



Scenario and Cost Benefit Analysis of Proposed Policy Options for the Supply of Legal Timber to the Domestic Market

**Gene Birikorang, Emmanuel Marfo,
Kyere Boateng & Beatrice Obiri-Darko**

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Gene Birikorang
Emmanuel Marfo
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This publication has been produced with the financial assistance of the European Commission's Programme for Environment and Sustainable Management of Natural Resources, including Energy.

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Published by: Tropenbos International, Wageningen, the Netherlands

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Citation: Gene Birikorang, Emmanuel Marfo, Kyere Boateng and Beatrice Obiri-Darko 2014. Scenario and cost benefit analysis of proposed policy options for the supply of legal timber to the domestic market, Tropenbos International, Wageningen, the Netherlands, 176 pp

Layout: Francis K.N. Nunoo

ISBN: 978-90-5113-122-2

All photos: CSIR FORIG and Tropenbos International

Printed by: Digigrafi, Veenendaal, the Netherlands

Available from:

CSIR Forestry Research Institute
Emmanuel Marfo
CSIR-Forestry Research Institute of Ghana
Universtity Box 63
Kumasi Ghana

Tropenbos International Ghana
James Parker Mckeown
P.O. Box UP 982 KNUST
Kumasi, Ghana
tel. +233 5160310/61361
euchainsawprojectghana@gmail.com
www.chainsawmilling.org

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ACRONYMS

AAC	Annual Allowable Cut
ADL	Air-dried lumber
AM	Artisanal Milling
CIF	Cost, Insurance and Freight
CSM	Chainsaw milling
EU	European Union
FAWAG	Forest and Woodworkers Association of Ghana
FC	Forestry Commission
FM&R	Failed to monitor and review
FORIG	Forestry Research Institute of Ghana
FR	Forest Reserve
GTA	Ghana Timber Association
GTMO	Ghana Timber Millers Organisation
HFZ	High Forest Zone
MSD	Multi-Stakeholder Dialogue
NINT	Non Integrated Mills
NREG	Natural Resource and Environmental Governance
NREL	National Renewable Energy Laboratory
OFR	Off Forest Reserve area
OPD/FSD	Operations Department of the Forest Service Division
PMT	Project Management Team
RMSC	Resource Management and Support Centre
RWE	Round Wood Equivalent
SFM	Sustainable Forest Management
TBI	Tropenbos International Ghana
TIDD	Timber Industry Development Division

TUC	Timber Utilization Contract
VLTP	Validation of Legal Timber Programme
VPA	Voluntary Partnership Agreement
WAG	Woodworkers Association of Ghana

EXECUTIVE SUMMARY

Introduction

Much of Ghana's forest sector problems can be traced to illegal chainsaw lumber production which presently stands at about 2.5 million m³ accounting for 80% of total supplies on the domestic market. This has contributed significantly to forest depletion and decline in the forest sector's contribution to GDP from about 6% in the 1990s to roughly 2%. Price distortions on the domestic market, largely caused by over concentration on the export market for better turnovers and an unwillingness to sell grade lumber on the domestic market by the formal sector have created a large supply gap which has been met largely through illegal chain saw lumber supplies. Attempts to regulate forest use through enforcement of legislation have not been successful but rather generated a lot of conflicts and undermined good forest governance.

Under the VPA with the European Union, Ghana has made a commitment to ensure that legal timber is not only traded on the export market but on the domestic market as well. Therefore, Ghana is seriously looking for options for supplying legal timber to the domestic market. The EU is supporting the Government through the NREG Programme and a Tropenbos International Ghana led project to develop alternatives to illegal chainsaw milling through a multi-stakeholder dialogue process backed by scientific research. These initiatives have developed the following three policy directions as a first step towards formulating specific strategic options for dealing with the problem:

1. Sawmills to supply the domestic market with legal timber obtained from sustained yields;
2. Sawmills and artisanal millers¹ supply the domestic market with legal timber obtained from sustained yields ; and
3. Artisanal millers supply all lumber required by the domestic market while sawmills focus on export, in keeping with the legal timber framework.

1 As of the time of this study, Artisanal milling was defined as the use of small-medium motorized mobile milling equipment capable of recovering **at least 50%** dimension lumber from logs purposely for the domestic market. Artisanal mills should include all bush mills, lucas mills, wood mizer sand mobile dimension mills but exclude any form of chainsaw machines (source: TIDD/TBI discussion paper on domestic supply of timber)

However the current, stakeholder understanding of the costs and benefit implications of prospective intervening measures associated with these policy directions is scanty. Therefore this research was commissioned to provide a cost benefit analysis in order to inform policy decision on the most appropriate policy strategy.

The analysis has been carried out at the backdrop of the following forest sector conditions: weakness in forest regulation and enforcement associated with rent-seeking behaviour among public officials; a high rate of illegal logging by both formal and informal forest businesses; a likely future decline in resource availability; increasing share of harvest by a few but large scale companies and a shrinking forest industry. In addition, inadequate legislation has worked against community access to timber: in particular, the non-existence of timber felling rights to the informal sector, farmers' tenurial rights to naturally regenerated trees on farms and failure of distributed forest revenues to trickle down to forest fringe communities. These create a disincentive for local support for enforcement of forest laws and actually encourage farmers to do business with illegal CSM operatives who offer them better deals.

The Methodology employed in the research has four key components, viz: Developing the critical parameters for analysis through stakeholder consultation, literature review, of secondary data collected from a number of recent empirical studies in the sector and modelling. The financial and economic modelling of the formal and informal wood businesses and state revenues and costs was done to identify and analyze the impacts of key policy scenarios (as measures) under each of the three policy options (as strategies). The model was designed on the basis of key assumptions consisting of researched 2007 indicators. Secondly, a unit cost analysis of business operations for three categories of producers was constructed using industry source data. These two compartments were combined to produce complete value chains for the producers comprising total volumes and values of timber inputs, domestic and export sales values, cost of timber inputs, other costs and profits. Below the business operating line, the model recalculates the components of forest revenues and other payments to stakeholders and cost of institutions. The weaknesses of the model are that it is not designed to forecast level of demand or the degree of substitution of imports for domestic supply. Levels of demand are determined outside the model by policy; prices are also imposed on the model and not determined by it. A full investigation of environmental impacts of the options has not been included in the research work.

Scenarios and key assumptions for the cost-benefit analysis

In order to proceed with the analysis, four scenarios departing from the baseline (business-as-usual) situation were developed under the 3 policy options:

1. Sawmills only supply legal lumber to the domestic market (policy option 1)
2. Sawmills and artisanal millers supply legal lumber to the domestic market under conditions of a lumber export ban (policy option 2)
3. Sawmills and artisanal mills supply legal lumber to the domestic market under a regime of domestic harvest quotas and fiscal incentives (policy option 2)
4. Artisanal millers only supply legal lumber to the domestic market (Policy Option 3)

The Baseline Model consists of a progressive shift of policy from the “Business-As Usual” conditions of 2007 to a full implementation by 2015 of legal timber enforcement under VPA. No other major policy reform is assumed to occur under this model. Reference to the 2007 baseline, sawmills consumed about 910,000m³ of timber in 2007 and produced a total of 360,000 m³ of lumber, of which about 150,000m³ was disposed on the domestic market.² CSM produced an additional 497,000 m³ of lumber. In terms of business profits, export markets, with better prices (US\$425 per m³) than the domestic (US\$180 per m³) provided better business opportunities in 2007 for sawmills to return business margins of between 9% and 14%. CSM was a still better business option with a return of 28%, twice that of the integrated mills.

In terms of forest taxes and other transfer payments, Sawmilling contributed about US\$8 million in stumpage fees and export levies in 2007. This was equivalent to US\$9.50 per m³ forest tax. CSM informal payments were also equivalent to about US\$5.5 per m³ of input used. CSM contributed to livelihoods to the tune of some US\$130 million and about US\$12 million to developments in Districts. The integrated sawmills are reported to make informal payment amounting to US\$8/m³ of timber harvest or about US\$7 million to traditional authorities and their subjects through logging activities. Together, sawmills would have made additional cash payment of about US\$400,000 in Social Responsibility Agreements.

² Recovery from sapwood is a major component of joinery works in the informal sector. Joinery for low cost housing and furniture and joinery for local food bars depend on this material.

In terms of employment, direct employment in sawmills was about 11,600 persons. In contrast, CSM employed 130,000 persons. These consisted of 70,000 direct employments in production.

The cost-benefit analysis of the scenarios was informed by key assumptions that were maintained as constants.

1. In contrast to an administrative annual harvest limit of 2 million cubic meters, a VPA Assessment Study put the sustainable annual harvest limit tentatively at 700,000m³ (Mayers et al. 2008). This study prioritized sustainability in the analysis and thus maintained this figure as the annual sustainable cut (ASC) awaiting any further national inventory that might provide a different estimate.
2. Wood sourced from plantations and underwater reserves are not factored into the analysis
3. Based on recent national market survey, the domestic demand for lumber is estimated as 600,000m³
4. Based on comparative study of different milling techniques which gave an average recovery of 54.5%, it is taken that a milling recovery of 55% should be taken for the scenario analysis.
5. It is assumed that given the history and politics around determination of stumpage regime in Ghana, the stumpage fees are retained at their 2007 level estimate of US\$8.44/m³.
6. It is assumed that domestic prices of lumber will increase from about US\$180 to US\$310.

Results of the cost benefit analysis and modeling

Based on unit production costs, informal payments, institutional costs, predicted resource availability and production levels, export-domestic distribution of production, pricing, employment prospects and prevailing fiscal fees, the various scenarios generated different levels of net financial and economic benefits. The situation under the different scenarios in terms of availability of resources (log inputs), domestic lumber volume and export volume is summarized in table 1.

Table 1: Log input and domestic lumber production for both domestic and export markets under different policy scenarios implemented at the ASC level

	Log input from natural forest ((‘000) m ³)	Domestic lumber volume (‘000) m ³			Export lumber volume (‘000) m ³	Critical condition
		Sawmill	artisanal	chainsaw		
Baseline	2550	150	-	497	210	
Scenario 1(policy option 1)	450	600	-	-	225	1,091,000 m ³ of round wood imported
Scenario 2 (policy option 2)	562	183	114	-	-	Ban on lumber exports enforced
Scenario 3 (policy option 2)	562	101	137	-	73	Lumber export-domestic supply quota systems enforced

Reduced future harvest levels, due to continued depletion of the resource mean future domestic supplies of lumber to the domestic market, including large proportions of Lesser-Used and Lesser-Known Species, will be inadequate to meet the current estimated demand of 600,000m³. It will therefore be necessary to import logs (in the short term) for domestic processing or lumber. Importation of logs for processing for the domestic market will be unprofitable for sawmills. Consumers will depend for at least 50% of demand on importation of lumber and also face higher price in the order of US\$310/m³. Thus domestic price are likely to rise up to the import parity price level.

Declining resource volumes will also negatively affect both State revenues and other payments to forest communities (represented by Traditional Authorities, District Assemblies, communities and farmers). This could reduce opportunities for creating incentives for protecting the remaining timber trees in off-reserves

and promoting sustainable forest management in forest reserves if business-as-usual continues.

The economy will benefit from engagement of Artisanal Millers in production of lumber for the domestic market as they show a potential for creating value added in processing. Potential employment levels will continue to depend on availability of timber. Still within this limit, increased large-scale sawmill costs in the future threaten the realization of this potential limit of employment. For AMs, they will only be able at the maximum provide direct employment for about 26,000, compared to the 130,000 under CSM. This is also a challenge. Interventions in minimizing adverse impact of reforms may have to pay attention to both CSM and the formal sector.

The results of the financial, economic and social cost benefit analysis (CBA) conducted using the broad spectrum of research results and in particular a result of the model scenarios is summarized in table 2:

Table 2: Cost benefit analysis results of policy options:
NPVs discounted @ 20%, (US\$,000)

	Baseline	Sc.1 (Option 1)	Sc.2 (Option 2)	Sc.3 (Option 2)
Financial	837,734	502,973	779,567	813,783
Economic	289,919	39,771	294,242	317,859
Incremental NPV of options (over baseline), US\$,000				
Financial		-334,760	-58,167	-23,951
Economic		-250,148	4,322	27,940

A highly positive financial return and a contrasting lower (35% of financial value) economic gain in the baseline case confirm the existence of the situation under which policy makers do not address the issue of economic pricing of timber and the lack of incentives for processors to improve efficiency. Informal payments from CSM operations sustain the operation which is inefficient. While these create economic costs which are not considered by private operators, failure of policy to correct the wrong market signals end up putting money in private pockets.

Importation of logs under Scenario 1 to augment the domestic lumber supply is expensive and not attractive from both the financial and economic perspectives. Scenario 3 which involves the use of export and domestic supply quotas, as well

as fiscal incentives to promote log sales to AMs, has higher financial and economic returns is a better option than Scenario 2 which depends on a lumber export ban supply. Scenario 3 shifts policy towards allowing greater roles in the markets for artisanal millers as micro enterprises. Comparing the financial gains in Scenario 3 to the Baseline, there is a financial loss of about US\$ 424 million, but an economic gain of about US\$27 million (**Table 2**). This implies in the shift of policy choice, some stakeholders are bound to lose. However, there are opportunities and good justification for the state to invest in mitigation measures, using the economic gains, to turn the outcome into a “Win-Win” situation. A comparison of the options using Option1 as the standard clearly shows that scenario 3 (of option 2) promises maximum impact of reforms, and is by far the most economically efficient policy choice (**Table 2**). Scenario 3 also uses a deliberate state policy to positively influence access to forests by improved artisanal millers. It should be noted that the CBA results reveal potential impacts. The numbers do not suggest the forest economy is out of the woods. The models show that efficiency and market pricing need to work simultaneously to achieve the Scenario 3 results.

Reflecting on the sustainable harvest of 718,000 in comparison with the current legal harvest (1 million m³) and administrative cut limits (2 million m³), all things being equal, table 3 shows how lumber production by the various players under conditions of scenario 3 will look like.

Table 3: Lumber production by various producers under scenario 3 conditions at different annual allowable cut levels

Lumber Supplier	Mill input RWE (m ³)	Share	Lumber Production, m ³	Domestic lumber component, m ³	% of domestic market size supplied
AAC: 718,000 m ³					
Integrated Mill	188,501	32%	103,676	31,103	
Non-Integrated Mill	127,714	22%	70,243	70,243	
Artisanal Mill	274,909	47%	137,454	137,454	
TOTAL	591,124	100%	311,373	238,800 (77% of total)	40%
AAC : 1,000000 m ³					
Integrated Mill	262,537	32%	144,395	43,319	
Non-Integrated Mill	177,875	22%	97,831	97,831	
Artisanal Mill	382,882	47%	191,441	191,441	
TOTAL	823,293	100%	433,667	332,590 (77% of total)	55%
Administrative harvest limit : 2,000,000 m ³					
Integrated Mill	525,073	32%	288,790	86,637	
Non-Integrated Mill	355,749	22%	195,662	195,662	
Artisanal Mill	765,763	47%	382,882	382,882	
TOTAL	1,646,585	100%	867,334	665,181	111%

The implication drawn from table 3 is that, other things being equal, meeting the domestic demand for lumber from the domestic harvest is highly unsustainable. Considering the current legal limit (AAC=1,000,000m³), which presently lacks credibility on account of resource depletion reported in studies (World Bank/

DFID/ISSER, 2005), reforming and addressing a size more than 2 times the potential sustainable level could on the domestic activity account alone displace over 50% of those who depend on the unsustainable harvest level for livelihoods.

Conclusions and recommendations

Conclusions

The analysis suggest that any possible reforms to supply legal timber to the domestic market at sustainable levels must be done with difficult decisions, both politically, economically and socially speaking.

Even though Scenario 3 promises to be the most economically efficient option, the choice comes with some costs. These costs may be a removal of perverse incentives through reforms or constitute adverse social impacts. In respect of the latter, there are better opportunities under the scenario to mitigate them.

Under the best scenario, supplying the domestic market with legal timber will require that:

- integrated mills, non-integrated mills and artisanal mills are given 188000, 128000 and 275,000 cubic meters of timber resources respectively from the forests
- only integrated mills should be allowed to export lumber under a 1:1 export-domestic salesroundwood equivalent quota system.
- Only 240,000 cubic meters out of the 600,000 cubic meters (40%) of the domestic demand can be supplied from natural forests.
- Appropriate pricing policies should be adopted to enable domestic market price to 'jump' to USD 310/m³. These could include importation of lumber and other wood products at zero tax rates
- Institutional costs for forest management and monitoring should meet the challenge of industry (both sawmills and Artisanal mills) willingness-to-pay under the VPA.
- Chainsaw operations are fully cramped down and that about some 20,000 affected operators are possibly integrated into artisanal milling sub-sector to fill the job opportunities that will be created by it.

