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"Roles and Challenges of Brazilian Small Holding Agriculture"

Antônio Márcio Buainain *

Junior Ruiz Garcia **

Abstract:

This paper aims at a critical review of roles, perspectives and challenges of small holding agriculture in Brazil, highlighting in particular the role of public policies and technological innovation in meeting current challenges to secure poverty reduction and sustainable growth. Though the paper draws exclusively from the Brazilian experience, some of the issues raised reflect also the reality of other Latin American countries. Lessons and policy implications for other emerging economies will also be raised at the end of the paper.

Key words:

Small Holding, Rural Livelihood, Agrarian Structure, Rural Poverty.

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Introduction

Over the time, in different periods and by different authors of virtually all schools of thought, the small holding agriculture (SHA) has been condemned either to disappear or to economic irrelevance. Yet the doomed destiny has not occurred and in most parts of the developing and less developed world the SHA is still quite strong and very relevant from all standpoints one might view it.

Berdegú and Fuentealba (2011) estimate that in Latin America and Caribbean (LAC)¹ approximately 15 million smallholders still live, work and farm in about 400 million hectares. In spite of the small size, they produce considerable amount of food and non food agricultural products for their own subsistence and/or for local, national and international markets. However and in spite of overall social, economic and political improvements in LAC over the last 3 decades, poverty and inequality are still striking features of LAC rural areas. According to CEPAL (2010), in 2010 there were still 108 million poor (74 million in the early 1980s) and 72 million very poor (unable to meet basic food needs; 62 million in 1980s).

Rural poverty is to a great extent concentrated amongst smallholders' farmers and landless workers. And what is worse and worrying, Berdegú and Fuentealba (2011) sustain that their welfare have deteriorated over the past 20 years or so. "In ten out of 15 countries analyzed, there has been a growing gap in poverty rates between this category and the rural average." And this increase in the poverty gap of small holders is even more perturbing if one considers the improvements in provision of public services and in particular the "reduction in the gaps in services such as education of households members over 15 years of age and access to electricity, between households headed by 'self-employed in agriculture' and those headed by 'employers in agriculture.'" (Berdegú and Fuentealba, 2011, 1, quoting Modrego *et al.*, 2006).

The concepts, current understandings and actual sizes of small holding agriculture vary amongst countries. The use of 2 hectares as the key parameter to define smallholder agriculture may be deeply misleading as holding size by itself does not capture additional features that may be important to be considered (taken into account), such as the quality of resources, organization and social relations of production and market linkages. In some contexts 2 hectares may even be "too big" as far as the modal size of smallholdings is concerned. This is the case of many regions in both China and India, where average size of farms are less than 1 hectare. But 2 hectares may be too small as far as the provision of adequate land support for the survival of a family in above poverty conditions. This is certainly true in most semiarid regions of LA but is also true in some areas of tropical forest ecosystems, where sustainable exploitation and family livelihood would require larger plots. Although the 2 size definition is largely used by international organizations such as IFAD (International Fund for Agricultural Development), World Bank and FAO (Food and

¹ The Latin America and Caribbean (LAC) include the 19 countries south of the Mexico-USA border, including two Caribbean countries – Dominican Republic and Cuba.

Agriculture Organization), Berdegué and Fuentealba (2011, 1) consider that “the ‘2 hectares’ definition is a measure of our ignorance and not of our understanding of smallholder farming, nor of what is needed for well-designed strategies and policies.” We can not but agree with them!

In this paper we do not attempt to use a precise definition of small holding agriculture. We will follow Berdegué and Fuentealba (2011, 2) and consider smallholder or family-based agriculture indistinctively “as a social and economic sector made up of farms that are operated by farm families, using largely their own labor.”

In Brazil the use of farms’ size for policy purposes has been largely replaced by family and non-family based agriculture, whose definition may be even more misleading than that of small holding agriculture. Family agriculture in Brazil is legally defined by Law 11,326/2006 and encompasses agricultural holdings which meet at least two main criteria²: (i) use more than 50% of labour from the family, and (ii) hold an area equal or smaller than 4 legal modules. And both criteria are quite slippery. On the one hand, as even very simple productive processes may include positions of different nature and strategic importance as well as workers operating at significant different levels of productivity, the questions of how to account for the family labour and to weight its share in total labour are not trivial ones. On the other hand, the size of legal land modules varies from region to region and can reach up to 110 hectares (INCRA, 2005). The outcome is that the legal family size definition includes from the poorest farmer holding a tiny plot of land, hand ploughing with a hoe, to a large well to do farmer, holding dozens or even hundreds of hectares, using the most modern technologies and linked into world agro trade chains. In practical terms and for policy purposes the legal definition has been operationalized through the use of two additional parameters: (i) income ceilings and (ii) a kind certificate of family farmer status issued from an accredited social or public organization.

Regardless of the concept one may adopt to define it, the universe of smallholders – family farmers is a very complex, diversified and rich one, whether from the economic, social, political or cultural viewpoints. As mentioned above, it includes from very poor family farmers holding tiny plots, almost landless, to well to do farmers; there are well established landowners, landowners with fragile land ownership titles and tenants and sharecroppers whose access to land is conditioned by different institutional arrangements regarding land ownership and usage rights and claims. Technology and production systems ranges from rather primitive cut and burn shifting cultivation used by smallholders in the rain forest regions –known as ‘*roça*’ in Brazil— to diversified productions systems using up-to-date technology; from subsistence farming to contract farming, from market isolated and insulated groups to smallholders producing high quality food and non-food products fully integrated to the world markets; it includes producers trading in local street fairs with local

² In Brazil, it is understood as rural family company and family agriculture the one practicing rural activities, meeting the following requirements: i) do not own, under any title, an area larger than 4 fiscal modules; ii) the main manpower is family; iii) the family income is predominantly generated by activities related to the property; and iv) the property is managed within family (Law 11,326/2006).

intermediaries and pray of local money lenders to arrangements with agro-industry companies operating worldwide, which provide both financial and technical support.

Culturally the smallholder / family farmer universe could well be represented by a patchwork made from many different tissues: traditional peasants producers with strong and lively native cultural heritage; indigenous groups; family farmers communities of European or Asian origin, with well established market knowledge; forest producers (whose political claim for recognition as 'forest people' is already acknowledged by many international organizations), living primarily from the collection of products of the forest; commercial family farmers highly specialized in one or two major commodities traded internationally. From the political standpoint the smallholder group embodies a varied and even conflicting set of interests. The best, but not unique, example is the struggle between forest producers whose survival depends upon the preservation of the forest and farmers' –small settlers, ranchers or large agribusiness corporations– claiming for new land to cultivate or cattle raise.

Berdegú and Fuentealba (2011), following de Janvry and Saudoulet (2000), draw attention to a very relevant dimension, often overlooked in the analysis of smallholder agriculture: the context, or the "characteristics of its proximate environment, socioeconomic as well as biophysical." In fact, the 'context' is another dimension of the diversification and differentiation amongst smallholder farmer. What a contrast between smallholders struggling to survive in the rain forest environment, hundreds of miles from the nearest regional relevant urban center, isolated even from nearby markets during the rain season, and those living in the periphery of metropolitan areas, with facilitated access to markets and productive and financial services? Both the performance and prospects of smallholders are highly conditioned by the context, particularly by the overall dynamism of the local/regional economy and society as well as by the business opportunities offered and viable in the different contexts. Very small farmers can become viable and prosperous farmers in a dynamic local economy and larger farmers may run an unsustainable business in an isolated and stagnant territory.

Not surprisingly, such diversified material and institutional conditions lead to quite different survival and accumulation strategies amongst smallholders which are always a combination of auto consumption and income generated by agricultural production in the plot with off farm employment —in agriculture and non agricultural sectors—, remittances, cash transfer and other welfare support from government and private/NGOs donors. It should be clear that, if on the one hand the material conditions and the context define the alternatives and the selection and adoption of the survival / accumulation strategy by the small / family farmers, on the other hand, the context is also a strong determinant of the performance and prospects of reproduction and growth of the small producers. Therefore, any successful strategy in support of smallholders' agriculture should consider farm material assets, family farmer's human assets and the context, as indicated above.

This paper aims at a critical review of roles, perspectives and challenges of small holding agriculture in Brazil, highlighting in particular the role of public policies and technological innovation in meeting current challenges to secure poverty reduction

and sustainable growth. Though the paper draws exclusively from the Brazilian experience, some of the issues raised reflect also the reality of other LA countries. Lessons and policy implications for other emerging economies will also be raised at the end of the paper.

An overview of Small Holding Agriculture in Latin America and Caribbean³

LAC is characterised by inequality, because the economy growth and the rapid transformation have not resulted in poverty reduction. According to CEPAL (2010), the poverty rate in LAC was 33.1% in 2009, with 13.3% of the population living in extreme poverty or indigence. In 2009, there were in LAC around 183 million poor and 74 million living in indigence. The distribution income is the most unequal in the world. The income received by the 20% richest is 19.3 times more than for the 20% poorest (CEPAL, 2010).

LAC's rural population is very poor. For example, while Mexico's GDP (Gross Domestic Product) per capita is US\$ 8,920, the average income of the poorest 40% of the rural people is US\$ 652, and that of the poorest 20% is of US\$ 456 (Berdegú and Fuentealba, 2011).

As mentioned, the socioeconomic and productive profile of smallholding farmers is highly differentiated, and no classification can deal with all the particularities whose importance varies according to the context and producers' profile. Berdegú & Fuentealba (2011) proposes "a simplification of the heterogeneity of smallholder agriculture that is useful for the purpose of designing and implementing development strategies, policies and programs". Combines assets and territorial and regional contexts, they group smallholder in 3 groups: (i) poor smallholders living in poor areas; (ii) smallholders living in territories with some economic growth and social development and (iii) rich smallholders living in very dynamic territories.

The smallholder agriculture in LAC is not decreasing in absolute numbers. It is estimated that there are around 14 million farms, of which 60% correspond to subsistence smallholder. In Argentina the smallholder farms of less than 5 hectares are 14% of the total, but they account for less than 1% of land access. Around 40% of householders are poor according 2002 Argentina Agricultural census, or 132,272 householders (Berdegú and Fuentealba, 2011).

In Chile, 43% of the agricultural landholding have 5 hectares or less, but they control less than 1% of the total land. Jara *et al.* (2009) *apud* Berdegú and Fuentealba (2011) estimated that 74,459 smallholder farm in Chile produce to self-consumption. In other LAC's countries the smallholder also is very important sector. Even, if small, the income derive from this agriculture structure is really critical for smallholding survival. Their livelihood particularly depends on their lands, and therefore the smallholders operate and manage their lands with the members of their family.

³ Based on Berdegú and Fuentealba, 2011.

The smallholding is integrated in markets, but there are many challenges derived from the limits of their own household and farm assets. About 4 million smallholders are in this situation, which control around 200 million hectares. They are deeply embedded in the local economies, their agriculture are based on development has produced and consumption linkages that makes them important local and regional stakeholders. The opportunities as well as the challenges of the smallholding depend of the dynamics of economic growth, in their proximate geography.

