



# **A Framework for Sustainable Food Security for latin America and the Caribbean**

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**Inter-American  
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**A FRAMEWORK FOR SUSTAINABLE FOOD SECURITY FOR  
LATIN AMERICA AND THE CARIBBEAN**

Cesar Falconi, Maximo Torero, Eduardo Maruyama,  
Manuel Hernandez and Miguel Robles

## Abstract<sup>1</sup>

This Technical Note presents a framework for food security in LAC that takes into consideration the key drivers and external factors behind food security. This framework for food security policy interventions will guide policymakers and analysts in answering the following questions: i) Which are the top priority interventions needed to provide a more focused approach to food security aimed specifically at dealing with the issues that are impeding LAC's capacity to reduce the impacts of the food crisis on its population and at helping to solve the food crisis, given the region's comparative advantages in agriculture; ii) What is the net impact of policy interventions across households in the region, taking into consideration environment and climate change, water management, trade liberalization, and domestic food prices; and iii) How does a specific policy intervention compare to other policy interventions with respect to net impact on food security, other positive impacts, and net intervention costs?

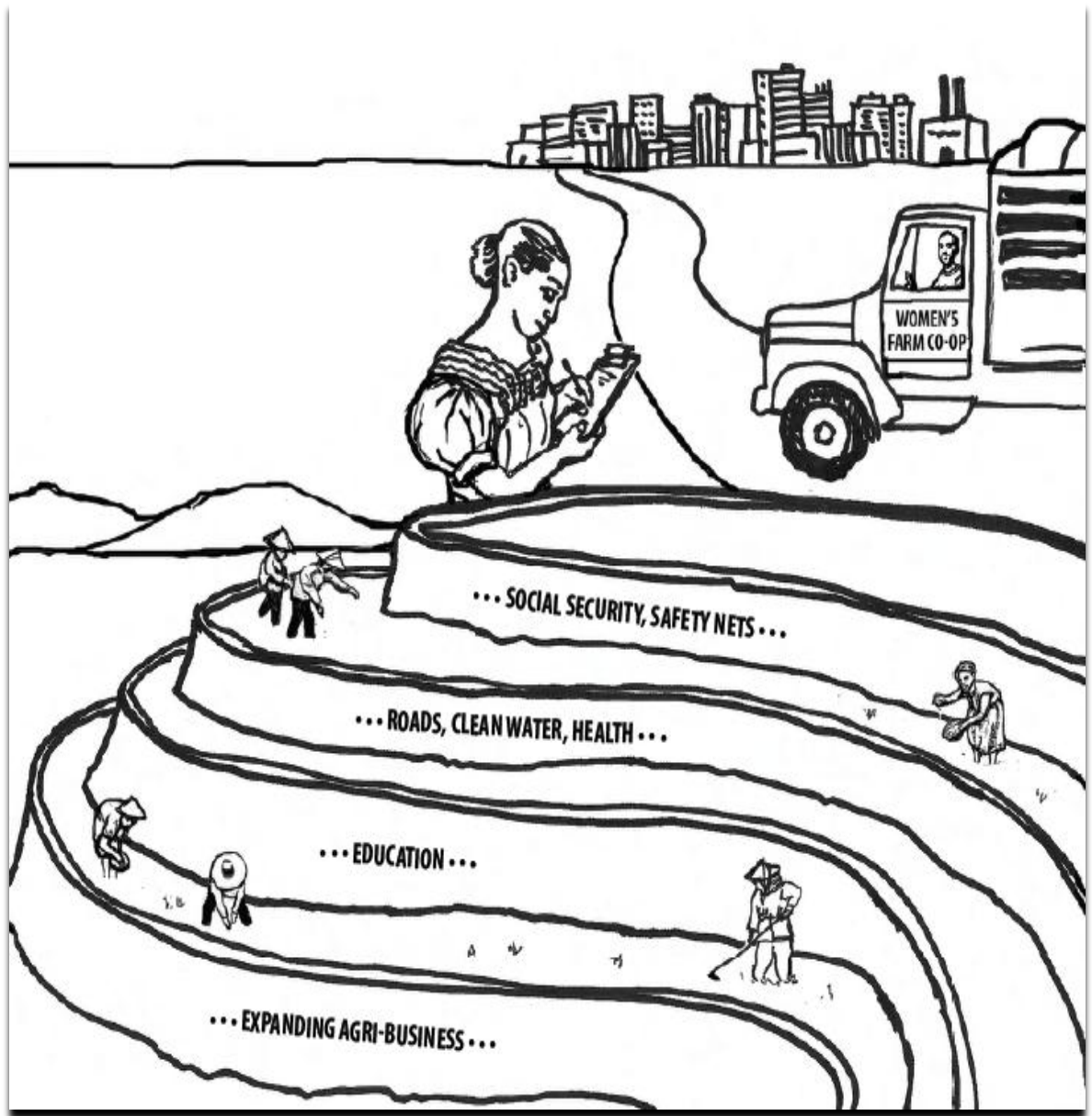
To accomplish these objectives, the proposed framework also presents at the end a proposal for a policy evaluation tool design that will allow policy decision-makers and donors to quantify the direct and indirect impact of policy interventions, as well as other economic and social benefits and costs that can be attributed to such food security interventions.

**JEL Codes:** Q18; N56; O13

**Keywords:** Food Security; Agriculture; Policy Interventions; Policy Evaluation Tool

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## 1. Introduction

Since the late 1980s, almost all Latin American countries have adopted a series of far-reaching economic reforms, including trade, financial, and capital account liberalization. Increased economic openness has gone hand-in-hand with large financial inflows—particularly in the first half of the 1990s—and has brought new sources of economic growth. As a result, economies grew, inflation declined, and there was a large surge in foreign capital inflows. Although overall growth slowed after 1995, the region has continued to experience strong growth in the past five years, the best sustained performance since the 1970s. With the exception of a handful of countries, this economic growth has been accompanied by relatively modest inflation.

Despite these positive results, virtually all Latin American countries share similar problems: uneven economic growth, lagging agricultural growth, and unacceptably high poverty and malnutrition rates in certain cases. More than 60 percent of the region's poor live in rural areas, where slow economic growth, unequal distribution of assets, inadequate public investment and public services, and vulnerability to natural and economic shocks are major policy issues. In terms of malnutrition, the average prevalence of underweight in children under five years in the region is 5.4%, but countries like Guatemala and Haiti still exhibit rates above 16%, only equivalent to malnutrition rates observed in some Sub-Saharan Africa countries.



**Table 1 Prevalence of underweight in children under five years (%)**

Argentina	2.3
Bolivia	4.5
Chile	0.5
Colombia	5.1
Costa Rica	0.9
Ecuador	6.2
El Salvador	5.8
Guatemala	16.9
Haiti	18.9
Honduras	8.6
Jamaica	2.2
Mexico	3.4
Nicaragua	6.0
Panama	3.8
Paraguay	3.0
Peru	0.6
Venezuela, RB	3.7
Simple Average	5.4

*Source: World Development Indicators, 2011*

The 2007/08 and the 2010/11 food price crises have exacerbated these problems. Although the region was considered relatively stable and capable of absorbing external shocks—due to its higher foreign exchange liquidity, decreased public sector and external borrowing needs, exchange rate flexibility, lower exposure to currency, interest rate, and rollover risks in public sector debt portfolios, and more access to local currency loans—the food price crises have severely affected most LAC countries in terms of inflation, especially food inflation.

The impact has been greater on net importing countries (specifically, Central America and Mexico), as well as on poor consumers in peri-urban and rural areas. Most Central American countries are net consumers of basic food; for example, it is estimated that before the crisis, in El Salvador, Guatemala, Honduras, and Nicaragua, 68.2 percent, 83.3 percent, 88.8 percent, and 90.2 percent of households, respectively, were net food consumers. As a result, when the food price crisis of 2007/08 hit, a rural household in El

Salvador was able to buy only 56 percent of what it bought 18 months prior with the same amount of money (\$0.17)<sup>2</sup>.

Before the crisis, most LAC countries were on track to reach the Millennium Development Goal of halving the proportion of people who suffer from hunger by 2015; with the food crisis, a significant number of countries had to revise their ability to accomplish this goal. Furthermore, the fear of more permanent inflationary pressures coming from food prices alerted most central bankers in the region.

As a response to this situation in the region, the following document presents a framework for food security in LAC that takes into consideration the key drivers and external factors behind food security. This framework for food security policy interventions will guide policymakers and analysts in answering the following questions: i) Which are the top priority interventions needed to provide a more focused approach to food security aimed specifically at dealing with the issues that are impeding LAC's capacity to reduce the impacts of the food crisis on its population and at helping to solve the food crisis, given the region's comparative advantages in agriculture; ii) What is the net impact of policy interventions across households in the region, taking into consideration environment and climate change, water management, trade liberalization, and domestic food prices; and iii) How does a specific policy intervention compare to other policy interventions with respect to net impact on food security, other positive impacts, and net intervention costs?

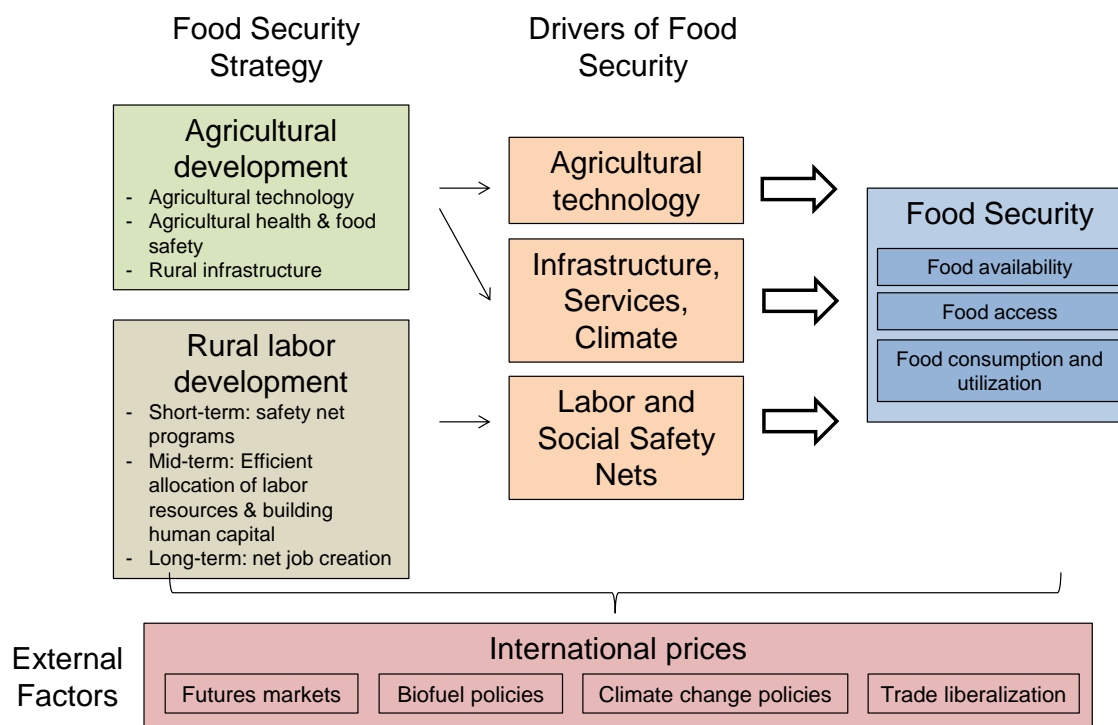
To accomplish these objectives, the proposed framework also presents at the end a proposal for a policy evaluation tool design that will allow policy decision-makers and donors to quantify the direct and indirect impact of policy interventions, as well as other economic and social benefits and costs that can be attributed to such food security interventions.

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<sup>2</sup> World Food Program (2008) with data from DIGESTYC, EHPM, 2003 and MAG, División de Información de Mercado, mayo 06- enero 08. Análisis: PMA, El Salvador, 2008.

The next figure summarizes the proposed integral framework for food security in LAC in the context of internal drivers and external factors that affect food security. The framework involves both an agricultural development strategy and a broader rural labor development strategy, which will have a direct impact on the key drivers behind food security: agricultural technology, infrastructure, access to services, climate change mitigation and adaptation, and labor and social safety nets. In particular, the agricultural strategy is intended to maximize benefits for agricultural farmers and includes the development of agricultural technology, agricultural health and food safety, and rural infrastructure. The rural development strategy is intended to implement safety net programs in the short-term, achieve efficient allocation of labor resources and build human capital in the medium-term, and result in net job creation in the long-term. The potential impact of external factors on food security, such as the behavior of commodity futures markets, global biofuel and climate change policies and trade liberalization policies, is also recognized.

**Figure 1 Summary of the framework for food security in LAC**



The remainder of the document is organized as follows. Section 2 provides a formal, traditional definition of food security and further associates the concept of food security with all sectors of the economy. A broader understanding of food security is crucial for developing an integral framework that goes beyond the development of the agricultural sector. Section 3 outlines the key drivers for food security and presents a diagnostic of the current situation in LAC. Section 4 presents the proposed framework for agricultural development, which can be divided into three key pillars: agricultural technology, agricultural health and food safety, and rural infrastructure. Section 5 discusses the rural labor development strategy, which involves four key steps: quick response with safety net programs in the short-run, efficient allocation of labor resources and human capital development in the medium-run, and net job creation in the long-run. Finally, Section 6 proposes a framework for food security policies, which is intended to guide policymakers and analysts in future interventions.



## 2. Definition of Food Security

Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO).

Food security has three key dimensions. First, food availability or food supply. Food supply availability is a pre-condition for food access. At the national level, food supply availability has two sources: i) domestic food production and net of food exports; and ii) food imports. Therefore policies that promote the expansion of domestic food production and facilitate international food trade are potentially pro-food security policies.

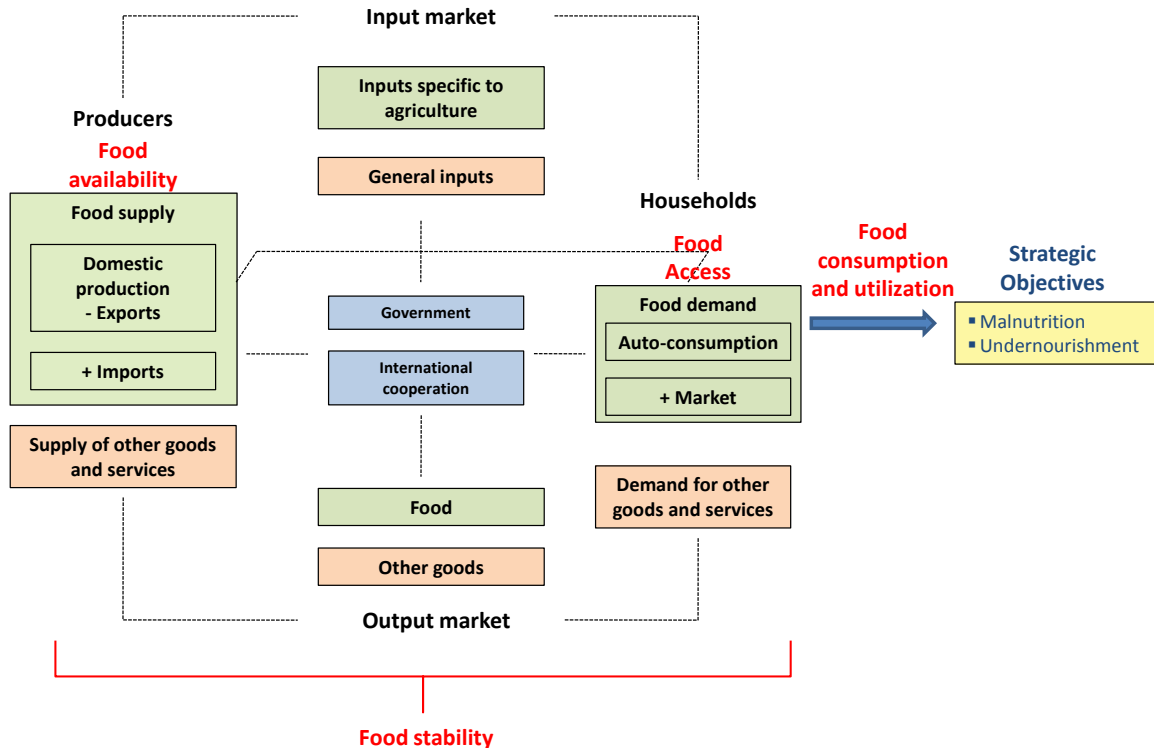
Second, purchasing power for food access by households. Access to food requires households to have adequate purchasing power (real income) for food acquisition through markets. While in the short-run this is not the case for the poorest households in LAC, medium-term policies that promote higher sustainable real income for the poor are without doubt pro-food security. Real food demand capacity is also affected by food prices which are influenced by domestic interaction between supply and demand, by international prices, and by policies that shape domestic and international food price transmission.

