

REDUCED INEQUALITIES

CONTRIBUTIONS OF EMBRAPA

Terezinha Aparecida Borges Dias
Maria Consolacion Fernandez Villafañe Udry
Antonio Luiz Oliveira Heberlé
Joaquim Dias Nogueira

Technical Editors



**Brazilian Agricultural Research Corporation
Ministry of Agriculture, Livestock and Food Supply**

Sustainable Development Goal 10

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Foreword

Launched by the United Nations in 2015, 2030 Agenda for Sustainable Development is powerful and mobilizing. Its 17 goals and 169 targets seek to identify problems and overcome challenges that affect every country in the world. The Sustainable Development Goals (SDG), for their independent and indivisible character, clearly reflect the steps towards sustainability.

Reflecting and acting on this agenda is an obligation and an opportunity for the Brazilian Agricultural Research Corporation (Embrapa). The incessant search for sustainable agriculture is at the core of this institution dedicated to agricultural research and innovation. Moreover, sustainable agriculture is one of the most cross-cutting themes for the 17 goals. This collection of books, one for each SDG, helps society realize the importance of agriculture and food in five priority dimensions – people, the planet, prosperity, peace and partnerships –, the so called 5 Ps of 2030 Agenda.

This collection is part of the effort to disseminate 2030 Agenda at Embrapa while presenting to the global society some contributions of Embrapa and partners with potential to affect the realities expressed in the SDG. Knowledge, practices, technologies, models, processes and services that are already available can be used and replicated in other contexts to support the achievement of goals and the advancement of 2030 Agenda indicators.

The content presented is a sample of the solutions generated by agricultural research at Embrapa, although nothing that has been compiled in these books is the result of the work of a single institution. Many other partners joined in – universities, research institutes, state agricultural research organizations, rural technical and extension agencies, the Legislative Power, the agricultural and industrial productive sector, research promotion agencies, in the federal, state and municipal ranges.

This collection of books is the result of a collaborative work within SDG Embrapa Network, which comprised, for 6 months, around 400 people, among editors, authors, reviewers and support group. The objective of this initial work was to demonstrate, according to Embrapa, how agricultural research could contribute to achieve SDG.

It is an example of collective production and a manner of acting that should become increasingly present in the life of organizations, in the relationship

between public, private and civil society. As such, this collection brings diverse views on the potential contributions to different objectives and their interfaces. The vision is not homogeneous; sometimes it can be conflicting, as is society's vision about its problems and respective solutions, a wealth captured and reflected in the construction of 2030 Agenda.

These are only the first steps in the resolute trajectory that Embrapa and partner institutions draw towards the future we want.

Maurício Antônio Lopes
President of Embrapa

Preface

According to targets 10.1, 10.2 and 10.3 of the Sustainable Development Goal 10 (SDG 10)¹ on reduced inequalities, countries took responsibility for, by 2030 “[...] progressively achieve and sustain income growth of the bottom 40% of the population at a rate higher than the national average”; (b) “[...] empower and promote the social, economic and political inclusion of all, irrespective of age, gender, disability, race, ethnicity, origin, religion [...]” and c) “ensure equal opportunity and reduced inequalities of outcome, including by eliminating of discriminatory laws, policies and practices and promoting appropriate legislation [...]” and related policies. This great challenge of reduced inequalities is directly linked to the targets of SDG 1, 2, 3, 5, 8, 11, 12 and 16, demanding public policies and institutional structures to reduce inequalities.

The General Assembly of the United Nations’s Sustainable Development Goals (SDG) point to the global course of action to address the problem of poverty, promote prosperity and well-being, protect the environment and address climate change. Among the 17 SDGs, number 10 addresses the reduced inequalities within and between countries in the context of the global pact for the promotion of sustainability. We evaluate Embrapa’s participation and involvement in the aforementioned goal.

Inequality between and within countries has increased considerably over the past 2 centuries. Overall, global growth benefited disproportionately the highest income groups, while lower income families were left behind. Low-income people have had their human capital limited or were unable to fully realize their development, which is bad for national economies as a whole. Some factors, such as different access to land, water, markets, technology and public policies, contribute to the intensification of inequalities between and within countries. Inequality is present in both developed and peripheral countries, but it is in the latter that, due to economic, political and social organization, the most significant differences are recorded.

In Brazil, because of the inequalities of social classes, gender and race, millions of people live below the poverty line. The scenario is a strong increase in the concentration of income, which widens the inequalities of access to employment, education, public services, among others. In the last decade, this context has

¹ Available at: <<https://www.un.org/sustainabledevelopment/inequality/>>.

demanded a set of public policies to promote income distribution, gender equity, support to small-scale producers, and to historically marginalized social groups such as indigenous peoples and traditional communities.

For more than 40 years, offering information, knowledge and technology, Embrapa has contributed to the innovation and sustainability of agriculture, reduced inequalities and food insecurity. Embrapa adapts its research to the reality of small-scale producers, innovating in diverse social and environmental contexts, supporting productive inclusion, income generation and improving the quality of life of rural workers, their cooperatives and associations. Embrapa extends its activities in the promotion of agroecology and organic production, strengthening environmentally sustainable agricultural systems in several territories and biomes.

The detailing of research results and managerial actions, regarding reduced inequalities, can be found in the chapters of SDG 10. These are topics related to targets 10.1, 10.2 and 10.3, for income generation, empowerment and social inclusion of the poorest, regardless of gender or social and ethnic group and the interface with public policies.

In order to follow Embrapa's involvement with the themes proposed in SDG 10, we present a sequence of six chapters, according to the following titration:

- General aspects of inequality and sustainability and Embrapa's role.
- Research agenda focused on reduced inequalities and social inclusion.
- Embrapa technologies in the context of reduced inequalities and of income generation.
- Research, technology transfer and innovation for social inclusion.
- Public policies for sustainable rural development and Embrapa's participation.
- Challenges of Embrapa's research agenda in reduced inequalities.

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Chapter 1

General aspects of inequality and sustainability and Embrapa's role

Terezinha Aparecida Borges Dias

Introduction

Reducing inequality within and between countries is a major challenge to be overcome in the context of global commitments to sustainable development. This chapter presents general aspects of inequality and its contextualization in Brazil, as well as the role of agricultural research, especially Embrapa, in its reduction. Broadly, it dialogues directly with the following targets of the Sustainable Development Goals 10 (SDG 10),

10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard (United Nations, 2018).

It is also related to SDG 1, 2, 3, 5, 8, 11, 12, 16, among others.

General aspects of inequality

The United Nations (UN) Member States, at the UN Summit on Sustainable Development 2015, have established and committed to a new sustainable development agenda in defining the "Future we want." The 2030 Agenda is a new pact to face the great challenges of planetary sustainability and institute sustainable development in its three dimensions: social, economic and environmental. The Agenda defined 17 Sustainable Development Goals (SDG), among which is to reduce inequalities within and between countries.

Inequality and sustainability are key challenges of our time and are embedded in such a way that it is impossible to address one theme without considering the other, as stated in the World Social Science Report (Relatório..., 2016). The report points to seven levels of inequality:

- Economic inequality – differences between levels of income, resources, wealth and capital, living standards and employment.
- Social inequality – differences between the social status of different population groups and imbalance in the functioning of education, health, justice and social protection systems.
- Cultural inequality – discrimination based on gender, ethnicity and race, religion, disability and other groups identities.
- Political inequality – the differentiated capacity of individuals and groups to influence political decision-making processes, to benefit from these decisions, and to participate in political action.
- Spatial inequality – spatial and regional disparities between centers and peripheries, urban and rural areas, and regions with more or less diversified resources.
- Environmental inequality – irregular access to natural resources and the benefits of their exploitation; exposure to pollution and risks; and differences in the agency's ability to adapt to such threats.
- Knowledge-based inequality – differences in access to and contribution to different sources and species of knowledge, as well as the consequences of such disparities.

In order to face these inequalities, it is necessary to know the challenge of unsustainability. It consists of finding means of production, distribution and consumption of existing resources in a more cohesive, economically efficient and ecologically viable way. Sustainability, according to the Brundtland Report (Nosso..., 1991), can be understood as a process of transformation in which the exploitation of resources, the direction of investments, the direction of technological development and institutional change harmonize and reinforce the potential present and future, in order to meet human needs and aspirations. The report points out that the inequalities and discrimination push the poorest and marginalized into unsustainable practices, while powerful elites can continue with these practices without fear of recrimination. In this context, poverty can be

considered as a problem of unsustainability of the environment, a key topic for the pursuit of sustainability.

Studies (Zanden et al., 2014) with information of almost 2 centuries on data on income, education, life expectancy, height of the population, political institutions, environmental quality and gender inequality, among others indicated that inequality between countries increased considerably. The Reward Work, Not Wealth Report (Compensem..., 2018) states that 82% of all wealth generated in 2017 was in the hands of the richest 1% of the population. Meanwhile, the poorest half of the population (3.7 billion people) was left with nothing. The report indicates that over the last 25 years, while the richest 1% captured 27% of overall income growth, more than half of the world's poorest people accounted for 13% of every dollar in the economy.

If it maintains the same level of inequality, the global economy would need to grow 175 times to allow everyone to earn more than US\$ 5 a day. The gap between rich and poor continues to widen. Growth benefited disproportionately the higher income groups, while lower income families were left behind. This long-term increase in income inequality not only raises social and political concerns, but also economic ones. Low-income people have been prevented from expressing their human potential, which is bad for development, given the sustainability and future of the poorest nations. There are several practical consequences of inequality, such as different opportunities for access to land, markets, technology and public policies. These factors contribute to the intensification of inequality between and within countries.

Human Development Report (HDR), released by the United Nations Development Programme (UNDP) (Human..., 2016), showed that some groups have been left out of this development. Women, ethnic and racial groups and rural populations have not been able to benefit from global progress. UNDP also points to the national and global policies and strategies needed to reach these excluded populations. The report highlights four axes:

a) Social protection – universal policies of health and education; of social assistance, such as Bolsa Família (Family Allowance) and Benefício de Prestação Continuada (Continuous Cash Benefit); social security benefits for vulnerable groups and financial inclusion.

b) Affirmative action policies – for women, blacks, indigenous people, people with disabilities among other vulnerable groups.

c) Sustainable human development – so that shocks, such as economic recessions, epidemics, natural disasters, do not bring people back into poverty.

d) Participation and autonomy of the excluded – implement human rights treaties, guarantee access to justice, promote inclusion and the right to information.

The development process generates a large number of people excluded from citizenship. Studies by the Economic Commission for Latin America and the Caribbean (ECLAC) indicated that 37% of indigenous people and 34% of blacks are among the poorest 20% excluded from participation (Reunión de la Mesa Directiva de La Conferencia Regional sobre Desarrollo Social de América Latina y el Caribe, 2016). These inequalities are derived from a heterogeneous productive matrix that generates high inequality with effects on the socioeconomic level, gender, ethnic-racial condition, age and territory.

Reduced inequalities in Brazil

The Gini index (which measures the inequality from 0 to 100) pointed out that in Brazil there was an increase in inequality of income distribution, going from 47 in 1820 to 61 in 2000 (OECD, 2012). Brazil leads the countries with the highest concentration of wealth, which is in the hands of the richest 1% of the population, according to the [Social Panorama of Latin America 2017](#) report, released by ECLAC (Panorama..., 2018). ECLAC cited in the report data from the international network of researchers [World Wealth](#) and Income Database, which gathers tax information to estimate income inequality in countries. According to information from this network, the richest 1% of the Brazilian population accounts for 27.8% of the country's total income, in the data for 2015. The Human Development Index (HDI) indicate that social and gender inequality has intensified in Brazil, according to 2015 data released in 2016 by the [United Nations Development Programme](#) (Human..., 2016).

In a country of continental dimensions such as Brazil, there are many differences between regions or localities, whether cultural, historical or economical (Fernandes, 2001). The Pesquisa Nacional por Amostra de Domicílios (National Household Sample Survey) (IBGE, 2016) indicated that, in terms of monthly real income inequality (measured by the Gini index), the Northeast and North regions had higher rates than other Brazilian regions (IBGE, 2016). The levels of regional poverty, according to the Síntese de Indicadores Sociais (Synthesis of Social

Indicators – SIS) (IBGE, 2017), are higher in the North and Northeast regions. The most significant numbers of poverty are in the Brazilian states of: Maranhão (52.4% of the population), Amazonas (49.2%) and Alagoas (47.4%). The study shows that, in general, poverty occurs more frequently in rural households of the interior of Brazil than in the urban peripheries of the capitals.

On the other hand, in the context of inequalities, those related to gender and race are structuring of Brazilian social inequality. The document *Retrato das Desigualdades de Gênero e Raça* (Portrait of Gender and Race Inequalities) (Retrato..., 2011) points out that for decades, policies have been developed based on homogeneous groups of human beings, without sex and without race, which should, from this conceptual framework, have similar conditions to access public policies and benefit from them. Studies show that inequalities remain and that the reversal of this picture demands new actions.

Organized civil society, especially feminist movements, those of blacks, indigenous peoples and traditional communities, has for decades been showing and denouncing the worst living conditions in this part of the Brazilian society. They point out the barriers to equal participation in various fields of social life. They point out to the consequences that these inequalities and discriminations produce not only for these specific groups, but also for society as a whole.

Since 1990, the Institute for Applied Economic Research (Ipea) shows data and makes reflections related to inequalities of gender and race in the country. They are subsidies for stakeholders and diverse fields, such as academics, government managers and members of organized social movements. According to Ipea, these factual evidences were not alone able to give government agencies a new paradigm for the construction of interventions that reduce inequalities and poverty (Retrato..., 2011).

Poverty and inequality have a distinct nature, although poverty is determined by inequality. One of the great consequences of inequality is hunger. In 2013, when the last survey of the Escala Brasileira de Insegurança Alimentar (Brazilian Food Insecurity Scale – Ebia) was carried out, the [food insecurity index](#) was severe and showed a vulnerability to hunger of 3.2% of the population (Escala..., 2014). It is believed that hunger is not a problem of insufficient food supply. It turns out that one important layer of the population does not have access to land or the support to produce, and another, which is in the cities, does not have the income to have the guaranteed access to the food. It is therefore a question of distribution, which implies in State management.