The main conclusions of Berdegú & Fuentealba (2011) regarding smallholding agriculture in Latin America are:

“About 65% correspond to a category of smallholders that rely significantly and perhaps increasingly on non-farm sources of income to sustain their livelihoods; for them, agriculture complements other activities, and remittances and cash and in kind social transfers and supports are of great importance. Still, this group owns or controls about well over 100 million hectares. Even if small, the income derive from this land is absolutely critical for their survival and to reduce their vulnerability to shocks of all kinds. Many if not most in this group would be considered poor. Yet, an agriculture-based or agriculture-led development strategy would miss the fundamentals in the case of this group.

A second category is those family farmers that indisputably and most clearly meet the criteria considered by most authors. Their livelihood predominantly depends on the operation of their farms, they hire little or no non-family labour, and therefore they operate and manage their farm with the members of the farm family. They are integrated in agricultural markets, but face significant challenges derived from the limits of their own household and farm assets, and because of the imperfections of factor and product markets, and the gaps and limitations of institutional frameworks of all kinds. This group is made up of about 4 million small farmers who control around 200 million hectares of farmland. The contribution of this group to feeding Latin America and, increasingly, other regions of the world, cannot be underestimated. Because they are deeply embedded in the local economies, their agriculture-based development has production and consumption linkages that make them important local and regional players. This is a group made invisible by the definition of smallholders according to the 2-hectare criterion, but at least in LAC, we believe that they represent the best bet for the revitalization of rural societies.

The third and final component of the smallholder sector in LAC, are farms that are at the border between the family farm and the corporate agriculture sectors. The key factor that distinguishes from the previous group is that these farmers routinely hire non-family labour to help with the farm operations. Yet, at least some of the family members continue to be engaged in the operation of the family farm, and certainly in its management functions. Of course, these are fully commercial farms, many of them highly competitive that are behind many of the recent booms that have put Latin American agriculture in the global map of food production. There are probably slightly more than 1 million of these farms (about 8% of the total smallholder sector), and they control about 100 million highly productive hectares. As in the case of the second group, because of the forward and backward linkages with other sectors

of the local and regional economy, and also because of the labour they hire, these farmers are crucial players in the rural economies of Latin America.”

Table 1 reproduces a summary data collected by Modrego *et al.* (2006) and reproduced by Berdegúe and Fuentealba (2011) on types of rural households in LA.

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Table 1 – Rural households by economic activity of head of household in Latin America (Percentage).

Country	Year	Self-employed ag	Employers ag	Employees ag	Agriculturally based HH	Self-employed not ag	Employer not ag	Employee not ag	Not agriculturally based HH	Unemployed not in the labor force
Chile	1990	18.35	2.79	33.66	54.81	5.14	0.46	11.66	17.26	27.93
	2003	19.48	1.74	27.54	48.76	5.70	0.74	12.24	18.67	32.56
	D	1.13	-1.05	-6.13	-6.05	0.56	0.28	0.58	1.41	4.64
Colombia	1995	19.66	5.63	23.78	49.07	16.12	2.03	16.64	34.79	16.14
	2000	24.73	5.42	18.07	48.22	16.72	1.87	14.78	33.37	18.42
	D	5.08	-0.21	-5.71	-0.85	0.60	-0.16	-1.87	-1.42	2.27
Costa Rica	1995	10.44	3.18	18.55	32.17	11.61	3.56	32.05	47.22	20.61
	2001	9.76	4.67	17.04	31.47	12.00	4.65	30.11	46.76	21.92
	D	-0.68	1.49	-1.52	-0.70	0.39	1.09	-1.94	-0.46	1.31
Guatemala	1989	9.42	0.52	6.89	16.83	19.42	3.47	43.75	66.64	16.53
	2002	34.09	5.19	16.71	55.99	9.27	3.88	15.03	28.18	15.84
	D	24.67	4.67	9.82	39.16	-10.16	0.41	-28.71	-38.46	-0.69
Honduras	1995	34.44	1.95	14.23	50.62	14.97	2.25	14.66	31.88	17.50
	2003	40.94	1.29	16.34	58.57	12.29	0.51	11.44	24.24	17.19
	D	6.50	-0.66	2.12	7.96	-2.68	-1.74	-3.21	-7.64	-0.32
Mexico	1994	29.36	5.05	24.36	58.77	8.94	1.05	17.27	27.27	13.96
	2002	26.10	4.10	22.31	52.50	9.82	0.98	20.69	31.49	16.01
	D	-3.27	-0.96	-2.05	-6.27	0.88	-0.07	3.42	4.22	2.05
Nicaragua	1993	36.40	0.13	15.08	51.62	8.57	0.08	14.56	23.21	25.18
	2001	34.17	8.74	16.52	59.43	7.69	1.45	14.35	23.50	17.07
	D	-2.23	8.60	1.44	7.82	-0.88	1.37	-0.21	0.29	-8.11
Paraguay	1995	52.65	0.00	8.73	61.38	13.11	2.21	13.49	28.82	9.80
	2001	43.31	3.64	8.28	55.23	10.81	2.42	16.45	29.68	15.09
	D	-9.35	3.64	-0.44	-6.15	-2.31	0.21	2.96	0.86	5.28
Peru	1994	61.78	0.00	11.62	73.40	10.88	0.00	10.18	21.06	5.54
	2002	53.63	9.10	8.24	70.97	9.23	1.13	12.49	22.86	6.18
	D	-8.15	9.10	-3.38	-2.43	-1.65	1.13	2.32	1.80	0.64

Source: Modrego *et al.* (2006).

Roles and Performance of Brazilian Small Holding Agriculture

The Brazilian agriculture is characterized by a deep structural heterogeneity whose complexity is far from the polarizations often used in literature, between small and big, poor and rich, export cultivations (commodities) versus food crops, producer's areas and type. The Brazilian Small Holding Agriculture is also characterized by structural and social heterogeneity, which is rather complex and comprehensive. It encompasses agriculture as a whole – including Family Farming – and it can be observed in almost all the important indicators, from land tenure distribution, size of holdings, technology and land use, productivity and insertion in the markets.

One of the marks of the Brazilian agrarian structure is the exacerbated concentration of land property – and agriculture income, a historical inheritance reproduced in the way that were occupied the frontiers. According to Hoffmann; Ney (2010), in 2006 the Brazilian Gini Index of land property concentration was 0.856 and the accessibility to land was low.

The purpose of this section is to describe the roles and to assess the performance of smallholder / family agriculture in Brazilian economy from three perspectives: i) agricultural production; ii) employment and occupation; and iii) livelihood. The bulk of the analysis is based on data from the 2006 Census of Agriculture.

Role 1 – Agrarian Structure and Agricultural Production

Brazilian society has undergone deep structural transformations over the last 30 years. It moved from a military dictatorship to a democracy regime with strong civil institutions that are in continuous process of improvement; from a closed and unstable economy characterized by inflationary crises, lack of credibility among international organizations and stakeholders, Brazil has become an emerging economy, well integrated into the world-wide market with a leading role in the international scene. Brazil, Russia, China, India and South Africa together form the BRICS group that is playing prominent roles in international forum such as Doha negotiations. Progresses in the social area were notable. The number of poor people fell from 58.5 million to 39.6 between 2001 and 2009 (IPEADATA, 2011); the HDI increased to 0.718 in 2011 (UNDP, 2011), level that upgrades Brazil to the group of countries with high human development.

In the recent period the access to electricity, education and health has become almost universal in Brazil, although the quality of public services in general is still quite low, especially of education and health services. A few decades ago the Brazilian agriculture was characterized by the presence of unproductive *latifundia*, and now it is known by its high level of competitiveness and is praised by its potential to contribute to respond to the increasing demand for food, agricultural raw materials and biofuels. A characteristic of Brazilian society has not changed: skewed income distribution that to a great extent explains social inequality, a striking feature of Brazilian society.

Data from the 2006 Brazilian Agricultural Census confirm the deep heterogeneity of the Brazilian agriculture. The Census registered around 5.18 million agricultural holdings, which occupy 330 million hectares allocated to temporary crops (48.2

million); pastures (158 million; 101.4 million planted pastures and 57 million ha of natural pastures); permanent crops (11.6 million); native forests (94 million) and planted forests (4.5 million)(Table 2).

The distribution of area is unequal among the farmers, a direct result of the high concentration of land ownership in Brazil. Agricultural holdings smaller than 2 hectares represent 20% of total landholding and occupy only 0.3% (828,000 hectares) of the 3.300 million hectares; those with up to 5 hectares represent 35.6% of total holdings and 1.1% (2.5 million hectares) of total area. Almost half of the holdings in Brazil (around 48%) are smaller than 10 hectares, but have only 2.4% of the total area (Table 2).

At the other extreme, those holdings with more than 100 hectares represent only 9.1 of total establishment, but detain 79% of farming area. There are only 15 000 holdings larger than 2,500 hectares; together they count for less than 0.3% of the total holdings but for 30% of the total area, an extension of 100 million hectares, larger than the territory of many countries in Latin America (Table 2).

The current agrarian structure reveals the deep inequalities found in Brazil – not only in rural areas –, which is the result of the excludent development models adopted since the colonial period. Though it is a constitutive and general characteristic of Brazilian society, inequality appears in different intensities among the Brazilian regions (North, Northeast, Midwest, Southeast, and South). In the Northeast Region around 33.6% of the total population is poor, and 9.64% are in extreme poverty (indigent); in rural areas approximately 33% of the population lives in poverty situation; in some states of the Northeast region more than 40% of the population is poor. At the other extreme, in the South region, only 7.7% of the total population and 7.1% of the rural are poor. Santa Catarina, a state in the South region, registers the lowest indicators of total (3.4%) and rural poverty (3.8%) of Brazil (IETS – Instituto de Estudos do Trabalho e Sociedade, 2011).

The material living conditions of small producers are also much differentiated amongst the regions. The Agricultural Census has counted about 2.45 million holdings in the Northeast region. They represent 47% of total but occupy less than 23% (75 million hectares) of the total farming area. Almost 800,000 holdings in the Northeast region are smaller than 2 hectares, and almost 50% of total holdings in the region (1.23 million) have less than 5 hectares. The holdings with up to 10 hectares (almost 1.5 million) represent 61% of the total and occupy only 5% of farming area. In the upper limit, the holdings larger than 100 hectares represent only 5% of the total, but occupy 68.5% of the farming area in the Northeast (Table 2).

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Table 2 – Number of Farming Property and Area of Farming Property by Groups of Total Area: 2006

Number of Holding							
Region	Total	More than 0 to less than 2 Ha	More than 2 to less than 5 Ha	More than 5 to less than 10 Ha	More than 10 to less than 100 Ha	More than 100 Ha	Producer without area
Brazil	5,175,489	1,048,956	791,778	636,337	1,971,577	471,817	255,024
North	475,775	60,720	35,061	30,751	229,105	88,983	31,155
Northeast	2,454,006	786,630	440,722	271,037	650,855	123,652	181,110
Southeast	922,049	108,135	150,896	134,383	411,437	97,681	19,517
South	1,006,181	83,171	145,293	178,017	515,456	64,433	19,811
Midwest	317,478	10,300	19,806	22,149	164,724	97,068	3,431
Area of Holding							
Region	Total	More than 0 to less than 2 Ha	More than 2 to less than 5 Ha	More than 5 to less than 10 Ha	More than 10 to less than 100 Ha	More than 100 Ha	Producer without area
Brazil	329,941,393	828,699	2,485,062	4,484,847	62,893,092	259,249,696	0
North	54,787,297	36,816	110,103	214,811	9,338,721	45,086,847	0
Northeast	75,594,442	631,330	1,318,531	1,835,859	20,102,139	51,706,583	0
Southeast	54,236,169	85,656	499,256	984,006	13,450,974	39,216,277	0
South	41,526,157	66,502	488,272	1,284,325	13,656,980	26,030,078	0
Midwest	103,797,329	8,395	68,900	165,846	6,344,277	97,209,911	0

Source: Prepared by authors with base on *Censo Agropecuário 2006* / IBGE (2006).