Third, food consumption and utilization. Food security also requires access to adequate, safe and nutritious food. This, in turn, depends on several economic and sociocultural factors. In particular, poverty, education, gender disparities, geographical location, available sanitary conditions, and cultural practices are important factors that affect food consumption patterns. Consequently, policies that increase the level of education of the population, promote better dietary habits, and improve sanitary and health services are also pro-food security policies.

In addition, safety net programs for vulnerable groups are crucial for food access. Safety net programs assist populations with inadequate purchasing power to gain food access. Safety net programs can provide additional purchasing power through cash transfers and/or provide food directly to vulnerable groups. In both cases, safety net programs have an effect on food demand and food supply. Cash transfers can directly affect the demand for food as program beneficiaries use the cash to increase their food purchases in local markets. Food transfers also affect food demand, as programs must purchase the food to be transferred. If induced demand of safety net programs has an impact on prices, this might also induce food supply response.

In a broader sense, the concept of food security can be associated with all factors underlying the economic circuit of an economy, including both the agricultural and non-agricultural sector (see Figure 2). Understanding the concept of food security from a broader economic perspective is important to distinguish between direct policies oriented to promote agriculture development and indirect policies oriented to promote rural labor in a broader sense and increase household income, which also contribute to ensure food security. It further helps to identify the mechanisms through which the different policies can reduce food insecurity and to better assess the impact of these policies across time. Policies to promote agricultural development, for example, might involve short-, medium-, and long-term programs, while policies to promote sustainable rural income growth typically require an important number of medium- and long-term policies.

**Figure 2 Food Security and the Economic Circuit**



All of the food security dimensions were significantly affected during the 2007/08 and 2010/11 food price crisis (Robles and Torero 2010). Empirical estimations for the welfare effects of high food prices between 2006 and 2008 in Guatemala, Honduras, Nicaragua, and Peru reveal several facts. First, the rise in food prices has represented a negative shock for the great majority of households in urban as well as rural areas. In urban areas, almost all, if not all, households have been negatively affected. Under an optimistic scenario in which rural producers benefit from high prices, we estimate that no more than 20 percent of rural households in Honduras and Nicaragua would have benefited from high food prices; in the case of Guatemala and Peru, this would have been only 2 and 5 percent, respectively. Second, there are important disparities across countries regarding the magnitude of the shock and its impact on households. The average loss (as proportion of total consumption expenditure) ranges from 1.7 percent in Peru to 7.1 percent in Nicaragua; in all cases, loser households in rural areas suffer more than their urban counterparts. Third, within countries, high food prices have a negative and regressive



effect; poorer households suffer proportionally more than richer ones as they devote a larger proportion of their income to food expenditure. This regressive effect is extremely marked in the urban areas of all four countries. In rural areas, the effect is also present in all countries with the exception of rural Guatemala. Fourth, the aggregate magnitude of the losses as a proportion of national consumption expenditure is not minor; losses range from 1.4 percent in Peru to 5.8 percent. However, in all countries except Nicaragua, the resources needed to fully compensate the two poorest quintiles in each country are relatively inexpensive - in the order of half a percent point of the aggregate national consumption expenditure. Only in the case of Nicaragua does this compensation require more than 1.5 percent of aggregate consumption. Fifth, food price shocks contribute to an increase in poverty rates in the order of 1 percent point in Guatemala, Honduras, and Peru; in Nicaragua, the effect is much larger, 4 percent. In terms of poverty dynamics, we found that a poverty deepening effect dominates by large. In all countries and regardless of the region, we found that almost all poor households become even poorer due to high food prices. Only in the case on rural Nicaragua do we find evidence that 2.6 percent of initially poor households escape poverty under the assumption of full price transmission to producers. Sixth, accounting for substitution effects is not a minor issue in quantifying the effects of the increasing food prices between 2006 and 2008. Our estimates indicate that these effects (among loser households) will be overestimated by 8 and 7 percent in Guatemala and Honduras if substitution effects are omitted. In the case of Nicaragua and Peru, the overestimation is lower but far from insignificant, 2.3 and 3.5 percent. Seventh, relaxing the assumption that rural farmers benefit from high prices when selling in the market does not make an important difference in our overall estimates of the impact of high food prices. Clearly, in this case all households will be negatively affected as we shut down the channel through which rural food producers might enjoy benefits. However, as we estimate that only a small proportion of households might become net winners due to rising prices, this effect does not account for much in the aggregate. For example, our estimates of poverty changes are nearly the same in Guatemala, Peru, and Honduras; in Nicaragua, not allowing for price transmission to producers adds 1 percent point to the national poverty rate.

When assuming a common price shock across countries (10 percent increase in most food items), we get further interesting results. In this case, the cross-country comparison is not influenced by differences in the size of the price shocks across countries, which in part could be explained by domestic policy responses. Hence differences in the welfare impact are due to differences in production and consumption structures between countries. First, we confirm that at a national level most households are negatively affected, but rural winner households are more likely in Nicaragua and Honduras (more than 10 percent). Interestingly, we find that in rural Guatemala, Nicaragua, and Honduras, the proportion of winner households is higher among the poorest quintiles. In the case of Nicaragua and Honduras, this difference is important, as 18 percent of the poorest households become winners. Therefore as rural farmers face higher prices for what they produce, there is potential for even the poorest ones to grab benefits. Second, we confirm that the impact of high food prices is regressive in urban areas, although in rural areas we do not find a clear regressive or progressive pattern. Cross-region comparisons tell us that rural households suffer more than urban ones in Guatemala and Peru. However, in Nicaragua and Honduras, the opposite is true; urban households suffer slightly more than rural ones. Third, when we compare loss size across countries, we find that on average the largest losses take place in Guatemala (while before Nicaragua was the most affected) in both urban and rural areas (4.6 percent and 5.8 percent, respectively). The smallest average losses are found in Honduras, where on average, loser households suffer a 2.9 percent reduction in their expenditures. Fourth, important disparities in total aggregate losses do not disappear. The range of total aggregate losses goes from 2.5 percent in Honduras to 5.3 percent in Guatemala. Fourth, the increase in poverty rates goes from 1.5 percent points in Honduras to 2.3 percent points in Nicaragua and is very similar in Guatemala (2.2 percent points). Hence even though in Nicaragua the average loss (as a fraction of consumption expenditure) is not as high as in Guatemala in terms of poverty impact, both countries are similarly affected. Also, as before in all countries except Peru, the poverty rate change is larger in urban areas. Overall our controlled common price shock scenario indicates that the differences in the internal

structure of the countries does matter in understanding the welfare impacts of an increase in the relative price of food. Honduras and urban Peru are relatively more immune to high food prices while Guatemala and rural Peru suffer the most.

A related issue pertains to the potential impact of the recent food price crises on adequate food consumption and utilization. A recent study by Ianotti, Robles, Pachon and Chiarella (2011) using data from Guatemala shows the important negative effects that high food prices and poverty can have on micronutrient intake (see Box 1).

In summary, it is essential to clearly outline the policies that are needed to ensure food security by minimizing the costs and maximizing the benefits from situations similar to the 2007/08 and 2010/11 food crises. To minimize the costs, we argue that policymakers should focus on a strategy for rural labor markets that will focus on the extreme poor, as we have shown they are the most negatively affected. To do this, countries can take advantage of existing social protection programs. Latin America, contrary to other developing countries in Africa and Asia, has successfully developed conditional cash transfer programs that could play a significant role in addressing the risks that high food prices represent for the poor, not only because of the negative income effects but also due to a reduced access to food. Where such programs do not exist, targeted cash transfer programs arise as an alternative in the short term. However, whenever food markets function poorly or are absent, food provision programs should be considered. Microfinance programs, which include both credit and savings, should be also considered as part of the policy response. This will help to prevent drastic actions by the poor such as distress sales of productive assets that can permanently damage future earning potentials.

**Box 1: Food prices and poverty negatively affect micronutrient intakes (Ianotti, Robles, Pachon and Chiarella, 2011)**

This study examines the impact of changes in price and income on micronutrient consumption of Guatemalan households. The tested hypothesis is that increasing poverty and rising food prices would reduce consumption of high quality “luxury foods” leading to an increased probability of inadequacy for several nutrients. The study uses the 2006 Guatemala National Living Conditions Survey. Using a demand system model, the effect of two shocks on nutrient intake is simulated: reductions in income and two price scenarios: an increase in food prices similar in magnitude to the food-price crisis of 2007-2008; and a standardized 10% increase across all food groups. The disparities in intakes and adequacy of micronutrient consumption levels are then analyzed.

The results show that economic factors of food prices and income differentially influence micronutrient intakes in Guatemala. Disparities in nutrient intakes were greatest for vitamin B12 (0.62 Gini coefficient) and vitamin A (0.49 Gini coefficient). These nutrients were highly and positively correlated with income. While baseline probability of inadequacy was highest for vitamin B12 (83%), folate showed the greatest increase in probability of inadequacy as income was reduced, followed by zinc and vitamin A. With rising food prices, folate intake was most acutely affected in the poorest quintile (+7 percentage points), but zinc probability of inadequacy increased across all quintiles. Price-nutrient elasticities were highest for vitamin B12 and the meat group (-0.503) and for folate and the legumes group (-0.343).

What can be done to maximize the benefits of food price increases for Latin American farmers? In the medium run, there is clearly a need to scale up investments for sustained agricultural growth. The transition to long-term viable investments, particularly in support of market access, in agricultural science and technology is urgently needed to transform crises into opportunities and to build resilience to food crises in the future. Investments for sustained agricultural growth include expanded public spending for rural infrastructure, services, agricultural research, and technology. These investments not only have high returns in terms of agricultural growth, but also have a large poverty reduction impact in both rural and urban areas through increased production and employment and lower food prices. In particular, better market access will have implications for price transmission. As our simulations show, when farmers are able to benefit from higher prices there is the chance for even poor farmers to become winners. Our analysis here shows that transmission from international prices to domestic prices in major urban areas is present, but more research is needed to address how much of that transmission is present in minor urban center and rural areas and in particular whether farmers are able to sell their output at these higher prices.

### 3. Drivers of Food Security in Latin America

Food security is a term used to qualify the availability, accessibility, and utilization of food products; it is generally defined in terms of “access by all people at all times to sufficient food for an active and healthy life” (World Bank, 1986; World Food Summit, 1996). Having a population that is food secure requires that there is sufficient food production and food imports to allow the population satisfy their food needs. Many conditions are necessary to be able to domestically produce or import adequate amounts of food; agricultural productivity is affected by climate change, weather fluctuations, the area available to be harvested, and the infrastructure available to complement productive activities. These conditions vary widely from country to country, and their current level helps inform the mechanisms through which a food security policy would have the most effective results. We follow with a discussion of what the drivers of food security are, what the state of these drivers is in the Latin American and the Caribbean (LAC), and how a well-planned food security policy can improve the lives of the poor in LAC, help the competitiveness of the countries in the region, promote long-term growth prospects, and reduce inequality.

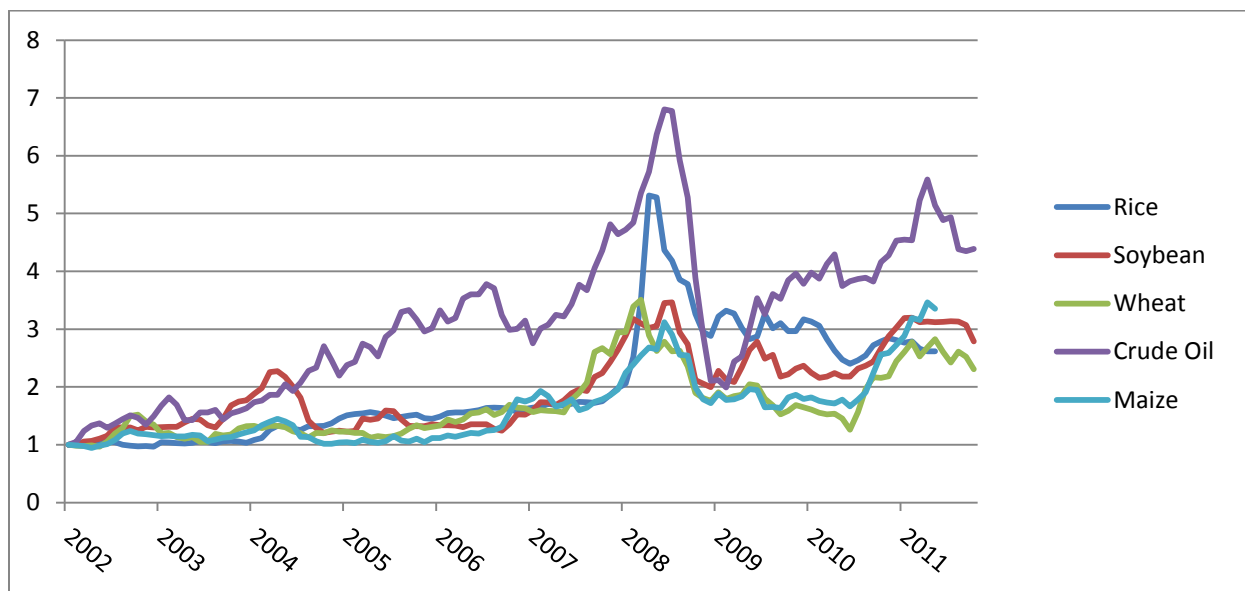
The spikes in commodity prices in 2006-08 made the need for a food security policy painfully evident. The low level of grain stocks during the period, coupled with adverse weather that stifled production, low price expectation for grains, and rising demand for grains from the energy sector caused the price of corn, wheat, and soy beans to increase very rapidly in international market, as can be seen in Figure 3.

Figure 4 shows the quarterly growth rates in these commodities. These figures highlight the brevity of the price spike which allows us to put into context the disastrous consequences such spikes can cause, as seen by the food riots during this period. These price spikes were reflected in domestic markets of LAC countries as increases in food staples, especially the staples related to wheat and rice [Robles and Torero (2010), Robles (2010)]. The issue of commodity price increases and their volatility is at this moment of

renewed importance as the effect of the crisis in LAC has increased the vulnerability and size of the population at risk of being food insecure. The crisis, coupled with the increases in commodity prices since 2010, points to the need for policy that ensures the food consumption levels of vulnerable sectors of the population.

A food security framework for LAC is not just a means to insure against the inherent volatility in commodity markets. A food security policy that puts emphasis on agricultural productivity in key sectors of each country, human capital and social institutions specific to each country, and the level of capital and infrastructure available would be able to improve the lives of the poor in LAC in ways that could be self-sustainable in the future.

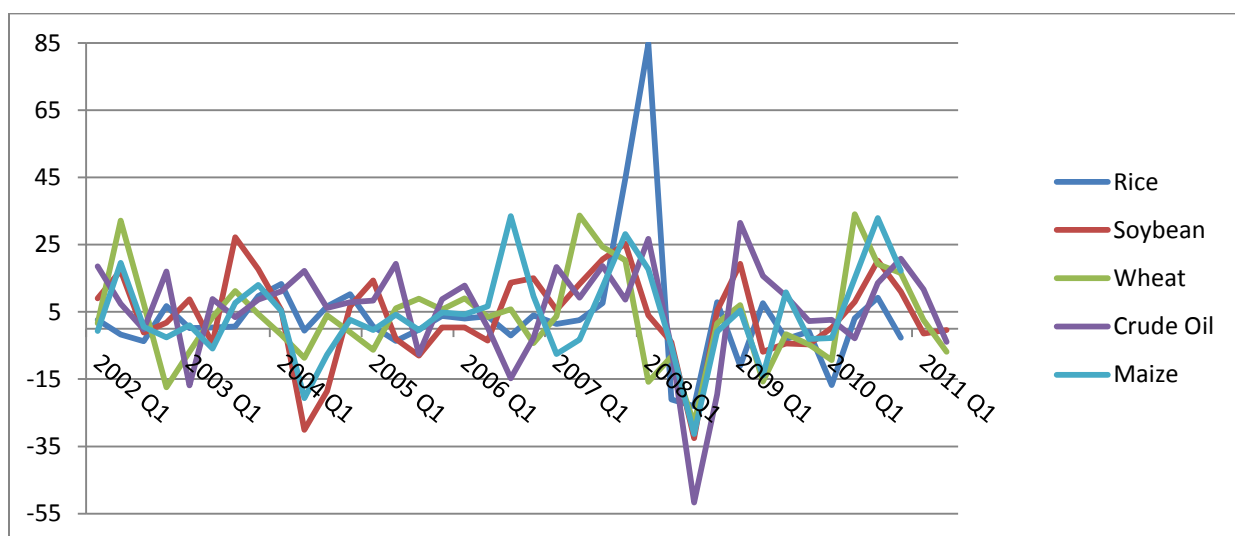
**Figure 3 Commodity Prices, 2002-2010**



Source: IMF, International Financial Statistics

\*Normalized to equal 1 in 2002

**Figure 4 Quarterly Growth Rate of Commodity Prices, 2002-Q1 to 2011-Q1**



*Source: Calculations from IMF, International Financial Statistics*

### 3.1. Agricultural Technology

The LAC region is full of possibilities and possesses many advantages. The gap in total factor productivity between LAC countries and the rest of the world is a well-documented fact. LAC countries are considerably behind in total factor productivity, and there is evidence that LAC countries are on a divergent path.

