



# Evaluation of artisan training in metal silo construction for grain storage in Africa: Impact on uptake, entrepreneurship and income



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## ABSTRACT

This study assesses the impact of training sheet metal workers in Kenya on their uptake of learned skills and their income. Fifty-eight artisans trained in the construction of metal silos for hermetic grain storage were compared to a random sample of 123 untrained artisans. Results show that two-thirds of the trained artisans were making the silos, half of these in their own workshops and half as employees. The probability of using the skills learned declined with age but increased with previous experience in technical work. The training did not significantly increase the income of employed artisans, but increased the annual income of those who made the silos in their own workshops by KSh315,173 (about US\$3,600). The overall impact could be improved by better targeting of trainees, by using apprenticeships as an alternative mode of training, and by encouraging entrepreneurship through business training and provision of credit.

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## 1. Introduction

Many projects provide technical training for artisans in developing countries on the use of new technologies, yet few studies have assessed the impact of this training, in particular in rural areas. Hence, there are few opportunities to learn from previous experience how to conduct this type of training, what topics should be covered, which trainees should be selected, and how the impact of the training could be improved.

One of these technologies is the hermetic metal silo for grain storage. These silos were first developed by the PostCosecha project in Central America, in collaboration with the Swiss Development Corporation (SDC), to help small-scale farmers store their maize, reduce insect losses and increase income (Fishler et al., 2011). The project was implemented in four countries in Central America from 1983 to 2003, during which time more than 2000 artisans were trained in metal silo construction. By 2009, these artisans had produced 670,000 silos (SDC, 2012). An ex-post impact study showed that uptake of the skills learned substantially increased the income of the trained artisans (Fishler et al., 2011).

In 1999 the technology was introduced in Kenya through the Grain Storage Pilot Project run by the Catholic Relief Service (CRS) in collaboration with SDC (Sieber, 1999); this project was later expanded to include central and eastern Kenya (Ouma and Njogu, 2007). The technology was then adopted by the Efficient Grain Storage Project (EGSP) of the International Maize and Wheat Improvement Centre (CIMMYT). The first phase of the project was implemented in Kenya and Malawi from 2008 to 2010, and covered training, technology promotion, efficacy, and economic and impact studies (CIMMYT, 2011).

Preliminary analysis indicated that the metal silos had a high potential for use in Africa, as they reduced post-harvest maize losses from insect pests from an estimated 20–30% to almost nothing (Tefera et al., 2010). On-station trials showed that the metal silos were highly effective in protecting maize against storage pests, and that the additional use of insecticide, as practised in Central America, was not necessary (De Groot et al., 2013). Economic analysis based on data from Kenya and Malawi found that larger metal silos in excess of one ton were the most cost-efficient for grain storage, provided that insect losses and maize prices were sufficiently high to justify the investment (Kimenju et al., 2009). Finally, impact assessment based on farmer surveys in Kenya showed that metal silos almost completely eliminated losses due to insects, increased the storage time of maize by two months, increased the period of adequate food provisioning by one month, and increased household income through sales later in the season at higher prices (Gitonga et al., 2013).

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Based on experiences and lessons drawn from the first phase, a second phase of the EGSP was initiated in 2012 in two more countries, Zambia and Zimbabwe, in addition to Kenya and Malawi. Hermetic bags, operating on the same principle as metal silos but much cheaper and more cost-efficient at lower volumes, were also introduced in the second phase as an alternative for small farmers and those who could not afford a silo. In Kenya the project was broadened to include Nakuru County.

Different projects have now trained many artisans in metal silo production in Africa, but there is no information providing feedback on the uptake of the skills learned or the impact of the training, that could be used for the organization of future training. A World Bank review noted the lack of reliable information on the scope and performance of non-governmental skills training (Johanson and Adams, 2004): this is an impediment to designing appropriate and effective policies and programs. The literature provides little information on the uptake of skills learned in training or the impact on livelihood of the trainees, and thus brings little empirical evidence to the wider policy debate.

This study was therefore undertaken with the following objectives: (i) to determine the uptake of the skills learned by trainees in metal silo production in Kenya; (ii) to analyze the factors that affect the uptake; and (iii) to assess the economic benefits for artisans trained in the construction of metal silos.