In the Midwest Region, nowadays the most dynamic agricultural frontier in Brazil, the holdings with 10 hectares or less are much less important than in the Northeast (16% in comparison with 61% in the Northeast) and occupy even a smaller percentage of total acreage (0.3% of total agricultural area). Holdings with more than 100 hectares account for approximately 30% of the total, but control almost 94% of the area registered by the Census in the Midwest Region. The situation in the North and Southeast Regions are somewhat in between the pictures of Northeast and Midwest: the common features are the skewed distribution of the land and the unbalanced share of land hold by smallholders / family farms.

It is striking that even in the frontier regions, where fiscal land was relatively abundant until not long ago, smallholder / family farmer have neither prospered nor become the dominant stakeholder of the agricultural sector. While this is certainly the outcome of the complex institutional set up that has traditionally favoured land grabbing by large settlers and ranchers in Brazil, one should not overlook two crucial factors that have undermined – and continues to do so—the conditions for the establishment of a prosperous small holding sector in the frontier zones: poor, if existent at all, infrastructure, particularly main and local roads, and lack of consistent long term support from the public sector. The prevailing conditions in the frontier zones favours large-scale enterprises and reduce the potential competitive advantage of small-scale producers, which are not able to face the numerous structural and institutional obstacles to succeed as farmers.

It is worthwhile noting the high concentration of smallholdings (*minifundia*) in the Brazilian Semiarid. The *minifundio* is technically defined as a holding whose size does not allow the subsistence of a family. The Agricultural Census registered around 1.7 million of the establishments in Brazilian Semiarid, occupying almost 50 million hectares. From these, around 450,000 are smaller than 2 hectares, account for just over 27% of the total holdings and occupy only 0.8% of farming area in the semiarid. Other 560,000 holdings, 33% of the total, have an area more than 2 and smaller than 5 hectares, and occupy only 2.1 of the regional farming area. It means that 1 million holdings are *minifundia* units, because in most sub regions of the semiarid 5 hectares is insufficient to maintain sustainable economic units, broadly speaking (*lato sensu*). Indeed, the level of income generated by the smallholdings is lower than the poverty line defined by Brazilian Government, which is set at very low level to ensure the focus of social policies on the poorest. The most dramatic thing is the finding from Helfand and Pereira (2011) that the removal of the restriction of land size and technological level in the semiarid would have low impact on the income level of smallholdings, insufficient to raise them out of income poverty. Nevertheless the holdings smaller than 5 hectares occupy only 3% of the Semiarid farming area, they contributed to 31% of the total value of agricultural production in 2006 (IBGE, 2006).

Another feature of smallholding / family farm sector in Brazil is land tenure insecurity. 61% of the holders of plots smaller than 2 hectares declared to be the legitimate owner of the plot, whereas 39% are settlers without ownership title, tenants, sharecroppers and squatters. Amongst farmers holding up to 10 hectares, the percentage of owners is higher but tenure insecurity is still high. The vast majority of landownership titles hold by small farmers was acquired by heritage, and there are

evidences that a high proportion of these titles fail to comply with current land legislation. This has at least two consequences: on the one hand, irregular titles can not be used as collateral and even entrepreneurial small farmers face difficulties to raise funding outside governmental programs, which though important can be also rather restrictive; on the other hand, land without regular land ownership title tends to be undervalued in market transactions. This is particularly relevant in the periphery of growing urban centres, where urban dwellers purchase plots from small farmers for bargain prices and seek to regularize it afterwards (Table 4).

In a country as large as Brazil the production systems vary considerably amongst the regions, size of the plot and social organization of production. The most common production system of the smallholders and family farmers is a combination of one or more temporary crops with some kind of live stocking. A small number of holdings keep permanent crops as the main economic activity and, contrarily to the common sense view, even a smaller number have horticulture as the main activity. Though it is clear that the importance of live stocking and forest production increases with the size of the holding, the traditional polarization between small and large holdings, the first specialized in the production of food staples to the domestic market and the later in the production of non-food commodities for export do not hold and is far from representing the complexity of the social and productive relations in which smallholding agriculture is currently involved in (Table 4).

Table 3 – Number of Holding by Condition of the Farming Producer and Groups of Total Area: 2006

Condition	Holdings						
	Total	More than 0 to less than 2 Ha	More than 2 to less than 5 Ha	More than 5 to less than 10 Ha	More than 10 to less than 100 Ha	More than 100 Ha	Producer without area
Total	5,175,489	1,048,956	791,778	636,337	1,971,577	471,817	255,024
Owner	3,946,276	642,754	602,916	542,279	1,724,015	434,312	-
Without ownership title	189,191	24,066	20,470	22,831	113,926	7,898	-
Tenant	230,110	92,441	41,821	22,574	58,170	15,104	-
Partner	142,531	75,573	36,654	12,285	14,993	3,026	-
Occupier	412,357	214,122	89,917	36,368	60,473	11,477	-
No declaration of area	255,024	-	-	-	-	-	255,024

Source: Prepared by authors with base on *Censo Agropecuário 2006* / IBGE (2006).

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Table 4 – Number of Brazilian Agricultural Holdings by Main Agricultural Activities and Group Area: 2006

Activities	Total	More than 0 to less than 2 Ha	More than 2 to less than 5 Ha	More than 5 to less than 10 Ha	More than 10 to less than 100 Ha	More than 100 Ha	Producer without area
Total	5,175,489	1,048,956	791,778	636,337	1,971,577	471,817	255,024
Temporary Crops (annuals)	1,908,654	532,926	325,121	228,114	605,902	112,174	104,417
Horticulture and Floriculture	200,379	70,341	40,695	25,686	45,162	7,378	11,117
Permanent Crops (perennials)	558,587	107,341	116,217	92,677	207,990	33,979	383
Seeds etc.	2,682	461	410	307	1,005	461	38
Livestock and Keeping other animals	2,277,211	295,404	282,873	267,568	1,037,777	298,939	94,650
Forest Production – planted	74,344	9,549	9,818	9,627	33,679	8,828	2,843
Forest Production – native	126,649	26,518	13,002	10,062	33,640	8,084	35,343
Fishery	15,072	4,668	2,003	1,028	2,415	531	4,427
Aquaculture	11,911	1,748	1,639	1,268	4,007	1,443	1,806

Source: Prepared by authors with base on *Censo Agropecuário 2006* / IBGE (2006).

Table 5 – Share of the Agricultural Production Gross Value (PGV) by Group of Area and Brazilian Region: 2006

Region	Production Gross Value (1,000 R\$)	More than 0 to less than 2 Ha	More than 2 to less than 5 Ha	More than 5 to less than 10 Ha	More than 10 to less than 100 Ha	More than 100 Ha	Producer without area
Brazil	143,821,309	3.30%	5.23%	6.60%	34.08%	49.96%	0.83%
North	6,148,812	5.82%	4.38%	4.61%	43.86%	37.89%	3.45%
Northeast	28,413,462	9.53%	10.43%	9.70%	30.53%	37.84%	1.98%
Southeast	47,953,805	1.78%	3.61%	5.04%	31.34%	57.81%	0.42%
South	41,465,102	1.86%	5.67%	9.19%	48.23%	34.57%	0.47%
Midwest	19,840,128	0.27%	0.99%	1.17%	13.20%	84.24%	0.12%

Source: Prepared by authors with base on *Censo Agropecuário 2006* / IBGE (2006).

In 2006, the gross value of Brazilian agricultural production (GVAP) was of R\$ 143.8 billion, which was distributed in: livestock (R\$ 30.5 billion); crop production (R\$ 110 billion); and agroindustry (R\$ 3.2 billion).⁴ Smallholdings with area smaller than 2 hectares generated R\$ 4.7 billion (3.3% of the total), although they represent 20.3 of total holdings. Holdings in the range up to 10 hectares produced R\$ 21.8 billion or 15.2% of the total (R\$ 143.8 billion) in less than 2.4% of total agricultural area registered by the Census.

In order to provide a reference to the level of income generated by smallholdings, the value of agricultural production *per capita* was estimated for ranges of holdings sizes. It is a rough estimation, which simply divides the Gross Value of Agricultural Production by the 28 million people employed in the agricultural sector. On the one hand, this figure strongly underestimates the *per capita* income of holdings because it does not including children and old persons who also live in the holding⁵ nor deduct the expenses incurred to generate the gross value of production. These production costs tend to be small in the poorer holdings, but it rises in those that generate the higher value of production, such as poultry, raising (pork), fruit-growing and milk production holdings. On the other hand, it tends to underestimate the capacity of smallholdings to provide family subsistence as far as it underestimates the production for family consumption, whose value may be important and it is difficult to accounting. Still, it is a worthwhile exercise.

For all holdings the estimated monthly *per capita* gross value of production was R\$ 428, equivalent to 1.2 Brazilian minimum wage in 2006. For holdings with less than 100 hectares the value found was well below minimum wage (

Graph 1). There are significant differences in the regional average values for all the groups of the farming area. In the North and Northeast regions the estimated *per capita* average value was R\$ 186, whereas in the Midwest, South and Southeast the values were R\$ 836, R\$ 813, and R\$ 644, respectively (

Graph 1).

The comparison of *per capita* gross value of production with the poverty line ($\frac{1}{2}$ of the minimum wage, R\$ 175) and extreme poverty ($\frac{1}{4}$ of the minimum wage, R\$ 87.5)

⁴ According IBGE agricultural database (Pesquisa Agrícola Municipal – PAM; Pesquisa Pecuária Municipal – PPM; Produção da Extração Vegetal e da Silvicultura) the agricultural production value was in 2009 R\$ 178.8 billion: permanent crops (R\$ 26.7 billion); temporary crops (R\$ 114 billion); extractive (R\$ 4.6 billion); forestry (R\$ 9 billion). Regionally, the production value was divided in: Southeast with R\$ 55.3 billion; South with R\$ 52 billion; Midwest with R\$ 34.9 billion; and Northeast with R\$ 27.5 billion.

