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A comparative study of appropriateness and mechanisms of hard and soft technologies transfer

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ABSTRACT

Technology transfer continues to play a significant role in fostering economic growth, enterprise and human capability development in many emerging and developing economies. In this paper, we examine the appropriateness and mechanism of hard and soft technology transfer in the African cotton industry. Focusing on Uganda, a land-locked African country, we comparatively examined the appropriateness and pro-poor nature of Indian and US made hard and soft ginning technologies transferred into Uganda. Data for our inquiry come from two cotton ginneries in the eastern region of Uganda. We found that a technology transferred into a developing economy can only be appropriate if both the hard and soft component of the technology is transferred into the economy. Our study also reveals that while ginning technologies from India appear to be much more appropriate relative to those from USA, they are not environmentally friendly and affordable for those at the bottom of the pyramid. In addition, the long staple cotton lint the Indian made technologies churn out tends to attract higher prices on the international market. Nevertheless, ginning technologies from the United States tend to have very high rates of production. Implication for theory and policy are presented.

1. Introduction

Innovation and technology researchers have begun to increasingly develop comprehensive models of technology transfer to developing countries (e.g. Archibugi and Pietrobelli, 2003; Bell and Pavitt, 1993; Costantini and Liberati, 2014; Majidpour, 2016). While these studies have extended our understanding on the wider social, historical, and economic context within which technology transfer succeed or fails, the transfer mechanism, and appropriateness of these technologies, which can be decomposed into capital equipment, intermediate goods, and consumer goods and services have not been fully explored (Botchie et al., 2016; Kaplinsky, 2011a, 2011b).

While the concept of technology appropriateness for developing countries has received scholarly attention, a bulk of the seminal works was published before the 1980s. These studies were widely developed in the context of not-for-profit indigenous technologies and their relevance towards poverty reduction (Kaplinsky, 2011a, 2011b). It was only until the 1990s that technologies from foreign sources were recognised to be more appropriate for northern economies and relatively not exactly suitable for developing countries (Kaplinsky, 2011a, 2011b). In recent times, high demand for new technologies in low-income markets as observed by Prahalad and Hammond (2002), presents

an extraordinary opportunity for multinational organisations in the northern economies to seek their fortunes and bring prosperity to those at the bottom of the pyramid (Dey et al., 2013). Nevertheless, empirical evidence rather suggests that emerging economies, led by China and India appear to be taking advantage of this opportunity than their Northern counterparts (Kaplinsky, 2011a, 2011b; Lema and Lema, 2012). In making sense of this empirical puzzle, researchers have invoked the larger spread effects, leading to smaller gaps in technological know-how between south-south, and the appropriateness of these technologies by virtue of been induced in similar context as the fundamental factors driving the emerging south-south technology transfer trends (Amanor and Chichava, 2016; da Nobrega Cesarino, 2013). By appropriate technology, we refer to any form of hard and soft technology that is accessible, affordable and simple to use, with its embodied knowledge and skills easy to acquire and transferred to users of the technology (Hazeltine and Bull, 2003; Los and Timmer, 2005). In this regard, Kaplinsky (2011a, 2011b), pp.193, argues that “the very large size of China and India, coupled with their growing technological capabilities and the rapid growth of low-incomes, makes it likely that they will become the dominant sources of technological innovations for the poor”.

The focus of this paper is on a relatively under-researched

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dimension of the appropriateness' of technologies transferred into developing countries - a comparative study of the appropriateness and mechanisms of hard and soft technologies transfer in a developing economy. As part of a national foresight exercise aimed at improving national competitiveness, we focus on the Ugandan cotton industry to examine cotton ginning technologies transfer from the USA (representing northern economy) and India (representing emerging economy), to ascertain their appropriateness and mechanism of transfer into Uganda. We develop our contribution at a time when Indian made ginning machines; by virtue of their cheap price have come to dominate the market, even though most Ugandans tend to consider technologies from the northern economies as the most reliable and efficient (Kaplinsky, 2011a, 2011b). Data from the World Integrated Trade Solution (WITS) of the World Bank shows that import value of ginning technologies from India¹ to Uganda increase from US \$9400.00 in 2000 to US \$232,000 (see Fig. 1 below). Contrariwise, the value of cotton ginning technologies imports from the USA into Uganda remains significant but has underperformed when compared to India.

Such investigation is relevant and valuable as technologies transferred into African countries, in particular, are creating conditions for emerging indigenous and local firms to flourish and thrive (Amankwah-Amoah, 2015). Despite this noticeable trend in a shift towards the adoption and utilisation of technologies in many developing countries, recent STI reports have concluded that over reliance on inappropriate technologies is one of the main causes of their under development and high levels of poverty, particularly, in many African countries (World Economic Forum, 2013). For example, some of these transferred technologies are not suitable for developing countries environment; hence may lead to the creation of inequalities in job creation, incomes, and consumption patterns (Chataway et al., 2014). Such problems, we follow scholars such as Papaioannou (2014), Chataway et al. (2014) and Kaplinsky (2011a, 2011b), to suggest, can be partly explained by the mechanism of transfer and the inappropriateness of these technologies. Our premise is that the strategic importance of appropriateness lies at the core of hard and soft technology transfer to developing countries (Paunov, 2013), since consumers and firms without the relevant competence and abilities cannot effectively adopt and utilize a given technology to enhance their capabilities and improve their welfare.

