



DRUID society

Paper to be presented at DRUID18
Copenhagen Business School, Copenhagen, Denmark
June 11-13, 2018

Impact of Entrepreneurship Training Programs: Evidence from Micro Firms in
Sub-Saharan Africa

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manufacturing sector to extend measurement indicators from standard measures such as profits to more simple and reliable indicators such as tools. We show that our entrepreneurship training program based on Kaizen as an organizational innovation causes a substantial increase in investment into tools. We further show that the trained entrepreneurs invest substantially more into electric tools. We argue that this is important because it allows for stronger productivity

increases in the manufacturing process which reflects exactly the trainings' goal. We further show that an important underlying channel is less spending on consumer or non-business related goods. This suggests that reallocation of resources from household to business is an important strategy to enhance performance. By focusing on micro firms, this paper adds to the nascent but growing literature on entrepreneurship in Africa.

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1 Introduction

Micro firms are the predominant organizational form in Africa. Most of these firms can be categorized as being informal, thus constituting a large informal economy, which occurs outside the formal, but within the informal institutional boundaries. These firms account for the lion's share of employment in the developing world, around 80 percent, but their contribution to the gross domestic product is as little as 8 percent (Mbuta, 2007). The large share of employment and the low share of output means that productivity improvements of micro enterprises could be an important contributor to growth and poverty alleviation.

Entrepreneurship training programs have become a key policy strategy to achieve this. They act as supplements to macro policies aiming at improving basic infrastructure and institutions. The perhaps most well known examples include the Improve-Your-Business (IYB) and Start-Your-Business training (SYB) programs of the International Labour Organization (ILO). Management scholars and development economists have argued that entrepreneurship trainings may be an effective tool to achieve increases in productivity (Mano et al., 2012; Bloom et al., 2013) Since on the most general level, entrepreneurship trainings contribute to new patterns of managerial attention (Cho and Hambrick, 2006; O'Connor, 2013). Hanna et al. (2012) show, for instance, in the context of rural farmers that shifting entrepreneurial attention to alternative input dimensions may have large effects on performance.

However, though entrepreneurship trainings are becoming increasingly popular in these economies, the evidence of their performance-enhancing effects remains limited. While positive effects have been shown in the context of corporate entrepreneurship in the developing world, e.g. textile firms in India (Bloom et al., 2013), the evidence for micro firms is rather mixed (for an excellent overview, see McKenzie and Woodruff 2008 and McKenzie and Woodruff 2013). There are mainly two distinct, but interlinked reasons that seem to be responsible for the rather mixed results: First, potential measurement errors. In the informal economy, most firms do not keep any accounts. This might reflect either the low level of math and literacy skills, or the limited understanding of basic business concepts.

As financial records are usually not maintained, performance measures need to rely on the entrepreneurs' memory, i.e. their recall capabilities. This is, as De Mel et al. (2009) show, potentially associated with large measurement errors. Employing triangulation methods, the correlation between different measures of calculating profits¹ is extremely low and ranges between 0.2 to 0.3. This holds true even for sectors like retailing which are characterized by more simple transaction tasks. Even if Personalized Digital Assistants (PDAs) are provided, measurement errors are not substantially reduced (Fafchamps et al., 2012). To encounter this issue, we use insights from cognitive psychology which has identified conditions under which memory tends to be more accurate (Lindsay and Norman, 2013; Hintzman, 1976; Hintzman et al., 1992). In line with studies in this field, we suggest the ownership of tools, i.e. a discrete investment indicator, as an additional outcome variable that is less prone to measurement errors. We are aware that investment into business equipment is, like changes in entrepreneurial orientation, only a channel to achieve better outcomes and not a goal in itself, but we assume that investments are only made if they affect the bottom line of businesses. More fundamentally, one of the important messages is that if we want to be able to evaluate the effect of entrepreneurship programs, we may have to rely on simple and more reliable indicators, rather than employing standard measures of business success such as profits which might be hard to measure in a developing economy context.

Second, a further reason for the mixed results of previous studies is the content and design of the training itself. Regarding the content, most trainings have applied management programs that are "broadly applicable to most businesses, rather than...sector-specific" (McKenzie and Woodruff, 2008, 7), with the exceptions of Mano et al. (2012), Sonobe et al. (2011) and Higuchi et al. (2015) who carry out trainings designed specifically for the metal and garment-related sectors, respectively. Further, training programs have often been classroom based, and include one-on-one follow-ups only in few cases (see McKenzie and Woodruff, 2008). However, individual visits help to verify the implementation of the knowl-

¹Entrepreneurs are asked directly for their profits; additionally, they are asked for their revenues and expenses so that profits can be calculated by the researchers.

edge learnt in the classroom, to correct any mistakes or misunderstanding, and to create a trust-based relationship with the instructor in order to facilitate behavioral changes.

The design of previous studies is another reason for inconclusive findings as most have applied research designs that do not allow for causal conclusions. In a recent paper on entrepreneurship training in emerging economies which have been published in leading entrepreneurship journals, Kiss et al. (2012) show that the majority of studies are primarily “qualitative” or “descriptive”, and apply only “some form of regression” (57 out of 88 studies). This finding is corroborated by Martin et al. (2013) in the context of entrepreneurship research dealing with human capital formation and learning. In their meta-analysis, they show that only 6 out of 42 studies apply a design that allow for causal conclusions to be drawn such as random assignments.

In an attempt to overcome these gaps in content and design, we implement an entrepreneurship training program as a randomized control trial, which is characterized by a basic management training program with strong sector-specific elements and individual follow-ups which allows entrepreneurs to define adequate strategies to improve firm-level productivity.

Our main findings can be summarized as follows: First, we show that our entrepreneurship training on productivity improvements causes substantial increases in the investment in tools, measured by a binary indicator of ownership. Second, we show that the trained entrepreneurs invest substantially more into electric tools, and not into hand-powered tool sets. We argue that this difference is important because it allows for stronger productivity increases in the manufacturing process, precisely reflecting our trainings’ content. Moreover, consistent with the channel of productivity increase, we also find that investment into electric tools reduces the weekly working hours by around 10 percent. Third, we show that an important underlying channel is less spending on consumer or non-business related goods. This suggests that reallocation of resources from household to business is an important strategy to enhance performance. The paper by focusing on micro firms also adds to the nascent

but growing literature on entrepreneurship in Africa. Given the critical role of micro firms as the predominant source of employment, entrepreneurship trainings provide an important opportunity to contribute to poverty alleviation.

