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HOW CAN MICRO AND SMALL ENTERPRISES IN SUB-SAHARAN AFRICA BECOME MORE PRODUCTIVE? THE IMPACTS OF EXPERIMENTAL BASIC MANAGERIAL TRAINING

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Abstract

The vast majority of micro and small enterprises (MSEs) in developing countries are located in industrial clusters, and the majority of such clusters have yet to see their growth take off. The performance of MSE clusters is especially low in Sub-Saharan Africa. While existing studies often attribute the poor performance to factors outside firms, problems within firms are seldom scrutinized. Entrepreneurs in these clusters are unfamiliar with standard business practices. Based on a randomized experiment in Ghana, this study demonstrates that basic-level management training improves business practices and performance, even though the extent of improvement varies considerably among entrepreneurs.

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How Can Micro and Small Enterprises in Sub-Saharan Africa Become More Productive? The Impacts of Experimental Basic Managerial Training

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Abstract

The vast majority of micro and small enterprises (MSEs) in developing countries are located in industrial clusters, and the majority of such clusters have yet to see their growth take off. The performance of MSE clusters is especially low in Sub-Saharan Africa. While existing studies often attribute the poor performance to factors outside firms, problems within firms are seldom scrutinized. Entrepreneurs in these clusters are unfamiliar with standard business practices. Based on a randomized experiment in Ghana, this study demonstrates that basic-level management training improves business practices and performance, even though the extent of improvement varies considerably among entrepreneurs.

Keywords: Africa, Ghana, industrial development, survival clusters, management training, randomized experiment

JEL classification: M31, M41, O14, C93

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1. Introduction

Micro and small enterprises (MSEs) are widely recognized as a major source of employment and income in developing countries. If they grow in size, they would contribute more to economic growth and poverty reduction. In reality, however, their productivity remains low and their sizes remain small (e.g., Mead and Liedholm, 1998, Tybout, 2000). While their low performances may be attributed to the unfavorable circumstances surrounding them, recent empirical studies have identified problems within firms, especially problems regarding management (e.g., Bloom et al., 2010; Bruhn, Karlan, and Schoar, 2010).

Management has been increasingly recognized as a major determinant of productivity in the recent economics literature (e.g., Syverson, 2010). Bloom and Van Reenen (2007, 2010) collected data on management practices from a number of medium-sized firms in developed and fast-growing countries to establish a close association between management and productivity. Using unique data, Ichinowski, Shaw, and Prennushi (1997), Lazear (2000), and Bertrand and Schoar (2003), among others, show that human resource management and top executives' management style are important determinants of productivity in the U.S.

To establish causality more directly, Karlan and Valdivia (2011), Drexler, Fischer, and Schoar (2010), and Bruhn, Karlan, and Schoar (2010) have carried out randomized control trials in which management training or a consulting service is provided for MSEs in their study sites in Latin America. The most clear-cut result of these experiments is that rudimentary, as opposed to standard, management training improves business practices. This indicates that many MSE entrepreneurs in developing countries know little about management. A somewhat discouraging result of the experiments, however,

is that the impacts of the management training and consulting on sales and profits are economically large but are statistically weak.

This paper attempts to extend this line of research by using experimental data gathered before and after a management training program offered to MSEs in Africa. In our view, MSE entrepreneurs' lack of management knowledge has a great deal to do with their location choices. Although the existing studies do not specify where their subjects are located, we suspect that they are located in industrial clusters because the vast majority of MSEs in developing countries are located in industrial clusters, that is, the geographic concentration of a number of firms producing similar and related products. Industrial clusters are spontaneously formed in a wide range of countries and sectors because of the benefits of localization economies (Nadvi and Schmitz, 1994). As documented in recent case studies, localization economies in clusters allow new entrants with little managerial and financial capital to start businesses (e.g., Schmitz and Nadvi, 1999; Ruan and Zhang, 2009; Sonobe and Otsuka, 2006, 2010). Moreover, like human capital, managerial capital may well be underinvested in due to failures in markets for knowledge and finance. Thus, it is not surprising that MSE entrepreneurs lack the basic knowledge and skills of management. Nonetheless, it is likely that many of them are now willing to learn about management because the profitability of their businesses have been declining due to intensified competition with an increasing number of new entrants producing similar products and the massive import of cheap products from newly industrialized economies.

This study provides an elementary management training program for MSE entrepreneurs in an industrial cluster. It examines whether they are willing to learn about management and to what extent the training improves the performance of their businesses. We find that the vast majority of the entrepreneurs invited to the training program attended

the training sessions in earnest, and many adopted the management practices taught in the program. As with the existing studies, however, we find that the estimated average effects of the training on the sales and profits of the participants are economically large but statistically insignificant. In the experiment carried out by Bruhn, Karlan, and Schoar (2010), the provision of consulting services to MSEs was expected to improve the clients' business performance, but statistically, the effects were only marginally significant. The authors attribute this result to noisy data and the relatively small sample size. In our experiment, the cause of the statistically weak effect of the training on the participants' business results seems to lie in the heterogeneity among them. The training increased the percentage of participants adopting the recommended practices from near zero to 50 percent, but the rest of the participants did not even attempt to adopt the practices. Moreover, there is a sub-sample in which the estimated effects are highly significant, and even within this sub-sample, the training effect is highly heterogeneous. Thus, some participants benefit greatly from the training, while others do not.

The next section reviews the studies of industrial clusters in developing countries and clarifies the questions to be addressed in this paper. Section 3 describes the sampling scheme and the training design, and Section 4 presents the basic statistics. After specifying the regression models, Section 5 reports the estimation results and discusses the directions of possible estimation biases due to attrition, spillovers, market stealing, and psychological effects. Finally, Section 6 discusses the implications for future research.

