and family farmers (SOUZA& VILLAR, 2019).

A nutritionist is the technician in charge at the PNAE, whose activities include “planning, coordination, direction, supervision and assessment of all the feeding and nutrition measures in a school setting” (BRASIL, 2017). MACHADO et al. (2018) analyzed the purchase of FF products in different Brazilian states and concluded that the volume of food items obtained from FF for the PNAE is 2-4 fold higher in states where there is a nutrition technician (NT).

Thus, the absence or inadequacy of an NT at the PNAE hinders enforcement of article 14 of Law 11.947/2009. SILVA et al. (2018b) analyzed 214 municipalities in Goiás State and reported that the vast majority do not have enough PNAE nutritionists, which could influence the absence of effective nutritional and feeding measures for students. In addition to not meeting the program guidelines, this limitation causes work overload (FERREIRA et al., 2019) and hinders the creation of school menus that include FF products.

PNAE nutritionists are essential to maintaining healthy food and establishing FF as a primary food supplier to the program. Municipal departments of education need to hire nutritionists to operationalize the PNAE.

The role of rural extension institutions

PNAE commercialized foods require a specific commercialization scale and qualitative traits such as color, size and maturation in line with the guideline booklet provided by the FNDE. However, farmers do not always have the tools, equipment and production techniques needed to meet these guidelines. In this respect, the technical assistance of institutions specialized in production and agriculture is important, but remains scarce in several Brazilian municipalities (TRICHES et al., 2019).

According to COSTA et al. (2015), in Minas Gerais State, the lack of technical assistance in collective undertakings hampers the organization of production, commercialization in specific niche markets, improvement in product quality, and farmer and manager training. It may also compromise production and raise transaction costs (OLIVEIRA et al., 2013). Technical assistance is a dynamic element, since it favors farmers and promotes the innovation of their production process, including meeting the legal implications of becoming a school food supplier (MOSSMANN et al., 2017). Thus, it is important to increase the number of rural extension institutions in the different Brazilian states, in order to boost and strengthen FF.

Family farmer behavior and characteristics

The literature reports that the lack of farmer interest in dealing with the PNAE is also a limitation to enforcing Law 11.497. This may be related to the reluctance of farmers to expand their activities, delays in receiving sales payments and the difficulty in participating in collective actions (SILVA et al., 2018a).

GONÇALVES et al. (2015) investigated the PNAE in 82 municipalities in the states of São

Paulo and Rio de Janeiro and concluded that almost 40% of farmers were not interested in dealing with the PNAE because they could not meet the required quality standards. According to this study, the lack of government assistance means they cannot comply with mandatory sanitary requirements.

The lack of technical support causes insecurity in supplying FF foods. SARAIVA et al. (2013) showed that the impossibility of regularly supplying the PNAE drastically reduces farmers' interest, who prefer to sell their products to supermarkets and street markets. Added to this is the question of logistics, since the available procedure does not always favor the transport of certain FF foods (FERREIRA et al., 2019), making it difficult to maintain quality standards.

Student behavior

The World Health Organization (WHO) recommends a minimum 400 gram daily per-person intake of fruits, legumes and vegetables. However, consumption in Brazil is substantially lower than the recommended level. The daily average of 90 grams per person (DAMIANI et al., 2017) contributes to the occurrence of chronic diseases (cardiovascular, chronic respiratory, cancer and diabetes) and obesity.

Costa et al., 2012 analyzed school food in Santa Catarina State. The results showed that only 2.7% of students consumed an adequate amount of fruits and vegetables (> 5 times a day), while 26.6% consumed none at all. Social settings can influence human behavior. In schools, processed foods are widely available to students, leading to undesirable food standards (TEO et al., 2017). Promoting an environment where healthy food is predominant is considered beneficial and enhances psychosocial development is vital to fostering citizens who are both aware and critical.