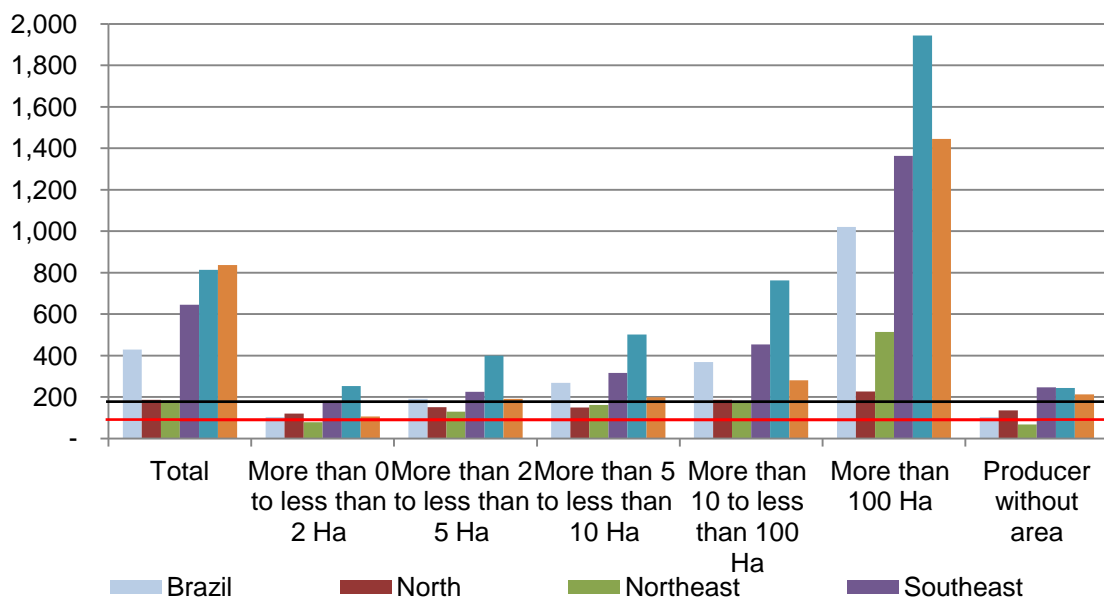
⁵ In Brazil the most of aged people receive a retirement of the one Brazilian minimum wage a month, and this income is one of the main responsible for reducing of the rural poverty, and the “viability” of smallholding.

confirms that people employed in the holdings with less than 2 hectares fall in the extreme poverty status (

Graph 1). Even in the groups smaller than 100 hectares people employed in the North and Northeast regions were in poverty situation, while the national average was close to R\$ 400 (

Graph 1).

Graph 1 – Agricultural Production Gross Value *per capita* (R\$) by Group of Area and Brazilian Region: 2006



Source: Prepared by authors with base on *Censo Agropecuário 2006* / IBGE (2006).

NOTA: MW – Brazilian Minimum Wage; in 2006, Brazilian Minimum Wage was R\$ 350, then, ¼ MW was R\$ 87.5, and ½ MW was R\$ 175.

The Agricultural Census 2006 also shows the results by family and non-family farmers (or patronal holdings), classified according to Law nº 11,326/2006. 4.3 million holdings were classified as family farmers, very similar to the figure found by Di Sabbato,

Buainain and Guanziroli (2011)⁶. Official family farms occupy an area between 80 and 106 million hectares (IBGE, 2006).

The results from Agricultural Census showed that family farming contributed on average with 40% from physical agriculture production, and generate 38% of the gross value of agricultural production in 2006 – R\$ 54 billion. The main crops produced by family farmers are: rice; beans; cassava; maize; soybeans; wheat; and coffee. Di Sabbato, Buainain and Guanziroli's paper show that family farmers also contribute with 16.7% of beef cattle; 38.9% of milk production; 42.5% of pig production and 30.3% of poultry production.

The participation of smallholdings is significant: those with less than 2 hectares responded for 20% of the manioc production; 16% of green bean; 14.2% of black-eyed bean; 7.4% of colour bean; 4.7% of cow milk and and 4.3% of paddy rice. Considering holdings with less than 10 hectares, the participation is considerably higher: 51.6% manioc; 48.7% green bean; 47% black-eyed bean; 30% black bean; 30% chicken (number of chicken); 25.7% cow milk; and 25.7% colour bean (Table 7). The share of smallholding is relevant for all these basic food crops, even more in the light of severe land restriction land and massive poverty amongst smallholder farmers.

Table 6 – Share of family farming and non-family farming production (%): 2006

Products	Family Farming (Law nº 11.326)	Non Family Farming
Total	40.0%	60.0%
Rice (paddy)	33.9%	66.1%
Black bean	76.8%	23.2%
Color bean	53.9%	46.1%
Black-eyed bean	83.8%	16.2%
Manioc	86.7%	13.3%
Maize (grain)	45.9%	54.1%
Soybean (grain)	15.7%	84.3%
Wheat (grain)	21.2%	78.8%
Coffe	34.2%	65.8%
<i>Canephora</i> Coffe (robust, conilon) in grain (green)	55.0%	45.0%
Milk	58.0%	42.0%
Chicken	50.0%	50.0%
Pork	59.0%	41.0%
Cattle	30.0%	70.0%

Source: Prepared by the authors based on IBGE, 2006.

Table 7 – Share in the Brazilian Agricultural Production by Group of Area (hectare): 2006

⁶ The methodology used by the authors to qualify an establishment as a family farming or employers (non-family farming) is based on: i) towards the establishment is the producer; ii) the total of FWU – Family Work Unit is higher than the total UHL – Unit Hired Labour; iii) the total area of the establishment is smaller than or equal to maximum regional area – 15 fiscal modules (Di Sabbato; Buainain; Guanziroli, 2011).

Products	Total	0 < 2	2 < 5	5 < 10	10 < 100	> 100
Rice (paddy)	100%	4.3%	2.6%	1.9%	26.1%	64.5%
Black Bean	100%	4.1%	12.2%	13.7%	53.6%	15.8%
Color Bean	100%	7.4%	9.7%	8.6%	32.2%	41.4%
Black-eyed Bean	100%	14.2%	20.5%	12.3%	37.1%	14.5%
Green Bean	100%	15.9%	18.5%	14.3%	34.1%	16.1%
Manioc	100%	20.0%	18.8%	12.9%	37.2%	10.3%
Maize	100%	2.4%	4.8%	6.7%	35.9%	50.0%
Soybean	100%	0.0%	0.5%	1.2%	16.2%	82.0%
Wheat	100%	0.0%	0.4%	1.2%	26.2%	72.2%
Milk	100%	4.7%	10.5%	10.5%	43.8%	23.6%
Chicken (number of chicken)	100%	4.1%	12.4%	13.4%	52.2%	16.1%

Source: Prepared by the authors based on IBGE, 2006.

The universe of smallholding agriculture is deeply differentiated from any point of view. Regarding the adoption of sustainable agricultural practices⁷, the picture is dismaying: only 61% of large holdings reported the use some kind of agronomic practice. As to show that in spite of recent progress towards sustainability, Brazilian agriculture has still a long road ahead, 57% of the holdings do not use any type of technicality recommended soil preparation practice and only 10% use direct tilling techniques. Amongst smallholdings below 100 hectares, the percentage that did not accomplish any kind of soil preparation is around 55% and amongst larger is 58%. Overall, 65% of the holdings did not use any kind of green manure (63% amongst smallholdings and 65% amongst larger holdings). Around 90% of the holdings do not use any kind or methods to pest control. Moreover, the percentages for both small and large holding are basically the same: approximately 90%.

Probably the most surprising result is that only 19% of the holdings (994 thousand) reported to use some kind of machine and/or agricultural implement. And here there is a noticeable difference between small and larger holdings: only 18% of the small reported to have agricultural machines and implements, in comparison to 38% of those with more than 100 hectares.

It is actually striking that over 80% of farmers with less than 2 hectare do not use animal or mechanical traction in the production process. Only 11% of these holdings use mechanical traction and 18% can rely on animal traction. Amongst those with less than 10 hectares, the proportion a little higher: 15.5% and 23.2% for animal and mechanical tractions, respectively. In the Northeast the situation is worse and even in the North, where small holdings are in average larger, small farmers have to face the forest almost barehanded, with axe, hoe and ... fire.

⁷ Agricultural practices – planting in level terrace use, crop rotation, use of cultivation for reform and/or renewal and/or recovery of pastures and fallow or soil rest.

Di Sabbato, Buainain and Guanziroli (2011) estimated the share of the family farming that adopts some technologies that may have positive effects on production and productivity. Around 74% of family farmers use electricity in the production process. Put in others words, in the XXI century there are 1.1 million families farming that do not have access to electric power, not even to household usage. Another alarming indicator is the high percentage of family farmers that use only human traction: only 30 and 38% use animal and mechanical power, respectively (Table 8).

Table 8 – Share of Family Farming that use components for the Modernization of Agriculture in Brazil: 2006

Technologies	%
Technical Assistance	20,88
Associated with cooperative	4,18
Use Electricity	74,10
Use Force Animal	38,75
Use Force Mechanics	30,21
Use Force Manual	31,04
Use Irrigation	6,23
Use fertilizers and correctives	37,79

Source: Authors modified it with based on Di Sabbato, Buainain and Guanziroli, 2011, p. 16.

Small farmers do use their resources intensively; there is no question about that. But it should be no doubts that the low level of capital and technology applied to production jeopardizes their performance. In general they use traditional techniques that may have been sustainable in the past but no longer correspond to the conditions prevailing in the smallholding sector nowadays. On the one hand, the yield of the land associated with traditional techniques do not allow the generation of enough product and income to feed and maintain the families which are therefore compelled to seek complementary and alternatives means of surviving, from migration to seasonal off farm occupations. One should not forget that the general increase of social productivity of labour implies a devaluation of the work of lower productivity producers, as it is the case of smallholding agriculture. And hence the income generated from the sale of products of small producers decreases in real terms and tends to cover an increasingly smaller portion of their needs.

On the other hand, families of small farmers no longer have abundant labour, nor have the same time available and not even the same availability of land as in the past. Migration to regions with different environmental conditions from those prevailing in the regions of origin exacerbates the dysfunctionality of traditional technologies, which are in general poorly adapted and suited to the new conditions. This means that the use of so-called traditional technologies, sometimes idealized by stakeholders, including policy makers and NGOs, should be updated to respond to current resources restrictions and market conditions. This finding puts innovation as central to the survival and improved wellbeing of small farmers in general.

This situation reflects the relative failure of family farms supporting policies. After 10 years of implementation of a robust public credit program for smallholdings (PRONAF, see below), the Agricultural Census showed that about 4.2 million holdings did not use external funding. On the one hand, 2.2 million of producers reported no need of credit (20% with less than 2 hectares). On the other hand, 2 million of producers reported they need and applied for credit but could not obtain for the following reasons: lack of personal guarantee (78,000 producers); no information on how to apply (61,700 producers); high bureaucracy (355,700 producers); non-payment of previous loan (133,000 producers); afraid of incurring debt (878,600 producers); other reasons (538,400 producers). Amongst the holdings with less than 2 hectares that needed funding but did not get it, the main reason reported was the fear of incurring into debt (247,800 producers).

