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## Impact of Manufacturing Equipment on Growth of Smallholder Agro-processing Industry in Bureti District, Kericho County, Kenya

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### Abstract

A gradual shift from agriculture to industry has been witnessed in the pattern of economic growth in developing countries over the past decade. Agro-processing is being focused-on as the main driver of the transformation from primary agriculture to industry to provide additional income generating opportunities. In spite of the emerging importance of agro-processing in the industrialization process its growth has been faced with the constraints of access to agro-processing technologies, especially among smallholder agribusinesses. This research sought to determine the extent to which access to manufacturing equipment impact on growth of smallholder agro-processing industry using a cross-sectional descriptive design. The study found that costs of acquiring manufacturing equipment and distances to sources of manufacturing equipment, as influential factors of access to technology, have inverse relationships with growth of smallholder agro-processing industry.

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For instance chi-square test for relationship between distances to manufacturing equipment sources and the number of smallholder agro-processing businesses set up was significant at 0.05 confidence level ( $\rho$ -value = 0.002). It was established that long distances travelled to purchase manufacturing equipment are critical impediments to growth in number of smallholder agro-processing businesses. Similar trends were observed between cost of manufacturing equipment and growth in number of agro-processing businesses as high costs of equipment constrained the access to – and – therefore reduced the rate of growth in number of small agro-processing businesses. Diversity of processing equipment was found to be low and had linear relationship with growth of the industry. It was therefore concluded that low level of access and narrow range of agro-manufacturing equipment significantly constrain the growth in number of smallholder agro-processing units. It was recommended that governments should create conducive environment for local manufacture of agro-manufacturing equipment as a strategy of stimulating and decentralizing agro-industrialization of rural areas.

**Keywords:** Bureti-Kenya; Growth in number; Impacts of manufacturing equipment; Smallholder agro-processing units or businesses.

## 1. Background of the study

Today, agriculture related industrial businesses are the main occupation of rural people in many parts of the world. At global level agro-processing industry has realized tremendous growth in size and complexity [1]. Agro-processing industry continues to process simple agricultural goods while also transforming highly sophisticated industrial inputs that are often the result of considerable investments in manufacturing technology and innovation [2]. Corresponding to this growing complexity of inputs is an increasing range of transformation processes, characterized by physical and chemical alteration, aimed at improving the marketability of raw agricultural produce. Satisfaction of these varied needs requires a wide variety of manufacturing equipment ranging from simple home tools to the advanced industrial machinery. These complexities make it crucial for agro-processors to employ varied types of manufacturing equipment in their businesses.

Access to agro-manufacturing equipment enables new agro-processing businesses to be set up and existing ones to be expanded. Growth in agro-processing sub-industry is therefore dependent on, among other factors, the availability and access to suitable manufacturing equipment. The concept of access to manufacturing equipment has many dimensions. One important aspect is availability of equipment to agro-processors. However, for the available equipment to be functionally accessible to prospective users several factors must be ensured. Factors such as equipment purchase capital, local availability of the manufacturing equipment and the back-up service rendered by dealers are important determinants of functional access to agro-processing technology and the consequent growth of agro-processing industry [3,4]. Other factors are; the cost of equipment and spares and presence of in-built or within-business technical skills to operate the manufacturing equipment [5,6]. These factors are especially critical in the remote settings where, as the case in Kenya, most smallholder agro-processors are located [6].

In Kenya the importance of agro-industry is underpinned by the fact that approximately 80 percent of the population derives livelihood from agriculture and its linkages with other sectors such as agro-manufacturing.

