

THE POLITICAL ECONOMY OF AGRICULTURAL TECHNICAL CHANGE AND AFRICAN FOOD SECURITY

Mats Harsmar

Nordic Africa Institute, P O Box 1703, S-75147 Uppsala, Sweden

Keywords: sub-Saharan Africa, agriculture, technical change, food security, food sovereignty, innovation system, selective learning

Contents

1. Introduction
 2. Links between food security and technical change in agriculture
 3. Theories on technical change
 4. Central actors and incentive structures
 5. Concluding remarks
- Glossary
Bibliography
Biographical Sketch

Summary

Food security is both a widely accepted and a contested concept. There is wide agreement that “...all people, at all times, (should) have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2001). Without food security human existence is threatened and social and economic activities undermined. But there is disagreement over the extent to which food security may be achieved through market exchange. Is food special in the sense that local control of its production is necessary, implying that it is rather “food sovereignty” that should be sought for? Such arguments have appeared both at local, and at national levels. When international food prices rose in 2007-08, many governments responded by restricting trade in food products in order to protect their own citizens.

In sub-Saharan Africa (SSA) lack of food security is widespread primarily in rural areas, especially among those producing their own food: subsistence farmers. Reasons behind this are manifold, and multi-level: local power relations in villages, lack of infrastructure and badly functioning markets, misdirected policies and regulations, unfair international trade relations and others. In order to improve food security, growth in the agricultural sector is imperative. This is because more food need to be produced, but primarily also because agricultural growth is especially effective at reducing poverty, through linkages with other economic activities.

Agricultural growth in sub-Saharan Africa faces numerous constraints, such as international trade rules, national policies, badly functioning markets and market institutions, lacking human capital, lacking security systems and others (Harsmar, 2006). Furthermore, such growth needs to come through increased productivity, which in turn depends on technical change occurring. This chapter deals with how technical

change may be understood and promoted. It is argued that the innovation system approach is best placed to explain the technical change that is taking place. This approach allows a focus on various linkages that constitute constraints and possibilities for the promotion of technical change. Actors such as National Agricultural Research Systems (NARS), agricultural extension systems, farmers and farmer organizations, market actors of various sorts, politicians and regulators and the linkages between them are highlighted. Given the high degree of agro-ecological, socio-cultural, market and institutional diversity and complexity in SSA, a strong case for “*selective learning*”, or the decentralized “*bazaar model*” of innovation is made. This implies a need for active stakeholder participation in the adaptation and shaping of innovations.

While many research organizations see the need for such innovation strategies, weak capacity, a focus directed towards the international level, and pressure from large scale land investments create difficulties for decentralized practices. Hence, lessons need to be drawn from good examples, and good practices scaled up for food insecure people in sub-Saharan Africa to have improved control over their own lives.

1. Introduction

A majority of the population in sub-Saharan Africa (63%) lives in rural areas (World Bank 2009). This is a region where economies of most countries are dominated by agriculture. It is also the region in the world with the largest share of the population experiencing poverty. In 2005, 51% of the population in sub-Saharan Africa was living on 1.25 USD/day or less (ADI, Aug 2011). This marks a decrease from 59% living on 1.25 USD/day a decade earlier. However, poverty is still widespread, and primarily in rural areas. People living out of subsistence agriculture have experienced hunger more often than others. 31% in this category had experienced hunger “many times” or “always”, whereas comparable figures for people living in urban areas were between 7 and 12% (Afrobarometer, 2005).

While economic growth on average has been very rapid in many African countries during the 2000-2010, a number of these countries have experienced growth accompanied by slow reductions in poverty. In these cases, rural areas have been marginalized in growth processes (Hårsmar, 2010). Agriculture has an especially important role for reducing poverty in low income countries, particularly through its linkages to other economic, labor intensive sectors, such as rural industries and services. Against this backdrop it is especially note-worthy that agricultural productivity has been growing more slowly in SSA, compared to other regions in the world.

SSA is the only region in the world where agriculture was growing at a rate lower than the population growth rate during the period 1965-2000 and also slower than the growth rate in the agricultural labor force 1980-2000. Even if the quality of this data often is questionable, because of a large shares of subsistence farming in many countries, the overall pattern in SSA is that most of the increase in agricultural production that has taken place has come from expansion of the area under cultivation (“*extensification*”), and especially from expansion of the area under cereal cultivation at the expense of other crops. A simultaneous decrease in fertilizer use, and only a small increase in irrigation led only to meager increases in cereal yields (Dorward et al, 2002). The

economic growth during 2000-2010 has not changed the pattern of extensification of agricultural production. Rainfed cultivation continues to dominate massively, despite examples where gross margins of irrigation are more than double those of rainfed cultivation (Hagos et al, 2009:12). Agricultural value added per worker, which is a measure of agricultural productivity, has increased slowly for SSA, however recovering from a dip in the mid-1990s (WDI, 2011). Another indicator of the state of SSA agriculture is the net import of cereals, which has increased from 30 million tonnes in 1990 to 50 million tonnes in 2008 (Smedshaug, 2010: 42).