Whether Brazilian small farmers lack entrepreneurship or not is a matter still to be studied. Surviving in such an unfavourable conditions may require at least some dose of entrepreneurship. But the facts are that Brazilian smallholdings did not face positive incentives to develop entrepreneurial skills and culture. As it is well known rural areas have been virtually abandoned by governments and during decades have suffered from under investments in all sector, from basic infrastructure to education⁸ and health care and technical assistance and access to technical assistance. In 2006 only 9% (482,500) of the holdings received regularly technical assistance. Other 662,600 holdings received it occasionally, and more than 4 million did not receive technical assistance at all. Of those who received regularly technical assistance, around 48% of were in the South region. Amongst the holdings with less than 5 hectares only 3.7% received regularly technical assistance, and only 2% amongst those with less than 2 hectare.

Role 2 – Employment and Occupation in the smallholding sector

Though Brazil is nowadays an urban society, with more than 85% of its population living in urban areas, agriculture and rural territories are still a very important source of occupation and livelihood as well as a populous place of residence. In fact, approximately 30 million people live in rural areas, and though this is only 15.6% of total Brazilian population, it is a contingent larger than the population of all Latin America Countries, except Argentina and Mexico.

In 2006, according to the Agricultural Census, an estimated 28 million people were occupied in the 5.36 million agricultural holdings in Brazil: 17.5 million had some kinship tie with the producer and 10.5 million did not. This figure probably overestimates the actual labour absorption capacity, as it does not individualize part time and full time occupations or sub occupation, which grasses in the agricultural sector. Notwithstanding, it is a significant number of people, representing 31% of Total Active Population and equivalent to one person for every 8.11 hectares allocated to agricultural use. It should be clear that the majority of the 17.5 million that has reported family ties with the farmer is occupied in smallholdings (almost 45% in holdings smaller than 10 hectares) and family farmers.

⁸ About level education of the producer see Role 3.

The largest share of people employed in agricultural sector is in the Northeast, around 12.8 million people (one person employ for each 5.9 hectares). Out of this, 8.4 million have kinship ties with the head of the holding and 4.4 million did not have. 6.2 million people were employed in the Southeast region, 3 million with kinship ties), and 4.2 million (3 million have kinship tie) in the South. The main difference among the three regions is that in the Southeast the percentage of occupied persons which had kinship tie with the holding head is smaller than in other regions, around 50%, while in the South and Northeast the percentage of people with kinship relations goes up to 70% and 65%, respectively. This confirms that in the South and Northeast regions family agriculture is very relevant as a source of occupation to family members.

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Table 9 – People Occupied in the Agricultural Holdings by Kinship Tie the Producer: 2006 (in people)

Region	People Occupied	Total	More than 0 to less than 2 Ha	More than 2 to less than 5 Ha	More than 5 to less than 10 Ha	More than 10 to less than 100 Ha	More than 100 Ha	Producer without area
Brazil	With Kinship Tie	17,477,239	3,164,207	2,514,298	2,072,285	6,834,018	2,047,140	845,291
	Without Kinship Tie	10,480,848	639,077	771,846	877,536	4,248,500	3,823,986	119,903
North	With Kinship Tie	2,077,216	224,258	128,380	120,862	982,088	496,988	124,640
	Without Kinship Tie	666,724	23,054	19,435	36,620	223,016	359,097	5,502
Northeast	With Kinship Tie	8,363,681	2,379,804	1,476,606	954,371	2,433,907	528,273	590,720
	Without Kinship Tie	4,430,468	490,795	442,838	468,492	1,715,104	1,212,939	100,300
Southeast	With Kinship Tie	3,013,599	296,487	463,991	432,390	1,356,158	406,576	57,997
	Without Kinship Tie	3,183,837	93,845	178,935	205,188	1,407,170	1,288,986	9,713
South	With Kinship Tie	2,963,242	228,869	389,793	508,041	1,541,902	231,326	63,311
	Without Kinship Tie	1,282,667	24,476	100,268	126,192	644,933	383,278	3,520
Midwest	With Kinship Tie	1,059,501	34,789	55,528	56,621	519,963	383,977	8,623
	Without Kinship Tie	917,152	6,907	30,370	41,044	258,277	579,686	868

Source: Prepared by the authors based on IBGE, 2006.

Holdings smaller than 2 hectares absorb 3.8 million people in various occupations, an average of 3.5 people per establishment. 83% have family ties with the farmer and are engaged as Family labour without payment. Considering the total gross value of production generated in these very smallholdings in 2006 and the number of persons employed, it was possible to estimate the gross value *per capita* of R\$ 1.25 thousand per year. This means that a monthly salary of less than 30% of the minimum wage in 2006⁹, equivalent to 60% of the poverty line and 120% of the poverty line. 75% of persons employed in holdings of less than 2 hectares are in the Northeast, and generate a gross value of production per capita of R\$ 942, less than R\$ 80 per month and below the poverty line of ½ minimum wage.

Finally, considering the holdings with an area smaller than 10 hectare, the number of persons employed was 10 million (77% have family ties), an average of 3.9 persons per establishment. As the 2.48 millions of small holdings with less than 10 hectare occupy only 2.4% of the total area, the density of people employed per area is high: one person for 0.25 hectare. Whereas the total number of people living in the establishment is always greater than the number of people employed, it is possible to have an idea of the level reached by the fragmentation of smallholdings and the increasing difficulty they face to absorb family labour and to maintain production of food for auto consumption and as a source of income. The gross value of output per capita generated in these holdings was R\$ 2.17 mil.

However, the high absorption of labour by family farming needs qualifications. Neder (2008) showed that the number of hours worked during the week by the group of "unpaid workers of family holdings" decreased from 32 worked hours in 1995 to 27.9 in 2006. In the same period it is noticeable an increase in the relative share of this group in the total employed persons in agriculture. "Almost 30% of occupational effort measured in terms of total hours worked is concentrated in non-remunerated occupations (Neder, 2008, p.55)." It can also be observed an increase in both the relative participation of workers engaged in production for self-consumption and in the hours worked by this group. The increase in unpaid work as well as in self-consumption occupations reflects the lack of better occupational alternatives and partly explains the high reproduction of rural poverty and the growing reliance of small farmers on income transfer from the Federal Government.

Small-scale agriculture has indeed an important role in the occupation of the population in rural areas. As mentioned above, the number of people employed is high. However, with regard to income generation, the situation is completely different: the income level is low and a significant proportion of persons employed in smallholdings are poor and do not generate agricultural income higher than the poverty line. Moreover, labour relations are fragile, family workers lack the legal protection of wagedworkers; they have no guaranteed labour rights and live therefore in a situation of great insecurity.

The low productivity and low gross value per capita generated by smallholdings results from low availability of assets in general: very small plots of arable land, in

⁹ In 2006, the Brazilian minimum wage was R\$ 350.

many cases already overexploited, low technological level, low level of human and physical capital, depreciation of traditional knowledge to face current challenges, insufficient productive infrastructure and poor public support. All these factors results in productive systems that though use intensively the available resources, fail to generate sufficient income to lift families above the poverty line. They therefore live within the vicious circle of poverty, and the possibilities of breaking it through agricultural production seem increasingly restricted to fewer and fewer a number of small farmers.

Data from the 2006 Census showed that 24.5% of the persons who the holdings are illiterate, unable to read or write, and that other 42.4% had not completed elementary school. Another 8.4% had only finished the elementary school. It means that around 75% of Brazilian agricultural holdings are headed by people with extremely low level of education, which probably results in low learning ability and with negative effects on the adoption of new technologies. Thus, any attempt to raise productivity of smallholding agriculture shall have to face seriously the basic education deficit amongst poor farmers.

37.5% of those responsible for the management of holdings with less than 2 hectare are unable to read or write, and other 36.4% had only elementary education. In the Northeast the reality is more dramatic. Illiterate people head around 41% of all holdings, and in the range of up to 2-hectare illiteracy reaches 45% of the holdings heads.

On the other hand, in the South, Southeast and Midwest, the situation is quite different from that observed in the Northeast. The South records the lowest percentage of illiterate people running the establishment, only 5%. In the Midwest the percentage is 8% and in the Southeast almost 11%. However, in these regions the percentage of holdings run by people that have only incomplete elementary education is fairly high: 47% in the Midwest and Southeast and 64% in the South, more than twice which found in the Northeast where the participation of illiterates is higher.

These indicators show, in general lines, the situation of smallholdings and what are the main challenges that must be addressed by public policies to raise productivity and income of small businesses, which hold the largest share of people in rural areas who still depend on agriculture to nourish the family.

Role 3 – Rural Livelihood

Livelihood comprises the capabilities, assets – including both material and social resources – and activities required for a means of living (Department for International Development – DID, 1999). In rural areas Livelihood has three basic dimensions: i) food security; ii) entrepreneurship development; iii) improved access to resources and market (Centre for Youth and Social Development – CYSD, 2011). In short, a person's livelihood refers to the "means of securing the necessities of life". For example, a small farmer's livelihood depends on the availability and accessibility of land, amongst other resources.

The sustainable livelihoods approach (SLA)¹⁰ draws on the main factors that affect poor people's livelihoods and the typical relationships between these factors. The two key components of the SLA are: i) a framework that helps in understanding the complexities of poverty; ii) a set of principles to guide action to address and overcome poverty (Serrat, 2008).

The concept livelihood can be extended to include social and cultural means, i.e. "the command an individual, family, or other social group has over an income and/or bundles of resources that can be used or exchanged to satisfy its needs. This may involve information, cultural knowledge, social networks and legal rights as well as tools, land and other physical resources." To some extent, the extension of the livelihood concepts leads to the context, whose relevance was remarked by Berdegué and Fuentealba as mentioned in the introduction.

It is not possible to analyse here the different territorial contexts in which they are inserted into the different types of smallholdings. A survey conducted by Favareto (2010) reveals a large number of areas with quite different natural resources endowments, socio-economic structures and levels of development. We will only present some important indicators that characterize the context and living conditions of smallholdings, including poverty indicators, conditions of production, food security, technical assistance and access to land and credit.

Food Security

The food security and socio-economic indicators published by 2006 Agricultural Census and 2010 Demography Census can help to characterize some of the factors that influences the standard of living in rural areas.

In 2004 the IBGE held the first national survey on food security, adjusting the scale of food security created by the US Agricultural Department in the 1990s to the Brazilian situation; the same survey was replicated in 2009, and the comparison of 2004 and 2009 allows an accurate view of recent evolution as well as current food security status in Brazil. Additionally, in 2010 the IBGE has published the 2009 POF – Family Budget Research, which includes an entire section on the perception of food security by the Brazilians in different income strata.¹¹ According to IBGE (2010a), in 2004, 35% of Brazilian households were living in some degree of food insecurity and in 2009; this percentage fell to 30.2%, representing 65.6 million people living in 17.7 million households. According to these estimates, in 2009 there were nearly 40.1 million people in 11 million households living in low food insecure situation; 14.3 million people in 3.8 million households living in moderate food insecurity situation and over 11 million people suffering from severe food insecurity. Interestingly, the percentage of households in situations of low food insecurity remained stable between

¹⁰ SLA is a way of thinking about the objectives, scope, and priorities for development activities. It is based on evolving thinking about the way the poor and vulnerable live their lives and the importance of policies and institutions (Serrat, 2008).

