

## **ISPC Foresight Study:**

### ***Agriculture Towards 2030 – Changes in Urbanization and Farm Size and Their Implications for CGIAR Research***

*Background Note (July, 2012)*

The next two decades will see continuing and dramatic changes in world food systems, both on the demand and the supply sides. This concept note is intended to point the way towards a systematic study of the ways in which some major trends and issues are likely to impact the international public research system, with specific relevance for the research portfolio of CGIAR and its partners.

This concept note acknowledges the numerous foresight studies that have been carried out in recent months by different actors and international institutions (e.g., the UK Government Foresight Programme; the UN Food and Agriculture Organization's Global Perspectives Studies; the French efforts through CIRAD on Orchestration of Global Agricultural Research, the International Food Policy Research Institute; the UK Department of Environment, Food, and Rural Affairs; the International Institute for Applied Systems Analysis; the Organization for Economic Cooperation and Development; and the World Bank, to name a few). Although these studies provide valuable insights into the trends, directions, and constraints facing global agriculture, these studies do not identify points of specific relevance to the CGIAR.

In contrast to other foresight studies, this concept note does not attempt to be comprehensive in mapping out the long-term changes that will occur in food systems and summarizing the associated literature. Instead, it highlights two particular changes that will have major repercussions for agricultural systems in developing world, and thus for the CGIAR: the increasing importance of urbanization and the geographically heterogeneous pattern of changes in farm size and structure—with emphasis on Sub Sahara Africa and South Asia . These are not the only changes that will confront the international system. For instance, the next twenty years will also see important challenges in areas such as climate change. But the current foresight exercise focuses on the urbanization and farm size trends by briefly summarizing the characteristics of these trends and then identifying key questions and gaps in the existing literature that the proposed CGIAR foresight studies should address.

#### ***Urbanization and its consequences***

This note begins by summarizing some of the patterns of urbanization that will have important implications for the CGIAR and its research portfolio. Many of the changes that derive from urbanization will occur on the demand side. Data suggest that urbanization shifts consumption habits – both directly and through related increases in income. Numerous studies suggest that the absolute and relative demand for different agricultural commodities will change in important ways over the coming decades as

populations move, consumption habits change, marketing systems and processing systems evolve, and markets continue to globalize and integrate. Some of these changes have been well described elsewhere.

For instance, growth in human population will lead to increased demand for almost all agricultural commodities. The United Nations projects that world population will grow from approximately 7.0 billion today to 8.1 billion in 2030 (under the medium scenario). The overall growth in population represents a 15 percent increase, which is daunting indeed. But this growth pales in comparison to the expected growth rate in urban populations. The world's urban population in 2012 was just over half the total population, at about 3.5 billion; but this number is expected to grow to about 5 billion in 2030 (UNFPA 2007), an increase of about 50 percent. And the growth of urban population in developing countries will be even more dramatic. The UNFPA estimates that by 2030, urban populations of Asia, Africa, and Latin America will double from 2.0 billion to 4.0 billion such that 80 percent of the world's urban population will reside in developing countries.

The growing urban population will dramatically alter the patterns of demand for food and other agricultural commodities. Urban consumers throughout history have consumed different diets and have had different demand for quality and food characteristics than their rural counterparts. The implication is that urbanization will have significant repercussions for world food markets over the next two decades. This foresight study will examine changes in demand that will arise from urbanization as the basis for focusing on the implications and challenges for the CGIAR. For example, urbanization and income growth together typically drive increases in the demand for high-value foods, including meat, dairy, edible oils, and processed and packaged foods. But this in turn may have implications for the marketing of starch staples; instead of growing grain for human consumption, farmers in the developing world may increasingly face demand for grain as an input into food processing and animal feed. This could have significant implications for issues of grain quality and consumption characteristics, as well as for value chains through which small farmers can benefit from increased demand and prices for the commodities they produce.