The paper is structured as follows. The second section is a brief review of the literature on technology appropriateness and transfer in developing countries. Following this, we provide an overview of the ginning technology in the cotton sub-sector in Uganda. Next is our research methodology. The penultimate section is our research findings. We conclude with a discussion of our findings, and its implications for policy and economic development.

1.1. Technological appropriateness in developing countries

The concept of appropriate technology is frequently used to refer to any small-scale technology that is simple enough that people could adapt to meet their socio-economic needs. For Stewart and Ranis (1990; p.4.), it is a “technology which best makes use of a country’s resources to achieve its development objectives”. In developing countries, appropriate technologies make best use of available resources because they are labour intensive, less skills intensive and less reliant on infrastructure, and operate on small scale basis. Thus, unskilled labour in developing countries are able to use them because they are less skills intensive—thereby leading to the creation of more jobs (Chataway et al., 2014; Kaplinsky, 1990). Technologies that are appropriate for developing countries are less reliant on infrastructure because they

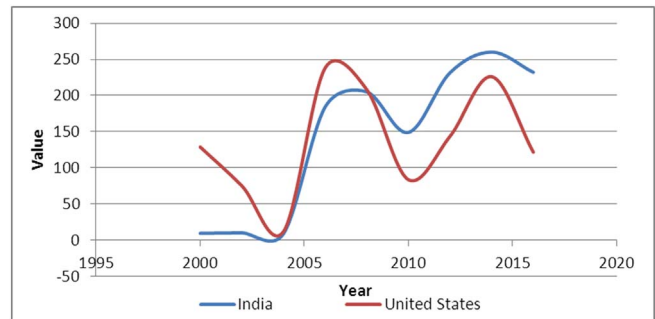


Fig. 1. Comparing cotton ginning imports from USA and India into Uganda (\$ 000). Source: WITS Database, World Bank.

often do not require electric infrastructure to operate (Kaplinsky, 1990). From this perspective, Schumacher (1973) advocated for the development of \$100 technologies that are simple, affordable and less reliant on infrastructure. Schumacher’s proposal gave rise to the publication of three major studies by the Organisation for Economic Co-operation and Development (OECD, 1976), The World Bank (1976), and the United States Agency for International Development (USAID, 1976). The three publications made a very strong argument against the reliance on northern capital intensive technologies in developing economies. They argued that developing countries do not have the capacity to generate resources—financial, human and infrastructural—that would mitigate the developmental challenges in key sectors of their economies.

The three documents further argued that capital intensive technologies generally have socially disruptive repercussions and in many cases were introduced in developing economies as a result of distorted factor prices and protection. The technologies tended to produce for either the high income group of the domestic economy and/or for export purposes. They argued further that capital intensive technologies are usually not adapted for the supply of labour in developing countries. Hence, the industrial sector generally suffers from under-utilised capacity and excess downtime. This stifles growth of technological capacity and innovation in developing countries. It also leads to very adverse developmental outcomes. Thus, they argued that technology in developing countries must be appropriate.

The traditional appropriate technology movement as espoused by the international organisations in the 1970s and 1980s were overwhelmingly driven by not-for-profit organisations. More recently though, a new school of thought have postulated that the rise of emerging economies such as China and India suggests that this dominant trajectory may be subject to change and that—for-profit appropriate technology may become increasingly prevalent. This is driven not just by the growth in capabilities in these economies but also because the rise of some Asian economies, like China and India, has coincided with a rapid growth in demand by poor consumers. These poor consumers may aspire to branded positional goods, but because of their low incomes will settle for simpler and lower quality products (Kaplinsky, 2011a, 2011b). This form of demand from poor consumers has reignited the appropriate technology concept with China and India serving as the likely sources.

The re-emergence of the appropriate technology concept has come in the wake of advocacy for profit oriented less skills intensive technology for the poor since there is more unskilled labour than skilled labour in developing countries (Chataway et al., 2014; Fu et al., 2011; Kaplinsky, 2011a, 2011b; Papaioannou, 2014). This is one of the main reasons why Fu and Gong (2011, pp. 1214) argue that firms using “unskilled labour augmenting technology will be more efficient than firms using skilled-labour augmenting technology in low-technology industries” in developing countries. However, Fu et al. (2011) makes an important point that the fact that a technology is labour intensive does not always mean that the technology is efficient and appropriate. This is

¹ Uganda has for many years had a human capital skills set that is of Asian (predominately South Asian/Indian) origin, hence the presence of ginning technologies from India in Uganda, we concede also has deep historical roots (Baffes, 2009).

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