Figure 5 shows these trends in total factor productivity; we can observe the divergence in the region. Daude and Fernandez Arias (2010) study these trends and conclude that TFP is the principal factor to explain the low incomes in the LAC region vis-a-vis developed economies. Their evidence suggests that to improve the productivity gap, policies should favor productivity-specific interventions over policies that promote factor accumulation, without diminishing the importance of increasing the levels of human and physical capital.

A food security policy that invests in agricultural technology through extension services, promotion of new yields, etc., in unison with the diverse climate conditions in the region

and the trade agreements already in place, would allow for a more food secured region, by increasing both yields and necessary imports. Yield increases make agricultural products more accessible in domestic markets while opening the possibility of exporting the surplus and using these resources to finance imports of other food products. Investing in agricultural technologies in the LAC region can greatly improve productivity in the region. Given the richness of natural resource in LAC countries, the gap in cereal yields between LAC and OECD and East Asian countries, observed in Figure 6, is in large part attributable to the lack of modern agricultural technology adoption in most LAC countries. Figure 7 shows the agricultural productivity gap trends in the LAC region and the United States. Even though agricultural productivity has been constantly increasing in the LAC region, the region has not seen the acceleration that occurred in the United States in the 1990's. Figure 8 shows the ratio of the series in Figure 7; agricultural productivity in the 1980s was around six times higher in the US than in the LAC region. In 2009, the gap still stood at over 14 times higher in the US than in LAC. The previous figures highlight the importance of investing in agricultural technology, not only to catch up but to keep up with the growth in technology elsewhere.

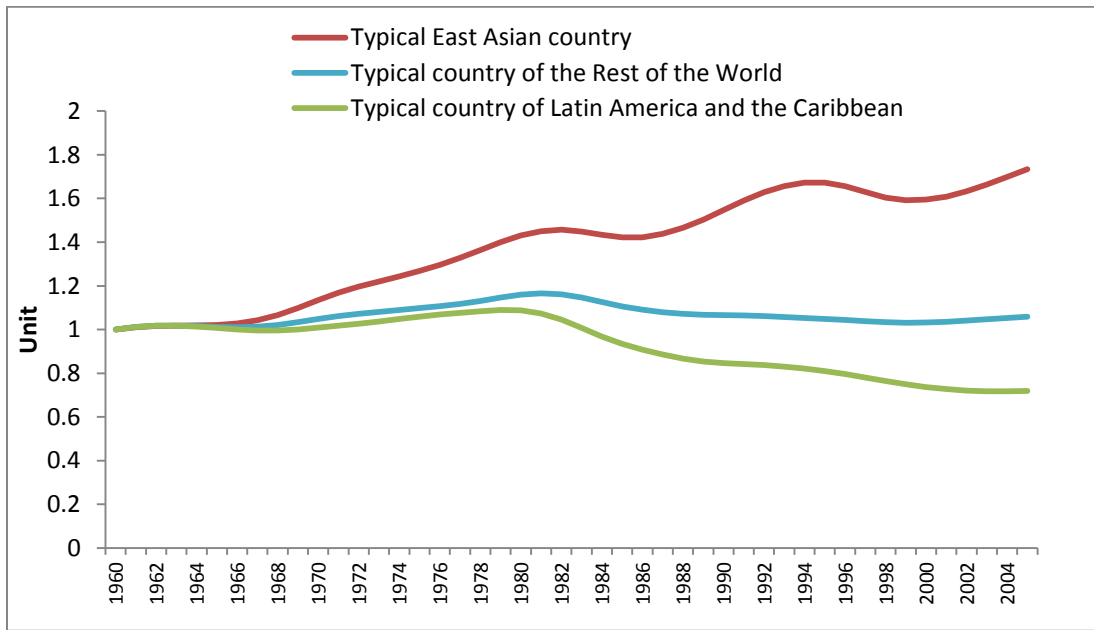
Restuccia, Yang, and Zhu (2008) conduct a cross-country study and provide evidence that suggests the differences in TFP not only explain cross-country differences in labor productivity, as emphasized in the literature, but also help account for differences in agricultural productivity. They find that developing economies with low TFP also tend to have larger labor shares in the (low-productivity) agricultural sectors; other intermediate input factors where agricultural technology is most present are substituted by the lower cost labor inputs, due to the 'excess' supply of labor in the sector.

A food security policy needs to provide incentives for the adoption of modern agricultural technology such as chemical fertilizers, new seeds and pesticides to raise agricultural productivity, making the agricultural sector more attractive to non-subsistence farmers and decreasing the entrenchment of poverty in urban centers, as the



rural population will no longer be forced to migrate to the cities to provide for their families.

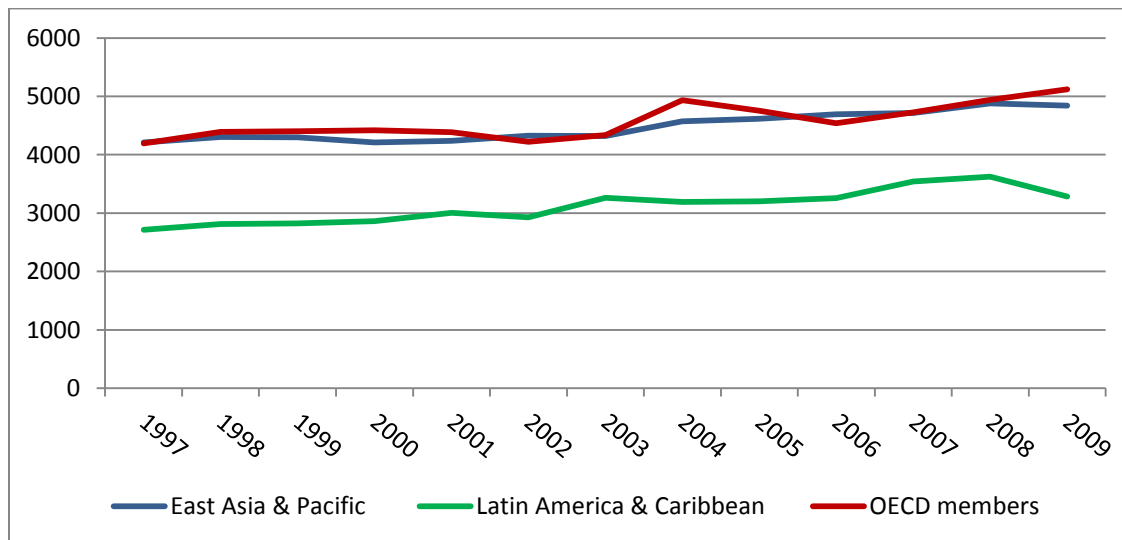
**Figure 5 TFP Gap with respect to the United States**



Sources: IDB, 2010. Data are from Daude and Fernandez Arias (2010) based on Heston, Summers and Aten (2006), World Bank (2008), Barro and Lee (2000).

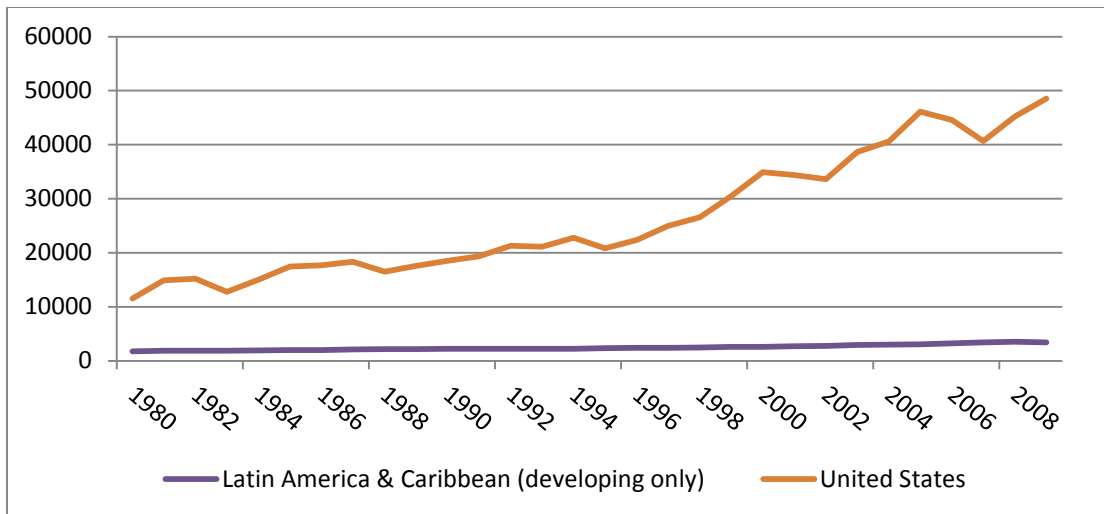
Notes: Productivity index relative to the United States. The reference year is 1960. The typical country refers to the simple average of the log of Total Factor Productivity for the countries within that region.

**Figure 6 Cereal Yield in Kg per Hectare**



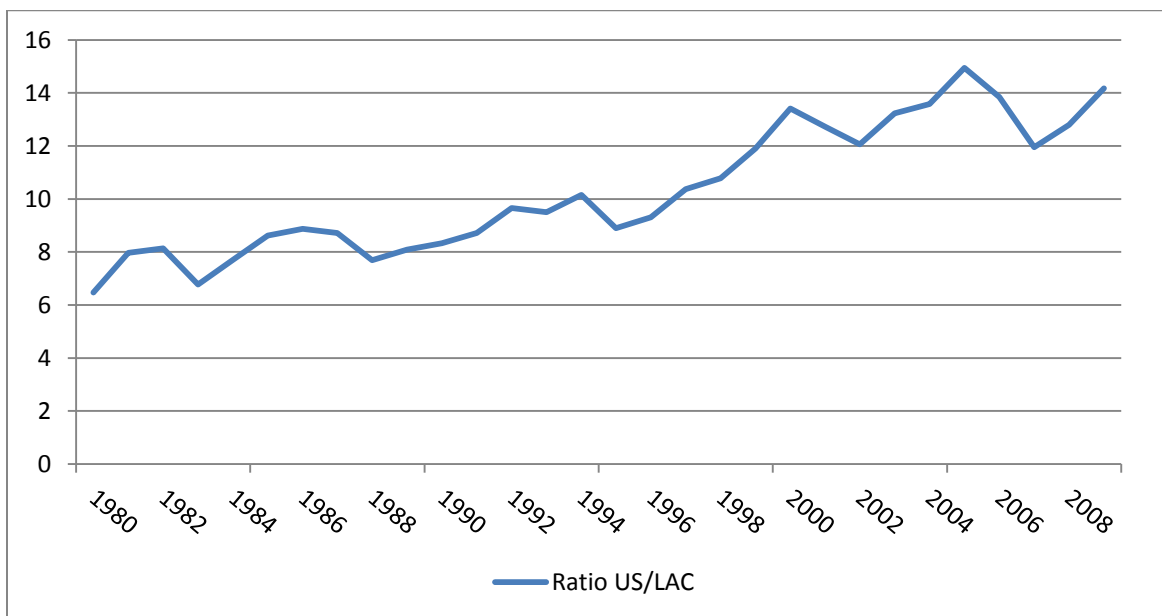
Source: World Development Indicators, 2011

**Figure 7 Agricultural Productivity Gap (Agricultural Value Added)**



Source: World Development Indicators, 2011

**Figure 8 Ratio of Agricultural productivity in the US versus LAC**



Source: World Development Indicators, 2011

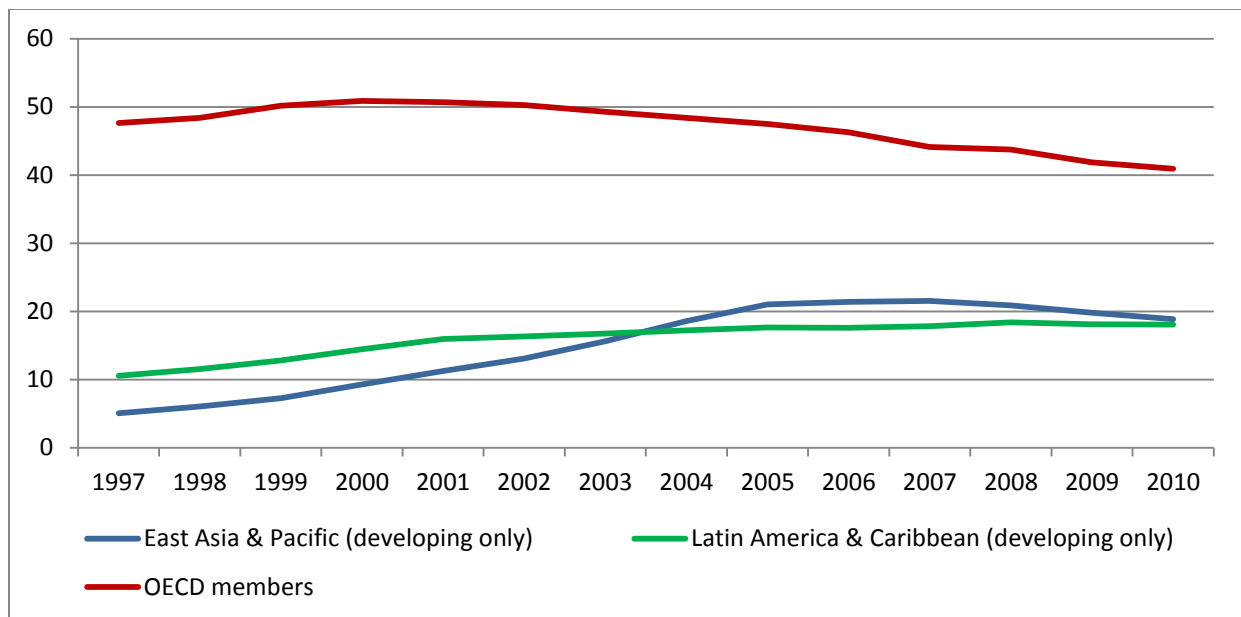
### 3.2. Infrastructure, Services, and Climate

Development policies for infrastructure have often concentrated on urban centers. The need to develop infrastructure in the rural areas of LAC countries cannot be overemphasized. Investment in rural infrastructure needs to be complementary to the particularities of the rural situation and its productive capabilities. There is a burgeoning literature on the effect of infrastructure on development. Calderon and Serven (2004) show that infrastructure quantity and quality positively affect growth and decrease inequality. Improvements in infrastructure that disproportionately affects the poor is a sensible strategy to reduce poverty. Calderon and Serven (2003, 2004) show that after accounting for the possible endogeneity of infrastructure investment and quality of infrastructure, telecommunication, transport, and power assets have a higher marginal productivity than that of non-infrastructure capital and that the slow growth in the LAC region relative to East Asia is related to the lack of accumulation of infrastructure assets in the region. Consistent with Lopez (2003), they find that infrastructure also reduces inequality, interpreting their results as evidence that infrastructure decreases transaction costs by connecting poor households to other economic activities (markets) and allowing them to access product and input markets at lower costs [consistent with results in Estache 2003, Ferreira 1995, and Gannon and Liu, 1997]. Jacoby (2000) and Jacoby and Minten (2009) show that improvements in road services increase capital gains for the rural poor and increase non-farm earnings.