CONCLUSION

Law 11.947 is undoubtedly important in strengthening Brazilian family farm (FF). It addresses the problem of commercialization, one of the key points of sustained competitiveness for small-scale agricultural production in Brazil. On the demand side, the initiative seeks to provide students with healthy meals, while respecting local food culture, and prioritizing short food supply chains that would also contribute to strengthening local and regional economies. However, executing the public policies of this legal directive faces problems. The results of the present study revealed that the factors that hinder

the PNAE in preparing and distributing at least 30% of meals containing FF foods are multifaceted and overlapping. The present study demonstrated that the barriers to greater and more effective FF participation in the PNAE comprise a set of factors that can be grouped into three analytical constructs (political-administrative, infrastructure and human capital).

It is clear that full compliance with Law 11.947, with respect to FF purchases by the PNAE, face obstacles related to the practices of purchasing institutions, storage and food preparation in schools and the production culture of the family farmers themselves. Thus, the solution to the problem will not likely be found in a single public policy. Although vital, simply increasing investment in family farming or schools will not remove all the obstacles against wider use of FF in school meals. These investments should be accompanied by actions to reduce and standardize state bureaucracy in acquiring foodstuffs and improve the management and production of family farmers and their collective organizations, in addition to changes in food handler and student habits.

The proposed conceptual model makes it possible to identify and analyze the barriers to FF food acquisition. Each of the three constructs, and the factors that created them, may play a larger or smaller role, depending on the characteristics of the municipalities and/or schools studied and the type of product in question. As such, this is a flexible model, which is a positive point. It presents a roadmap that PNAE management can use to formulate measures that promote the use of FF products in school meals at the desired scale.

It is suggested that future studies conduct an empirical validation of the theoretical proposals presented here. Quantitative research carried out in the Brazilian regions with PNAE managers and farmers will make it possible to validate and complement the theoretical constructs presented in this study.

DECLARATION OF CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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AUTHORS' CONTRIBUTIONS

The authors contributed equally to the development and writing of the manuscript.

