ESTIMATING THE NUMBER OF JOBS CREATED BY CHAINSAW ACTIVITIES IN GHANA

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ABSTRACT

Chainsaw milling, a practice of using chainsaw machines to process trees to lumber, has been banned in Ghana for over ten years by Act 547 and LI 1649. In spite of this, the activity has been going on posing a real challenge to forest monitoring and sustainable forest management in Ghana. In order to be able to fully understand the social and economic impact of any policy intervention to deal with the issue, there is the need for policy makers to have a clear understanding of the scope of the problem, in terms of the number of people involved. The paper makes a contribution to this need by reviewing the various studies that have attempted and gives a current estimation. The paper draws mainly on two main approaches based on volume of illegal harvest and actual market stock volume of chainsaw lumber to estimate the number of people who engaged in chainsaw milling. The paper estimates that chainsaw milling directly employs nearly 97,000 people. The paper argues that using volume of chainsaw timber in reaching the market and a production efficiency parameter based on ratio of lumber to tree volume rather than lumber to log/beam volume is a more credible approach.

Keywords: Chainsaw milling, estimation of jobs, informal timber industry, Ghana

INTRODUCTION

Even though chainsaw milling in Ghana has been criminalised since 1998, the operation has survived. One reason that has been identified is that it serves as the primary supplier of timber to the domestic market (Odoom, 2005; Adam *et al.*, 2007; Marfo, *et al.* 2009; TIDD/FORIG, 2009). This market opportunity has sustained the operation and provided job opportunities to rural folks as well as urban timber brokers. Over the past few years, there has been an increasing public debate as to how to deal with the issue in policy and in practice. It has been argued that chainsaw milling provides livelihood to many people and even if the ban is effectively enforced, it will throw many people out of jobs. Others have argued that the provision of jobs does not legitimise entertaining an illegal operation and some have gone as far to compare it to cocaine business and have asked whether it has to be entertained just because it provides jobs for some people.

In spite of the larger public interest in the issue, information on the level of employment generated by the operation and the extent to which this is sustainable in the face of dwindling forest resources is scanty and scattered. For example, Birikorang (2001) estimated that primary chainsaw milling operations provided jobs for about 900 people in 1999. Odoom (2005) reported

that an estimated 50,000 people were engaged in chainsaw milling in Ghana. This figure can be taken to represent a conservative estimate for the early periods of the 2002 - 2004 as Odoom carried out his work in the first half of the year 2004 and cited this as a secondary data. The activities were reported to be predominantly occurring in Western, Ashanti, Brong Ahafo, Central and Eastern Regions. The chainsaw enterprise, if described according to the various operational phases (Stump site, highway transportation, re-processing and marketing), was judged as an important employment avenue giving jobs to about 80,000 people (Adam et al, 2007). They further estimated that the reprocessing/utilization and marketing sector of the chainsaw milling enterprise alone provides employment to nearly 50,000 people per year. Thus, while some estimates exist, these have not been systematically validated and compared in order to inform the policy discourse about the growth in this sub-sector. This information is very important as it is needed to inform policy discussion on the social and economic impact of the activity.

This paper presents an assessment of the number of jobs created through chainsaw operations. This introductory section is followed by a description of the methodology used. The presentation and discussion of the results follow. The paper ends with a conclusion section that highlights the main findings and recommendations.

METHODOLOGY

Estimating Number of People Employed Through Chainsaw Activities

Due to the illegal framework within which chainsaw operations occur, it is difficult to have official records to help one estimate the number of jobs created through the activity. Several estimates have been given (Table 1).

Table 1 estimates of number of jobs provided by chainsaw milling

Study	Year of estimate	Estimated number	Remark
Birikorang *et al.*, 2001	1999	900	Did not include all people involved in stump site operation or retailing of products
Odoom 2005	2003	50,000	Methodology not elaborated
Adam *et al.*, 2007	2005	80,000	Methodology based on estimated volume of illegal harvest; captured entire production-market chains
Marfo and Acheampong, 2009	2007	94,000	Methodology based on Adam *et al.*'s approach with fresh empirical data

Adam *et al*. (2007) approached the challenge by using indirect estimation based on volume of trees reported to have been exploited by illegal operators, recovery rates of the milling and re-sawing operations and number of people engaged in the various phases of the logging, milling and marketing process (from site logging, haulage, reprocessing and then selling). This involved using survey data to corroborate secondary data. The estimation method used by Adam *et al*. (2007) can be expressed as a formula (Box 1).

