Facing food security and climate change adaptation in semi-arid regions: lessons from the Brazilian Food Acquisition Program

Segurança alimentar e a adaptação às mudanças climáticas em regiões semiáridas: lições do Programa Brasileiro de Aquisição de Alimentos

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doi:10.18472/SustDeb.v10n1.2019.23309

Received: 02/28/2019
Accepted: 04/08/2019

ARTICLE – VARIA

ABSTRACT

Family farmers of semi-arid regions are especially vulnerable to climate change, due to the reliance on rain-fed production systems and the limited capacity to cope with and adapt to impacts. The Brazilian Food Acquisition Program (PAA), as an example of a food procurement program that also functions as a food-based safety net for vulnerable populations, is analyzed in a context of extreme drought in the Cariri region (Ceará state, Brazil). Limitations that prevent the full range of potential PAA benefits are examined as perceived by institutional actors involved with the program, while measures to foster the full potential positive impacts on beneficiaries are discussed. Findings indicate that more consideration of the importance of governance and institutional factors on the functioning of food acquisition programs, as well as the importance of the role of climate change on this equation, are essential for program sustainability, especially in a scenario of climate change.

Keywords: Food Acquisition; Climate Change Adaptation; Social Protection; Policy Integration; Semi-arid; Brazil

RESUMO

Os agricultores familiares de regiões semiáridas são particularmente vulneráveis às alterações climáticas, dada sua dependência de sistemas de produção de sequeiro e à capacidade limitada de lidar e se adaptar aos impactos. O Programa Brasileiro de Aquisição de Alimentos (PAA), que também funciona como um sistema de segurança alimentar para populações vulneráveis, é analisado em um contexto de seca extrema na região do Cariri (Ceará, Brasil). O artigo examina as limitações que impedem a implementaçãodos benefícios potenciais do PAA, à partir da percepção dos atores institucionais envolvidos, ediscute potenciais ações para promover impactos positivos. Os resultados indicam que aspectos como governança e fatores institucionais, além daconsideração do papel das mudanças climáticas, são essenciais para o funcionamento e a sustentabilidade do programa.

Palavras-Chave: Aquisição de alimentos; adaptação às mudanças climáticas; proteção social; integração de políticas públicas; semiárido; Brasil

1 INTRODUCTION

Climate models indicate that semi-arid regions around the world are likely to experience increased rainfall variability and longer droughts in the coming years (PBMC 2013). In the Brazilian semi-arid region, farmers' vulnerability to climate stems in part from reliance on scarce and seasonally variable water resources (BURNEY et al., 2014; LINDOSO et al., 2014; 2018). While these farmers may have some degree of coping capacity, their adaptive capacity - ability to adjust to and thrive in changing conditions - is what drives resilience in the long term (BURNEY et al., 2014). Community strategies and policy responses for managing risks to protect livelihoods and reduce vulnerability are amongst the variables that influence their capacity to recover from drought-related social, economic and environmental impacts (SHIFERAW et al., 2014). Additionally, disasters related to "capability failures", associated with market access, and socioeconomic and political entitlements can occur in the presence of drought and declines in food availability (SEN, 1981).

In the vast range of impacts caused by environmental and climatic modifications, the influence of climate on farmers is known to be responsible for ex-ante and ex-post adaptation strategies. Ex-ante impacts, related to opportunity costs associated with conservative strategies that risk-averse decision makers employ to protect themselves against the possibility of climate shocks, and ex-post, referring to the losses following climatic shocks (SHIFERAW et al., 2014), can be influenced by policy responses. For example, social protection programs and the vast array of safety-net strategies, related to cash, food, asset transfers and insurance, have been demonstrated to produce socioeconomic transformations in the livelihoods of vulnerable population in developing countries (DEVEREUX, 2007; MESQUITA; BURSZTYN, 2016) and thus can be related to those adaptation strategies.