¹¹ In 2010, the Brazilian government established the Organic Law on Food and Nutritional Security - LOSAN (Federal Law No. 11346 of September 15, 2006, which created the National System of Food and Nutritional Security - SISAN) and launched the National Policy on Food and Nutritional Security - PNSAN (Decree No. 7272 of August 25, 2010) (IBGE, 2010a).

2004 and 2009 (18% of total), while moderate and severe food insecurity status declined, respectively, from 10% and 7% to 6.5% and 5%.

Table 10 – Brazilian Householders by Food Security Situation: 2004/2009

2004						
Food Security Situation	Total		Urban		Rural	
	Number	%	Number	%	Number	%
Total	51,666	100.0	43,671	100.0	7,996	100.0
Food Security	33,607	65.0	29,099	66.7	4,508	56.4
Food Insecurity	18,035	34.9	14,550	33.3	3,485	43.6
- Low	9,321	18.0	7,711	17.7	1,610	20.1
- Moderate	5,123	9.9	4,012	9.2	1,111	13.9
- Severe	3,592	7.0	2,827	6.5	765	9.6
2009						
Food Security Situation	Total		Urban		Rural	
	Number	%	Number	Number	%	Number
Total	58,646	100.0	49,882	100.0	8,764	100.0
Food Security	40,909	69.8	35,223	70.6	5,685	64.9
Food Insecurity	17,738	30.2	14,659	29.4	3,079	35.1
- Low	10,973	18.7	9,258	18.6	1,715	19.6
- Moderate	3,834	6.5	3,082	6.2	753	8.6
- Severe	2,930	5.0	2,319	4.6	611	7.0

Source: Prepared by authors based on IBGE, 2010a.

In the rural sector, quite paradoxically, the proportion of food insecure households (35.1%) is higher than in the urban sector (29.4%). Likewise, in the North and Northeast, the poorest regions of Brazil, the percentages of households in food insecure (40.3% and 46.1%, respectively) are significantly higher than in the Southeast and South (23.3 % and 18.7% respectively).

Data from 2009 Family Budget Research confirms the reduction of food insecurity in the last decade. The research has asked to household head the following question: *“which of the following statements better describe the quantity of food consumed by your family? It is always enough, sometimes is not enough and usually is not enough.”* Between 2003 and 2009 the percentage of *“it is always enough”* increased from 51% to 62% and 38% to 50% in urban and rural areas, respectively, and the percentages of *“sometimes is not enough”* and *“usually not enough”* fell considerably in both rural and urban zones. This is a subjective type of research, which can't be taken as an objective indicator of day to day nutritional deficit, especially amongst those households in which food quantity is *“sometimes not enough”*, However, 10% and 14% of households in urban and rural areas declare that food shortage is a usual situation.

Some argue that these researches increase food insecurity in rural areas because they do not take accurately account the production for self-consumption. According of Grise and Conterato (2011: 4), “family farms produce their own food and therefore guarantees the direct and easy access to food [...]”. Thus, the production for self-consumption reduces the exposure of the rural families the fluctuations of food markets, which more recently has been characterized by intense variability in prices. Also, the production for self-consumption would guarantee, in many situations, the quality of food consumed by families farming.

These are more in the field of possibilities than an actual representation of the reality. On the one hand, a large number of smallholdings are located in areas with high climatic risk. Only in the Semiarid North-eastern there are 1.4 million the smallholdings in areas subject to intense desertification process; an estimated 11.5 million people live in smallholdings (IBGE, 2010b) that generate agricultural income below the poverty line. The Semiarid region is naturally characterized by high hydric insecurity. The popular sense (common sense) – that is not far from scientific observation – says that in every 5 years, only one is good, one is more or less, in one the drought in mild and in two drought is severe. And in spite of efforts to reduce the water insecurity – especially through irrigation – the fact is that the scope of these policies was quite limited. And not even the problem of shortage of drinking water, in rural and urban areas, has been resolved.

This is not just a localized problem in Semiarid. Waquil’s research (2011) about the new faces of rural poverty in the South region highlights precisely the effect of climate change and increased frequency of droughts and/or floods on the food security of the smallholdings in the South. According to Waquil, the reduction of food security is a main factor responsible by the fragility of the smallholdings in the South region, as far as it requires family members to search off farm alternatives for income generation that have negative effects on labour-intensive agricultural production systems adopted in the region by family farmers.

Depletion of natural resources of the smallholding has also negative impact upon food security. In the Northeast region, the desertification process is a real fact that has been strongly underestimated and therefore overlooked by public policy; in the North region, the decrease of average size of holdings has reduced the sustainability of the traditional production system, known as *roça* and *coivara*, because the producer is forced to return to areas that have been already cultivated before the recovery of the forest, which is essential for the restoration of fertility. The result is the rapid decrease of land productivity, with negative effects on production and on food security.

Finally, migration and different strategies for survival have also effects on production to self-consumption. On the one hand, occupations outside the holdings open opportunities to generate additional income, with positive effect on food security. On the other hand, it reduces the availability of family labour to work on the smallholding. Two different paths have led this process. The first one is that the poorest farmers, with less availability of land, give priority to income generation outside the holdings, which become more a residential place than a production unit. In many areas family members continue to produce some items for self-consumption, as

a complementary source of food purchased in local markets. The second one can be observed in more complex production systems, capital-intensive and more integrated at the market. The available family labour is allocated to support the main production of the small farming, reducing the production to self-consumption. In both cases smallholdings become more dependent of the market to feed their members.

The self-consumption still is important for the small farming. According to estimates made by Grisa and Conterato (2011), around 3.8 million out of 5.1 million holdings have allocated a share of production to self-consumption. Around 1.4 million holdings with self-consumption have less than 5 hectares, and 1.86 million less than 10 hectares. In Brazil, there are 2.48 million holdings with less than 10 hectares, and 75% of them reported production to self-consumption. The authors show that around 473,000 family farmers live exclusively from production to self-consumption.

According to Grisa and Conterato (2011), the production to self-consumption in small farming (area smaller than 5 hectares) represented around 26% of gross production values of this group. Therefore, the production to self-consumption is important, especially to the poorest. However, even if imperfectly, we must indicate that the gross production value incorporates an estimate from self-consumption production. This means that even taking into account the relevant share of the self-consumption of the small farmers are poor and live in food insecurity.

Conditions of the Smallholding Production

Another set of variables that may reflect the livelihood concept is the characteristics of agricultural practices adopted by small producers, particularly access to technical assistance and rural extension services advice. In 2006 only 22% (1.15 million) out of 5.1 million holdings received some kind of technical assistance. Amongst those smaller than 2 hectares only 62,700 holdings out of 1.1 million received technical assistance; in the range from 2 to 5 hectares only 119,000 out of 791,800 and in the range from 5 to 10 hectares only 155,000 from 636,000. Therefore, the majority of the small farmers did not receive any technical assistance. They are completely helpless regarding technical assistance and the introduction of improved agricultural techniques that could increase productivity and well being of the family.

An optimistic view could emphasize that 1.15 million holdings received technical assistance, including almost 340,000 with less than 10 hectares. These numbers are undoubtedly significant, but insufficient to sustain optimism regarding the future of smallholdings. The low quality of the technical services, especially for the small farming, is well recognized. A large number of producers received only one or two annual fast visits of the technical assistance services, often out of season and without any relevant interaction with other policy instruments that could enabling to put into practice the recommendations received during the visit. In this context, the technical assistance service provided to smallholders is formally and inappropriate for the small farming, because most of them need a continued assistance from rural extension rather than occasional technical assistance visits.

The type of traction force used can exemplify the precariousness of agricultural occupation and production systems adopted by the small farming. The Agricultural

Census' data show that approximately 700,000 holdings with an area smaller than 2 hectares use only manual force (human force) with auxiliary tools, such as hatchet, hoe, sickle and machete. Not even the animal traction force is used. Among the holdings with less than 10 hectares, around 1.3 million (54%) do not use any kind of traction force, only human force. And this takes place irrespective to the increasing scarcity of family labour.

Instruments and Public Policies: National and Regionals Experiences

Brazil has been a laboratory for public policies in many areas, such as health, social inclusion, support for family farmers, food security, etc. Unfortunately, it lacked autonomous and objective assessments about the impacts these policies and on their operation. We present the following some brief considerations about some initiatives designed to encourage family farming and small agricultural production in general.

Braga (2011) conducted a detailed survey of the main rural development policies and she found that in fact the last two decades a set of relevant policies, programs and actions to promote family farming has been implemented. The adoption of these policies represent a significant step forward and reflects a political redefinition of the status of this group, which was finally incorporated into public policy agenda as a relevant actor. However, the same assessment shows that the policies addressed the different needs of small farmers in isolated and fragmented fashion, as disconnected issues that can be overcome through topic short-term interventions. Moreover, it reveals that there was poor or no coordination among different levels of government, nor consistency nor persistence in the pursuit of targets. She also concludes that rural poverty combat and rural development strategies have not taken into account the multidimensionality of the issues surrounding the small farmer.

Agrarian Reform¹²

In 1993, the Brazilian government resumed the agrarian reform initiative (Emergency Program Settlement) and has since settled over 1 million of the families in agrarian reform projects¹³. In Brazil, the basic objective of agrarian reform is to reduce the concentration of land ownership and promote access to land for landless workers and small producers or with insufficient land. The direct beneficiaries of agrarian land are the landless, small farmers, traditional rural communities, riverside population (*ribeirinhas*), affected by dams and other major infrastructure works, non-Indian occupants of the indigenous areas, rural women and young workers and others.

The Brazilian government has four basic instruments of intervention: the expropriation of unproductive estates for agrarian reform (Traditional Agrarian Reform Program – INCRA in Portuguese); financing acquisition of land by organized farmers (Agrarian Reform Program Assisted by Market); direct acquisition of land for distribution, carried out by INCRA and state institutions in special cases (Decree 433/1992) and the settlement on public land owned by Brazilian government.

¹² Based on II Plano Nacional de Reforma Agrária (Brasil, 2005).

¹³ The official numbers are subject to Strong controversy. Still, all sources estimate that in 16 years of Administrations of Cardoso de Melo (1995-2002) and Lula da Silva (2003-2010) were settled around 1.2 million of the families, half in each administration.

Assessments of the Brazilian agrarian reform results are contradictory and present strongly divergent views, numbers and conclusions, reproducing the ideological and political polarization that involve the all intense debate on agrarian issue. Leite *et alii* (2004), for example, emphasize the positive impacts that many settlements had on local economies. The authors emphasize the improvement in standard of living of the settlers and that, despite the difficulties, after few years most of them are integrated into the local economy and society. Xico Graziano (2004), on the other hand, points out to the limited results in terms of increased production and living conditions of the settlers. Navarro (2011) highlights the large concentration of settlements in the North and Northeast regions, particularly in environmental fragile areas with poor infrastructure supply. In fact, official data show 447,000 settlements in the North region and 369,000 in the Northeast region, just over 70% out of total 1.1 million of the families settled officially recognized by INCRA. Social organisations traditionally linked to the Lula administration, which were highly critical of the government actions of the Cardoso, government in recent years resumed criticisms against the government, accused of negligence with the issue, cutting resources and paralysing the implantation of new settlements.