Box 1: Formula for estimating the number of jobs created by chainsaw activities

$E=A+B+C+D$

$E=[ac/12d) + (bf/365e) + (bh/365g) + (bj/i)]$

Where
E = estimate of total jobs created by chainsaw operations
A = estimate of jobs generated at stump site
B = estimate of jobs generated through haulage/transportation of chainsaw beams/lumber
C = estimate of jobs through re-sawing spots
D = estimate of jobs generated through sale of lumber

a = total annual estimated volume of timber exploited through illegal chainsaw operations (m^3)
b = estimated total recovery volume using a 50% recovery rate (m^3)
c = average size of milling crew at stump site
d = input volume per month per production crew (m^3)
e = average capacity of haulage trucks (m^3)
f = average size of the haulage crew
g = average capacity of re-saw mills (m^3)
h = average size of the re-saw crew
i = average annual stock received by a broker
j = average number of people engaged by a broker

Adam *et al.* (2007) estimated that about 80,000 people were involved in production, haulage, processing and retailing of chainsaw lumber in Ghana. Marfo and Acheampong (2009) followed a similar approach in principle but collected fresh empirical data on number of people engaged in site operations, haulage, re-saw sites and lumber retail sites. This was aimed at validating the figures observed by Adam et al. (2007) in order to be able to reach a more conclusive estimate.

Marfo and Acheampong (2009) validated the parameters used by Adam *et al.* (2007) and used the same method to estimate the number of people employed through chainsaw operations. They, however, critiqued Adam *et al.* (2007). They argued that the assumption of 50% recovery efficiency for free hand sawmill in the estimation was too high even compared to empirical estimates available at the time of their study. Correcting this flaw using a processing efficiency of 43% from a case study (Owusu *et al.* 2009), and other survey data, Marfo and Acheampong (2009) estimated the number of jobs to be about 94,000 people (see Annex 1).

This study further observes a couple of flaws in the approach used by Adam et al. (2007) and followed by Marfo and Acheampong (2009). First, using an estimate of the volume of illegally logged trees as a basis to assess the volume of wood processed by chainsaw operators is problematic. This is because it fails to capture the actual volume of trees exploited by chainsaw operators alone. Therefore attributing the reported illegal harvest level of 2.7 million m^3 as at the time of study to chainsaw operation alone was an overestimation. This is because about 1 million m^3 of trees illegally exploited is reported to be taken by licensed operators (Birikorang *et al.* 2001; Hansen and Treue, 2008). Consequently, it is argued that using the round wood equivalent of the volume of timber reaching the local market is a better substitute for assessing the production.

Second, it is argued that by using processing efficiency (PE) rather than conversion efficiency (CE) values, both estimations by Adam *et al*. (2007) and Marfo and Acheampong (2009) could have been distorted. This is because PE does not take the entire volume of trees into account; rather it uses the volume of input beams and therefore cannot serve as a better measure for projecting exploitation levels. For example, reported conversion efficiency figures ranged between 15%-36% (Birikorang *et al.* 2001; Frimpong-Mensah, 2004, Owusu *et al.* 2009) giving rise to a mean of 30.4% (Marfo, 2010). Furthermore, using an average of several empirical measurements of recovery efficiency studies than outcome from a single case study can give a more reliable estimate. Third, the previous studies had assumed that all the people somehow engaged were involved in chainsaw operations on full-time basis. It is argued that working out peoples' involvement on actual part-time equivalence will give a better estimation. The approach used in this study attempt to correct these flaws in approach used by Adam *et al.* (2007) and Marfo and Acheampong (2009).

Data Collection and Analysis

The empirical data to support the assessment was obtained from the surveys of Adam *et al.* (2007) and Marfo and Acheampong (2009) collected in twelve and six forest districts respectively and from a range of people involved in chainsaw operations. Adam *et al.* (2007) studied 8 lumber markets and interviewed 79 chainsaw firms while Marfo and Acheampong interviewed 50 operators, 41 resaw firms and 41 lumber retailers.

Empirical data were collected on the number of people in a crew, volume of lumber processed per operation, capacity of re-saw mills, number of people engaged at the resaw firm, annual stock of chainsaw lumber received and sold, number of people engaged at retail points, number of people

engaged in a haulage crew and capacity of haulage trucks. The average values of these parameters from the various studies were used for computation.

In addition, secondary data based on some recent studies were also employed. Particularly, data from market study on local and overland stocks and consumption of chainsaw lumber (TIDD/FORIG, 2009) and recovery efficiency rates of four case studies (Table 2) were used.

RESULTS

The computation for the jobs created by CSM is a summation of the jobs created at the different phases of the enterprise as presented in Table 3.

