INFRASTRUCTURE AND CLUSTER DEVELOPMENT:

A CASE STUDY OF HANDLOOM WEAVERS IN ETHIOPIA

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ABSTRACT

Rural non-farm development plays a key role in generating employment in many developing countries. Clustering is an important industrial organization in the rural non-farm sector. Based on primary surveys of both urban and rural handloom weaver clusters in Ethiopia, one of the most important rural nonfarm sectors, this paper examines the mechanism and performance of clustering. The clustering way of handloom production is observed even in remote rural areas, illustrating its vitality and flexibility in adapting to restricted environments. Despite its resilience in surviving in harsh environments, improvements in infrastructure can significantly increase labor productivity in a cluster. In towns with electricity access, producers work longer hours than those in towns without electricity and more entrepreneurs with limited access to capital are able to participate in handloom production because of finer division of labor.

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INTRODUCTION

Rural non-farm development is a strategic priority for many developing countries during their economic transformation from an agricultural to industrial society. It plays an important role in generating local employment and linking with other sectors in developing countries (Reardon et al. 2007). Despite its importance, there remains a great knowledge gap how the rural nonfarm activities are organized in rural areas, especially in more remote places. One major challenge in developing the rural nonfarm sector is credit constraints. The poor usually neither have enough financial resources nor have access to formal credits to start a business in the nonfarm sector. Therefore, a common view in the literature is that a functioning financial market is a precondition for industrial development (Ayyagari et al. 2006; Banerjee and Newman 1993; Goldsmith 1969; King and Levine 1993; McKinnon 1973; Rajan and Zingales 1998). Yet in many developing countries, development of a functioning financial market is often a daunting task in itself. Rather than wait for financial markets to develop, it would be useful to identify alternative approaches of industrial development that adapt to and arise from an environment of lacking formal institutions.

Industrial clustering is one way of overcoming such constraints. A cluster is a sectoral and geographical concentration of enterprises (Schmitz 1995). Marshall and Krugman identified the benefits of industrial clustering, specifically the external economies relating to access to markets, labor market pooling, and technological spillovers (Krugman 1991; Marshall 1920). Essentially through the collective efficiencies, clusters can enable more entrepreneurs to participate in industrial production that may otherwise be inaccessible to them (Schmitz 1995; Schmitz and Nadvi 1999). This is especially important in developing countries where labor is abundant and capital is scarce. One key collective efficiency is that clustering helps lower the capital barriers to entry through division of labor, thereby enabling more potential entrepreneurs with limited capital to enter the production process and achieve returns to their investment (Ruan and Zhang 2009).

There is a distinct body of literature studying industrial clusters and their impact on economic development (Bell and Albu 1999; Fujita et al. 2001; Gordon and McCann 2000; Meyer-Stamer

1998; Nakabayashi 2006; Porter 2000; Ruan and Zhang 2009; Sonobe and Otsuka 2006; Weijland 1999). Most of these studies focus on urban and peri-urban areas. Of the limited number of rural cluster studies, most center on rural clusters in Asian countries, while the literature on rural clusters in Africa is more scant, with a few exceptions. Oyeyinka and McCormick (2007) present nine case studies of clusters across seven African nations, highlighting the role and mechanism of clustering in promoting innovation and market linkage. In a book of case studies in seven African countries, Zeng (2008) describes the development process of clusters and illustrate some features of clusters in fostering technological innovation and knowledge sharing. While the literature on African industrial clustering is growing, there remains a knowledge gap in understanding how clusters in African countries structure themselves in response to their external environments, including infrastructure conditions, particularly in the rural context. The literature has yet to fully explore the production structure and mechanisms of clusters when formal institutions are lacking and infrastructure is limited.

To supplement the growing literature on rural clusters in Africa, this paper introduces an in-depth case study of handloom clusters in Ethiopia, with particular interest on the workings of rural clusters. Studies of clustering within Ethiopia to date have maintained a geographical focus on the capital city of Addis Ababa and nearby areas (Abdella and Ayele 2007; Sonobe et al. 2006). In this study, we survey not only three urban clusters in the capital city but also six rural clusters in the southern part of Ethiopia. Based on a primary survey of 488 producers and 154 traders in both rural and urban clusters, we map out the structures and linkages among producers and traders. Detailed production data enable us to compare cluster performance both through labor productivity and working hours across different types of clusters. Our results indicate that access to electricity improves the overall welfare of a community by extending working hours through lighting conditions and enabling the poorest segment of the population to work in the sector through sharing lightened rental space.

BACKGROUND & DATA COLLECTION

The handloom sub-sector in Ethiopia is derived from the cotton sub-sector and is an example of a traditional-based and home grown activity. Handloom is a simple value chain activity and is pivotal in the cotton sector as it binds the rural and urban households together and is grown from the home-based traditional handcraft industry. Handloom weaving was established to meet household need and demand for clothing, then gradually grew to be an additional source of income as an off-farm activity. In fact, handlooms (informal operators) are the major demanders of raw cotton, and are engaged in weaving and preparation of traditional fibers, especially woven dresses that are popular both at the rural and urban centers and are also exported to Ethiopians living abroad. The main providers of raw cotton to handlooms are smallholder peasant farmers.

The major products of the handloom sector can be divided in to semi-finished fabrics and finished products. While the semi-finished fabrics are usually channeled to the domestic garment factories for further processing, the finished products are divided into traditional clothing categories like *netella*, *gabi*, *kemis*, and *kuta* which are sold mainly in the domestic market and to Ethiopians living abroad, and home furnishing textiles, which are destined to the international market (Abdella and Ayele 2008).

There are several aspects of the handloom weaving sector that guided its selection for this study. First, it is the most important non-agricultural source of income in the country (Central Statistics Agency 2003a). Across the country, over eight times as many people generate their livelihoods from micro-enterprises and small scale manufacturing industries than from medium and large scale industrial establishments(Central Statistics Agency 2002). As weaving activities can fall under either category, the sector's importance to this category of livelihood generation is clear. Second, it is one of the few non-agricultural sectors with a discernable presence in both urban and rural areas. In both urban and rural areas, there are strong patterns of geographically clustered handloom activities. In Ethiopia, hand-weaving is a particularly important sub-sector, being the most important employer of rural families after agriculture (Abdella and Ayele 2008).