In Brazil, the last fifteen years have given rise to a new set of social protection strategies, which have been directly improving many of the socio-economic indicators related to social vulnerability (CABRAL et al., 2014; CIRENO; SILVA; PROENÇA, 2014) and indirectly providing increased capacity to cope with climate change. Most of them were related to the Zero Hunger Strategy, which included a series of short and long-term programs with the common goal of eradicating hunger in Brazil (SILVA et al., 2011). As one of the main strategy components for rural areas, the Food Acquisition Program (PAA) (Law 10.696/2003) was a public procurement initiative based on the purchase of food products from family farmers, with the aim of increasing food and nutritional security, improving stock formation for price regulation and use in food programs, providing storage to family farmers, and strengthening family farmers' position in society.

Although the program was not designed as a climate adaptation policy, the contributions to these objectives can be observed at many levels, as discussed in the first section of this article. Due to the potential to promote multiple goals related to food security, agricultural production, and climate adaptation, this initiative could be consolidated as a broader political strategy combining all those objectives. Nonetheless, more information about the bottlenecks of the program is still necessary. Thus, herein we explore the implementation process of the program, according to a set of institutional interviews in four municipalities of the Brazilian semi-arid region during a climatic shock in 2012, when the region was hit by an extended drought. Despite its cross-sectorial approach, the program implementation process faced several institutional issues, which were mainly related to the still limited capacity in promoting policy integration. Conclusively, we present recommendations for improvements in its operation.

2 OVERVIEW: CONTRIBUTIONS OF INSTITUTIONAL MARKETS AND FOOD BASED SAFETY-NETS TO CLIMATE ADAPTATION

Climate-related risks are particularly important to rain-fed farming systems in tropical and sub-tropical drylands, where farmers tend to favor precautionary strategies over investments in improved agricultural technology and market opportunities (VERMEULEN et al., 2012). Rain-fed farmers sometimes modify ex-ante their production practices to provide 'self- insurance' so likely impacts of adverse climate consequences are reduced to an acceptable level (HANSEN et al., 2004). They often

employ conservative production strategies, which may be costly in terms of declined opportunities for income gains (SHIFERAW et al., 2014). In this context, access to risk-reducing technologies, diversification of livelihoods, better access to agricultural markets and market information are considered important strategies for reducing vulnerability and effectively managing climate variability and extremes (HELLMUTH et al., 2007).

In this context, PAA contribution in securing family farmers' access to stable markets may reduce part of the risk associated with agricultural production in a variable climate. The program represents an example of "institutional demand", which consists of interventions that target procurement from smallholder farmers with distribution to other sectors (e.g. schools, hospital, prisons). It is also worth observing that market failures and climate-induced variations of aggregate production may lead to large price fluctuations with variable effects on net-sellers, and net-buyers, which are mostly resource-limited consumers. Therefore, efficient markets may also play a major role against climate risk by stabilizing prices and stabilizingconsumption during drought years (SHIFERAW et al., 2014). Indeed, there is already some evidence that PAA plays a crucial role in reducing vulnerability and strengthening rural livelihoods, particularly in terms of income generation, price stabilization and food security (NEHRING; MIRANDA; HOWE, 2016). This could have a direct impact on regional food security, which is also influenced by food price fluctuations.

In addition to the impacts on farmers' productive potential and resilience in a context of climate changes, PAA has the potential to work as a safety-net strategy and possibly increase the resilience of beneficiaries facing seasonal climate variability. Safety-net strategies can protect vulnerable populations from persistent impacts, such as adverse weather conditions, providing livelihood support and contributing to immediate food security (SHIFERAW et al., 2014). For example, in several semiarid regions of Africa, safety nets have provided an "insurance" when the primary source of income is impacted by drought events (GAUTAM, 2006).

In the case of PAA, that could be possibly observed in two ways. Farmers, which are the primary beneficiaries, employ different ex-post drought coping strategies depending on the severity of climate shocks. These strategies range from reduction in food sales and household consumption, increased borrowing, higher rates of seasonal out-migration to child withdrawal from school (SHIFERAW et al., 2014). Hence, during those events, the program role as a food-based safety net can also impact the family through school feeding of children and teenagers (secondary beneficiaries), decreasing household food expenditures. The provision of food by programs that contribute to school meals and other institutions, such as hospitals, prisons and social centers, has been praised as a main contributor in the fight against malnutrition and hunger for the most vulnerable strata of population (ROGERS; COATES, 2002).