Common characteristics for many sub-Saharan Africa countries are the centrality of land as a productive factor and customary land tenure. A major part of all cultivated land in SSA has, partly or fully, been allocated through some kind of “customary” or “communal” tenure system (UNECA, 2004). Even in countries where the state has declared all land state property, multiple rights to land and to land use are common. This often implies various kinds of conflicts over land, despite a high flexibility and adaptability of customary tenure. Issues over land control have been high on the political agenda in a number of countries for many years, and aroused heated debates. A general trend of increased land investments is currently taking place in sub-Saharan Africa. This is driven by efforts at climate change mitigation through the increased use of bio-energy, and by increasing world market food prices peaking in 2007-08 and reaching even higher levels in 2011. Such land investments may have various aims. It might be a matter of cultivating food crops at large scale, or through small-holders sharecropping, for domestic or foreign markets. It might as well be a matter of cultivating energy crops for enhanced energy security or climate change mitigation purposes. The interest in African lands is motivated by its relative abundance and very low leasehold- or market prices by international standards.

Cultivated land in SSA amounts to about 200 million hectares. Rough estimates state that an additional 600-800 million hectares of potentially cultivable lands are available (FAO-IIASA, 2000, FAO, 2009). However, given that most of these lands currently provide ecosystem or other services (forest, savannah, tourism) or are situated far from markets and infrastructure, a more reasonable figure for additional cultivation until the year 2050 is about 65-70 million hectares (FAO, 2009, Bruinsma, 2009). Land investors may particularly aim for this land.

The scale of ongoing investments is unclear. The “Land Matrix Partnership” research consortium claims that 227 million hectares have been requested for sale or leasehold in the global South since 2001 (Oxfam, 2011). A significant part of this is in SSA, and the rate of investments increased considerably from 2007/08 (Oakland Institute, 2010). Investors comprise international corporations, sovereign wealth funds as well as domestic investors. When large scale investments occur, these may introduce agricultural systems that imply higher productivity. Newly introduced technologies may potentially also spread to surrounding farmers, raising the agricultural productivity more generally.

What from a macro level perspective seem to be a host of golden opportunities of freely available lands may involve significant complexities with various kinds of land user rights at a local level. Access to land usually comes in the form of bundles of rights,

which individuals or groups hold. Several individuals can hold different kinds of rights to the same plot of land, as members of kinship or village groups or of other kinds of organizations. Many planned land investments have not been implemented because processes of negotiating mandatory final deals at village or district levels have proven too cumbersome (Matondi et al, 2011). In addition, where large scale investments have been undertaken, the spread of technologies has been very slow, if occurring at all (Daniel and Mittal, 2009).

2. Links between Food Security and Technical Change in Agriculture

Food security has been defined in many different ways. A fair international agreement on the definitions was reached at the World Food Summit in 1996, and further refined in FAO's State of Food Insecurity in 2001:

“Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”

Food security is a concept that includes the physical, social as well as the economic access to food that meets people's nutrition needs and their food preferences. The “healthy life” and the “social” parts are meant to capture the entitlements of households and individuals, in line with the thinking of Amartya Sen (1981).

Food security is in this view built on three pillars:

- Food availability: having sufficient quantities of food available consistently.
- Food access: having sufficient resources to obtain a nutritious diet.
- Food use: appropriate use based on knowledge of basic nutrition and care, adequate water and sanitation as well as social acceptance of food.

Food security is a complex issue around which there has been a great deal of debate. For instance, it has been argued that:

- There is enough food in the world to feed everyone; the problem is distribution.
- Future food needs cannot be met by current levels of production, especially since water will become increasingly scarce.
- National food security is paramount - or no longer necessary because of global trade.
- Globalization may - or may not - lead to the persistence of food insecurity and poverty in rural communities.

Furthermore, the food security concept as such has been questioned. Even though it covers everyone's right to have enough food to eat, it does not say anything about how that food is produced, or where it comes from (Rosset, 2003). In reaction, the social movement *Via Campesina* coined the term “food sovereignty” (1996). This concept – or policy framework – includes seven principles:

- (i) Food as a basic human right;
- (ii) The need for agrarian reform in cases of landlessness;
- (iii) Protection of natural resources in a sustainable way;

- (iv) Reorganization of food trade so that imports do not replace food self-sufficiency;
- (v) Ending the “globalization of hunger” that follows from the control that multinational corporations and international organizations exert over agricultural policies;
- (vi) The avoidance of using food as a weapon; and
- (vii) Democratic control over international and national decisions related to food.