REFERENCES

- AMORIM, A.L.B. et al. Acquisition of family farm foods for school meals: analysis of public procurement within rural family farming published by the cities of São Paulo state. **Revista de nutrição**, v.29, n.2, p.297-306, 2016. Available from: <<https://doi.org/10.1590/1678-98652016000200012>>. Accessed: Jun, 15, 2022. doi: 10.1590/1678-98652016000200012.
- BARONE, B. et al. Oferta de frutas e hortaliças da agricultura familiar na alimentação escolar. **Revista visão em debate: sociedade, ciência e tecnologia**, v.4, n.3, p.86-95, 2016. Available from: <<https://doi.org/10.22239/2317-269x.00758>>. Accessed: Jul. 01, 2022. doi: 10.22239/2317-269x.00758.
- BRASIL. Lei n. 11.947 de 16 de junho de 2009. **Dispõe sobre o atendimento da alimentação escolar**. Available from: <http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/11947.htm>. Accessed: Sept. 30, 2022.
- BRASIL. Ministério da Educação. **Material orientativo para formação de manipuladores de alimentos que atuam na alimentação escolar**. Elaboração: CCAN/Universidade Federal do Rio Grande do Sul. Brasília, DF: MEC/FNDE, 2014.
- BRASIL. Ministério da Educação. **Alimentação e Nutrição**. 2017. Available from: <<https://www.fnde.gov.br/index.php/programas/pnae/pnae-eixos-de-atuacao/pnae-alimentacao-e-nutricao>>. Accessed: Oct. 24, 2022.
- BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. **Declaração de Aptidão ao Pronaf (DAP)**. 2022. Available from: <<https://www.gov.br/agricultura/pt-br/assuntos/agricultura-familiar/dap>>. Accessed: Oct. 10, 2022.
- BEVILAQUA, K.; TRICHES, R. M. Implicações da venda de gêneros alimentícios ao Programa de Alimentação Escolar nos aspectos de renda e organização dos agricultores familiares. **Segurança Alimentar e Nutricional**, v.21, n.2, p.448-460, 2014. Available from <<https://periodicos.sbu.unicamp.br/ojs/index.php/san/article/view/8634474>>. Accessed: Sept, 02, 2022. doi: 10.20396/san.v21i2.8634474.
- BORGES, L. V. et al. The national school feeding program (PNAE) in a São Paulo state municipality: the integration of management, production and handling in the hygienic-sanitary dimension. **Brazilian Journal of Development**, v.8, n.7, p.54022-54039, 2022. Available from: <<https://ojs.brazilianjournals.com.br/ojs/index.php/BRJD/article/view/50649/38046>>. Accessed: Sept. 23, 2022. doi: 10.34117/bjdv8n7-327.
- CASTELLANI, A. L. A. et al. Purchase of family farm and organic foods by the Brazilian School Food Program in Santa Catarina state, Brazil. **Revista de Nutrição**, v.30, n.5, p.651-662, 2017. Available from: <<https://doi.org/10.1590/1678-98652017000500010>>. Accessed: Jan. 15, 2023. doi: 10.1590/1678-98652017000500010.
- COSTA, L. C. F. Factors associated with adequate fruit and vegetable intake by schoolchildren in Santa Catarina, Brazil. **Cadernos de Saúde Pública**, v.28, n.6, p.1133-1142, 2012. Available from: <<https://doi.org/10.1590/S0102-311X2012000600012>>. Accessed: Jan, 1, 2023. doi: 10.1590/S0102-311X2012000600012.
- COSTA, B. A. L. et al. As Cooperativas de Agricultura Familiar e o Mercado de Compras Governamentais em Minas Gerais. **Revista de Economia e Sociologia Rural**, v.53, n.1, p.109-126, 2015. Available from: <<https://doi.org/10.1590/1234-56781806-9479005301006>>. Accessed: Feb. 19, 2023. doi: 10.1590/1234-56781806-9479005301006.
- DAMIANI, T. F. et al. Consumption of fruit, greens and vegetables in the Midwest region of Brazil: prevalence and associated factors. **Ciência e Saúde Coletiva**, v.22, n.2, p.369-382, 2017. Available from: <<https://doi.org/10.1590/1413-81232017222.12202015>>. Accessed: Jan. 19, 2023. doi: 10.1590/1413-81232017222.12202015.
- DENYER, D.; TRANFIELD, D. Producing a systematic review. In: BUCHANAN, D. A.; BRYMAN, A.: **The SAGE Handbook of Organizational Research Method**, London: Sage, 2009, p. 671-689.
- DIAS, P. C. et al. Compra da agricultura familiar para alimentação escolar nas capitais brasileiras. **Revista de Saúde Pública**, v. 54, 2020. Available from: <<https://doi.org/10.11606/s1518-8787.2020054001963>>. Accessed: Mar. 07, 2023. doi: 10.11606/s1518-8787.2020054001963.
- DINIZ, R. F. et al. Emergência dos mercados institucionais no espaço rural brasileiro: agricultura familiar e segurança alimentar e nutricional. **GEO-UERJ**, v.29, p.234-252, 2016. Available from: <<https://doi.org/10.12957/geouerj.2016.19161>>. Accessed: Mar. 10, 2023. doi: 10.12957/geouerj.2016.19161.
- FERREIRA, D. M. et al. Perception of the operating agents about the Brazilian National School Feeding Program. **Revista de Saúde Pública**, São Paulo, v.53, p.34, 2019. Available from: <<https://doi.org/10.11606/S1518-8787.2019053000597>>. Accessed: Mar. 04, 2023 doi: 10.11606/s1518-8787.2019053000597.
- FNDE. Fundo Nacional de Alimentação Escolar. **Valores investidos na aquisição de gêneros alimentícios diretamente da agricultura familiar para o PNAE em 2019**. Available from: <<https://www.fnde.gov.br/index.php/programas/pnae/pnae-eixos-de-atuacao/pnae-agricultura-familiar>>. Accessed: Oct. 01, 2022.
- GONÇALVES, H. V. B. et al. Family farming products on menus in school feeding: a partnership for promoting healthy eating. **Ciência Rural**, v. 45, n.12, p. 2267-2273, 2015. Available from: <<https://doi.org/10.1590/0103-8478cr20150214>>. Accessed: Oct. 15, 2022. doi: 10.1590/0103-8478cr20150214.
- GREGOLIN, M. R. P. et al. Potencialidades e fragilidades do Programa Nacional de Alimentação Escolar - PNAE no território Cantuquiriguaçu (PR). **Revista Conexão UEPG**, v.13, n.3, p.548-567, 2017. Available from: <<https://www.redalyc.org/journal/5141/514154372016/html/>>. Accessed: Oct. 27, 2022. doi: 10.5212/rev.conexao.v.13.i.0015.
- HIRATA, A. R. et al. **Manual de Gestão do PNAE para os Institutos Federais**. Pouso Alegre: IFSULDEMINAS, 2017. 92 p. Available from: <https://portal.ifsuldeminas.edu.br/images/PDFs/proex/pnae/Manual_de_Gestao_do_PNAE_para_os_IFs_-_Rog%C3%A9rio_Socorro_e_Luizinho.pdf>. Accessed: Oct. 20, 2022.