Recommendations

- A political decision is necessary in order to shift timber harvest volumes from natural forests from the current 2.5 million m³ to about 700,000 cubic meters in order to operate at sustainable levels. Industrial standards must be developed and the industry retooled to build their capacity to recover at least 50% of lumber from round logs. Both social and economic incentives must be provided to support full enforcement of the chainsaw ban. Fiscal incentives such as reduction of stumpage for mills producing for local market, use of export quotas on traditional species and retention of special value added tax for tertiary processors to support forest industry re-structuring, particularly, the short to medium term reforms towards the development of a rational domestic market for lumber. Scenario 3, where sawmills and artisanal mills supply legal lumber to the domestic market under a regime of domestic harvest quotas and fiscal incentives, promises maximum impact of reforms, and must be adopted as the best policy option.

1 INTRODUCTION

1.1 Background

Ghana's forest sector contributes 6% to Gross Domestic Product (GDP) and is the fourth highest foreign exchange earner. Forests directly support livelihoods and social lives of about 70% of Ghana's rural population. They also protect the existence and sustenance of other natural resource uses from which the state apparatus generates annual revenues (Birikorang & Rhein, 2005).

But regulation of the forest has not constrained industry harvesting. Illegal logging by both the formal sector and informal chain sawyers have resulted in over-depletion of off reserves and in a sizeable number of cases forest reserves as well. In recent years, there has been growing concern for the protection of forest reserves as long held assumptions about Ghana's forest wealth are no longer valid and the off-reserve forest has largely gone (World Bank, AFD & RNE, 2007). Recent studies have also shown that in 2005-06, the cost of annual environmental degradation in major natural resource sectors, in terms of the value of natural assets depletion, stood at 10% of GDP (World Bank, AFD & RNE, 2007). Annual economic losses from environmental degradation in Ghana associated with deforestation and land degradation were earlier estimated at 4.5 percent of GDP in 2003, and forest depletion accounted for the highest 2.5 percentage (World Bank, AFD & RNE, 2007). Primary cause largely attributed to excessive logging by both formal and informal sector timber operators.

In addressing this issue, Government forest policy reform has centred on balancing forest resource utilization and conservation objectives. Along the reform path, policy and market failures, characterized partly by inappropriate economic pricing of timber and domestic price distortions, as well as an inequitable distribution of forest benefits and lack of community access rights to forest resources that worked together to discourage forest communities from supporting sustainable forest management have also been identified as key issues.

Price distortions on the domestic market, largely caused by both a ban on log exports without appropriate accompanying measures have resulted in a continuation of low efficiency in wood processing, over-concentration on exports for better turnovers and an unwillingness to sell grade lumber on the domestic

market. In the early 2000s, attempts by the Ministry of Lands and Forestry to ensure adequate supply of lumber to the domestic market through the issue of special timber harvesting permits resulted in timber resources finally destined for the export market. The size of the domestic market, largely comparable to the export has in the past two decades been met largely through illegal chain saw lumber supplies.

1.2 Project objective

The purpose of the project is to ensure adequate supply of legal lumber to the domestic market. Under the EU funded project on developing alternatives to illegal chainsaw milling being implemented by Tropenbos International Ghana, Forestry Research Institute of Ghana and the Forestry Commission, a multi-stakeholder dialogue process (MSD) is being used to define policy options. The project has already developed the following three policy directions as a first step to developing specific strategies:

4. Sawmills to supply the domestic market with legal timber obtained from sustained yields;
5. Sawmills and artisanal millers supply the domestic market with legal timber obtained from sustained yields; and
6. Artisanal improved mills to supply all lumber required by the domestic market while sawmills focus on export, in keeping with sustained yields.

In order to inform the MSD process on formulating a feasible policy direction to deal with illegal chainsaw milling by addressing the domestic timber supply, a cost-benefit analysis of the proposed policy directions is needed. Currently, stakeholder understanding of the costs and benefit implications of intervening measures is scanty. Therefore the immediate objective of the current research is to undertake this cost benefit analysis in order to inform policy decision on the most appropriate policy strategy.

1.3 Organization of report

Section 2. Approach and Methodology

Section 3. Wood sector in context

Section 4. Forest and trade regulation in forest fiscal context

Section 5. The policy options and their scenarios

Section 6. Emerging issues

Section 7. Summary of Policy analysis, conclusions and recommendation

The report has been divided into seven main chapters. Chapter two follows the introduction by establishing the study approach and methodology employed. Chapters three and four provide the relevant background and context descriptions by introducing the wood sector and the forest, trade regulations and fiscal requirements respectively. Chapter five then presents the results of the policy options and their scenario analysis .The emerging issues that need policy attention are elaborated in chapter six. Chapter seven then provide a summary of the policy analysis, draw conclusions and provide some recommendation.

2 APPROACH AND METHODOLOGY OF STUDY

Approach

The research was undertaken by a team constituted by the Forestry Research Institute of Ghana with members having expertise in the areas of forest economics, policy analysis, socio-economic analysis and forest management. Approach to the research consists of a process of consultation at various stages of work with key forest stakeholders constituted into a Multi-Stakeholder Dialogue (MSD) platform and coordinated by Tropenbos International –Ghana. The various stages of the process are preceded by a peer review of outputs by the Project Management Team (PMT). This has facilitated an enrichment of the process through better communication and a focused approach to consultations. A first presentation of research results have been presented at the MSD platform.

Methodology

The methodology employed in the research has four key components, viz:

- (a) *Developing and completing an inception phase:* This phase involved a discussion of the drivers of chain saw milling (CSM) and the production by a multi-stakeholder technical team of a Market Conditions Matrix that set the policy conditions for meeting the domestic supply objective under the three policy options identified. This matrix is later employed as a tool to examine key policy measures and their impacts and identification of what policy scenarios might be relevant for analysis (Annex Table 1).
- (b) *Literature review:* A number of studies have been undertaken that have a bearing on the subject of the supply of legal timber to the domestic market in Ghana. The literature reviewed covered important areas such as forest resource situation and timber production and trade; CSM, its drivers and economic and social implications; assessment of the impacts of Ghana's VPA with the EU on legal verification of timber on forest stakeholders; fiscal and institutional implications of implementing a Validation of Legal Timber Programme (VLTP); forest sector analysis and natural resource management and environmental governance.

Rather than being a fresh empirical study, the research work has involved a synthesis of results from the under listed studies which engaged forest stakeholders in various processes of consultation.

Key references made in the current research include the following:

Ghana wood industry and log export ban study (Birikorang et. al, 2001)

The Ghana Wood Industry and Log Export Ban Study of 2001 comprehensively addressed policy failures in the past, singling out the following impacts: (a) development of industry overcapacity for primary processing; (b) uncontrolled national harvesting of commercial timber; (c) transmission of perverse incentives to industry that precluded development of value-added tertiary processing capacity; (d) under-valuation of the resource by forest owners and forest fringe communities that eroded a willingness to support sustainable forest management; and (e) a diminished state capacity to regulate the sector.

Validation of Legal Timber Programme (VLTP) background fiscal study (Birikorang et al., 2007)

The VLTP is on-going, generally under the umbrella of Ghana's Voluntary Partnership Agreement with the EU (VPA). Its objective is to correct forest strategy. Specifically its purpose is to re-establish forest control and secure forest revenues. The conclusion of the Background Fiscal Study was that fiscal policies affecting markets could not work effectively if they did not consider the appropriateness of the public institutional framework and its costs on the forest industry, as well as the environmental costs imposed on society by industry's forest practices. These considerations had become more relevant in an emerging forest harvest environment that was likely to reduce the future legal harvest to between 600-835,000 m³, which could potentially reduce the scope of financing institutions and supporting any private sector initiative at SFM. Some major observations made under the study were that financial constraints and commitment at the political, corporate and organizational levels had left much of Forestry Commission's (FC) organizational reforms still outstanding. Concurrently forest policy reforms sought to make the forest industry operators (both formal and informal) to internalize the costs of their own behaviours (the market approach). This was observed by the study as a cheaper alternative compared with the use by institutions of administrative resources to achieve the same ends (the institutional approach).

The study was a major output of an extensive government consultative process to negotiate forest fiscal reforms with the wood industry in 2005. The process included an FC financial support for the Ghana Timber Millers Organization (GTMO) industry to carry out its own financial analysis of sawmilling. A 2004 report, under the title “*Sawmilling Costs*,” prepared by GTMO’s consultants, *Brooks and Associates*, , fed into a joint stakeholder Forest Fiscal Reform Support Group initiative that informed fiscal policy in the mid-2000s. Sawmilling cost assessments obtained from the wood industry partly formed the basis of industry analysis in the VLTP study. The cost structures developed in the study have been found relevant to the current research work and are employed in designing financial models for the various policy options for supplying lumber to the domestic market.

Assessment of potential impacts in Ghana of a voluntary partnership agreement with the EC on forest governance (Mayers et al., 2008)

The objectives of the impact assessment were to assess, in consultation with stakeholders, the main social, economic and environmental impacts of potential policy options for the VPA in Ghana, and to suggest possible modifications. Methodology of the Study included the following:

- Review of 95 key references and other recorded information sources;
- Interviews held with about 110 resource people and stakeholders;
- Modelling of industry, institutional and economic data, generally from 2005 as the base year and
- A survey of 164 primary stakeholders in informal enterprise, labour and forest communities.

In consultation with a wide range of stakeholders the study accessed information and stakeholder opinion about actual and potential policy and governance actions in Ghana, and subsequently developed the following three main scenarios in the development of Ghana’s forest sector in Ghana:

- A *Baseline* scenario representing the current situation projected into the future;
- A *Legitimate timber* scenario representing legality assurance for export and domestic markets and
- A *Sector reform* scenario representing a transition to improved forest governance.

The future possible limits of timber resources, as reviewed by the study, have been used in the financial models and cost benefit analysis of the current research. The study also provided a valuable source of livelihood indicators.

Chainsaw milling in Ghana: Context, drivers and impacts (Marfo, E. 2010)

FORIG is collaborating with Tropenbos International (TBI) and Ghana's Forestry Commission (FC), in implementing an EU-funded project, "Developing alternatives for illegal chainsaw milling through multi-stakeholder dialogue in Ghana and Guyana." The project's overall objectives are to reduce poverty and promote viable livelihoods in forest-dependent communities; reduce the occurrence of illegal logging; and promote the conservation and sustainable management of tropical forests. Its goal is to reduce the level of conflict and illegality related to chainsaw milling by local communities.

In May 2009 FORIG, under the EU Chainsaw project, completed a case study report on chainsaw milling in Ghana. The report contained 13 specific research activities undertaken by 11 scientists (Marfo, Obiri and Adam,(eds). 2009). The study investigated the genesis of chainsaw milling and an analysis of policy and legal framework, compared production and recovery efficiencies of CSM and sawmilling, explored the major drivers of CSM and studied the economic, social and environmental impacts of CSM.

In order to have a comprehensive overview of the state of the art knowledge about CSM, another study was commissioned to synthesize all the major studies on the subject in Ghana. The report (Marfo, 2010) builds mainly on the works of Adam et. al (2007, a, b,c), the FORIG case study report (Marfo, Obiri and Adam, 2009) and TIDD/FORIG (2009) to provide an overview of the situation. The synthesis is useful for both national and international stakeholders, particularly those involved in policy dialogue processes. Substantial database on CSM and livelihoods used in the current research originate from this source.

- (c) *Data collection:* This was guided by a number of questions posed by the Technical Team in an attempt to identify distinct drivers of chainsaw milling. Issues such as the improper timber pricing that avoids payment of appropriate economic rent, institutional corruption, limited access of informal operators to forests and communities to timber, inadequate compensations to farmers by the formal sector (compared to chainsaw milling) and the lack of incentives for farmers to reserve trees, the challenge of high rural unemployment, high transaction costs of doing

business with the public sector, particularly among informal operators and the lack of political will. A number of these factors have been subjected to quantitative assessment and others employed in qualitative discussions of the wood sector and institutional context. Data gathered followed the structured outline presented in Table 1 below:

Table 1: Structure of Database for Research Work

Database	Data Specification	Data Source
Harvest volumes, sources and market control	Timber volumes (TIFs) and production by Property Mark	RMSC/FC/GTA
Harvest volumes to sawmills sub-sector	TIF Data (Forest Reserves and Off-Reserves); Export Permit Records	RMSC/TIDD/ Birikorang et al., 2007
Wood volumes	Wood production volume; export and domestic market volumes, CSM production	TIDD/Birikroang et al., 2007
Lumber import volumes and values	Wood product imports and cif values	Customs, Excise and Preventive Service (CEPS)
Technology	Recovery rates of alternative technologies of sawmilling	Marfo, 2010; KNUST, FORIG, Masdar, U.K., 2002
Industry revenues and cost structure	Revenues and milling costs: integrated sawmills; non-integrated sawmills; CSM costs	GTMO/Brooks & Associates, 2004
Employment and livelihoods	Sawmill employment, CSM direct and indirect job creations; Value of employment and livelihoods	Birikroang et al., 2001/Marfo, 2010/ Obiri&Damnyag, 2009/Mayers et al., 2008
Farmers' benefits from trees	Farmers compensation paid by timber operators and CSM	Birikorang et al., 2001/Marfo, 2010

Database	Data Specification	Data Source
Market prices	Export/domestic prices; CSM price	Birikorang et al., 2007/ Marfo, 2010
Forest revenues	Stumpage fees; Export levies	Birikorang et al., 2007/ TIDD/FC(HQ)/ Mayers et al., 2008
Institutional and costs	Forest Management and Regulation (FM&R) costs	Birikorang et al., 2007/ TIDD/FC(HQ)/ Mayers et al., 2008
	Trade regulation costs	
	Institutional cost per m ³ of wood	
	VPA implementation cost	
Compliance cost of industry	Private sector transaction costs	GTMO

(d) *Stakeholder consultations*: The research results have been subjected to a process of consultation with the MSD. Independent and critical consultations have also been made with the GTA, FAWAG and selected tertiary processors of the FAWAG and WAG.

Three of such key consultation process were the 4th MSD (held in 2010, a joint TIDD-TBI validation workshop and a meeting with key FC management and operational staff.

(e) *Modelling*: To meet the objectives of the research, financial and economic modelling of the formal and informal wood businesses has been employed to identify and analyze the impacts of key policy scenarios (as measures) under each of the three policy options (as strategies). The modelling in its form is not for the purpose of forecasting, but to present clearly the distinct impacts of the scenarios as they are presented in static comparisons.

3 THE WOOD SECTOR IN CONTEXT

The broad objective of the research project was to improve understanding of key issues in order to inform the MSD process on formulating a feasible policy direction to deal with illegal chainsaw milling by addressing the domestic timber supply. The immediate objective of the project was to undertake a cost benefit analysis of options in order to inform policy decision on the most appropriate policy strategy towards supplying the domestic market with adequate legal lumber. The major task of the research was to develop the conditions necessary to deal with specific drivers of chainsaw milling to ensure that the immediate objective of the project is met. In the sector overview presented below, emphasis is placed on conditions of the wood sector that will need to be reversed if the drivers of illegal chainsaw milling are to be brought under control.

3.1 A Shrinking formal industry combined with its increasing control over timber harvesting

3.1.1 Changes in the size of the forest industry and categories of participants

Dwindling resources have forced a number of businesses to close down, even over a period when fiscal reforms to bring industry capacity in line with the regulated (legal) harvest far from accomplished. According to TIDD, about two-thirds of the small and medium scale enterprises in the formal sector have folded up. In a contrasting development, however, TIDD export permits reveal that a number of small-scale enterprises have also emerged in the wake of the general industry consolidation. There have also emerged a significant number of *Teak* producers largely linked to the export trade to India. Examination of TIDD export permit records shows that for air-dried lumber (ADL), for example, the number of exporters have increased from about 100 in 1999 (pre-industry consolidation era) to 180 in 2007. These lumber exporters also included small scale loggers. According to the Ghana Timber Association (GTA), the independent small-scale timber operators, 25 operators from its membership either acquired their own micro sawmills or paid processing fees to redundant saw mills to process part of their harvest for export. These operators processed about 60% of their own harvest. Most of its members, however, still sold their harvest to processing mills.

In this year, the forest industry was estimated to engage close to 300 enterprises in primary and secondary wood processing in both the formal and informal sectors. There were also about 40 formal tertiary and about 30,000 informal tertiary processors. (Table 2). Among the primary and secondary processing group, about two-thirds, comprising micro-sawmills, re-saw and dimension mills, depend on illegal wood for the survival of enterprise owners. These enterprises with their micro-scale production and poor quality output are not likely to stand competition in the formal sector where compliance with harvest and trade regulations and their accompanying bureaucracy result in higher cost of wood raw material and fixed compliance costs to them.

Table 2: Size of the Ghana Forest Industry, Entities; 2006

Logging	511
Primay/Secondary Procesing	
Sawmilling	190
Ply-milling	15
Veneering	23
Lumber processing	36
Sub-total, prim/Sec. Processing	264
Tertiay processing	
Furniture and joinery (Formal)	40
Furniture and joinery (informal)	30,000

Source: TIDD/FC/Mayers, et al., 2007/HRC, 2008

In 1999, the forest industry (comprising logging, sawmilling, veneer and plymills, informal and formal tertiary processing) was estimated to employ about 100,000 people across the industry.³ This included about 14,000 workers in formal sector sawmills. It is estimated under this study that the formal sawmill sub-sector in 2007 engaged about 12,000 workers. About 70% of these workers were engaged by the integrated logging-processing group.⁴ The level of sawmill employment represented about 14% decline from the 1999 level. The industry decline due

³ This level of employment did not include chainsaw lumbering and related activities.