Urban food supply chains are also likely to raise a number of complex problems and challenges that go beyond the realm of production. Some of these may require research-based solutions. These might include issues of natural resource management, as urban supply chains are likely to create pressure on land, forest, water, and aquatic resources. Other examples might include emerging food safety issues or environmental issues associated with the growth of intensive peri-urban agricultural systems (e.g., the disposal of livestock waste, or the problems of pesticide exposures among farm families). Similarly, the growth of animal agriculture in response to urban demand may also raise problems of epizootic disease outbreaks and zoonotic occurrences. Finally, unlike the green revolution in Asia of the past 40 years in which a majority of increased food production came from irrigated systems, most of the increase in food production is expected to come from rainfed agriculture, from which

the amount of food produced each year is highly variable and much less certain than from irrigated systems. At issue is how to consistently provision rapidly growing urban populations from inherently risky rainfed agriculture, and need for a strategic vision about the role of irrigated agriculture in rainfed agricultural regions of Sub Sahara Africa and South Asia where water resources would allow sustainable irrigated agriculture on some portion of existing farm land.

### ***Changes in farm size and structure***

The rapid urbanization of the developing world will not occur in isolation. The forces of urbanization will also generate major changes in rural areas. At the same time, rural areas will also be experiencing many other shifts in social, political, and legal structures. The effects on rural cultures and societies will be dramatic and far-reaching. This study will focus on one particular dimension of the changes in rural areas: the change in farm size and structure.

As migration proceeds and as rural non-farm enterprises pull labor away from agriculture (and as changing cultural norms lead to the diminishing attractiveness of agricultural work), labor shortages may begin to emerge in many rural areas -- particularly those that are well connected to markets, and particularly at peak seasons. Scarcity of labor may drive mechanization in some places. Scarcity of labor is also likely to drive changes in the size and structure of farms.

These changes will be highly differentiated across agro-ecological regions and geographic space. Some parts of the developing world will witness further shrinkage of farms, especially in areas of intense population pressure and in locations where land markets are not well developed. Other places will experience a gradual consolidation of farms, with successful farmers buying out their neighbors or renting in land to increase the scale of management. Still other locations may see the emergence of very large-scale production units.

These changes will also affect the contracting structure and market orientation of farms. In many places, particularly in remote areas, agriculture will remain focused on quasi-subsistence modes of production. But other areas will see growing specialization and orientation towards urban markets, and others may engage at various levels in systems of contracting and sub-contracting, for either domestic or export markets.

All these changes have potential implications for research. Almost certainly, the world of developing country agriculture will look different in 2030 than it does today. What are the implications for research? While the CGIAR must always be conscious of the need to ensure the availability of staple foods in developing countries, research planning needs to recognize the emerging opportunities for farmers in some parts of the world to increase their income.

Here again, there will be important differences across groups of farmers. Those farmers who are living in remote areas or marginal environments, and who make their

living in quasi-subsistence, may benefit from interventions that allow them to produce more staple foods. These farmers may also benefit from efforts to enhance the nutritional value of the crops that they produce and consume for themselves.<sup>1</sup>

By contrast, farmers with better links to urban markets may benefit most from new technologies that allow them to sell higher-value outputs to urban consumers (e.g., meat, dairy, fruits and vegetables, sold either in domestic or international markets). In addition, farmers may be pulled into closer interaction with non-traditional markets for their crops, such as selling agricultural outputs for industrial uses or commercial food processing (e.g., fruit canning, brewing, industrial starch production).

### ***Moving towards a research agenda***

The background sketched out in this concept note suggests there are large-scale and long-term trends affecting the developing world that have important implications for publicly funded agricultural research. We envision an integrated study that would look at the forces of urbanization in conjunction with the changing size and structure of farms – while recognizing that these are only two of the important drivers that will shape agriculture in the decades to come. The study should reference other trends and forces where appropriate.

The purpose of the study is to inform the research agenda and priorities of the CGIAR system. This research agenda is defined by the current CRPs, but the study should not shy away from highlighting important areas for public sector research that fall outside the existing research portfolio.

The study should make use of existing surveys and analyses, rather than conducting new modeling exercises. It should draw on the best available scientific knowledge, while also acknowledging the limits and shortcomings of this literature. Where there are important uncertainties or disagreements in the projections of future trends, the study should highlight them and should indicate how these uncertainties might alter the CGIAR's research priorities.