Driven by the strong political engagement of organized civil society, in the last decades, Brazil has been implementing several policies of income transfer, promotion of equity and support to small-scale producers. In relation to the transfer of income, the Family Allowance Program stands out. Since 2003, the program has supported thousands of families and has kept children and young people in school. In 2011, the federal government launched Plano Brasil Sem Miséria (Brazil without Misery Plan), an expansion of Family Allowance, with the objective of promoting the social and productive inclusion of the extremely poor population. Public policies for rural development, especially for small-scale producers, were created, such as Programa Nacional de Alimentação Escolar (National School Feeding Program – Pnae), Programa de Aquisição de Alimentos (Food Acquisition Program – PAA), Programa Nacional de Fortalecimento da Agricultura Familiar (National Family Farming Development Program – Pronaf) and the measures and adjustments presented annually in Plano Safra da Agricultura Familiar (Family Farming Safra Plan).

In other words, a set of public policies were created and activated to stimulate the production of family farmers, their associations and cooperatives, allowing access to credit, differentiated markets and the solidary drive of local economies. Social movements were decisive in the implementation of several advanced policies, such as Política Nacional de Agroecologia e Produção Orgânica (National Policy on Agroecology and Organic Production), Decree 7,794/2012 (Brasil, 2012b). These policies have been strengthening income generation in the countryside based on agroecological principles, sustainability and ethnic and generational equity.

The Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais (National Policy for the Sustainable Development of Traditional Peoples and Communities – PNPCT) (Brasil, 2007) aims to promote the sustainable development of traditional peoples and communities with an emphasis on the recognition, strengthening and guarantee of territorial, social, environmental, economic and cultural rights, with respect and appreciation for their identities, their forms of organization and their institutions. This policy signals to government institutions the need to guarantee these social groups access to their services and products in order to promote sustainability and mitigate inequalities.

Indigenous peoples, whose territories represent almost 12% of Brazil, articulated with sectors of the federal government, have built the Política Nacional de Gestão Ambiental e Territorial Indígena (National Policy on Indigenous Environmental and Territorial Management – PNGATI), approved in 2012 – Decree 7,747/2012 (Brasil, 2012a). It aims to guarantee and promote the protection, recovery, conservation

and sustainable use of the natural resources of indigenous lands and territories, ensuring the integrity of indigenous heritage, improving the quality of life and the full conditions of physical and cultural reproduction of the present and future generations of indigenous peoples, respecting their socio-cultural autonomy.

Embrapa's insertion

Among the targets of SDG 10 to reduce inequalities by 2030, target 10.1 seeks to achieve and sustain the income growth of the poorest 40% of the population at a higher rate than the national one. Target 10.2 is about empowering and promoting the social, economic and political inclusion of all, regardless of age, gender, disability, race, ethnicity, origin, region, economic conditions. They are challenging goals in the context of national agricultural research, technical assistance and innovation in rural areas.

The agricultural census data shows that the Brazilian reality is not different from that observed in most of the countries in the world that are at the same pace of development. Data from the Brazilian Institute of Geography and Statistics (IBGE) of 1996 showed that, in a universe of 5,175,489, the typical properties of family farming amounted to 4,367,902, while the non-family reached 807,587. In this context, 91.6% have less than 100 hectares and 68% have less than 20 hectares (IBGE, 2009).

Thus, there is a profound inequality, since, although family farm accounts for 84.4% of the total number of establishments, it occupies only 24.3% of the country's agricultural land (or 80.25 million hectares). It is interesting to note that, even occupying only a quarter of the area occupied for agricultural production, family farming employs seven out of ten people employed in the field.

Low productivity and the lack of technologies by family farmers are one of the main obstacles to increasing income for small and medium-scale farms. Agricultural research plays a fundamental role in reduced inequalities, since it acts directly on production and rural productivity. This action has a direct impact on the availability and price of food products, increasing (or not) the purchasing power of the poorest. Agricultural research contributes to the increase of income and employment of the entire social network involved with the activities in the field. It can also collaborate in the strengthening of cooperatives, associations, agroindustries, improvement of tax collection with repercussions in education, health, welfare and is projected in the conditions of life and permanence of the

farmers in the rural area. Increasing rural producers' incomes weakens possible rural-urban migration waves, avoiding human accumulation on the outskirts of cities, where large contingents are concentrated in conditions of extreme poverty.

Brazil stands out as one of the countries that have one of the most structured systems of agricultural research. With national and international partners, Embrapa develops leading research, generating and making available high-impact technologies for a significant portion of the poorest rural producers. Its international activities have strengthened South-South cooperation since 2007. On the African continent, several actions and partnerships have provided the availability of technologies and institutional capacities aimed at supporting national development initiatives and their impact on poverty reduction.

In Brazil, adjusted to national policies to promote family farming and agroecological basis, among others, Embrapa faced positively the reflections on social, environmental and economic sustainability in its research projects. These actions are reflected in the biomes, where the environmental challenge is very great and diversified, as in the Amazon and the Northeast. Embrapa develops and adapts technologies of wide impact to the existing social inequalities, especially regarding the sustainable use of the forest and the cope with the drought.

Embrapa, through its internal management mechanisms, currently has a diversified portfolio of projects organized in 23 portfolios and 84 thematic arrays, many with a close interface with the general sustainability challenges, in particular, targets 10.1 and 10.2. In the institutional perspective of Embrapa, an array is an instrument of organization of related projects, according to a thematic vision with the objective of finding solutions to regional demands, biomes and productive chains, according to Embrapa's Sixth Master Plan (PDE). The arrays deal with the contribution of the Research Units to the strategic planning of Embrapa. The portfolio is an instrument according to a thematic vision that originates from the corporate perspective, with the purpose of finding solutions to national, institutional, or governmental demands, as described in Embrapa's Sixth Master Plan. Among the research portfolios are:

- Forestry
- Coping with Droughts
- Integrated Crop-Livestock-Forestry Systems
- Ecologically-Based Production Systems

Among the arrays are:

- Strategies to Increase the Efficiency and Sustainability of Dairy Cattle in Brazil (More Milk).
- Restoration of Degraded Pastures in the Amazon (Repasto).
- Restoration and Environmental Adequacy of the Rural Landscape in the Atlantic Forest of the South and Southeast Regions (Sustrural).
- Family Farming without Fires in the Amazon (ASQ).
- Conservation and Sustainable Use of Bee Genetic Resources in Agroecosystems and Impacts on Brazilian Agribusiness (Abelha).
- Development of Technologies for the Sustainable Cultivation of Fruit Species Native to the Amazon (Sisnativa).
- Agroecological Innovation: construction and knowledge exchange with family farming in the Northeast region of Brazil (Agroeco-NE).
- Agroecological Systems as an Alternative for the Development of Family Farming in the Midwest Region (AgroE-CO).
- Building and Exchanging Knowledge for the Sustainable Development of Traditional Peoples and Communities (ConPCT).

Embrapa's commitments in SDG 10 provide a set of reflections on: the challenges of its research and innovation agenda; its technologies to reduce inequalities; broad coverage and social impact; research, technology transfer and innovation for the social inclusion of indigenous peoples and traditional communities; its participation in the impacts of policies to promote equal socioeconomic opportunities in rural areas and the perspectives and challenges of integrative actions focused on reduced inequalities and promoting income generation.

Final considerations

The pursuit of economic, social and environmental sustainability has a deep relationship with actions to reduce inequalities. Combating poverty is a key topic for sustainability. Poverty is present in specific categories of the national peasantry, especially in small-scale family farmers and certain ethnic and racial groups that have historically been abandoned from public policies that are more inclusive. Embrapa's greater institutional involvement with these categories will determine

the broadening of the institutional contribution to reduced inequalities, especially in targets 10.1, 10.2 and 10.3.

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Chapter 2

Research agenda focused on reduced inequalities and social inclusion

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Introduction

Target 10.1 of the Sustainable Development Goal 10 (SDG 10), to reduce inequalities by 2030, seeks to achieve and sustain the income growth of the poorest 40% of the population at a higher rate than the national one. Target 10.2 is about empowering and promoting the social, economic and political inclusion of all, regardless of age, gender, disability, race, ethnicity, origin, region, economic conditions. Target 10.3 seeks to ensure equal opportunities and reduce inequalities in outcomes, including through the promotion of appropriate legislation, policies and actions in this regard. They are challenging goals in the context of national agricultural research, technical assistance and innovation in rural areas.

The contribution of agricultural research to sustaining this process of social inclusion and reduced inequalities, as targets 1, 2 and 3 of SDG 10, was a priority in the last 20 years, manifested in social policies of inclusion and income distribution. The strong presence of the State in sustainable rural development and family farming is notorious. The Política Nacional de Agricultura Familiar (National Policy on Family Farming – PNAF) – Law 11,326/2007 (Brasil, 2007) – was fundamental to support all other public policies and programs aimed at reduced inequalities and increasing income.

Research and innovation agenda

Scientific and technological development and innovation have contributed significantly to reduced inequalities and social inclusion, especially in rural areas. The government effort was reflected in the increase of income, by the adoption of technologies; improvement of production systems; the organization of production and marketing and access to new markets and institutional markets. Developing the country is not an easy goal to achieve because of the extensive and diversified agricultural area and its continental dimensions. However, with

the institution and implementation of assertive policies in the last 2 decades, Brazil broke with the rural poverty circuit and left the Hunger Map. In 2014, the Food and Agriculture Organization of the United Nations (FAO) instituted the International Year of Family Farming, an important step in valorizing the work of family farmers (Brasil, 2014a).

Among the public policies focused on productive inclusion in rural areas, we highlight food security in agroecology because they have been translated into research programs and projects at Embrapa. The Política Nacional de Segurança Alimentar e Nutricional (National Policy on Food and Nutrition Security – PNSAN), Decree 7,794/2012 (Brasil, 2012), aims to promote food and nutritional security, as well as ensuring the human right to adequate food throughout the Brazilian territory (DHAA). It has as one of the guidelines the promotion of universal access to adequate and healthy food, with priority for families and people in situations of food and nutritional insecurity. It is aimed at promoting the supply and structuring of sustainable, decentralized, agroecological-based systems of production, extraction, processing and distribution of food.

The Política Nacional de Agroecologia e Produção Orgânica (National Policy on Agroecology and Organic Production – Pnapo), Decree 7,794/2012 (Brasil, 2012), acts in the strengthening and structuring of short agro-food chains and promotes the increase of income generation in the field, based on general principles of sustainability, involving agroecology and organic production. Also worthy of note is the Política Nacional de Desenvolvimento e Sustentabilidade de Povos e Comunidades Tradicionais (National Policy for the Sustainable Development of Traditional Peoples and Communities) (Brasil, 2007). It promotes the sustainable development of traditional peoples and communities, with an emphasis on recognizing, strengthening and guaranteeing their territorial, social, environmental, economic and cultural rights, with respect and appreciation for their identity, their forms of organization and their institutions. This policy guides the sustainability and mitigation of inequalities, directly promoting the social inclusion of race and ethnicity, provided for in target 2 of SDG 10, by advocating that: by 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status. The policy also contributes to the achievement of the targets of SDG 2, target 2.1, which provides for the elimination of hunger by 2030 and guarantee access to safe, nutritious and sufficient food throughout the year. It is also concerns target 2.2, which aims to eliminate all forms of malnutrition by 2030.

Embrapa contributes heavily to the extent that it develops and implements technologies and services in regions with a historical record of poverty in the countryside, especially in the Northeast and North (Amazon) regions. The focus in these territories is the family farmers and traditional peoples and communities, according to what was identified in research survey and later reported by more than 200 researchers in the *Coleção Povos e Comunidades Tradicionais* (Traditional Peoples and Communities Collection), which is presented in a synthesis too: research, technologies and innovations for social inclusion of indigenous peoples and traditional communities (Dias et al., 2016).

With regard to rural poverty in Brazil, the majority of vulnerable farmers occupy the Semiarid region of the Northeast. Public social inclusion policies were prioritized for this region and for regions with the lowest human development index (HDI) and the highest concentration of poverty. One policy of great importance in this regard was the Programa Brasil Sem Miséria (Brazil without Misery Program), which has been in operation since 2012, which has contributed greatly to reduced inequalities with differentiated public policies and programs for the distribution of income.

In the field of action of Embrapa, the partnership in the implementation of the Política Nacional de Assistência Técnica e Extensão Rural (National Policy on Technical Assistance and Rural Extension – Pnater) – with the technical assistance program focused on the training and transfer of knowledge and technologies for family farming– allowed to meet the demand of farmers with local and regional specificities. Pnater has contributed to overcome one of the greatest challenges faced by family farmers: low-income subsistence. The program enabled farmers to access institutional and local markets, as demonstrated by Chapter 5 of this report.

Apparently simplistic, the generation of jobs and income hides paradoxes provoked by modernization. Agricultural mechanization raises productivity in the field, but it has dramatic consequences on the human labor force. The reality of large agricultural farms shifts a large contingent of labor to unemployment. The intensive use of state-of-the-art chemical inputs has eliminated the *capineiros*, *roceiros* and applicators of products.

Family farmers turn to more labor-intensive activities, which pose difficulties in mechanization and therefore constitute an opportunity for these farmers. In this context, workers in vegetables and fruit, the so-called extractivists, are another set of activities in which agricultural research needs to focus attention. Low productivity and lack of ownership of technologies by family farmers are one of

the main barriers to income growth in small and medium-scale farms across the country. The importance of agricultural research to reduce rural income inequalities is direct and indispensable. Whether by the implementation of public policies directed to family farming, or in what is Embrapa's institutional responsibility, as a public corporation. In an indirect or ancillary way, research can contribute to the generation of employment and income in the countryside, installation of processing industries, creation of agricultural cooperatives, increase of tax collection and improvement of education, health, transportation, among others.