According to CSA's 2003 Cottage/Handicraft Manufacturing Industries Survey, the textiles industry has the second highest number of establishments in the cottage and handicraft manufacturing industry (221,848), representing 23% of the total number of cottage and handicraft enterprises, with almost 55% of these located in rural areas. Across the nation the textile industry employs the second highest number of people among the cottage and handicraft manufacturing industries, following food products and beverages. This industry accounts for 23% of the total employment in the cottage and handicraft manufacturing industries, and 20% of the rural employment in the cottage and handicraft manufacturing industries. Hand-weaving enterprises make up 73.2% of the textile industry in number of establishments, and 42.8% in total number of workers. (Central Statistics Agency 2003b)

In selecting clusters for this study, we found that clustered handloom activities are apparent in Addis Ababa as well as in parts of the countryside which have been traditionally associated with weaving. For the purposes of this study, we focused on the Addis Ababa neighborhoods of Shiromeda, Adisu-Gebeya, and Kechene-Medhaniyalem. For the rural segment of this study, we examined other regions with longstanding cultural traditions of handloom weaving, including Amhara (Gondor, Wollo), Oromia (Harargue/Dire Dawa) and the Southern Nations Nationalities and Peoples Region, referred to hereafter as SNNPR. While Amhara boasts the largest number of establishments in the textile industry (82,572), SNNPR has the largest number of rural textile production establishments (46,393), which better fits the interests of this study(Central Statistics Agency 2003b). Interestingly, the neighborhood clusters in Addis Ababa correspond ethnically to these "source regions" (for example, most of the producers and traders of traditional clothing in Shiro Meda come from the Arba Minch and Gamo area Dorze community in the south).

One key feature of our study is that our survey covers both urban and rural clusters. A detailed analysis of cluster structure and function has been carried out in three different cluster areas within Addis Ababa (Shiro-Meda, Adisu-Gebeya, Kechene-Medhaniyalem), classified as "urban" and referred to as "Addis Ababa" in this study, and 6 sites in the Gamo zone, 500 km south of Addis Ababa in the Southern Nations Nationalities and Peoples Region (Figure 1). The Gamo zone is largely rural, and our survey sites were centered in the Chencha district (Figure 1),

so these will be classified as "rural" and referred to as "Chencha" for the purposes of this study. Within the Chencha group, all 6 sites are market towns with handloom activities while only 3 of these towns have regular electricity and all-weather road access. For a full list of survey sites, see Table 1.

Regarding primary data collection, the survey instruments consist of: (a) a producer questionnaire, (b) a trader questionnaire, and (c) a community questionnaire. The questionnaires are based on previous interviews and field visits as well as cluster research performed elsewhere[2]. We reviewed both published and unpublished reports regarding handloom production as a prelude to the primary data collection. We interviewed a large number of informants, producers associations, producers, and traders to understand the cluster structure and function in various places before designing the questionnaire. The questionnaire was further amended in the field after a pilot test.

The producers surveyed in urban clusters are classified into producers who operate from their homes and producers who operate as part of an association, while classification of rural clusters is based on access to electricity. The sample size of each classification was determined according to the proportion of the sample population. The rural sample was divided almost equally between electrified and non-electrified towns (Table 2), while the distribution of the sample in the urban study varied in each cluster according to the sample population of sub-clusters and types of producers. In total, 486 producers are studied. Of 195 producers studied in urban settings, 51 are from 15 active associations in two sub-clusters and the remaining 144 are households working at home. Of the 291 rural producers, 145 and 146 are from electrified and non-electrified towns respectively.

[2] We intentionally adopt some of the questions and structure of surveys done elsewhere in order to allow for some cross-country comparison of the histories and strategies of similarly clustered firms in different settings. In particular, our producer and trader questionnaires several overlapping content with survey instruments developed for children's clothing and footwear clusters in China (Huang et al. 2008; Ruan and Zhang 2009).

The second component of the study is a trader survey which is mainly drawn from traders who are working in shops, in the open market and along the roadside. A total of 154 traders were surveyed, of which 97 were in urban and 57 were in rural clusters. Roadside traders are found only in the rural cluster in the Dorze area and 8 of them are included in the study. The trader surveys are used as a point of comparison within this study, and will be examined more closely in future works. The third component consists of focus group discussions in 13 communities. Of these, four were from Addis Ababa and the remaining nine were from the Chencha district. The community survey data will be used to identify infrastructure differences between the various rural and urban communities. These infrastructure differences include travel time to state capitals and presence of health care centers.

The Chencha district includes 45 rural and 5 'urban' kebeles, or neighborhoods, with a total about 12,045 household heads. Of these kebeles, only five are electrified. The district classified 50 kebeles into 8 service-rendering units, however for the purpose of this study we classified them into six service-giving units in consultation with the district administrative office, medium and small scale manufacturing desk and other stakeholders. Access to electricity and thinned-roofed houses are two of the many determinants of labor productivity for rural producers, and influence productivity in two specific ways. Producers with access to electricity prefer to work longer hours using electric light, while the hut houses in which the majority of rural producers operate have thin roofs prone to leakage, which can contribute to significant quality control issues during the rainy season.

The majority of handloom traders were concentrated in the urban district of Shiro-Meda, where there is a developed commercial trade district. Output traders could not be found in the urban district of Kechene-Medhaniyalem. In order to diversify the study sample, about 21 traders working at open market were captured from the urban Adisu-Gebeya cluster. In this cluster we classified the traded into two categories: full and open structured shops. We further classified the full structured shop into two: smaller and larger shop, according to shop location and size. The full structured shops are registered at the city municipality, whereas open structured shops are registered at the kebele level.