This framework includes support for smallholders and for collectively owned farms, fisheries, etc., rather than the promotion of larger scale agriculture and international food trade.

These debates illustrate the lack of consensus around food security. Everyone does not agree that access to food is enough. Some see a need for local control over the production of food. Following the quickly rising food prices in 2007-08 it became evident that there exists mistrust against international trade in food also at governmental level in many countries. A number of governments restricted their food trade through various measures. Among them were a number of large food exporters such as Argentina, India, Indonesia Russia and Thailand (Benson et al, 2008). A rapid spread of bilateral trade agreements in the area of food trade is another indication of the same phenomenon. The contested issue – both at local, national and international levels – is whether food security requires local control over food production, or to what extent food security may be attained through trade and via market transactions.

While food security concerns a wider set of issues than those related to agricultural production (and hence agricultural technical change), issues relating to food production nevertheless seem important in more than one sense, as will be argued in the following.

When investigating who the food-insecure at local level are, we find a paradox. Information can be obtained from the Afrobarometer surveys, which are undertaken every third year in some 20 sub-Saharan countries. The surveys aim at obtaining information about various aspects of democratic developments. Hence, they cover countries with some level of political openness. The surveys questions have been put to a representatively selected group of approximately 1200 persons in each country, and include queries about the extent to which they have experienced hunger; hence this is an indicator of self perceived food insecurity. In 2005, this was reported for different occupational categories. The occupation most frequently connected to hunger was subsistence farming. Almost one out of three subsistence farmers (31.4%) had experienced hunger “many times or always”. They were followed by peasant farmers (21.5%), farm workers (21.1%) and domestic workers (20%). Even commercial farmers had a rather large share who had experienced hunger “many times or always” (17.2%). This placed them on the same level as fishermen (17.6%). Comparable shares for government workers, teachers, business owners and other professionals were between 7% and 12%. In analogy to this, subsistence farmers had the lowest share of people who had never experienced hunger. In other words, the pattern of hunger being mainly a rural problem was evident (Own calculations based on Afrobarometer surveys, various years). This is also part of the reason why growth in agriculture is many times more effective in reducing poverty among the poorest than growth in other economic sectors

in low-income countries. In sub-Saharan Africa agricultural growth may be up to eleven times more poverty reducing among the poorest. However, effects disappear when people and countries grow richer: Growth in non-agricultural sectors becomes better at reducing poverty among the slightly less poor. And poverty-reducing effects from growth in agriculture decline sharply in middle-income, as well as in more unequal countries (Christiaensen et al, 2010). These are some findings from an empirical study of 80 countries during 1980-2002, reinforcing results from earlier studies using cross-country regressions (Ravallion and Datt, 1996, Timmer, 1997, Dorward et al, 2002, Haggblade et al, 2007, Ligon and Sadoulet, 2007).

Some 80% of all reductions in poverty come from reduced rural poverty (Ravallion et al, 2007). However, while most poverty reduction has occurred in rural areas this does not in itself prove that growth in agriculture has been the causal factor. In fact, much development theory has over the years treated agriculture as a backward sector. Following this view, labor and capital should preferably be shifted out of this sector into more productive use (Lewis, 1954, Collier and Dercon, 2009).

The major reason why agricultural growth reduces poverty is its effects on other economic sectors, its indirect poverty reducing effects. These indirect effects are observable through the existence of time lags. In a study of India, Datt and Ravallion (1998) found the poverty reducing effect of agriculture to be five times as great in the long run (three years and more) as in the short run (one year). They also found time lags in the effect of agricultural growth on rural wage rates. Similar time lags also appear in the study of Christiaensen et al (2010) where three-year averages for growth are used. The largest reduction in poverty does not come immediately when wages in agriculture rise, but later when peasants increase their consumption of local goods and services. This leads to increased wages in these economic activities (Mellor, 1999: 14). As well, some researchers point to gradual, possibly inter-generational processes of accumulation as essential to the agricultural pathway out of poverty (Shepherd, 2010:6)). However, for such effects to come about growth needs to first get started in agriculture, and contain both the direct and the indirect poverty reducing effects. There is a growing consensus that investments in agriculture might result in increased overall economic growth, even though agriculture itself grows slower than other economic sectors (Christiaensen et al, 2010: 8, Shepherd, 2010: 3). Agricultural growth multipliers act through different kinds of linkages (Haggblade et al, 2007: 143):

- Production linkages, which include increased demand for agricultural inputs and increased processing of agricultural products (“backward and forward linkages”);
- Consumption linkages, which occur when farmers spend increased incomes on locally produced goods and services such as milk, fruit and vegetables as well as health care and education;
- Factor market linkages, which occur when agricultural labor is freed up to move to non-farm sectors;
- Productivity linkages, which occur when increased productivity in agriculture leads to lower food prices, which in turn increases the productivity of poor manual laborers in other sectors, who for instance can afford more and healthier food.