However the results of Government efforts in improving access to manufacturing equipment are still unquantified: access to agro-processing equipment has gained recognition in policy circles due to its potential to commercialize and industrialize the whole agricultural-sector but its impact on agro-processing industry at smallholder level is still not estimated [7,8]. According to [9] Kenya's small-scale entrepreneurs often receive technical and financial support from grass-root organizations. The Government of Kenya employs a two pronged approach involving public and private institutions to increase funds access to small-scale enterprises for acquisition of agro-manufacturing equipment. Aid funds, grants and credit to small-scale agro-processing enterprises have therefore been channeled to entrepreneurs through various programmes and organizations to support acquisition of input factors including agro-manufacturing equipment [7,10]. Reference [9] however, reckons that the often unknown is whether these groups access the right tools and equipment with the funds they get; and if they do, what has been the impact of the equipment on the income generating activities (IGAs). One way the impact of access to agro-processing technologies on smallholder agro-processing industry can be seen is through the effect such acquired tools and equipment have on agro-processing businesses.

## **2. Statement of the problem:**

Up-to 2002 Kenya's sectoral plans for agriculture were criticized for their failure to recognize the existing agro-processing opportunities among smallholder farmers. These past agricultural sector plans are said to have been unresponsive to external economic environment to the extent that attaining food security became elusive and agricultural growth continued to decline [8]. Kenya today puts strategic importance on agro-processing sub-sector as the driver of agricultural modernization and has, since 2003 developed policies aimed at improving access to agro-processing technologies among small-scale farmers. The turning of focus to smallholder agro-processing industry is, perhaps, an admission that the future growth in the levels of agro-industrialization lies not with the large corporations but with smallholders who constitute the weakest part in the agricultural product value chain. In spite of this emerging importance of agro-processing sector its growth has been faced with a number of constraints. One of the major constraints is that of inadequate access to agro-processing technologies at local level. This challenge raises fundamental questions about how it impacts on growth of the smallholder agro-processing sub-sector in Kenya. In Bureti District, [11] indicates that Ministry of Agriculture (MoA) has provided Kenya shillings (KES) 40.2 million in grants to 18 smallholder agribusiness groups in the last 7 years to acquire new agro-manufacturing technologies to modernize their enterprises. Whether or not there is a relationship between access to agro-manufacturing equipment by small-scale farmers and growth in number of smallholder agro-processing income generating activities (IGAs) is a gap to be investigated. Reference [9] in her research project undertaken in Nyando District observed that; *"rural people often received technical and financial support from grassroots organizations but the often unknown is whether these groups access the right tools with the funds they get; and if they do, what has been the effect of these tools on the IGAs"*. This statement aptly captures the justification for this study.

## **3. Objective of the study:**

(i) To determine the extent to which manufacturing equipment impact on growth of smallholder agro-processing industry in Bureti District, Kericho County, Kenya.

#### 4. Significance of the study:

The study results could be useful in formulating future agro-processing development strategies for smallholder farmers in Kenya’s agro-industry. The findings could influence farmers or producers, entrepreneurs, government and non-government organizations, who may want to intervene in the smallholder agro-processing and marketing chain. The study findings will enlighten International development partners who may have interest in supporting the smallholder farming communities, and financial institutions with interest in providing development credit to the informal sector.

#### 5. Conceptual framework:

The impact of agro-processing technologies on growth of agro-processing industry is anchored on the conceptual framework given in Figure I below. It is postulated that the level of growth of smallholder agro-processing industry (dependent variable measured by the number of agro-processing IGAs set up) is affected by the degree of access to agro-processing technologies (independent variable measured by access to manufacturing equipment). The relationship between the independent and dependent variables is regulated by access to investment finance (intervening variable). When finances are accessible to smallholder entrepreneurs they use the funds to acquire manufacturing equipment to set up agro-processing units [10]. Access to investment finance also is moderated by government policy environment. Access to agro-processing equipment is examined in the context of cost of purchasing the equipment, diversity of accessed processing equipment and the distances travelled to source the equipment. The impact of access to agro-processing equipment on growth of the smallholder agro-processing industry is measured in terms of the increase in number of agro-processing units.