⁴ These have been estimated by a 2007 snapshot model of the wood industry, using employment coefficients derived in the 2001 Wood Industry And Log Export Ban Study

to timber scarcity logically would have affected the logging industry as well which employed rural labour in harvesting. Chain saw milling in its production and marketing chain provided substantial livelihood support for about 700,000 people in 2007 (Mayers *et al.*, 2008; Marfo, 2009)

3.1.2 Timber harvesting and sources

The formal industry is a large consumer of roundwood, relative to the official Annual Allowable Cut (AAC) limit of 1 million m³ recommended under the 1995 Forest Inventory. This AAC comprised annual harvests of 500,000 m³ from forest reserves and 500,00 m³ from off-reserves. In 2007, it exported about 528,000 m³ of wood products, of which 77% constituted primary and secondary products (lumber, veneers and plywood. The roundwood equivalent of this is estimated at 1,630,000 m³ under an assumed weighted export recovery rate of 25%. The off-reserve resource (OFRs), a very significant source of timber harvest contributing over 60% of legal harvest in the 1990s, has since 2000 provided less than 40% of harvest due to depletion. Harvest records in 2007 confirm earlier an emerging trend that forest reserves (FRs) have become the mainstay of industry (Figure 1).

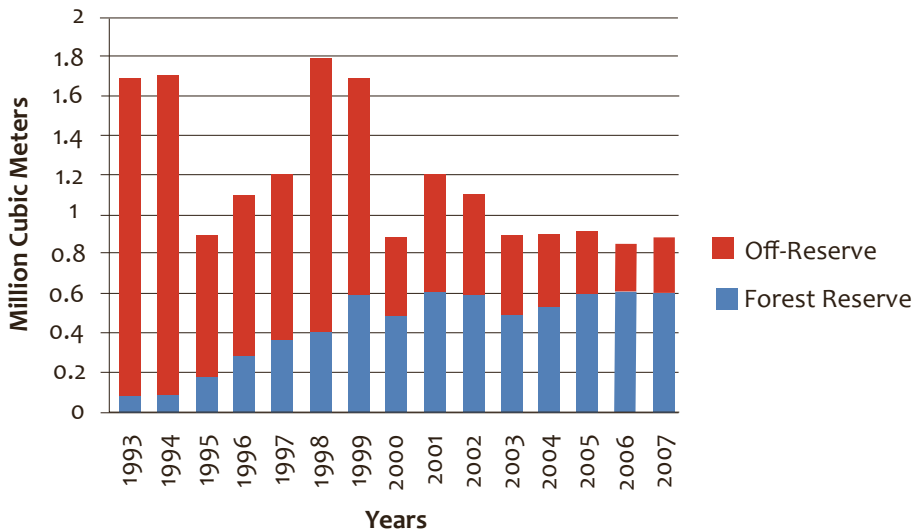


Figure 1: Relative importance of forest category sources in legal timber harvest, 1993-2007

Sources: World Bank/DFID/ISSER, 2005 & RMSC

3.1.3 The annual allowable cut: its numerous interpretations and the future sustainability levels.

In 2004, the ministry responsible for forestry introduced an administrative cut limit of 2 million m³ by increasing the off-reserve national quota by 1 million m³. This was based on recommendations of a Forest Policy Advisory Committee in December 2003 to the effect that it was to be a temporary measure to accompany reforms and keep possible “price shocks” on the domestic market in check. The administrative AAC was to be reviewed downwards over 3 years to coincide with the 1995 legal AAC limit. Presently, the administrative AAC is still in force, but is unsustainable. Based on a review of Resource Management Support Centre’s (RMSC) inventory data and current official harvest records, one study concludes that the Administrative AAC is unsustainable (Birikorang *et al.*, 2007). The study generated four resource availability scenarios ranging from a total national volume of 600, 000 (worst scenario) to 835,000 m³ (best scenario) per annum (Table 3).

Table 3: Four scenarios of future resource availability

Resource availability under VLTP		(A)		(B)	
		Off reserve		Off reserve	
		Minimum harvest level		Maximum harvest level	
		m ³ /year		m ³ /year	
		High demand species	0	High demand species	5,000
	Forest reserve	Moderate demand species	280,000	Moderate demand species	365,000
1	Minimum harvest level	Low demand species	215,000	Low demand species	220,000
	m ³ /year	Others	105,000	Others	110,000
		Total harvest	600,000	Total harvest	700,000

Resource availability under VLTP		(A)		(B)	
		Off reserve		Off reserve	
		Minimum harvest level		Maximum harvest level	
		m ³ /year		m ³ /year	
		High demand species	10,000	High demand species	15,000
	Forest reserve	Moderate demand species	330,000	Moderate demand species	415,000
2	Maximum harvest level	Low demand species	265,000	Low demand species	270,000
	m ³ /year	Others	130,000	Others	135,000
		Total harvest	735,000	Total harvest	835,000

Source: VLTP studies and RMSC

Based on the “best” and “worst scenarios, the Administrative AAC for off-reserves will have to be reduced by 80% to 90%. In respect of off-reserves, the resource faces a high risk of being depleted, and it is expected that sustainable harvest levels will decrease to within the limits of 150,000 m³ and 250,000 m³. Forest reserves are expected to be the major source of harvest in the future. The likely annual volumes could vary from 450,000 m³ to 585,000 m³. Thus, sustainable harvest levels from these sources are expected to decline by 10% from the Administrative AAC in the worst case and increase by close to 20% under the best scenario. (Table 4).

Table 4: Future resource availability, m³ Annual Sustainable Harvest: “Worst” and “Best” Scenarios

	Worst Scenario			Best Scenario		
	Forest reserve	Off reserve	Total	Forest reserve	Off reserve	Total
High	0	0	0	10,000	5,000	15,000
Moderate	150,000	130,000	280,000	200,000	215,000	415,000
Low	200,000	15,000	215,000	250,000	20,000	270,000
Others	100,000	5,000	105,000	125,000	10,000	135,000
Total	450,000	150,000	600,000	585,000	250,000	835,000

Source: Birikorang et al. 2007

The difference between the worst and best scenarios (and for the intermediate scenarios, as well) derives from the key assumption that in response to the changing structure of the forest, more lesser-used and lesser-known species, classified under Forestry Commission’s schedule of stumpage fees (reference L.I. 1649, Schedule 2) as “low demand” and “Other demand,” will be harvested for both export and domestic markets. These species are expected to come mostly from forest reserves. When compared to 2005 official harvest records (Table 5), the future resource availability scenarios suggest drastic reductions in “high demand” species and relatively moderate reductions in “moderate demand” species, significant changes in the species composition still coming from forest reserves under the “Best” scenario.

Table 5: Species distribution in recorded harvest, 2005 (Based on RMSC TIF data)

	Forest Reserve, m ³	Off-Reserve, m ³	Total recorded harvest, m ³	% FR	%OFR	% Total
High demand	103,619	9,125	112,745	17%	3%	12%
Moderate demand	354,864	280,310	635,174	59%	85%	68%
Low demand	132,826	30,129	162,955	22%	9%	17%
Other species	14,574	9,437	24,012	2%	3%	3%
Total	605,883	329,002	934,886	100%	100%	100%

Source: Extracted from Birikorang et al., 2007

Thus, under Ghana’s Voluntary Partnership Agreement with the EU (VPA), enforcement of legal compliance could reduce high demand species harvested from forest reserves from 17% in 2005 to less than 2% under a legal timber regime under the “Best” Scenario. Off-reserve volumes of high demand species are also likely to decline from 3% to less than 2%. For the national harvest, the decline in “high demand” category will decline from 12% to 2%. Similarly at the national level, future harvest volumes of “moderate demand” species are likely to decline by 35% from the 2005 level. Legal enforcement could also confine about 50% of the national harvest to “low demand” and “other” species. About 90% of this share could come from forest reserves. Until a full implementation of VPA, contemplated by FC to extend to 2015, a 10 year continued depletion of forests would threaten realization of the “Best” Scenario. An impact assessment study on implementation of VPA estimates that the legal harvesting limit could decline from 835,000m³ to 700,000m³, assuming that practices that deplete the forest would be avoided by 2015.⁵

5 Forestry Commission has indicated that an additional 199,000m³ wood flow might be obtained from a private sector project aimed at an underwater harvesting from the Lake Volta, which could add 100,000m³ to the legal AAC. It anticipates that this volume would be processed for both the export and domestic markets. It is early to conclude on this project. The expected domestic market volume availability might be 50,000m³ in the maximum, or 8% of the domestic market size targeted – a 50% recovery rate of the 100,000 annual volume is assumed. Environmental arguments are being raised by Civil Society against this project (Reference: ISODEC verbal communication). For these reasons, projection of domestic harvest sources of timber under this research work excludes this expected annual volume.

3.1.4 Illegal harvesting

Comparing the actual throughput to the recorded harvest, the formal sector is estimated to have illegally acquired some 800,000 m³ of timber in 2007. The informal sector also indulged in illegal chain sawing that was partly integrated with small scale artisanal re-sawing and dimensioning, albeit at greater volumes than the formal sector. This was estimated at 2 million m³ in 2007 (Marfo, 2009). Overall, illegal logging at the national level stood at 80% in 2007. With close to 50% of its intake being illegal, the formal sector contributed 20% of the national illegal volume. The illegal logging indicator was evidence that over a long period, the forest regulation had not succeeded in controlling industry harvest levels. It was also a sign of the existence of a rent-seeking behaviour (corruption) among public officials that prevented enforcement of forest regulations.⁶

3.1.5 Harvest and market control

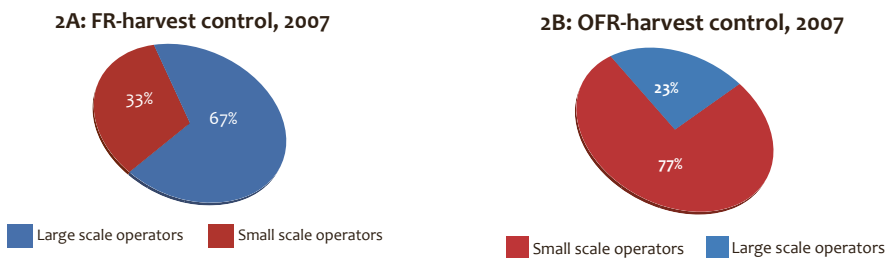
in response to the setting of an administrative AAC at 2million m³ in 2004 by the then Ministry of Lands and Forestry, participation in the logging industry increased. According to the Ghana Timber Association (GTA), the sole organized small-scale logger- trade association, timber permit holders in the early 2000s numbered about 800, a significant number of them not belonging to their membership. With a registered number of about 500 members, the GTA had only some 50 members active in 2007, as estimated by (Mayers et al 2008). In the same year, registered timber operators with valid property marks numbered 348. These comprised 23 large-scale and 325 small-scale operators. Thus, the GTA's active members were only 15% of the total number of small operators.

A comparison of 1999 and 2007 official data on forest harvest indicates that 23 large scale companies within the last 8 years increased significantly their share of forest harvesting from 40% to just over 50%. In forest reserves, their share of harvest volume increased substantially from about 50% to 70% (Figure 2A). In off-reserves, their share remained at 20%.

This suggested a significant presence of small operators in off-reserves (Figure 2B). Two distinct aspects of forest access emerge from these comparisons. Firstly, the intensive engagement of small operators in off-reserves was made possible by the nature of off reserve landscapes (a mixture of farms and trees) which made small operations more feasible, as they typically involved the use

⁶ Failure of the Regulator to fully charge economic rent results in the passing on of rent to public officials by the private sector timber operators.

of less sophisticated equipment and less damage to farms. Secondly, in forest reserves, small operators accounted for 30% of harvest. This occurred despite two developments that could otherwise have kept small operators away from forest reserves: (a) a reduction in the size of the formal industry accompanied by a drive towards acquisition of more concessions by large-scale integrated companies, and (b) The Timber Resources Management (Amendment) Act, 2002 (Act 617) set “Medium-Scale” (and a corresponding 40km² forest size) as the minimum size of operation in forest reserves. The practice by policy makers of discretionary allocation of timber resources, alluded to in other studies (World Bank\AFD\RNE, 2007), accounted for the significant presence of small-scale operations in forest reserves.⁷ From the perspective of GTA, in the case of off-reserves, the retention of a high level of small operators’ presence was partly explained by the discretionary allocation of timber resources, and partly by a willingness of small-scale operators to collaborate with the large scale companies to. Most of small-scale operators received pre-financing from large-scale integrated companies under what is popularly known in the logging industry as “50-50” agreements which allow the large scale operator to acquire the small operators’ harvests and pay the latter 50% of the value of timber delivered at the mill. This study concludes that the influence of large scale operators through the pre-financing arrangements applied as well to forest reserves. So, despite a 47% of total official harvest volume produced by small operators in 2007, these volumes were not freely available on the open market, but were largely delivered directly to large scale integrated companies.



Based on analysis of RMSC TIF/property Mark data

* “Market Logs” are timber produced outside the direct control of large-scale integrated operators

Figure 2a and b: Harvest Control Analysis, 2007

7 According to the legal specification, one would have expected on the average, an annual harvest of 8,000 m³ from a 40 km² forest (i.e the harvest of 2 m³ per hectre according to Ghana’s forest management prescriptions). The average production for the 325 small operators was under 600 m³ in 2007.

This revelation is not different from a similar observation of as high as 95% of national timber harvest consumed by large scale integrated logger-processors in 1999 (Birikorang et al., 2001). According to the GTA, they accounted for over 60% of domestic timber harvest in the early 1980s, but now rely on Timber Utilization Permits that serve small harvest operations from off-reserve forests.

The observation of a shrinking formal industry, a possible future decline in resource availability and increasing share of harvest by large scale companies in 2007 presented a threat to the formal entry into the timber harvesting business by the informal sector; at the same time, the observation of a high national rate of illegal logging was a sign of weakness in forest regulation and enforcement associated with rent-seeking behaviour (corruption) among public officials.

3.2 Tenure and benefit sharing

the Timber Resources and Management Act, Act 547 has become a “timber” rather than a “forest” Act (Birikorang and Kyeretwie, 2003). Its requirements, through complex procedures under legislative instruments, prevent the participation of small informal operators in the allocation of timber resources. This has made the State to serve timber interests of the formal sector to the exclusion of small informal operators. Informal small-scale carpenters, with a capacity approximating 80% of chainsaw lumber production in 2007 claim they had no access to legal sources of wood and had to rely on chainsawn lumber. They also cite their exclusion from the allocation of plantation timber.

Legislation on land use (tree) rights is not clear, having regard to the unquestionable rights of land title holders. Thus, the Timber Resource and Management Act (Amendment Act, 2002), Act 617 provision that seeks to grant full private ownership rights to the person who planted the tree is contentious. This provision may be convenient under the case of land owned by traditional authorities but not under state control. In off-reserves, agreements under tenure systems extend rights to lands, but not to trees, so that landowners could insist they have first rights to benefits which flow from trees. The risks of investment in trees are high under these circumstances. For similar reasons and an inequitable distribution of forest revenues to communities that affected them, farmers had no incentives for preserving trees on their farms (see Amanor, 2002; Marfo 2006).

The distribution of forest revenues to Stool Lands and Traditional Authorities did not trickle down to farmers. Farmers also received little or no compensation for damage to their crops by timber operators (see Marfo, 2006). In 1999, less than US\$0.10/m³ was paid to farmers as compensation by timber operators, but they were paid or compensated instantly in cash by chainsaw operators (Birikorang et al./FC database, 2001). Marfo et al. (2009) estimated that, as of 2007, farmers received about GH¢. 9.5 million (US\$9.8 million) from Chainsaw lumber producers, who removed an estimated volume of 2.5 million m³ of timber. This put the average farmer's receipts at US\$4/m³, obviously a more attractive deal for minimum crop damage when compared to payments by formal sector operators..

Inadequate legislation worked against community access to timber: in particular, the non-existence of farmers' tenurial rights to trees on farm. Failure of distributed forest revenues to trickle down to communities created a disincentive among communities to support Sustainable Forest management (SFM) and conservation, and among farmers in preserving trees on farms. Farmers nonetheless favoured dealing with CSM operatives who offered better compensation than formal sector operators. Generally in respect of the informal operators, they were inequitably treated in the allocation of timber rights under existing legislation.

3.3 Production and trade

3.3.1 Export trade

In 2007, the formal sector produced 630,000 m³ and exported 530,000 m³ (84%) and sold about 154,000 m³ on the domestic market.⁸ Export value amounted to US\$ 252 million, the highest in two decades. Along these developments, there were significant changes in the production structure of industry. Export data on 2007 performance suggest a shift away from sawmilling to plywood production (Table 6).