The paper is organized as follows: Section 2 provides a literature review that guides the content, design and measurement of training. We then present the research design and methodology in Section 3. This is followed by a presentation of our empirical findings in Section 4 and Section 5 offers a discussion of the main findings and the conclusions.

2 Entrepreneurship trainings in the developing world: A review of the literature

2.1 Entrepreneurship training: Evidence and outcomes

Micro firms² in developing economies suffer from extremely low productivity (Bartelsman and Doms, 2000; Foster et al., 2006). Productivity improvements in these firms could be an important avenue to help achieve growth, employment and poverty alleviation (Mead and Liedholm, 1998; Tybout, 2000). Entrepreneurship trainings which teach more efficient management methods and techniques³ therefore fulfill an important role in improving firms' performance (Lima et al., 2015; Gielnik et al., 2017; Fiet, 2001).

On a very general level, entrepreneurship trainings aim to trigger attentional change from more outdated modes of attention to new opportunities, which may contribute to increases in firms' performance. As a result, trainings may induce strategic changes (Cho and Hambrick, 2006). Especially in persistently constrained environments like in the developing

²Micro firms activities overlap with other categories of entrepreneurial work like informal entrepreneurship or self-employment (Webb et al., 2013).

³O'Connor (2013) distinguishes between four types of entrepreneurship education: Trainings that focus on the entrepreneur herself (i.e. on entrepreneurial traits), on the entrepreneurial process (i.e. new venture creation), on entrepreneurial cognition (i.e. on decision making to engage in entrepreneurial activity) and on entrepreneurial methods (i.e. teaching portfolio of techniques to practice entrepreneurship). Our training belongs to the category of entrepreneurial methods and teaches basic management methods, i.e. basic business skills (see also Ladzani and Van Vuuren (2002)).

world (Bloom and Van Reenen, 2010; see also Sonobe et al., 2011), entrepreneurship trainings which can be realized more easily by the entrepreneur herself and which are more independent from external constraints – such as, e.g., productivity improvements – play a pivotal role in identifying rooms for initiating strategic change. However, the evidence of the effects of entrepreneurship training programs on management outcomes is rather mixed. De Mel et al. (2014) find significant impacts of a program combining training and grants, but these gains only hold true in the short run; moreover, they also do not find evidence of the training program on profits, even in the short run. Drexler et al. (2014) find that basic training leads to significant increase in sales during what they refer to as “bad weeks”, but the effect on “bad months” is very small; these findings are corroborated in a study by Valdivia (2015). Berge et al. (2014) show that human capital intervention improved the sales of male entrepreneurs but not of females. They also show that financial capital intervention has no significant effect on business outcomes for both genders. Bruhn and Zia (2013) conduct a financial literacy program in Bosnia-Herzegovina. They find that the program had a significant impact along the intensive margin (i.e. growth of surviving firms) but not on the extensive margin (i.e. firm survival or business start-up, or loan default rates).

Other studies show that trainings can have substantial effects on businesses and their performance. A closely related study is Mano et al. (2012), who implement a basic training program for metalwork entrepreneurs in Ghana for a duration of three weeks. Their training focuses on imparting basic business skill, which have a strong link to *kaizen* techniques, as opposed to management programs that require higher human capital and more systematic firm structures.⁴ The authors find that the training increases the business skills of entrepreneurs, though they do not analyze impacts on profits or sales. Furthermore, results suggest that after the managerial training, there is an increase in entrepreneurs’ investment into machinery. Sonobe et al. (2011) also implement a training program drawing its principles from the field of *kaizen*. They show that classroom training in an industrial cluster in

⁴Also refer to Pascha et al. (2011) and Ramachandran and Storz (2018).

Vietnam significantly improves management practices. Analyzing the mechanisms, they find that the quality of instructors, in terms of teaching experience, is an important moderator for increasing sales and revenues. Bjorvatn and Tungodden (2010) investigate the effect of an entrepreneurship training in Tanzania on small-scale firm's participation and performance. They analyze determinants of participation and find that entrepreneurs who are more educated, skilled (in terms of math), and experienced (in terms of age) have higher attendance. Thus, they too find that training increases entrepreneurial business skills. Calderon et al. (2013) implement a business training program for women in Mexico; the authors find that those who received the treatment earn higher profits, have larger revenues, serve a greater number of clients, are more likely to use formal accounting techniques, and more likely to be registered with the government.

Summing up, mainly two factors potentially explain the mixed results of the effects of entrepreneurship trainings in the developing world: measurement errors and weaknesses in content and design. We elaborate on these issues in the following sections.

2.2 Evaluating entrepreneurship trainings: Improvements in Measurement

The measurement of outcomes is challenging in an environment where entrepreneurs do not keep financial records, and where measurement basically relies on recall.⁵ One of the seminal studies trying to understand measurement errors in business outcomes is De Mel et al. (2009). They collect estimates of profits using two methods: the first measure calculates profits as the difference between reported revenue and expenses. The second measure calculates profits by directly asking for them. In a perfect world, the correlation between the two estimates would be one. However, the authors show that the Pearson correlation is very low, i.e. in the range of 0.04 to 0.29. They explore how measurement can be improved through detailed

⁵McKenzie and Woodruff (2008) provide an excellent overview of measurement issues in the informal economy where the business outcomes of micro enterprises have been shown to be notoriously difficult to measure and often inconsistently reported.

questions allowing for consistency checks, examining recall errors and underreporting (e.g. asking for units and their sub-units). Based on their results they conclude that “that simply asking profits provides a more accurate measure of firm profits than detailed questions on revenues and expenses” (De Mel et al., 2009, 19).

Fafchamps et al. (2012) report that the use of PDAs helps to reduce the coefficient of variation and increases the autocorrelation of observations, but they also conclude that “the consistency checks have very minimal effect on the means, standard deviations, and autocorrelations of sales and profits for the full dataset. As such, it appears that the use of PDAs or other electronic data collection methods for measuring firm profits and sales is unlikely to be justified on the basis of better measurement alone” (Fafchamps et al., 2012, 52). This is an important conclusion, as management processes in the retail sector in which the PDA experiment has been carried out tend to be less complex than in the manufacturing sector. In the manufacturing sector, costs emerge not only during processes of purchasing and storing but also during the production process. This means that the measurement of outcomes in the manufacturing industry should be even more prone to measurement errors.