Irrespective to the different views, the facts are that between 1995-2008 approximately 80 million hectares were expropriated for land reform and that almost 1 million families were settled during this short period. There are now an estimate 8,360 rural settlements occupied by a population of 1 119 thousand families (according to official statistics of INCRA). Regardless such impressive figures, traditional skewed land ownership pater has remained unchanged and unaffected by agrarian reform settlements, as shown by the evolution of the Gini indexes, 0.857 in 1985 and 0.854 in 2006 (Hoffmann and Ney, 2010). This finding has obviously a double side interpretation: it is either an evidence of government's shyness in dealing with the structural and prejudicial agrarian unbalances or an evidence of the ineffectiveness of compulsory land redistribution to promote structural changes in landownership patterns.

These different interpretations reflect different views of the so called agrarian question: on the one side, those who consider that massive land redistribution is still necessary to ensure long term social and economic sustainability; on the other side those which emphasize that the need of massive land reform has been surpassed by the transformation of traditional *latifundia* into modern and sustainable family and corporate agricultural business, and that land redistribution should be used to promote access to land in a rather selective fashion. Once again, though expropriation and redistribution have not been massive enough to impact on landownership distribution patterns, it is weird to sustain the shyness theses compared to the 80 million hectares expropriated, which is equivalent to 1,5 the size of the territory of France.

The critics argue that following almost 20 years of the re-launch of agrarian reform program the agricultural output of settlers is almost negligible and their performance contrasts with the rapid expansion of the Brazilian agriculture sector, either family-based, non-family or corporate farmers. We share this concern with the poor results achieved by settlers in terms of food and non-food agricultural

production, which in our view is certainly associated to design and implementation problems which together result in poor incentives to foster autonomous investments of resources and efforts towards strengthening production capacity of the plot. Notwithstanding, it should be noted that the critics, amongst whom we include ourselves, might be demanding too much in too short time from very poor families settled in low quality land, in far away areas, with poor infrastructure and support from the State.

Irrespective to the rather positive view presented by Leite *et alli* (2004), there are some evidences that may authorize strong doubts regarding the effectiveness of agrarian reform as means to foster smallholding / family farm agriculture in Brazil. In addition to what has been called the productive failure, it is possible to mention the recreation of *minifundio* holdings within land reform settlements, the already mentioned concentration in fragile territories in the North (60 million hectares) and Northeast (9 million, mostly in semiarid areas), high rate of abandonment (up to 30% in average) following the cessation of installation grants during the initial phase of the settlements operations.

Buainain (2006) has argued that the current land reform strategy, driven by social conflicts, has not become a consistent and coordinated intervention and therefore has not been capable to cope with the conflicts themselves neither to provide solutions to the obstacles faced by the majority of smallholders as far as access to land is concerned. In short, in his view Brazilian agrarian reform is neither a viable answer to the landless nor to the *minifundio* issues. While the landless may have alternatives—some even better than becoming a small farmer—in the context of a growing economy, the *minifundio* is currently one of the main sources of rural poverty, and at least a portion of the very smallholder farmer could be prevented to become either landless in the near future or urban poor without adequate conditions to comply with the requirements of urban labour markets.

Land is certainly a main constraint faced by Brazilian smallholders, but so far this constraint have been looked at mostly as a matter of physical size and addressed by an agrarian reform that paradoxically focus only on landless families and does not tackle the *minifundio* problem. The institutional dimensional of the land constraint, in particular fragile landownership titles and possession— is almost entirely overlooked by public policies. And the same may be said to the promotion of alternative strategies to release land size restrictions through the introduction of land saving and higher land productivity techniques. Most of the rural credit directed to small holding / family farm agriculture is oriented to cover current expenses and not to investments and productive restructuring with could “enlarge” the small holdings without increasing its size—which is not as trivial as has been demonstrated by recent experience of agrarian reform.

Support to family farm agriculture

The main public program in support of family agriculture and rural development is the PRONAF – National Program for Strengthening Family Farming, implemented under the direct responsibility of the Ministry of Agrarian Development (MAD). Brazil has two different ministries dealing with agriculture, the Ministry of Agriculture



(MAPA) and the Ministry of Agrarian Development, the first dealing with agricultural policies designed to non family farmers and the later in charge of family farmers affairs. In 2010/2011 and 2011/12, Brazilian government is expected to allocate around R\$ 16 billion (US\$ 9.1 billion) to 2 million family farming (MDA/SAF, 2011)¹⁴.

Pronaf's main objective is to foster production and promote the increase of agricultural income of family farmers and agrarian reform settlers through provision of credit to individual farmers or group of farmers organized in associations or cooperatives. Over time the beneficiary group was extended to include rural households involved in non-agricultural activities; new and innovative funding mechanisms have also been added to cope with different regional contexts and beneficiaries' socioeconomic profiles. Irrespective to its ambitions, PRONAF remains, in essence, a rural credit program focused on small farming, especially operational credit.

The massification of Pronaf raised the level of default, which incidentally is a general and traditional problem among Brazilian farmers. The delays are due to poor harvests, falling prices as to the opportunistic attitude of farmers pressure groups that have enough political power to impose the renegotiation of rural debt payment terms and conditions and to gain advantages from the federal government during situation of crises.

One of the most serious problems faced by small producers is high risk associated with climate, market conditions and family health. Despite the adoption of traditional risk management strategies, small producers are generally unprotected and are strongly and negatively affected by adverse events. A bad harvest may be enough to undo years of effort, a disease may consume all family assets accumulated over years of hard working and sacrifice, a slight drop of prices may small farmers to the dilemma of defaulting or cutting down household consumption, which may be already too low. The family and community safety nets are important, but not sufficient to avoid and reduce significantly the negative effects of these events. Here innovations may also play a central role. On the one hand, institutional innovation which enable the introduction of protection mechanisms such as insurance, and on the other the introduction of management techniques, new seeds, farming techniques and practices that are more resistant to climatic variations and allow the reduction in the cost of production and therefore the exposure to market prices fluctuations are very helpful and relevant.

Another important initiative is the Family Farming Insurance (SEAF), a national program that aims to cover the entire amount financed and provide insurance to farmers that guarantees 65% of net revenue expected or projected for the project in case of weather events that result losses greater than 30% of the crop (MDA/SAF, 2011).

Along the same line the Federal Government created in 2006 the Family Farming Price Guarantee Program (PGPAF). Like the crop insurance program (MDA/SAF, 2011), the main objective of the PGPAF is to protect family farmers who use the resources of PRONAF from price swings irrespective do climate conditions. Still in this line of action

¹⁴ Ministério do Desenvolvimento Agrário, Secretaria da Agricultura Familiar (SAF).

the Harvest Guarantee (PGS), also linked to Pronaf, focuses exclusively on family farmers from the Northeast and northern Minas Gerais – regions where the draught risk is very high.

The Harvest Guarantee Program aims to provide assistance to producers who suffer crop losses due to drought or excessive rain. Assistance is provided when losses reach at least 50% of expected production of selected crops included in the Program (cotton, rice, beans, cassava and corn are the most important). The Federal Government pays the benefit or compensation in six monthly instalments (MDA, 2011).

Small producers face serious difficulties to access markets in appropriate remunerative terms. Only a small portion—precisely those with the best general conditions—is inserted into the most dynamic and profitable agribusiness value chains. The vast majority continues to trade with middlemen at the farm gate or at the local fair, subject to significant price reductions and fluctuations in the price that may occur simply because of a heavier rain on the day of the fair.

The complexity of this problem is often underestimated by rather simplistic policies schemes that focus more in the condemnation of intermediaries than in tackling the actual factors that are responsible for the low level of market development in rural areas. Among the factors that hinder access to the market is, on one side, the deficit in infrastructure, particularly roads. On the other there are the shortcomings or deficiencies of the supply itself, either regarding the output quantity and quality or the delivery time and reliability, just to mention the most relevant ones. Traditional policies of price support or automatic acquisition failed to deal with these structural problems and those most successful have merely reproduced the structural inefficiencies rather than removing them and improving smallholders' competitiveness.

Here again innovation has an important role for overcoming the bottlenecks. First, there is need for innovations in the production system itself, to enable the increase of scale and quantity and especially to bring the product to market requirements. Second, there is also strong need for management technologies applied to the holding, which would facilitate the compliance with market regulations and requirements. Third, innovations that facilitate the creation and operation of networks of small producers, whether in the form of cooperatives, associations, agro-industry integration, are also on strong need. In most instances individual producers have no sufficient scale to trade in the most dynamic markets without the formation of production and trade networks.

In particular, significant progress has been achieved in the promotion of access of small farmers to institutional food markets. The purchase of smallholding / family farmer food production by public institutions and programs (food distribution programs, hospitals, schools, military forces, etc.) had, in many areas, a positive impact on smallholding farmers. It triggered institutional mobilization of small producers for additional resources and support to respond to this market opportunity. In many rural territories small producers have regained market share in value chains they have traditionally participated, and in some cases they have even increased their role in

relevant local markets. The access to institutional markets have played a catalytic role of combining several so far isolated initiatives, such as the operating credit, focalized investments in the plots and in strategic associations / cooperatives' assets, such as refrigerated milk reception posts to collect scattered production, and guaranteed price. The main problem is the very low ceiling of the amount that each producer can sell under the program scheme. It is indeed to low and does not even ensure an income level above the poverty line for those very poor and it restricts growth of those more dynamic which could lead a local accumulation process amongst smallholders farmers.

Within this same context, another interesting initiative is the More Food Program (WFP) (*Mais Alimentos*) launched in 2008. The program aims to stimulate the supply of agricultural products from family farmers in general and is directed more precisely to those groups who are struggling to respond to the incentives offered by the programs mentioned above. *Mais alimentos* is funding investments in infrastructure at the plot level and equipment which is expected to have direct impact on production capacity and productivity.

Another interesting instrument adopted by the government is creation of institutional markets for family farm production. It followed previous initiatives of state and local governments, which are interested in encouraging small local farming and food production, occasionally purchased food from local small holders either to distribute or to use in school, hospitals, prisons etc. However, the creation of the Food Acquisition Program (*Programa de Aquisição de Alimentos – PAA*) in 2003, under the *Fome Zero* Program, has institutionalized this support to family farming, and has since been one of the strongest drive force for new investments by organized groups of family farmers.

The Federal Law nº 10.696/2003 established the PAA, whose main objectives are: i) ensure access to food in quantity and regularity of the populations vulnerable to food insecurity; ii) contribute to the formation of strategic stocks; iii) enabling farmers storing their products; and iv) promoting social inclusion. The main actions of PAA are formation stocks and direct purchase of family farming (MDA, 2011).

There is no doubt that finance small farmers and facilitate access to credit sources are relevant measures to promote local development and combat rural poverty. However, access to credit alone does neither change production capacity nor the poverty condition of the small rural producers. It is necessary to intervene directly in the technology base to increase total productivity of the resources, which are rather limited as shown above.

It should be noted that most credit goes to fund current expenses and just a limited amount to fund investments required to overcome the structural deficits of resources of the small family farms. As is known, during the crisis season's small farmers are forced to consume the capital they have managed to accumulate during the good years, in particular animals. Moreover, technology by itself is not enough without money resources and proper technical assistance and extension. In most cases the increase in productivity requires innovation, or changes from traditional practices and known by the farmer.