Most of the traders in rural clusters work in electrified towns and actively work during the market day. We tried to capture all traders working in rural markets on various market days as market day fell on a different day of the week in each of our survey sites. Careful consideration was also paid to avoid double enumeration during market day as many traders work in all rural markets. The study of roadside and open market traders can be considered a census, as it captured the majority of traders working in these undertakings.

One interesting feature of rural handloom markets is that a few traders from Addis Ababa, Awassa and other major towns collect output in bulk over a few market days and supply it to the major towns where these traders base their businesses. These traders were mostly born and raised in the Chencha region and have family ties to the rural areas, but base their business in outside towns. They collect products on each market day from rural markets and stay for a month or a few weeks, depending on the volume of product they need to obtain. Some travel widely, depending on the market for the products.

Other traders who are based in rural towns also assemble products and sell them in Addis Ababa and other major towns. More than 95% of the rural handloom products consumed are bought/used (via traders) by other town consumers. Almost all traders working in the Chencha district do not have trade licenses and very few specialize in handloom sales; rather, the majority mix handloom sales with other trading activities.

STRUCTURE AND FUNCTION OF CLUSTERS

Based on the survey data, we were able to isolate several cluster characteristics. For producers, three production types exist: household, rented workspace, and workshop. Household producers were more prevalent in the rural setting (see Table 3) than in the cities, both proportionally and in real terms. Traders are made up of three types of enterprises: shop, market, and roadside markets. There are no roadside markets in Addis Ababa, while the majority of enterprises in

Addis Ababa are shops. In Chencha, an overwhelming majority of traders can be found in the marketplace, rather than in shops or at the roadside.

The average size of enterprise varied widely between urban and rural traders and producers. For urban producers, average starting capital was 194 ETB (22 USD), while for rural electrified producers this fell to 95 ETB (11 USD). The story for traders was quite a bit different: in urban settings, starting capital for a trader was 6,560 ETB (732 USD), compared with 1,332 ETB (149 USD) in rural electrified settings and 1,660 ETB (185 USD) in rural non-electrified settings. This reflects an increased prevalence of shops in urban clusters, which can be explained by consumer concerns over quality in the more competitive urban environment. In all cases but the urban traders, however, the starting capital necessary was less than the per capita GNI (Atlas method) of 170 USD reported in the World Development Indicators 2008 (Development Data Group 2008). This finding is largely consistent with McKenzie and Woodruff (2006), who found that many Mexican micro-enterprises were able to enter the market despite credit constraints, as the startup costs for small-scale entrepreneurs were small enough to come from entrepreneurs' own savings.

Table 4 presents detailed funding information for each type of cluster. The most common method of starting capital across both urban and electrified rural clusters is from a household's own savings, indicating that those taking part in the clusters had enough private capital to invest to get their businesses going. All categories of producers indicated that a minimum of 40% of their starting capital came from their own savings, ranging up to 86% for urban producers (Table 4). The second most important, and most important for rural non-electrified producers, is borrowing from friends and family. At least 20% of producer starting capital came from friends and family. There were fewer observations for traders, but the general trend remained the same: own savings represents the most important source of starting capital, while borrowing from friends and family are a close second. Loans from banks are practically nonexistent for all types of traders. Starting capitals were also low because a large number of both producers and traders sought trade credits from one another to help fund operations. This reduced need for operating capital makes it easier to enter the market, enabling a greater number of participants. Initiation of

trade credit was bound by several conditions. Most important to the decision to provide credit or not was a history of successful business together. The average time period for establishing this successful business varied but stayed largely between 1-1.5 years. The rather low capital requirement for entry into the market reduces reliance on formal institutions, enabling a larger number of people to engage in handloom production through their own savings. Wide availability of trade credits further eases working capital constraints. Overall, it appears that cluster-based handloom production can occur even in the absence of the formal institutions that standard textbooks deem necessary.

To better understand the flexibility of clustering, we examined the structure of production as pertains to flows between producers and traders. These are presented in Tables 5, and 6. Most rural producers sold directly to the open market, with over 90% of respondents acknowledging this channel, while urban producers had a more varied approach with only 64% of respondents indicating this was their main channel of sale (Table 5). Shops, which require a large fixed cost, only existed in the urban producer cluster for several reasons. First, since shops are more expensive to set up, only the relatively rich urban traders can afford to establish a shop. Second, shops send a signal of high product quality. Producers would like to market their product in shops because merchandises displayed in shops are usually deemed higher quality than those sold roadside and can therefore command a higher price. Third, in urban centers, the large sale volume can help offset the higher cost of shops. In the rural areas, producers rely more on open market and visits from traders. In terms of sourcing raw materials, the picture in Addis Ababa varied from that in the rural districts in that 98.5% of the raw materials were sourced from shops, while in the rural districts shops provided only 77.2% of electrified producers' raw materials and only 58.2% of non-electrified producers' raw materials. With fewer shops in rural clusters, it is natural to see that shops play a less important role in providing raw materials.

Following analysis of production data, quality control issues were examined. Among urban producers, around 2.7 quality control complaints were reported in the last year. Among urban traders, 13.89% of quality problems were reported in the last year. The numbers for rural producers were slightly lower (2.2) and for rural traders slightly higher (16.34%). More

interesting, however, are the methods employed by traders and producers to correct quality problems. Methods for resolving quality control issues varied widely among both producers and traders in both rural and urban areas, and different methods were reported to be sued simultaneously.

The vast majority of respondents in all categories made use of "talking directly with trader/buyer" as a method of resolving a quality control dispute, with 100% of rural producers, 100% of urban traders, 93.48% of rural traders, and 97.67% of urban producers acknowledging use of this method of resolution in the past year. Other important methods of resolution included reductions in price or payment, return of products without payment, and return of product with a request for repairs. This is similar to Fafchamps' findings as well, in that Fafchamps found trade credits to be an effective means of reducing quality control problems (2004). In both Fafchamps' study and this one, traders would refuse to pay outstanding balances in the presence of quality problems. One common theme emerged: among producers, police and court systems were never utilized, and among traders, only 1.32% of urban traders utilized the police to resolve a quality control issue. These results indicate the importance of unofficial means of conflict resolution, and the ability of the cluster formation to operate in the absence of formal contractual institutions as described in Fafchamps (2004).