Although it will ultimately be the responsibility of the study's audience – the ISPC and the CGIAR itself – to digest the relevance of the findings and to translate these findings into research strategies and priorities, the study should (to the extent possible) take into account the changing context for the CGIAR and its research. This might include:

- The evolving role of the CGIAR system relative to stronger national programs (e.g., Brazil, China, India, and some other scientifically advanced national programs).

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<sup>1</sup> Nutritionally enhanced foods may be attractive to farmers in quasi-subsistence even when there is little market demand for nutritional traits. This is because the farmers themselves (unlike urban consumers) may be able to see and assess the health benefits of the varieties. Farmers in isolated areas may also have relatively poor access to nutritional supplements, making biofortified foods particularly valuable in these settings.

- The changing role of the private sector in agricultural research.
- Advances in the scientific frontier in agriculture, including information and communication technologies, and agricultural biotechnology.
- Public goods and gaps in the current system: the role of the CGIAR.

The study should also take note of some of the recurring strategic issues that face the CGIAR and the CRPs. These include:

- Whether CGIAR research can better achieve the current system-level objectives (SLOs) by emphasizing increases in the quantities of food produced in the developing world or by focusing on income generation for farmers (not necessarily involving staple food production), or by doing both.
- The degree to which increases in food grain production per se will play an important role in reducing poverty and hunger, and the importance of other drivers such as reduced post-harvest losses and waste.
- The degree to which technological innovations are important for increasing agricultural productivity, or whether the primary constraints are institutional.
- The extent of heterogeneity and diversity across farms and farming systems.
- Whether the CGIAR should target some or any research to mechanized farming systems or large farms (perhaps logical if the goal is to increase the quantities of food); or alternatively whether it should pursue research on cash crops (perhaps logical if the goal is to increase the income of farmers, including smallholders). And if adopting a dual strategy (both), where and when?

These broad issues are inevitably in the background, but the more specific questions that follow are intended to frame the analysis and to give an indication of the kinds of issues that the study should address. It should be emphasized, however, that there is no need for the study to answer all of these questions or to take this as an outline or organizational scheme for the final study. We also sketch out a bibliography of relevant literature – although this is in no sense meant to be comprehensive or authoritative.

## **1. Questions on Urbanization**

- What will be the patterns of urbanization that we can anticipate over the next twenty-odd years? How sensitive are current projections and trends to assumptions? How accurate have been the previous projections?
- It is now widely accepted that urbanization is associated with changes in food consumption patterns. Some general trends appear common across the developing world; e.g., the increased demand for meat, fish, dairy, and other protein foods; the increases in consumption of oils, fats, and sugars; and an increase in demand for easily prepared foods, including processed and convenience foods. But what do we know about the regional and geographic diversity in these trends? What forms will urban food demand take in different parts of the developing world? Do we expect dietary homogenization to continue, or will we see the emergence of divergent regional cuisines? What evidence do we have on these points? Specifically, do we think that urban demand in India or Ethiopia will look the same as urban demand in Brazil or Mexico? If not, what are the implications for agriculture?
- To what extent will urbanized food systems increase pressures on land, water, and energy resources? How will the climate impacts of developing country food systems change as with urbanization? What (if any) are the implications for agricultural science? Are there researchable questions (for the new CGIAR) related to mitigating or reducing these impacts?
- How will rural demand change as urbanization occurs? Will rural dietary patterns remain static? Should we expect to see urban eating habits reflected in rural areas? Or should we expect that urban demand will alter the relative prices (and shadow prices) of different foods in rural areas, altering rural consumption patterns in significant ways? What kinds of differences will we observe across rural areas?
- The move of food marketing towards supermarkets seems to be well underway in some parts of the developing world, but in others (e.g., much of Africa), rapid growth in supermarkets is consistent with very low levels of “food intermediation;” *i.e.*, most food is still consumed in the households that produce it. Urban markets in many African countries are not well linked to rural producers, so supermarkets specialize in selling imported foods. Will this pattern continue, or will it change? What are the implications for domestic agriculture in developing countries?
- How will supermarkets in different parts of the world source their products? Is the growth of supermarkets likely to concentrate supply in the most productive areas globally (perhaps displacing local production in some developing countries) or will supermarkets drive down transaction costs in local marketing systems by bringing in improved knowledge of logistics and distribution?