## 2. Background: training artisans for the informal sector in Africa

### 2.1. Technical and vocational education and training

An analysis of skills training of informal-sector artisans needs to start from a general discussion on the training of workers in technical skills, and to review the principles and empirical evidence of different approaches, particularly in Africa. Training in technical skills is commonly referred to as 'technical vocational education and training' (TVET), often shortened to 'vocational education and training' (VET) or even just 'training', 'vocational' here meaning job-related (Middleton, 1991), in contrast to 'education' which usually refers to general or academic education. In rural and pre-industrial societies, technical and professional skills are typically passed from parents to children. Specialized labour and higher-level skills are required, however, when societies become increasingly urbanized and industrialized (Ashton et al., 2002). Developing economies thus face an increased demand for an adaptable, multi-skilled and creative labour force, especially when undergoing rapid transformation, in order to facilitate economic development (Middleton, 1991). The need for education as well as for training steadily increases, although economists and educationalists argue about the best way to provide these and about what exactly is needed. The debate focuses particularly on the merits of general education vs. vocational training, and whether the latter should be provided in schools, during courses or on the job.

TVET used to be a central tool of development cooperation, in particular from the 1950s through to the 1980s (McGrath, 2002). It was favoured by policymakers because it provided an alternative to students who did not succeed academically, preparing them for practical work and reducing pressure on higher education (Haddad et al., 1990). This reasoning has been criticized as the 'vocational-school fallacy', because vocational schools are expensive and difficult to run, and are not appreciated by either students or parents since they lead to fewer opportunities in the labour market and lower social status (Foster, 1965).

Initially the World Bank financed many TVET programs, but economic analysis of these projects showed their limitations. A tracer survey in Tanzania concluded that none of the five core

artisan training courses offered by training centres was likely to be cost-effective because of low training-related employment, high costs and subsequent relatively low earnings (Bennell et al., 2006). Consequently, since the World Conference on Education for All in 1990 (McGrath, 2002), the World Bank and other donors have transferred the focus of their efforts to supporting general primary and secondary education, while advocating a stronger role in TVET for the private sector (Haddad et al., 1990).

Reviews of World Bank projects indicate that public interventions in TVET are economically justified by reasonably high rates of return, in particular from in-firm training or training in institutions with good connections in employment, but that training in industrial institutes and vocational secondary schools is less cost-effective than more informal, firm-based training (Metcalfe, 1985). Moreover, short training courses have a bigger payoff than longer ones (Metcalfe, 1985; Middleton, 1991).

The criticism of TVET known as the 'vocational-school fallacy' is changing, with some multilateral organizations and some governments starting to appreciate once again the place of TVET and vocational training in general (King and Palmer, 2007). Similarly, the World Bank's views have been challenged, in particular, because of the returns to investment in vocational skills in Asia (Ashton et al., 2002; Lewis, 2009). These evolutions have led to the development of a new and increasingly popular paradigm, 'skills for development', which is a wider concept that pays more attention to the informal sector and the opportunities for entrepreneurship that this sector offers (McGrath, 2002). In this paradigm, skills training is increasingly important since it supplies skilled manpower to the informal sector, which is key to the economy of developing countries, in particular those with dwindling opportunities in the formal sector (Haan and Serriere, 2002). Moreover, it provides more flexibility: trainees can choose to be employed in a workshop or to become an entrepreneur (Haan and Serriere, 2002). The concept of skills training has been broadened from simply teaching technical skills to including problem-solving, communication, teamwork and other core skills (McGrath, 2002).

However, a review of institutions and programs offering training skills to the informal sector in East Africa and southern Africa, found them to be largely inadequate (Haan, 2002). Most offered old skills not based on labour market analysis, and were still focusing on the needs for wage-employment, while requirements for self-employment such as basic management skills were only slowly being introduced. The review recommended more attention to basic management skills and further exploration of apprenticeships. A study of Kenyan artisans indicated that entrepreneurial skills training had a positive effect on their business performance (Berengu, 2012).

Apprenticeship has been receiving increasing attention as a means of improving development skills. In Europe apprenticeships evolved from traditional forms in which trainees received training in crafts from master artisans, who also provided food and lodging in exchange for cheap labour (Ehmer, 2001), towards the structured and externally-regulated forms that now dominate in advanced economies (Wolter and Ryan, 2011). In North, West and Central Africa, traditional apprenticeship systems, in which parents pay skilled artisans a small fee to have their children trained, are well-developed (Middleton, 1991). These fees have increased over the years, especially in the modern trades (Haan and Serriere, 2002). This system meets a large part of training needs in the informal sector of many countries, at no cost to the government (Middleton, 1991). Apprenticeships are much cheaper than formal training (Haan and Serriere, 2002), so many donors find enterprise-based apprenticeship training preferable to training in institutions (World Bank, 1991). A study in Zimbabwe comparing different ways of training engineering artisans found

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