2. Location and management of MSEs

Casual observations suggest that the vast majority of MSEs in developing countries are located in industrial clusters including small clusters of furniture makers along

roadsides, garment markets in which tailors are producing and selling clothes, and the like. The benefits of localization economies, which attract MSEs to industrial clusters, include favorable access to market information, low transaction costs due to easy monitoring and the effective functioning of the reputation mechanism among firms located near each other, and the resulting development of the division of labor among manufacturers and between manufacturers and traders (Sonobe and Otsuka, 2006).

Case studies of industrial clusters in Asia, Latin America, and Africa suggest that clusters in different industries in different countries follow the same development path until they reach a certain phase and then the path bifurcates, as illustrated in Figure 1 (e.g., Schmitz and Nadvi, 1999; Sonobe and Otsuka, 2006, 2010). An industry is born in a developing country when a cheap imitated substitute of an imported product wins popularity in a local market. An industrial cluster is formed as an increasing number of new firms begin producing imitated products near the pioneer's location. As new firms enter the cluster, the division of labor is developed in the cluster, each specializing in a narrow segment of a value chain, with only a narrow range of skills and a small initial investment in fixed and working capital (Ruan and Zhang, 2009).

Thus, a cluster attracts a swarm of new entrants, and the increased scale of the cluster reinforces localization economies. Sonobe and Otsuka (2006, 2010) refer to this phase of industrial development as the quantity expansion phase since the expansion of the cluster is based on the new entry of imitators without qualitative improvement in products or production processes. In this phase, owners do not keep records of transactions or inventory (e.g., de Mel, McKenzie, and Woodruff, 2009), and they fail to separate financing for their businesses with that of their own households. Even casual observers notice that in their disorganized workshops, owners and workers waste time looking for

necessary tools and materials on a daily basis. These owners are not managers in the real sense of the term. Still, they are able to maintain their small businesses. Because every transaction and activity takes place in full view of the owners, small businesses are easy to operate.

The increase in the supply of homogeneous low-quality products due to the proliferation of imitative firms will sooner or later saturate the local market. The product price and profitability will eventually decline, as illustrated by curves *AB* and *CD* in Figure 1. Declining profitability induces entrepreneurs to attempt product quality improvements. According to case studies, successful quality improvement involves the establishment of brand names, the development of new marketing channels and the introduction of a standard management system with stricter control of product quality and work effort, and the establishment of trust-based long-term subcontracting relationships with parts-suppliers (Sonobe and Otsuka, 2006). For such multifaceted improvements, it is important to gain knowledge about technology and management from outside the cluster and to take advantage of the pool of human resources within the cluster, such as traders, engineers, and parts-suppliers. With the progression of quality improvement, successful firms become larger and the total number of firms decreases through exits and mergers of inefficient firms, as illustrated by curves *BE* and *DF*.

If a cluster fails in quality improvement, however, profitability will continue to decline until new entry ceases, as illustrated by the two broken lines in Figure 1. Firms will continue to produce the same low-quality product, and their ways of running businesses will remain far from systematic and efficient. When local economies were closed to international trade, firms could survive without difficulty. In the era of globalization, however, they face competition with foreign producers who improve

products or reduce costs incessantly. The literature on industrial clusters report several cases in which negative external shocks turned out to be blessings in disguise in the sense that they triggered multifaceted improvements within clusters.[1] In many other clusters, however, negative external shocks have worsened the downward trend in profitability, and firms are struggling to survive (e.g., Altenburg and Meyer-Stamer, 1999; Kennedy, 1999; McCormick, 1999; Akoten and Otsuka, 2007).

Thus, a cluster may either enter the quality improvement phase or stay as a survival cluster. A major hypothesis is that among the important determinants of a cluster's fate is the management knowledge of the entrepreneurs in the cluster. This study examines to what extent basic management training can improve the business practices and business results of firms in a survival cluster. The evaluation of the full effect of the training will require several rounds of follow-up surveys. At this stage of research where we have completed only the first post-training survey, we can only analyze the short-run effects.

According to the literature on technology diffusion, the same technology is adopted by different adopters several years apart, and a major explanation for such a phenomenon is that different adopters put different values on the new technology (e.g., Hall and Khan 2003). Likewise, management training participants will be heterogeneous in both incentive and in the ability to put the knowledge they learn from the training into practice. Moreover, their business results will be subject to idiosyncratic shocks. Thus, we expect that the effect of the training on business results will vary considerably among the participants.

If management training proves to be useful for at least some participants, a question arises as to whether the benefit is large enough to justify the cost of the training. For this reason, we focus on the short-run private benefit because the benefits and losses for non-

participants, neighbors, and consumers (i.e., social welfare) are practically impossible to capture in the data. In short, this paper examines the effects of a managerial training program on participating entrepreneurs' business practices and performance and compares the cost and private benefit of such a program.

3. Surveys and training program

Our study site is Suame Magazine, located in Kumasi, the second largest city in Ghana. Kumasi is a junction of the artery roads connecting the major coastal cities and the major inland cities including Ouagadougou, the capital city of Burkina Faso.[2] Suame Magazine is known in West Africa as a large cluster of garage mechanics, but it is also a cluster of metalwork enterprises producing a variety of metal products, such as bolts and nuts, corn mill machines, threshing machines, and cash safes.[3] The garage cluster has had a long period of quantitative expansion because the demand for car repair services has increased dramatically. As the garage cluster expanded, scrap metal became increasingly available, helping the expansion of the metalwork cluster.