These calculations assume that workers are involved full time in the chainsaw enterprise. However, Obiri and Damnyag (2009) reported that about half of those involved in chainsaw activities in the communities earn their main income from CSM. Factoring the assumption of 50% part-time involvement into account in the stump site and haulage sub-sectors, Table 4 lists the actual number of people who may be involved in practice.

Table 2: Reported conversion efficiencies of chainsaw operations

Source	Processing Efficiency (%)	Conversion Efficiency (%)
Birikorang et al. 2001	39*	27
Frimpong-Mensah 2004	40 (22-51)	28 (15-36)**
Gyimah and Adu-Gyamfi 2009	51	36**
Owusu et al. 2009	43 (32-57)	30 (22-40)**
Average	43.1 ± 5.6	30.3 ± 4.0

* Reported estimate of 27% multiplied by 1.43% to account for 70% log recovery rate
** Multiplied by the 70% rate of log recovery (Owusu *et al.* 2009) when butt and top end residues were not included in the conversion efficiency estimate.

Table 3: Summary of results on the computation of jobs created through CSM

Definition of parameters		unit	Parameter	Result	Reference
		Production data			
annual volume of timber processed (local market and direct export market)	a	$m^3.y^{-1}$		756,815	cf TIDD/FORIG,2009 Blackett and Gardette, 2008
annual volume of timber processed (local market)	b	$m^3.y^{-1}$		558,054	TIDD/FORIG, 2009
recovery rate	c	%	30.3		Table 2
annual RWE of processed chainsaw lumber	d= 100*a/c	$m^3.y^{-1}$		2,497,739	Based on 30.3% conversion efficiency ± 95% confidence interval
		Stump site (local and direct export markets)			
volume processed per crew per operation	e	m^3. $operation^{-1}$.$crew^{-1}$	5.94		Marfo 2010
annual number of operations per operator	f	operations. $crew^{-1}.y^{-1}$	60		Adam et al. 2007a; Marfo et al. 2009
annual volume processed per crew	g=e*f	$m^3.crew^{-1}.y^{-1}$		356.40	
number of crews	h=d/g			7,008	
average size of operating crew	i	workers. $crew^{-1}$	6		Adam et al. 2007a; Marfo et al. 2009
number of workers (stump site)	j=h*i			42,049	
		Haulage (local and direct export markets)			
average load per truck	k	$m^3.truck^{-1}$	26.5		Adam et al. 2007a; Marfo et al. 2009
annual number of round trips per truck	l	roundtrip. $truck^{-1}.y^{-1}$	96		Adam et al. 2007a; Marfo et al. 2009
annual volume of lumber hauled per truck	m=k*l	$m^3.truck.y^{-1}$		2,544	
number of trucks needed to transport annual production volume	n=a/m	trucks		297	
average size of haulage crew	o	workers. $truck^{-1}$	7		Adam et al. 2007a; Marfo et al. 2009
number of workers (haulage)	p=n*o	workers		2,082	
		Re-sawing (local market)			
annual capacity of re-saw mill	q	$m^3.y^{-1}.mill^{-1}$	92.34		Adam et al. 2007a; Marfo et al. 2009, assuming 240 working days

number of mills	r=b/q	mills		6,044	
average size of the re-saw crew	s	workers. crew^{-1}	4.5		Adam et al. 2007a; Marfo et al. 2009
number of workers (resaw mills)	t=r*s	workers		27,197	
		Retailing (local market)			
average annual sales per firm	u	m^3.firm^{-1}.y^{-1}	497		Adam et al. 2007a; Marfo et al. 2009
number of firms	v=b/u	firms		1,123	
average crew size	w	workers. firm^{-1}	3.5		Adam et al. 2007a; Marfo et al. 2009
number of workers (retail)	x=v*w	workers		3,930	
Total estimated number of people engaged directly in the chainsaw enterprise				75,258	

Table 4a: Estimation of number of jobs created by CSM comparing different approaches and adjustments

approach	2005 (Adam et al. 2007)	2007 (Marfo and Acheampong, 2009)	2007 (this study using market-based approach)
Volume-based assuming chainsaw account for all illegal harvest	80,000	94000	97,000
Adjusted by actual chainsaw harvest volume only*	55,000	59,000	97,000
Adjusted by RE factor*	40,000	49,000	97,000

*adjustments help to standardised the volume-based approach to ensure that important parameters remain the same to help achieve a better comparison.