Hence, the question of how to improve the measurement of performance changes has remained largely unresolved in the literature. Its solution remains challenging, given the low levels of business skills, and, more fundamentally, the lack of numeracy, literacy and abstract problem solving skills (Musonda and Kaba, 2011). The measurement is even more demanding in the case of micro entrepreneurs where companies usually are considered to be the property of the entrepreneurs’ extended family, linked to the normative pressures of sharing earnings with their relatives’ social network (Webb et al., 2013; Valdivia, 2015).

However, if management scholars and development economists contend that entrepreneurship trainings may be an important answer to improving firm performance, obviously more reliable outcomes to measure the impact of trainings are needed. Based on insights from cognitive psychology, we suggest easier-to-memorize measures and focus on our training on investment into new manufacturing tools as an additional performance indicator.

To understand why memorization of tools tends to be more accurate than reporting profits, it is important to know how people memorize and what improves recall. We suggest tools to be a more reliable outcome variable for mainly three reasons: First, making mistakes and forgetting initial information increases as a function of the number of calculations stages between the initial presentation and subsequent utilization of information (Hitch, 1978). Obviously, costs, revenues and profits are more complex to calculate than counting tools. In the case of the former, entrepreneurs need to calculate over a variety of product classes, and over longer and different periods of time. In contrast, there are no major calculation stages in the case of tools, especially if entrepreneurs possess only a few tools and if these tools do not change. Tools in our setting are few, and even more relevant, visible and located in the entrepreneurs' immediate environment so they are simple to count. The discrete and lumpy nature of tools should, therefore, imply that tools are less subject to measurement errors, especially at the extensive margin.⁶

Second, it has been shown that memory improves when connections with other information can be made. Goldstein (2014) provides rich evidence to show that the more connections people are able to make, the more this helps to retrieve the information when they try to remember it. Linked to this, memory is improved if the person who needs to memorize is able to create a link to herself. This so-called self-reference effect means that memory is improved if the information is encoded with reference to the person who is asked to retrieve the information (Goldstein, 2014). Rather than profit data, tools should meet this condition: In the case of tools, entrepreneurs can connect the tool to existing knowledge on how to produce manufactured goods, and they should also more easily relate the tool to themselves in their identity of being carpenters. Also, connections should be easier made because the same tools are used on a daily basis.

⁶This is in line with Dupas and Robinson (2013, 169) who note in the context of Kenya that “many respondents did not keep good records of their sales during the day, in part because they did not have time to record each small retail transaction that they had. In contrast, the data on business investments (mostly wholesale purchases) is relatively reliable, albeit somewhat noisy.” We also follow Mano et al. (2012) whose results also suggest that managerial training increases entrepreneurs' investment in machinery.

Third and finally, Draschkow et al. (2014) have shown that “memory performance was markedly better for searched objects than for objects they had explicitly tried to memorize, even though participants in the search condition were not explicitly asked to memorize objects”. Put differently, tools that need to be looked for are easier to recall correctly than data which are asked to be retrieved from the memory. This is exactly what we can be observed in an entrepreneur’s daily work routine where it is common to have a look for tools during the manufacturing process.

Independent from the issue of recall is another potential measurement error, i.e. strategic misreporting. In this regard, the use of tools has the additional advantage to reduce strategic underreporting. As shown by Alby et al. (2011), family members within the African context often have claims over business resources. In such an environment, reporting on profits is sensitive (Alby et al., 2011) and might give incentives to strategic misreporting. However, there is no reason to assume why entrepreneurs would not tell the truth – as long as it is correctly memorized – in the case of tools.

We, therefore, argue that measuring the business investment into tools as a performance indicator may be prone to fewer recall errors, and provide an important complementary indicator to the measurement of profits.⁷

2.3 Content and design of entrepreneurship training programs in developing economies

The substantial heterogeneity in the content and design of entrepreneurship training programs is another problem complicating the conclusion of whether these programs enhance the performance of micro entrepreneurs in the developing world. We focus first on two facets of the program that have been implemented in the literature – the extent of industry-specificity and the use of follow-up visits and then comment on the design of prior trainings.

⁷In the same vein, McKenzie and Woodruff (2008) argue that a focus on a specific industry may allow more detailed monitoring of physical inputs and outputs.

One of the common features of most of the previous trainings programs is the lack of industry specificity (McKenzie and Woodruff, 2008, 7). As constraints as well as learning opportunities on how performance may be enhanced are dependent on the sector, entrepreneurship trainings are needed that focus on a single industry, taking exactly the industry's conditions into account (see McKenzie and Woodruff, 2008). Again, an important lesson to be learnt is that trainings should be carried out within a clearly defined industry.

Second, regarding the content, Drexler et al. (2014) have argued that one-on-one follow-up visits help to verify the implementation of the knowledge learnt in the classroom, to correct any mistakes or misunderstandings, and to create a trust-based relationship with the instructor in order to facilitate changes in behavior. We follow this insight by extending our classroom trainings with follow-up trainings.

Next, with respect to the design of entrepreneurship trainings, research design should allow for a causal link to be drawn between the entrepreneurship training and the outcomes. Entrepreneurship research in developing economies has been plagued, however, with design issues: In an overview, Kiss et al. (2012) and Martin et al. (2013) show that effects of entrepreneurship trainings in emerging economies which have been published in leading entrepreneurship journals do not apply a rigor design and hence do not allow for causal conclusions. In development economics, there has been an increasing turn towards employing randomized experiments, which allow to estimate causal effects. We make use of this research design to achieve a better understanding of entrepreneurship in the developing world. In a recent review paper, McKenzie and Woodruff (2013) identify 16 studies that use randomized experiments to uncover causal effects of business training.⁸ Our paper adds to this growing body of studies and forms the first randomized experiment in the context of Zambia.

⁸Refer to Table 1 of McKenzie and Woodruff (2013) for a list of the studies.

3 Research design and method

3.1 The setting: The furniture sector in Zambia

The manufacturing sector in most Sub-Saharan African countries is plagued by low productivity. The majority of firms are informal micro firms which account for 95 percent of all firms and for 88 percent of non-farm employment but only for five percent of the total GDP (Conway and Shah, 2010).