We conducted a survey of metalwork entrepreneurs in early 2005. In those days, most masters, whether garage mechanics or metalwork entrepreneurs, were members of the Suame branch of the Ghana National Association of Garages (GNAG). As shown in Table 1, the number of members in 2003 exceeded 10,000, of which more than 1,000 were metalwork entrepreneurs. The number of metalwork entrepreneurs does not seem to have increased since then. As will be shown in Table 3 below, the profitability in this cluster began decreasing clearly in the early 2000s. The metalwork cluster in Suame Magazine was a typical survival cluster except for the extraordinarily large size of the annexed garage cluster. For the survey, we selected 167 metalwork entrepreneurs

randomly from the GNAG member list. Their data on educational and occupational backgrounds, production and costs, marketing channels, and investments were gathered by visiting each of them (Iddrisu, 2007).

The training program was implemented for three weeks from the middle of November, 2007.[4] The program consisted of three modules of classroom training: Module 1 on entrepreneurship, business planning, and marketing; Module 2 on production management and quality management; and Module 3 on record keeping and costing.[5] Each module lasted for five weekdays, 2.5 hours per day. The venue was the Suame Branch of the National Vocational Training Institute (NVTI) in the cluster, so that busy entrepreneurs could attend the class after work.

The instructors were three Ghanaian consultants with extensive experience. They were selected through an international competitive tender, based both on the cost and quality of their submitted proposal, following the World Bank's procurement guidelines.[6] They spoke the local language, Twi, and thus communicated smoothly with the participants. Modules 1 and 3 were based on the textbooks of the improve-your-business (IYB) and start-your-business (SYB) training program developed by the International Labor Organization (ILO). IYB and SYB are implemented as standard business training modules in many developing countries. Our instructors emphasized the importance of identifying good customers, separating business and household finances, keeping records, and other very basic practices. The training hours were allocated almost evenly to the instructors' lectures and to group work and debates.

The contents of Module 2 are not as standard as those of Modules 1 and 3, but they are as easy to understand. This module begins with an explanation of the concepts of productivity and quality, which is followed by discussions regarding the difference

between value adding and non-value adding activities, and the workplace housekeeping method called 5S.[7] The instructor also discusses an inexpensive approach to improving productivity and quality called KAIZEN.

Before selecting the entrepreneurs to invite to the training program, we were advised by an expert that the number of participants should be 60 or less. Since we had already committed ourselves to inviting seven entrepreneurs who had assisted in our study, we selected 53 other entrepreneurs randomly from the sample of the baseline survey. The seven pre-selected participants are excluded from the analysis below.

When we invited the selected entrepreneurs to the training program, we explained that the program was not related to any financial assistance to them. Nonetheless, many of the participants expected to receive low-interest credits, according to our informants. They were disappointed to learn that such credits would not be extended to them, but they continued to attend class and became increasingly enthusiastic about learning toward the end of the program.[8]

The training program costs about 40,000 US dollars, which includes the hiring cost of the instructors, the cost of teaching material production, the cost of the instructors' travel and hotel expenses, and the cost of renting the venue. The cost of selecting the instructors and the researchers' travel cost are not included in this amount. The venue cost was very low because we were able to use the NVTI classroom for an insignificant amount. If the total cost is divided by the number of the participants including the pre-selected participants, the training cost per person will be just 741 US dollars for the 15 days. If we had to rent a function room at a hotel, the cost could have been about 1,100 US dollars per person.

A follow-up survey was conducted in November 2008, i.e., about a year after the training sessions were completed. We attempted to visit the 167 enterprises in the sample of the baseline survey and obtained data of 139 enterprises. The attrition of 28 sample entrepreneurs occurred due to a variety of causes. One entrepreneur refused to cooperate with our survey, 13 enterprises had closed down. and the remaining 14 attritors were missing for unknown reasons.[9] These 28 attritors had not been invited to the training program. That is, no attrition occurred in the treatment group. We will discuss possible estimation bias due to the attrition in Section 5.

Although our original sample included foundry men casting metal, we do not include them in the sample used in the analysis below because the foundry business is distinct and because they received technical training from an aid agency in the same year. We also exclude from the sample several entrepreneurs who were ejected, after the training, from a prime location which they had occupied without permission. As mentioned earlier, the seven pre-selected participants are also excluded from the sample. The attrition and these adjustments reduced the sample size to 113.

4. Basic statistics

As shown in Table 2, the treatment group consists of 47 entrepreneurs and the control group consists of 66 entrepreneurs. By the treatment group, we mean those entrepreneurs invited to attend the training program. In the treatment group, there are six refusers, who did not attend the training at all or only attended the first two days. The remaining members in the treatment group are called participants. The participants attended 14.1 days on average, and the majority recorded perfect attendance. The high

rates of participation and attendance are consistent with our hypothesis that entrepreneurs in survival clusters are willing to learn management practices.

The treatment group and the control group share similar background attributes. A typical entrepreneur is male, about 45 years old, from the Ashanti region, where the cluster is located, went to school for a little more than 10 years, learned the skill of the trade as an apprentice from a master of either fabrication or machining for three to four years, and has been operating his own business for nearly 14 years. Fabricators are basically welders whereas machinists are basically lathe turners. Many workshops have both fabricators and machinists because their activities are complementary. We classify the entrepreneurs into these two types—fabricators and machinists—based on the original line of work that they were engaged in when they started their businesses.

Table 2 shows that the refusers tended to be older than the participants. Older entrepreneurs may have had higher time costs or lower expected benefits from the training than younger entrepreneurs. Another characteristic of the refusers is that none of them are from outside the Ashanti region. Local inhabitants would have greater involvement in extended family functions, community functions, and sideline businesses than those from other regions. If this was the case, their opportunity costs would be higher.