Increased agricultural production and productivity can reduce food prices and thus increase the purchasing power of the poorest populations and thus contribute to reduced inequalities. The research on family budgets, despite being out of date (2008), indicates that, in the ranges below two minimum wages, food consumes (24.96%) of the income twice as much as spent by the range over 25 minimum wages (11.55%), in relative terms (Homma, 2017; IBGE, 2017).

Thus, there is a strong economic, social and environmental inequality in the country that can be deepened if there is an institutional political change of rupture in policies and programs of income distribution and promotion of sustainable rural development. There is a tendency of governments to value public policies aimed at the expansion of export agribusiness, given the unique opportunity of generating foreign exchange for the country. The model is based on large-scale, high-productivity production with state-of-the-art technologies and concentrator of land and especially income. In territorial extensions, the production of soybean-corn and livestock from the South/Southeast to the Midwest, the occupation of the Cerrado and part of the Amazon, and recently in the transition region of Cerrado and Semiarid in a large area called Matopiba (formed by the states of Maranhão, Tocantins, Piauí and Bahia).

In the areas of agricultural expansion, the pace of land occupation is accelerated with high concentration of capital, land and insertion in the global food and commodities market. The model, on the one hand, strengthens economic development and integration into the world food market, by the continued and consistent expansion of commodity exports. On the other hand, it intensifies internal inequalities, putting pressure on sustainable rural development, focusing on the strengthening of small producers, multifunctionality, regional and local economies and job and income generation.

In the specific case of Brazil, the multiplicity of conditions of family farming could appear to threaten productivity and competitiveness. However, in practice,

this segment responds to food security and may represent an opportunity for establishing new models focused on the conservationist management of natural resources. That is to say, family farming contribute significantly to the conservation and sustainable use of water and can collaborate to achieve the targets of SDG 6. The great challenges or difficulties to be overcome are to keep the population of family farmers in the rural area with income generation and added value, through the strengthening of agroindustries and, in this regard, numerous contributions from Embrapa can be mentioned.

The strengthening of local production and consumption systems, prioritizing local and regional markets, also addresses one of the objectives of sustainable development, which consists of changes in the pattern of production and consumption, strengthening local and regional markets, thus enabling social inclusion, increase of income and reduced inequalities.

Despite the holding of the *United Nations Conference on Sustainable Development* in Rio de Janeiro in 1992, which mobilized the *Peoples' Summit* event, the sustainable rural development agenda came to be prioritized only at the beginning of the 21st century, with public policies aimed at reducing hunger, poverty, and inequality since 2003. Government programs have been implemented, such as Fome Zero (Zero Hunger), Bolsa Família (Family Allowance) (Campello; Neri, 2013) and Brazil without Misery (Plano..., 2013), which have as a structuring axis the strengthening of family farming. The basis was the National Policy on Family Farming (PNAF) in 2006 (Brasil, 2006) and the Programa Nacional de Fortalecimento da Agricultura Familiar (National Family Farming Development Program – Pronaf) (Brasil, 1996), which was the basis for this policy. There were numerous plans, programs and projects to reduce inequalities, such as: Programa de Aquisição de Alimentos (Food Acquisition Program – PAA); Programa Nacional do Biodiesel (National Biodiesel Program – PNB); National Policy on Technical Assistance and Rural Extension (Pnater); Seguro da Agricultura Familiar (Family Agriculture Insurance – Seaf); Lei Orgânica de Segurança Alimentar (Organic Food Security Act); Programa de Garantia de Preços para a Agricultura Familiar (Price Guarantee Program for Family Agriculture – PGPAF); Programa Nacional de Desenvolvimento Sustentável de Territórios Rurais (National Program for Sustainable Development of Rural Territories – Pronat); Programa Mais Alimentos (More Food Program); Programa Nacional de Alimentação Escolar (National School Feeding Program – Pnae); Programa de Garantia de Preços Mínimos (Minimum Price Guarantee Program – PGPM-Bio); Política Nacional sobre Mudança de Clima (National Policy on Climate Change – PNMC); National Policy on Agroecology and Organic Production

(Pnapo); Plano Nacional de Segurança Alimentar e Nutricional (National Plan for Food and Nutrition Security); Plano Nacional de Agroecologia e Produção Orgânica (National Plan for Agroecology and Organic Production – Planapo).

Policies have been filling the gaps and opportunities to expand social inclusion and reduce inequalities, favoring redistribution of income towards more balanced rural development. However, it is worth reflecting on the future of these policies and programs, a consistent agenda of State, committed to the inclusion and reduced inequalities and misery. These are government policies that have not yet been transformed into state policies and are subject to relegation due to new priorities established by institutional political changes that are taking place in the country as of 2016. For example, the resources of Plano Safra da Agricultura Familiar 2018/2019 (Family Agriculture Safra Plan 2018/2019) were frozen. They rose from approximately 1,3 billion dollars¹ annually in the early 2000s to approximately 9,2 billion dollars in 2016/2017, remaining unchanged in 2018/2019. In addition, there was a 37% reduction in rural credit from Pronaf (Mattos, 2017).

Embrapa, in the programming of research and technology transfer, has an active and consistent participation in these policies and programs. It has a research network with more than 40 Units, and can expand and maintain a research agenda aimed at meeting the demands of family farming. Institutional capillarity is present in all Brazilian biomes. The Amazonian biomes, predominant in the North, and Caatinga in the Northeast, due to their edaphoclimatic peculiarities, demand a great contribution of knowledge and technologies. The first case refers to the management of forest biodiversity and the second to coping with drought, as will be presented in the following chapters.

Embrapa's portfolio of multi-institutional and interdisciplinary projects aimed at strengthening the sustainable development initiatives of family farming and traditional communities with a view to aggregating values has, as a priority, a territorial approach. The project arrangements and the portfolios, within the logic of Embrapa's knowledge production, are connected with the actions carried out by its Research Units in the different Brazilian regions.

However, research is also affected by institutional contingency. The resources for Research, Development and Innovation were reduced in the public budgeted 2018/2019. This fact has a direct impact on the research agenda and there will be compromise of projects in progress and future projects. Embrapa's

¹ Values related to December 30, 2016: US\$ 1.00 corresponded to R\$ 3.2585. (Taxa..., 2016).

Macroprogram 6, which includes projects aimed at strengthening the family farming initiatives, was closed at the end of 2017. These events compromised the development of a series of activities that supported, with technologies, family farmers in the context of the generation of income, productivity and inclusion. Other programs and projects on the research agenda aimed at inclusion or income generation continue, among them Produção Orgânica de Base Ecológica (Ecological Based Organic Production), Rota do Cordeiro (Route of the Lamb) and Balde Cheio (Full Bucket), among many, which are strategic in this context. The problem lies in the continuity and expansion of this agenda for sustainable rural development in line with public policies. Lately, reduced government investment in research entail a readjustment of the PDTI agenda at Embrapa, aiming at re-adapting it to the national reality.

Another central issue for sustainable rural development and to promote equity in the field is access to technologies developed by research institutions, the technical assistance system and rural extension. The creation of Agência Nacional de Assistência Técnica e Extensão Rural (National Agency for Technical Assistance and Rural Extension – Anater) (Brasil, 2014b), with the participation of Embrapa in management, poses the challenge of integrating the agricultural research system into the system of technical assistance and rural extension, fostering the improvement of new social technologies that support reduced social inequalities in the field. Among Anater's competences are to promote, encourage and coordinate programs of technical assistance and rural extension, with a view to technological innovation and appropriation of scientific knowledge of a technical, economic, environmental and social nature; support the use of social technologies and traditional knowledge by rural producers; promote programs and actions of a continuing nature for the qualification of technical assistance and rural extension professionals that contribute to sustainable rural development; promote the generation of new technologies and their adoption by producers. The basis for this is the strengthening of the Ater system by the permanent and continuous training of rural development agents linked to this institution, in its role of articulation with Embrapa to enable the construction of an agenda of inclusion, with a territorial approach.

Final considerations

In recent years, Embrapa's participation in various inclusive social policies related to sustainable rural development has been expanded, which has allowed the expansion of research and generation of technologies and innovations to

increase income of family farmers related to SDG 10 in its targets 10.1, 10.2 and 10.3. New advances in meeting the demands of family farming depend on the strengthening of interactions between research actions and technical assistance and rural extension. Embrapa has contributed by developing and implementing technologies and training farmers in territories with a historical record of poverty, especially in the North and Northeast. These actions are also related to SDG 1 (End poverty in all its forms and everywhere), SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture).

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Chapter 3

Embrapa's technologies in the context of reduced inequalities and of income generation

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Introduction

This chapter addresses target 10.1 of Sustainable Development Goals 10 (SDG 10) – By 2030, progressively achieve and sustain income growth of the bottom 40% of the population at a rate higher than the national average. It refers to the effort to overcome income inequality through the distribution of wealth within countries, in order to expand opportunities, especially to the most vulnerable. This goal is closely related to SDG 1, which addresses the eradication of poverty in all its forms and in all places.

Although it is not possible to precisely quantify the association between poverty and inequality within countries, it can be considered that there is a relationship between these variables, therefore, it requires coordinated efforts, with measures and solutions that can be integrated in order to minimize their effects over time. The supply of technology alone does not provide the solution to all the problems posed by these development challenges, but it is part of the set of efforts that must be considered in order to reduce inequalities in the countries. This implies the need to evaluate the Millennium Development Goals (MDG) established for the period 2000–2015 and to meet the Sustainable Development Goals (SDG) for the period 2015–2030.

Embrapa's technologies

Since its creation in 1973, Embrapa has developed technologies that contribute to increasing the income of rural producers in their farming, animal husbandry, fishing

and extractive activities. An extensive survey of the technologies developed for the family farming segment allowed to list more than 600 innovations, information that is available. Among them, 80 potential and effective Embrapa technologies and services were used to increase the income of the less favored populations (Table 1). We emphasize that the impact of the income increase of farmers, especially the poorest, is not only a result of the adoption of new technologies, but also involves a training program and the process of rural extension and assistance. Thus, Table 1 lists courses in alphabetical order referring to training programs that include good management practices, conservation, harvesting and post-harvesting of numerous agricultural products or systems. Some technologies have a direct impact on increasing productivity, for example, integrated management of rice crop in favored rainfed system. Others refer to general benefits of inclusion, such as the redesign of family-based agroecosystems in the Semiarid region. However, all the technologies and services listed in Table 1 positively influence farmers' incomes proportionately more on those with lower incomes.

Table 1. Some technological solutions and services of Embrapa related to the Sustainable Development Goal 10 (SDG 10).

Item	Embrapa's Technological Solution
1	Modular slaughterhouse for pigs
2	Adaptation to the traditional model of extraction of oleoresin from copaibeira tree
3	Green manuring and no-tillage in agro-ecological-based systems
4	Peanut – management of irrigation and grain quality of the peanut crop in the Cerrado
5	Branching ring
6	Araticum – breaking seed dormancy
7	Storage of <i>Crotalaria juncea</i> seeds
8	AcessoNutri – Remote Nutrition Advisory Service for Small Ruminants
9	Baculovirus for soybean: biological insecticide for the control of soybean caterpillar (<i>Anticarsia gemmatalis</i>)
10	Underground dam
11	Colorful beijus made with fruits and vegetables
12	Good harvest and post-harvest practices of cupuaçu
13	Bovemax – biological insecticide
14	Solar collector for disinfestation of substrates
15	Clarified cashew jam

To be continued...

Tabela 1. Continued.

Item	Embrapa's Technological Solution
16	Agroforestry consortium for the production of cupuaçu (<i>Theobroma grandiflorum</i>), Brazil nuts (<i>Bertholletia excelsa</i>) and seeds of peach palm (<i>Bactris gasipaes</i>)
17	Social construction of markets: planning and installation of family farming fair
18	Creation of tambaqui in excavated tank
19	Caring for male sheep to improve the fertility of sheep herds
20	Care in the dry period of cows in a milk production system
21	Rice cultivars for favored and irrigated rainfed areas
22	Cultivation of cassava for the Cerrado
23	Cultivation of passion fruit in greenhouse
24	Spatial distribution course and stand to maximize banana productivity
25	Course of organic production of vegetables
26	Course of new technological focus of coexistence with the Semi-arid region
27	Face-to-face dehydration and fruit crystallization course
28	Course on agroforestry systems: financial viability analysis
29	Course on organic animal production systems
30	Course on agroecological zoning of small rural property
31	Course on coconut cultivation
32	Course on fertilization of guaraná
33	Course on ecological pest management
34	Easy cost – integrated producer
35	Chemical hoe for manual control of invasive plants
36	Adequate spacing and density for the cultivation of cowpea in Amazonas – BRS Caldeirão and BRS Novaera
37	Structuring and strengthening of the family agroindustry in the production of fruit pulps for commercialization and self-consumption
38	Structured fruits
39	Manufacture of passion fruit structure
40	Biological nitrogen fixation in soybean crop in Cerrado region
41	Implantation and management of forests in small farms
42	Innovation in the agroindustry of artisanal rennet cheese for family farming
43	Solar irrigator
44	Lamb selection kit
45	Agroecological management of soil
46	Integrated management of rice crop in favored rainfed system

To be continued...

Tabela 1. Continued.