In other words, most of the poverty reducing effect from agriculture stems from the rural non-farm sector, which is labor intensive, and where wages subsequently increase. The strategy to follow has been described as “*walking on two legs*” – agriculture and the rural non-farm sector (Shepherd, 2010). When farmer’s incomes increase, poor farmers spend around 80% on local products and services (Mellor, 1999). Richer farmers tend to spend lower shares of their incomes than the poor do, and not as much on local products and services. This is part of the reason why agricultural growth is less poverty reducing in situations where initial inequality is larger.

Growth in the agricultural sector can occur either through increased input of production factors already in use, such as labor, land, capital and biological/chemical resources, or through a more efficient use of them. The latter occurs through some process of technical change. Putting new products, processes or institutions into practical use is referred to as innovations. In SSA, the scope for raising productivity might be larger than elsewhere, since agricultural productivity has increased much slower than in other parts of the world.

In conclusion, linkages between food production, agricultural technical change and food security are multiple. The agricultural productivity level and the way agriculture is undertaken impact on livelihoods and economic opportunities for some of the most food insecure in many African countries. Higher productivity may contribute to open up pathways out of poverty. This comes in addition to their production of food for direct consumption. What the discussion on food sovereignty illustrates is furthermore that there are issues of unequal power relations to consider when analyzing food production from a food security perspective.

-
-
-

TO ACCESS ALL THE 28 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

AFAAS, (2011): <http://www.afaas-africa.org/papers-download/> accessed on 2011-09-16 [Description of objectives and activities of the umbrella organization coordinating African national agricultural advisory services.]

Africa – Brazil, (2011): <http://www.africa-brazil.org/>, access on 2011-09-16 [Web site for collaboration initiative initiated by the Brazilian president Lula da Silva in the field of agriculture.]

Afrobarometer, (2005): Data Round 3, merged, available at: http://www.afrobarometer.org/index.php?option=com_content&view=article&id=131&Itemid=79, accessed on 2010-11-22 [Database covering 20 countries in SSA. It provides surveys mapping the perceptions of a number of factors relevant for the state of democratic governance.]

Ahmad, S., (1966): “On the Theory of Induced Investment”, *The Economic Journal*, LXXVI (June), 344-357. [One of the early works developing the theory of induced innovation.]

Benson, T., N. Minot, J. Pender, M. Robles and J von Braun, (2008): “Global Food Crises – Monitoring and Assessing Impact to Inform Policy Responses”, *Food Policy Report*, IFPRI, Washington D.C. [Brief description of various country policy responses to food price increases.]

Binswanger, H. and V.W. Ruttan, (1978): *Induced Innovation: Technology, Institutions and Development*, Johns Hopkins University Press, Baltimore. [Basic discussion of the applicability of the induced innovation theory in developing countries.]

Boserup, E., 2008 (1965): *The Conditions of Agricultural Growth – The Economics of Agrarian Change under Population Pressure*, Aldine Transaction, New Brunswick, USA and London, UK. [Pioneering work on technical change in developing country subsistence agriculture.]

Botoni, E. and C. Reij, (2009): “La transformation silencieuse de l’environnement et des systèmes de production au Sahel: Impact des investissements publics et privés dans la gestion des ressources naturelles”, Centre for International Cooperation, the Free University, Amsterdam, the Netherlands. [Empirical study of the spread of soil and water conserving techniques in the Sahel over the last 25 years.]

Bruinsma, J. (2009): “The Resource Outlook to 2050: by how much do land, water and crop yields need to increase by 2050?” *Paper* presented at FAO Expert Meeting in Rome on How to Feed the World 2050. [Scenarios for future resource needs.]

Braun, A., J. Jiggins, N. Röling, H. van den Berg, P. Sijders, (2006): “A Global Survey and Review of Farmer Field School Experiences”, ILRI, Wageningen, the Netherlands. [Assessment and evaluation of the Farmer Field School model for agricultural extension and learning.]

Byerlee, D., (1998): “The Search for a new paradigm for the development of national agricultural research systems”, *World Development*, 26:6, pp 1049-1055. [Early description of the need for increasingly demand driven agricultural research in SSA.]