Production figures are presented in Table 7. The average monthly production for the most important product was 25.31 units in the rural clusters, compared to 15.55 units in rural electrified and 14.83 units in rural non-electrified clusters. To examine whether infrastructure has a smoothing effect on monthly production, the coefficient of variation across months for each location type was calculated and reported in Table 7. With a coefficient of variation of 0.05, the urban clusters had less variation between months than did rural electrified clusters (0.15), and even less variation than the rural non-electrified clusters which boasted the highest between-month variation (0.23). This indicates that there is more seasonal variation among rural and non-electrified clusters than there is in urban clusters. Our informal interviews with subjects indicate that the relatively higher variation among rural and non-electrified clusters is likely due to electrified clusters' ability to operate consistent working hours through access to lighting

independent of the season, and to access to collective workshops with sturdy roofs, which helps prevent quality control issues associated with hut roofs in the rainy season. The average sales price of one unit of the most important product is significantly higher for urban clusters than for the rural ones, and again for electrified clusters as opposed to non-electrified ones. The cost of raw materials is also greater for urban clusters than for rural clusters. The same is true of total costs in general. This is logical as it most probably reflects the fact that urban producers and traders are engaged in higher end products in a setting with higher competition than those in the rural sectors.

PERFORMANCE

One of the main purposes of this study is to understand the determinants of productivity in industrial clusters. The basic hypothesis proposed by this paper is that infrastructure improvements facilitate cluster productivity. Urban versus rural clusters, and within rural clusters electrified versus non-electrified clusters, have different productivities based on the specific environment available. This paper proposes that labor productivity in clusters with access to electricity will be higher than those who do not have access to electricity.

Our initial examination of the data consisted of a set of pair-wise t-tests, first between the rural and urban clusters, and then between rural clusters with and without access to electricity. An examination of average daily hours worked shows that workers in non-electrified rural villages only worked 7.21 hours per day while their counterparts in other electrified (but rural) villages worked 10.73 hours per day (Table 8). A comparison of rural and urban clusters yielded a similar result, with those clusters located in Addis Ababa, who all have access to electricity, working 10.3 hours per day and those in the rural areas as a whole working 9.03 hours per day. These results show that clusters with access to electricity do work longer hours than their non-electrified counterparts.

Enterprise size was the next variable to be analyzed. Our results indicate urban clusters have 1.83 workers per enterprise and rural clusters have 1.31 workers per enterprise in electrified clusters

and 1.67 workers per enterprise in non-electrified clusters. To determine the productivity of the workers in each location, we ran pair-wise t-tests for the average annual revenue per worker. We found that annual revenue per worker was significantly higher in the urban clusters than in the rural clusters (14,859 ET Birr/worker compared to 7,237 ET Birr/worker, significant to the .001 level). Given the higher operational cost associated with better quality products, this finding is not surprising. Similarly, rural non-electrified clusters had a far smaller revenue per worker than did their electrified counterparts (6,021 ET Birr/worker compared with 8,461 ET Birr/worker, significant to the .10 level).

Next, we calculated value added, defined as revenue less operational costs and cost of raw materials, and tested the profit per worker for urban versus rural clusters and electrified versus non-electrified clusters. These results are presented in Table 8 as well. Once again, the results show that the producers in electrified towns were more productive than their counterparts without electricity.

However, the simple t-test comparisons may omit some important factors, such as capital, which could contribute to the observed differences between electrified and non-electrified towns. Our next level of examination was to control for capital availability per labor and other factors in multivariate regressions. We record labor productivity through two different measures, revenue per worker and value added per worker, to test the robustness of our findings. The estimation regression for revenue/labor is as follows:

$$\ln\frac{Y}{L} = \alpha + \beta \ln\frac{K}{L} + \boldsymbol{\gamma} \cdot \boldsymbol{X} + \varepsilon \qquad (1)$$

Where *Y* stands for the annual sales revenue for the top three most important products, L stands for the number of workers who contributed to production; *K* stands for the sum of fixed assets, operating costs, and annual cost of raw materials. X is a vector of enterprise type and community and infrastructure controls (dummy variables for Rented Workspace and Workshop, Addis Ababa, electrified, and health center), and ε is an error term. Rented workspace producers are all considered to have a single worker (as each enterprise is made up of one owner/operator who is

renting workspace from a separate entity). Fixed assets are defined as the current value if sold (in Et Birr) of major assets, specifically production equipment. Operating costs are defined as recurring monthly costs in ET Birr of operating the business, aggregated to a full year, and include (but are not limited to) taxes, utilities, insurance, and other costs as appropriate. Cost of raw materials is the self-reported per-unit cost expressed in ET Birr multiplied by annual production units.

The second measurement is value added/labor, with the following estimation regression:

$$\ln\frac{\overline{Y}}{L} = \alpha + \beta \ln\frac{\overline{K}}{L} + \boldsymbol{\gamma} \cdot \boldsymbol{X} + \varepsilon \qquad (2)$$

where $\overline{Y}$ is the annual value added; $\overline{K}$ is the total amount of fixed assets per enterprise; X represents the same vector of enterprise type and community and infrastructure controls; ε is an error term. Value added is defined as the annual sales revenue of the three most important products less the annual cost of raw materials and operational costs.