The focus of our study is micro firms in the Zambian furniture sector. Typical products include chairs, sofas, kitchen furniture and furniture for bedrooms and living rooms, as well as cabinets for televisions and other goods for domestic premises. Also the Zambian furniture sector is dominated by micro firms and characterized by low value production, mainly for the domestic market. Its low productivity also becomes apparent in comparison to furniture producers in other developing economies. Comparing the Zambian furniture sector to Vietnam, for instance, the cost of producing a wooden chair in Zambia is around \$30, whereas in Vietnam the cost is only around \$18 (Dinh, 2013). In terms of labor productivity, the average number of chairs produced per worker per day, again in the formal sector, is 0.2-0.6, whereas it averages 2 in Vietnam. The sector also suffers from the use of outdated technology. Micro producers often rely on the use of old and manual equipment; for instance, equipment in Zambia is, on an average, 28 years old, compared to 7-13 years in Vietnam. These data hold true for the formal sector; for the informal sector, the differences should be even much higher.

3.2 Training program and the intervention

The training program was designed as a randomized field experiment and took place between October 2015 and the middle of January 2016. Our study site is Lusaka, the capital of Zambia. The participants of the present study are located in four of Lusaka's markets. Production within markets is typical for entrepreneurs in the developing world, as they usually

locate in markets to compensate for resource constraints.⁹ The selected four markets, i.e. Buyantanshi, Chifundo, Mutonyo and Mwasauka, are representative for furniture production sites in Sub-Saharan Africa: they are informal, have little access to financing, possess low levels of business skills, and lack formal qualifications. They are located in low-income areas and primarily cater to low-income consumers. Working and production areas are located within a square in the market which is not visible from the street. Once a product is produced, it is usually placed on the streets outside the market and displayed to individuals crossing the streets surrounding the market. Customers are either individuals who notice displayed products and purchase them or prior customers who pre-order the furniture products or recommend them to friends and acquaintances.

We created a listing of all furniture producers in the four markets in December 2014, containing 136 firms. We conducted a baseline survey in April 2015 and obtained data on 121 firms. We could not obtain data on the remaining 15 firms. Table 1 provides a description of the key characteristics of the micro entrepreneurs in our sample.

Insert Table 1 about here

The average entrepreneur is a single proprietor (81 percent) and is operating his business for 14 years. There are no female entrepreneurs in the sample, which is typical for the furniture industry in the developing world (UNECA, 1988). The vast majority of companies is unregistered and belongs to the informal economy (94 percent). Very few entrepreneurs maintain any kind of business records (5 percent). Only few entrepreneurs have received any business training (10 percent), somewhat more a carpenter training (25 percent). Access to finance is very limited with only 6 percent of firms report borrowing from any source. Working hours are long; entrepreneurs typically work 51 hours in a week. Entrepreneurs possess only few tools, on an average six. Electric tools are rare; a typical carpenter possesses one electrical tool. This means that the production process is extremely labor intensive, a

⁹Webb et al. (2013) identify strategies to overcome resource constraints: to cluster into markets, to exchange tools, and to reallocate resources.

factor underlying the reported long working hours, which again is typical for micro firms in the developing world (Webb et al., 2013). Within the group of electrical tools, electric drills are most common and owned by 50% of the entrepreneurs; less common are electric sanders (21%) and other electric tools (31%). Such electrical tools - for example, battery-operated drills - improve the speed of the production process, reduce waste and improve the product's quality, but do not require any further education or special training.

The training program was implemented between October 2015 and January 2016 and consisted of two modules, i.e. two classroom sessions (module I) and three onsite trainings (module II). The two classroom sessions of the module I have been carried out in October 2015, each of them taking place between 9h – 15h. They have been followed by three on-site training sessions (module II), carried out between the beginning of November 2015 and the end of January 2016. During these three trainings, entrepreneurs have been instructed at the firm's production site, following up the content of the two classroom sessions.

Both classroom sessions introduced basic management methods to improve productivity throughout the production process. The onsite-sessions gave advice on how these methods can be applied to the individual firm. More specifically, the first classroom session introduced a number of strategies to improve productivity, focusing on potential productivity gains over the whole production process, including the step of the purchase. This session aimed to shift the entrepreneurial attention to the link between productivity and competitiveness and to encourage the participants to identify opportunities for productivity improvements. In the second classroom session, the main products of the participants, as well as tools and equipment necessary to produce them, were identified. This involved understanding how simple but new and improved techniques could help reduce purchase and production costs. Examples included the reduction of wasted timber that would reduce procurement costs, the diminution of miscuts that would reduce production costs, or the use of electric tools which would ensure better cutting and precision and hereby again less waste, but also higher customer satisfaction (McKenzie and Woodruff, 2016). Organized into smaller groups,

entrepreneurs then identified concrete channels of productivity gains.

During the three one-on-one follow-up sessions, entrepreneurs have been supported in implementing the lessons learnt in the classroom sessions. Session 1 of the follow-up focused on the processes involved in purchase, and sessions 2 and 3 on the production process.

Our training program, for both modules I and II, has been developed in three stages: The first stage involved intensive exchange with experienced trainers in the European small-scale manufacturing sector which helped to get a better understanding of the concrete production process and possible productivity gains in the furniture sector. The second stage was the development of the classroom modules. They were based on the Improve-Your-Business (IYB) and Start-Your-Business training (SYB) program developed by the ILO, and additionally on general principles of lean management (*kaizen*) with its focus on productivity gains in production. Following the advice of our local instructors, we adapted, in a third stage, the classroom sessions to the carpenters' specific needs; for example, we included in both classroom sessions group discussions on how production processes of a specific wood product may be optimized (see Table 2). In the very end, we provided entrepreneurs with a management training that identified purchase and production as the two main steps, highlighted potential avenues for productivity gains, as well as strategies linked to it. Thus, as compared to previous trainings focusing which focus on financial literacy (Drexler et al., 2014; Field et al., 2010), on accounting, marketing or investment analysis (Berge et al., 2014; Bruhn and Zia, 2013; Calderon et al., 2013), our training program similar to Mano et al. (2012) and Sonobe et al. (2011)) focuses on at productivity increases during production processes.