Thus, social protection instruments may contribute to climate adaptation in several ways: i) protection of the most vulnerable to climate risks; ii) prevention of damaging coping strategies as a result of impacts to weather-dependent livelihoods; iii) promotion of resilience through livelihood diversification and security in order to withstand climate related shocks; and iv) reduction of underlying social and political vulnerability (DAVIES; LEAVY, 2007; JOHNSON; KRISHNAMURTHY, 2010).

Thus, as many of those programs can have influence on the adaptive capacity of rural populations, further integration between social protection and climate change adaptation has already started to be discussed (MESQUITA; BURSZTYN, 2016). Nevertheless, as it will be discussed ahead, these initiatives for managing risks related to weather shocks and enhancing resilience of farmers need to be integrated with others, contributing to reducing farmers' reliance on climate-sensitive activities (DAVIES et al., 2009), and thus requiring integration of institutional and policy options (SHIFERAW et al., 2014).

3 STUDY AREA AND RESEARCH METHODS

The semi-arid region of Brazil is home to approximately 23.5 million people (in 980.133 km2) with 38% living in rural areas (INSA, 2012). This region is characterized by a rainy period that normally extends

from October/November to May (varying from 300 to 800 mm/yr) and a dry season during the rest of the year. Major climatic variability in the amount and distribution of precipitation has been documented, with many past years resulting in extreme drought, crop failure, and subsequent social impacts (TAVARES; ANDRADE; PEREIRA, 1998). In 2012, another drought period hit the region, being considered one of the most significant droughts in Northeast Brazil in the last 50 years according to the World Meteorological Organization (WMO, 2014). In many municipalities the drought persisted for more than 5-6 years.

In the Northeast region, the state of Ceará is characterized by many semi-arid areas affected by drought and climatic variability, low development rates and a large percentage of households located in the countryside. This region as a whole has long featured a top-down policy-led approach, where the Federal and State governments collaborate to address specific needs and emergency actions (BURNEY et al., 2014).

Over the years, many events of extended drought resulted in periods of social unrest and the need for emergency interventions especially related to the provision of food and water. A diverse set of strategies, including cash for work programs (work fronts) for the construction of dams and roads, and food aid (food baskets containing basic staple items) were widely employed in the past (NELSON; FINAN, 2009). However, local power concentration in the hands of a few (patrons) and faulty governance systems have historically restricted the efficiency of emergency measures, giving rise to manipulation and consequent limitation of benefits to a restricted set of people (BURSZTYN, 2008).

For this study, the semi-arid area in the region of Cariri (southern portion of Ceará) was selected as a representative case of a dry region in Brazil facing productive and food security challenges due to recurrent climatic impacts.

The Cariri comprises 28 municipalities in an area of 16.350 Km2 (Figure 1) but, for this study, four municipalities in semi-arid areas were chosen: Salitre, MissãoVelha, Altaneira and Mauriti. This choice was based on a regional report concerning the spatiotemporal distribution and variability of precipitation during the period of 1910 to 2010 (FETTER; OLIVEIRA; SAITO, 2012). Briefly, the authors identified climatic areas with low, intermediate and high precipitation variability over the years and our selection includes municipalities that cover the full spectra. The final selection of municipalities covered an area with approximately 9,000 rural households (IBGE, 2006b).

In November 2012, key institutional actors were interviewed in each of the selected locations to gather regional information related to family agriculture, local impacts of drought and information on the functioning of the PAA. The selection of actors consisted of randomly approaching main municipal offices responsible for actions related to family farming, food security and drought management. The interviews consisted of open-ended questions, which were tested in three other field campaigns in the Northeast region (LINDOSO, 2013). Questions on the status of family agriculture in the region, main challenges, programs in place, effects of participation on PAA, emergency initiatives, drought management and climatic impacts were explored. Due to variation in local institutional arrangements and schedule issues, the interviews covered different institutions over the study area.

The final data were analyzed with the use of thematic analysis of open-ended questions and sorted to identify the main challenges (bottlenecks) related to the implementation of PAA in the region. Review of the literature was employed to explore the relationships between social protection, food acquisition programs and climate change adaptation.