- Will the development of supermarkets effectively separate urban consumers from domestic sources of supply, or will it create stronger links than currently exist?
- How will supermarkets mediate demand for food safety and quality? How will the increasing urban demand for food safety and quality affect the purchasing decisions of supermarkets? Will this drive a standardization of products and processes (e.g., packaging and handling of produce) in the food supply chain?
- How will urbanization affect the desired processing and storage characteristics of agricultural commodities (e.g., uniformity, long shelf life, etc.)?
- As processing and food preparation transform from households and artisanal enterprises into industrial activities, what will be the effects on the environment? What will be the consequences for human health? (Consider, for example, the growth of industrial-scale abattoirs.) What are the implications, if any, for agricultural science?
- What are the vulnerabilities of urban food systems to disruption and disaster? Are there ways in which research can offer solutions or address the issue of resiliency? Should rainfed agriculture receive more prominence in the future?
- How will the evolving urban demand affect smallholder production systems? Will supermarkets bypass smallholders because of the high costs of contracting and monitoring their production?
- As smallholders strive to access urban markets, pressures may mount for them to use pesticides, fungicides, and other chemicals that have harmful health effects on users – and potentially negative consequences for rural environments. What role can agricultural research play in mitigating these harmful effects?

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## **2. Questions about farm size<sup>2</sup> and structure**

- How will farm size and structure change in different parts of the developing world? Will farm size continue to decrease as population growth leads to division of existing properties? Or will farm size expand through consolidation of holdings by existing farmers? How will these patterns differ across/within regions and countries?
- What do we know about the geography of farm size within developing countries? Are small farms concentrated in certain agroecozones or landscapes? How does farm size relate to proximity to markets? To the mix of crops that are cultivated?
- How much do we know about the *changes* in farm size in relation to the geography and landscape of agriculture? Are farm sizes shrinking in marginal areas, or are they expanding with outmigration, or both at once (depending on location)?
- Can the *management scale* of farms differ from the *ownership scale*, through robust rental markets or other contracting mechanisms? What does this imply about the changing patterns that we will see in farm size?
- How will the labor intensity of farming change (i.e., workers per hectare) as distinct from the hectares per farm?
- How will changes in the patterns of farm size be reflected in mechanization or other changes in farm management practices? How will these changes be reflected in the demand for inputs that can substitute for land and/or labor, such as fertilizer and pesticides/herbicides?
- What do we actually know about the productivity of small farms as opposed to large farms? Will changes in farm size (either fragmentation or consolidation) alter aggregate productivity? If so, in which direction? Existing discussions of farm size often find an inverse relationship between farm size and productivity levels, but this analysis at the macro scale typically fails to account for differences in land quality; and at the micro scale, the distinctions are often between farms that are very similar in size (i.e., between very small and small). What can we learn from the best available evidence?
- To what extent do production systems depend on farm size? Do small farmers choose systematically different production systems than larger farmers? Why? What changes in the supply chain can we anticipate because of changing farm size?
- To what extent do farmers operating at different scales demand different technologies? Which technologies are effectively scale-neutral, and what are the implications for research? If the CGIAR were to focus on developing technology for small farmers, what would be the tradeoffs in terms of

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<sup>2</sup> Refers to both crop and livestock farming.

improving technologies for larger farms? What are the arguments for and against specializing in this way in the research process?

- What constraints do small farms face in accessing new (and growing) urban markets? What are the constraints in relation to contracting, marketing and distribution, quality and standards, etc.? Are there minimum scales at which farms can participate in urban markets? How does minimum scale differ across countries/regions?
- How important is agriculture as a source of income and well-being for small farmers? How does this differ across countries/regions? Do improvements in agricultural productivity result in increasing income for small farmers? Under what conditions should we expect that agricultural research is an effective tool for increasing the incomes of small farmers? Where (and when) would we expect these conditions to be met?

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