Table 3 reports the data on the adoption of recommended practices and three indicators of business performance. The data on the situations in 2000 and 2002 are recall data collected in 2004. The left side of the table shows the percentages of the entrepreneurs who visit customers periodically, kept records, and routinely analyzed the records in the specified year. Visiting customers is not a common activity in this cluster, and the majority of the sample firms do not keep records. Even if records are kept, they are seldom reviewed or analyzed. The data on the adoption of production management

practices are not shown in the table because we could not obtain useful data. This is because few non-participants understood our questions about production management.

After the training, the percentage of firms in the control group keeping records increased by only 6 percentage points whereas the increase was 36 points in the treatment group. Similarly, the adoption rates of the other two practices (i.e., keeping and analyzing records) increased much more in the treatment group than in the control group. These results indicate that the training had strong impacts on the adoption of the recommended practices. Another noteworthy point is that well over one third of the treatment group firms did not adopt the recommended practices. The variance of each adoption variable within the treatment group increased after the training because the variance of the dummy variable increases as the mean approaches 0.5.

The right side of Table 3 reports the data on annual sales revenue, value added, and gross profit by treatment status. Gross profit here is defined as sales revenue minus material cost and labor cost. Because the majority of firms did not keep records, we estimated these financial variables by asking each entrepreneur about the number of pieces sold and their prices by product type, material inputs and material prices, payments to subcontractors, and payments to workers and apprentices. We checked that the estimate of gross profit was consistent with the entrepreneur's earnings, investment, living expenses, purchase of durable goods, and so on.[10] Written records, whenever available, were used deliberately, taking into account that each entrepreneur might have his own unique concept of costs and that his calculation might be incorrect.

The trend of declining profitability is visible in Table 3. Some respondents said definitely that this trend was set by the proliferation of competitors within the cluster, and that it was being worsened by massive imports of similar products from Asia and

increasing competition with similar clusters in the country. Decreases in sales, and gross profits after the training were somewhat smaller for the treatment group than for the control group. These differences in the mean values are small but suggest that the training had favorable effects.

The training seems to have impacts on equipment investment as well. Note that this table shows investment amounts in GHS, whereas Table 3 shows the sales, value added, and gross profit in 1,000 GHS. The median investment amount in each year is zero, i.e., the majority in each year undertakes no equipment investment. Although the average of the investments by the fabricator control group is relatively high in 2008, the magnitude is not impressive for equipment investment even by the standard in the cluster. Sizable investments were undertaken by three machinist participants, who purchased machine tools, and by a fabricator participant, who relocated his workshop to a better conditioned site outside the cluster and installed new machines. As a result of the investment in machine tools, the difference in investment between the treatment and control groups of machinists became significant at the 5 percent level after the training, as shown in Table 4. The fabricator's relocation is not reflected in the data because it took place a few months after the follow-up survey.

Table 5 shows data on the practice adoption and financial outcomes in 2008 by treatment status and the initial line of business. As the left side of the table shows, the fabricators and the machinists share similar patterns of practice adoption after the training. That is, the adoption rate is higher for the treatment group than for the control group. As shown on the right side, the machinists have larger sales, value added, and gross profit than the fabricators, reflecting the fact that every machinist owns at least one machine tool, which is much more expensive than fabricators' welding machines. More importantly,

the treatment group of both fabricators and machinists recorded greater means of sales, value added, and gross profit than the control group, suggesting that the training had positive impacts.

5. Estimation

5-1 *Specification*

The average effect of the training on the training participants' outcome Y, which can be the adoption of a management practice or a financial variable, may be given by $E(Y_{1i}|D_i = 1) - E(Y_{0i}|D_i = 1)$ or $E(Y_{1i} - Y_{0i}|D_i = 1)$, where Y_{1i} is the outcome that entrepreneur i will have if he participate in the training, Y_{0i} is the outcome that he will have if he does not receive the training, and D_i is a dummy variable that is equal to 1 for participants and 0 for non-participants. By definition, $E(Y_{0i}|D_i = 1)$ is hypothetical and unobservable, but it may be replaced by $E(Y_{0i}|D_i = 0)$, which is observable, if the participants are randomly selected. Note, however, that although invitation was randomized, participation was not, and that the invited participants decided themselves whether to participate.

To cope with self-selection biases and take advantage of the randomization in invitation, we resort to the framework of the local average treatment effect (LATE). In this framework, a key role is played by the dummy variable Z_i that is 1 if entrepreneur i was invited to the training and 0 otherwise. Obviously, D and Z are closely associated because only the invited entrepreneurs could participate in the training. Let D_{1i} and D_{0i} be the values of D_i when $Z_i = 1$ and when $Z_i = 0$, respectively. LATE is the average treatment effect on those whose treatment status is affected by random assignment (i.e., invitation in our case) and defined by

$$\text{LATE} = E[Y_{1i} - Y_{0i} \,|D_{1i} \neq D_{0i}]. \quad (1)$$

Imbens and Angrist (1994) show that if Y_{1i}, Y_{0i}, D_{1i}, and D_{0i}, are independent of Z_i and if $D_{1i} \geq D_{0i}$, for all i (monotonicity),

$$\text{LATE} = Cov(Y_i, Z_i) \,/\, Cov(D_i, Z_i). \quad (2)$$

Since all the participants in our program were invited, D_{0i} is 0 and D_{1i} is either 0 or 1. Those invited entrepreneurs with $D_{1i} = 0$ are refusers and those with $D_{1i} = 1$ are participants. Thus, $D_{1i} \neq D_{0i}$ in equation (1) means that entrepreneur i will participate in the training if invited, and LATE in our case is equivalent to $E[Y_{1i} - Y_{0i}|D_i = 1]$, i.e., the average training effect on the participants. It is easy to show that the monotonicity condition is satisfied in our case. Equation (2) implies that LATE can be estimated as coefficient β in a regression model, $Y_i = \alpha + \beta D_i + \varepsilon_i$, by using Z_i as an instrumental variable (IV). In our case, the sample size is small and, hence, it is advisable to use the pre-training data as well as entrepreneurs' attributes as follows:

$$Y_{it} = \alpha + \beta D_i T_t + X_{it}\gamma + \rho_i D_i + \lambda_t + u_i + \varepsilon_{it}\,, \quad (3)$$

where subscript t denotes year 2000, 2002, 2004, or 2008, T_t is a dummy variable which is equal to 1 if year t is after the training (i.e., t = 2008), X_{it} is a vector of the entrepreneur's background attributes (which are mostly time invariant), λ_t is a year effect, u_i is an unobserved individual effect, and ε_{it} is an error term. The average training effect on the participants, β, is estimated by using Z_i and $Z_i T_i$ as instruments.