Tables 9a and 9b report the findings from our initial regression analysis for labor productivity measured in revenue and value added, respectively. Seven specifications are presented in the tables. The first specification is for the whole sample, including a set of dummy variables: electrification, Addis Ababa, rented workspace, and workshop. In addition, years of established the business are included as a control variable. Next, we run regressions based on two stratified samples, the urban clusters (Addis Ababa) and rural clusters (Chencha). In regression 4, a dummy variable for having a health center in town, surveyed only the rural clusters is included. In the last two regressions, the Chencha sample is further stratified into electrified and non-electrified samples. The coefficients for the capital per worker variable are significant in all the specifications in Table 9a and six out of seven specifications in Table 9b. However, the coefficients for the electrified variable are insignificant in any of the regressions in the two tables, which are somewhat contrary to simple t-test results in Table 8. In order to solve this

puzzle, we ran a nonparametric Lowess plot of labor productivity for both measures. These plots are presented in Figure 2.

From the Lowess plots of electrified versus not electrified communities in Figure 2, we can clearly see that the labor productivity performance differs greatly among the bottom segment of the producers in terms of capital per worker. For enterprises with the smallest ratio of capital to labor, typically those with little financial resources, labor productivity is significantly higher for those enterprises with access to electricity. This trend seems to be more prevalent in measures of value added per worker.

Revenue is not a good indicator of labor productivity as it includes the cost of raw materials and operational cost. After controlling for capital and other factors, revenue no longer varies between producers in electrified towns than non-electrified towns. To clarify the relationship of electricity within the different groups, we focus on value added per worker, a better measure of labor productivity by running the same equation as previously used, but this time stratifying the sample into thirds by size of fixed assets to workers. These regressions were run only for the Chencha region, which is considered rural, to bring out the specific impact of electricity and other infrastructure variables, as opposed to including Addis Ababa in the sample. Results of these regressions are presented in Table 10.

The results are consistent with the visual patterns revealed in Figure 2, particularly for the bottom third of the sample. The value added per worker regressions indicate that for the bottom third of the sample, enterprises with access to electricity are 55% more productive than their counterparts in non-electrified communities. This implies that the electrification improves the productivity for those with the least access to credits. For enterprises on the lower end of the spectrum, access to electricity enables sharing of rented workspace and longer working hours, which contributes to higher returns.

CONCLUDING COMMENTS

This study presents primary data describing cluster activities in Ethiopia. This study is different in that it covers both rural and urban clusters in an African country in detail, an area which has previously received only limited attention by researchers. Rural clustering is a previously under-studied topic, particularly in the context of African developing countries. With its low cost of entry, and the market access and cost reduction it entails, clustering is a viable mode of improving nonfarm incomes in rural areas which are often financially constrained.

Our study shows that cluster activities can survive even in harsh environments with no formal institutions and limited infrastructure. Entrepreneurs are able to seek new production structures to circumvent the constraints they face. With the low cost of entry inherent in the clustering mode of production, many potential entrepreneurs with limited financial resources are able to engage in productive nonfarm activities which contribute to overall household income. The use of trade credit helps entrepreneurs to ease the constraints of operating capital necessary to run their business, which makes participation in the market easier. Despite the high degree of adaptability inherent in the organizational structure of clusters, improvements in infrastructure can further boost labor productivity. Clusters with access to electricity are able to work longer hours, increasing the labor productivity. Access to shared workspace reduces individual producer costs through shared rent and services costs. Both average revenues and value added per worker are higher for clusters with access to infrastructure. Even after controlling for other factors, it is evident that access to electricity greatly contributes to higher labor productivity for those with limited financial assets.

Within the African context, the promotion of less-capital intensive production systems can be extremely useful when capital markets are less developed and most entrepreneurs have limited financial resources. The clustering production structure provides a way for many potential entrepreneurs to participate in nonfarm activities, particularly in the rural sector. Further research is needed to examine the origins and evolution of clusters as well as ways to facilitate their growth.

Table 1: Urban and rural sample breakdown

Urban Clusters	Producers	Traders	Total
Shiro-Meda (kebele 18)	46	0	46
Shiro-Meda (kebele 19-21)	52	76	128
Adisu-Gebeya	35	21	56
Kechene-Medhaniyalem	62	0	62
Total	195	97	292

Rural Clusters	Producers	Traders	Total
Chencha	55	15	70
Dorze	51	21	72
Ezo	39	16	55
Shama	39	0	39
Mesho	64	5	69
Zozo	43	0	43
Total	291	57	348

Table 2: Sample population and size of the rural cluster

	Sample population	Sample size	% from sample population size
Chencha wereda	12045	293	2.4
Electrified towns	7948	142	1.8
Chencha town	1774	52	2.9
Chencha kebele 01	338	14	3.8
Chencha kebele 02	512	16	3.1
Chencha kebele 03	924	22	2.4
Ezo town	2305	38	1.6
Dorze town	3869	52	1.3
Non-electrified towns	4097	151	3.7
Deco-mecho	1584	66	4.1
Mesho	493	20	4.1
Kale	480	20	4.1
Shaye	264	11	4.1
Losha	347	14	4.1
Zozo	922	44	4.8
Setena borche	430	20	4.8
Boyena tupa	239	11	4.8
Gendo gembela	253	12	4.8
Shama	1591	41	2.5
Shama town	829	21	2.5
Webera	762	19	2.5
Total	12045	293	2.4

Note: population is based on household head.

Table 3: Composition of the sample

	Addis Ababa		Electrified		Not Electrified	
Total number of observations	292		199		151	
Share of producers in sample	195	66.78%	145	73.60%	146	96.69%
Types of producer enterprise						
Household	109	55.90%	72	49.66%	114	78.08%
Rented Workspace	74	37.95%	72	49.66%	32	21.92%
Workshop	12	6.15%	1	0.69%	0	0%
Technology of production (# of producers)						
Traditional/wooden	147	75.38%	145	100%	146	100%
Improved wooden	0	0%	0	0%	0	0%
Improved metal	43	22.05%	0	0%	0	0%
Modern/semi-automatic	5	2.56%	0	0%	0	0%
Share of traders in sample	97	33.22%	52	26.13%	5	3.31%
Types of trader enterprises (# of traders)						
Shop	77	79.38%	1	1.92%	0	0%
Market	20	20.62%	43	82.69%	5	100%
Roadside	0	0%	8	15.38%	0	0%

Note: Electrified vs. Not Electrified includes only the Chencha District.