Carlsson, B., S. Jacobsson, M. Holmén and A. Rickne, (2002): “Innovation Systems: Analytical and methodological issues”, *Research Policy*, Vol 31, pp 233-245 [Fundamental discussion about basic tenets of innovation systems.]

Carter, M.R., (1997): “Environment, Technology, and the Social Articulation of Risk in West African Agriculture”, *Economic Development and Cultural Change*, pp 557-590. [Early work that lays the foundation for an empirical critique of the induced innovation system.]

Carter, M.R., (2008): “Inducing Innovation: Risk Instruments for Solving the Conundrum of Rural Finance”, *Paper* presented at 6th AFD/EUDN Conference, Paris. [One of very few empirical tests of the induced innovation theory in SSA.]

Christiaensen, L., L. Demery and J. Kuhl, (2010): “The (Evolving) Role of Agriculture in Poverty Reduction – An Empirical Perspective”, *Working Paper No 2010/36*, UNU-WIDER, Helsinki, Finland. [Empirical cross-country test of what role agricultural growth has to poverty reduction.]

Christoplos, I., (2008): “Agricultural Advisory Services and the Market”, *ODI Natural Resource Perspectives*, ODI, London. [State-of-the-art-description of the ongoing transformation of developing country agricultural advisory services.]

Collier, P. and S. Dercon, (2009): “African Agriculture in 50 Years – Smallholders in a Rapidly Changing World?”, *Paper* presented to the Expert Meeting on How to Feed the World in 2050, FAO, 24-26 June, 2009, Rome, Italy. [Leading mainstream development economists take on the future of African agriculture.]

Daniel, S. and A. Mittal, (2009): “The Great Land Grab – Rush for World’s Farmland Threatens Food Security for the Poor”, The Oakland Institute, Oakland, Ca, USA. [Critical update on the recent trend in large scale land acquisitions and their impact on small holders.]

Datt, G. and M. Ravallion, (1998): “Farm Productivity and Rural Poverty in India”, *Journal of Development Studies*, 34:4, 68-85 [Empirical study with important insights for the discussion of the role of indirect effects from agricultural growth on poverty reduction.]

David, P.A., (2000): “Path dependence, its critics and the quest for ‘historical economics’”, in Garrouste, P. and S. Ioannides (eds): *Evolution and Path Dependence in Economic Ideas: Past and Present*, Edvar

Elgar, Cheltenham, England. [The founding father of the “path development” concept lays out the main arguments.]

David, P.A., De Laiglesia, J.R. (2006): “Institutional Bottlenecks for Agricultural Development”, *Working Paper 248*, OECD Development Centre, Paris. [Overview and description of the main channels through which indigenous institutions affect agriculture in SSA.]

Djurfeldt, G., H. Holmén, M. Jirström and R. Larsson (eds.) (2005): *African food crisis - the relevance of Asian experiences*. CABI, London. [Main volume in a thorough project analysing African agriculture and its prospects in comparison with Asian experiences from the Green Revolution.]

Dorward, A., J. Kydd, J. Morrison and I. Urey, (2002): “A Policy Agenda for Pro-Poor Agricultural Growth”, *Working Paper*, Imperial College at Wye, Ashford, UK. [Overview description of conditions for agricultural growth to reduce poverty.]

Doughtwaite, B, (2002): *Enabling Innovation – A practical guide to understanding and fostering technological change*, Zed Books, London. [Standard volume providing empirical and theoretical support for the “selective learning” model of innovation.]

Fan, S., B. Nestorova and T. Olofinbiyi, (2010): “China’s Agriculture and Rural Development: Implications for Africa”, *China-DAC Study Group on Agriculture, Food Security and Rural Development*, Bamako, Mali, 27-28 April. [Overview of current Chinese investments and engagements with African agriculture.]

FAO, (2001): *The State of Food Insecurity in the World 2001*, FAO, Rome. [Providing widely accepted definition of “food security”]

FAO, (2009): “How to feed the world 2050”, *Working document*, High-level expert forum, Rome. [International policy document providing scenario and action plan for tomorrow’s global agriculture.]

FAO-IASSA, (2000): “Global Agro-Ecological Zones -2000” Food and Agriculture Organization of the United Nations, Rome, Italy and International Institute for Applied Systems Analysis. [International assessment of currently unused lands available for cultivation.]

Fellner, W., (1971): “Empirical Support for the Theory of Induced Innovation”, *Quarterly Journal of Economics*, Vol. LXXXV, pp 580-604. [One of the early works on the induced innovation theory.]