The magnitude of the training effect may vary from participant to participant. Heterogeneous training effects may be captured by adding $W_{it}D_iT_t$ and $W_{it}D_i$ to equation

(3), where W_{it} is one of the variables in vector X_{it}, such as the education variables (years of schooling and a high education dummy), age, the apprenticeship experience dummy, and the Ashanti dummy. This attempt turned out to be most successful when W_{it} is the dummy variable M_i indicating whether entrepreneur i is a machinist or a fabricator. This variant of the model may be written

$$Y_{it} = \alpha + \beta_F(1 - M_i)D_iT_t + \beta_M M_iD_iT_t + X_{it}\gamma + \rho_F(1 - M_i)D_i + \rho_M M_iD_i + \lambda_t + u_i + \varepsilon_{it}, \quad (4)$$

where β_F is the average training effect on the fabricators who participated in the training, and β_M is that on the machinist participants.

5-2. *Estimation results*

The results of the estimation of equation (3) can be summarized briefly. The training had positive and significant effects on the participants' adoption of the recommended practices. The training effects on their sales, value added, or gross profit are positive and economically large but statistically insignificant.

In the estimation of equation (4), the first-stage dependent variables are $(1 - M_i)D_iT_t$, $M_iD_iT_t$, $(1 - M_i)D_i$, and M_iD_i. Since D_i and Z_i are closely correlated, the instruments, $(1 - M_i)Z_iT_t$, $M_iZ_iT_t$, $(1 - M_i)Z_i$, and M_iZ_i, have highly significant coefficients, where the regression model is specified as a fixed-effects model or a random-effects model. Consistent with Table 2, the age variable and the Ashanti dummy variable have negative and significant coefficients in the regressions of $(1 - M_i)D_i$ and M_iD_i, when the model is specified as the random-effects model. No other variables have significant coefficients in the first-stage regressions.

The results of the second-stage regressions are reported in Table 6. *Panel A* presents the full results of the random-effects model estimation. *Panel B* reports only the estimates of β because the fixed- and random-effects models share very similar estimates.[11] In the first three columns, the dependent variables are the dummies indicating whether the recommended practices were adopted. In the last three columns, the dependent variables are sales, value added, and gross profit, which are not logarithmic but in 1,000 USD units.

The estimated average effects of the training on the participants are shown in the first two rows. In the first three columns, they are positive and significant at the five or one percent level for both fabricators and machinists. The average training effect on record keeping is particularly strong among the fabricators, but it is significant also among the machinists. Note, however, that the training effect on participants' adoption of the practices is not homogeneous even within either the fabricator group or the machinist group. This is clear from Table 5 because one third to half of the participants in each group did not adopt the practices.

In the last three columns, the estimated average effects of the training are positive and significant at the five percent level for the fabricators, but they are not significant for the machinists. Training participation increased the gross profit of the fabricators by 15,000 USD on average, which is much more than 100 percent of their average gross profit. In the case of the machinists, the average effect is only 2,600 USD, or 10 percent of their average profit. The estimate of β_M has a standard error twice as large as the estimate of β_F. The low mean and the large variance of the estimated effect suggest that the training benefited only a few among the machinist participants. There are two possible explanations, even though they are not supported by compelling evidence at this

stage of research. First, according to our open-ended interviews with the sample entrepreneurs, the machinists in the study sites had hardships during the period from the training and the follow-up survey. For example, thread cutting dies, one of the most important tools for machinists, continued to be in extremely short supply during this period. It may well be that the training program did not provide solutions for the struggling machinists.

Second, the training effects on business results may be related to the training effect on record keeping practices, which is stronger for the fabricators than for the machinists, as shown in column (2). Drexler, Fischer, and Schoar (2010) find that a "simplified, rule-of-thumb" training of accounting has significant impacts on business results. The third module of our program involved exactly such basic training on record keeping. Before this training, the percentage of entrepreneurs who did not keep any records of transactions and inventory was 67.6 percent for the machinists and as high as 85.7 percent for the fabricators. Although it is not clear where this *ex ante* difference comes from, these results suggest that keeping records is often critical to improving business results of firms that have not kept any records.

Another noteworthy result is that the years of schooling have positive and significant effects on record keeping and business results. These results are consistent with the findings reported by Ramachandran and Shah (1999) from Kenya, Tanzania, Zambia, and Zimbabwe, Mengistae (2006) from Ethiopia, and Akoten and Otsuka (2007) from Kenya, as well as the findings of numerous case studies in Asia.

5-3. *Economic magnitudes of the estimates*

The average training effect on the participants' gross profit may be written $E(\pi_{1i}-$

$\pi_{0i}|D_i = 1$). It is the pecuniary private benefit of the training per participant in the first year following the training. The hypothetical gross profit π_{0i} can be regarded as the opportunity cost. As long as the training effects are felt in the years ahead, $E(\pi_{1i} - \pi_{0i}|D_i = 1)$ is only a part of the private benefit. In contrast, the training cost of 741 USD per participant is a one-time cost. As reported above, $E(\pi_{1i} - \pi_{0i}|D_i = 1)$ is estimated to be 2,600 USD for a machinist and 15,000 USD for a fabricator, which are more than three times and about 20 times the training cost per participant, respectively.