8 The domestic sales volume, about 90% lumber, and including sales of sub-grade lumber (sapwood and off-cuts) and total production is estimated on the basis of the structure of production and sales analyzed in 2005 (Ref: Birikorang et al., 2007). About 23% of timber was recovered for the export market and 17% for the domestic. Total volume intake of timber for sawn timber production in 2007 was approximately 910,000m³ and total recovery rate 40%

Table 6: Selected wood product exports, cubic metres

	1999	2005	2007	2008	2009
Sawn timber	252	253	205	187	119
Plywood	25	58	129	138	147
Rotary veneer	67	59	29	29	10
Sliced veneers	34	39	39	40	29
Total Volume	433	466	529	549	426
Total value	174	220	252	280.5	192

Source: TIDD Export Permit Records

Over 70% of wood production in 2007 was contributed by large scale integrated logger-processors who dominated both primary (sawn wood and veneers) and secondary processing (plywood and processed lumber). This aspect of industry production structure and who controlled production are important to the current research work. Product segments other than lumber also compete for logs and usually only saw log grades, and therefore, a maximum volume at any time, are available for lumber production. Thus, from an estimated 910,000m³ input in 2007, sawmilling accounted for less than 60% of total wood processors' intake compared to about 76% estimated by Birikorang and others in 2005. These developments could potentially increase the domestic wood balance in subsequent years and hence induce increased production of chainsaw lumber.

Though across product segments industry has introduced a wide range of species since 1997, wood processing was in 2007 still skewed towards a limited number of species. For example, in 2003, *Ceiba*, *Wawa*, *Ofram Chenchen* and *Teak* accounted for 67% of total export volumes. 38 other species (including 24 in the low market demand classification) accounted for 33%. Production and export of kiln-dried lumber and rotary veneer are presented as examples in (See **Figures 4A and 4B** and **Table 7** below).

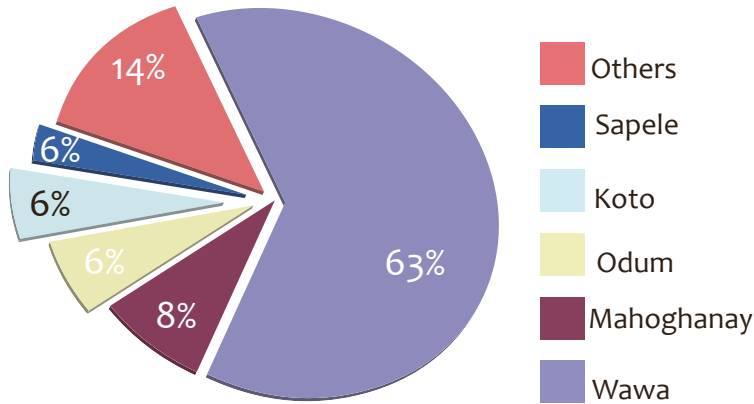


Figure 3a: Leading species (KD Lumber exports), 2003 (Total volume:118,800m³)

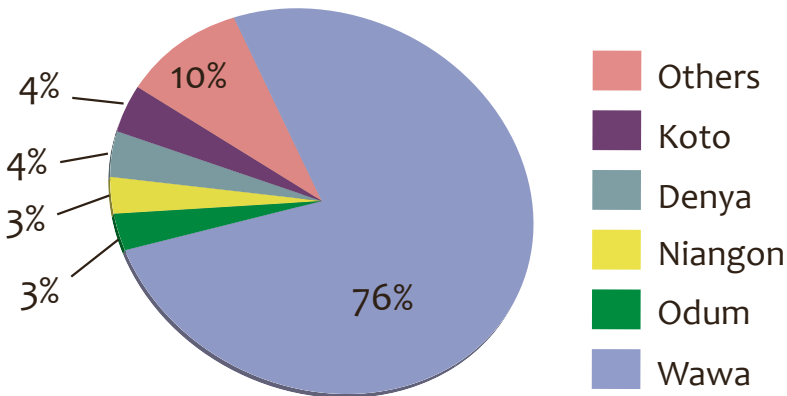


Figure 3b: Leading species(Processed wood/Moulding),2003(Total volume: 39,508m³)

Source: Forest Sector Policy Reform Support Group,FSDP2/FC, 2005

In 2007, 10 leading species in the export trade accounted for not less than 88% of total volume (**Table 7**). Thus, while the formal sector was largely export-oriented, it restricted production to a limited number of species, most regularly with a concentration on traditional species classified under “high” and “moderate” demand categories. In contrast, Marfo and others reveal that CSM processed about 72 species in 2007 (Marfo et al., 2009).

Table 7: Weight of top moving species in selected product segment exports, percentage; 2007

	First 5	First 10
Air-dried Lumber	80%	88%
Kiln-dried lumber	80%	90%
Sliced veneer	70%	91%
Processed lumber & moulding	81%	92%

Source: Based on TIDD Export Permit Records, 2007

3.3.2 Overland trade

Overland trade amounted to about 40,000m³ in 2007, as part of a period of systematic increase in that trade (Table 8).

Table 8: Overland trade in Lumber and Plywood, Volumes in m³/Values in US\$; 2005-2008

	2,005	2,006	2,007	2,008
Lumber				
Volume	1,207	3,199	3,497	3,843
Value	214,793	340,453	555,276	461,416
Unit Value	178	106	159	120
Plywood				
Volume	21,461	83,788	104,695	124,357
Value	7,741,402	29,732,851	39,546,345	51,420,274
Unit Value	361	355	378	413

Source: Based on TIDD Export permit records

Close to 90% of overland lumber trade was conducted by 8 intermediaries (non-processors).⁹ The overland trade also witnessed a spectacular increase in volumes of plywood exports by millers. Plywood production, as observed in

⁹ According to 2007 TIDD Export Permit records, 10 companies engaged in overland lumber exports,

the 1990s (Birikorang *et al.*, 2001), responded strongly to price incentives and relative changes in prices among the various wood products. The relative shift of exports from traditional markets diverted trade more to regional markets than the domestic. Both intermediaries in the case of lumber and processors in the case of plywood preferred the regional market to the domestic. The case of overland lumber presents another group of competitors who diverted potential lumber supplies of similar grades to the domestic market.

Import trade

Ghana imports significant volumes of wood products when compared with export volumes. About 290,000 m³ of various wood products, equivalent to 60% of wood export volume, were imported in 2005 (Birikorang *et al.*, 2007). Sawn timber accounted for about 80% of imports. The landed value of imports is estimated at about US\$300 per m³ (**Table 9**). This is close to twice the average domestic market price for lumber (US\$180 per m³) and equivalent to 75% of the average lumber export price (US\$425 per m³ in 2007).

Table 9: Import trade and prices

	Volume, m ³	Total CIF, ¢m	Unit values, \$/m ³
Sawn wood	227,324	547,985	268
Chipped wood	11,456	48,932	475
Veneers	9,118	32,032	390
Wood panels	21,924	87,082	441
Tertiary products (doors, frames, joinery, etc.)	9,906	52,048	584
Construction wood	6,142	11,414	206
Household appliances	860	13,520	1,747
Other wood	5,388	25,313	522
Total	292,118	818,326	311
FER/US\$	9,000		

Source: Birikorang *et al.*, 2007

Lumber imports average US\$268/m³, CIF (Table 9). Adding port charges and transport and handling costs would put the average lumber price in Kumasi at about US\$305/m³ (Table 9A). This assumes that lumber is imported by direct users and, therefore, the price estimated here does not include a profit mark-up.

Table 9A: Lumber import price estimate, Delivered in Kumasi

	US\$/m ³
Lumber cif value	268
Port/Bank Charges, 7% *	18.76
Transport and handling *	18.5
Total	305.26

Source:* Based on Birikroang et al., 2007

3.3.3 Domestic market

The level of export orientation of the formal sector in 2007 resulted in the sale of ‘prime wood’ to the export sector while supplies to the domestic market consisted largely of residual production. From a recent FORIG/TIDD study (August, 2009), the domestic market demand was estimated at 600,000 m³. The formal sector supplied about 150,000 m³ of lumber to the domestic market in 2007, leaving a gap of approximately 450,000 m³. The domestic market supply gap has since the 1990s been filled by chainsawn lumber, with the large informal tertiary sector depending on it for its annual intake of close to 400,000 m³ (Birikorang et al., 2007). In 2007, close to 500,000 m³ were put on the domestic market (Marfo et al. 2009).

The production/marketing chain, dependent on this source of wood, was intricate. Chainsawn lumber was integrated with a wide spectrum of intermediate and tertiary processing that provided a link between re-sawing, dimensioning furniture and joinery works. There were also direct market lumber sales for households and public projects. It is the nature of this production and marketing chain that generated the over 700,000 direct and indirect jobs in 2007, or 7 times what the formal industry engaged in 1999. The processing of chainsawn lumber is criminalized by Act 547 and LI 1649. Like the formal sector, it is a major cause of forest depletion and consequently the loss of national wealth. It presents to policy makers a challenge in resolving the trade-offs between employment and livelihoods on the one hand and forest conservation and long term national wealth creation taken in the long term on the other.

Communities' total consumption of lumber from both markets and outside the markets largely came from chainsawn lumber through part-payment to farmers or landowners for negotiated trees. There are no robust estimates of this component of annual wood consumption. Estimates under this study put it in a wide range of 150,000-300,000 m³.¹⁰

3.3.4 Pricing

An important observation made with regard to the formal sector's over-concentration on exports is the disparity between export and domestic prices.

Domestic prices of formal sector lumber was about 40% of the export price in 2007 (Table 10). This reflected the grade of lumber and the price domestic end-users were willing to pay. Chainsawn lumber producers did not pay stumpage fees and so their production distorted the domestic price of lumber. The supply and pricing of chainsawn lumber was linked to the general forest policy and market failures that plagued the sector. Plywood for similar reasons sold at higher prices on the domestic market than export on account of import duties on substitutes. These tariffs contributed to domestic price distortions.

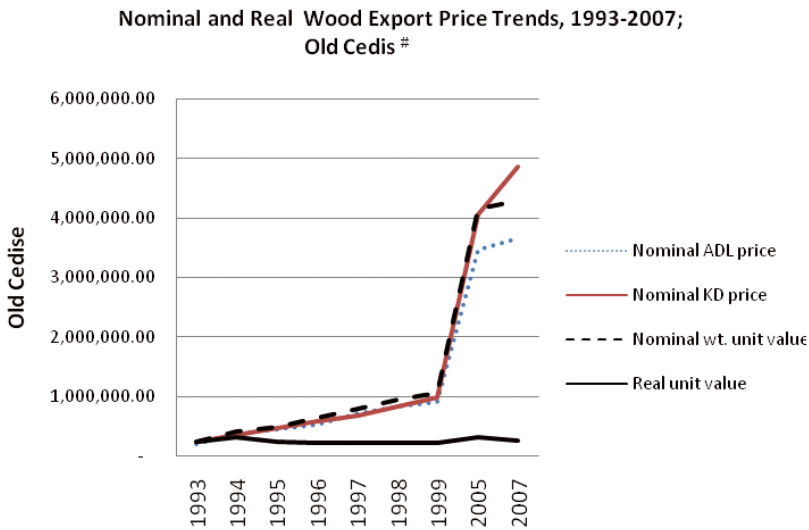
Table 10: Wood sector domestic-export price ratios, 2007

	Export price, US \$/m ³	Export value (,000 cedis)	Domestic price (,000 cedis)	Domestic price (US\$/m ³)
Air-dried lumber	427	3,843	1,600	178
Plywood	370	3,330	4,534	504
Overland lumber	159	1,431		
Overland plywood	378	3,402		
Chain saw Lumber			1,135	126

Source: TIDD Export permit Records/Market research

10 A 2001 study in the agriculture sector estimated per capita rural wood consumption parameter to be 0.02 m³ per annum (Ref: Masdar UK Limited, "Ghana Agro-Industrial Processing Study," MoFA, 2002. A population size of 20 million is assumed, with 75% as rural population. Views expressed by some PMT members point to a lower per capita rate for rural areas of about 0.01 m³, or one-third of the national.

The industry has benefited from a trend improvement in wood export prices in close to two decades. Sawn timber prices did not play any significant role in this general increase, with the exception of a 2007 increase in the price of kiln-dried lumber. When past current prices of timber were adjusted for inflation and foreign exchange variations, the resulting wood export prices (real prices) were found to be no better than prices in 1993 (Figure 4). This meant the purchasing power from a unit of export in 2007 was not different from that in 1993, even though current export prices had improved over the years. Ghana’s wood export policy, and for that matter sawn timber exports did not contribute meaningfully to economic growth.



Results of analyses of TIDD Export Permit data and Bank of Ghana/Ghana Statistical Services macroeconomic data.

Figure 4: Nominal and Real Wood Export Price Trends, 1993—2007; Old Cedis

An overconcentration of production by the formal sector on production for the export market left the domestic market to be filled by illegal chainsawn lumber that has over a decade depressed domestic prices due to its illegal avoidance of stumpage fee payment. This further prevented the formal sawmill industry from expressing interest in selling good grade lumber on the domestic market. As the formal sawmilling industry utilized a limited number of species, opportunities were offered to provide additional species on the market. Against these developments, it was also observed that export concentration did not bring real benefits to Ghana’s economy.

3.4 Industry profitability

3.4.1 The formal sector

According to the wood industry, it requires a minimum throughput in order to break even (Brooks and Associates, 2004). Production of rotary (peeled) veneer was not profitable, while sawmilling earned minimum returns but profitability improved with re-manufactured by-products; sliced veneer production was more profitable, while plywood was most profitable, rewarding; and plywood was the most profitable. (Birikorang et al., 2007). The Ghana Timber Millers Organization's (GTMO) cost structure of sawn timber production produced by its consultants, Brooks & Associates are presented below:

Table 11: Sawn timber production cost as estimated by Brooks & Associates, 20041

Raw material	36.9%
Production	30.7%
<i>Including, haulage to port =2.4%</i>	
Export charges	9.6%
Overhead costs	22.8%
	100.0%
Export price = US\$350/m ³	
Total cost = US\$325/m ³	
Gross profit	7%

According to the industry, trend increases in fuel/energy prices after the above cost structure had been produced further reduced profits. Generally, an explanation offered by the formal wood industry in Brooks and Associates study of sawmill costs (2004) that it required more inputs to break even was rather a problem of low inefficiency leading to low profits. Low recovery rates of the industry together with the industry's capacity drove the rate of over-harvesting which in existing literature has significantly been associated with environmental degradation.

3.4.2 CSM real business perspectives

CSM generated positive benefits in 2007. Marfo (2009) estimated that in domestic and overland trade, CSM made US\$35 million in informal payments. It also provided substantial livelihood support in the supply and marketing chain. It is estimated in this report that the average worker earned on part-time basis about US\$190 annually, or about 40% of the national per capita income (Table 12).

Table 12: Estimated annual value of livelihood per worker in CSM production and marketing in 2007, US\$ (Based on Annex Table A2)

Group	Numbers #	Annual opportunity cost estimate per worker in CSM supply and marketing chain *
CSM Operators (Sawyers and handlers)	70,000	160
Head loaders	60,000	120
Transport	200,000	200
Integrated re-sawing	20,000	820
Brokers, lumber production and selling	350,000	170
Total	700,000	
Weighted average (Ref Annex Table A2)		190

Source: Mayers et al; 2007; Marfo, 2009; * estimated on the basis of KS Nketia Survey data from CSM production chain (2007) for CSM operatives and head-loaders and Ghana Living Standards Survey-5, 2008 (GLSS5) for others (See Annex 2).

For an estimated total number of workers engaged in the supply and marketing chain, CSM has the potential to generate about US\$130million. (See Annex 2).¹¹

In addition to the direct employment, CSM also contributes generally to rural economies. Based on Obiri and Damnyag's research work on the structural distribution of CSM benefits (2009), the CSM model employed in this research work has been used to estimate its contributions to rural economies. The

¹¹ 2007 stumpage fees collected by Forestry Commission amounted to US\$8.2 million. 50% was due as share of forest owners.

business could have generated some US\$12 million in contributions to rural economies (**Table 13**).

Table 13: CSM Contributions to rural economies, 2007; US\$,000

Category	Wts #	Model estimates
Services	0.20%	24
Firewood	0.30%	36
Lumber	3.90%	474
Taxes	4.90%	596
Community benefits	6.40%	779
Employment	84.30%	10,255
Total contribution to Rural Economies	100.00%	12,165

Source: # Based on Obiri & Damnyag in Marfo et al. (eds), 2009

Similar to the formal wood industry, CSM is also associated with a broader environmental havoc on account of its low recovery rate of 30% that makes chainsawing to constitute an equally intense pressure on forests as the formal sector. CSM presents to policy makers a challenge in resolving the trade-offs between employment and livelihoods on the one hand and wealth creation on the other.

