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African Firms : Learning and Productivity Improvement

Among the most pressing questions facing manufacturing firms in Sub-Saharan Africa is how to raise productivity. Market liberalization and the move away from inward-looking trade policies has forced African firms to compete head-on with stronger, more experienced rivals both at home and abroad. In order for them to survive and take advantage of the new opportunities created by economic reforms, African firms must find ways to raise their technical capabilities.

The study, *Training, Technology and Firm Efficiency in Sub-Saharan Africa* examines private "learning" mechanisms by which firms build up technical capability and improve productivity. The paper then attempts to measure the impact of these learning investments on enterprise productivity. Survey data from five African countries: Ghana, Kenya, Zimbabwe, Tanzania and Zambia are used in the study. The data come from firm level surveys conducted in the mid-1990s by the World Bank's Regional Program on Enterprise Development - more than 1,000 firms of all sizes were surveyed across four manufacturing sub-sectors. In the interviews, managers were asked about worker training and technology investments. This information was augmented by a random sample of workers in the firms from each employment category. Workers were questioned about their training experience, work histories, and compensation.

Acquisition of Technology

The study reviews three ways in which firms generally acquire new technology: R&D, foreign license agreements, and technical assistance contracts. In terms of R&D, since in the early stages of development most new technology is imported from more advanced countries, one would not expect to find much innovation-oriented R&D taking place in Africa. However, one might expect to observe technical efforts to modify imported equipment to fit the local environment and efforts to copy foreign machinery or products. Indeed the surveys found a great deal of these activities taking place. However, only a very few firms, almost all quite large, conduct any formalized R&D in the sense that there is a fixed budget for it, or in the sense that it comprises the main duty of specified personnel. Firms in Zimbabwe, the most industrialized country in the group, conducted the most R&D. But, with less than 20 percent of firms in the Zimbabwe sample conducting any formal R&D, overall R&D effort is well below the level found in most industrial countries. In addition, most of the R&D observed is in the form of adapting foreign equipment for local needs; little is directed toward developing new indigenous technologies.

Foreign license agreements and technical assistance contracts are more in evidence. But, while these learning mechanisms are more important in Africa than R&D, they are still not widespread and less than 15 percent of firms in the sample invested in either of these learning mechanisms. License agreements and technical assistance contracts are also mostly restricted to large firms who can afford them. Also, the majority of firms with license agreements or technical assistance contracts have some foreign ownership

or are foreign joint ventures. In short, it would appear that formal efforts to acquire new technology from abroad is restricted to large firms with relatively complicated technologies and foreign connections.

Training

The survey results demonstrate, as might be expected, that the vast majority of training done by African firms is informal on-the-job instruction. The incidence of formal training (internal or external classroom instruction with professional or experienced specialized training materials) across the countries is low. Very few firms have internal training programs or have a training specialist on staff. With the exception of Zimbabwe, where 13 percent of firms have personnel designated as internal trainers, less than 5 percent of firms in the cross-country sample provide any formal in-house training with their own resources. A few more firms (about 10 percent of the sample) provide in-house training using external trainers, such as equipment suppliers, buyers or business partners. Again Zimbabwe is an outlier, and about 25 percent of firms provided training using external resources. Generally, most formal training done by African firms is conducted externally by sending workers to technical institutions, universities, or industry associations.

There is a great deal of variation across different types of African firms in the incidence of training, as in all countries around the world. In all five countries it is the larger firms that provide the most training. Firms that export, or have foreign ownership, or use complicated production processes also provide more training. The cross-country variation in the incidence of training is likely due to this variance in incidence across different categories of firms. For example, Zimbabwe's higher incidence of training is most likely the result of its higher level of industrial development and larger average firm size (more on this below).

External training by firms is more prevalent than in-house training in all countries, except for Ghana. Presumably, the high cost of formal in-house training induces firms to seek out external alternatives. The extent of external training also appears to depend significantly on the availability of local institutions providing industry-specific courses. For example, Zimbabwe's more extensive array of technical schools and privately-provided training courses make available more training alternatives external to the firm than do institutions in other countries and the relatively low level of external training in Ghanaian firms reflects the relatively low number of public and private external training resources available to firms in that country.

The survey data also reveal that, just as in industrial countries, firm training in African enterprises firms is provided to mostly skilled personnel. Administrative and clerical staff, skilled production workers, and technicians received the most training in each country. But, while it is indicated that African firms are expending resources to train workers, the surveys also show that they are spending far less than firms in industrial countries. Zimbabwe, for example, has the highest proportion of workers receiving firm training out of the five countries in the sample. Yet at 16.5 percent, it is less than half the level found in most industrial countries.