Item	Embrapa's Technological Solution
47	Management for sustainable extractivism of pequi (<i>Caryocar brasiliense</i>)
48	Stripper Rice Harvester
49	Crab Bean Harvester
50	Bean harvesting machine
51	Improvement of the native field by fertilization and introduction of forage species
52	Methodology to support the sustainable development of family farmer communities
53	Fast multiplication of cassava propagation material
54	Vacaria mutation in sheep
55	Bacterial inoculants
56	Center of excellence in bovine genetics for bull races - PoloGen
57	Process of application of edible coating and packaging for the conservation of minimally processed peach palm heart
58	Process of extraction of passion fruit seed oil
59	Process of preparation of green maize of minimally processed Ag 1051 normal endosperm
60	Process for obtaining peppercorns and using a dryer developed for this purpose
61	Production of organic compost
62	Production of jelly based on carnauba fruit
63	Production of cassava seedlings by rapid multiplication in budding chambers
64	Integrated production of common bean
65	Recommendation of table cassava cultivars, with white pulp roots, for Cerrado conditions
66	Recommendation of dates for the planting of rice (<i>Oryza sativa</i>) in the south of the State of Maranhão and microregion of Chapadinha
67	Recommendations for breeding dairy heifer
68	Technical recommendations for soil conservation management in no-tillage system in the Cerrado
69	Redesign of family-based agroecosystems in the Semiarid region
70	Solar drying for the production of dehydrated fruit in a traditional community of the Pantanal
71	Manual seed drill for no-till corn and bean
72	Consortium system with cassava
73	Sheep breeding control system
74	Ora-pro-nobis cultivation system (<i>Pereskia</i> sp.)

To be continued...

Tabela 1. Continued.

Item	Embrapa's Technological Solution
75	Mango tree production system
76	Araucaria production system
77	Sistema Filho – fruit growing integrated with crops and vegetables
78	Agroecological and agro-ecosystem systems for the Southeast region
79	Software for efficient use of water and irrigation economics in crops in the Cerrado
80	Organic coffee production system

Note: The technologies available in Table 1 and referenced in the Embrapa Portal Information System may undergo changes at any time and be unavailable. Embrapa's official data repositories: [Technological Solutions](#) and [Library](#).

In addition to the mentioned technologies, the following are highlighted in detail: those that have great potential to contribute to reduced social inequalities and that have been appropriated by the most de-capitalized portion of the national agriculture, since they have generated greater impact in terms of breadth and number of beneficiaries of low-income family farm in the Legal Amazon, the Northeast and the Midwest, the Southeast and the South. Some examples are the management of acai palms, with a large territorial dimension and impact on the income generation of the riverside inhabitants of the Amazon, Balde Cheio (Full Bucket) project for dairy cattle raising, which covers all Brazilian biomes, the structure of goat breeding and sheep farming in the Northeast and sheep farming in the South, the cashew nut minifactories and clones of dwarf cashew tree in the Northeast. The results of these projects benefit a large part of rural establishments in low-income family farmers.

Management of acai palm and other Amazonian species

A series of studies related to the domestication of extractive resources of native Amazonian species has been developed over the last decades, especially involving independent partnerships between Embrapa Eastern Amazon and Museu Paraense Emílio Goeldi. The aforementioned assertion can be proven with the results of the research related to the management of acai palms adopted by the community that lives by the mouth of the Amazon River, the so-called *ribeirinhos*. These researches were initiated in the 1980s by Embrapa Eastern

Amazon researchers, Oscar Lameira Nogueira, and the Emilio Goeldi Paraense Museum, Anthony B. Anderson and Mario Augusto G. Jardim, and later with the participation of Embrapa Amapá. This knowledge was improved, which coincided with the popularization of acai consumption in Brazil from the 1990s on.

These management technologies place the acai among the ten most produced fruits in the country, with more than 1.1 million tons, yielding around 800 thousand tons of pulp. Of this production, 60% is consumed in the state of Pará, expanding the local market, which was seasonal, to be made available all year round, due to the beneficiation and freezing process. Approximately 30% of the acai is destined for interstate commerce, especially the states of São Paulo, Rio de Janeiro, Minas Gerais and the Federal District, which consume 72%. Exports represent only 10% of the pulp produced, in which three countries, United States, Japan and Australia, import 80.25%. The rest of the Brazilian acai goes to 29 countries, which indicates a great growth potential (Tavares; Homma, 2015; Tavares et al., 2017). Considering interstate sales and exports, the acai moved in 2016 over 481 million reais.

The handled areas of acai palms can be estimated at around 100 thousand hectares, and the recommendations of the survey were adopted by approximately 15 to 20 thousand *ribeirinhos*, which improved their living conditions, notably in the acquisition of durable goods, such as outboard motor, light generator, refrigerator, freezer, furniture, phones, TV, among other commodities (Homma et al., 2006; Santos et al., 2012). In Figure 1, acai fruits are shown ready to be marketed.

Photo: Ronaldo Rosa



Figure 1. Sale of acai fruits in panners, in Pará.

The growth of consumption also stimulated the planting of irrigated acai palm, by medium and large-scale producers. There are plantations with 1,400 hectares of acai palms irrigated with varieties and cultural treatments developed by Embrapa Eastern Amazon and improved by the producers, generating employment and income for the local populations.

This success of the acai palm can be repeated for other plants of the Amazonian biodiversity, especially the tucumanzeiro, with a large consumer market in Manaus, totally dependent on extractivism, without conditions to expand the supply. The bacurizeiro (Figure 2) and the Brazil nut tree (Figure 3) also represent examples of regional fruit trees; however, its management or planting is necessary to increase the supply, bringing benefits to the family farmers, besides recomposing Legal Reserve Areas and Permanent Preservation Areas.



Photo: Antônio Menezes

Figure 2. Bacuri fruits.

For the consolidation of the production of acai in the Amazon region, the challenges relate to the generation of technology, market size, environmental and land pressures and institutional organization.

For many plants, the cultivation of some stage of the production process is quite difficult to adapt to mechanized processes. This is the case of rubber extraction from the rubber tree, the harvest of the acai, cupuaçu, cocoa, peach palm, Brazil nut, taperebá, pepper, mangosteen, palm, guava, banana, vegetables, among others. It is possible that advances will occur in the future, as in the case of oil palm tree and acai palm. Figure 4 shows cultivated Brazil nut trees.



Figure 3. Brazil nut almonds.



Figure 4. Brazil nut cultivation area in Itacoatiara, in the Amazon.

Labor is a challenge for family farmers, since middle and large producers, by reasons of labor and social security legislation, are avoiding labor-intensive activities. There is a set of inventions that would enable family farmers activities and increase their productivity, but agricultural implements companies have not yet been aware of this niche. Among these inventions or processes are the improvement of assai threshing, acai harvester, nut peeling, Brazil nut hedgehog crusher, murumuru, tucumã and babassu, bacuri and tucumã pulp extractor, manual extraction press for the extraction of boiled andiroba seed oil, among dozens of others.

Other possibilities for reduced inequalities in the Amazon region through new processes and techniques are the new labor-intensive markets. This market could generate jobs and income, such as: the dehydration of jambu leaves; the improvement of the production of acai and tucupi powder; the utilization of the acai seed, shell of cupuaçu, bacuri, among others. Other possibilities are the production of vegetables and fruit trees in the region, since a great amount of these products is imported from the South and Southeast regions to supply the metropolis of the Amazon region. These products can be grown in the region itself.

Full Bucket project

Full Bucket project applies some pre-analytic choices proven to be robust enough to promote change in productivity and income of producers in all regions and Brazilian biomes. It is a technology transfer project focused on intensive, sustainable and efficient dairy farming with an innovative approach. Full Bucket involves a succession of continuous trainings of technicians using a small-scale family dairy farm as a “practical classroom”, where proposals are debated and adapted to the particular situation of that property and finally implemented. The results have been consistent throughout the course of the project, which completed 20 years of operation in 2017. The properties used as a practical classroom are now known as Demonstration Units (UD), and the other properties are now called Assisted Properties (PAs). The instructors’ and technicians’ expenses are paid by the local partnerships or producers. Hence, the establishment of strong partnerships (with rural extension services, associations, cooperatives, non-governmental organizations, prefectures, foundations, development agencies and, especially, autonomous professionals linked to rural extension) is fundamental.

On average, the volume of milk produced increased by 23 times (from 113 liters/day to 260 liters/day) at a time of declining trend of milk production in

the state (-8% between 2003 and 2009) (Novo et al., 2013). The increase in milk production by area and property had an effect on economic and zootechnical indicators. The trend of better performance was also observed in other datasets collected from 50 producers with at least 3 years of data monitoring in five different Brazilian regions.

Other studies in five regions where the technology has been used have indicated that the average gross margin per hectare has almost doubled. This was obtained by combining gains in different indicators, such as more milk produced (43%), using less area (-7%), with gains of 54% more in the productivity of the factor land and higher productivity per cow of the herd (24%). In addition, there was a significant improvement in labor performance (37%). The higher income per property was a result of gains in productivity rather than higher milk prices paid to producers, which in the period grew only 7% in real terms. Another interesting feature – besides the largest generation of income per property – was the generation of more jobs at the rate of 0.2 men/ha. In other words, producers who intensify production generate jobs on the farm, either by hiring more labor or preferentially by involving other family members in the productive process.

The good economic and zootechnical results obtained have created the bases for the national expansion of Full Bucket project. By 2016, the methodology was being applied in 11 states, 1,472 properties, 417 municipalities by 253 technicians in training, which characterizes a broad scope. The potential of the project is even greater, given the challenge of serving a universe of 1.3 million milk producers distributed in 99% of Brazilian municipalities, which can lead to income generation and better living conditions for family farmers.

Structuring of production chains – sheep and goat breeding

Sheep and goat farming are livestock activities carried out practically throughout the country; both with emphasis on the northeastern Semi-arid region and the Pampas region of the state of Rio Grande do Sul. Especially related to small-scale family farms, goat breeding and sheep farming in the Northeast and sheep farming in the South are present in approximately half a million rural establishments in Brazil (IBGE, 2016). The Rota do Cordeiro (Route of the Lamb) is an initiative of the Ministry of National Integration (MI) in partnership with Embrapa, which seeks to promote the development of regions producing goats and sheep through social

technology to mobilize producers and their representations, relations with the markets, the valorization of local products and the use of latent potentialities of each territory involved, as well as the contribution of infrastructure for collective use.

The Route of the Lamb is a broad and innovative proposal of Embrapa as a form of intervention, quite different from those adopted in traditional research, development and innovation (RD&I) projects. In 2012, a pilot project was started in the city of Tauá, state of Ceará, due to the importance of goat breeding and sheep farming in the producer's income, in the culture and economy of the municipality, and because of its proximity to Embrapa Goats & Sheep. It is estimated that the municipality has about 2,500 rural properties with sheep and/or goats. In 2014 and 2015, the pilot project of Tauá was marked by the following actions, involving Embrapa, MI, the Secretariat of Agrarian Development of Ceará (SDA), Department of Agriculture of Tauá, Empresa de Assistência Técnica e Extensão Rural (Technical Assistance and Rural Extension Company – Emater) and the Brazilian Micro and Small Business Support Service (Sebrae), among others:

- Selection, training and contracting of 11 multiplier technicians – 26 technicians trained by Embrapa. Contracting of three technicians of superior level and eight of medium-level) or technical follow-up of the 240 beneficiaries.
- Monthly technical follow-up of each of the beneficiaries for 18 months.
- Field days for the training of the beneficiary producers and other stakeholders within the districts served in the municipality of Tauá, CE.
- Training of producers, with the support of Sebrae, in direct collective purchases and sales and formation of Business Center.
- Support for the organization of monthly animal fairs for slaughter or reproduction.
- Construction and use of Collective Termination Center and Training Field for forage production and storage.
- Installation of two Technical Reference Units, in properties selected according to technical criteria and with the consent of the other beneficiary producers.
- Consultation workshops for evaluation and future perspectives of the Route of the Lamb in Inhamuns, CE, consultation workshop for the definition of a breeding program based on local genetics.

In 2014, the pilot project reached its peak and, due to the success of the implementation, the Ministry of National Integration Order 162/2014 (Brasil, 2014) was formulated and issued, instituting Integration Routes, public policies oriented to local productions and networks of productive arrangements with the potential to assist in regional development, with the creation of new route such as Honey, Fish, Milk and Acai.

The agreement, which involved MI, Embrapa, Associação Brasileira de Criadores de Ovinos (Brazilian Sheep Breeding Association – Arco) and the Ministry of Industry, Foreign Trade and Services (MDIC), established 13 priority poles for action. This agreement made it possible to concentrate efforts on territories that cover approximately 41% of the sheep herds and 61% of the country's caprine herds and certainly more than 50% of the properties that exploit these species, since the area is in areas characterized by small herds of up to 60 animals. The 14 poles currently developed include 203 municipalities in total.

For action in other poles, the proposal received profound changes in Stage II of Route of the Lamb. An approach based on the Sistemas Agroalimentares Localizados (Concept of Localized Agri-Food Systems – Sial) was adopted as strategy. Embrapa's performance in Stage II is linked to projects approved in some territories, such as the project Utilização do Enfoque de Sistemas Agroalimentares Localizados como uma Estratégia de Desenvolvimento Rural Sustentável para o Sertão dos Inhamuns, Ceará (Use of the Approach to Localized Agri-Food Systems as a Sustainable Rural Development Strategy for Sertão dos Inhamuns, Ceará). The implementation is in the Inova Social scope, projects funded by Brazilian Development Bank (BNDES), which involves the Poles of Inhamuns, Integrated Paraíba/Pernambuco Hub and Alto Camaquã Hub (Pampa Gaúcho). These projects are in line with the strategies of the Route of the Lamb, which, as a program, negotiates, with several institutions, the connection of its specific projects with the poles portfolios.

Embrapa has proposed to act in strategic territorial intelligence, in the training of multipliers, in research and innovation involving social technologies, in the research of territorial products and in their recognition, in the search to favor the greater autonomy of the poles and the sustainability of regional development projects. In the Northeast, two technologies had a strong impact on the income increase of family farmers, the cashew nut minifactories and the development of clones of cajueiro-anão-precoce.

Minifactories of cashew nuts and clones of early dwarf cashew trees

The technology of the cashew nut minifactories arose from the need to insert small and medium-scale artisan producers of cashew nut almonds in the national and international markets through associations, cooperatives and their representations, adding value to the product and generating employment and income throughout the cashew production chain. The experiment was carried out in ten municipalities of Ceará, in five settlements (Aroeira Vilany, Che Guevara, Zé Lourenço, Novo Horizonte e Redonda) and six communities (Cemoaba, Justiniano de Serpa, Sambaiba, Guajiru, Caiana, Pascoal). A central cooperative was established to receive and commercialize the minifactories' production. It brought a radical change in the concept of processing cashew nuts in the Northeast (Os frutos..., 2010). Even today there are domestic family units that process the product without observing the principles of quality and safety of food, attributes that must be incorporated into the methods linked to the knowledge and practices of tradition and cultural memory. A mode of artisanal production inherited from the indigenous peoples who inhabited the region.