4 FOREST AND TRADE REGULATION IN FOREST FISCAL CONTEXT

Institutional costs

Forest management and regulation (FM&R) is a virtual monopoly of the Forestry Commission. The Operations Department of Forestry Services Division (OPD/FSD) enforced compliance with forest management regulations in the High Forest Zone (HFZ) at a cost of US\$5/m³ for the 965,000 m³ recorded harvest in 2005 (Birikorang et al., 2007). In FRs and OFRs, the cost was estimated at US\$7.5/m³ and US\$2/m³ respectively. Its total budget on FM&R in the High Forest Zone (i.e. on FRs and OFRs) in 2005 was estimated at approximately US\$4m. These costs worked out to be about 7% of the 2005 fob lumber price. The Timber Inspection Division also regulated the industry and trade at a cost of US\$5.50/m³ of wood product. Its total cost in 2005 was approximately US\$3m. For forest management in the HFZ and trade regulation it cost the FC a total estimated cost of US\$7 million in 2005. FC's internally Generated Funds (IGF) in 2005 comprised stumpage (US\$8.67 million) and TIDD levies (US\$7.2 million). Stumpage revenues were shared with forest owners in a 50:50 ratio. FC's revenues from these two sources would have amounted to US\$11.5 million in 2005. From 2006, FC's revenues from export levies has declined sharply as a result of industry resistance to payment of export levies, while financial resources from plantation timber bidding has also dwindled from declines in matured plantation stands. In 2007, the FC projected a deficit of GH¢9 million.

Hidden private sector costs

Apart from these institutional costs, there are other costs of regulation that are not considered in FC's budget impact. This has to do with the cost of operators complying with FM&R in particular. Through a wider industry and FC stakeholder consultation in 2005, it was estimated that the public sector regulation cost the industry as much as US\$6.5/m³ on top of FSD/OPD costs. Further, Traditional Authorities appear to have lost confidence in the FC-managed royalty payment system and have also tried to justify their dealings with timber operators by insisting that they do more than the 5% stumpage value paid as Social Responsibility Agreement (SRA) to forest communities. As a result, large-scale operators, for instance, are forced into meeting informal social responsibilities

in order to continue to have access to forests. This imposed an estimated US\$8/m³ cost on key operators in 2005.

While the institutional regulation “harms” industry’s finances, a conflict of CSM and FC staff interests is also recognized: CSM operations pose a long term risk of reducing FC’s financing capacity from stumpage fees. In reality, this risk is emerging with the rate of depletion of high and moderate valued species.

Cost of compliance

With the coming up of VPA’s implementation, cost of compliance with legality becomes a key issue. Reckoning with the procedures GTA operators follow in attaining a short term TUC, the cost of compliance comes to US\$13/m³. Compliance with VPA verification is also estimated at US 3/ m³ (**Figure 5**). If the institutional FM&R remains in a *status quo*, the cost of total compliance and forest access could come close to US\$30/m³. This removes the potential for fully capturing economic rent through any fiscal instrument. But under programmes linked to Ghana’s Natural Resources and Environmental Governance (NREG), an FC institutional reform can restore Traditional Authorities confidence, while the VPA process and accompanying dialogue can eliminate the high transaction costs associated with compliance and thereby improve future financial security of FC. This is feasible under institutional reforms that incorporate shared functions with the private sector and minimizes the tendency towards “rent seeking” among FC staff. Verification of legal Compliance and Verification of Legal origin under VPA creates opportunities for reduced TIDD costs as some present core services of the Division are likely to converge with the verification system under VPA.

Future Scenario			
Current (2005) Tax Potential under Log Export Ban Policy US\$m ³	Subtraction from Real Stumpage price of trees US\$m ⁻³		Cost implications of legal enforcement
28	Operators' Compliance Cost	13.0	<ul style="list-style-type: none"> Operators' compliance cost – US\$ 13m⁻³ Cost of verification estimated at US\$ 3m⁻³
	Existing Transaction costs	6.5	State bureaucracy (monopoly) cannot finace itself at US\$ 14m ⁻³
	Informal SRA	8.0	
	Verification Cost	3.0	<ul style="list-style-type: none"> Potential Stumpage price might reduce from US\$28 to US\$15 of which 50% share goes to forest owners
	Total	30.5	

Figure 5: Future institutional costs under “status quo” bureaucracy

:Extract from HRC, “ Macro and sector issues relevant to Timber Verification in Ghana, VERIFOR Project-Forestry Dept., FAO International Workshop, November 25, 2008

5 THE POLICY OPTIONS AND THEIR SCENARIOS

The three policy options stated under the objective of this research are:

- (a) Sawmills to supply the domestic market with legal timber obtained from sustained yields;
- (b) Sawmills and artisanal millers supply the domestic market with legal timber obtained from sustained yields and;
- (c) Artisanal improved mills to supply all lumber required by the domestic market while sawmills focus on export, in keeping with sustained yields.

In examining possible scenarios under the three policy options, a number of key policy elements that are likely to emerge in the scenarios are reviewed below to give support to some of the key assumptions made under the scenarios. These are mill efficiency, importation of logs, policy affecting domestic pricing and a ban on export of wood products.

Mill efficiency

Wastage of forest economic rent through milling inefficiency is a policy issue. Improved milling efficiency under legal enforcement can impact positively on profitability, employment and economic value added. In the various scenarios treated, a change in sawmills' lumber recovery rate from 40% to 55% has been assumed to reflect improved technology and innovation. The assumption derives from a 54% average recovery rate computed from available milling technologies (regular mills, Logosol, Wood Mizer) produced in a study by a FORIG Research Team (see Wilson et al. 2009; Marfo 2010). Conversion of chain saw millers to improved (artisanal) millers could increase their recoveries from the current average of 30% (Wilson et al. 2009; Marfo, 2010) to 60%. A KNUST research on graded lumber recovery from logs using the Logosol (artisanal milling) produced an average result of 50% (cf Wilson et al. 2009). The current study's assumption is that sub grade lumber (sapwood, etc) with potential rural consumers' demand, including sub-grade joinery could raise recovery to 60%. The current study's assumption uses the 50% recovery rate. This rate would still allow the inclusion of low grade and defective logs, which may not be economic for the formal sector concessionaires to transport over long distances.

Importation of logs

Granted that legality of timber will be enforced, and that an objective of supplying 600,000 m³ of lumber to the domestic market must be met, importation of logs is assumed to occur as a short to medium term measure, while supplies from domestic plantation timber sources, not included in the analysis of scenarios, are planned as a long term measure ¹².

For sawmilling, a potential RWE gap of 700,000 m³ is likely to emerge. But integrated mills, which control close to 60% of timber harvest, will find it less imperative than non-integrated sawmills to embark on imports as a strong business alternative for meeting domestic market demand, particularly because of higher cost of using imported logs. It will require a high domestic price, in the region of 80% of the current export price, to induce their sales in the domestic market. ¹³. Large-scale firms have consequently been excluded from all but the first scenario set in the context of Option 1 (Sawmills only supply lumber to the domestic market). Conversely the search for low cost alternatives among improved artisanal millers could be interesting.

Domestic price distortion

Due to the existence of an export-domestic price differential, sawmillers are not interested to sell on the domestic market nor to make investments in production processes that will promote development of the market. To correct this price differential, some form of guaranteed price combined with fiscal measures will be required. The fiscal measures will include a full collection of stumpage fees by FC. All this must occur in the context of the enforcement of legal rules set by the VPA. In the scenarios a domestic price of US\$310 per m³ of lumber, equivalent to 70% of the 2007 fob lumber price has been used. This price is imposed on the scenario models, and conditions for its realization are explained in recommendations.

¹² This proposition considers a future risk that timber producing countries in the West and Central African Sub regions might be pursuing and advancing similar policy measures as are under consideration by Ghana, and might therefore pose a risk to Ghana using log importation as a long term strategy to solve the country's raw material needs.

¹³ The position of large-scale firms indicated here does not mean for them the domestic market will basically never be a realistic alternative. There are other alternative situations that may result in their selling lumber on the domestic market, such as may result from the imposition of export quota systems. These conditions are outlined in recommendations of the appropriate fiscal measures and circumstances that demand these measures.

Export ban

Banning export sales of lumber is tested under one policy option and is not recommended, at least not in the short term. However, it is worth looking at a lumber export ban in the context of a long term fiscal policy towards developing and fully integrating the tertiary sub-sector in forest industry's development.¹⁴

5.1 The scenarios

On the basis of the policy options, and elements discussed above, as well as the general context of the forest industry performance and institutional regulations, a number of scenarios and their key assumptions are defined. The scenario (model) results are analyzed, the various analyses focusing on both the micro- and macro-economic, as well as forest sector indicators. Forest sector implications are later inferred from these scenario analyses to discuss forest owners' CSM operatives', industry's and the State's perspectives.

5.1.1 Baseline Model

The 2007 condition is characterized by the current forest governance environment under which various industry players in both formal and informal sector operate. Essentially, they consist of policy and market failures (poor timber pricing and discretionary timber allocation) as well as institutional cost burden on industry and weaknesses in regulation and legal enforcement. These conditions as overviewed in **Sections 3 and 4**, constitute a "Business-As-Usual" environment. The Baseline Model consists of a progressive shift of policy from the "Business-As Usual" conditions of 2007 to a full implementation by 2015 of legal timber enforcement under VPA. No other policy reform is assumed to occur under this model. A VPA impact assessment study expected enforcement of legality to bring the annual national harvest limit down from the administrative limit of 2 million to about 700,000 m³ in 2015 (Mayers *et. al.*, 2008).

From a presentation of the wood sector context, the following additional assumptions are made in the model:

- Sawmill share of national harvest will be 57%;
- The future sustainable harvest is put at 700,000 m³ ;

¹⁴ In the short term, banning exports of lumber is equivalent in impact to the log export ban that over-protects the primary processing industry

- The current export price of US\$425 per m³ will continue in the future, but the domestic price is assumed to adjust to US\$302 per m³.

The model results are summarized in **Table 14**.

Table 14: Sawmilling Baseline (Based on Annex Table A3.1 & A3.3)

	2007			Baseline Legal Timber, 2020=718,000m ³		
	NINT	INT	CSM	NINT	INT	CSM
Timber volume input; 000,m ³	273	637	1,640	123	286	820
Lumber output, 000m ³	109	255	497	49	114	248
<i>Of which:</i>						
Export Volume, 000m ³	63	147		28	66	
Domestic market volume, 000m ³	46	108	497	21	48	248
Export price, US\$/m ³	425	425	-	425	425	-
Domestic price, US\$/m ³	180	180	126	180	180	126
Unit production cost, US\$ per m ³	291	276	92	343	362	90
Economic value added per m ³ output; US\$	(121)	(119)	24	(157)	(178)	25
Employment,	3,485	8,131	130,000	1,564	3,649	64,990
Gross profit margin, %	9	14	27	(7)	(13)	28
Stumpage fees, US\$,000	2,458	5,735	-	1,103	2,574	-
Export levies, US\$000	134	312		60	140	

	2007			Baseline Legal Timber, 2020=718,000m3		
	NINT	INT	CSM	NINT	INT	CSM
Social Responsibility Agreements (SRAs) , US\$000	123	287		55	129	
Payments to farmers			9,544			4,787
Informal payments, US\$000	2,185	5,098	8,967	980	2,288	4,483
Contributions to rural economies			1,910			955
Institutional costs						
<i>Of which</i>						
FC costs	1,712	3,995		768	1,793	
(VLTP)Costs	-	-		770	1,798	
Notes: NINT=Non-integrated sawmills; INT=Integrated large-scale mills						
VLTP = Validation of Legal Timber Programme						

Current Conditions

Lumber production for the domestic market

In this scenario, sawmills consumed about 910,000 m³ of timber in 2007 and produced a total of 360,000 m³ of lumber, with 70% of production contributed by large-scale integrated mills. About 150,000 m³ of the sawmills' production, equivalent to 40%, was disposed on the domestic market. This volume included sub-grades for the market.¹⁵ CSM produced an additional 497,000 m³ of lumber. Thus, out of about 650,000 m³ of total supply of lumber to the domestic market in 2007, CSM contributed about 80%.

¹⁵ Recovery from sapwood is a major component of joinery works in the informal sector. Joinery for low cost housing and furniture and joinery for local food bars depend on this material.

Business profits

Export markets, with better prices (US\$425 per m³) than the domestic (US\$180 per m³) provided better business opportunities in 2007 for sawmills to return business margins of between 9% and 14%. CSM was a better business option with a return of 27%, twice that of the integrated mills. It sold lumber at US\$126 per m³ but spent US\$90 per m³ to produce. It contributed about 80% of the domestic market supply.

Employment

Direct employment in sawmills was about 11,500 persons. In contrast, CSM employed 130,000 persons. These consisted of 70,000 direct employment in production, more than 6 times the size of employment generated in the formal sector, and 60,000 employment in head-transportation. In terms of value, CSM employment was about 2.5 times of the formal sawmill sector (See Annex Table A3.1). In terms of value, CSM employment was only just about the size of contributions by small scale mills, or 45% of integrated mills.

Forest taxes and other transfer payments

Sawmilling contributed about US\$8 million in stumpage fees and export levies in 2007. This was equivalent to US\$9.90 per m³ forest tax (stumpage and export levies). CSM did not contribute forest tax, this suggesting that there was an unequal level playing field between its operation and that of the formal sector. Nonetheless, it made about US\$9 million informal payments in 2007, which were equivalent to about 5.8 per m³ (about 60% of formal sector payment) of input used. In terms of total transfer payment, the formal sector paid US\$17.9 per m³, compared to US\$12.4 per m³ (70% of formal sector payments) by CSM.

In terms of economic assessment, both sawmills and CSM subtracted from the nation's wealth by recording negative value addition.¹⁶ . Nonetheless, in their inter-sectoral linkages, both provided opportunities for value addition in other key sectors. Sawmills had significant linkages with the services industry, namely, insurance and administration, technical and transport/port services. Through road transportation alone, CSM contributed 30% of other sectors' value added generated through sawmill linkages.

¹⁶ Economic value added analysis uses the import parity price of timber sales in valuing raw material inputs. These losses are different from losses due to environmental degradation resulting mainly from logging.

CSM contributed to livelihoods to the tune of some US\$130 million and about US\$12 million to development projects in Districts. Based on GTMO's estimate of the level of informal payment, amounting to US\$8/m³ of timber harvest, integrated sawmills may also have contributed about US\$7 million in informal payments to traditional authorities and their subjects through logging activities in 2007. They would also have made an additional cash payment of about US\$400,000 in Social Responsibility Agreements which according to Legislative Instrument 1721, is calculated at 5% of stumpage fees.

Though both sawmills and CSM made the observed contributions to the national economy, these were based on unsustainable use of timber. With total annual harvest volumes in the region of 4 million m³ about 3 times or more than sustainable levels, forest communities are the losers as they bear the long term adverse impacts of forest degradation such as land degradation and loss of their livelihood base.

Future conditions

The resource limit

Implementation of VPA is expected to bring about enforcement of a sustainable AAC. It is assumed that legal enforcement will go through some transition period during which attempts might be made initially to enforce the pre-existing 1,000,000 m³, though it may not be a sustainable cut limit, given many years of depleting the resource (Mayers *et al.*, 2008). Eventually, progress is expected to be made towards enforcing a sustainable AAC after 2015. VPA Assessment Study put the sustainable annual harvest limit tentatively at 700,000 m³ (Mayers *et al.*, 2008).

In the future, sawmill inputs will be expected to decline from the 2007 level to about 400,000 m³ when Ghana's VPA is fully implemented by 2015. This will make sawmills highly vulnerable in terms as they will be unable to break even. On the other hand, it is assumed under the model that CSM will continue in the absence of other policy reforms.

Employment

The baseline model estimates that the sawmills will be likely to shed off about 7,000 jobs (from about 11,000 to 5,000). With respect to CSM, the baseline assumes that a ban is not enforceable apparently for lack of both market and

administrative interventions. In this case, while sawmills head for a severe hard landing unless it integrates downstream, CSM continues with a high rate of profitability. By 2012 and 2020 CSM volumes are still expected to be significant declining from the current 1.6 million m³ to about at about 1.3 million m³ and down to about 1.1 million m³ respectively (Mayers et al., 2008). In the long term, CSM also runs the risk of being hit by further resource depletion unless the State embarks upon comprehensive sector reforms (Mayers et al., 2008).

5.1.2 Model Scenario 1: Sawmills only supply legal lumber to the domestic market (Policy Option 1)

This scenario also consists of the following policy conditions:

- A ban of CSM is enforced;
- Improved milling efficiency from 40% to 55%;
- Large scale integrated mills retain 54% control over harvest;
- Importation of logs by integrated mills (INTs);
- Stumpage fees are retained at their 2007 level estimate of US\$8.44/m³;
- Improved domestic pricing: domestic price of lumber increases from about US\$180 to US\$310.

The model is not designed to forecast level of demand. Thus, demand is imposed on the model by policy to supply adequate legal lumber (600,000 m³) to the domestic market.” Implicitly, however, the model reasonably assumes a theoretical postulate that lumber imports will increase to fill a domestic supply gap (represented by lower production costs in INTs), or the domestic demand will be met through importation of the roundwood equivalent of the domestic supply gap (represented by higher production costs in INTs).