Friis-Hansen, E. and H. Egelyng, (2007): “Supporting Local Innovation for Rural Development – Analysis and Review of Five Innovation Support Funds”, *DIIS Report 2007:4*, Copenhagen, Denmark. [Overview of innovation models for developing country agriculture, and assessments of active programmes.]

Friis-Hansen, E. (2004): “Concepts and Experiences with Demand Driven Advisory Services – Review of Recent Literature with Examples from Tanzania”, *DIIS Working Papers*, 2004:7, DIIS, Copenhagen, Denmark. [Overview of reforms of agricultural advisory systems towards increased market orientation and demand pull.]

Friis-Hansen, E. and D. Duveskog, (2011): “The Empowerment Route to Well-being: An Analysis of Farmer Field Schools in East Africa”, *World Development*, doi:10.1016/j.worlddev.2011.05.005 [Empirical and theoretical support for the thesis that Farmer Field Schools lead to improved well-being for participants, through the route of empowerment.]

Geels, F.W., (2004): “From sectoral systems of innovation to socio-technical systems – Insights about dynamics and change from sociology and institutional theory”, *Research Policy*, No 33, pp 897-920. [Early description and discussion on the multi-level perspective of innovation.]

Goldman, A., (1993): “Agricultural Innovation in Three Areas of Kenya: Neo-Boserupian Theories and Regional Characterization”, *Economic Geography*, 69,1: pp. 44-71. [Empirical test and critique of the induced innovation theory in East Africa.]

Haggblade, S., P.B.R. Hazell, and P.A. Dorosh, (2007): “Sectoral Growth Linkage between Agriculture and the Rural Nonfarm Economy” in Haggblade, Hazell, and Reardon (eds), *Transforming the Rural Nonfarm Economy*, Johns Hopkins University Press, Baltimore, USA [Detailed study on the links that make agricultural growth poverty reducing.]

Hagos, F., G. Makombe, R.E. Namara and S.B. Awulachew (2009): "Importance of Irrigated Agriculture to the Ethiopian Economy – Capturing the Direct Net Benefits from Irrigation", *IWMI Research Report 128*, International Water Management Institute, Colombo, Sri Lanka. [Provides estimated profit margins of various types of cultivations in Ethiopia. Especially important when it comes to comparing rainfed and irrigated agriculture.]

Hall, A. and N. Clark, (2010): "What do Complex Adaptive Systems Look Like and What are the Implications for Innovation Policy?", *Journal of International Development*, 22, pp. 308-324. [Empirical test of agricultural system change from Soroti district in Uganda.]

Harsmar, M. 2006 (ed): "Agricultural Development in sub-Saharan Africa", *Workshop proceedings*, EGDI, Ministry for Foreign Affairs, Stockholm, Sweden. [Description and discussion of main factors impacting on agricultural sector growth in SSA.]

Hayami, Y. and V.W. Ruttan, (1970): "Agricultural Productivity: Differences Among Countries", *American Economic Review*, Vol 60, No 5: 895-911. [Basic discussion of the economics of agricultural productivity.]

Hayami, Y. and V.W. Ruttan (1971): *Agricultural Development: An International Perspective*, Johns Hopkins University Press, Baltimore. [More comprehensive than the article above, a standard reference on the factors behind agricultural growth.]

Hayami, Y. and V.W. Ruttan (1987): "Population Growth and Agricultural Productivity" in Johnson, D.G and R.D. Lee (eds) *Population Growth and Economic Development: Issues and Evidence*, University of Wisconsin Press, Madison. [More specific on the role of population and labor supply in agricultural growth.]

Hicks, J., (1932): *The Theory of Wages*, McMillan, London 1st ed., 2nd ed. 1963. [First origin of the induced innovation theory.]

Hulme, D. (1991): "Agricultural extension services as machines: the impact of the training and visit approach", in W.M. Rivera, D.J. Gustafson, (eds); *Agricultural Extension: Worldwide Institutional Evolution and Forces for Change*, Elsevier, Amsterdam. [Critical assessment of traditional approaches to agricultural advisory services.]

Jayne, T.S. J. Govereh, M. Wanzala and M. Demeke, (2003): "Fertilizer market development: a comparative analysis of Ethiopia, Kenya, and Zambia", *Food Policy*, 28:4, pp. 293-316. [Assessment of impact from economic structural adjustment programmes on agricultural input markets.]

Jayne, T.S., Z. Ballard and J.J. Nijhoff, (2006): "Stabilizing food markets in eastern and southern Africa", *Food Policy* 31:4, pp. 328-341. [Assessment of impact from structural adjustment programmes on agricultural product markets.]