In 2001, Embrapa enrolled the Cashew Minifactory Technology – Multiple Agroindustrial Module for Processing and Marketing of Cashew Nut Almonds in Social Technology Award of the Banco do Brasil Foundation (FBB), and it was the winner. Embrapa then started a partnership with FBB, which engaged in the effort to disseminate this technological alternative. Ceará, the largest Brazilian cashew producer, was the first state to implement the project, since it has several minifactories and also for hosting the Centro Nacional de Pesquisa de Agroindústria Tropical (National Center for Tropical Agroindustry Research – CNPAT), and this Center of Embrapa was the promoter of this technology.

The development of early dwarf cashew tree – Clone BRS 226 (early dwarf cashew tree) technology – was launched in 2002 as part of Embrapa Tropical Agroindustry's Improvement Program (Paiva et al., 2002), for the Semiarid region of Piauí. BRS 226 is cultivated in the rainforest, with its production of chestnut and peduncle marketed in the table and almond markets (Figure 5). According to Paiva et al. (2002), 1 ha of BRS 226 at 3 years of age can provide 470 kg of cashew per year. An important benefit of dwarf cashew tree is the possibility of manual harvesting due to the low plant height, allowing the peduncle to be commercialized for the production of cashews, juices, sweets and other products that increase the producer's income.



Figure 5. Early dwarf cashew tree – BRS 226 clone.

An important feature of the BRS 226 clone is its resistance to low water supply in periods of long droughts and resinosis, a disease caused by the fungus *Lasiodiplodia theobromae* (Pat.) Grig., which reduces the production of cashew plants. The early dwarf cashew tree clone Embrapa 51 was launched by Embrapa Tropical Agroindustry for commercial planting in rainfed cultivation in the Semiarid region. In addition to being resistant to resinosis, one of the major diseases affecting the species, in recent years the cultivar has shown to be quite resistant to drought. Another advantage is that the crop occurs almost uninterrupted for up to 10 months because the fruit development stages occur simultaneously. The average productivity of Brazil nuts in the rainy season in the sixth year of production is 1,255.6 kg/ha (Barros et al., 2000). The percentage of broken almonds in the cut is 1.3% and whole almonds after skimming is 85% (Barros et al., 2000). Embrapa 51 is resistant to anthracnose and moderately resistant to black mold (Cardoso et al., 1999).

Final considerations

The use of technologies to reduce inequalities presented here contributes to achieving the objectives of sustainable development in the scope of social

inclusion and reduced inequalities. These actions are oriented to the development and adaptation of technologies in plural scenarios of the Brazilian rural space. They are innovative, shared solutions and many of them are created together with family farmers.

The development of technologies and innovations, as well as the actions of capacity building and technology transfer, have characterized Embrapa's performance, especially to serve the North and Northeast regions, which have the highest poverty rates.

Management actions aimed at increasing income led to the structuring of technological networks with a potential to contribute to reduced social inequalities. Less capitalized and more vulnerable social groups participate in these networks, constituting a significant number of beneficiaries of low-income family farming in the Legal Amazon and in the Northeast. Some examples are the management of acai palms, with a large territorial dimension and impact on the income generation of the riverside inhabitants of the Amazon, Full Bucket project for dairy cattle raising, which covers all Brazilian biomes, the structure of goat breeding and sheep farming in the Northeast and sheep farming in the South, the cashew nut minifactories and dwarf cashew tree clones in the Northeast.

New programs, such as Inovasocial, initiated in 2018, whose target audience are traditional peoples and communities, and the Projeto Integrado para a Amazônia (Integrated Project for the Amazon), have a strong training and inclusion component through increased income.

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Chapter 4

Research, technology transfer and innovation for social inclusion

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Introduction

One of the major national challenges is to promote social, economic and political inclusion, regardless of race and ethnicity through research and technology transfer actions. This chapter especially adheres to target 10.2 of Sustainable Development Goal 10 (SDG 10), by 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion, economic or other status. In addition to being related to SDG 10, these actions fit in the context of Embrapa's array Building and Exchanging Knowledge for the Sustainable Development of Traditional Peoples and Communities Arrangement (ConPCT). It has strong adherence to SDG target 15.1, since Embrapa's research, development and innovation actions with traditional peoples and communities strengthen compliance with commitments to international agreements aimed at the conservation, recovery and sustainable use of terrestrial and aquatic ecosystems. Of particular notes are the agreements of Convention on Biological Diversity (CBD) and International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), since the projects developed in this field have actions directly related to the use and sustainable management of native and cultivated biodiversity, with a deepening of the studies and transfer of technologies on agrifood alternatives of these products.

In addition, it contributes to international agreements related to water, including Mercosur Environment Framework Agreement (Mercosul, 2001), United Nations Convention to Combat Desertification (UNCCD) and/or Desertification-affected Countries (Brasil, 2020) and *Ministerial Declarations of the World Water Forums II, III and IV* (2000, 2003 and 2006 respectively) (Brasil, 2018) through projects with farmers' communities, riverine communities, artisanal fishermen, coastal and archipelago inhabitants in the Amazon region, and as of the peoples living in the Brazilian Semiarid Region and Cerrado (Principais..., 2014). It contributes to SDG 13 (Take urgent action to combat climate change and its impacts), especially target 13.3. In this context, the ConPCT Array projects contribute by identifying

strategies for coping with climate change, such as resilient agricultural systems, as well as strengthening initiatives by farmers to protect native seeds by promoting in situ/on farm conservation of genetic resources, among others. It is also worth mentioning its interface with SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture), specifically in the goals of reducing hunger and promoting food security, in which several ConPCT Array projects promote the exchange of knowledge to increase agricultural productivity and income generation.

Rural diversity in the context of traditional peoples and communities and productive inclusion

A strong social and cultural diversity characterizes the Brazilian countryside. Those human populations framed as indigenous peoples and traditional communities are among the most affected by diverse social problems, related and derived from food insecurity (high infant mortality, malnutrition and more recently obesity). Many live in territories with area below their needs, facing problems from agrarian conflicts. In the past 2 decades, traditional peoples and communities have sought to strengthen their community organizations and thus demand more appropriate policies from the federal government.

This diversity refers to different ways of appropriating natural resources and their legal recognition, which characterize the so-called “traditionally occupied lands”, the common use of forests, water resources, etc. Fields and pastures appear combined with ownership and possession, either perennial or temporary, and involve different productive activities carried out by family labor units, such as extractivism, agriculture, fishing, hunting, handicrafts and livestock (Almeida, 2008). According to this author, to have an order of magnitude of these specific territorialities, which cannot be read as “isolated” or “incidental”, of the 850 million hectares in Brazil about a quarter does not fit the categories “establishment” and “rural property”. That is, around 12% of the Brazilian surface or approximately 110 million hectares correspond to about 600 indigenous lands. The lands of *quilombolas*, according to official estimates, correspond to about 743 communities in 30 million hectares. Add to the lands of indigenous and quilombolas the territories where more than 20 peoples and traditional communities live.

Traditional peoples and communities have different forms of appropriation of land traditionally occupied by their ancestors, involving collective property

(*quilombolas*), permanent possession (indigenous), common temporary use, but repeated in each crop (cocoa-babassu breakers), collective use (faxinalenses), the common and open use of water resources and other concessions of use, such as commodate (gypsies) and the overlapping of traditional territories with environmental preservation units (Pomeranians, *quilombolas*, natives and others). Many of these traditional social segments still do not have legal-format apparatus (decrees, normative instruments) and technical itineraries to ensure territorial regularization. Many traditional communities have used sustainable development reserves, extractive reserves and even agrarian reform settlements, among other modalities, as a way of maintaining part of their traditional territories and their traditional way of life.

Historically these peoples have had their cultural diversity made invisible, lacking an adequate policy of education, health and especially of promoting food security in their territories.

The visibility of traditional peoples and communities has gained official status only with Decree 6,040, which establishes the Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais (National Policy for the Sustainable Development of Traditional Peoples and Communities – PNPCT) (Brasil, 2007). By this policy, traditional peoples and communities are understood as culturally differentiated groups that recognize themselves as such, have their own forms of social organization, occupy and use territories and natural resources as a condition for their cultural, social, religious, ancestral and economic reproduction, using knowledge, innovations and practices generated and transmitted by tradition. The PNPCT urged the federal public institutions to focus efforts to promote the sustainable development of traditional peoples and communities, with an emphasis on recognizing, strengthening and guaranteeing their territorial, social, environmental, economic and cultural rights, with respect and appreciation of their identities, their forms of organization and their institutions.

In accordance with this policy, the Conselho Nacional dos Povos e Comunidades Tradicionais (National Council of Traditional Peoples and Communities – CNPCT) (Brasil, 2016) recognizes different categories of traditional peoples and communities: andirobeiras, sempre-viva flower gatherers, caatingueiros, caiçaras, castanheiros, mangaba pickers, gypsies, cipozeiros, extractivists, faxinalenses, fundo e fecho de pasto, geraizeiros, ilhéus, indigenous, isqueiros, morroquianos, pantaneiros, artisanal fishermen, piaçaveiros, pomeranos, povos de terreiro, breaks of coco babassu, *quilombolas*, retireiros, ribeirinhos, seringueiros,

vazanteiros, veredeiros. The CNPCT has also alerted to the serious problems of social inequality of the traditional peoples and communities in relation to the rest of Brazilian population and has demanded the strengthening of social inclusion actions of these peoples.

Currently, Brazil has important legal frameworks to guarantee differentiated process of productive inclusion of traditional peoples and communities that are added to Decree 6,040/2007, such as Law 11,326/200 (Brasil, 2006), which establishes the guidelines for the formulation of the Política Nacional de Agricultura Familiar e Empreendimentos Familiares Rurais (National Policy on Family Agriculture and Rural Family Enterprises), and Law 12,188/2010 (Brasil, 2010a), which instituted the Política Nacional de Assistência Técnica e Extensão Rural (National Policy on Technical Assistance and Rural Extension – Pnater) and the Programa Nacional de Assistência Técnica e Extensão Rural na Agricultura Familiar e na Reforma Agrária (National Program for Technical Assistance and Rural Extension in Family Agriculture and Agrarian Reform – Pronater).

According to Dias et al. (2016), this inclusion promote the production of healthy food, income generation and food security and food and nutritional sovereignty, always taking into account the traditional knowledge of traditional peoples and communities. This knowledge accumulated over generations through socio-cultural observations, experimentation and adaptation is rich and needs to be incorporated into the construction of scientific knowledge through the elaboration of interactive, dialogic and constructivist strategies to ensure the advancement of science in the context of the challenges of sustainable development.

Despite the recent legal advances, much still needs to be done to meet the historical claims regarding the productive inclusion of the different traditional peoples and communities segments. In this context, in addition to the legal instruments mentioned above, a set of other policies, such as The Política Nacional de Segurança Alimentar e Nutricional (National Policy on Food and Nutrition Security – PNSAN) (Brasil, 2010b) and the Política Nacional de Gestão Ambiental e Territorial Indígena (National Policy on Environmental and Territorial Management of Indigenous Lands – PNGATI) (Brasil, 2012), identify the need to foster research actions and technology transfer in support of the productive activities of the traditional peoples and communities. These actions should recognize and value the knowledge and practices locally built by these communities and foster the dialogue of scientific and traditional knowledge in the construction of knowledge.

Seeking an adaptation of the processes of generation of research and availability of social technologies for traditional peoples and communities audiences, Brazilian Agricultural Research Corporation (Embrapa) has historically been developing several projects with multiple partnerships to meet the demands of indigenous communities, *quilombolas* and other categories of peoples and communities. These actions seek to improve the quality of life, food and nutritional security, conservation of agrobiodiversity and territorial planning, as well as provide reflection on ethnodevelopment and ethnoscience that fit and respect the generation of locally constructed knowledge in the dialogue format of knowledge, aiming, among other things, to reduce social inequalities.

Embrapa, indigenous peoples and traditional communities

In 1994, the indigenous people Krahô sought Embrapa's seed conservation chambers to rescue lost corn varieties. The meeting culminated in a partnership that influenced pioneering actions at Embrapa related to the Convention on Biological Diversity (CBD) regarding the authorization of access to genetic resources and associated traditional knowledge. In this context, an agreement was reached between Embrapa and Fundação Nacional do Índio (National Indigenous Peoples Foundation – Funai), which culminated in the signing of General Cooperation Agreement in 1997 and later a contract between Embrapa and Kapey Indigenous Association (representative of the Krahô people). Dias et al. (2015) present a detailed history of Embrapa's approach to Funai in the context of indigenous food security. It indicates that Embrapa, in conforming to the current national legislation, built in 2004 the first Brazilian prior consent (prior authorization of the Krahô for collection actions and access to associated traditional knowledge).

In 1997, Embrapa and the Secretariat of Policies for the Promotion of Racial Equality of the Presidency of the Republic signed a technical cooperation agreement involving research and technology transfer actions for sustainable productive inclusion in traditional communities of African origin. In 2003, Embrapa, together with other governmental organizations, participated in the structuring and implementation of Programa Nacional de Fortalecimento da Agricultura Familiar (National Family Farming Development Program – Pronaf), where traditional peoples and communities are included. In that same year, an extensive process of consultation with indigenous communities was held to

support the formulation of public policies (Brasil, 2006), within the framework of Intersectoral Commission on Indigenous Health, in which several ministries were involved. This action culminated in the creation of Fome Zero (Zero Hunger) project and the Sustainable Development Project in Indigenous Communities (known as Indigenous Portfolio), a process in which Embrapa had an important participation in its implementation (Dias, 2007).