Price is also imposed by our research results about import parity price of lumber not generated by the model. What the current research has attempted to do is to present in recommendations how to bring the price adjustment about: eg minimum pricing, full economic stumpage collection, etc.

Summary of results of the scenario model is presented in Table 12

Table 15: Policy Option1, Scenario 1 (Sawmills only supply legal lumber to the domestic market (Based on Annex Table A3.5)

	2007				2020				Scenario 1 (Option 1), Legal Timber, 2020 = 718,000 m ³				
	NINT	INT	CSM	NINT	INT	CSM	NINT	INT	NINT	INT	CSM	NINT	INT
	Timber volume input; 000 m ³	273	637	1,640	123	286	820	450	1,050				
Lumber output, 000 m ³	109	255	497	49	114	248	247	577					
Of which:													
Export Volume, 000 m ³	63	147		28	66		67	157					
Domestic market volume, 000 m ³	46	108	497	21	48	248	180	420					
Export price, US\$/m ³	425	425	-	425	425	-	425	425					
Domestic price, US\$/m ³	180	180	126	180	180	126	310	310					
Unit production cost, US\$ per m ³	291	276	92	343	362	90	366	353					
Economic value added per m ³ output; US\$	(121)	(119)	24	(157)	(178)	25	-228	-216					
Employment,	3,485	8,131	130,000	1,564	3,649	64,990	2,929	6,835					
Gross profit margin, %	9	14	27	(7)	(13)	28	(162)	(152)					
Stumpage fees, US\$,000	2,458	5,735	-	1,103	2,574	-	1,103	2,574					

	2007				2020				Scenario 1 (Option 1), Legal Timber, 2020 = 718,000 m ³			
	NINT	INT	CSM		NINT	INT	CSM		NINT	INT	CSM	
	Export levies, US\$000	134	312		60	140			112	262		
Social Responsibility Agreements (SRAs), US\$000	123	287		55	129			55	129			
Payments to farmers			9,544				4,787	0	0			
Informal payments, US\$000	2,185	5,098	8,967	980	2,288	4,483		980	2,288			
Contributions to rural economies			1,910				955	0	0			
Institutional costs												
<i>Of which</i>												
FC costs	1,712	3,995		768	1,793			983	2,295			
(VLTP)Costs	-	-		770	1,798			2057	4,801			
Notes: NINT=Non-integrated sawmills; INT=Integrated large-scale mills												
VLTP = Validation of Legal Timber Programme												

Production for the domestic market: Sawmills under this scenario utilize about 1.5 million m³ of round logs in 2020. Imports will account for approximately 1.1 million m³ or 73% and domestic harvest about 410,000m³ or 27%. The domestic component represents the harvest share for sawmilling which will originate from the sustainable legal harvest of 718,000m³.

Total sawmill output will be 824,000m³, with 600,000m³ destined for the domestic market. 70% of the domestic market volume will be supplied by INTs, and 30% by NINTs. A lower proportion of sawmill output, 27%, will be exported, NINTs contributing only 30%. Thus INTs depend largely on imported logs to meet 70% of the domestic demand for lumber, while keeping exports low.

Production costs: Cost of production of INTs will decline in 2020 when compared with the corresponding baseline. However, for all sawmills costs will be higher than the 2007 condition. Log importation at a higher cost is a significant factor in escalation of production costs. The decline in INTs' costs partly explained by scale advantage and improved efficiency which partly offset the impact of higher cost of imports. In the case of NINTs, they miss scale advantages, and improved efficiency is not adequate to counter-balance higher cost of raw material.

By similar deductions, improved efficiency is unable to counterbalance higher costs of imports which more reflect the economic price of raw material. Thus, processing leads to negative value added.

Profits: under this scenario, profits decline considerably when compared with the 2007 condition. This situation suggests that the baseline conditions of enforcement of legality without importation of logs are better for sawmills.

Employment: The scenario suggests that increased volumes of timber through imports have the potential to generate an additional 4,550 employment in 2020 over the expected level in the corresponding baseline. However, the impact of negative profits for sawmills threaten the sustainability of this employment level. Sawmills could decide to put more saw logs into sliced veneer or imported logs into the production of plywood if these options offer better profits. At least, the condition of other product segments being more profitable than lumber existed in 2007 and previous years and was demonstrated by an expansion in production and export overland of plywood and veneers and a decline in lumber exports.

Forestry fees and levies: Levels of forest tax do not change from the baseline condition in 2020, but FC's forest management/trade regulatory costs and VPA

running costs increase as a result of timber imports. This represents a challenge to FC's finances..

Informal payments: Enforcement of legality will not affect informal payments to traditional authorities, because the payments are not formally related to volume, and are paid as traditional homage. The ban on CSM eliminates informal payments to communities and farmers (US\$9.2m), community level support (US\$12m) and, generally, livelihoods in CSM supply and marketing chain. Sawmills' payments to traditional authorities do not change between this scenario and the corresponding baseline period, while contributions to SRAs with communities remain limited and insignificant.

5.1.3 Model Scenario 2: Sawmills and artisanal millers supply legal lumber to the domestic market under conditions of a lumber export ban and harvest quota for AMs (Policy Option 2)

This scenario comprises policy option 2: It also consists of the following policy conditions:

- Improved milling efficiency (As in scenario 1) Sawmills produce lumber under 100% domestic supply quota (that is there is a lumber export ban)
- Improved artisanal milling produces lumber at a recovery rate of 50% compared to 30% from CSM It is a high recovery (higher than normal milling)]
- Artisanal millers receive financial assistance (loans) to cover new investments
- Improved domestic pricing (as in scenario 1)
- Small operators obtain permits in off-reserves under condition that they sell to artisanal millers
- Artisanal millers receive timber felling permits that grant them access to 50% of off-reserve volume harvest.
- Thus, AMs benefit from a 50% quota from Off-reserve harvest and additional 50% induced sales of 50% of total production from small operators
- The State facilitates a pre-financing credit scheme for small forest reserve operators in order to reduce their dependence on INTs and to induce them to sell timber to AMs

- The supply of timber to the various categories of lumber producers under this scenario will be as follows:

	Harvest level (2015) = 1 million m ³	Harvest level (2020) = 718,000 m ³
INTs	287,253	206,248
NINTs	177,875	127,714
AMs	317,247	227,784
Total	782,375	561,745

In addition to the key assumptions already identified as external to the model, the following become relevant to this scenario:

- *Improved access to timber:* The State facilitates financial sector pre-financing credit for small harvest operators/stumpage to induce sales to AMs
- *Limited harvest quota:* There is a further assumption here that excluding potential GTA investors, administration of forest access through quotas may not work for large number of CSM operatives exiting into artisanal milling
- *Strong AMs Trade Association:* The State invests in a special scheme to facilitate the building of a strong Artisanal Millers Trade Association.

Summary of results of the model is presented in **Table 16**.

Table 16: Scenario 2 (Policy Option 2): Sawmills and artisanal millers supply legal lumber to the domestic market under conditions of a lumber export ban and harvest quota for AMs (Based on Annex Table A3.7)

	2007				2020				Scenario 2 (Option 2), Legal Timber, 2020=718,000m ³			
	NINT	INT	CSM	NINT	INT	CSM	NINT	INT	NINT	INT	AMS	
Number of artisanal mills											431	
Timber volume input; 000, m ³	273	637	1,640	123	286	820			128	206	228	
Lumber output, 000 m ³	109	255	497	49	114	248			70	113	114	
Of which:												
Export Volume, 000 m ³	63	147		28	66				0	0	0	
Domestic market volume, 000 m ³	46	108	497	21	48	248			70	113	114	
Export price, US\$/ m ³	425	425	-	425	425	-			Lumber export ban in place			
Domestic price, US\$/ m ³	180	180	126	180	180	126			310	310	310	
Unit production cost, US\$ per m ³	291	276	92	343	362	90			251	308	122	
Economic value added per m ³ output; US\$	(121)	(119)	24	(157)	(178)	25			-5	-56	229	
Employment,	3,485	8,131	130,000	1,564	3,649	64,990			2,241	3,619	26,326	

	2007				2020				Scenario 2 (Option 2), Legal Timber, 2020=718,000m ³				
	NINT	INT	CSM		NINT	INT	CSM		NINT	INT	NINT	INT	AMS
Gross profit margin, %	9	14	27		(7)	(13)	28		19	21	61		
Stumpage fees, US\$,000	2,458	5,735	-		1,103	2,574	-		1,078	1,741	1,923		
Export levies, US\$000	134	312			60	140			0	0	0		
Social Responsibility Agreements (SRAs), US\$000	123	287			55	129			54	87	96		
Payments to farmers			9,544				4,787		0	0	1,325		
Informal payments, US\$000	2,185	5,098	8,967		980	2,288	4,483		1,022	1,650	0		
Contributions to rural economies			1,910				955		0	0	0		
Institutional costs													
<i>Of which</i>													
FC costs	1,712	3,995			768	1,793			639	1,031	1,139		
(VLTP)Costs	-	-			770	1,798			688	1,112	1,228		
Notes: NINT=Non-integrated sawmills; INT=integrated large-scale mills													
VLTP = Validation of Legal Timber Programme													

Production for the domestic market: Sawmills under this scenario utilize about 334,000 m³ of round logs in 2020 and AMs approximately 228,000m³ (59% share). Sawmills do not import logs. The entire domestic harvest share of sawmills and AMs (approximately 562,000m³) is destined for the domestic market because of an export ban on lumber. The deliberate use of policy reduces INTs' influence on off-reserve harvest, which is restricted to small operators. So, the total harvest for national lumber processing increases to 78% of legal national harvest (718,000m³), compared to 57% in the business-as-usual (true) situation of 2007 and the 2020 baseline when legal lumber processing would be 57%.

Total lumber output will be approximately 300,000m³, including 38% supplied by AMs. There is a domestic supply gap of 50% which is assumed to be imported at the import parity price of US\$310/m³.

Production costs of sawmills will decline in 2020 when compared with the corresponding baseline. However, costs will be higher than the 2007 condition. The decline in costs is explained by improved efficiency. Unit production cost for AMs (US\$125/m³) in 2020 will be higher than CSM's (US\$90) in the corresponding baseline period. The higher cost will be associated with AMs formalization which makes them pay stumpage fees, as well as the introduction of overhead costs associated with the new technology. But as profit rates show below, the higher cost indicator does not signify inefficiency

Profits of sawmills under this scenario will turn positive and significant when compared to losses in the corresponding baseline period, and will still be better than in 2007 when INTs in particular operated at a higher level of scale. The introduction of the LOGOSOL creates high gross profit rates of more than twice the level of CSM profits. This is largely explained by a higher price-cost ratio (2.5) in 2020 than in the corresponding baseline period for CSM (1.5)

Employment: when compared with 2007, sawmills will shed about 50% of its employment (about 5,800) due to the reduced harvest level. Comparing the corresponding 2020 and baseline levels, this scenario will increase employment by only 650, approximately. The increase will come from NINTs whose log intake will increase, but insignificantly. INTs will shed labour as its intake declines. Introduction of AMs will bring about some 80% of direct employment.

Levels of **forestry fees** contributed through lumber production will increase by close to 30% largely as a result of an induced supply of timber to lumber processing. AMs will contribute 40%.

FC's forest management/trade regulatory costs and VPA running costs will increase insignificantly in 2020 when compared with the corresponding baseline period. It is significant to note that the entry of AMs only increases costs by 14%.

Informal payments: Enforcement of legality will not affect informal payments to traditional authorities, because the payments are not formally related to volume, and are paid as traditional homage. The ban on CSM eliminates informal payments to communities and farmers (US\$9.2m), community level support (US\$12m) and, generally, livelihoods in CSM supply and marketing chain. Sawmills' payments to traditional authorities do not change between this scenario and the corresponding baseline period, while contributions to SRAs with communities remain limited and insignificant.

5.1.4 Scenario 3 (Option 2): Sawmills and artisanal mills supply legal lumber to the domestic market under an Export/ Domestic harvest quota regime and fiscal incentives

Under this scenario, the following conditions occur:

- The state combines an export-domestic supply quota system of 4:1 reckoned in roundwood equivalent and fiscal measures such as rebates in stumpage fees for INTs as incentive to sell timber to Artisanal Millers
- The State also exercises discretion in allocating 50% quota of timber from off-reserves and deliberate policy (eg minimum pricing and stumpage rebate) to secure for NINTs and AMs 50% sales of forest reserve production by small operators
- Under this scenario, INTs are assumed to have no harvest operations in off-reserves
- There is no restriction on exports of lumber by INTs.
- NINTs are not permitted to export lumber, but are assisted with timber quota for lumber production for the domestic market
- The supply of timber to the various categories of lumber producers consistent with the above scenario assumptions is as follows:

	Harvest level (2015) = 1 million m ³		Harvest level (2020) = 718,000 m ³	Shares
INTs	262,537		188,501	32%
NINTs	177,875		127,714	22%
AMs	382,882		274,909	46%
Total	823,293		591,124	100%

(See Annex A3.9 [Addendum])

- The State facilitates the establishment of a pre-financing scheme for small timber operators to induce them to sell timber to AMs
- The State facilitates and finances the cost of establishing and building the capacity of an Artisanal Millers Trade Association to operate as both a self-interest seeking body and a collaborator with Forestry Commission in sustainable forest management and conservation.¹⁷

Discussion of this scenario, with summary results presented in Table 17 focuses on key strategic interventions that depart from those in Scenario 2.

¹⁷ The cost of enforcing legal compliance under VPA will embrace CSM ban enforcement as part of FC's and law enforcers' activities. Complimentary activities could be introduced by AMs Trade Association checking its own membership and preventing entry of non-AM CSM operatives. Cost of their activities would be expected to be embedded in the ir running costs. It is expected that this cost will be at a minimum and embodied in the Trade Association's .

Table 17: Sawmills and Artisanal Mills supply legal lumber to the domestic market under regime of domestic harvest quotas and fiscal incentives (Based on Annex Table A3.9)

	2007			2020			Scenario 3-FISCAL (Option 2), Legal Timber, 2020=718,000m ³		
	NINT	INT	CSM	NINT	INT	CSM	NINT	INT	AMS
Number of artisanal mills									510
Timber volume input; 000,m ³	273	637	1,640	123	286	820	128	165	269
Lumber output, 000m ³	109	255	497	49	114	248	70	109	135
Of which:									
Export Volume, 000m ₃	63	147		28	66		-	91	-
Domestic market volume, 000m ³	46	108	497	21	48	248	70	18	135
Export price, US\$/m ³	425	425	-	425	425	-		425	
Domestic price, US\$/m ³	180	180	126	180	180	126	310	310	310
Unit production cost, US\$ per m ³	291	276	92	343	362	90	251	357	121
Economic value added per m ³ output; US\$	(121)	(119)	24	(157)	(178)	25	-9	18	228
Employment,	3,485	8,131	130,000	1,564	3,649	64,990	2,241	2,895	35,308
Gross profit margin, %	9	14	27	(7)	(13)	28	19	12	61
Stumpage fees, US\$,000	2,458	5,735	-	1,103	2,574	-	809	1,045	2,271

	2007				2020				Scenario 3-FISCAL (Option 2), Legal Timber, 2020=718,000m ³			
	NIINT	INT	CSM	NINT	INT	CSM	NINT	INT	NIINT	INT	AMS	
	Export levies, US\$000	134	312		60	140		0	193	0	0	0
Social Responsibility Agreements (SRAs), US\$000	123	287		55	129		40	52	114			
Payments to farmers			9,544			4,787	0	0	1,565			
Informal payments, US\$000	2,185	5,098	8,967	980	2,288	4,483	1,022	1,320	-			
Contributions to rural economies			1,910			955	-	-	-			
Institutional costs												
<i>Of which</i>												
FC costs	1,712	3,995		768	1,793		639	664	1,345			
(VLTP)Costs	-	-		770	1,798		688	493	1,450			
Notes: NIINT=Non-integrated sawmills; INT=Integrated large-scale mills												
VLTP = Validation of Legal Timber Programme												

The Essential differences between this scenario (3) and Scenario 2 are the following:

There is a shift in the relative shares of INTs and AMs in log inputs, the latter being the beneficiary. Total volume of domestic log processing remains at 562,000 m³, but the share of AMs increases from 40% to 48%.

INTs profitability improves substantially (21%) under the export quota system, compared with 1% in the case of an export ban under scenario 2.

Better INT profitability partly results from a 25% stumpage rebate for timber sales to AMs.

In the economic discounted cash flow analysis, these measures contribute to making Scenario 3 a more preferable Option 2 policy strategy (export quota/fiscal incentive regime) than an Option 2 policy strategy of export ban to support domestic lumber supply policy.

5.1.5 Scenario 4: Artisanal millers only supply legal lumber to the domestic market (Policy Option 3)

This scenario comprises policy option 3: Only AMs supply legal lumber to the domestic market. This is an extract from scenario 3 under which a challenging longer term forest industry development scenario emerges in the form of an artisanal lumber processing integrated with a high value added domestic tertiary processing sub-sector, and development of a formal wood industry value added processing for both export and domestic markets. At this stage, a ban on lumber export would be justified, and increased opportunities offered for formal sector sales of saw logs to AMs. Further reforms in the forest fiscal regime could be the overarching driver for this development.