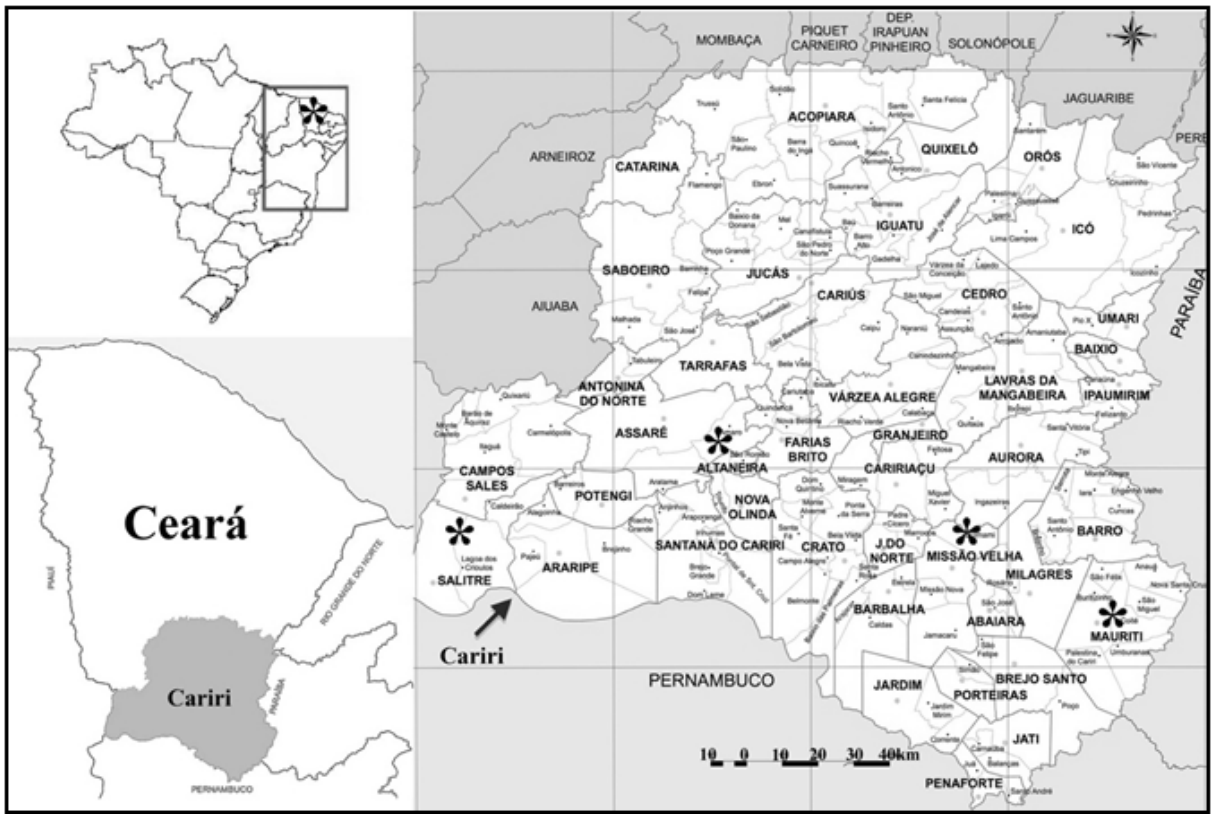

Figure 1: Study area. * represents the studied municipalities.
Source: adapted from IPECE-IBGE (2010).

4 RESULTS AND DISCUSSION

Bottlenecks and Local Adaptations in the Implementation of PAA

As explained in the overview section, the establishment of PAA was based on a cross-sectorial approach, combining policy instruments for improvements in food and nutritional security of different beneficiaries (including school feeding) and agricultural production. At the same time, the program has the potential to contribute to climate adaptation objectives, particularly in the Brazilian semiarid region, as discussed above. However, program implementation processes can be undermined due to local challenges and insufficient policy integration, representing an important challenge for program sustainability. Understood as a process of governing, policy integration addresses the challenge of managing often siloed and fragmented public administration (ADELLE; RUSSEL, 2013).