Table 4: Starting capital

	Addis Ababa				Electrified				Not Electrified			
	Producer		Trader		Producer		Trader		Producer		Trader	
Value of starting capital (in ET Birr)	194.29		6,559.56		95.23		1,332.23		114.86		1,660	
Value of starting capital (in USD)	21.68		732.09		10.63		148.69		12.82		185.27	
Source of starting capital *												
Own savings	48.38	86	67.42	59	45.34	62	80.19	41	41.25	51	80	4
Borrowing from friends and family	27.39	47	21.96	17	34.45	46	10.19	4	43.24	54	20	1
Loan from foreign bank or donor agency	0	0	0	0	0	0	0	0	0	0	0	0
Loan from bank	0	0	0	0	0	0	0	0	0	0	0	0
Loan from suppliers	0	0	0	0	0	0	0	0	0	0	0	0
Loan from traders	0	0	1.03	1	0	0	0	0	0	0	0	0
Gift from family	19.08	35	5.67	5	18.62	27	5.77	3	14.83	21	0	0
Loan from private money lender	0.51	1	1.03	1	0.90	1	0	0	0	0	0	0
Gift from employer	1.10	2	0	0	0.69	1	0	0	0	0	0	0
Loan from microfinance	2	3	2.89	1	0	0	3.85	2	0	0	0	0
Relatives/friends	0	0	0	0	0	1	0	0	0	0	0	0
Support NGOs	0.31	0	0	0	0	0	0	0	0	0	0	0

* As % of total starting capital, followed by the number of respondents who reported as sole source of capital.

Table 5: Sale of products

	Addis Ababa	Electrified	Not Electrified
	Producer	Producer	Producer
Method of sale (% of Respondents)			
Open market	63.59	93.79	99.32
Door-to-door buyers	8.21	2.07	0
Third party	14.87	4.14	0.68
Street stand/shop	13.33	0	0
Most important buyer (% of Respondents)			
Open market (same town)	43.08	87.59	41.78
Open market (other town)	8.72	4.14	56.85
Shop keeper (same town)	23.08	1.38	0
Shop keeper (other town)	4.62	1.38	0.68
Visiting trader	5.13	0	0
Direct sale to consumers	2.05	0.69	0.68
Order by contract/third party	12.82	3.45	0
Door-to-door buyers	0	0.69	0
Other	0.51	0.69	0

Table 6: Supply of products

	Addis Ababa		Electrified		Not Electrified	
	Producer	Trader	Producer	Trader	Producer	Trader
Source of raw materials (% of Respondents)						
Open market	1.54	--	22.07	--	41.78	--
Third party	0	--	0.69	--	0	--
Shop	98.46	--	77.24	--	58.22	--
Most important supplier (% of Respondents)						
Open market (same town)	2.56	55.67	24.14	75	19.86	40
Open market (other town)	0	6.19	0.69	17.31	28.77	60
Shop keeper (same town)	91.28	9.28	68.97	1.92	20.55	0
Shop keeper (other town)	6.15	0	6.21	0	30.82	0
Visiting trader	0	20.62	0	0	0	0
Other	0	8.25	0	5.77	0	0

Table 7: Production

	Addis Ababa		Electrified		Not Electrified	
	Producer	Trader	Producer	Trader	Producer	Trader
Number of observations	195	97	147	52	146	5
Average monthly production for top product (in product units)	25.31	--	15.55	--	14.83	--
Monthly coefficient of variation (variation across months for each location)	0.05	--	0.15	--	0.23	--
Average sales price of one unit of most important product (ET Birr)	116.07	130.32	56.25	46.03	47.9	28.2
Cost of raw materials to produce one unit of most important product (ET Birr)	69.38	--	39.42	--	33.47	--
Number of days taken to produce one unit of most important product	3.11	--	1.82	--	1.68	--
Average other costs in the last month (in ET Birr, unless otherwise noted)						
Rent paid	33.91	482.04	7.42	12.21	5.58	6
Loan interest paid	2.54%	4.39%	0.91%	38.87%	0.63%	0%
Electricity payment	12.21	34.97	5.86	6.62	0.43	0
Water payment	8.20	5.77	0.13	0.6	0	0
Telephone payment	13.47	77.58	0.97	16.82	0.05	12
Fuel payment	0	23.92	0.10	2.46	0	6.2
Transportation (excluding fuel) payment	17.79	65.82	3.42	221.56	1.82	185.6
Office supplies payment	0.16	4.95	0	9.13	0	0
Wage paid	54.87	183.61	8.80	23.44	0.07	9
Insurance paid	0	0.68	0	0	0	0
Promotion/advertising/design	0.03	1.65	0	0	0	0
Shop/other maintenance	4.29	23.75	0.69	1.35	1.10	0
Tax paid	0.19	51.57	0.78	36.22	0.81	4
Storage payment	0.07	3.09	0	18.33	0	7
Payment to meals provided to workers	3.03	55.05	0.34	0.38	0	0
Payment to security/janitor	0	0.62	0	0	0	0
Payment for accommodation/food	0	7.94	0	77.6	0	106.8
Other major costs	0.26	1.66	1.11	13.08	1.03	0
Total average costs	146.89	1024.67	35.49	439.79	10.87	336.60

1 USD = 8 ET Birr

Table 8: Productivity Measures

	Addis Ababa	Chencha*	P-Value	Electrified	Not Electrified	P-Value
Hours worked per day (average)	10.3	9.03	0.001	10.73	7.21	0.000
Average number of workers per enterprise	1.83	1.49	0.003	1.31	1.67	0.000
Average annual revenue per worker (In ET Birr/worker)	14,859.38	7,236.93	0.000	8,460.75	6,021.49	0.021
Average annual value added per worker (In ET Birr/worker)	4,427.22	2,168.72	0.000	2,543.74	1,796.28	0.086

*All rural clusters, as a whole.