5.2 Perspectives of key stakeholders under the scenarios

Landowners' share of stumpage fees (which they normally refer to as royalties, will not change under all the scenarios because they are tied to an assumed legal harvest. In practice, however, FC budget constraints in the past have caused an accumulation of royalty arrears.

Communities lose out on CSM contributions to developments in the districts (Scenario1) and farmers who forego better informal payments from CSM: as observed in section 3, sawmill compensations are negligible, so likely loses to

farmers could still be reckoned at US\$9 million. Marfo (2010) estimated 40% of net stumpage fees as a competitive compensation for farmers.

Direct revenue contribution to communities from timber operators' who largely consists of the large-scale integrated mills will come from Social Responsibility Agreements. The off-reserve resource is running out and only a few of the large scale integrated companies have shown interest in collaborating with communities in conservation practices in off-reserves. Under scenarios 2 and 3 involving artisanal millers, there are opportunities for communities and AMs to work out forest utilization plans for the off-reserves and to transform depleted off-reserves into forest plantation and agro-forestry landscapes. Legislation on tenure reforms that recognizes and protects the interests of communities in planted trees is an important intervention necessary to safeguard community investments and sustain their livelihoods, but is presently lacking.

Environmental havoc caused to farms by timber harvesters becomes an issue under scenario 1 where only sawmills are involved in harvesting. On the other hand, AMs, like CSM, are expected to be environmental friendly.

A ban on CSM will involve a loss of livelihoods of about 700,000 people. These are the 130,000 operatives and head loaders on the one part and 670,000 engaged in the marketing chain. In the short-term (2 years) an option that can be exercised consists of a managed, compensation payment scheme for members of the CSM production and head transport crew who are unable to secure alternative job opportunities offered by reformed CSM (artisanal) operations. Other options may include mitigation measures involving the training of stakeholders in alternative livelihoods or focusing on the broader opportunity of providing social safeguards in other sectors of the economy.¹⁸

In the long term, there are opportunities for about 200,000 people engaged in CSM road transportation (truck drivers, assistants and loaders) to secure alternative employment in the transport sector. The services sector under Ghana's GPRS-2 was known to be the fastest growing sector. Similarly, some members of about 20,000 re-sawyers have the skills to be potential employees of the tertiary sector which is to receive priority attention in industry development in the Ministry of Lands and Forestry's Medium Term Development Plan under review. A number of the 350,000 lumber brokers may retain jobs on the domestic market. However, together with the CSM operatives and head-loaders, they largely run a risk of not securing jobs in the forest sector as a result of a growing

¹⁸ This is further discussed under "Emerging Issues" (Section 7)

wood scarcity or direct import substitution for domestic lumber, which may also result from increases in domestic prices. For about two-thirds of the total number dependent on CSM, the state will be compelled to finance the cost of providing alternative livelihoods from its own budget under scenario 1, given, the limited opportunities for FC's budget. In the other scenarios involving artisanal millers, there are opportunities for them to make net contributions to the FC while tertiary industry processing depending on regular domestic lumber supply to add value can also make additional contributions to FC. The challenge for both operatives and FC is to promote value addition and sustainable profits.

The VPA impact Assessment Study projected a tentative decline in FC's future revenues from about US\$16million in 2010 to about US\$ 11million in 2020 due to a decline in timber resources.

In respect of legal enforcement of timber regulations, there are the institutional costs of regulation (FC's internal costs) and those of the VPA (Timber Validation). The FC's normal forest management and regulation as well as TIDD's costs of regulating the trade amount to US\$7million annually. A full enforcement of legal timber procedures under VPA will involve both FC's timber and trade regulation and implementation of the Legality Assurance System under VPA. It is estimated that FC's Validation of Legal Timber will cost some US\$12 million over 5 years (Birikroang et al, 2007/VLTP Secretariat/FC sources).¹⁹ Together with FC's FM&R and TIDD trade regulation costs of US\$7 million, the annual cost of legal timber enforcement would amount to an estimated US\$ 10 million for 5 years. Thereafter, annual costs, including staff, are expected to stabilize around US\$700,000.

Enforcing a ban on CSM is a sub-set of the VPA programme whose costs are estimated across the various categories of lumber producers. The costs of enforcement under scenario 1 will correspond to the cost estimates above. In respect of scenarios 2 and 3, where improved artisanal millers are introduced, and measures to address the export –domestic price gap and market incentives are prescribed side by side with sanctions against non-compliance with legality, the cost of enforcement might be lower. From these costs, it would be a herculean task to attempt to associate specific costs of enforcement to CSM. Beyond the financial costs of FC, there are also the costs of interventions to mitigate the

19 The VLTP Secretariat estimated that about US\$3/ per m³ of legal roundwood (based on an anticipated one million m³ sustainable harvest) would be required from stumpage fees to finance the cost of enforcement. With a possible decline in the sustainable harvest level to the 700,000m³ level, about US\$4.3 per m³ would be required.

adverse social impacts of the VPA, which would include cost of safeguarding livelihoods of CSM-dependent stakeholders.

By giving recognition to a reformed CSM, and building the capacity of the new artisanal millers to become efficient in processing there will be opportunities to develop their willingness to comply with legislation. According to the Wood Industry Training Centre (WITC), it will cost about GH¢180 (US\$126) per capita to train AMs from the pool of CSM operatives in sawing and allied techniques and basic principles of business management.

When their skills development and formalization are accompanied by friendly institutions that provide them with entry points, artisanal millers are more likely to remain formal than exist in the formal sector. These conditions can contribute significantly to enforcement of the CSM ban. It is important in this regard to safeguard profitability of artisanal milling.

New roles of artisanal millers may require best forestry practice which will also call for their engagement of a professional forester. It will be appropriate for this professional input to be provided and managed at a Trade Association level. Establishing and building the capacity of a Trade Association for artisanal millers could cost about US\$300,000 as illustrated below:

Investment costs in establishment of a Trade Association for Artisanal Millers, US\$*	
3 All purpose vehicles (For 2 stations and Head office)	195,000
Office rental (2 years)	3,000
Salary, Executive, 1 year	6,000
Salaries, 3 Professional Foresters (1 year)	18,000
Salaries, 2 Office staff (1 year)	3,200
Office/Communication equipment	40,000
Tools	5,000
Office running cost (1 year)	12,000
Contingent expenditure	14,000
Total investment	296,200
* Assessment prepared in consultation with GTA	

5.3 Results of economic and social cost benefit analysis

A full investigation of environmental impacts of the options has not been included in the research work. However, it can be fairly assumed that the option of depending on micro-production for 50% supply of the domestic lumber requirement could be done using unit investment costs of less than US\$200,000 (for a mobile mill and light truck. In contrast, formal sector production would introduce to the forest some US\$3-4 million investment in a single logging unit (Dozer/Side/5 240HP trucks). Of the two technical choices, the minimum environmental damage to the forest associated with the formal sector production would outweigh that of the minor investment. It is assumed that outside these comparisons, best practices prevail under the two technical options.

A financial, economic and social cost benefit analysis (CBA) has been conducted using the broad spectrum of research results and in particular results of the model scenarios. The CBA results are summarized below in Table 18:

Table 18: (A) Cost benefit analysis results of policy options:
NPVs discounted @ 20%, (US\$,000)

	Baseline	Sc.1 (Option 1) - Sawmills Only	Sc.2 (Option 2) - Sawmill & Artisanal millers (with lumber export ban)	Sc.3 (Option 2) - Sawmill & Artisanal millers (with lumber export quota and fiscal incentives)
Financial	837,734	502,973	779,567	813,783
Economic	289,919	39,771	294,242	317,859
(B) Incremental NPV of options (over baseline), US\$,000				
Financial		-334,760	-58,167	-23,951
Economic		-250,148	4,322	27,940

Source:Based on Annex Table A6

A highly positive financial return close to three times the economic benefit in the baseline case confirm the existence of policy and market failures characterized by distortions and perverse incentives. The net economic benefits here have not

been off-set by the negative impact of environmental degradation which were not taken into account in this research. At best, they are accruals from depleted resources that have largely been appropriated as private benefits.

In all the scenarios, it is the third, carrying reforms and shifting paradigm to allow greater roles in the markets for micro enterprises brings about positive impacts. Sometimes as in this case, some people must lose as is indicated by a negative financial and positive economic results pattern in Scenario 2 and 3 (**Table 18[B]**). However, there is good justification for the state to invest in mitigation measures (theoretically to an annual maximum of US\$7million which is the annuity of the NPV of net benefit associated with Scenario 3.) so as to turn the outcome into a “Win-Win” situation. A comparison of the options using Option1 as the standard clearly shows that scenario 3 (of option 2) is by the most economically efficient policy choice (**Table 18B**).

The third scenario, representing Option 2 with a deliberate state policy to positively influence access to forest by improved artisanal millers, will be the most effective option. It should be noted that the CBA results reveal potential impacts. The numbers do not suggest the forest economy is out of the woods. The models show that efficiency and market pricing need to work simultaneously to bring about sustained growth.

6 EMERGING ISSUES

The major issues emerging from this report relate to:

- (a) Enforcing the ban on CSM;
- (b) Implications of legal enforcement for employment;
- (c) Importance of the domestic market for future economic growth;
- (d) Capacity building to “formalize” an informal sector;
- (e) Institutional capacity to support the working of markets;
- (f) Strategies for safeguarding informal employment and livelihoods; and
- (g) Observing the specific (real) impacts of the policy choice.

Enforcing the ban on CSM

The nature of the problem with enforcement has always been human and the immediate cause of its failure social consideration. But its root cause and possible solution is economic in nature. Theoretically, a ban can feasibly be enforced at the maximum cost equal to the maximum economic gain it brings. This cost will include distributing the gains to the humans who enforce the ban. This cost is at its minimum, if there are sufficient market incentives for potential offenders to desist from illegalities.

Implications of legal enforcement for employment

A major issue emerging from the 2007 model and baseline analysis is that employment in the forest sector is based on unsustainable harvest levels. The likelihood of 7,000 job losses in the formal saw milling sub-sector and some US\$130 million livelihoods for about 700,000 people will be a direct consequence of the choice of a VPA, and not that of the policy option. By similar reasoning, the cost of enforcing the ban on CSM should be grouped under two perspectives. These are the financial costs of enhanced FM&R and enforcement of legal compliance, and the costs of financing specific VPA social safeguards under the selected options.

Importance of the domestic market for future economic growth

It has been established under this research work that the formal sector's over-reliance on exports has shown no improvement in real prices. This means when both market efficiency (from both supply and demand sides) and domestic prices improve, the domestic market could make a better contribution to economic growth. Improved efficiency in the domestic tertiary sector is, therefore, as important to other interventions to bring about a sustained supply to the domestic market. Price increases are expected to accompany growing scarcity of timber resources. This makes a policy strategy supporting value addition by the domestic tertiary industry the only answer to generating a higher willingness to pay for intermediate materials and at the same time keeping the sub-sector competitive.²⁰ In view of this, there should be sufficient market incentives to enable Artisanal millers to sell to the domestic market. Fiscal policies should be expected to play an important role in bringing these changes about.

Capacity building to “formalize” an informal sector

Developing the technical skills of CSM operatives and formalizing their operations as artisanal millers will improve their efficiency and enable them to retain profits that under CSM operation were partly distributed to public officials. When their skills development and formalization are accompanied by friendly institutions that provide them with entry points, artisanal millers are more likely to remain formal than exit the formal sector. These conditions can contribute significantly to enforcement of the CSM ban.

²⁰ The tertiary sector can demonstrate such competitiveness and a higher willingness to pay. According to FAWAG, a number of its members have capabilities of exporting higher value-added products and have offered to pay sawmillers net export prices (that is mill gate prices for export grade lumber), sawmillers have not shown interest in selling to them. This scheme will require FC to build a capacity to manage. The FSD and TIDD in 2006 developed a framework with GTMO under which stumpage fees could be collected at the point of export. FC can build on this framework for application to AMs local lumber sales. FC's VLTP could provide the infrastructure and logistics supporting its timber verification to support the new fiscal scheme for AMs.

Institutional capacity to support the working of markets

For forest fiscal policy to work effectively and support the working of markets, FC will need to build its capacity in managing competition on the domestic market. Its major challenge will be how to introduce international pricing to the domestic market and maintain incentives across the entire forest industry.

In attempting to be a watch dog over domestic competition, the FC must also be seen to deliver competitive services to the private sector, including artisan millers. It must, therefore, ensure that costs of the industry doing business with it are reduced.

Strategies for safeguarding informal employment and livelihoods

Appropriate technology with low fixed cost and low total production volume and a reasonably high output per labour will be desirable. This can support higher levels of livelihoods than suggested by the model using the LUCAS mill that achieves a single shift production of 1.5 m³ (See **Annex A.7**). This approach could enhance a pro-poor policy.²¹ Within the forest sector, appropriate technology for AMs will not solve livelihood problems of all engaged in the entire production and marketing chain of CSM, because there is not enough timber resources for everyone. Rather, inter-sectoral coordination of policy reforms could contribute significantly to the identification of job and livelihood opportunities for CSM-dependent stakeholders. The fast growing services sector has been identified in a discussion of stakeholder perspectives under the scenarios treated as a potential area for generating alternative livelihoods for CSM-dependent stakeholders. Thus, the forestry sector may not necessarily be the only sector to provide solutions to social problems originating from reforms in that sector.

21 The PMT considered the size of alternative investments in relation to pro-poor policy and concluded that pro-poor policy does not necessarily require the criterion of ownership of assets. In other words, in the same way that small investments (for example in the LOGOSOL) may be affordable to the poor, relatively larger investments with potential to generate the same or higher employment could also be pro-poor. Between the two, it was suggested that the choice should be left to a political decision.

Observing the specific (real) impacts of the policy choices

Very often reforms in the forest sector to address timber resource scarcity and under-pricing of create a dilemma for political decision making. Good examples are economic pricing of timber based on the capturing of economic rent, and ensuring legal compliance in timber trade under the VPA. Both reform approaches create unemployment. Under good forest governance, the two approaches can complement each other to generate an acceptable compromise. Under economic pricing, users of the resource (winners) pay a higher price. They are the ones who pay for the cost of financing measures that restore the livelihoods of target groups. In contrast to this, the Business-As-Usual condition allocates timber resources administratively and cause both winners and losers. On its part, the VPA without comprehensive sector reforms, for similar reasons, is considered not to be the best option (Mayers et. al., 2008).

Among the scenarios treated under Section 5, the Baseline condition is a case of “winners” and “losers.” Timber is under-priced (due to a log export ban unaccompanied by other complementary measures, under-valued stumpage fees, non-payment of stumpage by CSM, administrative allocation of timber resource, etc), and the entire forest industry does not have the incentive to reduce wastage of the resource. The private forestry sector (dominated by few) become the winners and the State losers. On the other hand, scenario 3, appears to be the most efficient option that addresses pricing (higher domestic price) and reduces waste (improved technology). Real resources recovered create opportunities for part-financing of the cost of providing social safeguards in the VPA. The argument in policy dialogues that timber must sell at “affordable prices” to make reform measures acceptable runs counter to scenario 3 and fits into the Baseline condition that creates both “winners” and “losers.”

7 SUMMARY OF POLICY ANALYSIS, CONCLUSION AND RECOMMENDATIONS

Summary

The major task of the research was to develop the conditions necessary to deal with specific drivers of chainsaw milling to ensure adequate supply of legal timber on the domestic market. In the sector and institutional overview presented in sections 3 and 4, emphasis was placed on conditions of the wood sector and the institutional environment that needed to be reversed if the drivers of illegal chainsaw milling were to be brought under control.

From presentation of an overview of the wood sector's performance in 2007, it is observed that the formal industry has shrunk in size, the informal sector remaining notably larger in size. The forest industry faced a wood scarcity with possibilities of a worsening future sustainable harvest levels. Along with these developments, large scale companies increased their share of legal harvest. This presented a threat to the entry into the timber harvesting business by the informal sector. Increased unemployment was associated with declines in the formal industry, including logging, but CSM sustained significant livelihoods across its production and marketing chain and made other contributions to district level development. These contributions underlined local level approval of CSM. A high national rate of illegal logging that accompanied the level of formal sector and CSM businesses signalled a weakness in forest regulation and enforcement. This weakness was associated with corruption among public officials.

An over concentration of production by the formal sector on production for the export market left the domestic market to be filled by illegal chain saw lumber. Over a decade, depressed domestic prices due to cheap chainsaw lumber have prevented the formal sawmill industry from expressing interest in selling good grade lumber on the domestic market. Policy in 2007 continued to favour exports, despite their failure to register real benefits in terms of the how much a unit of export was worth in terms of domestic production. The formal sawmilling industry utilized a limited number of species, with the first 5 and 10 species accounting for 80% and 88%, respectively, of volume of exports in 2007. This created opportunities for CSM to balance species utilization on the domestic market as it processed 72 species.