In 2004, the *I Encontro dos Técnicos da Embrapa (1st Embrapa Technicians Meeting)* was held in Brasília, with technicians who worked with indigenous peoples and traditional communities, indicating the importance of further developing the methodological aspects and fostering multidisciplinary projects in the context of ethno-cognition. In 2005, Embrapa carried out a survey to identify the company's actions with indigenous peoples, at which time 39 units were identified in 20 indigenous territories (Udry et al., 2015).

In 2006, a survey was carried out with Embrapa Units that worked with this segment, identifying 94 in execution (Udry et al., 2015). In the same year, a working group was created composed of researchers and analysts from Embrapa (Embrapa, 2006) to organize the event: Ethnoscience in Agricultural Research. This event was held in December 2006 at Embrapa Headquarters (*Ethnoscience and Agricultural Research Meeting – Knowledge Dialogue*), which was attended by researchers from 21 Embrapa Units and representatives from five universities, two research institutes both national and international, four public agencies, four civil society organizations of public interests (Oscips), seven traditional communities and 13 representations of indigenous peoples (Dias, 2007). The institutional adequacy of Embrapa for work with traditional communities and indigenous peoples implied the formalization of agreements and the following referrals: 1 – Promote and/or foster training in ethnoscience; 2 – Disseminate legislation relevant to the topic; 3 – Create a virtual internal network for employees interested in the theme; 4 – Improve the relationship and/or discussion with programs related to family farming and traditional peoples and communities; 5 – Promote internal discussion on terms related to the topic; 6 – Enable the hiring of externa consultants specialized in the subject; 7 – Promote broad discussion on appropriate models of technology transfer; 8 – Strengthen relations with strategic partners within the federal government; 9 – Create a working group at Embrapa to form a Reference Framework for Ethnoscience, which will allow the institutionalization of the theme and contribute to the discussion of Embrapa's Executive Plans.

In 2007, in order to meet these demands, in particular the last one (9), a Ethno-cognition Working Group (WG) was appointed by Embrapa researchers and technicians (Embrapa, 2007) to diagnose and propose guidelines for the organization of research, development and innovation (RD&I) actions and technology transfer (TT) of Embrapa with traditional peoples and communities. The report "Ethnic Knowledge: Organization of Embrapa research, development and innovation actions and technology transfer related to traditional peoples and communities" prepared by the WG, was sent to Embrapa's Technology Transfer Executive Board, in December 2007, which included: the contextualization of actions related to ethno-cognition in the international, national and Embrapa environment; the contributions for insertion of themes related to indigenous peoples and traditional communities in the agenda of Embrapa's strategic and operational discussions; the contribution to foster the elaboration and implementation of projects that meet the demands of these peoples and communities; and the proposition of institutional forms that favor the adequate reception of demands and the processing of projects, in accordance with the requirements of the specific laws in force.

Also in 2007, the event *Ethnoscience and Agricultural and Forestry Research of the Amazon Meeting* was held in Rio Branco, AC, as a result of the 2006 Ethnoscience meeting, where legal and methodological issues and project exchange actions were discussed in different areas of Embrapa researchers, partner institutions and indigenous and traditional communities. This event was attended by Embrapa professional and representatives of CNPCT, which is responsible for coordinating and monitoring the implementation of the National Policy for the Sustainable Development of Traditional Peoples and Communities, established by Decree 6,040/2007 (Brasil, 2007).

In 2013, an update of the surveys on Embrapa's involvement with traditional peoples and communities was carried out. A questionnaire was applied in the 47 Embrapa Units, seeking to identify the projects/activities with their respective social groups and the main bottlenecks and challenges (Udry et al., 2015). This survey indicated the need to broaden research on the work with traditional peoples and communities at Embrapa in response to the demand and the political institutional context of the country. In addition, a survey was carried out in 2015 in Embrapa's Programming Management System, in which more than 100 researchers related to the research topic with family farmers, indigenous peoples and/or traditional communities were identified (Udry et al., 2015).

In 2016, Embrapa and National Institute of Historical and Artistic Heritage (Iphan), with support from the Food and Agriculture Organization of the United Nations (FAO), signed a technical cooperation agreement to enable the implementation of the Globally Important Agricultural Heritage Systems (GIAHS), opening up wide possibilities of research for identification and recognition of traditional agricultural systems.

That same year, Embrapa was invited by the Attorney General's Office in Amazonas to discuss the adaptation of the regionalized supply of school meals in the state of Amazonas, especially the Yanomami people. Because of this action, a technical note was prepared for the development of a Guidance Manual that should contain both the operationalization, the quality issue, the prioritization of the purchase of family farming products (including traditional peoples and communities) and the provision of accounts.

Add to these initiatives Embrapa's participation in committees and councils related to traditional peoples and communities as: Food and Nutrition Security (Consea), Rural Development (PCT commissions of National Council for Sustainable Rural Development– Condraf), Agroecology and Organic Production (WG of Socio-biodiversity of the National Commission of Agroecology and Organic Production – Cnapo), among others, all with guidelines related to traditional peoples and communities.

Research on ethnoscience and other actions with traditional peoples and communities at Embrapa have made advances in the scientific and local development context such as: building strong local partnerships in territories of peoples previously inaccessible to national agricultural research with authorization for the collection of genetic resources (Krahô, in Tocantins, Xingu Indigenous Park, in Mato Grosso, Kaxinawá, in Acre and Kulina, in Acre); recognition of the institutional role in promoting food and nutritional security (indigenous peoples of Roraima); the creation of public policies for the conservation of natural resources and ways of life of disappearing social groups; the subsidy of Chico Mendes Institute (ICMbio) and The Instituto Nacional de Colonização e Reforma Agrária (National Institute of Colonization and Agrarian Reform – Incra) in the studies of the implementation of extractive reserves and agroextractivist settlements; the participatory mapping of natural areas and traditional communities in Brazil; the contribution to gender equity by encouraging the political and economic action of the extractivist peoples. Figures 1 and 2 show images of joint researcher and indigenous farmer work and field course on banana management.



Photo: Valdemar de Sousa Silva

Figure 1. Knowledge exchange meeting (researcher and indigenous farmer) in Barra village.



Photo: Terezinha Dias

Figure 2. Field course on banana management, with distribution of seedlings resistant to blak sigatoka.

RD&I strategy and reduced social inequalities: ConPCT Array

About 43 Embrapa experiences in research, innovation and technology transfer with traditional peoples and communities can be accessed in Dias et al. (2016). Due to the growing demand of this segment, eager to access new knowledge that promotes its sustainable development with income generation, the national social and political scenarios indicated the need for Embrapa to organize and centralize the actions related to the theme. In that sense, in 2017, Building and Exchanging Knowledge for the Sustainable Development of Traditional Peoples and Community Array (ConPCT) was institutionalized as one of Embrapa's project organization structures.

The array will bring together convergent, complementary and synergistic projects organized to meet the priority challenges with traditional peoples and communities. This array counts on the participation of 17 Embrapa Units and several projects related to the territories of indigenous peoples and traditional communities. A consultation with these 17 Units in 2017 indicated the existence of 19 effective projects. These projects have supported communities to reflect on the use of their territorial spaces and especially on their strategies of food and nutritional security.

ConPCT's biggest challenge is to reduce social inequalities in the context of traditional peoples and communities. It aims to promote innovation actions among traditional peoples and communities that contribute to identify, characterize and value traditional systems for the use, management and conservation of natural resources that contribute to food and nutritional security with a territorial focus, guaranteeing sustainable ways of life. In this context, its goals are:

- Guide the processes of research, development and innovation related to ethnosciences, valuing interculturality, articulation and the exchange of scientific knowledge with traditional knowledge.
- Promote research, exchange and construction of knowledge with traditional peoples and communities related to their territories as well as socially construed cultural landscape as living spaces, with knowledge related to agriculture, use and conservation of natural resources.
- Promote research, exchange and construction of knowledge aiming at identifying the main aspects related to the regeneration capacity and

resilience of agroecosystems of traditional peoples and communities in the face of climate change.

- Identify, systematize and value the systems of classification, management and conservation of natural resources related to the practices of traditional peoples and communities, with a view to promoting inter-ethnic interchange and dialogue.
- Contribute to the solution of problems related to food, health and the conservation of agrobiodiversity in territories of identity of traditional peoples and communities, through studies on local knowledge systems, strategies and practices of food and nutritional sovereignty and security, as well as new alternatives for income generation.
- Contribute to the processes of elaboration, implementation, monitoring and evaluation of public policies related to traditional peoples and communities.
- Promote the local economy and the social construction of markets, from the identification and characterization of local production/distribution circuits and reciprocity relations in the commercialization and exchange experiences of traditional peoples and communities, and the creation and strengthening of spaces of interaction.
- Promote the establishment of interinstitutional arrangements, national and international, with a view to hosting and streamlining the FAO's Important Agricultural Heritage Systems (GIAHS), in order to act in accordance with the objectives of the 2002 *World Summit for Sustainable Development*.
- Expand Embrapa's capacity for institutional action with traditional peoples and communities through the qualification of Embrapa professionals and partners, including agents of technical assistance and rural extension (Ater), based on teaching-learning processes based on the ecology of knowledge, popular education, interculturality and interciency.

These goals guide research, development and innovation with traditional peoples and communities at Embrapa, indicating to the institution itself, and in an expanded way, the commitments of the Brazilian government to this social segment, establishing connections with locally built knowledge and practices to challenges of reducing social inequality. One of the initiatives was the organization by Embrapa of a collection that addresses conceptual and practical issues related

to traditional peoples and communities work, including the reports of Embrapa experiences in the dialogue format of knowledge (Udry et al., 2015; Dias et al., 2016).

Challenges in social inclusion of traditional peoples and communities

Traditional peoples and communities have been sidelined from national rural development strategies, and their practical knowledge and locally constructed expertise are considered synonymous with technological backwardness. Emerging from a long process of internal reflection, Embrapa has sought to adapt to the international scenario in the agreements that Brazil signed and ratified (CBD and ITPGRFA) and national policies aimed at its implementation (biodiversity law) and those originating from the demands (Brasil, 2007), among others.

Among several challenges in the context of social inclusion of traditional peoples and communities are the participatory construction of projects that consider: a) strengthening of cultural identity and autonomy of traditional peoples and communities; b) recognition of territories as traditional peoples and communities identity spaces, including their contribution to the conservation and sustainable use of natural resources, as well as the valorization and visibility of socio-cultural and heritage diversity; c) economic and social recognition of traditional peoples and communities in the maintenance of environmental services provided, such as pest and disease reduction, phytosanitary control; d) food security and sovereignty of traditional peoples and communities considering their practices and ways of life; e) consolidation of social capital through the sharing of information and decisions, empowerment of local actors, co-responsibility, strengthening of ties in the community and external partners; and f) contextualized training of technicians related to rural development to act in the management and territorial management areas of traditional peoples and communities.

Final considerations

In the cultural diversity of the Brazilian countryside, traditional peoples and communities stand out as the most impoverished portion. In the challenge of reduced inequalities, recent public policies seek to increase the visibility of these peoples and stimulate actions that reduce food insecurity.

Aware of this scenario in the context of the generation of research and the availability of social technologies, Embrapa approved ConPCT Array and supported the editorial production of the Traditional Peoples and Communities Collection, aiming to stimulate its researchers to report on the challenges of Brazilian cultural and social diversity. This recent publication brought together in 43 chapters the actions of participatory research that have been developed by its researchers that stimulate productive activities, empower and promote social and economic inclusion, as well as political reflection on cultural and ethnic diversity, regardless of age, gender, disability, race, ethnicity, origin, religion or economic condition. Embrapa's greater involvement with traditional peoples and communities also contributes to the fulfillment of several international commitments related to cultural diversity and productive inclusion, contributing to the sustainability of environmental niches and traditional agricultural systems that are still well preserved. By making public these realities, the Embrapa also meets the demands of the international commitments agreed by the Brazilian government, bringing more support to people not seen before. In the context of the productive inclusion of these peoples, Embrapa poses a major challenge for the participatory generation of technologies and services that promote the aggregation of environmental and cultural value to products generated in traditional peoples and communities territories, especially those of local socio-biodiversity.

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Chapter 5

Public policies for sustainable rural development and Embrapa's participation

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Introduction

This chapter addresses some of the public policies and specific legislation that guided Embrapa's research and contributions to the achievement of target 10.3 of the Sustainable Development Goal 10 (SDG 10), to ensure equal opportunities and reduce inequalities of results, including through the elimination of discriminatory laws, policies and practices and the promotion of appropriate legislation, policies and actions in this regard. The contribution in the development of researches and technologies, services and innovation to meet the demand of family farm is part of the company's guidelines, however the implementation of specific legislation for family farming and recent public policies aimed at this public has increased Embrapa's involvement in promoting appropriate technologies for sustainable rural development.

Public policies and family farming in the context of reduced inequalities

The strategic role of family farming in sustainable rural development, and in all other social dimensions of the country, came to be recognized only after the 1988 Constitution and through the consolidation of specific policies aimed at the sector aimed at reduced inequalities in the rural environment. A key role was played by Programa Nacional de Fortalecimento da Agricultura Familiar (National Family Farming Development Program – Pronaf) established by Decree 1,946/1996 (Brasil, 1996), followed by other policies that culminated in 2006 with Law 11,326 of Family Agriculture (Brasil, 2006). Adopting the concept of "family farming", the Agricultural Census was carried out (IBGE, 2009) and a detailed analysis was carried out in the document titled: *O Censo Agropecuário de 2006 e a Agricultura*

Familiar (The 2006 Agricultural Census and Family Farming) (França et al., 2009). In 2006, the sector encompassed 4.3 million productive units (84% of the total number of establishments) and 14 million persons employed, which represents around 74% of total occupations distributed in 80.3 million hectares, representing 24.3% of the total area of Brazilian rural establishments. The contribution of family farming production is significant in Brazil, representing 38% of the total value of production and 34% of total agricultural income.