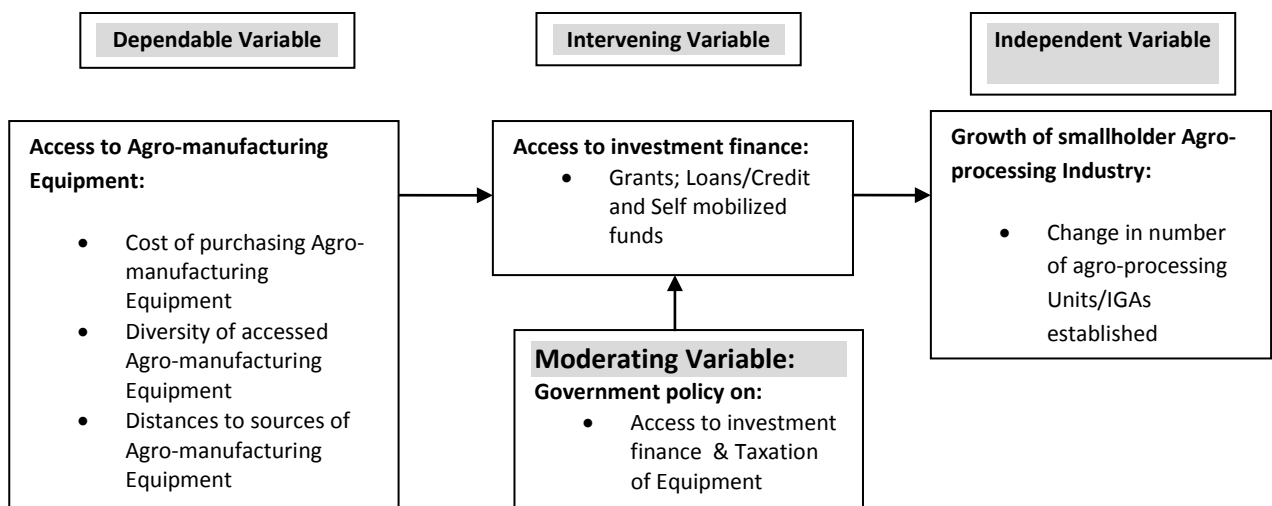


Fig. 1: Schematic diagram of the conceptual framework

## 6. Research methodology

The study was carried out using cross-sectional descriptive survey design. The sample size in this study was determined using the table provided in [12] for sample size determination. The sample comprised of 196 individuals drawn from target population of 400 members. It consisted of 183 smallholder agro-processors drawn from farmer groups, 3 individually practicing agro-processors and 10 agro-processing technical advisors. The study used mixed sampling techniques involving area sampling, purposive sampling in specific aspects and stratified sampling enriched with simple random method without replacement. A mixture of both quantitative and qualitative empirical data was collected. The study mainly relied on primary data collected from individual agro-processors, members of agro-processing groups and MoA technical officers in Bureti District. Data collection instruments included questionnaires and interview schedules. The data was coded, entered into SPSS programme and analyzed with the assistance of both qualitative and quantitative approaches. Statistical procedures included descriptive statistics and inferential analysis. The researcher used frequency tables to present the data.

## 7. Findings and discussions

### 7.1 Cost of manufacturing equipment and the number of agro-processing units/IGAs

#### 7.1.1 Investment cost of equipment and the number of agro-processing IGAs/units

Table I presents findings on the investment equipment cost requirements of different agro-processing units or businesses.

**Table I:** Distribution of agro-processing IGAs based on cost of manufacturing equipment

Equipment investment cost, KES	Frequency (f)	Percent (%)
Less than 10,000 (Less than 100USD)	0	0.0
10,000 – 50,000 (100 – 500USD)	49	26.3
50,001 – 100,000 (500 - 1,000USD)	0	0.0
100,001 – 300,000 (1,000-3,000USD)	98	52.6
300,001 – 500,000 (3,000-5,000USD)	0	0.0
Cost Over 500,000 (Over 5,000USD)	39	21.1
<b>Total</b>	<b>186</b>	<b>100.0</b>

Source: Own Computation from the Study Data – July, 2013

The findings show that most smallholder agro-processing businesses (52.6 percent) require between KES 100,000 and 300,000 to purchase agro-processing equipment to start up agro-processing IGAs. Another 21.1 percent require more than KES 500,000. This magnitude of investment, to smallholder farmers who largely depend on own funds to start agro-processing IGAs, is generally unachievable to many.