Kaboré, D. and C. Reij, (2004): "The Emergence and Spreading of an Improved Traditional Soil and Water Conservation Practice in Burkina Faso", *EPTD Discussion Paper No 114*, IFPRI, Washington D.C. [Overview description on the importance of customary SWC techniques and their spread in West Africa.]

Kennedy, C., (1964): "Induced Bias in Innovation and the Theory of Distribution", *The Economic Journal*, LXXIV (Sept), 541-547. [Early work on the induced innovation theory. Later heavily criticized for lacking micro foundation.]

Kennedy, C., (1966): "Samuelson on Induced Innovation", *Review of Economics and Statistics*, XLVII (Nov), 442-444. [Part of the early discussion on the induced innovation theory.]

Kherallah, M., C. Delgado, E. Gabre-Madhin, N. Minot and M. Johnson, (2000): "The Road Half Travelled – Agricultural Market Reform in sub-Saharan Africa", IFPRI, Washington D.C. [Brief summarizing major assessment of reforms of SSA agriculture undertaken during the structural adjustment period of the 1980s and 90s.]

Kydd, J., A. Dorward, J. Morrison and G. Cadish, (2002): "Agricultural Development and Pro-Poor Economic Growth in Sub-Saharan Africa: Potential and Policy", *ADU Working Paper 02/04*, Imperial College, Wye, UK. [Overview provided by leading scholars in the field of neo-institutional analysis of developing country agriculture.]

Lédea Ouedraogo, B. (1990): *Entraide villageoise et développement*, L'Harmattan, Paris. [Inside story by leader of the major peasant organisation « 6S », describing the organization's philosophy and approaches.]

Lewis, W.A., (1954): *Economic Development with Unlimited Supplies of Labor*, Manchester School of Economic and Social Studies, 22: 139-191. [Theoretical work by one of the classic development economists.]

Ligon, E. and E. Sadoulet, (2007): "Estimating the Effects of Aggregate Agricultural Growth on the Distribution of Expenditures", *Background paper for the World Development Report 2008*, World Bank, Washington D.C., USA. [Empirical tests of how much agricultural growth contributes to increased consumption among the poor, and on how it influences distribution of resources.]

Lundwall, B.-Å. (1985): *Product Innovation and User-Producer Interaction*, Aalborg University Press, Aalborg, Denmark. [Pioneering study of the innovation systems approach to technical change.]

Lundwall, B.-Å. (2007): "National Innovation Systems – Analytical Concepts and Development Tool", *Industry and Innovation*, Vol 14:1, pp 95-119. [Refinement and discussion of the innovation systems approach.]

Matondi, P., K. Havnevik and A. Beyene, (2011): *Biofuels, Land Grabbing and Food Security in Africa*, Zed Books, London. [Description and discussion of recent trends in large scale land acquisitions in Africa and its effects on small holders.]

Mellor, J.W., (1999): "Pro-Poor Growth – The Relation Between Growth in Agriculture and Poverty Reduction", USAID, Washington D.C., USA. [Early discussion of the role of agricultural growth in poverty reduction.]

Nordhaus, W.D. , (1973): "Some Sceptical Thoughts on the Theory of Induced Innovation", *Quarterly Journal of Economics*, Vol. LXXXVII, pp 208-219. [Critique of the induced innovation theory, claiming that a mechanism for inducing new research is lacking in the theory.]

Nordhaus, W.D., (2002): "Modeling Induced Innovation in Climate Change Policy", in Grubler, A., N. Nakicenovic and W.D. Nordhaus (eds): *Modeling Induced Innovation in Climate Change Policy*, Resources for the Future Press. [Critique of induced innovation theory taken further, with application to the field of climate change.]

Oxfam, (2011): "Land and Power – The growing scandal surrounding the new wave of investments in land", *151 Oxfam Briefing Paper*, Oxford, UK. [Critique of recent trend in large scale land acquisitions in developing countries and their effects on small holders.]

Pardey, P., J. Roseboom and J. Beintema, (1997): "Investments in African agricultural research", *World Development*, 25:3, pp 409-423. [Description and discussion of the state of agricultural research in Africa.]

Ravallion, M. and G. Datt, (1996): "How Important to India's Poor is the Sectoral Composition of Economic Growth?", *The World Bank Economic Review*, Vol. 10:1 [Empirical study of importance of agricultural development for poverty reduction.]

Raymond, E. (1999): "The Cathedral and the Bazaar", *Knowledge, Technology and Policy*, 12:3, pp 23-49. [Influential description of two separate models for innovation and innovation diffusion.]

Richards, P. (1993): "Culture and community values in the selection and maintenance of African rice", *paper presented at conference on Intellectual Property Rights and Indigenous Knowledge*, Granlibakken, Lake Tahoe, 5-10 October. [Discussion of the importance of indigenous knowledge for plant breeding in SSA.]