- MACHADO, P. M. O. et al. Purchase of products directly from family farms for the National School Feeding Program (PNAE): cross-sectional study with the universe of Brazilian municipalities. *Ciência & Saúde Coletiva*, v.23, n.12, p.4153-4164, 2018. Available from: <<https://doi.org/10.1590/1413-812320182311.28012016>>. Accessed: Oct. 29, 2022. doi: 10.1590/1413-812320182311.28012016.
- MAIELLARO, J. R. et al. School feeding program in Brazil: a case study of vegetables distribution using social network analysis in Mogi das Cruzes city. *Journal of International Food & Agribusiness Marketing*, v.34, n.1, p.96-120, 2022. Available from: <<https://doi.org/10.1080/08974438.2020.1857893>>. Accessed: May, 15, 2023. doi: 10.1080/08974438.2020.1857893.
- MARQUES, A. A. et al. Reflections by family farmers on the dynamics of providing their products for school food: the case of Araripe, Ceará, Brazil. *Saúde & Sociedade*, v.23, n.4, p.1329-1341, 2014. Available from: <<https://doi.org/10.1590/S0104-12902014000400017>>. Accessed: Jan. 23, 2023. doi: 10.1590/S0104-12902014000400017.
- MOSSMANN, M. P. et al. Interface Between Family Farming and School Feeding: barriers and coping mechanisms from the perspective of different social actors in Southern Brazil. *Revista de Economia e Sociologia Rural*, v. 55, n.2, p. 325-342, 2017. Available from: <<https://doi.org/10.1590/1234-56781806-94790550207>>. Accessed: Jan. 02, 2023. doi: 10.1590/1234-56781806-94790550207.
- OLIVEIRA, T. R. P. R. et al. Agricultura familiar na alimentação escolar: estudo de caso em dois municípios de Minas Gerais. *Nutrire: Revista da Sociedade Brasileira de Alimentação e Nutrição*, v.38, n.3, p.256-268, 2013. Available from: <<http://dx.doi.org/10.4322/nutrire.2013.024>>. Accessed: Feb. 02, 2023. doi: 10.4322/nutrire.2013.024.
- OLIVEIRA, L. G. et al. Comparative assessment of food purchase program and National school feeding program's impact in Ubá, Minas Gerais, Brazil. *Ciência Rural*, v.47, n.1, e20160395, 2017. Available from: <<https://doi.org/10.1590/0103-8478cr20160395>>. Accessed: Nov. 02, 2022. doi: 10.1590/0103-8478cr20160395.
- OLIVEIRA, L. G. et al. Conditioning factors to market fruits and vegetables from family farms to supermarket supply chains. *Ciência Rural*, v. 51, n.4, e20200136, 2021. Available from: <<https://doi.org/10.1590/0103-8478cr20200136>>. Accessed: Dec. 20, 2022. doi: 10.1590/0103-8478cr20200136.
- REAL, L. C. V.; SCHNEIDER, S. O uso de programas públicos de alimentação na reaproximação do pequeno produtor com o consumidor; o caso do programa de alimentação escolar. *Estudo & Debate*, v.18, n.2, p.57-79, 2011.
- ROCHA, N. P. et al. Analysis of the national school feeding program in the municipality of Viçosa, state of Minas Gerais. *Revista de Saúde Pública*, v.52, n.16, p.1-10, 2018. Available from: <<https://doi.org/10.11606/S1518-8787.2018052007090>>. Accessed: Feb. 10, 2023. doi: 10.11606/S1518-8787.2018052007090.
- SARAIVA, E. B. et al. Panorama of purchasing food products from family farmers for the Brazilian School Nutrition Program. *Ciência & Saúde Coletiva*, v.18, n.4, p.927-936, 2013. Available from: <<https://doi.org/10.1590/S1413-81232013000400004>>. Accessed: Feb. 21, 2023. doi: 10.1590/S1413-81232013000400004.