Note: Value added = revenue - fixed and variable capital costs + wage + taxes. 1 USD = 8.96 ET Birr

Table 9a: Regression Results – Revenue/Labor

	All	Addis Ababa	Chencha (1)	Chencha (2)	Electrified	Not Electrified
LN[(K + CORM)/L]	1.004***	0.970***	1.030***	1.030***	1.044***	1.025***
	(0.020)	(0.032)	(0.027)	(0.027)	(0.027)	(0.042)
Electrified	-0.042		-0.040	-0.043		
	(0.028)		(0.027)	(0.029)		
Addis Ababa	0.065**					
	(0.032)					
Year Established	0.003***	0.005***	0.001	0.001	0.001	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Rented Workspace	-0.029	-0.004	-0.044	-0.052*	-0.022	-0.102**
	(0.026)	(0.050)	(0.027)	(0.030)	(0.038)	(0.051)
Workshop	-0.085	-0.039				
	(0.071)	(0.077)				
Healthcenter				0.026	0.039	0.031
				(0.035)	(0.038)	(0.063)
Constant	-5.545***	-8.479***	-2.740	-2.833	-2.188	-3.413
	(1.861)	(3.066)	(2.193)	(2.205)	(2.689)	(3.162)
Adjusted R-Squared	0.919	0.892	0.920	0.920	0.932	0.906
AIC	94.688	80.974	3.515	4.751	-44.220	41.883
Observations	480	190	290	290	144	146

Note: K is the total amount of fixed assets plus operating costs; CORM is the annual cost of raw materials; L is the number of workers involved in production per enterprise. Rented Workspace is a dummy variable indicating an observation in a shared rent workspace, with each respondent operating a separate enterprise. Workshop indicates a wholly owned building, operating as one enterprise. Workshops were only found to exist in Addis Ababa. Healthcenter captures the presence of a health care center in a community. Healthcenter was only collected in the Chencha region. The symbols "*", "**", and "***" stand for significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Table 9b: Regression Results – Value Added/Labor

	All	Addis Ababa	Chencha (1)	Chencha (2)	Electrified	Not Electrified
LN(Fixed Assets/L)	0.292***	0.305***	0.336***	0.338***	0.078	0.587***
	(0.057)	(0.082)	(0.096)	(0.097)	(0.128)	(0.161)
Electrified	0.175		0.213	0.209		
	(0.139)		(0.143)	(0.145)		
Addis Ababa	0.461***					
	(0.147)					
Year Established	0.007*	0.018***	-0.002	-0.002	-0.006	0.002
	(0.004)	(0.006)	(0.005)	(0.005)	(0.008)	(0.007)
Rented Workspace	0.206	0.091	0.236	0.224	0.315	0.085
	(0.130)	(0.247)	(0.153)	(0.167)	(0.206)	(0.265)
Workshop	0.370	0.335				
	(0.348)	(0.376)				
Healthcenter				0.035	0.126	0.072
				(0.150)	(0.213)	(0.212)
Constant	-8.538	-28.716**	8.933	8.784	18.354	0.965
	(8.305)	(12.711)	(10.080)	(10.185)	(15.785)	(13.477)
Adjusted R-Squared	0.215	0.201	0.066	0.063	0.008	0.126
AIC	1417.979	538.485	877.034	878.971	441.524	437.445
Observations	472	185	287	287	142	145

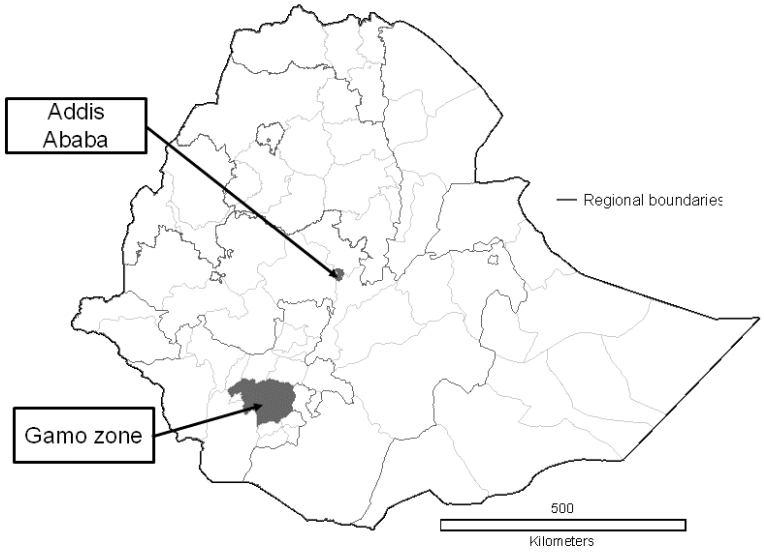
The symbols "*", "**", and "***" stand for significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Table 10: Regression Results – Segmented Value Added/Labor