Training, Technology and Productivity

The final section of the paper reports the results of econometric tests that look at the probability of training once different factors are accounted for, as well as the effects of training and investment in technology on firm productivity.

Multivariate analysis confirms some of the basic patterns discussed above. It is clear that the primary determinant of training is firm size as measured by the number of workers. In this analysis a 1 percent increase in size leads to a 0.05 percent increase in the probability of a firm engaging in internal training and a 0.11 percent increase in the probability of external training. The results of the regression confirm that an increase in the proportion of skilled workers in a firm will also increase the probability of it conducting training. Expectations that countries where manufacturing is more important do more training are supported as well. Thus, firms in Zimbabwe have a higher probability of conducting training than those in any other country. However, once firm size and other factors are accounted for, there is a weak

and insignificant correlation between training and foreign ownership and between training and whether or not a firm exports.

Up to this point it has been taken as given that training exerts a positive influence on productivity. The paper investigates this issue more carefully by examining the effects of training on value added. The study uses a log-linear specification of a Cobb Douglas production function where the coefficient on training may be interpreted as the increase in Total Factor Productivity (TFP) that is associated with firm training. The results show that training has a substantial effect upon TFP and that increased training results in much higher levels of productivity. The results also reveal that internal training has a much larger effect than external training. This makes sense if firms provide internal training that develops firm-specific skills and increase productivity of the firm. In contrast, external training may involve the creation of general skills that firms are reluctant to invest in because it will result in workers being lured away by other firms. The regression results also clearly show that acquiring technology by obtaining foreign licenses or technical assistance contracts significantly raises firm productivity.

Summary

Overall, the study finds that private learning mechanisms in African countries are far less developed than they are in other parts of the world. Very few manufacturing firms in Africa engage in the most common ways to acquire new technology; only a small fraction of firms conduct R&D, hold foreign licenses or have technical assistance contracts. Most firms in Africa are attempting to upgrade the technical capabilities of their work force and are expending resources on training. However, the majority of training is conducted informally, on the job and few firms have formal training programs. Though the incidence of training is much lower than that found in other parts of the world, the patterns are relatively similar; large firms conduct more training than small firms and most training goes to skilled workers and managers.

The value of training for increasing firm productivity has been clearly demonstrated. The only question that remains is why, given its benefits, African firms engage in so little training? In countries with little public training infrastructure and a high proportion of small firms, the cost appears to be too great. In other countries, the main reasons seem to be the lack of need for training because skilled workers are readily available or because firms use a mature technology that requires little training. This paper shows that given the importance of private learning mechanisms any attempts to spur growth and increase productivity in Africa will have to address ways to strengthen them.

*This article was written by Tyler Biggs, Senior Economist, Africa Region. **Training, Technology and Firm Efficiency in Sub-Saharan Africa** is a study in the cross-country studies series. To request a copy of the paper and for other information concerning the RPED please contact Ms. Melanie Mbuyi, RPED Program Officer, Regional Program on Enterprise Development, Africa Region, the World Bank, 1818 H Street, Washington, D.C. 20433. Ph: 202-473-9574. Fx: 202-477-2978. E-mail: mmbuyi@worldbank.org*

***ABOUT THE REGIONAL PROGRAM ON ENTERPRISE DEVELOPMENT (RPED)**

A major activity of the Africa Region is the Regional Program on Enterprise Development, a research program designed to investigate supply-side constraints that inhibit the growth of exiting firms and impede the entry of new ones. RPED offers suggestions for operational policies and support services to address these constraints.

The RPED is engaged in three levels of activities. The first is to collect survey data from a panel of large and small manufacturing firms in any given country. To date, RPED has collected data in Burundi,

Cameroon, Côte d'Ivoire, Ghana, Kenya, Mozambique, Tanzania, Zambia and Zimbabwe. These interviews focus on four manufacturing sectors: textiles and garments, food processing, wood working and metal working. Discussions with entrepreneurs seek general information on the firm and on issues relating to technology, labor, financial markets, conflict resolution, infrastructure, regulation and the use of business support services. The second component of the program is a series of case studies on selected aspects of the research agenda: finance, business strategy and technological capability. These case studies are selected from a stratified sub-sample of the panel firms and are conducted to complement quantitative information gathered in the broader survey exercise. Finally, the third component of RPED involves numerous cross-country studies of issues related to firm dynamics over time.