The instructors were two Zambian consultants with extensive experience in small firm business trainings in the manufacturing sector. This is important as it has been shown that teaching experience is an important moderator for performance changes (Sonobe et al., 2011). One trainer was also experienced in training carpenters. Both trainers were familiar with lean management practices. Both spoke the local language, Nyanja, in order to enhance communication and common problem solving on the ground.

In line with studies in the field of micro firm trainings, a follow-up survey serves as the main source of data to evaluate the outcomes of the training program. The survey was carried out at the end of April 2016, that is about four months after the training sessions were completed.

We completed our data with various databases and business and industry reports. Together with own visits to the field as well as information from external key informants, these data also helped us to contextualize our data (see Table 2).

Insert Table 2 about here

3.3 Selection and randomization

Our sample consists of 121 entrepreneurs: 42 entrepreneurs from the Buyantanshi market, 46 from Chifundo, 10 from Mutonyo and 23 from Mwasauka market. We randomized treatment across the markets. The two markets of Buyantanshi and Mwasuaka (total of 65 furniture producers) were assigned to receive the business training program, whereas the markets of Chifundo and Mutonyo (total of 56 furniture producers) were assigned to the control group. Those who received the business training are our treatment group. The main reason for randomizing across rather than within markets was driven by the fact that offering training to some furniture producers and not others might create ‘bad blood’ and undesirable competition among them. Randomization across markets also helped to ensure that there would be no spillover across treated and control units. In order to check whether the randomization across markets enables us to create a balanced sample, Table 3 compares the entrepreneurs assigned to control and treatment on a range of characteristics.

Insert Table 3 about here

The comparison of covariates - age, profit, years of operation, registration status, hours worked, site of production, place of sale, previous experience, carpenter training etc. -

shows that the baseline characteristics of firms are similar for a wide range of characteristics, indicating that our mode of randomization created balanced groups.

3.4 Measuring the impact of the entrepreneurship training: Profits and tools

Our sample of self-employed furniture producers poses exactly the same set of issues which we described above in the literature review on measurement (Section 2.2). We follow previous studies in the field (De Mel et al., 2009) to gauge the extent of potential measurement error and measure profits with two different methods: We asked respondents to directly report profits earned in a normal month, and next asked for total revenue and expenses¹⁰ in a normal month so that profits could be estimated by us. Table 4 shows the profit estimate arising from these two methods, as well as the Pearson and Spearman correlation between them.

Insert Table 4 about here

Table 4 shows that the correlation between the two measures is positive and is in the range of 0.20-0.26. Moreover, the coefficient of variation is the lowest for reported profit. Our data suggest what De Mel et al. (2009) recommend, that is, directly asking respondents for profits levels might be the best way to elicit the profitability of a business. Thus, we use reported profits as one of the outcome measures. However, another lesson that emerges from this exercise is that there is a lot of measurement error: Our within subject correlation for profits is between the range of 0.2 to 0.3. While this result is exactly in line with a number of other studies, including De Mel et al. (2009) who reported a range of 0.2 to 0.3 as well, it is still very low and shows that data are not consistent. Obviously, measuring profits when relying on recall is challenging.

¹⁰Expenses include: purchase of inventories, purchase of timber, purchase of electricity, water, gas and fuel, interests paid, wages and salaries for employees, rent for machinery and equipment, rent for land and buildings, telephone and cellphone charges, maintenance and general repairs, and travelling expenses.

We, therefore, decided to complement the profit measure with an outcome measure that is easier to recall. Given the trainings’ focus on productivity increases on the one hand and the important role of business equipment investment on the other, we measure performance changes with the ownership of tools. We do so for various categories and are especially interested whether an entrepreneur invests in electric tools. To shed some light on the underlying channel, we also explore whether the treated firms shift attention by reducing purchases of household consumables. Additionally, we use qualitative evidence, in particular meetings with the local instructors, training documents they provided, and own field observations (see Table 2). Following our instructors’ advice, we also included “working time” as they reported that working time is often not used efficiently.

3.5 Estimation

The design of the experiment is based on a randomized control trial, and moreover Table 3 shows that the treated and control firms are balanced on a range of important characteristics. Thus, our primary focus is on intention to treat (ITT) estimates of the entrepreneurship program. More, specifically we estimate:

$$Y_i = \alpha + \beta T_i + X_i + \epsilon_i, \tag{1}$$

where, Y_i refers to the outcome of interest of firm i ; T_i is a dummy taking the value 1, if the firm was assigned to receive the entrepreneurship training program; X_i is a vector of controls and ϵ_i , by assumption, independent and identically distributed.

4 Results

4.1 Treatment effect on performance indicators

In this section, we estimate the average treatment effects of the entrepreneurship training. The first column looks at the effect of the treatment on directly stated profit of the respondent. We come back to profits as an outcome indicator later in this section, but start to explore the impact of the training on the investment into tools.

Columns (2), (3) and (4) of Table 5 explore changes in investment into tools. There is a broad range of tools that might improve productivity. Most important, however, is the category of electrical tools because these do not only increase production speed, which means an increase in productivity by reducing working time, but also allow for more precise cutting and treatment techniques which help to reduce production costs. For instance, electric sanders reduce the polishing time of wood, and also provide better accuracy and superior quality of surface finishing. Similarly, an electric drill enables greater precision and reduces production time, especially when working with hard substances as it is the case with Mukwa, which is the main type of timber used in the markets under observation. We collect information on the ownership of electric sanders, electric drills and other electric tools both at baseline and four months after the end of the intervention. We construct a dummy variable which takes the value one in case the entrepreneur reports owning the tool and zero otherwise. Column (2) shows that entrepreneurs who were part of the business training are 18 percentage points more likely to report owning an electric sander after the intervention. Though the coefficient on the treatment dummy for ownership of electric drills is marginally insignificant, columns (3) and (4) of the table show that treatment also increases the possibility of reporting of ownership of an electric drill or other electric tools by 13 and 19 percentage points.¹¹

In contrast, as noted before, we do not observe any effects on profits (column (1) of

¹¹We collect information on both hand powered and electric tools. The treatment shows no effect on ownership of other categories of tools. The results are available from the authors.