Another way to assess the economic magnitude of the training effect may be to compare it with the effect of education. Our estimate of the increase in annual gross profit due to an additional year of schooling is 1,600 USD. The management training amounts to 9.4 years of schooling in the case of the fabricators and 1.6 years of schooling in the case of the machinists, in terms of the impact on gross profit.

5-4. *Attrition bias*

Attrition is one of the sources of potential estimation bias. The attritors account for 17 percent of the original sample. About half of the attrititors closed their workshops and disappeared. If their low performance was taken into account, the training effect would be estimated more strongly because no one in the treatment group closed a workshop. The rest of the attritors were missing for unknown reasons. The direction of bias that the attritors of this type cause is open to question.

5-5. *Spillovers and market stealing*

In industrial clusters, knowledge spills over quickly. Information on delinquents and cheaters spreads rapidly. Before a cluster enters the quality improvement phase,

firms produce almost the same products and share the same production processes because of apprentice training and emulation. According to our respondents, the training participants talked to other entrepreneurs about their impressions of the program, the instructors, and the outline of the training contents. Knowledge spillovers would reduce the estimate of the training impacts as spillovers improve the business results of the control group, which in turn reduces $Cov(Y_i, Z_i)$ in equation (2).

As Bloom *et al*. (2007) point out, firms' productivity improvement can affect other firms' performance through market stealing as well as spillovers. The first module of our training program encouraged the participants to be proactive in getting new customers. A few participants told us that soon after the training, they began issuing invoices and receipts on which their mobile phone numbers were printed, and they believed that the invoices and receipts doubled their sales compared with the previous year. Their sales may have increased at the cost of other firms' sales. The market-stealing effect would overstate the training effects on the participants by worsening the business results of the control group.

Nonetheless, it seems improbable that the estimates of the training effects on the participants are strongly affected by spillovers and market stealing. Knowledge does not affect business results if it is not put into practice. As shown in Table 3, the control group's adoption rates in 2008 increased only a little in contrast to the significant increases among the treatment group in the same year. Furthermore, not all the adopters would successfully assimilate the practices that they adopted. Market stealing by a participant would worsen the business results of the other participants as well as the non-participants. To the extent that these negative effects canceled each other out, the estimation bias due to market stealing should be small. The effect of spillovers and market stealing on the gap

between the social and private benefits of the training seems weak for the same reasons.

5-5. *Psychological effects*

The increases in the control group's adoption rates in 2008 may also be attributed to a psychological effect. It is only human to show that one is doing well, even if this involves some pretense. In the follow-up survey, some entrepreneurs may have exaggerated how well their firms were doing. Moreover, the control group may have been loath to admit that they failed to benefit from the training program. It is not difficult to imagine that some of them exaggerated not just the adoption of the recommended practices but also their business results. The follow-up survey data on the participants may have a similar problem. The participants may have been tempted to please us by exaggerating their benefits from the training program. If both participants and non-participants exaggerated the adoption rates and business results, the net impact on the training effect estimates will be small.

6. Conclusion

As in the rest of the world, there are a number of industrial clusters in Sub-Saharan Africa, but unlike clusters in other regions, these clusters have not yet achieved successful industrial development. Their low performances have been attributed exclusively to factors outside firms, such as poor infrastructure and unfavorable governance. By contrast, problems within firms have seldom been scrutinized. Based on a randomized controlled experiment in Ghana, this study demonstrates that entrepreneurs in a survival cluster are unfamiliar with standard business practices. It also indicates that participation in a rudimentary management training program improves the business practices and results of the participants with considerably varying degrees of success. Although we

should be cautious about generalization, these results are highly consistent with the results of earlier studies in Latin America. It seems safe to conclude that entrepreneurs in developing countries can improve the productivity of their MSEs by learning management techniques.

In earlier studies, the estimated training effects were economically large but statistically insignificant or only marginally significant. Our results suggest that such weak estimates come from the heterogeneity of the participants, in our case, between the fabricator group and the machinist group and within each of these groups. Probably, entrepreneurs' managerial abilities are more difficult to improve than workers' skills. Unlike vocational training, a management training program may improve the managerial abilities of only a few participants. Nonetheless, it may be worth providing from the social welfare point of view. This is because the quality improvement phase of industrial development is led by a few innovative entrepreneurs, and their success contributes to the overall social welfare through external effects including imitation by many other entrepreneurs, as the literature on industrial clusters attests to.

The results of this paper warrant considerable further research. The longer-term training effects should be examined in future. Our conjecture is that only a small number of participants will continue to improve their business performance based on the knowledge acquired in the training. Another direction to explore is to provide advanced training. By providing elementary training, we have confirmed that entrepreneurs in the survival phase know little about management. Advanced training will allow us to explore what factors help industrial clusters enter the quality improvement phase successfully.