Calderon and Serven (2010) provide a comprehensive overview of the quantity, quality, and accessibility of infrastructure in the LAC region and conclude that “given the gap in terms of infrastructure availability, quality and accessibility between the region and comparable country groups, [...] infrastructure development offers a considerable potential to speed up the pace of growth and poverty reduction across Latin America.” Figure 9 and Figure 10 illustrate the gaps in density of communication technologies, a common measure of infrastructure in the literature. The density in telephone lines has been constantly increasing in the LAC region; however, there is still a wide gap with

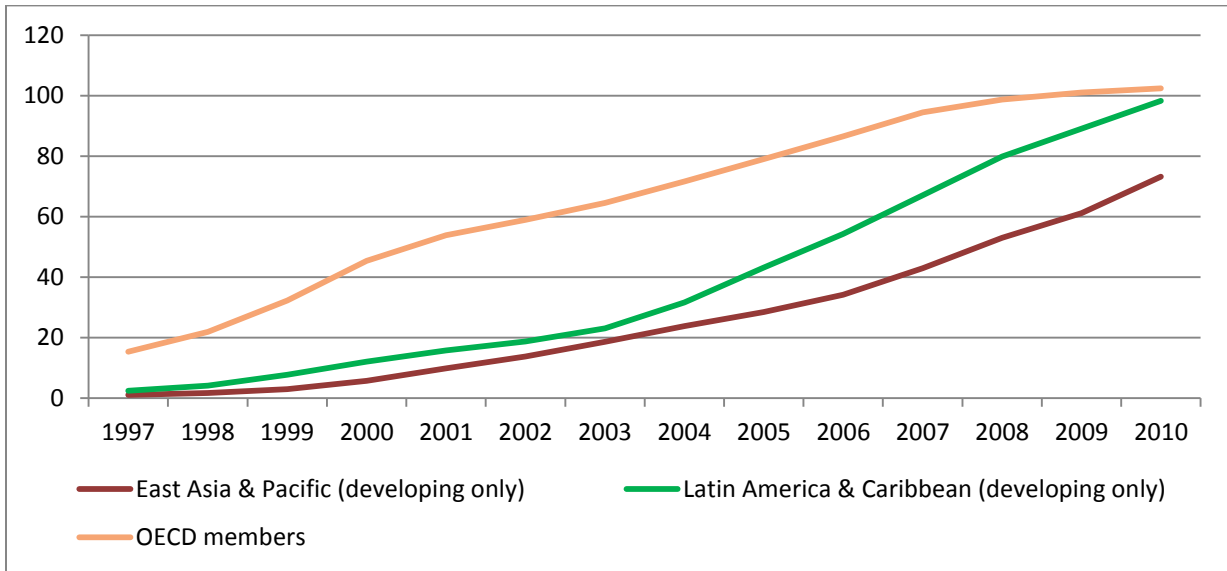
respect to industrial countries and one can see that the rate of increase has been slower than that of the East Asian region. In contrast, mobile cellular technology has penetrated the LAC region quite rapidly. The gap between industrial countries and LAC is almost closed for mobile technology; this highlights the possibility of using Information and Communication Technologies (ICT) to propagate information regarding agricultural technologies, as well as the advantages of having a food security policy that exploits the complementarities across different recommended interventions.

**Figure 9 Telephone Lines per 100 people**



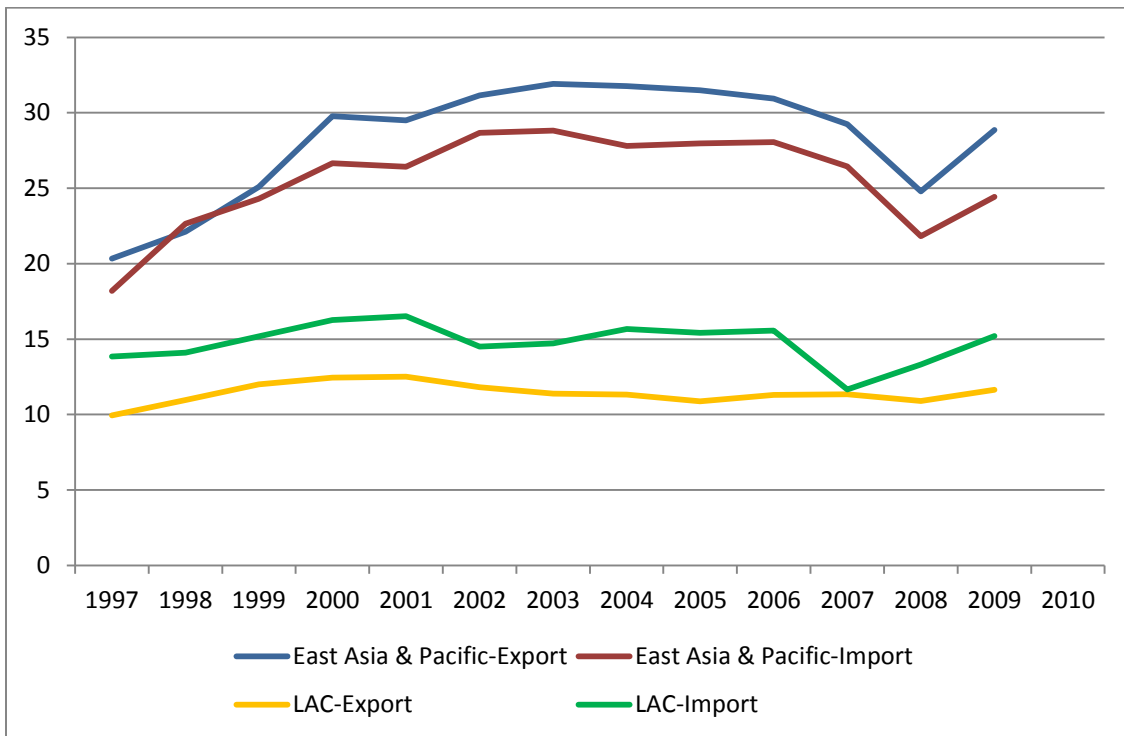
Source: World Development Indicators, 2011

**Figure 10 Mobile Cellular Subscription per 100 People**



Source: World Development Indicators, 2011

**Figure 11 ICT Exports and Imports for developing Countries by Region**



Source: World Development Indicators, 2011

Rural infrastructure building and agricultural technology are complementary pillars in any food security policy aimed at reducing hunger in a sustainable manner in LAC countries. One of the most important investments should be the development of rural irrigation systems and irrigation management. Water sources are abundant in region; however, the take-up of irrigation technologies has been low in sub-regions that could benefit greatly from better irrigation<sup>3</sup>. Figure 12 shows the trends in irrigation take-up for a selection of countries in the LAC region. With the exceptions of Chile, Haiti, and Mexico, the percentage of irrigated land has stagnated in other countries in the region. The total average, which includes all the countries for which data is available, has a flat trend and is consistently below 30 percent in all intervals.

Building and promoting the adoption of irrigation systems, coupled with the promotion of new seeds, use of fertilizer, etc., can increase both yields and the diversity of crops available in the LAC region, create employment in rural areas, and increase rural incomes, which would make the rural population more resilient to hunger and under-nourishment. Irrigation is central to achieve food security in the region; it promotes food security through increasing income, improving the quality of water use in agriculture, improving health and nutritional outcomes, and diminishing the gap between demand and production through increases in agricultural productivity that could satiate domestic market demand and provide resources to finance imports from export revenues. Ringler, Rosegrant, and Paisner (2000) provide an overview of the water access and irrigation situation in the LAC region. They emphasize that even though there have been sustainable ways to exploit water supplies, more attention needs to be focused on the management of water systems and irrigation systems to improve their efficiency and equity, which is central to maintaining productivity, arresting the degradation of soil and water sources, and promoting the well-being of the large number of producers that depend on these water sources.

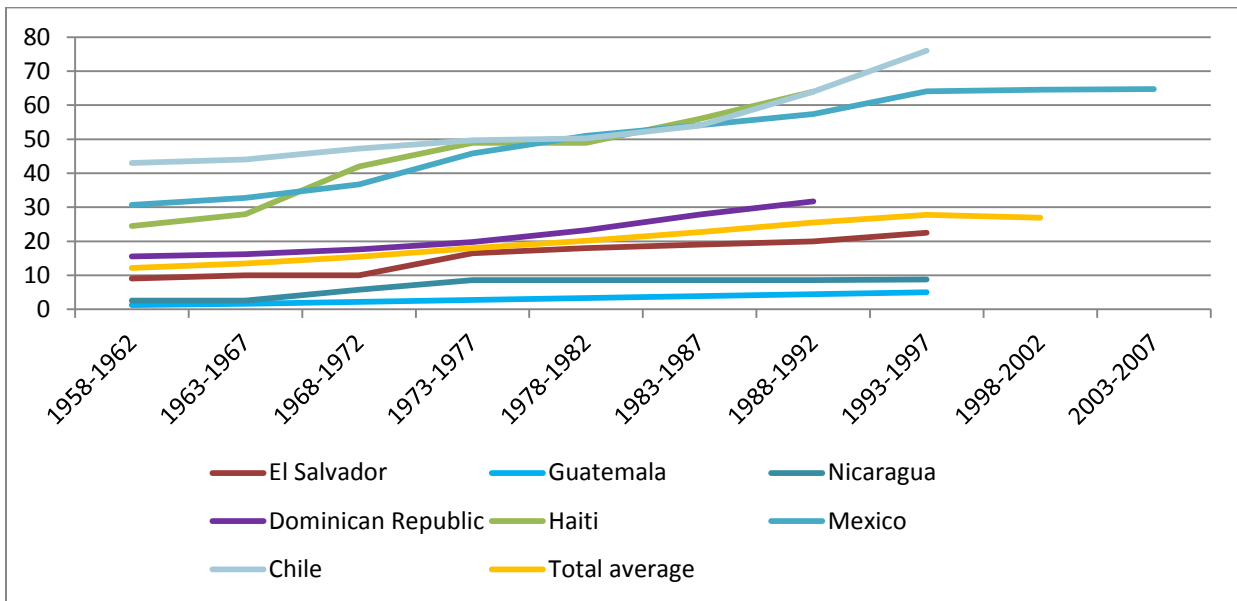
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<sup>3</sup> The obvious exceptions are countries where agricultural production would not be possible without irrigation systems.

Another important infrastructure that can impact food security is post-harvest infrastructure. These go hand-in-hand with agricultural technology investments in improving the ‘effective’ yields of productive land. In developing countries, where tropical weather and poorly developed infrastructure contribute to the problem of harvest losses due to spoilage and infestation, losses are sometimes of staggering proportions; other losses occur in intermediate operations from harvesting through final consumption [FAO, 1993]. Better post-harvest handling of agricultural products would increase the supply of agricultural products by reducing waste and improving quality, which increases the small farmers’ incentives and probability that they will participate in export markets. Investments in post-harvest infrastructure and training will create a sustainable stream of returns in exchange for investments that are sometimes inexpensive, but that farmers do not possess due to limited information regarding their benefits and the lack of local capacity to produce and provide information regarding post-harvest technology.

Investments in infrastructure and new agricultural technology are imperative to counteract the expected effects of climate change and the uncertainty they entail. Nelson et al. (2010) present a comprehensive study of the effects of different climate change scenarios on food security in the world and conclude that climate change acts as a threat multiplier, making the challenges of sustainable food security much more difficult. Their results agree with the recommendations in this proposal to address food insecurity in the LAC region, supporting investments in physical and human capital as a way of increasing the efficiency of land, water, and nutrient use as essential factors in growth and climate resilience. Increasing income allows farmers to weather shocks and invest in agricultural technologies which make them more resilient to the effects of climate change on their production.

**Figure 12 Percentage of Irrigation Potential Equipped for Irrigation (%)**



Source: FAO, AquaStat 2011

Finally, to achieve a more food secure population, food security policies need to facilitate the provision of risk coping mechanisms to poor population. LAC countries have a large unbanked population, which is mostly rural. Unbanked households have limited tools to stabilize their consumption and to respond to volatile prices and adverse weather shocks. Table 2 presents the density of deposit accounts of selected LAC countries in 2009. There is high variability in density of the unbanked population, signaling ample opportunity to intervene. For example, in Paraguay, there are only eight deposit accounts per hundred people, while in Mexico and Colombia there is over one deposit account per adult.

There is extensive literature that addresses the merits of introducing poor households into the formal financial sector. Credit access allows individuals to smooth consumption, invest in new capital, and finance short-run payroll costs and supplier debts; it has also been shown that credit access has an impact on new technology acquisition, health, and education [Jacoby and Skoufias (1997), Murdoch (1999), Pitt and Khandker (1998)].



**Table 2 Deposit Accounts, Commercial Banks (per 1,000 adults) in 2009**

Argentina	875
Bolivia	274
Colombia	1151
Ecuador	494
El Salvador	737
Haiti	330
Honduras	744
Jamaica	1172
Mexico	1014
Nicaragua	198
Panama	757
Paraguay	80
Peru	716
Venezuela, RB	518
Latin America & Caribbean (All income levels)	741
Latin America & Caribbean (Developing only)	737

*Source: World Development Indicators, 2011*

### **3.3. Labor and Social Safety Nets**

The last pillar on which an effective and well-targeted food security policy should rest is the provision of non-farm employment opportunities in rural areas. As mentioned before, rural-urban migration due to the inability of rural residents to find employment more often than not exacerbates poverty problems by localizing them in urban centers. Given better opportunities, the rural population would not need to migrate to urban centers and the value added in rural work could increase. The productivity gap between agricultural and non-agricultural work<sup>4</sup> is very wide in developing countries, including LAC, even after adjusting for human capital, cost of living, and sectors [Golling, Lagakos and Waugh, 2011]. This hints at a great misallocation of labor resources, since optimizing behavior by agricultural workers would dictate that they should exit the agricultural sector and start participating in the more profitable nonagricultural sector. Clearly, many of these agricultural workers do not have the possibility of abandoning farm work, first

<sup>4</sup> In the sense of differences in value added in each type of work.

because they and their families depend of their agricultural production to survive and second because the non-farm work opportunities are rather limited; thus the need to promote non-farm employment in rural areas.

Non-farm work in rural areas would allow farmers to participate in other productive activities in seasons when farm work is low and provide them with another stream of income that can serve to develop their farm, accumulate savings to smooth consumption, and procure credit in formal markets. Perhaps more importantly, it would allow for better allocation of labor resources in rural areas, both across time (seasons) and across productive sectors in the economy. A food security framework that incorporates the promotion of non-farm work can in the medium term achieve all this by creating and taking advantage of existing institutions. For example, social networks provide invaluable information regarding the productivity of workers in developing countries that can greatly improve the performance and ability of new businesses to survive. When an existing worker refers an individual to work for his firm, there is a sense of responsibility in the form a “joint liability”; the new worker’s performance reflects on the referee, thus allowing firms that use worker referrals to attract and maintain high- productivity workers and at the same time, reducing the cost of searching for workers [Ben-Porath (1980)]. The availability of tight networks in rural areas could be used to promote group schemes that link farmers to the agro-industry through contracts with organized farmer associations. At the same time, this would create employment outside of the farm setting and provide access to the ‘high-end’ product markets as farmers learn of the quality requirements for these markets and strengthen their bargaining position through group-level contracting.

In the short term, food security for the poor needs to be assured by effective social safety nets. As mentioned before, the evidence demonstrates that price volatility disproportionately affects the poor since they spend most of their income in food; increases in commodity prices are quickly reflected in the domestic markets of staple products like rice, bread, wheat-based products, etc. The most effective way to provide

food security through transfer programs is still an open question, and more empirical research is needed to clarify questions regarding the targeting efficiency of food transfers versus cash transfers, as well as if a combination of both is better able to provide food security to the poor when one takes into account individual preferences and the availability of markets where the beneficiaries live. The evidence regarding the benefits of transfer schemes is concentrated in the LAC region, and it is overwhelmingly positive. For example, Oportunidades in Mexico, which uses food and cash transfers in a complementary way, has improved child health, growth, and development [Gertler and Boyce(2003), Berham, Parker and Todd (2004) ]. The advantage of conditional transfer programs is that they attack food insecurity and short-term poverty from multiple fronts, providing resources to access food, providing nutritional information, and increasing the human capital of the beneficiaries (both health and education) which in turn provides long-term benefits that help beneficiaries escape poverty in a sustainable manner. Synergies between conditional cash transfers, agricultural policies, and food security need to be better exploited. CCTs represent a great opportunity to fight hunger in that they imply an increased flow of resources toward the poorest and most food insecure households in marginal rural areas; they also place emphasis on increasing demand for both health and nutrition services as a crucial component in assuring food security human capital accumulation [Davis, 2006].

For long-run food security, effective policies need to pay attention to human capital accumulation. Increasing human capital in rural areas, in terms of both health and education, will allow for more productive workers in the future. Here also, CCTs could play an important role. So far, CCT programs have focused on human capital building for children; more resources need to be allocated to human capital building for adult participants, with special attention to youth and females so these populations can increase labor participation and improve their job prospects.

## 4. Agricultural Strategy to Maximize Benefits for Rural Farmers to Ensure Food Security

Three key pillars stand behind the proposed agricultural strategy to maximize benefits for rural farmers to ensure food security: (i) agricultural technology; (ii) agricultural health and food safety; and (iii) rural infrastructure.