The legal concept of family farming establishes the guidelines for the formulation of the *Política Nacional da Agricultura Familiar e Empreendimentos Familiares Rurais* (National Policy on Family Farming and Rural Family Enterprises). In the Family Farming Act, a family farmer and a rural family entrepreneur is considered to be one whose activity in rural areas meets the following conditions:

does not have, in any capacity, an area greater than four fiscal modules; predominantly use family labor in the economic activities of its establishment or enterprise; has family income predominantly originating from economic activities linked to the establishment or enterprise; direct its establishment or enterprise with their family. (Brasil, 2006, art. 3º, incisos I, II, III, IV, our translation).

The Family Farming Act (Brasil, 2006) adopted virtually all the criteria in Pronaf (Brasil, 1996) and established the legal basis for the effect of all public policies for the category. Pronaf's main objective was "to promote the sustainable development of the rural segment made up of family farmers, so as to enable them to increase productive capacity, generate jobs and improve incomes." (Brasil, 1996, art. 1º, our translation). The success of Pronaf and the Family Farming Act has been deployed in a series of specific policies for the segment and gained visibility. New demands for access to public policies were being explained, leading to the expansion of the definition and the framing of the different identities as "family farmer".

Decree 6,040/2007 established the *Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais* (National Policy for the Sustainable Development of Traditional Peoples and Communities) (Brasil, 2007), covering 17 traditional communities that in 2010 are considered for agricultural purposes, family farmers governed by Law 11,326/2006 (Brasil, 2006). The new legal concept of family farming now considers family farmers the traditional peoples and communities who have access to all the public policies of family farming.

Due to movements in the political, social and institutional spheres, Embrapa frequently makes adjustments to the research agenda in response to new legal instruments. Thus, we highlight that, in the year in which the Family Farming Act was approved, Embrapa had a research program focused specifically on family farming – Family Farming Macroprogram – Macroprogram 6, which for years added specific research and technology transfer for the inclusion and increase of family farm income. To this end, it instituted participatory methodologies meeting the demands of representative social categories and movements. In the book *A agricultura na dinâmica da pesquisa agropecuária*, Sousa (2006) includes methodologies, technologies and concepts, such as agroecology and sustainability, environmental issues and food and nutritional security, and the maintenance of genetic resources and their conservation in all Brazilian biomes. Later in 2016, the *Coleção Povos e Comunidades Tradicionais* (Traditional Peoples and Communities Collection) was undertaken in an effort to disclose and qualify research interactions with these social groups and also to indicate and promote convergence with federal government policies (Stumpf Júnior, 2015).

The research carried out by Embrapa aimed at meeting the demands of family farming is also found in portfolios of specific projects such as, among other, Portfolios of Agroecological Transition and Organic Agriculture and more recently Ecological Base Portfolio; Inovasocial Array of Traditional Peoples and Communities. This project agenda has responded and contributed to the implementation of public policies, plans and government programs, strengthening and including broad sectors as demand for research and development. It also contributes for strengthening farmers, generating income and promoting social inclusion by recognizing the multifunctionality of this category and its diversity of demands, in short its complexity.

Among the main public policies for social inclusion to reduce inequalities, we mentioned the participation of Embrapa, with its research agenda in Plano Brasil Sem Miséria (Brazil without Misery Plan – PBSM).

Brazil without Misery Plan

Brazil without Misery Plan (PBSM) was instituted by Decree 7,492/2011 (Brasil, 2011), in order to overcome the extreme poverty situation of the population throughout the country, based on the integration and articulation of policies, programs and actions. The plan articulated and created by the federal government and coordinated by the Ministry of Social Development consisted of an inter-institutional, multidimensional

and intersectoral arrangement, involving 22 ministries, organs and entities of the direct and indirect administration, the private sector and the third sector for combating multiple forms of manifestation of poverty, characterized in addition to insufficient income to various deprivations such as food and nutritional security, reduced schooling, low insertion in the labor market, precarious access to water, electricity, health and housing. In this sense, the plan was structured in three axes: guarantee of income, access to services and productive inclusion.

In [PSBM](#), Embrapa's activities were linked to the [rural productive inclusion](#) axis, with the participation of 10 Decentralized Units that led actions in 14 Territories of Citizenship, through 12 territorial projects and five transversal projects. The projects were based on strategies that aimed to increase actions aimed at the training and technological qualification process, access to technologies, diversification of the production matrix, environmental sustainability, food and nutritional security and income generation.

To fulfill these commitments, Learning Units (UAs) have been set up as spaces for the appropriation, sharing and irradiation of knowledge, involving communities and their families in experimentation, adaptation, knowledge and technology. The operation took place in processes that involved the qualification and training of multipliers (local actors – farmers, technicians, development agents and researchers). The UAs were articulated in areas close to the productive systems of the beneficiary families of the plan, seeking to guarantee knowledge dynamics to be appropriated by the farmers and communities involved in these processes.

The differential of these projects was the direct involvement with participative methodologies; the integration and convergence (in some cases) of actions that were already taking place in the territories; the empowerment of farmers to the extent that they have become the protagonists of Embrapa's actions; the low-cost technological solutions used that have been adapted to the local context; the exchange of experiences and the valorization of knowledge/construction of the knowledge of each actor made possible by the approximation of the relations between extension, transference and research, and the use of different [communication](#) strategies. These actions involved the training of communicators and Ater agents in sustainable practices and were certified in 2017 as social technology by Banco do Brasil Foundation (FBB) (Beltrão et al., 2017).

The technological solutions implemented were chosen in the interaction with the beneficiary farmers, considering the productive project chosen by each family due to the development program and the relationship with Ater. The main

areas of work that presented potential identification and availability of Embrapa technologies were:

- Use of sisal residues in ruminant feed.
- [Country chicken breeding](#).
- Production yards, vegetable production.
- Sheep breeding, pasture formation.
- [Production of maize, sorghum and beans](#).
- [Fast multiplication of manioc](#).
- Implementation of water technologies (nitrates, underground dams, cisterns).
- Installation of eco-efficient stoves.
- Construction of green cesspools.
- Cowpea production.
- Dissemination of forage watermelon, mandacaru without thorns, gliricidia, leucena and fodder palm.

Among the main results achieved in the social inclusion dimension are the diversification of the productive systems of the families, the regional production of inputs for the technological transition, the management of agrobiodiversity and agricultural systems, the interaction with local socio-technical networks and communication for the development, local capacity building, agroecosystems management (property management), social market exchange and building mechanisms, water harvesting and management, rural sanitation, social and/or appropriate technologies. These innovations, coupled with other public policies accessed, contributed to the increase of income of the families involved and improved conditions, autonomy and food security.

The scope and size of the PBSM carried out by Embrapa reached 148 municipalities in the Northeast and North of Minas Gerais, covering 14 Territories (Agreste Alagoano, AL; Alto Oeste Potiguar, RN; Alto Sertão Sergipano, SE; Baixo Parnaíba, MA; Borborema, PB; Cariri Cearense, CE; Cocais, MA; Inhamúns-Crateus, CE; Irecê, BA; Piemonte Norte do Itapicuru, BA; Sertão do Araripe, PE; [Serra Geral, MG](#); Vale do Guaribas, PI; Velho Chico, BA). Technical training events were held to train multiplier agents (Ater technicians, farmers, students, radio broadcasters, municipal secretariats). These multiplier agents also had [technological information](#)

through the delivery of mini-library kits, the production of radio programs by Prosa Rural, and the [editing of institutional videos](#) (Beltrão et al., 2017).

Reduced inequalities with the domestication of extractive resources

The extractive economy presents limitations with the growth of the market, due to the supply tension that cannot meet the demand, dictated by the fixed existence of natural stocks. It is feasible as long as the market is reduced, existing in large inventories, serving to meet market niches or gain time until economic alternatives emerge (Homma, 2012).

With the process of domestication, it is possible to expand supply, obtain a better quality product and at lower prices, benefitting producers and consumers. The products that are most useful, have no substitutes, quick productive response, and are more attracted to domestication.

Several Amazonian plants were domesticated in the last three centuries, with emphasis on cacao (*Theobroma cacao* - 1746), cinchona [(*Chinchona calisaya* Wedd, *C. ludgeriana* R. et P.–1859], rubber tree (*Hevea brasiliensis* M. Arg. - 1876), jambu (*Spilanthes oleracea*), guarana tree (*Paullinia cupana* HBK), Brazil nut tree (*Bertholletia excelsa* H. B.K), cupuaçu tree [*Theobroma grandiflorum* (Spreng.) Schum], peach palm (*Bactris gasipaes* HBK), acai palm (*Euterpe oleracea* Mart.), jaborandi (*Pilocarpus microphyllus* Statf.), long pepper (*Piper hispidinervium*), jambu (*Spilanthes oleracea* L.), especially since the 1970s. Other plants undergoing a domestication process are mahogany (*Swietenia macrophylla*, King), paricazeiro (*Schizolobium amazonicum* Huber ex. Ducke), bacurizeiro (*Platonia insignis* Mart.), andirobeira (*Carapa guianensis* Aublet), uxizeiro [*Endopleura uchi* (Huber Cuatrecasas)], pau-rosa (*Aniba rosaeodora* Ducke), among the main ones.

For many of these plants, the process of domestication was supported by Embrapa and its predecessors, Instituto Nacional de Pesquisas da Amazônia (National Institute for Amazonian Research – INPA), Museu Paraense Emílio Goeldi, Comissão Executiva do Plano da Lavoura Cacaueira (Executive Committee of the Cocoa Crop Plan – Ceplac), Superintendência do Desenvolvimento da Amazônia (Superintendency of the Development of the Amazon – Sudam), the former Instituto Brasileiro de Desenvolvimento Florestal (Brazilian Institute of Forest Development – IBDF), the former Superintendência do Desenvolvimento da Borracha (Superintendency of Rubber Development – Sudhevea), the

current Federal Rural University of Amazonia, federal and state universities, state research institutions, among the main ones. The process of domestication often begins in the countryside yards, where indigenous peoples, ribeirinhos and producers sort the plants with the best useful characteristics. Other plants that will be incorporated into the domestication process due to market growth are copaibeira [*Copaifera langsdorfii* (Desf.) Kuntze], tucumanzeiro (*Astrocaryum aculeatum* G.F.W. Meyer), fava d'anta (*Dimorphandra mollis* Benth), piquiazeiro [*Caryocar villosum* (Aubl.) Perz.] cumaruzeiro (*Coumarouna odorata*), puxurizeiro (*Licaria puchurymajor*), among the main ones.

Many extractive products disappeared with the growth of the market, expansion of the agricultural frontier, cultivation of the plants that were collected, discovery of synthetic substitutes, depletion of existing reserves, urban rural migration, among others. The market signals reflect in the producers and entrepreneurs, not always in the areas of occurrence of the extractivism, inducing that its planting and new potential plants can be incorporated.

The transition from extractivism to planting can occur quickly or slowly, with the dualism of the extractive supply and another arising from plantations. Plants with more elastic demand are more likely to be domesticated. However, with the growth of the market, extractive exploitation is confronted with the difficulty of supplying increasing amounts of the product, together with the exhaustion of the producing sources, the depredation, the expansion of the agricultural frontier, among others. On the other hand, depending on the extractive process, the costs become increasingly high, which would lead to an unfeasibility for the market.

The following is a list of domestication technologies that have had greater democratization or economic impact for small, medium and large-scale producers generated in the region, transferred to other places or developed and adapted by the producers themselves (Embrapa, 1982; Nascimento; Homma, 1984; Homma, 2017):

- Cassava: Pará is the largest national producers, with recommendations for cultural practices and varieties for the floodplain and dry land areas.
- Rubber tree: 150,051 ha (2014/2016 average); Bahia and São Paulo concentrate 64.29%, and the Legal Amazon 18.10%, which supplies 40% of the national consumption.
- Guaraná tree: 11,391 ha (2014/2016 average), Bahia holds 59.24% followed by Amazonas with 36.51%.

- Brazil nut tree: 3,500 ha, with emphasis on Amazonas, Pará and Rondônia, making 3 to 5% production already come from small to large plantations.
- Cupuaçu tree: 25,000 ha with resistance to the witches' broom in Pará, Amazonas, Rondônia, Acre, Roraima, Amapá and Bahia.
- Acai palm: 100,000 ha managed in floodplains of the Amazonian estuary and 20,000 ha on land with (without) irrigation.
- Paricá: 93,833 ha in Pará, Tocantins and Maranhão.
- Forest management: the fall in native forest logging from the 1990s; these techniques are being used in community extraction.
- Peach palm: 21,483 ha (2014/2016 average); the Legal Amazon concentrates 23.34%, São Paulo 32.59%, Bahia 21.75% and Santa Catarina 16.73%.
- Piracuru, tambaqui, Matrinchã: with preliminary domestication with nurseries in Rondônia, Mato Grosso, Amazonas, Maranhão, Pará, Roraima, Tocantins, Acre and Amapá, in that order. The Legal Amazon produced 38% of the country's aquaculture production, equivalent to 216,568 t (2014/2016 average).
- Hybrid oil palm [African oil palm x Caiouê (native oil palm)]: 11,000 ha by medium and large producers in Pará with resistance to fatal yellowing.
- Malva: at its height reached almost 50,000 ha replacing the jute in the floodplain areas of Amazonas and Pará, until its disappearance.
- Bacurizeiros: 300 ha managed and 60 ha planted in Pará. It is the most expensive fruit pulp at the moment reaching US\$ 18.50/kg².
- Agro-industrial technology: guarana soluble powder, wood drying and acai powder.

The advance of domestication of extractive resources in the Amazon has involved the additive, associative and multiplicative collaboration of results achieved over time, with the participation of Embrapa and its predecessors, local, national and external institutions and the experience of producers.