Rogers, E.M. and L. Svenning, (1969): *Modernization Among Peasants*, Holt, Rinehart and Winston, New York. [Empirical description and assessment of the innovation diffusion model and its applicability to development country small holder agriculture.]

Rogers, E.M., (1995): *Diffusion of Innovations* (4th edition), The Free Press, New York. [Standard volume on the innovation diffusion model.]

Rosset, P., (2003): "Food Sovereignty: Global Rallying Cry of Farmer Movements", *Backgrounder*, 9:4. [Description of the "Via Campesina" peasant movement, its philosophy and programme.]

Ryan, B. and N.C. Gross (1943), "The Diffusion of Hybrid Seed Corn in Two Iowa Communities" *Rural Sociology* 8 (March): 15-24. [First study establishing the innovation diffusion theory.]

Samuelson, P.A., (1965): "A Theory of Induced Innovation along Kennedy-Weizacker Lines", *Review of Economics and Statistics*, XLVII, 343-356. [One of the classical articles on the induced innovation theory.]

Sen, A., (1981): *Poverty and Famines – an Essay on Entitlement and Deprivation*, Oxford University Press, Oxford. [Standard volume describing the most influential "capability" concept and its applicability to hunger and starvation.]

Shepherd, A., (2010): "Agriculture and Escaping Rural Poverty: An Analysis of Movements and Markets", *Paper for CPRC Conference*, Sept 8-10, 2010, Manchester, UK. [State-of-the-art paper summarizing links between agricultural growth and poverty reduction.]

Skarstein, R. (2002): "Induced Innovation and Agricultural Productivity – A Critical Note", (*mimeo*), Department of Economy, NTNU, Trondheim, Norway. [Critique of the induced innovation theory, along the same lines as Nordhaus.]

Slingerland, M.A. and V.E. Stork, (2000): "Determinants of the Practice of Zaï and Mulching in North Burkina Faso", *Journal of Sustainable Agriculture*, Vol 16, No 2:53-76. [Insights into the success of new methods for saving soil and water in Sahel agriculture.]

Spielman, D.J. (2005): "Innovation Systems Perspectives on Developing-Country Agriculture: A Critical Review", *ISNAR Discussion Paper 2*, IFPRI, Washington D.C. [Overview of the importance and applicability of the innovation systems perspective to agriculture in developing countries.]

Strang, D. and J.W. Meyer, (1993): "Institutional Conditions for Diffusion", *Theory and Society*, Vol 22, pp. 487-511. [Criticisms of the innovation diffusion theory from an institutional theory approach.]

Sumberg, J. (2005): "Systems of innovation theory and the changing architecture of agricultural research in Africa", *Food Policy*, Vol 30:1, pp. 21-41. [Discussion of the roles and functions of various African research organizations, for instance the NARS.]

Timmer, C.P., (1997): "How Well do the Poor Connect to the Growth Process?", *CAER Discussion Paper No 178*, Harvard Institute for International Development, Cambridge, MA, USA. [Overview discussion on linkages between economic growth and poverty reduction, and the role of agriculture in this process.]

UNECA, (2004): "Land Tenure Systems and their Impacts on Food Security and Sustainable Development in Africa", *ECA/SDD/05/09*, Addis Ababa, Ethiopia. [Overview description and analysis of the role and importance of customary tenure systems in SSA.]

Valente, T.W. and E. Rogers, (1995): "The Origins and Development of the Diffusion of Innovation Paradigm as an Example of Scientific Growth", *Science Communication*, 16, p 242. [Historic review of the importance of the innovation diffusion model.]

Van Weperen, W. (2011): "Abstract: Results from Market Oriented Agricultural Advisory Services Study", available at: <http://www.afaas-africa.org/papers-download/> [Highlighting various aspects of the current status of MOAAS implementation.]

WARDA, (2007): "NERICA Compendium, Module 2: Origins, nomenclature and identification characteristics", available at: <http://www.africarice.org/warda/guide-compend.asp> [Description of the character and history of the NERICA varieties – New Rice for Africa.]

World Bank, (2009): *World Development Indicators, Africa Development Indicators*, <http://www.worldbank.org/>, accessed 2011-08-19 [Statistical database available free of charge, containing more than 1000 development indicators.]

Biographical Sketch

Mats Hårsmar, PhD, is senior researcher and cluster leader for the globalization cluster at the Nordic Africa Institute in Uppsala, Sweden. Prior to that, he served as chief analyst for development policies at the Swedish Ministry for Foreign Affairs, and head secretary of the Expert Group on Development Issues, Swedish MFA.