### 4.1. Pillar 1 - Agricultural Technology

Agricultural technology is again in the public international agenda due to the challenges of feeding 9 billion people in the world by 2050 (in Latin America, this number will be 850 million) and continuing food price increases. One of the main factors to offset high food prices and to accelerate productivity growth is agricultural technology. Agricultural research has the potential to provide solutions to these current challenges for the region, but needs to change its *modus of operandi*. The current agricultural research organization model presents some difficulties: i) there are symptoms of fatigue in the current model; ii) there is heterogeneity that one model does not account for; iii) it is not clear how the present model assures that the new advances in science are brought to bear in solutions to the region's agricultural challenges; and iv) the model is overly reliant on public funding, something that makes it vulnerable and unable to take advantage of all potentially available resources. All these aspects provide clear justification for the evaluation of options and alternatives to the present way of doing business; in doing so, full consideration needs to be given to the special role that agricultural research organizations will need to play in relation to emerging and / or continuing issues, such as: i) climate change; ii) food security; iii) persistence of rural poverty; iv) intensified inter-linkages between the primary sector, agro-industry, and the retail sector; v) new scientific potential (biotechnology, post-harvested); vi) multiplicity of actors (NGOs, universities, private sector); and vi) intellectual property and biosafety.

This pillar should focus on:

- a. Exploring new models such as networks and innovation systems, which could be one response to these challenges. They are flexible and dynamic to account for a changing environment and can be adapted to the particular local conditions in a heterogeneous region. At the micro-level, we will focus on understanding firm- and farm-level responses to the development and deployment of improved cultivars and breeds, and on the legal, regulatory, and policy frameworks that influence these responses.
- b. Specific to extension, value chain development requires extension services that are broadly adapted to solving problems facing smallholders and other actors in the value chain. This means that extension services need to be strengthened to provide a diversified range of services, for example, demonstrating production technologies and crop management practices, disseminating price and market information, organizing farmers' associations as commercial actors, facilitating linkages between farmers' associations and agribusiness entrepreneurs, or providing business development services that help farmers manage commercial ventures, meet product standards, and fulfill consumer preferences. To achieve this, the existing models of public sector extension services could be strengthened with a wider range of technical and managerial capabilities, diversified to allow for more pluralistic service provision by public, private, and civil society organization, and encouraged to seek new opportunities through both competition and collaboration.
- c. Define public policies to promote agricultural productivity and agricultural research investment with special emphasis on the functioning of the seed system. In many LAC countries, market liberalization has encouraged the emergence of commercial and nongovernmental seed producers alongside the entry of domestic and foreign technology seed developers. However, public policies and investments designed to encourage the movement of genetic materials, information, and technologies between public researchers, technology companies, seed producers, and farmers often fail to improve smallholders' access to improved seeds. Effective policies related to seed access, seed regulation, intellectual property rights, seed trade harmonization, fiscal incentives for research and development, management of public innovation, and

compliance with the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) are critical.

- d. Propose new mechanisms to promote the interaction of the actors involved in agricultural research and technology within the country and in the region.
- e. Propose policies and strategies that sustainably increase agricultural productivity along the land-water-energy-food nexus. In the coming years, given current projections for population and economic growth and climate change, maximizing agricultural output while minimizing resource input and adverse impacts on ecosystems and the environment will be crucial. We will focus on policies that support the maximization of agricultural productivity under *all* natural resource constraints, including land, water, and energy, to increase food production sustainably. Up to this point, most agricultural technology policies have incorporated only part of this nexus (for example, technology policies on land management might focus on the fertilizer-land productivity nexus but might not assess associated greenhouse gas emissions or water uses). We propose to identify policies that can shape the development, dissemination, and marketing of technologies to increase agricultural productivity using more resource-efficient methods with an emphasis on incentives for technologies directly linked to the mitigation of and adaptation to climate change challenges, multifunctional technologies, and post-harvest issues, as well as policies that will make these technologies more accessible to poor women and men.
- f. Finally, promote South-to-South knowledge and technology transfer. For example, we can learn from policies being implemented in Brazil as shown in the following boxes.

## **Box 2: Learning from Brazil**

### **How has Brazil increased its aggregate agricultural production?**

Brazil's Agricultural Sector is presently characterized by two main subsectors:

- Commercial agriculture, which is oriented toward exports
- Family farming; when oriented toward markets, oriented toward domestic market

#### ***Key Question: How has Brazil increased commercial agricultural production?***

- Growth has been rapid and impressive in the past 20 years, particularly on the export side
- Exports have diversified; Brazil now leads the world in many categories
- Major contributor to that growth is agricultural research done by Embrapa (e.g. making it possible to grow soybeans in the *cerrado*)
- Agricultural research is clearly necessary, but not sufficient for growth (given Africa's experience)
- Government extended credit to commercial farmers and has made infrastructural improvements. However, infrastructural improvements are still lacking in some regards; cost of exporting soybeans is still relatively low
- Combination of policies result in relatively low levels of subsidies but large increases in production

#### ***Key Question: What does Brazil do to promote agricultural smallholder production?***

- At the national level, the primary strategy to fight poverty is "Fome Zero" (zero hunger). Fome Zero has three components, one of which is a focus on "Strengthening of Family Agriculture."
- At the state level, other programs run under the umbrella of a "Rural Poverty Reduction Program." The idea is that grants are made to states, which then work directly with communities to design programs to reduce poverty. These programs are largely run by States in Northeast Brazil.

#### ***Key Question: What does Brazil do to promote resilience to shocks and climactic uncertainty that might be relevant for sub-Saharan Africa?***

- Major initiative is in promoting no-till agriculture and other conservation agriculture techniques
  - Brazil has more sown area under no-till agriculture than any other country
  - Conservation agriculture is/will be promoted by *Feed the Future* (FTF), so possible synergies may be found between Brazil's experiences promoting no-till and work already being started in promoting and catalyzing the adoption of conservation agriculture messages
  - Some technologies—such as direct seeders—might be applicable in some parts of Africa
    - Other components of Brazil's sustainable agriculture approach—such as integrated crop-livestock systems—may be relevant in some parts of LAC but not in others.

**Box 3: Zero Hunger Program in Brazil (Fome Zero): Description and Assessment of components that focus on strengthening family agriculture**

Two pillars within Fome Zero relate directly to strengthening agriculture among smallholders:

- **Financing of Family Agriculture, which takes place through PRONAF** (Rural and Crop Insurance). PRONAF provides rural credit at subsidized interest rates financed by the government and targeted in several different ways. Examples include funds for Agribusiness development and agro forestry; some funds are targeted at female farmers and also provide microcredit. PRONAF is a demand-driven program; individuals or groups must apply for credit from PRONAF programs, and the condition is that farmers must be debt-free in order to participate.
- 
- **Food Acquisition Program (PAA).** PAA is to ensure market access for farmers that otherwise would not have access. Aspects of design are similar to the WFP Purchase for Progress program (P4P). The first component of PAA purchases food directly from producer-households at prices determined through market surveys (CDLAF) and fixed for 18 months. Individuals or producer groups can participate in this component of PAA. A second component of PAA purchases food and donates it to other food-insecure households (CPR-Donation). It is important to note that the whole program is heterogeneous in implementation across states

It should be emphasized that the PAA can serve as a “guaranteed market” for Brazil’s smallholder farmers. Guaranteeing a market for certain crops reduces the risk faced by certain farmers; therefore they can afford to grow cash crops that they might otherwise avoid due to price uncertainty

## **4.2. Pillar 2 - Agricultural Health and Food Safety**

Agricultural health and food safety have become increasingly important issues in international trade as well as in the local production and consumption of food (see Box 4). This pillar will focus on examining how to consolidate national agricultural health systems, how to incentivize more private sector participation in agricultural health planning and execution, how to promote integration among countries to combat agricultural pests and plagues (for example, setting up a regional fund for agricultural health), how to standardize agricultural health protocols in the region, how to better link agricultural health, food safety, and agricultural research, and how safety is addressed along the food chain (including internationally). With respect to food safety, special emphasis should be put on: i) understanding the dynamic relationship between food and water safety and food security; ii) evaluating the cost of compliance with increased food



safety requirements for smallholders; iii) identifying cost-effective control strategies to reduce the risk of food hazards in order to maintain market access; and iv) assessing the impact of food/water safety interventions on food security, health, and nutrition using rigorous methods for monitoring and evaluating the impact of interventions. Table 3 presents some of the priority areas on which this pillar should focus.

**Box 4: Agriculture-Associated Diseases: what they are and why they matter**

**Food-borne disease (FBD).** Diarrhea is one of the top three infectious diseases in most poor countries, responsible for the loss of 72.8 million DALYs (WHO 2008a) and killing an estimated 1.3 million children per year (Black et al. 2010). Most diarrhea is the result of contaminated food and water. Meat, milk, eggs, and fish are the foods most likely to be contaminated (Lynch et al. 2006); contaminated irrigation water is also a problem, especially in intensifying systems (Drechsel et al. 2010). FBD is estimated to cost America \$152 billion and Nigeria \$3 billion each year (Scharff 2010; Okike et al. 2010). Fungal toxins (mycotoxins) are an important food safety problem, leading to acute, chronic, and cumulative ill-health; the Center for Disease Control estimates that over 4.5 billion people may be chronically exposed to mycotoxins, and that aflatoxins may play a causative role in 5 to 28 percent of all hepatocellular carcinoma cases (Liu and Wu 2010). Like many food-borne pathogens, mycotoxins can also cause sickness and death in livestock. International trade—particularly of maize, groundnuts, and chili—is also affected, due to food safety standards.

FBD also imposes costs on animal production, the food industry, and trade (Bennett and Ijpelaar 2005). The inability to meet food safety standards threatens to exclude small producers from higher value markets and forces them to incur the transaction costs associated with work in the informal sector. Food safety can only be addressed effectively by considering the entire risk pathway from field to fork.

**Zoonotic and emerging disease.** At least 61 percent of all human pathogens are zoonotic (Taylor et al. 2001). Endemic zoonoses that prevail in poor countries are among the most neglected diseases. To give just one example, echinococcosis (caused by tapeworm larvae) is responsible for 1 million lost DALYs, in addition to human-associated economic losses (including medical costs and lost wages) of \$1.9 billion and livestock losses of \$2.1 billion (Maudlin et al. 2009). Sleeping sickness, rabies, leishmaniasis, cysticercosis, brucellosis, and leptospirosis are zoonoses of similar impact.

Most emerging diseases (75 percent) jump species from animals to humans (Taylor et al. 2001), and the actual and potential cost to human health and well-being is enormous. HIV-AIDs, which originated in non-human primates, has probably sickened and killed more people than any other disease in the history of mankind. As natural ecosystems come under more pressure, and as technology supports the keeping of unprecedented numbers of livestock in unprecedented ways, the rate of disease emergence is accelerating—currently, one disease every four months (Jones et al. 2008).

**Other health risks of agroecosystems.** Many other diseases and health risks are associated with agriculture. Agriculture can create conditions suitable for diseases or directly expose people to health hazards. Disease vectors often persist due to poor design or management and harmful agricultural practices (Boelee and Madsen 2006; Diuk-Wasser et al. 2006). For example, irrigation and water storage systems provide breeding grounds for, and exposure to, vectors of water-related diseases such as malaria, schistosomiasis, and cryptosporidiosis (Erlanger et al. 2005; Keiser et al. 2005a; Steinmann et al. 2006). People working in agrifood systems are directly exposed to a range of biological, chemical, and physical hazards. Misuse of agrochemicals (especially pesticides) causes thousands or tens of thousands of deaths

per year, while there are 170,000 recorded fatal injuries in agriculture annually (Cole 2006).

Many other emerging issues occur at the sub-microscopic level (the gene) or the supra-individual level (the ecosystem). For example, the use of antibiotics in farm animals can select for resistance that can then be passed on to human pathogens by plasmids (Shea 2003); agricultural use of insecticides can foster resistance in the vectors of malaria (IITA, 2011). At a different scale is the role of ecosystems in regulating human health, with the potential for shaping agriculture in ways that are pro-poor and that better support human health.

Source: CGIAR Research Program 4

**Table 3. Initial Priority Areas of Work on Pillar 2**

Category	Priorities	Impact (GBD)**	Priority risks
Food safety	Mycotoxins	Medium	Aflatoxins in staple crops & other food
	Biological hazards	Very high	Animal source foods in priority value chains.  Wastewater
	Plant toxins	Not high	Cassava, legumes
	Chemical hazards		
Zoonoses & EID	Neglected zoonoses	High	<i>Taenia solium</i>
	Emerging disease	High potential	RVF
Health risks in agroecosystems	Water associated disease Occupational disease Resistance Ecosystem services & change	High	Scoping work Vector control Pesticide toxicity Resistance to agrochemicals

\*\* For many AAD, the impact in terms of Global Burden of Disease (GBD) or economic losses has not been assessed; ratings reflect our current knowledge.

Source: CGIAR CRP4 proposal

### **4.3. Pillar 3- Rural Infrastructure (irrigation, roads and energy)**

Investment in rural infrastructure is a main factor in increasing productivity and regional food production, linking farmers to markets, and counteracting climate change effects. This pillar will focus on making more efficient investment in productive infrastructure such as: i) irrigation; ii) transport infrastructure (i.e. rural roads or unpaved roads); iii) electricity (interconnected and isolated); and iv) ICT technologies (Internet, telephone, and rural cabins).

With respect to irrigation, the pillar will also focus on examining how to promote new management models of irrigation systems such as public-private-partnerships, how to incentivize the use of more efficient irrigation techniques to mitigate climate change effects, and how to develop and use more irrigation technologies for smallholders. In relation to rural roads, the pillar will also emphasize the exploration of mechanisms to reduce the logistic costs of agricultural products related to roads and the value chain (for example, supply of warehousing, silos, cold chain facilities, infrastructure quality, and competition among transport suppliers) to lower food prices, in particular to Caribbean and Central American countries, and to promote rural community participatory maintenance schemes. For rural electricity, the pillar will also examine different mechanisms to foster the use of local electricity generation and renewable energy sources such as solar and aeolic for improving agricultural producers' market access and to promote rural community participatory maintenance schemes. In addition we will also look into post-harvest infrastructure including technologies that will allow small farmers to preserve their harvest and add value to their crops. However, it is important to maintain a wider definition and, whenever possible, evaluate the possible complementarities between this basic infrastructure and the remaining elements that constitute a more ample definition of rural infrastructure and other assets such as human capital assets and social networks.

With regards to ICT's, we know that much of the value-added in agricultural marketing depends on the processing of information--for example, information regarding the availability, location, and prices of products on farms and in markets and what product attributes consumers value. Information is subject to market failure in that it is difficult to sell (the buyer does not know its value until after it is "purchased") and easy to reproduce (making it hard for the "producer" to recover costs). We propose to use ICTs for: i) improving the flow of information in value chains in different countries across regions through the implementation of market information systems including prices, technologies, and technical solutions to farm-specific problems; ii) identifying the best practices in designing and implementing pro-poor market information systems and disseminating these recommendations; and iii) designing and scaling up a framework for proposed information and communication technology interventions.

Finally, regarding what is called financial infrastructure, we propose to explore access to two key *financial services*--financial markets and insurance mechanisms--for the different players in the value chain. It is well known that access to financial services is important but often inhibited by imperfections in the credit markets. In low-income rural areas, contracts are difficult to enforce and the problem of adverse selection is acute. Banks face high risks and lend conservatively. They lack appropriate, well-developed, and suitably designed credit-scoring models that can help identify suitable borrowers and significant asymmetries of information. The strategy for access to financial markets will promote institutional designs that can reduce the problems of adverse selection and lack of collateral. Such designs might include, for example, a certified warehouse receipt system for staple crops, innovative contract farming arrangements, and a credit-scoring system for rural lending. Absence of a well-developed credit-scoring system both restricts access to credit and prevents the growth of differentiated borrowing options (for example, a menu of choices involving interest rates, loan terms, and loan amounts) and innovative ways of providing weather index-based insurances.

Regarding insurance mechanisms as a key risk-coping strategy, we propose a strategy that promotes designs to overcome the weaknesses of current insurance mechanisms specially targeting small and medium size farmers.

Specifically within market-based insurance products, the proposed strategy should reduce the complexity of insurance products offered. Many of the weather-based index insurance products currently offered are complex, and some observers suspect that low take-up rates may result in part from farmers' limited understanding of the products (see in particular the results from Malawi presented in Gine and Yang 2007 in which take-up rates for uninsured loans were higher than take-up rates for insured loans). Increasing demand for these new products may require designing a simpler version, even if it results in more basis risk for an individual farmer. Our hypothesis is that a simple, more familiar mechanism will result in a faster learning process for farmers and therefore a faster adoption rate. Research on the specific design of the proposed lottery-insurance mechanism will be undertaken--in particular, analysis of indicators that will guide the underlying lottery. The definition of "losing" and "winning" events must be clearly identified based on indicators highly correlated to the source of risk one wants to insurance against. Experiences with weather-based index insurance schemes in developing countries will be analyzed to draw lessons;

These pillars are fundamental to promote food security through improving productivity, increasing competitiveness, and mitigating climate change effects. But to be able to make substantial progress on each of those pillars, the proposed platform needs to incorporate the heterogeneity of the agricultural sector within rural areas of Latin America. In LAC, there are also large inequalities across farmers, ranging from large-and medium-size modern farmers with good access to markets and services to a large number of subsistence smallholders. In fact, there is a rich typology of farmers between these two extremes. Rural households are extremely diverse in their economic characteristics due to: i) heterogeneity in the quantity and quality of their assets; ii) technologies available to them; iii) transaction costs in markets for outputs and inputs; iv) credit and financial

constraints; v) access to public goods and services; and vi) local agro-ecological and biophysical conditions.