DISCUSSION AND CONCLUSION

The study has estimated that the number of people engaged based on 2008 data in the entire product chain of the chainsaw enterprise is about 97,000. This compares quite well with the 94,000 people engaged as reported by Marfo and Acheampong (2009) for the same period. This should not be used to undermine the critique against the production-based approach used by Adam et al (2007) and Marfo and Acheampong (2009) in favour of the market-based approach used. The closeness of the estimates for the number of jobs in 2008 in both studies seems to be purely accidental to the closeness of two important fundamental data in both studies. In the case of Marfo and Acheampong (2009) following Adam *et al*. (2007), the total annual volume of wood processed was taken to be equivalent to the reported 2.7 million cubic meters of illegal logs harvested. In the case of this study, the roundwood equivalent of chainsaw lumber reaching the domestic market and being transported overland based on actual market study was about 2.5 million cubic meters. Thus, a difference of about 200,000 cubic meters should not be expected to give any significant difference in the final computation.

However, the argument still stands that if Marfo and Acheampong (2009) had used actual volume of trees harvested by chainsaw operators (then estimated as 1.7 million m^3), i.e. discounting the proportion of the illegal harvest by licensed concessionaires, the estimates would have been far different. Indeed, the total number would have been about 59,000 people, all parameters remaining the same, giving rise to a difference of about 38,000 to the estimate in this study. Furthermore, using the lower recovery parameter (i.e. the CE of 30.3%) instead of the PE of 43% would have given a much lower estimation of only 49,000 people. This would have underestimated the number of jobs by over 100%. Thus, the closeness of the two 2007 job estimates reported by Marfo and Acheampong (2009) and this study using the two approaches should not be attributed to equal quality of methods but to mere closeness of two fundamental data. It should also be noted that, applying the adjustments of the two parameters to the estimation by Adam et al. (2007) would have given total jobs of about 55,000 and 40,000 respectively.

However, what is clear is the fact that irrespective of the approach used, it seems that there is a progressive increase in the number of people engaged in the enterprise over the years. Table 4a depicted this trend more clearly.

Table 4b: estimated number of direct jobs (full-time equivalents) created by CSM

Phase in the product chain	Estimated employment (full-time equivalent)	Total number of people (on 50% part-time basis)
Stump site	42,049	63,074
Haulage	2,082	3,123
Resawing	27,197	27,197
Retailing	3,930	3,930
Total	75,258	97,324

The study concludes that a market-based approach such as the one used in this study seems to give a more reliable estimate of the number of jobs created than the volume-based used by Adam *et al*. (2007) and Marfo and Acheampong (2009), especially when corrected by using RE rather than CE as recovery parameters. This is because of the inherent difficulties involved in ascertaining first the actual volume of trees exploited by chainsaw operators alone and second the volume that is exploited by individuals for domestic use. Nonetheless, the reliability of the volume of traded chainsaw timber both in the domestic and overland export markets is crucial for such a claim. In this study, the reliability of the TIDD/FORIG nation-wide market survey which gave rise to volume of traded chainsaw lumber has been assumed.

The paper has demonstrated that the illegal chainsaw milling sector provides jobs for a good number of people and cannot be wished away in policy discourses. In particular, it shows that the sector deserves adequate attention on the social mitigation measures for enforcing timber legality measures under the Voluntary Partnership Agreement. Any policy purporting to address illegal chainsaw milling should not loose site of the large number of people involved and the livelihood implications.

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Annex 1: Summary of job estimates of chainsaw milling enterprise by Adam *et al*. (2007) and Marfo and Acheampong (2009)

Description of parameters	2005 (Adam *et al*., 2007)	2007 (Marfo and Acheampong, 2009
Volume of processed		
Average recovery	50% by Akrasi (1997) Frimpong Mensah (2003) could be high	43% (based on actual experimental figures by Owusu *et al.* 2009)
Total annual volume processed (secondary data); (a)	2,700,000	2,700,000
Annual volume to local market (b)	1,350,000	1,161,000
Operators Crew size (c)	6	6
Input vol./month/crew (d)	50	33
Monthly vol. processed (a/12)	225,000	225,000
Number of milling crews engaged per month (a/12d)	4500	6818
Total number of people employed at stump site (A=ac/12d)	27000	40,908
Haulage truck vol. m^3 (e)	27	26
Total roundtrips for haulage trucks (b/e)	50,000	44653
Size of haulage crew (f)	12	7
Total number of jobs in the haulage sector (B= bf/365e)	1644	856
Average capacity of re-saw mill (g)	0.36864	0.40083
Re-saw crew size (h)	4	5
Milling cycle for input vol. (b/g)	3662109	2896489
Total number of jobs in the re-saw sector (C= bh/365g)	40133	39678
Average annual stock received by brokers, m^3 (i)	460	391
Total number of brokers that will be engaged by annual production (b/i)	2935	2969
Average number of people engaged by a broker (j)	3	4
Total number of people engaged in the lumber retailing (D = bj/i)	8804	11877
Total estimated number of jobs	77,581	93,319