Integrating technological, institutional and policy responses is essential for strategies aiming to manage climate variability and enhance farmers' resilience to environmental changes. These may have positive effects on reducing sources of risk (production and market) and vulnerability; on influencing the access to resources, assets and capabilities of response; and thereby on increasing livelihood resilience (ADGER, 2006; BIGGS et al., 2014; SHIFERAW et al., 2014). Integrated strategies allow minimized trade-offs related to the use of natural resources and policy options, and to potential synergies between sectorial responses (GIATTI et al., 2016; PERSSON, 2004). Herein, the institutional dimension of PAA was observed to analyze aspects of policy integration during program implementation.

The integration process between PAA and other initiatives, particularly relying on the "institutional purchase modality" has been considered one of the most successful in Brazil (AVILA et al., 2013). This includes integration with other established programs, such as PNAE (National School Feeding Program), which has been successful in reaching not only federal, but also local levels. However, integration between PAA and PNAE has not been achieved through a deliberate rational planning process, but

through “unexpected effects” of public action and actors’ interactions along the programs’ trajectories (AVILA et al., 2013).

For instance, in MissãoVelha, these programs were highly interrelated at the local level. According to interviews in the municipal body for food security, 50% of producers selling to PNAE were suppliers of PAA. Also, 90% of food products procured for communitarian kitchens were provided by PAA producers. Nonetheless, this was not the reality found in all visited locations. In other municipalities, lack of integration due to bureaucracy, low institutional articulation, insufficient adaptation to local contexts, and conflicts related to local politics, created a set of bottlenecks in PAA implementation, which will be discussed hereafter (Table 1). In the case of MissãoVelha, some positive results stem from the activism of the local food security council, which worked in the institutional and sectorial integration at the local level. Hence, the establishment of new connections between these and other policy instruments are still necessary to overcome some of the challenges and to consolidate responses to enhance resilience of farmers in semi-arid regions.

Table 1: Perceived limitations of program and suggestion for improvements

Limitations of program	
Farmer	**Institutions**
Delay in payments;	Limited technical assistance for the local project management team;
Limited technical assistance;	Expiration of products (only delivered in a limited number of days);
Restriction in purchased products;	Challenges related to matching supply and demand of products;
Requirement for quality and diversification of products;	Lack of commitment of some institutions in picking up donations;
Lack of financial resources due to bureaucracy;	Concentration of beneficiaries in urban areas due to lack of transportation;
Lack of incentives for participation;	Manual preparation of receipts;
Difficulties on certifying organic production;	-
Suggestions for program improvement	
• Advance of 50% of budget for working capital; • Better technical assistance and farmer fairs to disseminate information among local producers; • Need of program becoming a permanent government service; • Need of municipal price scale (currently based on prices around the state);	

Source: field research.

The identified bottlenecks for the program were diverse and based on the views of institutional actors. These, commonly referred to operational challenges, were possibly related to adaptations employed by local institutions during program implementation. PAA requirements regarding the diversity, quality and safety of products were some of the sources of discontentment for some participants. Increasingly rigorous safety standards for dairy and pork-derived products and the required quality requested for delivery to beneficiaries were some of the mentioned barriers.

Additionally, it was noted that some farmers, even after receiving all guidance and training, were not adapting successfully to the production standards required for program participation. The assistance related to the quality assurance of food items was also deemed limited, and in one of the locations, instead of a nutritionist, a chemist was responsible for verifying the products.

An additional issue related to the expiration of products, delivered on a limited number of days throughout the month, and to the lack of commitment of some institutions in picking up food donations

on time. Some limitations in infrastructure and logistics, such as the lack of a freezer and vehicles for example, undermined the capacity of program implementation. Various local offices responsible for PAA do not have access to vehicles to transport the production to beneficiaries and thus most of the recipients are in the center of municipalities.

Program requirements for a diverse set of products were seen as a difficulty for part of the farmers, even though some institutional actors believed the establishment of PAA (and also PNAE) led to increases in the diversity of crops produced by farmers. Food items supplied in the first months of the program were very limited, and the demand for increasingly diversified menus in schools and communitarian kitchens were considered to influence the diversification of produced and procured crops. This was observed, for instance, in Mauriti, Altaneira and MissãoVelha where the products first marketed were normally limited to banana and manioc and other local crops. Interviews in MissãoVelha informed that many farmers showed resistance to respond to the requirements in the beginning, but that the program also worked as a source of learning to gradually improve post-harvest techniques, and practices in animal production.