Policy interventions can and must take into account an identifiable rich typology of farmers when designing pro-food security policies and programs. The net economic and social dynamic returns of a policy intervention or program can be very different depending on the location and the targeted primary beneficiaries. Policy interventions intended to build productive capacities will have higher returns when targeted to regions and households where there is room for productive efficiency gains. Hence, this platform will have inherited a policy evaluation tool that will allow policy decisionmakers and donors to quantify the direct and indirect impact of policy interventions on food security as well as other economic and social benefits and costs that can be attributed to such interventions. Such a tool will make it possible to rank different policy interventions with respect to their overall dynamic social and economic rate of returns. As governments might weight different groups differently, for instance vulnerable groups or groups with high economic potential, a tool capable of differentiating impacts by a sensible typology of economic agents is highly desirable.

## **5. Rural Labor Strategy: Key to Improving Purchasing Power for Food Access and Minimizing Vulnerability to Food Price Crises**

Agricultural labor is the one productive asset available to every poor household in rural areas of developing countries. In many cases, as a matter of fact, labor (specifically, unskilled labor) is the only asset these households possess. As such, building stronger rural economies with more jobs, better wages, and steadier markets means making purposeful use of this universal asset and promoting higher sustainable real income for the poor are without doubt pro-food security. Without a particular plan in place, however, farms and agribusiness currently continue to absorb the abundant labor supply in rural regions of developing countries, reflecting the constraints laborers face when they attempt to acquire skilled jobs as a path out of poverty. To remedy this situation and create strong rural nonfarm economies, a contextualized labor strategy is required.

### **5.1. Features and dynamics of rural economies**

To understand rural labor markets, there are several common features of developing-country rural economies to keep in mind. Unskilled labor is abundant in these areas, while skilled labor and managerial capabilities are in short supply. There is a massive smallholder presence with a limited scale of operations. As these small-scale farms are operated by households, they require little to no hired labor. The economies themselves are often hit with market failures, especially in the credit, risks, services, land, and research and development (R&D) markets. In addition, transaction costs are often high because public infrastructure (namely, roads, electricity, irrigation, telecommunications, water, and sanitation) is scarce. A rural labor strategy that addresses these issues for everyone—including children, women, and those affected by HIV/AIDS—will help raise labor productivity, labor incomes, and therefore purchasing power for food access.

There are also two broad economic development processes that affect the dynamics of labor markets in rural areas. First, agriculture's share in national income and employment falls as countries grow richer and begin to diversify into manufacturing and service sector activities. While this type of transformation has historically taken many generations to unfold, it is now occurring at a rapid rate in some areas of the developing world, and especially in fast-growing economies in LAC. This has put millions of small farms under enormous pressure to either adapt or find an exit strategy. Second, as agricultural productivity increases and rural–urban linkages and market access are facilitated by better public infrastructure, as mentioned in the previous pillars of this framework, labor demand in the agriculture sector becomes less important. Labor demand in other sectors and industries dominates the market, and, as such, household incomes in rural areas increase while household members diversify their consumption of tradable and nontradable goods and services. In such a setting, productive rural nonfarm activities can flourish by making use of labor resources not being employed by agriculture. These nonfarm activities can expand in four areas: i) nontradable services such as commerce, health, education, transportation, and housing (to respond to the increase in population and demand); ii) activities that rely on agriculture, including processing, packaging, storing, and distributing; iii) some specific tradable industries like mining and tourism; and iv) peri-urban industries that base their location decisions on lower wages and cheaper rents.

While unemployment—despite its prevalence throughout the ongoing economic crisis and food crises—is not necessarily an issue in rural labor markets due to the role agriculture plays in absorbing surplus labor, vast underemployment and “disguised” employment are major issues. Lack of high-quality education (or, in places, any education at all), poor health, malnutrition, and migration to urban areas (for potentially better jobs) often limit viable nonfarm employment opportunities. Therefore, relocating rural nonfarm jobs from less productive activities to more productive ones is a central feature of development. While this can mean a literal geographic relocation, it can also refer to the adoption of new technologies or the production of new goods that



subsequently provide the reallocation of labor into more productive activities. This kind of stationary migration is most easily available to poor rural communities because it requires minimal capital and skills, both of which the poorest of the poor often lack.

## **5.2.Elements of the rural labor strategy**

Increasing labor incomes in the rural economies of LAC is the central role behind this pillar of the strategy. In order to achieve that goal, the strategy must abide by several key concepts to facilitate permanent improvements in productivity and, thereby, a progressively steady increase in rural labor incomes. To efficiently allocate labor resources across productive activities, policies in rural economies must take a long-distance focus and seek the highest aggregate labor productivity over time. Creating these conditions will allow rural nonfarm economies to translate better labor productivity into better labor incomes.

A rural labor strategy based in an area where existing resources are used to their fullest potential and less-evident resources, like human capital, are actively pursued will require different approaches to different problems. A successful strategy requires short-, medium-, and long-term plans and goals. Responding to shocks and immediate concerns will require short-term programs (or safety nets), while building up available resources and human capital can help mitigate employment issues in the medium term. Finally, keeping an eye toward the long term, a rural labor strategy will focus on net-job creation.

### **Four key steps**

#### **Short-term: Responding quickly with safety net programs**

Steady growth of rural labor incomes and productivity, limited market failures, decent working conditions, and efficient allocation of resources are, of course, ideal. But, poverty and hunger is widespread among rural households in developing countries, and people are in need of prompt action. The lag time associated with implementing long-

term policies—not to mention the amount of time they take, once implemented, to have an effect on wages and labor incomes—is great. Hence, in the short-term, labor and employment programs are a key component of an anti-poverty, safety net program.

Employment-based safety nets, including public employment programs, not only provide immediate jobs and income to poor, unemployed rural workers, but they also make proper use of laborers' inputs to help build public infrastructure at the local level. These programs should not be mandated, but rather designed through self-targeting schemes, meaning that poor and unemployed individuals choose to participate in programs. The self-selection process would be based on criteria like low wages, type of work, and availability.

In 2005, India implemented an interesting demand-driven, guaranteed employment program called the National Rural Employment Guarantee Act (NREGA)<sup>5</sup>. NREGA provided at least 100 days of guaranteed wage employment (within a radius of five kilometers of the applicant's home) in every fiscal year for at least one adult member of every household who was prepared to do unskilled manual labor at the wage rate specified by the state government. Wages were paid in cash and a proportion of a worker's wages could be deducted as a contribution to a welfare system set up for participants of NREGA; benefits included health insurance, accident insurance, survivor benefits, maternity benefits, and social security. Overall, NREGA created durable assets and strengthened the livelihood resource base of the rural poor (Chakraborty 2007).

Public employment programs are often constrained by the availability of fiscal resources, especially in poorer countries. In developing countries, demand for these programs is greater, but, at the same time, available resources are fewer. In these instances, techniques for assessing and targeting sections of the population based on income must be acutely honed. The most vulnerable and least productive of the rural population should be approached for transfer programs or conditional cash transfer programs. The portion

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<sup>5</sup> <http://nrega.nic.in/>

of the population in the middle of the “most vulnerable, least productive” continuum would fare better with employment-based safety net programs given their higher productivity rates and better skills. And, finally, on the other end of the spectrum, the most productive (and, thereby, relatively less poor) people in these rural areas should be assisted using programs aimed at overcoming bottlenecks to allow them to expand their productive operations.

### **Medium-term: Allocating rural labor resources efficiently**

Given the large presence of smallholders in rural areas of developing countries, a dedicated effort to directly involve them—primarily, to bring modern inputs, capital, management, and public infrastructure to their farms—is essential to implementing a successful rural labor strategy.

Here we consider policies and interventions that promote efficient utilization of the rural labor resources in the rural economies of the developing world. The main objective is to bring modern inputs, capital, management and public infrastructure to smallholders.

a) **Through markets:** Policies aimed at removing market failures in the rural sector will allow for an allocation of labor and other resources in accordance with market prices. We identify particular bottlenecks in the small-scale agricultural sector. This sector basically combines small plots of land with unskilled labor and traditional inputs and has limited access to public infrastructure; thus its low labor productivity. Market failures not only limit the access of smallholders to other factors of production and modern technologies but also make them utilize their productive assets for non-productive purposes, for instance, as an insurance mechanism to smooth consumption. Therefore the key idea is to put markets to work in rural areas such that productive resources are entirely devoted in an efficient way to productive purposes. This in turn will lead to higher labor productivity and labor incomes. Four markets deserve special attention: credit, insurance, land, and services. Specific policies must be identified to eliminate failures and in some cases

create those markets (market of agricultural services: extension, legal, accounting, marketing, management, etc). Even though it is out of the scope of this document to point out what the policy options and effective interventions are to eliminate these market failures, it should be mentioned here that there is already much work done in this direction. As of today, there is much experience from which to draw lessons in micro-finance, land titling, and demand subsidies programs for rural services (i.e. PROMSA project in Ecuador).

In the specific case of rural labor markets in the developing world, there is some consensus that, given the absence of strong regulations, these markets more or less operate well<sup>6</sup>. In some areas where most households consume their own supply of labor, these markets can be thin due to lack of supply and demand. But the causes for this can be found in other market imperfections as well as in the mass presence of small productive units. Two factors that can mitigate the well-functioning of the rural labor markets are: poor and asymmetric information and high transportation costs.

Interventions that have proven to be effective in improving the flow of information among job seekers and job posters are job-matching programs. In China, a job-matching program for migrants provided off-farm employment to about 200,000 upland laborers over six years, including roughly 110,000 inter-provincial migrant laborers. This program put in place a computerized, demand-driven job placement system emphasizing local markets, monitoring worker safety and living conditions, and reporting abuses and grievances (World Development Report 2008, p218). Mexico has also implemented programs that pay for job search costs (transportation) in rural areas (SAEMLI).

b) **Public infrastructure:** There is wide consensus that the provision of adequate levels of rural infrastructure is essential for rural development and agricultural growth in many poor countries. Now the debate is more centered on complementarities among different

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<sup>6</sup> Labor markets are subject to agency problems. The inability of employers to observe employees' effort is a well-studied market failure. Family labor and piece rate payments are two strategies used to overcome this imperfection.

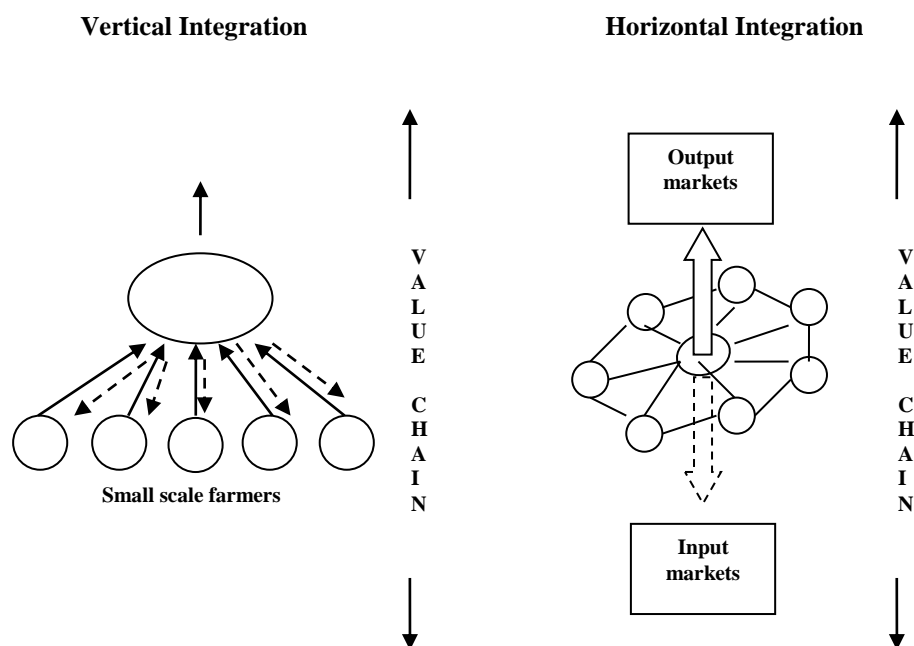
public investments (main roads, feed roads, telecommunication, irrigation, water and sanitation, storage, etc) in order to effectively and efficiently reduce rural poverty rates. The work carried out by Fan and Hazell (1999), Zhang and Fan (2000), Fan et.al (2000a), Fan et.al (2000b) and Fan et. al (2002) in India and China have looked into the relationships between investment in infrastructure, rural growth, poverty alleviation, and the role of complementarities of investments. A key issue is to clearly establish a causal relationship between investment in infrastructure services and the increase of income generating opportunities and welfare benefits of rural populations in order to establish appropriate intervention strategies for each specific context. Overall as public infrastructure contributes to increase local and regional productivity in the rural sector, it is expected to have effects on labor productivity and labor incomes. However, in the case of rural roads and telecommunication, a direct effect on the labor markets can be expected as these contribute to reduce job-matching costs. We are not aware of empirical studies measuring these expected outcomes. Research must be conducted in this area. Also, reduced transportation costs allow for greater mobility of the labor supply across different regions and facilitate temporary migration. Temporary migration can prove to be very efficient in the overall employment of labor services in rural areas as agricultural activities are subject to seasonality.

c) **Institutional Arrangements.** We see horizontal and vertical integration arrangements as relationships among productive units that allow them to combine productive resources through non-market relationships. From this point of view, these institutional arrangements might be of critical importance in rural areas where market failures are widespread. In this way, labor resources can be combined with other productive resources, modern inputs capital, and services that otherwise wouldn't be possible given market failures. In the case of vertical integration schemes among smallholders, such as contract farming, we foresee two potential effects related to labor resources. First, it allows the smallholder to give up on certain decisions with respect to his farm. As long as the contractor specifies certain characteristics of the desired product and provides the needed inputs and technology, this immediately solves several of the

small farmer's decisions that he otherwise would have taken by himself. Second, it allows the farmers to specialize in production activities, most probably where they have comparative advantage. As an extreme example, suppose the contractor chooses the seeds and fertilizers, provides extension services, takes care of transportation, packing, storage, develops a brand name, conducts market research, provides legal and accounting services, and gets insurance. Basically what is left to the farmer is the provision of his land and the hiring of needed labor force, himself included. In the case of horizontal integration, say cooperatives, small farms might get a sufficient scale of operation such that they can gain participation in markets or provide services within the cooperative, such as management.

In addition, these institutional arrangements allow for scales of operation. This is especially important given the new trends in agricultural markets (more safety requirements, demand for high quality products, supermarkets) which are making scales of operation increasingly important. And it should be highlighted that what matters is not the size of a property or the size of farms; what matters is achieving scale of operation.

**Figure 13: Non-market relationships - institutional Arrangements**



In order to exploit the potential advantages of these institutional arrangements, we must first learn what the bottlenecks and limitations would be and under what conditions it would be possible to scale up successful stories. Typically it is argued that limited commitment problems would prevent the adoption of these arrangements. In this case, new types of contracts must be developed in order to set the right incentives so that commitment problems can be avoided.

One possible drawback of vertical and horizontal integration schemes is that as long as they do not imply market transactions, it has not to be the case that payments to labor are in accordance with labor's productivity. However, there is a natural lower bound for labor payments; this would be the labor income that each unit of labor would get outside the contract.