### 7.1.2 Impact of cost of equipment on the number of agro-processing IGAs/units

Smallholder agro-processors' experiences regarding the impact of agro-manufacturing equipment costs on their businesses/IGAs are shown in Table II.

**Table II:** Impacts of agro-manufacturing equipment costs on agro-processing IGAs

Response parameter	Frequency (f)	Percent (%)
Rapid increase in number of IGAs/Units	9	5.0
No increase in number of IGAs/units	28	15.0
Slowed rate of increase in number of IGAs/units	149	80.0
<b>Total</b>	<b>186</b>	<b>100.0</b>

Source: Own computation from the study data – July, 2013

The findings show that 149 (80.0 percent) of agro-processors perceived that the rate of growth in number of agro-processing IGAs established in their areas slowed down as a result of the cost of manufacturing equipment. Five (5.0) percent of the agro-processing respondents, however, noted rapid increase in number of IGAs. These results imply that current cost of agro-manufacturing equipment is a factor that constrains the establishment and expansion of smallholder agro-processing businesses. This could be attributed to inhibitions occasioned by high costs of manufacturing equipment needed by smallholder agro-processors to expand or start new agro-processing IGAs. These results confirm the findings by [4] who concluded that unaffordable costs of agro-processing equipment and lack of equipment purchase capital are the greatest impediments to adoption of technological innovations by small-scale processors.

## 7.2 Diversity of manufacturing equipment and growth of agro-processing industry

### 7.2.1 Diversity or types of agro-processing equipment available in Bureti district

Table III provides the results of the investigation on diversity of agro-manufacturing equipment based on the distribution of agro-processing IGAs.

The findings indicate that there were six (6) major types of agro-processing tools available with small-holder agro-processing IGAs. However, the level of access to these equipment among small-holder agro-processors

was low with less than 31.0 percent indicating ownerships. Slicing equipment and crushing tools were the most available with about 30.3 percent and 21.4 percent of agro-processing farmers, respectively, reporting ownership. Use of mechanized equipment in small-scale agro-processing IGAs owned by the respondents was limited mainly to crushing operations, thermal and non-thermal techniques of preservation.

**Table III:** Diversity of agro-manufacturing equipment available in Bureti District

Type of agro-processing tool	Percent availability (%)	Percent distribution of power source (%)	
		Manual	Automatic/Electric
Crushing Tool	21.4	64.0	36.0
Slicing Tool	30.3	97.2	2.8
Thermal Preservation	19.0	63.6	36.4
Sorting Equipment	2.6	100	0.0
Packaging Equipment	17.2	100	0.0
Non-thermal preservation tool	9.5	0.0	100
Grinding Tool	0.0	-	-
<b>Total</b>	<b>100</b>	<b>-</b>	<b>-</b>

Approximately 36.0 percent, 36.4 percent and 100.0 percent of agro-processors who had these equipment respectively reported using electrically powered devices within their business units. Most agro-processing operations in the district therefore largely depend on manually operated tools and equipment. The degree of dependence on manual equipment ranged between 63.6 percent in thermal preservation and 100 percent in sorting and packaging.

### 7.2.2 Diversity of manufacturing equipment and impact on the number of processing IGAs

The impact of diversity of agro-manufacturing equipment on the number of agro-processing units established

was determined by asking the respondents to indicate their experiences based on a number of pre-determined indicators. The summary of the results is presented in Table IV.

**Table IV:** Diversity of manufacturing equipment and numbers of agro-processing IGAs

<b>Type of impact on number of Agro-processing IGAs</b>		
<i>Impact of equipment diversity (change in number of IGAs)</i>	<i>Frequency (f)</i>	<i>Percent (%)</i>
Rapid increase	112	60.0
No increase	74	40.0
Slowed rate	0	0.0
<b>Total</b>	<b>186</b>	<b>100.0</b>

Source: Own computation from study data – July, 2013

Findings indicate that 60.0 percent of farmers noted positive impact on the number of agro-processing IGAs or units established in their areas as a result of the diversity of agro-manufacturing equipment. Forty (40.0) percent of the respondents did not experience any impacts. The nature of impacts indicated includes rapid increase in the number of agro-processing businesses reported by 112 (60.0 percent) agro-processors. The remaining 74 (40.0 percent) of the respondents indicated no increase in the number of agro-processing businesses.