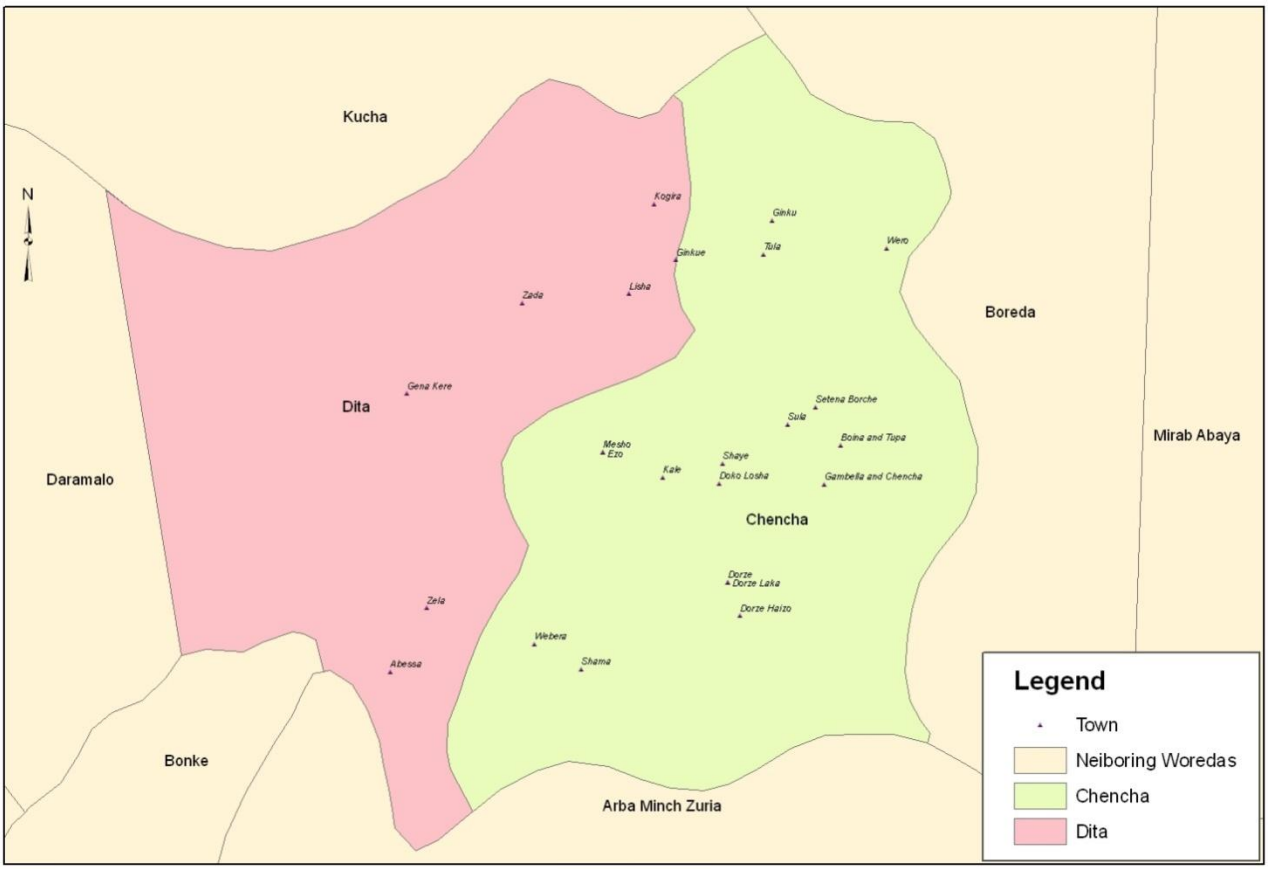
	Bottom Third	Middle Third	Top Third
Fixed Assets/Labor	0.535*	1.291***	0.450
	(0.283)	(0.387)	(0.303)
Electrified	0.552**	0.546**	-0.286
	(0.234)	(0.267)	(0.271)
Year Established	-0.002	-0.002	0.001
	(0.009)	(0.009)	(0.010)
Rented Workspace	0.780**	-0.325	0.076
	(0.316)	(0.284)	(0.278)
Healthcenter	-0.379	0.143	0.483*
	(0.249)	(0.250)	(0.261)
Constant	9.432	4.779	3.600
	(18.293)	(17.101)	(18.875)
Adjusted R-Squared	0.184	0.058	0.028
AIC	278.667	296.584	302.721
Observations	94	98	95

Note: The sample for Chencha was divided into thirds based on the size of the capital to labor ratio. The symbols "*", "**", and "***" stand for significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Figure 1: Study sites

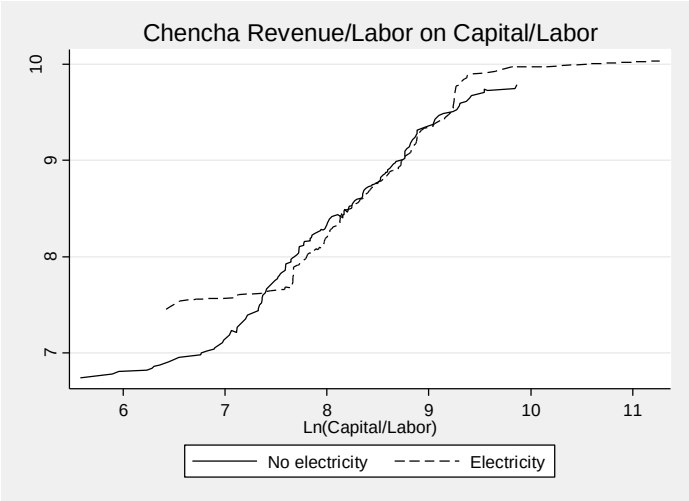


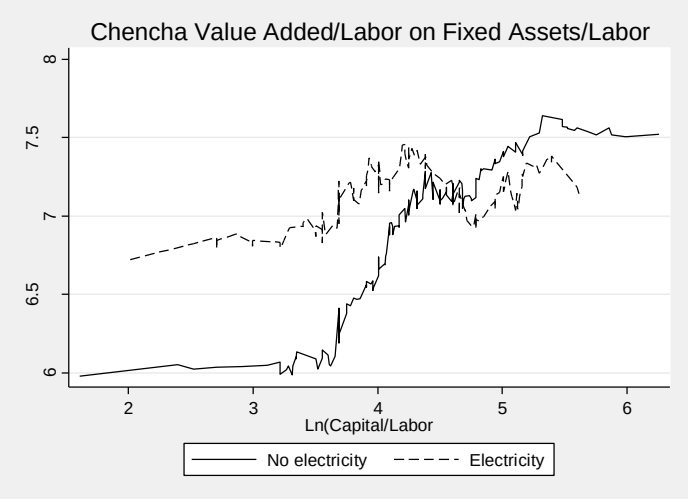
Gamo Zone



Source: Drawn by authors.

Figure 2 : Electrified vs. Not Electrified Lowess Plot – Chencha Revenue and Value Added





Note : The first chart shows Revenue/Labor versus Capital/Labor. The second shows Value Added/Labor versus Fixed Assets/Labor. Both charts show the Chencha Region.

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