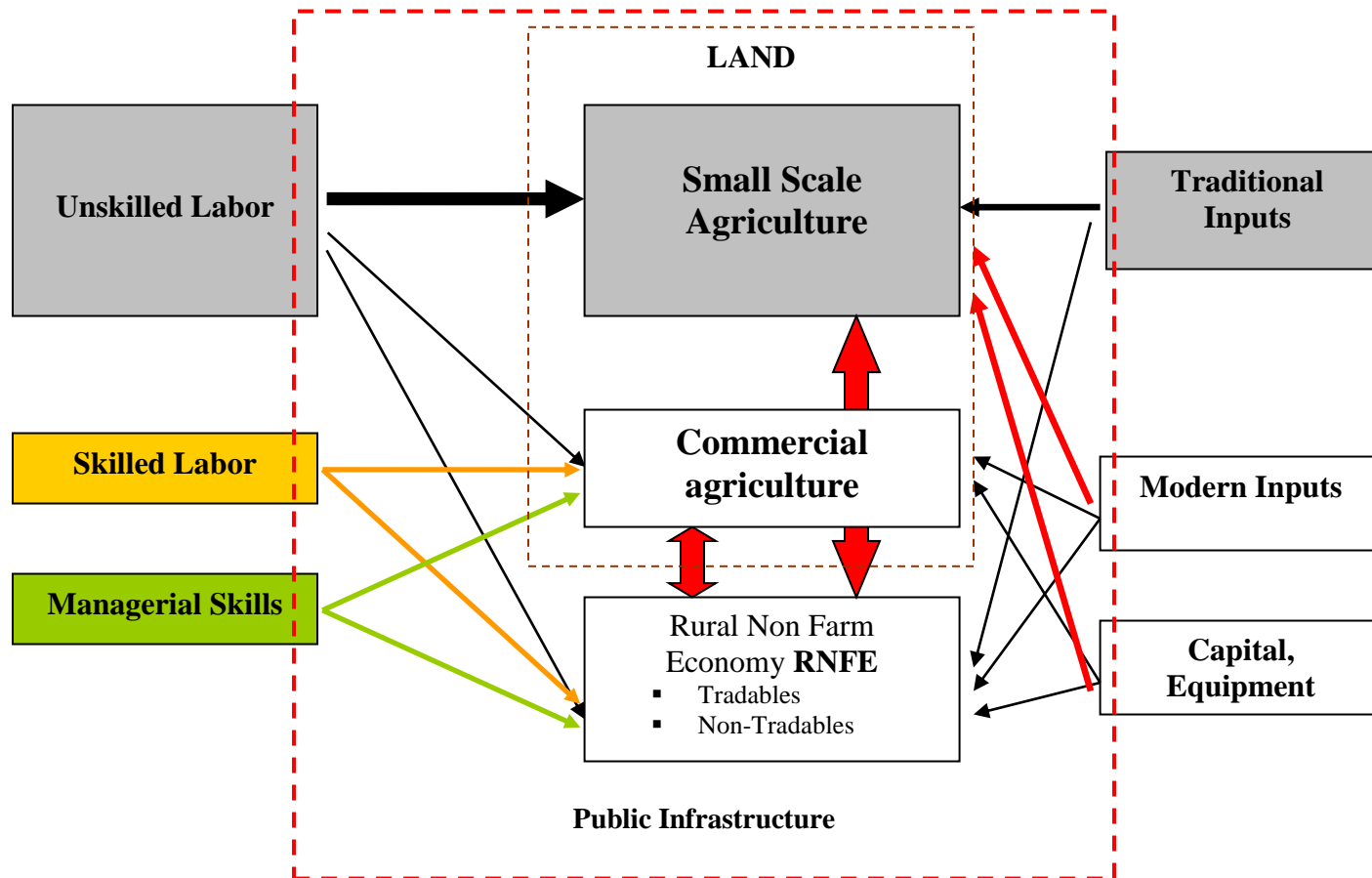
Related to the issue of institutional arrangements, but also to public infrastructure and management of natural resources, it is important to mention the role women play in the management of local public goods. It has been argued that through institutional arrangements that give women access to committees or positions responsible for managing local public goods, the effectiveness of community-level management could be raised. An increasing share of the literature suggests this might indeed be the case (see Pandolfelli et al. 2007 for a review), though systematic evidence is still lacking. However, this could be an institutional arrangement through which a more efficient allocation of resources is achieved while at the same time increasing inclusion and empowerment of women.

As we mentioned before, this first pillar relies on the idea that as labor resources are efficiently combined with other productive resources, there is room to increase the overall labor productivity; in this way, the corresponding labor incomes in the rural economies will also increase. In Figure 14 we emphasize the idea of combining the unskilled labor employed in small-scale units with modern inputs and capital as well as

with skilled labor and managerial talent, either through market or non-market transactions. The latter can be achieved by linking the small scale-agriculture sector with commercial farms and with the RNFE sector.



**Figure 14: Toward an efficient allocation of labor resources**



### **Medium-term: Building up human capital**

The idea behind this facet of the rural labor strategy is that the “whole is only as good as the sum of its parts.” Essentially, building up human capital—in other words, increasing the quality of the labor supply and the capabilities of the laborers themselves—creates an outcome of better work, higher productivity, increased incomes, and a stronger economy. In extreme cases, men between the ages of 18 and 25 have only attended school between 5.3 and 5.5 years over the course of their lifetimes. For women, the average attendance reaches a mere 3.0 to 4.3 years (World Bank 2008). The need for change is urgent.

Augmenting human capital involves the support—both through policy and otherwise—of formal education, vocational schooling, training programs, and business courses for entrepreneurs and managers. Increasing competition in domestic and international markets will soon eliminate the viability of traditional operations where management skills are scarce or simply absent, so this education needs to come quickly.

Policies regarding human capital must also take into account the conundrum of child labor in rural areas of developing countries. An ideal situation would clearly be one in which children learn and play instead of generating income. Many impoverished families in rural areas, however, are forced to put their children to work because of credit constraints. As the rural poor are prevented from borrowing against their future income, they must generate a constant current one. As such, children work.

Programs that help mitigate child labor include conditional cash transfers, which can effectively improve school attendance by giving households incentives that enable children to attend school (and increase their human capital) while simultaneously alleviating families’ immediate need for income (Morley and Coady 2003). Food-for-education programs have also proven beneficial.

In addition to regulating children in the workforce, policies must also be implemented to empower women in the job market. The incomes of rural women, as well as their access to decent jobs, are clearly lower than those of men. Differences in human capital accumulation account for an important share of this gap. Helping women obtain higher incomes or “outside options” allows them to have more influence on household decisions, including the education of children. This, in turn, increases the potential future income of the household and provides a possible pathway out of poverty. Once women enter the labor force and the household’s balance-of-power shifts, a new pattern is triggered—one in which women are better educated and more highly included in the labor market. This new pattern also helps women to improve their children’s welfare and human capital while reducing their own fertility rate. While more research into programs that effectively improve women’s job skills is needed, one-time interventions might have very high payoffs here.

### **Long-term: Promoting net job creation**

As rural populations continue to grow rapidly, so, too, do rural labor forces. In principle, with functioning markets, this growth would not be a problem because new labor resources would be absorbed to help create more output, which is necessary to sustain the now-larger population. This expansion also implies more income. The trouble with this scenario is that it corresponds more to a simplified economic model found in textbooks than a real situation. In reality, high growth rates in the labor force create serious short-term challenges because the jobs necessary to employ the net new additions aren’t necessarily available or created. Therefore, policies that promote job creation are an important part of ensuring long-term success for rural nonfarm economies.

Rural nonfarm job creation should rely primarily on the capacity of the private sector rather than on public employment because public infrastructure and public services cannot be evaluated in terms of their capacity to create employment. Instead, public employment is evaluated in terms of their economic net return.

Within the private sector, net job creation should focus on the positions being created, not on the size of the firm or employing organization. Usually, support to small productive units—in agriculture or any other sector—is based on the high capacity of such firms to create jobs (because the jobs they offer are typically more labor intensive and available to the abundance of unskilled laborers). Small firms, however, also disappear faster than medium or large firms, so while they do create more jobs than larger groups do, they also destroy more jobs. Alongside this idea, it is important that policies and actors support job creation in settings that have a high probability of expansion rather than exclusively focusing on start-up companies or organizations. In terms of net job creation, new entrants (or start-ups) are risky; it takes time to see and evaluate their real capacity to survive, compete, and expand. Thus firms that have survived for some time—even ones that are unable to expand further due to various constraints—represent stability and offer a more secure investment for long-term job creation.

In addition to the type of jobs and size of firms, it is important to consider the scope and relevancy of jobs being created. The rural nonfarm economy should target non-tradable industries, specific tradable industries with comparative advantage in rural areas, industries that rely on agricultural products as inputs (or, agribusiness), and tradable industries in peri-urban areas. The reason for this focus is that as connections between rural and urban areas improve, it will prove difficult for rural firms working in tradable industries to survive against urban competitors.

Finally, the quality and durability of positions being created are imperative to a lasting, thriving economy. This means that an essential component of net job creation is the provision of a legal and institutional framework that ensures equal opportunities, adequate health and safety conditions, and basic workers' rights for everyone, even (and especially) previously excluded groups. The goal, naturally, is for such a framework to achieve this harmony while still allowing enough flexibility to promote the ongoing creation of rural jobs.

In the following box, we present an example of job creation program in Peru from which lessons might be learned.

**Box 5: Economic corridors**

Republic of Peru: Development of the Puno-Cusco Corridor Project funded by IFAD (International Fund for Agricultural Development).

The project's overall objective was to raise the incomes of the rural poor and contribute to eradicating extreme poverty. Specific objectives were to: (a) build a demand-driven market for non-financial goods and services; and (b) contribute to building up the market for rural financial services. The project area includes a corridor along the main road network between the cities of Puno and Cusco and lateral feeder roads, comprising 128 districts in 14 provinces (five in the department of Puno and nine in the department of Cusco). The target group included 30,000 families, half of whom were to benefit directly from the project, accounting for some 15 percent of all rural families.

The project included three components:

- Incentives for strengthening rural markets, representing 67.6 per cent of total project cost and promoting the development of the technical assistance services market by: (i) transferring resources to users to hire technical assistance and training services; (ii) providing non-reimbursable funding for community investments in business development; and (iii) providing business development services to improve user access to business information and opportunities;
- Rural financial services, for 19.5 percent of total project cost, to strengthen local financial agencies, create a fund to make loans to users, set up a guarantee fund to reduce risks for financial institutions, and promote the adoption of new technologies and services by financial operators; and
- Project administration, monitoring and evaluation, at 12.9 percent of total cost, for operating costs.

In addition, strategies that were innovative for Peru were put forward, such as: (a) using the economic corridor approach to define the project area (rather than the more traditional political and administrative entities); (b) focusing on economic relations between urban and rural areas and strengthening links between farmers and micro-enterprises in intermediate cities, rather than the traditional focus on farming activities in the rural environment; and (c) pursuing a strategy for developing the technical assistance services market and transferring resources to user groups to hire such assistance. Finally, the design properly identified the poorest rural groups and their problems, and underscored the importance of women in production and marketing.

Overall, a solid, supported rural labor strategy is necessary to set up the environment for maximizing rural labor productivity and increasing rural labor incomes over time and assure access to food. But these necessary conditions are far from sufficient. A rural labor strategy must also be understood in the context of a more general food security framework as previously outlined that focuses on improving public infrastructure, allocating resources efficiently, expanding productive rural resources, and enhancing the connection between rural and urban economies.

## 6. Policy Evaluation Tool

In this section, we propose a framework for food security policy interventions that will guide policymakers and analysts in answering the following questions: i) What is the net impact of a policy intervention on food security across households in the country, taking into consideration all the dimensions and drivers previously explained? ii) How does a specific policy intervention compare to other policy interventions with respect to net impact on food security, other positive impacts, and net intervention costs? For this purpose we propose to create a policy evaluation tool that will take into account the following four elements:

a) Estimation of economic and social net returns: Policy interventions entail economic benefits and costs that, once estimated, determine an economic rate of return. However, in the absence of markets and prices for some of the intervention's inputs and/or outputs, a divergence between measurable economic and overall social returns might be far from negligible. A clear example of this would be the impact of a policy intervention on emissions and the resulting contribution to climate change or the common practice of assuming a zero price for water inputs for hydro power projects. From a policy perspective, a tool able to quantify all benefits and costs, both economic and social, is clearly desirable for policy evaluations.

b) General equilibrium effects. Most interventions have specific targets in terms of population groups or economic sectors; their evaluations are based on the benefits to those groups and direct interventions' costs. However, large interventions have economic impacts that go well beyond the primary intended beneficiaries, and those could be positive or negative impacts. Take for instance the case of food aid programs based on local purchases that, on the one hand, provide food to program's beneficiaries but, on the other hand, might raise local prices, compromising food demands of non-beneficiaries of the program. Other interventions, such as rural infrastructure provisions, can help raise populations' incomes and through that channel ease the need for food security and safety

net programs. For a policy that looks to evaluate the national income of interventions, then, it is highly desirable to have access to a policy evaluation tool that quantifies overall impacts (benefits and costs) on all populations and economic sectors.

c) Dynamic impacts. Any policy evaluation tool must take into consideration the fact that policy interventions generate benefits and costs that evolve over time. While in some cases the flow of such benefits and/or costs are clearly identifiable in the short term, in other cases, assumptions about how benefits and costs will evolve in the medium and long term might be necessary. However, the better informed those assumptions are, the more realistic it is that the dynamic effects can be estimated. In this respect, it is desirable to have an understanding of the dynamic structure of key economic variables (and their dynamic inter-linkages) in order to analyze the dynamic impact of policies interventions. Take the case of programs aimed at heavily expanding the network of rural roads. From a food security perspective, these roads will reduce transportation costs from producers to consumers in the short run. However, in the medium and long run, important income-generating activities might result, which will not only ensure more stable access to food for vulnerable populations but will also have a dynamic impact on the government's revenues and expenditures. As vulnerable groups raise their income over time, the fiscal burden coming from safety net programs is reduced.

d) Heterogeneity. Especially in the case of Latin America, it is extremely important to account for the high degree of economic and social inequality within countries and regions. Latin America is characterized as the most unequal region among developing nations, and the disparities within urban centers and between urban and rural areas are evident to any casual observer. Within rural areas, there are also large inequalities across farmers, ranging from large-and medium-size modern farmers with good access to markets and services to a large number of subsistence smallholders. In fact, there is a rich typology of farmers between these two extremes. In Latin America, rural households are extremely diverse in their economic characteristics due to:

- i) Heterogeneity in the quantity and quality of their assets
- ii) Technologies available to them
- iii) Transaction costs in markets for outputs and inputs
- iv) Credit and financial constraints
- v) Access to public goods and services
- vi) Local agro ecological and biophysical conditions

Based on these differences, we propose the development of a methodology to identify a typology that incorporates the criteria of productive efficiency, linkage to markets and income generation, geographical interdependence, and the bottlenecks associated with the livelihoods of the rural poor (Torero et.al 2009). Based on these criteria, it is possible to identify two key dimensions to construct a typology of rural producers: i) the potential of each household and micro-region; and ii) the degree of potential efficiency. Policy interventions can and must take into account an identifiable rich typology of farmers when designing pro-food security policies and programs. The net economic and social dynamic returns of a policy intervention or program can be very different depending on the location and the targeted primary beneficiaries. Policy interventions intended to build productive capacities will have higher returns when targeted to regions and households where there is room for productive efficiency gains.

A typology of micro-regions is an alternative way to classify and analyze very small rural areas within a country (for example, regions). Unlike other classification methods, such as poverty maps or cluster analysis, the above-mentioned typology allows us to justify the resulting classification on economic criteria such as productive potential and efficiency in resource management, allowing for a better investment focalization.

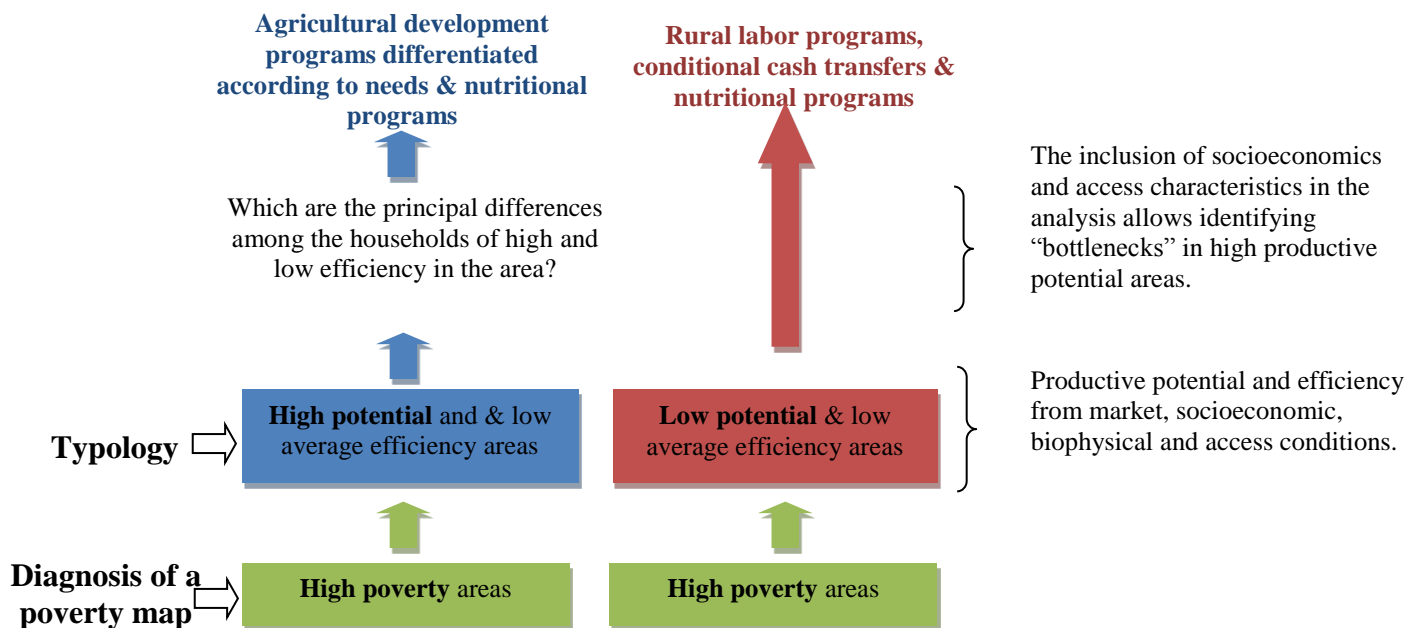
The identification of productive potential and efficiency is achieved through the estimation of an econometric stochastic profit frontier model that takes into account indicators of socioeconomic and market conditions as well as biophysical and accessibility factors. These indicators explain a big portion of the heterogeneity among rural households. Therefore, its inclusion in any policy analysis is fundamental. The



importance that each indicator has as a determinant of the potential and efficiency is strictly determined by economic theory and empirical evidence.

