Chapter 18

Technology Adoption and Economic Development:
Trajectories within the African Agricultural Industry

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ABSTRACT

Africa's economic development will result from conscious efforts directed towards diversification and increased productivity in its low-performing agricultural sector. Technology development, transfer and uptake, which are low for now, are indispensible necessities in this respect. The purpose of this chapter is to review the characteristics, importance, constraints and technology adoption process of African agriculture to identify factors that enhance or hinder technology uptake. This is with a view to isolating lessons for developers or packagers of new agricultural or other technologies for Africa, especially nanotechnology and microelectronics which are evolving and transformational. The attributes of technologies that have made desired impact in African agriculture included cheapness, simplicity, observability, visibility of results, usefulness, compatibility with existing technologies and farm- or farmer-specific socio-economic or socio-cultural conditions. Case studies of the welfare-enhancing impacts of adopted agricultural technologies were examined under use of fertilizers, improved varieties and biotechnology. Useful lessons for development and transfer of nanotechnology and micro-electronics to Africa were highlighted.

INTRODUCTION

Agriculture is one of the most important and possibly the oldest economic activity developed by humans and it is becoming increasingly dependent on development of technologies (Alexandre, 2009). Agriculture in Africa is a subsistent, low technology and low-performing one which requires reduced drudgery and increased commercialization. For crop production, farmlands are cleared using cutlass and/or fire after which land preparation is done using the hoe; hence the term "slash and burn" agriculture. Animal husbandry is based on extensive or semi-intensive systems

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in which feeds, water and shelter are not usually provided for farm animals. The growth of farm animals thus follows a staircase pattern (Williamson and Payne, 1978) in line with the trend in feed availability.

The dependence of African agriculture on human labour and crippling land tenure problems are the main reasons for small and uneconomic farm sizes unsuitable for mechanization. Furthermore, seeds, propagules and breeding stocks accessible to farmers and highly adaptable to African agriculture are the hardy, unimproved and low-producing types. The generic problem of low productivity of the existing seed-stock is one of the factors responsible for Africa meeting just about 50.0% of her per *capita* demand for food (Olalokun, 1998; Okunmadewa, 1999, Okunmadewa *et al*., 2002). The problems of pests and diseases are particularly serious because a larger proportion of African land area falls in the tropical region which is described as "a paradise of parasites." Poor animal health is the main reason for losses in animal production. Direct and indirect losses of meat, milk and work output are estimated at about US$40 billion a year in Sub-Saharan Africa (SSA) alone (World Bank, 2005). There is also soil fertility and other environmental management problems which negatively impinge on agricultural production and productivity (World Bank, 2006).

To assure increased food supply and attain sustainable economic development, there is a compelling need to increase agricultural production. This is necessary from the point of view of food, income, employment, poverty reduction and economic stability. In spite of the fact that a considerable proportion of Africa's annual budget goes for food import, under-nourishment and malnutrition are still prevalent (World Bank, 1990; UNICEF, 1990; Okojie, 1990, Mafimisebi, 2007). There are problems inherent in further food import which is projected to expand considerably in future. The most practical and sustainable way for Africa to achieve a reliable food supply is to give a powerful boost to her own agricultural system.

In order to turn the tables in the race between the growing population and dropping food levels, more countries of the continent must strive to achieve the recommended 4% agricultural production growth rate per year (World Bank, 1989; 1993) necessary to achieve overall economic development. Only very few countries, less than one-fifth of African countries, shown in Table 1, had achieved or came close to achieving this agricultural growth rate in the late 1980s or early 1990s.

Some of these countries; Botswana, Chad and Comoros are classified as resource-poor and this is heart-warming news to African countries in that category. Most of these countries were all poor performers in the 1960s and 1970s and the change in scorecard holds important lessons on what can be done to reverse agriculture's fortune in other African countries.

The objective of this chapter is to give a review of the present state of agriculture in Africa and the role of technologies in it. The chapter also touches on the process of adoption of technologies and factors that enhance or hinder it in Africa. A review of attributes and suitability of models used in technology transfer is also carried out. The overall

Table 1. African countries with high agricultural growth rates

Country	Year		
	1986-1989	1990	1991
Chad	6.1	8.9	20.0
Cape Verde	12.0	-3.8	9.3
Nigeria	4.3	4.1	5.0
Botswana	19.5	3.7	2.7
Guinea-Bissau	6.4	2.5	5.7
Uganda	6.0	3.4	2.9
Benin	5.0	1.4	4.5
Kenya	4.3	3.5	-0.7
Tanzania	4.5	2.9	-
Comoros	4.5	2.8	3.9

Source: World Bank, 1993.

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