Notes

1. Examples include a surgical instrument cluster in Pakistan (Nadvi, 1999), a garment cluster in India (Tewari, 1999), and shoe clusters in Brazil (Schmitz, 1999), and Ethiopia (Sonobe *et al*., 2009).
2. This area used to be the site of an army depot called Magazine during the colonial times. The name Magazine has been adopted by similar engineering clusters in the northern part of Ghana, whereas those in the southern part are called Kokompes.
3. McCormick (1999) provides a bird's-eye view of this cluster.
4. The training program was funded by the Government of Japan through its Policy and Human Resource Development (PHRD) trust fund at the World Bank.
5. The program was modeled on the "Business Course" provided by the Japan International Cooperation Agency (JICA) in eight transition economies; Cambodia, Kazakhstan, Laos, Mongolia, Ukraine, Uzbekistan, Kyrgyzstan, Vietnam.
6. The lead consultant was a SYB master trainer. The instructor in charge of Module 2 had received training in metalwork in Japan and was familiar with KAIZEN.
7. 5S is named after the corresponding Japanese words whose Romanized forms begin with the letter s. They are translated as sorting, straightening (or setting in order), systematic cleaning (or shining), standardizing, and sustaining (or self-discipline).
8. Including the pre-selected participants, the majority of the participants recorded perfect attendance. At the end of the program, the participants evaluated the program as follows: 98 percent found the program very important to their business, 94 percent had learnt very much, and 96 percent were satisfied with the program.
9. About a year later, we found that some of these attritors operating their own businesses.
10. We usually began by asking about the price of each product and the output in a busy

month and in a slack month, together with a question about when the workshop was busiest. If the respondent was unsure, we changed tack and asked, for example, how many units of a product were produced from one unit of a material, and how often and how many units of the material were purchased in a busy month and a slack month.

11. The Hausman specification test does not reject the consistency of the random-effects model estimator for the regressions of keeping records, analyzing records, value added, and gross profit as shown at the bottom of the table in columns (ii), (iii), (v), and (vi), even though the test results were not obtained for the other two regressions.

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Table 1. Estimates of Enterprise Population in the Suame Magazine Cluster by Sector

	Garages	Metalworking enterprises	Others	Total
2000	4,958	807	2,204	7,969
2002	6,222	990	2,618	9,830
2003	7,847	1139	2,844	11,830

Notes. These estimates are taken from the database of the Suame branch of the Ghana National Association of Garages (GNAG). Estimates do not include ancillary trades such as restaurants and telecommunication shops. "Others" include truck body builders, pot makers, sign writers, and some types of welders.

Table 2. Characteristics of the sample entrepreneurs

	Treatment group			Control group
	Total	Participants	Refusers	
No. of entrepreneurs	47	41	6	66
Male (%)	100	100	100	100
Age (as of 2004)	45.4	44.2	53.6	44.8
From Ashanti (%)	78.7	75.6	100	86.4
Years of schooling	10.4	10.4	10.4	10.3
Apprentice training (%)	91.5	92.7	83.3	87.9
Years of operation (as of 2004)	13.4	12.2	21.6	14.2
Machinists (%)	55.3	56.1	50.0	68.2

Notes. Treatment group refers to the group of entrepreneurs who were invited to the training program.

Table 3. Percentages of firms adopting recommended practices and their business outcomes by treatment status, 2000 - 2008

	Treatment (1)	Control (2)		Treatment (3)	Control (4)
Visiting customers (%)			*Sales revenues* (1,000 GHS)		
2000	19.2	12.2	2000	83.9	93.0
2002	19.2	13.7	2002	72.1	66.5
2004	20.3	13.7	2004	60.5	50.0
2008	51.1	21.2	2008	47.6	30.4
Keeping business records (%)			*Value added* (1,000 GHS)		
2000	23.4	19.7	2000	53.9	67.3
2002	23.4	19.7	2002	42.0	46.9
2004	27.7	24.3	2004	37.2	32.3
2008	63.8	30.3	2008	30.7	31.1
Analyzing business records (%)			*Gross profit* (1,000 GHS)		
2000	14.9	12.1	2000	44.6	49.2
2002	14.9	15.2	2002	34.1	34.3
2004	21.3	15.2	2004	30.0	23.9
2008	55.3	18.2	2008	27.2	17.0

Table 4. Real equipment investment before and after the training program (GHS)

	Fabricators			Machinists		
	Treatment (1)	Control (2)	*p*-value (3)	Treatment (4)	Control (5)	*p*-value (6)
2006	154.8	40.5	0.276	197.3	487.2	0.386
2007	108.1	39.5	0.263	258.1	299.6	0.201
2008	135.5	217.6	0.621	905.0	174.4	0.047

Table 5. Comparison between fabricators and machinists, 2008

	Treatment (1)	Control (2)		Treatment (3)	Control (4)
Visiting customers (%)			*Sales revenues* (1,000 GHS)		
Fabricators	42.9	14.3	Fabricators	33.0	21.0
Machinists	57.7	24.4	Machinists	59.4	34.8
Keeping business records (%)			*Value added* (1,000 GHS)		
Fabricators	66.7	19.0	Fabricators	17.5	9.2
Machinists	61.5	35.6	Machinists	41.3	25.8
Analyzing business records (%)			*Gross profit* (1,000 GHS)		
Fabricators	52.4	14.3	Fabricators	15.2	6.6
Machinists	57.7	20.0	Machinists	36.8	21.8

Table 6. The IV estimates of the effect of the training program on the participants