Table 5). The coefficient is seen to be small and insignificant (p -value = 0.58) suggesting that the training did not have an impact. We interpret the systematic difference for the outcome variables tools and profits as reflecting differences in entrepreneurial recalling capabilities. While we cannot rule out that measurement errors for the outcome of tools also exist, memory studies suggest that recall capabilities will be substantially enhanced when using tools: Tools, in contrast to profits, are linked to fewer calculative steps, more connections, and to better retrieval as they are searched for (Goldstein, 2014). Furthermore, self-reported data on tool ownership are less likely to raise the concern of strategic misreporting.

Insert Table 5 about here

4.2 Changes in entrepreneurial behavior

In this section, we analyze how the intervention affects the entrepreneurial behavior. Overall, we observe that the training had an impact on the reallocation of resources.

When entrepreneurs invest into tools, we would assume that they need financial sources to be able to do so. As the access to the financial market is severely restricted, reallocation has been shown to be an important road to performance improvements in the developing world (Webb et al., 2013). Indeed, in Table 6 we observe that treated entrepreneurs are more likely to shift expenses from consumer or non-business related goods to business purchases. Column (1) and (2) show that the treated entrepreneurs are 19 and 11 percentage points less likely to report having purchased clothes for their kids or parents, though the coefficient only in column (2) is statistically significant. Hence, the reallocation of resources from household to business seems to be one important underlying channel. It is important to note that we assume that our findings do not show a link between ownership of tools and profit changes. While we cannot exclude this possibility, we assume that reallocation has been identified by the trained entrepreneurs as the dominant strategy to achieve productivity increases.

To further corroborate the consistency in the measurement of tools as an outcome indicator, we explore whether individuals who report purchasing electric tools in 2016, controlling

for prior ownership levels in 2015, report an increase in the expenditure associated with electricity. Columns (3) and (4) of Table 6 show that individuals who report having purchased electric tools in 2016 indeed report higher expenditures on electricity, both in the last and a normal month, though the coefficient is significant only for the former. Given that the electricity expenditure in the baseline was around 60 Kwachas a month, the reported increase amounts to about a 50 percent increase. While this increase seems to document the robustness of our result, it is also important to notice that this increase is not substantial in terms of the entrepreneurial income; it corresponds to about 3% of the reported profits.

Moving on to hours worked, we also observe that entrepreneurs who invest into electrical tools work substantially less. Column (4) of Table 6 shows that training had a statistically significant effect on working hours. Trained entrepreneurs report working five fewer hours in a week, or in other words, reduce the amount of time worked by about 10 percent. This observation is strongly supported by evidence from the field. The majority of trained entrepreneurs reported changes in how they work on deliveries. More specifically, they reported that they started to work on customer orders as soon as they have been received to ensure timely delivery, and that they had reduced the time spent on idle talk such as politics and football, different from how they behaved before the training. This allowed them to use their working time more efficiently. Given that entrepreneurs report working over 50 hours a week, this reduction can be considered to be further beneficial in terms of improving health.¹²

Insert Table 6 about here

Finally, we also test for changes in levels of cooperation as an important channel potentially improving productivity. Our training incorporated various suggestions on cooperative strategies. More specifically, we elicit whether entrepreneurs cooperate in the following activities: (i) cooperation in borrowing and lending machinery; (ii) cooperation in training

¹²Notes of the interviews from the field are available from the authors.

workers; (iii) cooperation in product development; (iv) cooperation in marketing; (v) cooperation in procurement of raw materials except timber; and (vi) cooperation in procurement of timber. We assign 1's for the activities in which the firms answer in the affirmative and then take the mean for the six categories and create a standardized index. Given our trainings' focus on productivity increases, we would expect to observe more cooperative purchasing behavior to reduce costs and to achieve higher productivity. The results of the exercise are shown in column (5) of Table 6; the coefficient is small, positive and insignificant. The mean value of the index suggests that cooperation remains limited for treated entrepreneurs; the average value on the index is 0.35, as compared to a maximum possible value of 1.

However, the experience of our local instructors as well as our own observations in the field (see Table 2 for data sources) tell a different story. Participants interviewed during the on-site sessions reported that they had started cooperative activities. Repeatedly, the trained entrepreneurs referred to concepts having been taught in the first teaching module, the classroom sessions. For instance, they were conscious of the increase in costs inherent in buying paints and other raw materials, if bought in small quantities. The trained entrepreneurs reported that they intend to procure raw materials on a cooperative basis to benefit from economies of scale, and that they deliberately look for opportunities to share transport costs with entrepreneurs from the same market. In one of the two treated markets, the market of Mwasauka, entrepreneurs already established a procurement information notice board so that individual entrepreneurs could post weekly material procurement activities on a voluntary basis. Further, changes in the mode of material transportation could be observed. Usually, micro entrepreneurs operating in these markets rent trucks to transport material. In order to save procurement costs, entrepreneurs in the treated markets started to use bicycle trailers called "Vingolo" when they bought timber in another market, the Buseko market.¹³ Other entrepreneurs reported new suppliers located in geographically closer locations, so that transportation costs could be reduced. Linking these qualitative

¹³The Buseko market is the main source of timber supply for carpenters in Lusaka.

findings to our quantitative ones, we assume that treated entrepreneurs started to change their behavior, but that this change potentially takes more time than the period that could be covered by our endline survey; this is consistent with McKenzie and Woodruff (2016) who suggest that finding small and insignificant effects might not have been due to the fact that business practices do not matter, but more a question of detectability and timing. Compared to other indicators that are based on individual behavioral changes, this result is intuitive as changing collective behavior would typically require more time than changing individual behavior.

5 Conclusions and Discussion

In line with Berge et al. (2014), who show that human capital interventions tend to be more effective than financial interventions, we provided an entrepreneurship training that shifted the entrepreneurial attention to opportunities for productivity increases and identified room for productivity improvements during the production process. Our study shows that entrepreneurship training emphasizing industry specificity, and including follow-up visits as a component, can have positive effects on business outcomes of poor micro entrepreneurs. Our data suggests that an important underlying channel is the reallocation of resources by shifting expenses from household to business expenses, which is in line with the work of Webb et al. (2013). We use a randomized control design in order to be able to identify causal effects which has arguably been an important gap in research on the effects of entrepreneurship trainings (Kiss et al., 2012; Martin et al., 2013).