These findings suggest that diversity of agro-manufacturing equipments leads to rapid increase in the number of agro-processing businesses. This increase could be occasioned by the wider processing options brought about by the diverse types of processing equipment. Interview with agro-processors established that there has been an emergence of different types of agro-processing tools in the district brought about by the inception of MoA-supported programmes which promoted value addition of agricultural produce. However, the 40.0 percent 'no increase' rating by respondents could be attributed to other constraining factors like lack of equipment purchase capital, lack of technical skills and inadequate raw materials.

### **7.3 Distances to manufacturing equipment sources and growth of processing industry**

#### **7.3.1 Distances to the sources of agro-manufacturing equipment**

The distance to the sources of agro-manufacturing equipment has a significant bearing on accessibility especially among rural smallholder farmers who have limited financial capability. The study results given in Table V show that 83 (44.4 percent) small-scale agro-processors relied on local markets which lie within a radius of less than 50 km to purchase their agro-processing tools and equipment. Interviews with these farmers found that agro-processors who satisfied their processing equipment needs from within the locality realized



lower costs of acquisition. This resulted into a better access to agro-processing equipment by smallholder agro-processors.

**Table V: Distances to the sources of agro-manufacturing equipment by smallholder processors**

<b>Distance to the source of agro-manufacturing equipment (km)</b>	<b>Frequency (f)</b>	<b>Percent (%)</b>
Radius less than 50	83	44.4
50 – 100	10	5.6
101 – 150	0	0.0
151 - 400	62	33.3
More than 400	31	16.7
<b>Total</b>	<b>186</b>	<b>100.0</b>

Source: Own computation from study data – July, 2013

Findings indicate that a significant 55.6 percent (103) of farmers moved distances ranging from 50 to more than 400 km to search for agro-processing equipment. This suggests that equipment needs of the majority of agro-processors are not met from local sources. Thus additional costs are incurred to access the equipments from far-off markets such as Nairobi (151 – 400 km) which supplied 62 (33.3 percent) of the respondents with equipment. Regions in the 50 – 100 km zone, which is the second nearest source, supplied only 10 (5.6 percent) of the respondents. Agricultural Extension Advisors explained that farmers only seek relatively more sophisticated equipment from outside regions and such tools are found almost exclusively in Nairobi/Central region.

### **7.3.2 Distances to agro-equipment sources and the number of processing IGAs**

Findings indicate that 149 (80.0 percent) agro-processors felt that long distances to the sources of manufacturing equipment slowed the rate of growth in the number of agro-processing IGAs established in their areas (Table VI). Twenty (20.0) percent or 37 agro-processors did not notice any change in the number of agro-processing IGAs.

businesses. Agro-processors reported that delays in acquiring equipment sometimes take up to one (1) year whenever farmers lacked capacity to cater for these additional costs. This substantially delays the establishment of the planned agro-processing units/businesses. Farmers who returned a 20.0 percent ‘no increase’ verdict on the impact of distances to equipment sources are those associated with simple tools which were easily sourced from the locality. To such farmers distance has no appreciable impact on their businesses since they easily satisfy their equipment requirements from within the local region.

**Table VI:** Impact of distance to equipment sources on number of agro-processing IGAs

<b>Type of impact on number of Agro-processing IGAs</b>		
<i>Impact of distance to equip sources (change in number of IGAs)</i>	<i>Frequency (f)</i>	<i>Percent (%)</i>
Rapid increase	0	0.0
No increase	37	20.0
Slowed rate	149	80.0
<b>Total</b>	<b>186</b>	<b>100.0</b>

Source: Own computation from study data – July, 2013

Pearson Chi-square Test was conducted to establish whether there is a relationship between distances to equipment sources and the number of smallholder agro-processing IGAs set-up in the rural areas. The findings are shown in Table VIII.