The procedure of using regional costs of products to define the prices of the program was also narrated as a problem, as it was not always adjusted to local price variability in a timely manner and it caused financial losses to participants. In the early stages of PAA, prices of products were based on national estimates, but by 2012 (when the interviews were conducted) those were already being based on state level estimations. Nonetheless, interviewed actors suggested that prices should be calculated at the municipal level, since there was significant divergence between municipalities.

It is important to note that producers registered in the program had the flexibility of choosing their buyers (PAA/PNAE or private buyers). In 2012, drought led to crop reduction of manioc with subsequent price increases, so producers in Salitre stopped selling manioc flour to PAA (R$ 1.00/kg) to sell to local markets (R$ 1.50/kg). Indeed, during the drought period, selling in local fairs or to intermediary buyers became a general trend in the region due to price instability related to droughts, according to the regional officers of the National Supply Company (Conab). While the program assures a stable market and allows a better planning of the production and the acquisition of credit, on the other hand, climate events and price fluctuation may have negative effects on farmers' income.

PAA and technical assistance together were also deemed important to promote pro-environmental practices and discourage other widely-used damaging ones, which contribute to decreasing farmer vulnerability. Technical assistance aiming for soil conservation and rotational agriculture were influencing practices to avoid soil impoverishment in some areas, while in others, such as in Altaneira, were discouraging the use of pesticides blamed for the pollution of nearby dams. In localities where desertification processes are advanced, such as Mauriti, farmers were adapting and using residues as organic fertilizers, as a result of assistance.

Indeed, the role of local institutions, including the ones providing extension services, is widely recognized in the capacity of farmers to adapt to climate change (AGRAWAL; MCSWEENEY; PERRIN, 2008). Technical assistance providing access to adequate technology and capacity building, in addition to water supply, was demonstrated to be crucial to improve the adaptive capacity of farmers in the Brazilian semi-arid region (CESANO; OBERMAIER, 2011). Thus, technical assistance, and program requirements aiming to offer bonuses for environmentally friendly produce could drive some important changes at the local level. Nonetheless, some other barriers were observed during the interviews. Even though the program offered a 30% bonus for organic production, only a limited number of farmers were managing to get certified, discouraging others from investing in this productive model.

In this context, despite thePAA goal of supporting agricultural production, program alignment with local agricultural policies appeared to be weak. Again, limited local technical assistance was mentioned as an important bottleneck to assure a stable supply of food products. Interviews with institutional actors responsible for PAA in Mauriti revealed that the low productive capacity of farmers participating in the programs highly impacts their results. The state body for rural extension (Ematerce) was mentioned as the main institution contributing to improved production, providing extension services and seeds adapted to local climatic conditions.

However, Ematerce institutional capacity was considered weak at the local level due to a high turnover of technicians (which were temporary staff), limited human resources, and lack of vehicles for regular visitation to the communities. Furthermore, the low interaction between the extension services and other policies implemented by the local agricultural body, such as the agricultural insurance (Seguro-Safra), was mentioned as one of the main barriers for Ematerce providing high-level technical assistance.

In addition to the impacts on extension services, operational difficulties to access credit were also regarded as barriers for encouraging productive increments in the region. The Bank of Northeast and the Bank of Brazil were mentioned as important mediators in the credit policies, particularly the family farming credit federal program (Pronaf). However, bureaucracy and the low familiarity of farmers with the elaboration process of financial projects reduced their borrowing capacity.

These are common challenges in all rural areas of Brazil, but PAA was mentioned as an initiative that was increasing access of farmers to credit in some areas due to the guaranteed purchase of production. According to the interviews, advanced payments, as a measure to improve farmer productive capacity, could also promote access to credit.

Complaints related to delays in payment for the food products delivered to PAA were frequent, which contributed to hindering the capacity and interest of several farmers to remain as PAA suppliers. Some of them preferred to sell to intermediary buyers ("atravessadores"), who usually make prompt payments in cash. Better technical assistance, and advanced payment of 50% of credit to be used as working capital were thus deemed necessary to improve the investment, quality of production, and farmers' participation in the program.