- SILVA, T. M. et al. Territorial development and the national school feeding program in rural territories, coasts and fields above the Serra in Rio Grande do Sul. *Revista Brasileira de Gestão e Desenvolvimento Regional*, v.14, n.1, p. 61-85, 2018a. Available from: <<https://doi.org/10.54399/rbgdr.v14i1.3467>>. Accessed: Dec. 12, 2022. doi: 10.54399/rbgdr.v14i1.3467.
- SILVA, S. U. et al. Food and nutrition education actions and the nutritionist within the scope of the National School Food Program. *Ciência & Saúde Coletiva*, v.23, n.8, p.2671-2681, 2018b. Available from: <<https://doi.org/10.1590/1413-81232018238.19642016>>. Accessed: Jul. 23, 2022. doi: 10.1590/1413-81232018238.19642016.
- SILVERIO, G. A.; SOUSA, A. A. Organic foods from family farms in the national school food program: Perspectives of social actors from Santa Catarina, Brazil. *Revista de Nutrição*, v. 27, n.3, p. 289-300, 2014. Available from: <<https://doi.org/10.1590/1415-52732014000300003>>. Accessed: Apr. 15, 2022. doi: 10.1590/1415-52732014000300003.
- SODRÉ, M. T.; SALAMONI, G. The coexistence of the cartesian and the systemic thinking: the territorial limitations faced by the PAA and the PNAE in Pelotas/RS. *Sociedade & Natureza*, v.28, n.3, p.457-471, 2016. Available from: <<https://doi.org/10.1590/1982-451320160310>>. Accessed: Apr. 09, 2022. doi: 10.1590/1982-451320160310.
- SOUZA, V. M. G.; VILLAR, B. S. Acquisition of family farm foods in municipalities of São Paulo state: The influence of the management of the School Feeding Program and municipal characteristics. *Revista de Nutrição*, v.32, e180083, 2019. Available from: <<https://doi.org/10.1590/1678-9865201932e180083>>. Accessed: Jul. 17, 2022. doi: 10.1590/1678-9865201932e180083.
- TEO, C. R. P. A. et al. Articulação entre agricultura familiar e alimentação escolar em municípios de pequeno porte. *Campo-território: Revista de Geografia Agrária*, v.11, n.24, p.175-199, 2016. Available from: <<https://doi.org/10.14393/RCT112408>>. Accessed: Jun, 17, 2022. doi: 10.14393/RCT112408
- TEO, C. R. P. A. The partnership between the Brazilian School Feeding Program and family farming: a way for reducing ultra-processed foods in school meals. *Public Health Nutrition*, v.21, n.1, p.230-237, 2017. Available from: <<https://doi.org/10.1017/S1368980017002117>>. Accessed: Sept. 01, 2022. doi: 10.1017/S1368980017002117.
- TRICHES, R. M. et al. Condicionantes e limitantes na aquisição de produtos da agricultura familiar pelo Programa de Alimentação Escolar no estado do Paraná. *Revista de Desenvolvimento Regional (Redes)*, v.24, n.1, p.118-137, 2019. Available from: <<https://doi.org/10.17058/redes.v24i1.11713>>. Accessed: Sept. 18, 2022. doi: 10.17058/redes.v24i1.11713.
- VILELA, K. F. et al. Implementation of the national school nourishment program in the Brazilian Federal institution of Education of Bahia State. *Ciência Rural*, v.49, n.9, e201901052019, 2019. Available from: <<https://doi.org/10.1590/0103-8478cr20190105>>. Accessed: Sept. 13, 2022. doi: 10.1590/0103-8478cr20190105.