	Visiting customers (i)	Record keeping (ii)	Record analysis (iii)	Sales revenue (iv)	Value added (v)	Gross profit (vi)
Panel A: RE-IV model						
Fabricator $\times D_i \times T_t$	0.222**	0.593***	0.481***	25.34**	18.05**	15.05**
Instrumented	(2.26)	(4.56)	(3.42)	(2.09)	(2.16)	(1.99)
Machinist $\times D_i \times T_t$	0.270**	0.183**	0.292***	-6.008	7.145	2.629
Instrumented	(2.40)	(2.29)	(3.32)	(-0.18)	(0.33)	(0.14)
Machinist	0.094	0.116	0.060	61.46**	51.21***	39.75***
	(1.13)	(1.34)	(1.18)	(3.22)	(3.57)	(4.19)
Age	-0.003	0.003	0.004	-0.531	-0.284	-0.181
	(-0.92)	(0.59)	(0.92)	(-0.88)	(-0.77)	(-0.69)
From Ashanti	-0.039	0.074	0.079	0.028	4.950	3.657
	(-0.44)	(0.77)	(0.86)	(0.00)	(0.54)	(0.37)
Years of schooling	0.008	0.037**	0.022	3.218**	2.041**	1.592**
	(0.81)	(1.96)	(1.10)	(2.15)	(2.18)	(2.15)
Apprentice training	0.066	-0.052	-0.112	19.49	6.190	3.234
	(0.50)	(-0.30)	(-0.75)	(1.38)	(0.46)	(0.27)
Years of operation	-0.002	-0.001	0.003	0.212	0.147	-0.014
	(-0.54)	(-0.30)	(0.89)	(0.47)	(0.43)	(-0.06)
Fabricator $\times D_i$	0.107	-0.045	-0.041	-13.25	-9.932	-5.931
Instrumented	(0.88)	(-0.39)	(-0.36)	(-1.08)	(-1.31)	(-0.81)
Machinist $\times D_i$	0.094	0.101	0.142	32.84	10.95	14.36
Instrumented	(0.81)	(0.86)	(1.12)	(0.92)	(0.59)	(1.13)
Year 2002	-1.47e-15	-1.95e-16	-4.91e-15	-4.001	-3.639*	-2.681
	(-0.26)	(-0.03)	(-0.68)	(-1.38)	(-1.65)	(-1.30)
Year 2004	-8.90e-16	0.024	0.024	-10.45**	-9.102***	-6.870***
	(-0.16)	(1.02)	(1.03)	(-2.94)	(-3.24)	(-3.36)

Year 2008	0.095*	0.056	0.056	-24.71**	-17.43**	-12.25**
	(1.73)	(1.39)	(1.18)	(-2.30)	(-2.17)	(2.03)
Machinist×Year 2002	0.024	0.023	0.010	-29.16***	-20.80***	-17.04**
	(1.23)	(1.23)	(0.55)	(-3.72)	(-3.70)	(-3.97)
Machinist ×Year 2004	0.031	-0.018	-0.007	-36.50***	-27.87***	-22.06***
	(1.57)	(-0.55)	(-0.27)	(-3.32)	(-4.00)	(-4.27)
Machinist ×Year 2008	0.003	0.018	-0.021	-48.71***	-36.75***	-26.48***
	(1.57)	(0.34)	(-0.39)	(-2.41)	(-2.59)	(-2.69)
Intercept	0.105	-0.327	-0.314	16.67	7.739	6.430
	(0.38)	(-0.86)	(-0.95)	(0.35)	(0.32)	(0.31)
Panel B: FE-IV model						
Fabricator $\times D_i \times T_t$	0.222**	0.593***	0.482***	25.34*	18.05**	15.05**
Instrumented	(2.01)	(4.49)	(4.68)	(1.76)	(2.16)	(1.99)
Machinist $\times D_i \times T_t$	0.268***	0.182**	0.290***	-7.054	6.42	1.974
Instrumented	(2.93)	(2.43)	(3.21)	(-0.25)	(0.30)	(0.10)
Hausman test chi 2	†	5.69	1.12	†	0.42	0.35
p-value		0.682	0.997		1.000	1.000

Notes.

The number of observations is 429. Numbers in parentheses are *t*-statistics based on robust standard errors. *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively. † indicates that model fitted on the data fails to meet the asymptotic assumptions of the Hausman specification test.

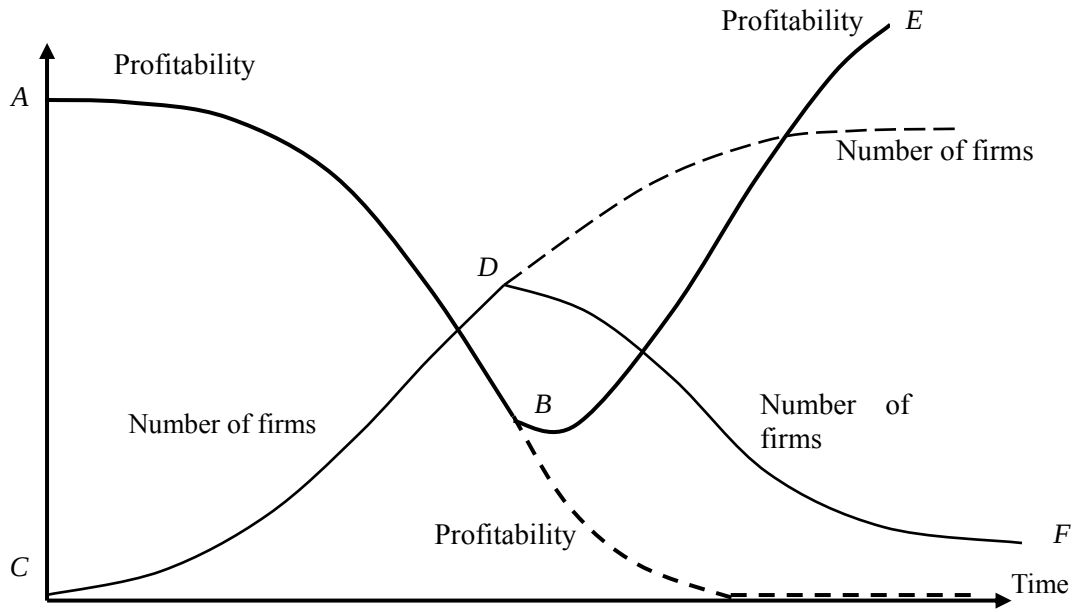

Figure 1. Path of cluster-based industrial development