While most trainings focus on business skills in terms of marketing, bookkeeping or investment analysis, our focus on production management has, to the best of our knowledge, only been applied by Mano et al. (2012) and Sonobe et al. (2011). These studies have been inspired by the Japanese post-war success in manufacturing to which production management techniques like *kaizen* or lean management made a substantial contribution. As it was in

particular production management which helped Japanese firms in the 60s to catch up, entrepreneurship trainings with a focus on production management techniques may be a particularly fruitful path.

Looking at the set of outcome measures, our data show that the effects of the entrepreneurship program vary depending on the choice of the outcome variable - “tangible” ownership of production tools versus “intangible” data on profits. As financial records are seldom kept in the developing world, measurement errors are a long-standing concern when outcomes are measured with standard accounting data like profits, savings or revenues, also within field experiments (De Mel et al., 2009). There are two sources of error: “Honest mistakes” due to insufficient memory, and “strategic mistakes” due to strategic considerations. In order to reduce the former, we suggest to not exclusively rely on standard business indicators like profits, saving and revenues, but to additionally make use of insights from cognitive psychology on how people memorize. Studies in cognitive psychology show that memory or recall is better: (1) the less the number of calculation stages, (2) the more connections between existing knowledge and the information to be retrieved exist, and (3) for objects which are searched for than for objects which have been explicitly tried to memorize. Hence, using tools which are few in numbers, which can be connected to daily work and are related to one’s own profession of being a carpenter should lead to more precise memorizing and recalling. Additionally, tools are simply visible and can be counted, given that they are ‘lying around’ in the workshop. We therefore suggest to extend performance measures, and to measure also the ownership of tools or other types of physical equipment. We suggest that this indicator may be an important complementary indicator especially for studies in the manufacturing and agriculture sectors where productivity may be substantially enhanced via investment into physical equipment. This indicator has, especially in the case of micro firms, the advantage that enumerators can also simply crosscheck or verify the reported outcome when conducting interviews.

Another reason for misreporting are strategic mistakes, in particular due to either tax

or family considerations. In the context of the developing world, we think that strategic mistakes due to tax reasons (De Mel et al., 2009) are overstated, given that most firms are unregistered, informal and hence do not pay taxes. However, an underestimated and important strategic mistake is linked to the culturally embedded conception of the firm which is conceived to be the property of the entrepreneurs' extended family, linked to normative pressures of sharing earnings with the family (Webb et al., 2013; Valdivia, 2015). This means a disincentive to report savings and profits as they would be expected to be shared with the entrepreneurs' extended family. This fact may also explain why the introduction of business accounts in the developing world has been shown to be quite challenging (Clarke, 2011). Obligations toward the family have been shown to be an important external constraint (see Berge et al., 2014 for female entrepreneurs). At the same time, this constraint makes it even more advantageous for micro entrepreneurs to invest into equipment which cannot be easily disinvested. Besides our argument on cognitive mechanisms of recall, we assume this to be a further important argument that, within certain contexts, investments into tools can be used as a reliable outcome measure.

Related to the notion of improving measurement, we think more attention should be devoted to how data from randomized control trials can be complemented with qualitative data from the field to better understand the observed results. Admittedly, also our focus is on quantitative indicators, but we attempted to include semi-structured interviews, observations in the field and document analyses to be able to draw a richer picture of the sector under study. In particular for the emergence of new cooperation patterns we have shown that our quantitative data might have underestimated the real effects. In this vein, a promising avenue seems to integrate ethnographical methods. Blattman et al. (2016), for example, complement their exercise with intensive qualitative work which include deep participant observation. These observations are then compared to the survey data to determine the direction of the bias and the magnitude. Also, Deininger et al. (2012) administer a survey method that draws on the large-scale implementation of diaries by respondents. These diaries

are to be filled by a household member who is assisted by a qualified local person, at the time of harvest, which are then compared to Uganda's 2005/06 National Household Survey (UNHS).

An important policy implication from our research is to put stronger effort in measuring the impact of entrepreneurship training programs, and to take the industry as an important frame of reference into account.

Acknowledgement

We thank the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung) for their financial support for our research project on African-Asian Relations (AFRASO) and the AFRASO team for their support and valuable inputs. Earlier versions of this paper were presented at conferences of DRUID, talk at Stockholm School of Economics and the Duisburg-Frankfurt Workshop on institutions in East Asia, as well as at seminars at the Goethe University. We appreciate insightful comments from the participants. We would like to thank Yaichi Aoshima, Scarlett Cornellison, Marcus Heinrich, Peter Maczey, Anja Matthies, Jan Rieländer, Thomas Douglas Schmitz, Marie Söderberg and Abo Tetsuo for their helpful comments on the Japanese *Kaizen* management and possible extensions to the developing context. We further thank Eva Berger, Dejan Draschkow, Neil Rankin, Yoshihiro Sato, Michaela Sonnicksen and Utz Weitzel for their excellent comments and suggestions. Special thanks to Egbert Marasigan Amoncio and Elssy Kiradjieva for careful research assistance, as well as to Obrian Ndhlovu and Owen Siyoto for help in coordinating the collection of the field data. We also thank David Chakonta, Michael Peschka and Peter Schüßler who helped with industry-specific knowledge. The views expressed in this paper are those of the authors and do not reflect the official opinions or views of AFRASO or BMBF. All remaining errors are ours.

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Table 1: Key descriptive statistics of sample

Variable	Mean	Variable	Mean
Age of respondent	39.10 (10.04)	Hours worked normal week on business	51.31 (12.03)
Previous work experience	.46 (.25)	Borrowed money for business	.06 (.50)
Carpenter training	.25 (.43)	Does the shop have a clear visible sign outside	.10 (.303)
Management/Business skill training	.10 (.30)	Proportion who own sanders in 2015	0.21 (0.40)
Single proprietor	.81 (.38)	Proportion who own sanders in 2016	0.37 (0.48)
Unregistered	.94 (.23)	Proportion who own electric drills in 2015	0.50 (0.50)
Maintains any accounts	.05 (0.12)	Proportion who own electric drills in 2016	0.58 (0.49)
Years since business was started	14.82 (8.47)	Proportion who own other electric tools in 2015	0.31 (0.46)
Produce goods on business premises	.89 (.312)	Proportion who own other electric tools in 2016	0.39 (0.49)

The standard deviations are shown in the parenthesis.