The planting of extractive species made it possible to reduce the unit cost of the product, the economy of labor, the increase of productivity of land and labor

² Values related to December 30, 2016: US\$ 1.00 corresponded to R\$ 3.2585. (Taxa..., 2016).

and the concentration of production in a reduced area. In addition, it allows the regularization and increase of supply without the typical mishaps observed in extractive farms, such as access difficulties, depletion of sources of production and the temporary flow of labor, and positive benefits of environmental conservation. Increases in land productivity, comparing the extractive and planted systems, are large. To cite just a few examples, in the case of the rubber tree, the yield per hectare of the extractive rubber plantation is a thousand times higher, the Brazil nut tree is 14 times, the guarana tree is 25 times and the cupuaçu tree is 47 times.

The dimensions of cultivated area of rubber tree in the country with more than 157,000 ha, 100,000 ha managed and 20,000 ha cultivated of assai trees, 93,000 ha of paricazeiros, 21,000 ha of peach palm trees, 25,000 ha of cupuaçuzeiros, 11,000 ha of guaranazeiros, 11,000 ha of hybrid palm trees, 3,500 ha of chestnut trees, among the main ones, attest to the contribution of producers, researchers, industrialists, extensionists, input companies in the generation of employment and income, reducing Brazilian inequality in the context of the Millenium Development Goals (Celentano; Veríssimo, 2007; Celentano et al., 2010) towards the Sustainable Development Goals. Figure 1 shows an area cultivated with acai palms.



Photo: Ronaldo Rosa

Figure 1. Area cultivated with acai palm.

Considering the future prospects for extractive products that have restrictions on their supply, it is necessary to make efforts to domesticate them with pre-established goals. The democratization of extractive products must be pursued to benefit producers, creating new economic alternatives, and for consumers to obtain a product at a lower price and of better quality. The domestication of extractive resources can promote the recovery of environmental liabilities. Most are perennial trees and can reduce the pressure on natural resources, with the formation of production centers and the possibility of agro-industrialization. Fast and low-cost techniques aimed at recovering the environmental liabilities of Permanent Preservation Areas and Legal Reserve Areas with biodiversity plants that may have economic utility need to be developed. The benefits of domestication are not restricted to the place of occurrence of the plant, but are likely to be transferred to new places, as is the case of rubber trees, guaranazeiro, cupuaçuzeiro, paricazeiro, acai palm, peach palm, jambu, among others. The benefits to the generation of employment and income, leading to reduced inequalities, are evident.

Final considerations

The public policies highlighted in this chapter have contributed in an innovative and persistent way in reducing poverty and social inclusion and increasing income. In particular, we highlight Política Nacional de Agroecologia e Produção Orgânica (National Policy on Agroecology and Organic Production – Pnapo) (Brasil, 2012) for its role of articulating and adapting the various policies and programs developed to promote agroecological production. Embrapa has a significant contribution to the production of healthy food, combining rural development with conservation of natural resources and appreciation of traditional peoples and communities.

Embrapa's contribution to research aimed specifically at family farming has led to the production of numerous specific technologies for the inclusion and increase of income in family agriculture. To this end, it adopted participative methodologies, meeting the demands of the categories and social movements that are representative of family agriculture in all regions of the country. A good example of this effort is the extractive economy in Amazonia, related to the process of domestication and management and the contributions to generate income of this population.

Among the main results achieved in the social inclusion dimension are the diversification of the productive systems of the families, the regional production

of inputs for the technological transition, the management of agrobiodiversity and agricultural systems, the interaction with local socio-technical networks and communication for the development, local capacity building, agroecosystems management (property management), social market exchange and building mechanisms, water harvesting and management, rural sanitation, social and/or appropriate technologies. These innovations, coupled with other public policies accessed, contributed to the increase of income of the families involved and improved conditions, autonomy and food security.

Among the main challenges are the interruption of social policies and the change of priorities in policies aimed at strengthening family agriculture, as a result of the change in Brazil's institutional policy in 2016, with a focus on prioritizing Embrapa's research agendas.

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Chapter 6

Challenges of Embrapa's research agenda in reduced inequalities

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Introduction

Reduced inequalities is a continuous challenges, especially for a country with continental dimensions such as Brazil. For this, there is a need for the search agenda to co-evolve with interregional, state and even municipal differences. Misconceptions of public policies reflect in the rural environment, as the increase of inequalities, annulling the achievements obtained.

In the Brazilian case, many of the achievements of the Millenium Development Goals (MDGs) were affected by the macroeconomic effects of public policies and the global recession, reflected in the Sustainable Development Goals (SDG). The continuous generation of new economic and technological alternatives is indispensable to reduce these regional, state and municipal differences.

Achieving development through reduced inequalities is a major challenge for Brazilian society. In a complex federation like Brazil, with different biomes, cultural patterns and diverse historical roots, it is necessary to make efforts to make public management more efficient and effective and able to accelerate the execution of public investments, to maintain social policies, to carry out diversification of the local economy, as well as improving the business environment and the quality of public spending.

The main challenges

The imbalances and impacts resulting from the process of globalization of the economy and the modern technological revolution impose the need to seek new alternatives to rural development, particularly for small production, as the situation of poverty persists, as well as social exclusion, degradation of natural resources and economic disparities. These themes appear increasingly frequent and evident in the Brazilian countryside (Fucks, 2001).

Analyzes of the Brazilian rural space of the 1970s and 1990s indicated that the transformations in the field led to the hegemony of agribusiness from the content of the technique, selectively and exclusively (Neumann et al., 2017). On the other hand, this space has been strongly market by struggles of family farmers organizations, with the aim of finding and maintaining their space in the midst of the diffusion of the capitalist mode of production in the countryside.

In recent years, as a result of the clamor of the popular movements and also of a series of international commitments assumed by Brazil, a set of public policies was created and implemented by specific plans, seeking to guarantee rural development with economic, social and environmental sustainability. We can mention, among them: Family Farming, Programa Nacional de Fortalecimento da Agricultura Familiar (National Family Farming Development Program – Pronaf), Política Nacional de Segurança Alimentar e Nutricional (National Policy on Food and Nutrition Security – PNSAN), Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais (National Policy for the Sustainable Development of Traditional Peoples and Communities – PNPCT), Política Nacional de Agroecologia e Produção Orgânica (National Policy on Agroecology and Organic Production – Pnapo), among others.

Most of the implementation plans for these policies contain specific actions under the responsibility of Brazilian Agricultural Research Corporation (Embrapa). These actions expanded Embrapa's research, development, technology and innovation (RDT&I) activities, as well as opened up a new set of activities to serve the most deprived part of rural areas, small-scale producers and specific social groups (indigenous peoples and traditional communities). This set of commitments assumed institutionally has allowed, in the last decade, a gradual institutional realignment of Embrapa, in particular regarding the generation of social technologies, moving from the context of developing technology "to" adopting a logic of developing "with", increasing social participation.

In this new context of the 21st century, a set of projects has been developed in an inclusive way, seeking to increase producers' income through dialogue and exchange of knowledge, contributing to the strengthening of networks and local productive arrangements. As an example, we mention Programa de Apoio a Inovação Social e ao Desenvolvimento Territorial Sustentável (Support Program for Social Innovation and Sustainable Territorial Development – Inovasocial), Building and Exchanging Knowledge for the Sustainable Development of Traditional Peoples and Communities Arrangement (ConPCT), and the continuity

of Bem Diverso Project, aimed at the income generation of extractive products from the Cerrado, the Amazon and the Caatinga.

In accordance with target 10.1 of increasing the income of the poorest 40% of the population, implementation of the Inovasocial program will contribute to reducing regional inequalities through the productive inclusion of low-income populations. It aims to promote the social and productive insertion of small producers, through the strengthening of Sistemas Agroalimentares Localizados (Localized Agrifood Systems – Sial), through interventions guided by the principles of social innovation. Its objectives are: a) strengthen and support network of production, processing and marketing of products derived from goats and sheep, with territorial identity associated with family farming; b) strengthen and support collective strategies for the conservation and use of agrobiodiversity as differentials for the valorization of territories and for access to agroecological seed markets.

Inovasocial will support projects where Embrapa's history of action has already established a network and will create processes for building knowledge, from the local context, committed to the social appropriation of innovations. Networks from the Inhamuns/Cratéus Territories in Ceará state will be supported; Cariri Paraibano/Agreste and Sertões do Motoxó and Pajeú Pernambucano, in Paraíba and Pernambuco states; and Alto Camaquã, in Rio Grande do Sul state. Also groups that perform in Goiás, Rio Grande do Sul states and some territories of the Brazilian Semiarid region. Each group will work to promote organizational and technological innovation aimed at the social and productive inclusion of farmers. It is planned to share knowledge and experiences among the different actors present in similar networks, allowing the obtainment of benefits and knowledge that can leverage local production, generating income and reduced inequalities in the territories and regions listed.

In order to promote economic and political social inclusion, regardless of age, gender, disability, race, ethnicity, origin, religion, economic condition or otherwise (target 10.2 of SDG 10), it is possible to highlight Embrapa's thematic organization with peoples and traditional communities through Building and Exchanging Knowledge for the Sustainable Development of Traditional Peoples and Communities, approved in 2017. It aims to promote innovation actions with traditional peoples and communities to identify, characterize and value traditional systems for the use, management and conservation of natural resources that contribute to food and nutritional security with a territorial focus, guaranteeing sustainable livelihoods. It also discusses target 10.1, since it intends to stimulate

in Embrapa projects with economic impact in the contexts of: increased income generated in agroextractivist systems for the generation of innovations; increased income generated by new technologies and techniques in agro-extractive management and exploitation; creation of market niches, new national and international markets, such as assai and Brazil nuts; development and monitoring of post-harvest processes and new markets.

In general, this and similar projects include actions to promote the local economy and the social construction of markets, from the identification and characterization of local production/distribution circuits and reciprocity relations in the commercialization and exchange experiences of traditional peoples and communities, and the creation and strengthening of spaces of interaction.

An example of such concerns is the implementation of Bem Diverso Project by the United Nations Development Programme (UNDP), which is coordinated by Embrapa. It operates in three biomes and six territories of citizenship, areas that go beyond the limit of municipalities. There are two territories per biome, reaching the Amazon, the Cerrado and the Caatinga. Driven by resources from the Global Environment Facility (GEF), the main objective of the project being implemented is the promotion and sustainable use of biodiversity, working with local communities to stimulate good practices in coexistence with diversity. To this end, 12 priority species, typical of the regions and with potential for promotion, exploitation and commercialization, are worked on. The goal is for these species to be a consolidated element of income generation for family farmers. The project works to empower communities, but also promotes the value chain for socio-biodiversity products, market access, and maps existing financial incentives to operationalize the marketing of these products. This project related to targets 10.1 and 10.2, promoting reduced national inequalities, the inclusion of the poorest 40%, and the conservation of Brazilian biodiversity through the promotion of sustainable development.

Actions like this are in line with the survey carried out by Characterization of the New Brazilian Rural Project 92-98, which indicated that the Brazilian rural area is no longer restricted to those activities related to agriculture and agroindustry. In the last decades, the rural environment has been gaining new functions – agricultural and non-agricultural – and offering new opportunities for work and income for families. It points to rural tourism, a booming activity in the areas of dams formed for the generation of electric energy and along the rivers, indicated as an important vector of development of new activities. With enormous potential to be exploited, low-impact tourism in areas of indigenous peoples and traditional

communities has the potential to contribute to increasing the income of these populations.

These activities and their impacts in the rural areas need to deepen research to subsidize related public policies. Modern agriculture and subsistence agriculture share space with a set of activities related to leisure, services and even industry, reducing, more and more, the boundaries between rural and urban in the country.

Embrapa

Concerned with the sustainable rural development and the facets of the diversity of agriculture, EMBRAPA established, under its Sistema de Inteligência Estratégica (Strategic Intelligence System – Agropensa), the observatories, among them Observatório da Agricultura Familiar (Observatory of Family Agriculture – OAF), aiming at subsidizing the formulation of research, development, exchange and construction of knowledge linked to cross-cutting issues that affect the performance of family farming. OAF will have the function of: a) identifying problems and challenges that are the targets of studies, research for and with family farming; b) monitoring the issues and challenges related to family farming in the different regions of the country; c) contributing to the definition of institutional guidelines and strategies and related themes. It also seeks the evaluation of good practices; forms of production and different styles of agriculture and social and economic reproduction; impacts of health legislation and tax issues; new material bases in the context of energy transition and climate change; product and process technologies; strategies of qualification of technicians for the availability of social technologies.

The public function of rural research and extension is emphasized in several contexts, especially with regard to the proposals and strengthening of public policies and the need to broaden the institutional performance of Embrapa and partners as co-responsible for sustainable and equitable development of agriculture in the face of confronting inequalities.

For its part and given its competence and mandate, Embrapa has adapted its research to the reality of family farming, innovating in diverse social and environmental contexts, supporting productive inclusion, income generation and improving the quality of life of rural workers, its cooperatives and associations. In all these efforts, the research expanded its activities in the context of promoting

agroecology and organic production, strengthening environmentally sustainable agricultural systems in several territories and biomes.

However, rural poverty and hunger are not equated solely by inclusion and productive insertion. It is not enough to reduce production costs and increase productivity to make the activities of less-capitalized producers viable. It will be necessary to look at the differences of biomes, territories and how to act locally and this is a huge challenge for the eyes and attitudes of research. There is a need for organizational and behavioral innovations to see beyond technological solutions.

For example, high agricultural production without observing logistics and access to markets is a problem and not a solution. In other words, agricultural research needs to incorporate other values, especially in order to meet sophisticated demands, such as that of traditional peoples and communities, which are significant populations in Brazil, to incorporate into its research, development, technology transfer and innovation processes. In addition, simple technologies can be added to production systems, without the need for time-consuming studies, as a way to quickly reach consumers, with typical products and high territorial adequacy. In general, there are ways to generate value and increase income through the differentiation of regional products, with origin identification.

It will be necessary to look at the differences of the biomes, the territories and especially the local culture of the farmers. This new look presents itself as a great challenge for agricultural research, as it demands organizational and behavioral innovations in addition to technological solutions. Simple technologies built through the dialogue of knowledge (scientific and traditional) can be generated locally, in participatory way, and boost productive systems, helping local socio-biodiversity products reach consumers quickly.

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