**Table VII:** Cross-tabulation of distances to equipment sources and number of IGAs established

<b>Distance to the source of agro-manufacturing equipment (km)</b>	<b>Impact on the number of agro-processing IGAs established</b>				
	Gone up		Remained same		Total
	<i>Frequency (f)</i>	<i>Percent (%)</i>	<i>Frequency (f)</i>	<i>Percent (%)</i>	
Less than 50	70	53.8	0	0.0	70(53.8%)
50 – 100	10	7.7	0	0.0	10 (7.7%)
151 – 400	0	0.0	50	38.5	50(38.5%)
<b>Total</b>	<b>80</b>	<b>61.5</b>	<b>50</b>	<b>38.5</b>	<b>130</b>

Source: Own computation from study data – July, 2013

Results show that 80 (61.5%) of those who responded experienced increase in the number of agro-processing IGAs while 50 (38.5%) did not realize any change. The findings indicate that shorter distances have greater positive impact on the number of agro-processing IGAs established than longer distances. Distances less than 50

**Table VIII:** Pearson chi-square test for the relationship between distances to equipment sources and the number of agro-processing IGAs established

	Value	p-value
Pearson chi-square	130.000 <sup>a</sup>	0.002
N of valid cases	130	-

Source; Own computation from study data – July, 2013

The results reveal that there is a significant relationship between distances to agro-manufacturing equipment sources and the number of agro-processing IGAs set-up by smallholder famers (chi-square  $p$  - value = 0.002,  $p < 0.05$ ). The chi-square ( $X^2$ ) value 130.00 was significant at 0.05 confidence level, indicating that shorter distances to sources of agro-manufacturing equipment caused a statistically significant influence on the number of smallholder agro-processing IGAs set-up in Bureti District. These findings are in agreement with [4] that when agro-processing equipment are available at the local level smallholder farmers find it easy to access them for setting-up processing businesses.

## 8. Conclusions

The study concludes that diversity of, and access to, agro-manufacturing equipment in Bureti District is still limited among smallholder farmers. The combined effect of low level of access and narrow diversity of agro-manufacturing equipment impeded the rate of growth in number of agro-processing businesses. The cost of agro-manufacturing equipment was prohibitive and thus a hindrance to growth in number of smallholder agro-processing IGAs established in the district due to un-affordability. Distances to the sources of manufacturing equipment were an important factor in the agro-processing industry in Bureti District as high quality equipment are unavailable from within the local region. Long distances to the sources of equipment were a critical impediment to growth in number of agro-processing businesses particularly because the smallholder agro-entrepreneurs lacked financial capacity to incur additional acquisition costs. This resulted in slowed rate of growth in the number of agro-processing IGAs established in the District.

In spite of the constraints of high costs, narrow diversity, long distances to sources and low levels of access to agro-manufacturing equipment, the overall impact however was a positive marginal increase in the number of agro-processing IGAs that resulted from the acquired processing tools by smallholder farmers.

## 9. Recommendations

In view of the findings of this study, the following recommendations are made:

- (i) The government and other development partners should develop and facilitate mechanisms that will realistically increase access of friendly investment capital to the young generation to purchase equipment

for starting small-scale agro-processing businesses. This will make agriculture attractive to the youth and help create self-employment for the jobless majority.

- (ii) Agricultural extension service providers should intensify awareness training of farmers on the importance of credit financing while at the same time facilitating the development of farmer-friendly credit packages by micro-financing institutions.
- (iii) Government should encourage and create conducive environment for local manufacture of agro-processing equipment as a strategy of lowering costs of equipment for small-scale agro-processing IGAs. Each county should establish an agro-technology development centre to address peculiar agro-manufacturing needs of the local farmers as a way of decentralizing industrialization.
- (iv) Deliberate efforts should be made to target graduates of tertiary institutions with agro-manufacturing knowledge and skills as a way of attracting intellectual insights into agricultural development, which is otherwise unfairly identified with the less educated.

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