Table 2: Features of data used in the analysis

Source of data	Type of data	Use in analysis
Industry experts and consultants, including local wood training institutes, Chamber of Commerce and Industries and financial institutes	Development of suited training program taking into consideration the market situation of the furniture sector in Zambia, in particular constraints and market development; in total 5 interviewees (in total about 15 interviews). Training program was developed with two consultants hereof.	Development of management training and survey questions, including alternative outcome variables
Local instructors	Local meetings and 10 Skype conferences during March 2015. Additionally 3 documents (consisting of 20, 6 & 57 pages) documenting and evaluating the two modules of the program (consisting of two classroom and three onsite sessions).	Content and design of the training
External key informants	Background on entrepreneurial training programs in Sub-Saharan Africa and Zambia; information on <i>Kaizen</i> training institutes and wood processing technologies in Zambia; in total 7 interviewees	Development of management training and survey questions, including alternative outcome variables, in particular use of tools; Interpretation of results
Business and Industry reports	Zambia Manufacturing Sector Profile; Economics of Scale; Furniture Production in Lafia; Micro and Small Cluster Based Furniture; Manufacturing in Tanzania; Small Scale Furniture Makers in Indonesia; Study of Wood Sector	Background information on industry conditions in the furniture industry; entrepreneurship training programs of international organizations in developing economies; information on market conditions Zambia
Databases	World Bank Enterprise Survey; Central Statistical Office, Zambia	Information on enterprise structure and firm characteristics in Zambia
Own visits to the field	Listing of firms in the four markets; two days market observations; baseline survey; after intervention semi-structured interviews with 10-12 treated entrepreneurs; in total 7 days of observation three meetings with the Business chambers and Technical Education Vocational and Entrepreneurship Training (TEVETA) in Zambia	Qualitative evidence on changes in entrepreneurial behavior; Interpretation of results

Table 3: Balance tests between firms assigned to control and treatment

Panel A: Interval Variables						
Variable	Control Firms Observations	Control Firms Mean	Treated Firms Observations	Treated Firms Mean	Diff	p-value
Age of respondent	54.00	37.87	65.00	40.12	-2.25	0.22
Total Profit Stated by Respondent	54.00	2117.59	65.00	1796.31	321.28	0.22
Total Profit (Revenue - Expense)	55.00	1978.87	62.00	1190.19	788.68	0.20
Total profit (Top selling items)	55.00	4561.47	65.00	4538.16	23.32	0.98
Years of Education - Entrepreneur	55.00	9.80	65.00	8.38	1.42	0.01
Years since Business was registered	2.00	13.50	5.00	11.20	2.30	0.73
Years since Business was started	54.00	14.20	62.00	15.37	-1.17	0.46
Hours worked normal week on Business	55.00	51.85	65.00	50.86	0.98	0.66
Panel B: Categorical and Ordinal Variables						
Variable	Fisher Exact	Variable	Kwallis Test			
Whether held previous job	0.46	Importance of wholesalers as customers (1-3 scale)	0.24			
Received training to become Carpenter	0.52	Importance of individuals as customers (1-3 scale)	0.88			
Received Business training	0.54	Access to electricity as constraint (1-3 scale)	0.13			
Legal Status	0.45	Place to display finished products as constraint (1-3 scale)	0.89			
Produce on business premises	0.57	Storage space as constraint (1-3 scale)	0.52			
Sell on business premises	0.57	Sources of finance as constraint (1-3 scale)	0.44			
Whether taken any loans	0.55	Too many identical producers as a constraint (1-3 scale)	0.89			
Where purchase inputs	0.71	Lack of regular assured buyers as a constraint (1-3 scale)	0.25			
Visit other businesses to learn	0.38	Insufficient product range as a constraint (1-3 scale)	0.42			
Whether done any advertising in last 6 months	0.14					
Cooperate with other firms to buy inventories	0.83					
Other than timber						
Cooperate with other firms to buy timber	0.69					
Subcontract to other firms	0.31					

Table 4: Within subject correlation between two methods of profit calculation

	STATED PROFIT [1942.10]; (1431.47)	REVENUE MINUS EXPENSE [1560.94]; (3335.53)
Stated Profit	1.00; [1.00] (Pearson; Spearman)	
Revenue minus Expense	0.20; [0.26] (Pearson; Spearman)	1.00; [1.00] (Pearson; Spearman)

Note: The standard deviation is shown in parenthesis and the Spearman rank correlation is shown in the square parenthesis.

Table 5: Impact of business training on profits and investment into business equipment

	(1)	(2)	(3)	(4)
Stated Profit		Purchase of Electric Sanders	Purchase of Electric Drills	Purchase of Other Electric Tools
Treated Dummy	-190 (347) [-879 - 500]	0.18** (0.082) [0.015 - 0.34]	0.13 (0.084) [-0.040 - 0.30]	0.19** (0.086) [0.020 - 0.36]
Dummy for Owned Electric Sanders in 2015	No	Yes	No	No
Dummy for Owned Electric Drills in 2015	No	No	Yes	No
Dummy for Owned Other Tools in 2015	No	No	No	Yes
Observations	90	109	109	109
R-squared	0.003	0.176	0.273	0.157

* $p < .10$; ** $p < .05$; *** $p < .01$. Robust SE's in parenthesis and 95 percent confidence intervals are shown in the square brackets.

Table 6: Impact of entrepreneurship training on other outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Purchase of Clothes for Kids	Purchase of Clothes for Parents	Change in Electricity Expense Last Month	Change in Electricity Expense Normal Month	Hours Worked 2015 Normal week	Hours Worked 2016 Normal week	Std. Index of Cooperative Activities
Treated Dummy	-0.19* (0.097) [-0.38 - 0.00028]	-0.11 (0.083) [-0.27 - 0.057]			-0.98 (2.21) [-5.37 - 3.40]	-6.68*** (2.45) [-11.6 - -1.82]	0.039 (0.21) [-0.39 - 0.46]
Dummy for owns Electric Tools in 2016			35.3* (20.5) [-5.58 - 76.2]	31.7 (19.9) [-8.07 - 71.4]			
Dummy for Owned Electric Tools in 2015	No	No	Yes	Yes	No	No	No
Observations	96	107	78	78	120	94	89
R-squared	0.040	0.016	0.038	0.035	0.002	0.075	0.001

* $p < .10$; ** $p < .05$; *** $p < .01$. Robust SE's in parenthesis and 95 percent confidence intervals are shown in the square brackets.