An accurate classification of the areas in terms of its agricultural potential is crucial to guide the type of interventions, which could be oriented to productive development, market creation (agricultural or not agricultural), or even assistencialism. In order to provide a solid estimation of the potential, the one obtained from the econometric stochastic profit frontier model can be compared and complemented with other kinds of potential that accounts, for example, for intensification and diversification of agricultural products. In this way, the accuracy of the analysis can be improved because the final potential, following the example, would take into account land conditions and their suitability for agricultural practices, without disregarding the importance of market conditions.

**Figure 15: Advantages of a typology of micro-regions**



As shown in Figure 15, the typology of micro-regions, once built, can be combined with other relevant information such as malnutrition and poverty maps in order to provide a

more detailed diagnosis of the needs and the potential solutions for the distinct rural areas of a country. Table 4 is an example of the classifications that can be obtained mixing potential and efficiency with malnutrition or poverty. For example, we could identify areas with high levels of malnutrition or high poverty (left part of Table 4). In addition, if those areas were of low agricultural potential, independently of its level of efficiency (red part of Table 4), broad rural development programs, conditional cash transfers and nutritional programs would be recommended. However, if those areas were of high/medium agricultural potential (dark green part of Table 4), agricultural development strategies with nutritional programs should be promoted, according to its level of efficiency<sup>7</sup>.

**Table 4: Example of a 3-dimensional classification**

Potential	Poverty/Malnutrition								
	High			Medium			Low		
	High efficiency	Medium efficiency	Low efficiency	High efficiency	Medium efficiency	Low efficiency	High efficiency	Medium efficiency	Low efficiency
High	High priority areas			Medium priority areas <b>with</b> agricultural opportunities			High performance areas	Low priority areas with agricultural opportunities	
Medium									
Low	Critical areas			Medium priority areas <b>without</b> agricultural opportunities			Low priority areas		

Box 6 presents the specific case for Guatemala, a country with unacceptable malnutrition rates compared to other countries in the region with similar per capita GDP levels. The analysis reveals, for example, that the Western Highlands is the region with the highest malnutrition rates in the country, but at the same time most of the areas in the region are not necessarily adequate for agricultural development. Broader rural labor development programs are essential to achieve food security.

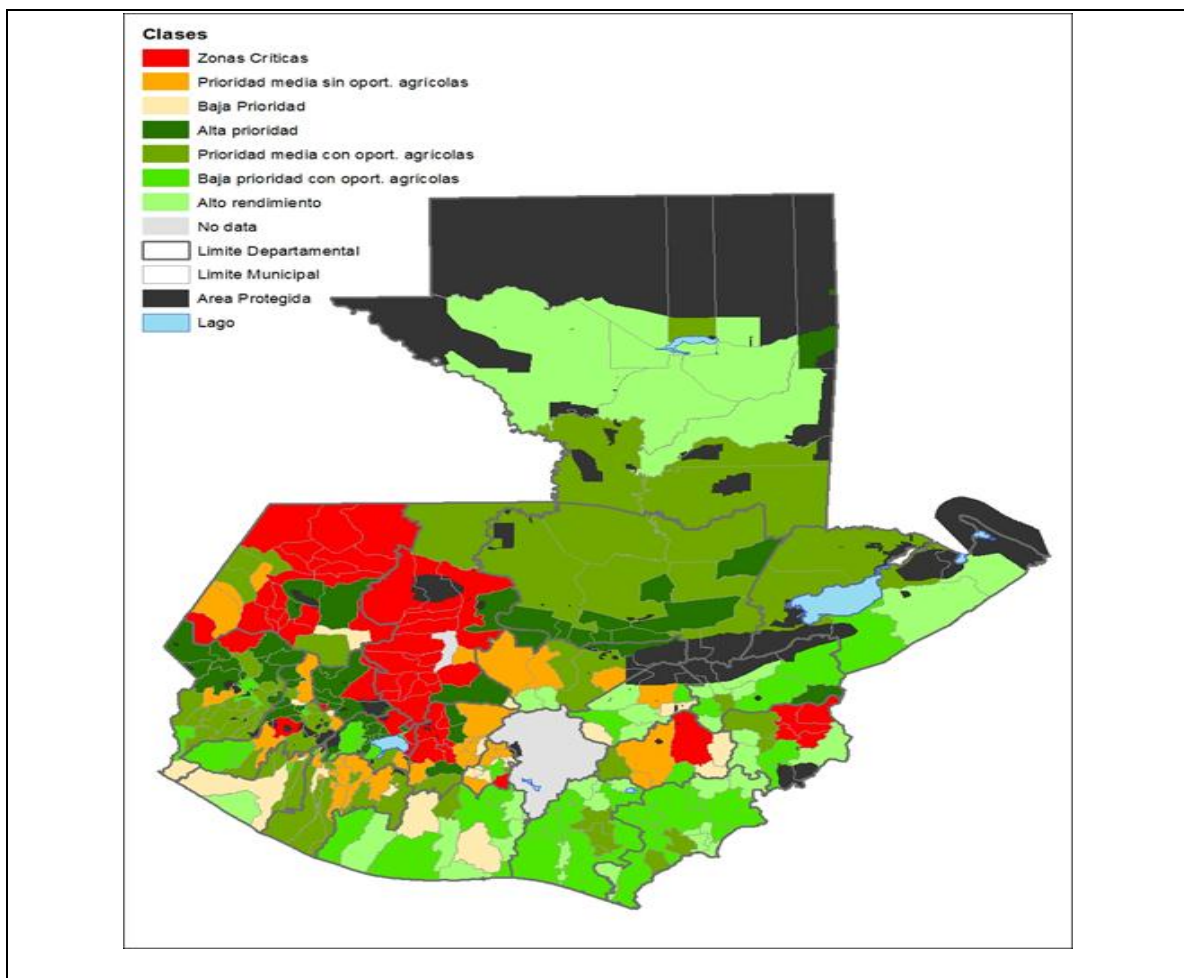
<sup>7</sup> It is possible to obtain a more detailed characterization of each area in order to recommend ad-hoc policies for each particular reality.

**Box 6: A typology of micro-regions for Guatemala (Hernandez, Robles and Torero, 2011)**

A typology of micro-regions is an alternative way to classify and analyze small rural areas within a country (“municipios” in the case of Guatemala). The estimation of the agricultural potential and efficiency level of an area is based on the estimation of an econometric model of stochastic profit frontiers, which accounts for several socioeconomic, biophysical, and market conditions. These factors explain, in turn, most of the heterogeneities across households in Guatemala, and their full understanding and identification is essential for rural policy making. The typology can, then, be combined with malnutrition and poverty maps to provide a more detailed diagnosis of the needs and potential solutions for each area of interest. The present study takes advantage of both accurate census data and detailed household surveys.

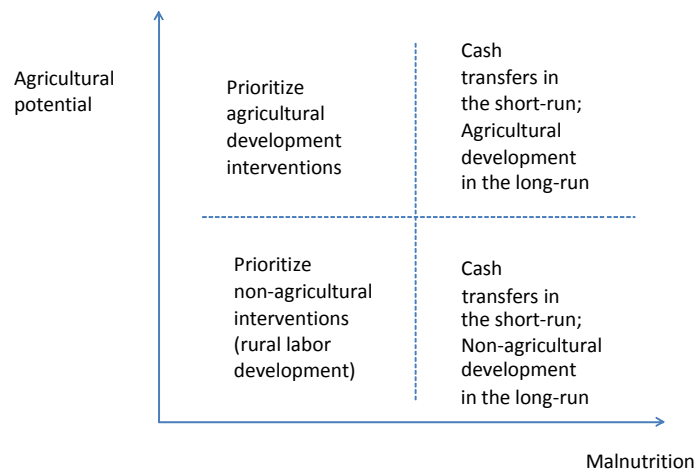
The map below is the result of combining the estimated agricultural potential and efficiency level for each micro-region (“municipio”) with their corresponding level of malnutrition. Assuming that we want to reduce the levels of malnutrition in the country, the “municipios” are classified into 7 groups; high priority areas (high/medium agricultural potential and high malnutrition); medium priority areas (high/medium potential and medium levels of malnutrition); high performance areas (high/medium potential, high efficiency and low malnutrition); low priority areas with agricultural opportunities (high/medium potential, medium/low efficiency and low malnutrition); critical areas (low agricultural potential and high malnutrition); medium priority areas (low potential and medium malnutrition); and low priority areas (low potential and low malnutrition).

The map indicates that the Western Highlands in Guatemala concentrates most of the areas with high levels of malnutrition (red and dark green areas). However, several of these areas also have a low agricultural potential (red areas). This implies that these areas are the first candidates to receive funds from cash transfer programs and other immediate assistance, at least in the short-run. In the medium- and long-run, it is necessary to implement broad rural labor development programs. The dark green areas, in contrast, which also exhibit high levels of malnutrition but also show a high potential for agriculture require policies to increase productivity and reduce transaction costs in order to take full advantage of the areas’ agricultural opportunities.



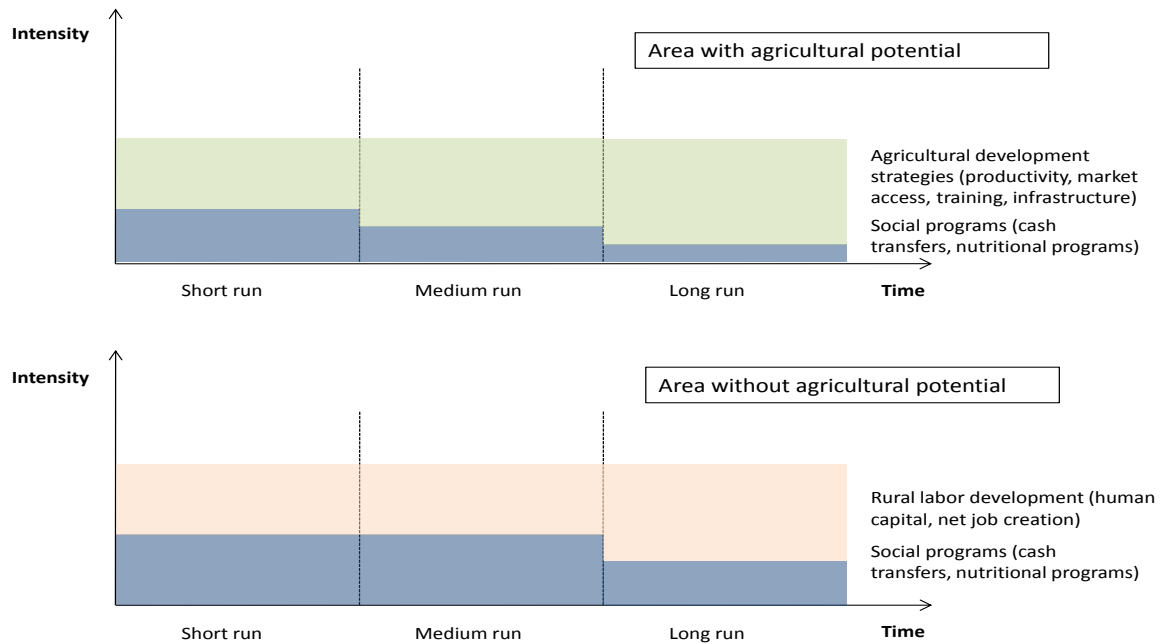
Overall, guided by this typology policymakers can design poverty reduction and food security programs adapted to each micro-region's particular combination of developmental challenges. In the context of the comprehensive development framework for food security proposed in the previous two sections, a typology of micro-regions is essential to prioritize agricultural and non-agricultural development policies across regions (see Figure 16).

**Figure 16: Prioritizing interventions based on agricultural potential and malnutrition**



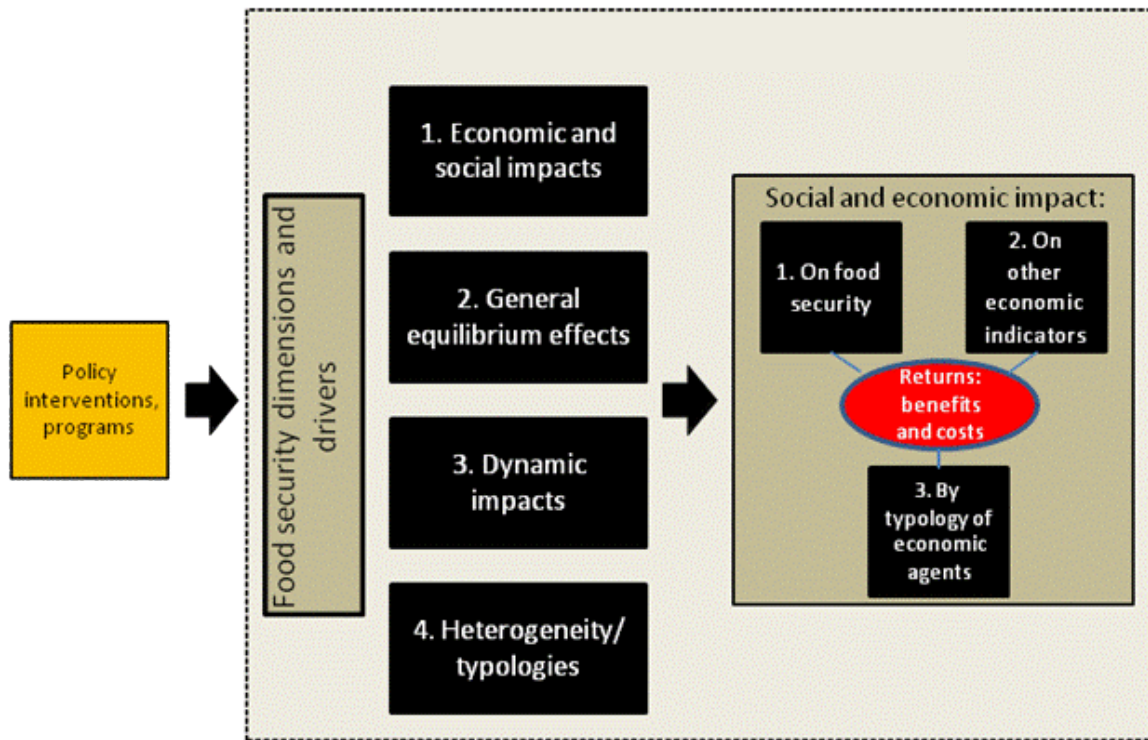
Note that the temporal dimension is also important when designing (and evaluating) food security policies. Conditional cash transfers, for example, are essential for vulnerable groups, but the dependency on these types of programs should be gradually reduced across time. In areas without agricultural potential, social and cash transfer programs are particularly important in the short-run, but in the medium- and long-run policies to promote rural income should be more important. In areas with agricultural potential, agricultural development strategies should constitute the main policy interventions.

**Figure 17: Intensity of policy interventions across time**



Hence, we argue here for the need for a policy evaluation tool that will allow policy decision-makers and donors to quantify the direct and indirect impact of policy interventions on food security, as well as other economic and social benefits and costs that can be attributed to such interventions. Such a tool will make it possible to rank different policy interventions with respect to their overall dynamic social and economic rate of returns. As governments might weight different groups differently, for instance vulnerable groups or groups with high economic potential, a tool capable of differentiating impacts by a sensible typology of economic agents is highly desirable. The general framework proposed here to develop such a policy evaluation tool is summarized in Figure 18. For the specific purpose of quantifying the impact of a policy intervention on food security, special attention must be paid to the impact of the intervention through the identified food security dimensions and drivers. Those impacts must account for: i) economic and social benefits and costs; ii) general equilibrium effects; iii) dynamic effects; and iv) a typology of economic agents that reflects the country's heterogeneity.

Figure 18: Policy Evaluation Tool



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