Restrictions, Innovations and Challenges

The intrinsic structural features of smallholding family farming sector impose several restrictions to the incorporation of technologies progress at the same pace observed in other sectors of agriculture. Restrictions may be grouped in three types according to the nature of the factors: (i) scale, dispersion and isolation, (ii) economic and financial factors, and (iii) socioeconomic personal and family profile.

The size hinders the incorporation of cost effective technology. Many technologies, particularly mechanical ones, are indeed indivisible as from a certain limit. The reduction of scale, even within the operational limits, reduces both efficiency and cost-effectiveness of the equipment. Overcoming this obstacle requires organizational innovation, formation of networks of producers, what is not a trivial deed, even for small producers with a history of cooperation.

The dispersion and isolation also require more than physical technology solutions organization and infrastructure investments. The introduction of the requirement for milk cooling provides an excellent example. As most of the small producers would not be able to comply with such requirement, it was predicted to be the final stroke for the remaining family farms dairy producers. However, the opposite has occurred: family farmers organized themselves into cooperatives or associations; governments funded the installation of refrigerated collectors of milk at strategic points in rural areas, which are administered by their own associations of producers; Pronaf financed investments at the plot level (animals and installation) and the result was the recovery of traditional dairy basins, which were in crisis. In its turn, that has attracted investments from private companies, who also co-finance the production of small producers. This example indicates that even more complex challenges may be successfully faced by coordinated actions of very different nature: technology is not a panacea and technology by itself is seldom a solution to any problem.

Family farmers face problems associated with the economic and institutional environment in which they operate. In all regions, small farmers have limited access to credit, particularly for investments, and to technical assistance. Part of family producers, particularly in South and Southeast regions, explores production systems that are intensive in purchased inputs, and therefore need working capital to fund the operational costs and to maintain the flow of production. Family farmers need of working capital to operate more efficiently, cost-effective and sustainable, and the lack of appropriate credit lines impose additional restrictions on family farming operations. The poorest need further investments to increase capacity and remove structural obstacles, and face even greater restrictions to access credit. There is an unbalance between the cost of technology and the overall payment capacity of smallholders. The viability of many investments requires long term funding which is not usually and easily available to small farmers. Again, access to technology and innovation are intrinsically linked to other factors, in particular to inadequate financing schemes and technical assistance.

The universe of family farmers is extremely diversified and the differentiation reflects local conditions such as weather, access to markets, infrastructure and the context mentioned in the Introduction. Differentiation is also a result and reflects the

conditions of the farmers themselves, such as farm size, level of accumulation to cultural heritage, technical and vocational training and the level of education. Agricultural farmers are not only profoundly different amongst themselves, but they also face different sets of restrictions. The analysis of production systems carried out by Buainain *et al.* (2007) revealed that farmers have a strong capacity to adapt to a number of constraints faced; they showed that these farmers tend to explore intensively the available resources in different environments. Finally, the analysis unveils a strong rationale in the systems adopted by small farmers. Rationality in the sense that the systems reflect quite directly their situation and the constraints faced, and that, given the restrictions, they usually extract close to the maximum from the available resources, under the conditions that the resources are made available and the means available for them to use the resources. It is within this perspective that must be understood, for example, that smallholders in many areas still allocate a high share of effort and production for family consumption. Rather than reflect any kind of 'backwardness' this decision is more likely a result of wisdom.

What are the production options for a small farmer located hundreds of miles from the nearest dynamic market, isolated part of the year due to lack of road, with no electricity supply and technical assistance? What alternatives he actually has to use the resources? How can he adopt the so-called modern technology and rely on unavailable technical assistance services? What will he do when the equipment breaks down during the period in which it is more intensively used? How can allocate resources on inputs with no guarantee of being able to sell the output at prices that compensate for the expenses? Finally, the analysis shows that most of the systems have a very strong internal logic, and that this logic is built on objective factors as well, not just in alleged subjective and backward behavioural factors usually attributed to family farmers, such as risk aversion or conservatism and resistance to change.

But rationality does not imply that the systems are sustainable and or competitive. The analysis of the *roça* system common in the North, based on rotating temporary crops in small plots of burned forest, is becoming unsustainable because the fallow period is too short to allow for the restoration of the forest, what leads to rapid loss soil fertility. In other cases, the difficulty is due to socioeconomic conditions. Systems based on permanent crops that take several years to go into production require continuous expenses and investment, which are beyond the reach of most small producers. Most are not able to care of the cultivation as recommended and at the end the outcome to not correspond to expected parameters and the sustainability of the system itself is negatively affected. In some cases the systems are put under pressure by institutional changes such as the requirement for milk cooling in the plot, which is inconsistent with the scale of the most family farmers milk producers.

From the standpoint of the internal logic of the productive systems the small producers face several bottlenecks: need for continuing investments; working capital requirement; scarcity of family labour; difficulties to catch up with the process of innovation; managerial deficit; coordination of production networks; information asymmetry and little knowledge / experience of markets; land availability; genetic resources / quality level inadequate to meet the new demands of the market, among

others. These restrictions, more than the lack of the so-called appropriate technology, explain the difficulties faced by smallholdings to innovate.

The viability of smallholding agriculture depends upon the increase in both efficiency and total productivity of factors, in particular of land and labour.

Given the main characteristics of the Brazilian family farming, the incorporation of relatively simple technologies can have significant impact on productivity. As shown by Di Sabbato, Buainain and Guanziroli (2011), access to electricity and the use of mechanization of processes could lead to overcoming the traditional agriculture of the "ax, hoe, sickle," with significant positive effects.

Technical assistance and extension services are crucial to the process of innovation among small farmers in general. In most cases, introduction of the technology is just the beginning of the innovation process, whose consolidation and sustainability requires the continuous improvement of the producer and the family, and this is only feasible with technical and financial support. It is estimated that only 21% of family farms in Brazil have access to technical assistance. As noted above, only 2% of producers with areas smaller than 2 hectares received technical assistance on a regular basis; in the range from 2 to 5 hectares, this percentage reaches 5.8% and amongst those from 50 to 100 hectares 9.8% had access to technical assistance. Finally, it is estimated that 31% of family farms using only manual force (manpower) for the development of production (IBGE, 2006; Di Sabbato; Buainain; Guanziroli, 2011).

To Batalha, Buainain and Souza Filho (2005) draws attention to the importance of the innovation agent. For them, the low technological level of the Brazilian family agriculture is not due only—and not even mainly—to the lack of technology, but is explained by many factors which have been mentioned in this paper. Even when technology is available often it does not become innovation because of the lack what they call the "innovation stakeholder", the agent who is responsible for selling the idea, the technology, the package, and for the diffusion of the technology among small producers. The major seed companies, for example, maintain a network of well paid skilled professionals doing fieldwork with its clients; agricultural machinery industries are usually responsible for the assembly of the funding schemes used by the clients their products; so do the major producers of fertilizers and the large trade companies. For the small farmers the innovation agents have been mainly the public sector, the NGOs and the international organizations (IO), whose importance cannot be reduced. Nevertheless, whereas the innovation stakeholders operating with the larger farmers are driven by economic incentives, public agencies, NGOs and IO are mainly driven by moral commitments, which stem from good intentions and policy guidelines that change with governments, employees and availability of resources to finance the aid programs of NGOs and IO.

It is the action of this agent of innovation, among other things, which explains that producers, which are vertically integrated into supply chains, coordinated by agro industries have achieved higher levels of technical development, productivity and income. In most cases these innovation stakeholders operate as coordinators of a set

of actions required to enable the innovation process, from the supply of technology package itself to technical assistance, funding and access to markets.

It should also consider that the "new" context requires that farmers can rely on tools to assist them in making decisions that are appropriate to their characteristics and profile. In particular, management tools must take into account the "culture" organizational and limitations with regard to formal education and the environment itself. The proper management of the estate is becoming increasingly essential to deal with increasingly complex situations. The adoption of a set of tools enables the maintenance of competitiveness and sustainability of the family (Batalha, Buainain and Souza Filho, 2005).

In regard to management technologies, there is need to invest in the development and introduction of tools to deal with the internal affairs of the holding and with the management of social networks and value chains in which they are inserted (Batalha, Buainain and Souza Filho, 2005)

It is common to think that family labour is abundant, and that small producers can count on "an unlimited supply of labour." This common sense is far from being true. Labour may be an abundant resource regarding the availability of capital, but even the majority of poor farmers do not have such elastic supply of labour, as family members have fled in search of occupation elsewhere. And family labour restriction is even more stringent for those smallholder farmers that have attained better production and living conditions, and explore more capital-intensive and labour-intensive systems. In their case, family members leave either to seek better education, to establish their own business and or to engage in higher paid and qualified job in rural and or urban areas. Amongst the factors that explain the growing shortage of family labour, it is worthwhile mention the following: increased complexity of those production systems which are more integrated into the more dynamic value chains; increasingly relevance of management activities even amongst smallholders farmers, particularly in those more market oriented; greater importance of education even among the rural poor; formation of new housing by rural youngsters who seek out new opportunities through migration.

In fact, there is a noticeable reduction of labour available to work in the family household. Both in the more developed and in poorer rural areas, for different reasons, it is clear that a process of 'emptying' is going on; it is also clear the reduction in occupations directly related to agricultural work, with the expansion of non-agricultural occupations. Among the more prosperous small farmers, the priority assigned to education of the children competes with agricultural work, and among the poorest, is the requirement for survival that pushes the children and youngster out of the family plot, either as a day labourer or as a migrant to other rural areas or to urban centres.

In Europe and in the USA this shortage of family labour was overcome through the introduction of labour saving technologies and through the incorporation of cheap work force provided by international migration. In Brazil, as mentioned, only a very small number of small producers have benefited from the introduction of new technologies since mid 70s.

It is now time to revert this situation. As mentioned above, the main bottlenecks are not the lack of so called adequate technology. There is no secret on how to produce small tractors or other modern agricultural equipment adequate to small producers scale, for instance. The real issues here is how to create and feed a market for these technologies, how to transform small producers' needs into demand and how to transform this potential demand into supply flows with sufficient scope to reach small producers. Successful innovations require more than the supply of the good and the sale of the service; it requires the creation and functioning of networks—which can be rather complex even for very simple innovations—to sustain the supply flows in accordance to the demand, to provide technical assistance, to supply spare parts, provide repair services and so on. On the other hand, it also requires the organization of producers to reduce transaction costs, which in many areas could be unbearable high due to the isolation and geographical dispersion of smallholders.

Buainain *et alli* (2007) argue that increasing shortage of family labour may bring competitiveness difficulties to well to do family farmers—particularly those which explore more intensive and integrated production systems. According to them, the great advantage of the family farm is precisely the lower cost of management and supervision of family labour, and to the extent that the basis of family labour is reduced, it is likely that the accruing benefits will also be reduced. That is why in many rural areas in Brazil the adoption of labour saving technologies is crucial for the future of family farming. This would allow the intensification of production without overexploiting the labour force, as it has always happened amongst the poor, the increase of the productivity of family labour and the harmonization of working needs with new social requirements such as education, health care and participation in the community life.

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