Furthermore, as expected, productive challenges were increased by the persistent drought. Decline in production and crop losses due to climate conditions were mentioned in almost all municipalities. In Salitre, for instance, cassava crops were deeply affected by the dry season in 2012, which also led to interruption of most cassava flour mill. But the challenge was greater for livestock and milk production according to interviews. In MissãoVelha, the purchase of milk under PAA (PAA-Leite) was interrupted in part because of production shortages related to high water deficits.

These appear to be not only related to the lack of financial and institutional resources reaching local administrative levels, but also to policy fragmentation. Despite programmatic integration between the objectives of promotion of food and nutritional security and of support to family farming at the federal level, the execution and integration at the local level also depend on adequate deployment of resources for complementary actions, as well on the challenges imposed by local environmental characteristics and climate variability.

5 PROGRAM RECOMMENDATIONS - COORDINATION WITH OTHER POLICIES AND PAA AS A PERMANENT PUBLIC SERVICE

PAA integration with other development policies, particularly the conditional cash transfer (CCT) program Bolsa Família (Family Allowance), has been praised as an important poverty reduction strategy. On this subject, Lemos et al (2016) provided some important insights which are related to integration between development and climate adaptation policies. According to the authors, building adaptive capacity requires a combination of interventions that address not only climate-related risks (specific capacity), but also the structural deficits (e.g., lack of income, education, health, political power) (generic capacity) that shape vulnerability. Based on an analysis of rain-fed agriculture in Ceará state, they showed how the level of generic capacities (particularly as a result of CCT) influenced a higher adoption of specific ones (such as irrigation practices).

Although Bolsa Família was shown to increase farmers' income, it was not sufficient to manage the risks of food insecurity during drought events. Hence, the combination of different types of support such as CCT, extension services, access to market and food safety-nets is the best approach to increase farmers' resilience. Isolated actions may produce adverse impacts such as production

decreases. Anti-poverty programs have to go beyond cash transfer and should incorporate risk management policies that enhance synergies between generic and specific capacities.

These results support conclusions of several interviews,since, in most localities, institutional actors mentioned the importance of aligning initiatives that ultimately promote poverty reduction in rural areas. In addition to Bolsa Família, agricultural insurances, rural pensions, distribution of rainfall cisterns, rural electrification and rural housing were mentioned as important instruments of social development and coexistence with drought. Some noted that in spite of the drought, there was no more food looting as seen in the past.

According to a farmer representative in Salitre, "social programs were important. No one else goes hungry. It may be that water quality is not excellent, but no one goes thirsty. The problem is the animals, which die mainly from hunger." Similar testimony was given by a local representative of the agriculture sector in Salitre: "[thanks to the social programs], people today do not feel the drought any more. What is bad really is the animal issue". This was also repeated by staff from the social protection department in MissãoVelha and from Ematerce in Mauriti. Another interviewer explained the social change related to these programs: "the increase of income allowed investments in irrigation and the use of electrical energy" and "PAA promoted higher personal satisfaction and significantly changed farmers' lives".

An interesting side note during the interviews concerned the long-term establishment of farmers in rural areas. The need for an extra "conditionality" of permanence in rural areas and the continuity in production for farmers participating in the CCT program was highlighted by an institutional actor. It was stated that some people migrate to the city after receiving the allowance and this pattern could ultimately bring a negative consequence in terms of the amount of production from family farming. On the other side, beneficiaries of retirement pensions and the rural housing program were associated with permanence in rural areas.

Around those issues, there is ample discussion on the role of CCTs as a work disincentive (GROSH et al., 2008) and about the human right to receive benefits without conditionality and the freedom of choice to participate or not in services (DEVEREUX; LUSTIG; SUBBARAO, 2012). Consequently, conditionality restricting rural-urban movement would be discriminatory, and also affect the use of migration as a climate adaptation strategy. Creating a conditionality based on fixing residency in rural areas would undermine the multiple uses of cash transfer programs, which are known to support planned migration and livelihood change strategies (WOOD, 2011).

Finally, a last important aspect raised by interviewers was the need of PAA changing to a permanent government service, so the program becomes independent of local government structures. Shifting of political parties in power was regarded as responsible for the discontinuity of many programs, owing to turnover of administrative staff and to a common practice of new politicians of erasing measures undertaken by their former opponents.

These changes in local government structures were also accounted as generating extra costs due to training of new staff. This common observation is related to historic structures of power and social hierarchy in semi-arid Brazil, which are marked by strong clientelistic practices (BURSZTYN, 2008). Hence, a change from a program to a permanent government service could also contribute to strengthening the institutional capacity involved in the program.

Following this finding, it is important to highlight that policy integration is not only a matter of sectorial coordination, being related to power disputes between sectorial agendas and between groups of interests at all administrative levels. Policy implementation relies on actors' interactions and local dynamics in the translation of policy instruments into practice. Clientelistic practices have influenced this translation process in the Northeast region for several decades. Local elites created a means of reproduction related to water insecurity based on a system of political patronage that marked the semi-arid since the end of 19th century (CUNNIF, 1970).

In the last few years, those practices were especially characterized by local politicians providing water-tank trucks for filling domestic reservoirs in exchange of votes. In spite of the progress related to social

programs, their results in overcoming this dynamic of power are still limited. Drawing on Hilgers' definition of clientelism, understood as a lasting personal relationship between individuals of unequal socio-political status, Eiró&Lindoso (2015) showed that these practices have been reinvented even with the implementation of programs related to the distribution of cisterns (for household consumption) and the CCT Bolsa Família.

According to the authors, the limited water storage capacity of cisterns (16 thousand liters), together with the absence of precipitation and the persistent need of water-tank trucks, contributed to the resistance of clientelism in the region. This was particularly true in periods of extreme drought, such as the one the region was experiencing in 2012-2018. Interviews in Salitre also mentioned the arbitrariness in the distribution of water by these trucks, even though they were funded by the federal government.

In essence, even if these programs increased families' livelihoods and ability to deal with climate shocks, their competence to increase the ability of farmers to break the trend of domination and dependence upon local elites was limited. Dealing with this type of local power dynamics will remain an important challenge to the implementation of social and rural policies in the region, especially as long as the context of material precariousness and low access to resources essential to livelihoods prevails.

6 CONCLUSION

Semi-arid regions are undeniably affected by environmental and climatic impacts, which are both foreseen to increase in the near future. This article discussed the multiple benefits of social programs such as PAA, not only to achieve goals related to food security and agricultural production, but also to increase ability of local populations to adapt to climate and environmental changes. Although the program was not designed with this purpose, strengthening these types of programmatic connections could bring more efficient and sustainable results. Policy integration in this context should be particularly considered in the implementation process, which still faces many challenges.

A variety of bottlenecks were observed at the study locations, such as lack of (or insufficient) credit, technical assistance, infrastructure, institutional articulation, and presence of conflicts related to local political power struggles, among others. Dealing with these challenges and building institutional structures that assure stronger adaptation of PAA to local contexts could contribute to a more integrated approach of poverty reduction, combining social protection and productive inclusion, possibly providing short and long-term benefits that decrease the vulnerability of people to predicted and unforeseen impacts of climate change.

The existing issues underlying the formal institutional structures at the different levels of government might hinder the federal decisions and benefits at the micro level. Thus, more consideration should be given to the importance of governance and institutional factors on the functioning of social protection initiatives. Investments in institutional structures and systems that support the interactions of programs as a means to strengthen local climate change adaptation are important to ensure the continuation of PAA and other social protection programs in the future.

ACKNOWLEDGEMENTS

Research supported by Banco do Nordeste do Brasil (BNB), Rede CLIMA, Science Without Borders scholarship, and project INCT nº 16- 2014 ODISSEIA, with funding from CNPq/Capes/FAPDF. Field assistance provided by researchers of Rede CLIMA-Regional Development team at the Center for Sustainable Development (CDS/UnB), and Leaders research group at the Federal University of Cariri.

NOTES

[1] Institutional actors are used herein to refer to interviewed employees from the visited public institutions. Results correspond to their personal opinions based on working experience.

[2] The Institutional Purchase Modality (Decree 7755/2012) ensures that states, municipalities and federal agencies are allowed to purchase from family farms, with their own financial resources and without bidding, to meet regular food consumption demands in hospitals, barracks, prisons, university restaurants, day-care centers and philanthropic schools, among others.

[3] 1 real = 0.30 US Dollar (November 14, 2017).

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