Legislation worked against community access to timber, with farmers in particular having no tenurial rights to trees on farm. Forest owners took an inequitable share of forest revenues, which also did not trickle down to communities. Informal operators were also inequitably treated in the allocation of timber rights due to inadequacies in legislation that favoured purely “timber” rather than “forest” interests. These conditions created among communities a disincentive for Sustainable Forest Management (SFM), and among farmers, lack of interest in preserving trees on farms. Chainsaw milling brought instant payment and was favoured by farmers.

Inefficiency in wood processing by both the formal sector and CSM were a major cause of forest depletion. In respect of CSM, its lower rate of 30% recovery makes its intensity of logging as high as the formal sector. Environmental degradation associated with over-logging was estimated in 2005) to be equivalent to 2.5% of GDP or 40% of forestry’s contribution to GDP (6%) was estimated by the Ghana Statistical Service.

Institutions created unhealthy transaction costs for the private sector. This suggested that small enterprises, not accustomed to bureaucracy, would become more vulnerable to these costs. The private sector was also noted to be more competitive than the FC in carrying out a number of forest management functions. So FC could share forest management responsibilities with the private sector. It could then focus more on core functions of forest regulation and build its capacity in those areas.

Landowners imposed informal charges on timber operators as a reaction to the risk of losing royalty payments, as FC managed them. These charges could harm the business of micro enterprises. It was observed that the introduction of transparency in FC’s business as expected under implementation of VPA, could re-build landowners confidence in FC and hence a minimization or elimination of their informal charges.

Conclusion and recommendations

Enforcement of the ban on CSM under implementation of VPA means any re-organization of chainsaw milling enterprises must comply with the payment of stumpage fees and other legislative and administrative procedures. These requirements will be in line with VLTP’s objectives of correcting forest regulation and securing revenues.

The VPA is expected to govern not only the export market but also the supply of legal timber to the domestic market. Under this reform, the operatives and other work force engaged along the production and marketing chain of CSM are counted among vulnerable groups. For this category of stakeholders, the challenge will be to provide adequate social safeguard measures to protect them from adverse impacts of legal enforcement.

Recommendations

Participation in production for the domestic market will require a transformation of free hand chainsaw millers to improved artisanal millers. They will receive appropriate skills so they can employ improved milling techniques. This transformation is expected to improve their efficiency in processing from 30% to about 60% lumber recovery. Training the new artisanal millers is estimated to cost US\$4 million.

Enforcement of the ban on CSM brings with it the challenge of ensuring transparency in the activities of the new artisanal millers, making laws on punitive sanctions and providing adequate incentives for forestry officials.

Recommendations

- (a) Improve the enforcement of monitoring rules;
- (b) Improve transparency and accountability in the sector;
- (c) Strengthen the role of civil society and communities in forest monitoring (all);
- (d) Application of sanctions;
- (e) Strengthen community (chiefs) capacity to undertake independent monitoring;
- (f) Institute specialised courts for environmental cases;
- (g) Build capacity of the judiciary to effectively enforce forest laws;
- (h) Strengthen the legal departments of the FC;
- (i) Strengthen district-level operations for a more effective monitoring.

Competitive pricing of timber can support legal timber to the domestic market. The non-payment of stumpage by CSM depressed lumber prices on the domestic market; sawmillers did not have the incentive to supply the domestic market; and the domestic supply gap in turn provided adequate incentives

for CSM production. Adequate supply of legal lumber to the domestic market will not be fully achieved without addressing the existing gap between export and domestic market price. Secondly, the domestic supply strategy must also include measures that reduce the concentration on exports.

A domestic price that approximates the import price should be the pricing objective. Past failure of timber resource allocation arrangements to realize supplies to the domestic market should be seen in terms of the absence of this pricing strategy. In the case of any of the recommended option three options considered under this research, production by artisanal millers could be prone to entering the export market or finding its way into illegal cross-border trade.

Recommendations

- (a) FC should aim at setting economic stumpage fees and their full collection from the total legal harvest;
- (b) In respect of AMs, rebates (subsidies) on stumpage fees from their own harvests could be offered to them at the point of domestic lumber sales. TIDD should collect stumpage fees net of AM rebates on behalf of FSD;²²
- (c) Minimum pricing for lumber that targets the US\$300 per m³ import parity price, or a price that allows sufficient profit returns to encourage producers to stay in business – whichever is lower- is recommended as a short- to medium-term policy for the domestic market;²³
- (d) Other fiscal options that could complement the preceding recommendations are:

22 The FSD and TIDD in 2006 developed a framework with GTMO under which stumpage fees could be collected at the point of export. FC can build on this framework for application to AMs local lumber sales. FC's VLTP could provide the infrastructure and logistics supporting its timber verification to give additional support to this new fiscal scheme for AMs.

23 Assuming that the formal sector lumber price of US\$180 per m³ is the equilibrium price, minimum pricing policy in principle suggests that the recommended minimum price will be a floor price, a price that is set above the US\$180 per m³ equilibrium price. Progressively (example quarterly), the domestic price can be adjusted towards the target price. Without minimum pricing, policy makers cannot efficiently implement export quota schemes or introduce special export taxes to encourage increased domestic use – because they will only serve to depress domestic prices. In their extreme cases, quotas and taxes are equivalent to an export ban in effect, and they will repeat the problems of depressed domestic log prices and little or no incentives for technical improvement created by the Log export ban policy. In the long-term, improved efficiency and competition on the market may not make the minimum pricing policy necessary.

- (i) Introduction of export quotas or taxes on traditional species to cause exporters to sell to lead tertiary processors. This will promote exports and domestic sales at the same time;²⁴
- (ii) A special value added tax scheme could be designed for tertiary processors to retain part of value added tax, where this scheme could be administered by the VAT Secretariat. This will be an incentive for tertiary processors to expand sales, and hence pay competitive prices for lumber; and
- (iii) To provide incentives for sale of Lesser-Known timber species to artisanal millers, integrated logger-processors could be given stumpage fee rebates. Modalities could be put in place for integrated logger-processors who enter specific business arrangements with artisanal millers.

Implications of legal timber for Ghana's wood balance:

Log importation should be freely encouraged and admitted without import duties. TIDD can bring its market intelligence experience and timber and wood product promotional expertise to benefit prospective importers, particularly artisanal millers.

Due to legislation that limit their forest rights and the inequitable distribution of forest benefits, that also make them losers, forest communities have not shown interest in supporting Sustainable Forest Management (SFM). The inadequacies in existing legislation will need to be addressed so that communities can have access to timber for their non-commercial use. Farmers have a better deal associating with CSM, in terms of prompt and more attractive payment. But they will still need to have more say in the future development of the off-reserve resource, particularly with regard to the intensity of tree felling and land use options, including plantation development.

²⁴ Producing to tertiary export specifications for Ghana's traditional export markets in Europe, for example, combines well with that of by-products sold on the domestic markets. These include, T&G profile boards, door components and other joinery materials. Generally, where domestic tertiary producers exhibit efficiency and are likely to add value to economically priced primary or secondary processed wood in specific species (whether for an export business or for the domestic market), export quotas and/or taxes may be imposed on exporters of lumber in specific species.

Recommendations:

- (a) Operational management of off-reserves should be ceded to local government and communities, while FC provides technical assistance to local governments and communities and retains an overall national forest planning and regulatory responsibilities;
- (b) The Ministry of Lands and Forestry Interim Measures to Control Illegal Logging in Off-reserves of 1994, implemented between 1995 and 1998 should be revived and institutionalized²⁵ Under it, enumeration was a joint function between operators and the District Forest Office, and farmers had powers to veto decisions on felling of trees. Under revived off-reserve measures, farmers could be brought into a compensation scheme based on existing off-reserve stumpage fee distribution.²⁶;
- (c) Clarification and further amendment of Timber Resource Management Act (Amendment Act, 2002), Act 617 is needed to the extent that the new amendment gives recognition to land use/tree rights of both land owners and farmers. The parent Act, Timber Resource Management Act (TRMA), Act 547, needs to be amended to make a distinction between management of forest reserves and access and management rights of communities in off-reserves.

The formal sector operatives have an upper hand in timber resource allocation. The state may have to use a deliberate policy to create an equal level playing field for AMs in timber resource allocation

Recommendations

- (a) TRMA needs to be amended, particularly accompanying legislation on procedures, to accommodate the interests of micro-operators, so they can have a level playing field with the formal sector operators;
- (b) A deliberate long term policy should be put in place that ensures about 20% of production forest areas are granted as TUCs to artisanal millers. This will require the State to re-allocate areas under expired TUCs to artisanal millers; and
- (c) Opportunities should be provided to small scale log producers to access pre-financing facilities from the financial sector, so they could break their

25 . Under the control measures, felling in off-reserves was conducted through participatory procedures involving the District Administration, farmers, District Forestry Office and timber operators.

26 Marfo (2009) recommended a payment system based on net stumpage (royalty) payment.

dependence on large scale integrated firms who finance them and receive small-scale producers' harvest. A contractual agreement between the State (as guarantor of pre-financing facility), the small-scale operator and the financing entity could be entered into to ensure sales of small-scale operators' harvest to Artisanal Millers.

Employment in the forest sector has always been driven by volume of timber. Thus, with the growing scarcity of timber, unemployment in the processing industry has occurred. With the enforcement of timber legality and a further reduced level of sustainable timber harvest, further unemployment will be a probable outcome in the sawmilling sub-sector. Part of the redundant work force is likely to add up to the existing pool of rural unemployed. Any social intervention programme that is planned to mitigate the impact of CSM ban must also manage the risk of this urban-rural migration.

Recommendations

Inter-sectoral coordination of policies offers a broad approach to providing social safeguards to the vulnerable poor likely to be affected by the VPA's implementation. The National Development Planning Commission (NDPC), as authors of the Ghana Poverty Reduction Strategy-2 Report, recognized the potential of the Services Sector, including the financial sector, to contribute to future poverty reduction and an increasing participation of women. This is an opportunity for forestry to be included in the current development by the NDPC of a 7-Year medium Term Development Plan.

Inefficiency partly explains intensity of illegal logging. Illegal harvest at the national level is three times the legal. Much of the pressure on forests results from low level processing efficiency. This condition results in higher turnover of raw material in both formal saw milling chainsaw milling. Thus, the industry argument of needing more timber inputs in order to break-even is a problem rather than a solution to their business profits.

Recommendations

- (a) Both Chainsaw milling and formal sawmilling can improve upon their current 30% and 38% rates of recovery to about 54% and 60%, respectively;
- (b) The introduction of market standards alongside technological improvement is recommended. Standards can stabilize the improved recovery rates. TIDD needs to put these in place in the first instance.

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APPENDICES

Annex Table A1

(Output from PMT working sessions)

Table A.1: Domestic Wood Supply Conditions Matrix

Conditions	Timber industry only supplies the domestic market (formal sector)	Sawmills and other players supply the domestic market with legal timber	Artisanal millers alone supply the domestic market with legal timber
Supplying the domestic market with adequate legal timber	<p>Issuance of FLEGT and other export licenses should be contingent upon proof of supply of domestic quota</p> <p>ensure that quota for local supply secures about xxx m³ of lumber</p> <p>develop incentives and sanctions to ensure compliance, including linking FLEGT and other licences for export to the supply of a quota to the domestic market</p>	<p>organize chainsaw millers into artisanal millers with required skills to employ improved milling techniques</p> <p>define a supply quota system for the two players (scenarios of how much combinations)</p> <p>provide organized artisanal practitioners with legal access to timber resources in conformity with the AAC</p> <p>link FLEGT and other licensing for export to the supply for the domestic market</p> <p>institute monitoring to ensure compliance with supply quota arrangements</p>	<p>organize chainsaw millers into artisanal millers with required skills to employ improved milling techniques</p> <p>pilot and implement artisanal milling teams (mobile recovery teams)</p> <p>provide organized artisanal practitioners with legal access to timber resources in conformity with the AAC</p> <p>institute monitoring to ensure compliance with supply quota arrangements</p>

Conditions	Timber industry only supplies the domestic market (formal sector)	Sawmills and other players supply the domestic market with legal timber	Artisanal millers alone supply the domestic market with legal timber
<p>competitive pricing of timber in the domestic market</p> <p>The issue is fundamentally paying for the economic rent of timber</p> <p>*ensuring payment of appropriate rent</p> <p>Minimise corruption among FC and law enforcement agencies</p>	<p>Determine export-domestic price differentials</p> <p>Ensure that the fiscal regime in the sector promote competitive pricing for sawmill lumber in the domestic market</p>	<p>Develop equitable fiscal measures/ incentives to cushion both players in selling at competitive prices</p>	<p>Ensure that the fiscal regime in the sector promote competitive pricing for artisanal lumber in the market</p>
<p>ALL</p> <p><i>NB: check Adam et al corruption report to identify important aspects for this work</i></p> <p>Improve conditions of service</p> <p>improve the enforcement of monitoring rules</p> <p>Improve transparency and accountability in the sector:</p> <p>Strengthen the role of civil society and communities in forest monitoring (all)</p> <p>Application of sanctions</p> <p>Strengthen community (chiefs) capacity to undertake independent monitoring</p> <p>Institute specialised courts for environmental cases</p>		<p>Improve conditions of service and enforce monitoring rules</p>	<p>Improve conditions of service and enforce monitoring rules</p>

Conditions	Timber industry only supplies the domestic market (formal sector)	Sawmills and other players supply the domestic market with legal timber	Artisanal millers alone supply the domestic market with legal timber
	<p>Build capacity of the judiciary to effectively enforce forest laws</p> <p>Strengthen the legal departments of the FC</p> <p>Strengthen district-level operations for a more effective monitoring</p>		
<p>Ensure legal access by communities to timber for domestic (non-commercial) use</p>	<p>clearly define non-commercial harvesting rights with registered chainsaw/improved chainsaw as special cases</p>	<p>set a production quota based on the portion of the AAC that can be given out to both producers</p> <p>Institute measures for wood importation and intensive plantation development</p>	<p>clearly define non-commercial harvesting rights with registered chainsaw/improved chainsaw as special cases</p>
<p>Streamline /review tenure to ensure equitable benefit sharing</p>	<p>bring farmers into benefit-sharing scheme, especially in off-reserve areas (40% of net stumpage seems competitive) recheck specifics!!</p> <p><i>Streamline compensation payment arrangement (ALL)</i></p>	<p>bring farmers into benefit-sharing scheme, especially in off-reserve areas (40% of net stumpage seems competitive)</p>	<p>bring farmers into benefit-sharing scheme, especially in off-reserve areas (40% of net stumpage seems competitive)</p>

Conditions	Timber industry only supplies the domestic market (formal sector)	Sawmills and other players supply the domestic market with legal timber	Artisanal millers alone supply the domestic market with legal timber
<p>Address high rate of (rural) unemployment</p> <p>securing political will and limiting interferences</p>	<p>develop sustainable alternative livelihood scheme for about 100,000 people; implement this as part of the social safeguard provision of the VPA is crucial</p> <p>this provokes scenarios: Do nothing? Do-little? or Implement social intervention programmes? Transaction cost to gather data on targets (critical dependents?), which strategies and sustainability: business training against specific livelihood skill. What is the relative advantage of shifting from csm to adopt alternative livelihood strategy?</p>	<p>organize qualified operators into artisanal firms and provide alternative livelihood schemes for the unqualified do nothing about 'victims'</p> <p>provide some social safeguards under the VPA</p>	<p>Organize operators into cooperative artisanal firms: transaction cost?</p> <p>Develop criteria for selecting candidates for who stays and who goes</p> <p>Provide minimal social safeguard provisions (not as many as required in scenario 1 and 2): what is the critical number that could be absorbed?</p>
	<p>provide regulations that support political action to strengthen civil society as a watchdog</p>	<p>provide regulations that support political action to strengthen civil society as a watchdog</p>	<p>provide regulations that support political action to strengthen civil society as a watchdog</p>

Conditions	Timber industry only supplies the domestic market (formal sector)	Sawmills and other players supply the domestic market with legal timber	Artisanal millers alone supply the domestic market with legal timber
<p>Ensure equity in access and enforce regulations</p> <p>Ensure improved processing technology</p>	<p>Respect existing timber rights law and regulations</p> <p>Improve efficiency through retooling What efficiency levels will make industry capable of supplying both domestic and export demands? What volumes can be given under: No export situation Export plus domestic supply situation? And what is the implication for setting standards for technology and processing efficiency requirements? At what cost?</p>	<p>Same as 3 but allocated yields will be informed by volumes based on market shares</p>	<p>What volume of timber is needed in total? Scenarios Artisanals to be recognised as a group in the existing category for the TUC process and allocate an area; where the area is both reserve and off-reserve only off-reserve with exclusive rights to artisanals Giving permits for specific species and quantities (yield) which are barred from export Use fiscal measures to induce TUC holders to sell to artisanals</p>
			<p>Investment cost for adoption of technology facilitate importation of equipments and accessories Training to build capacity and skills Diversification of products</p>

Strict enforcement of statutory regulations (law enforcement)
Reduce transaction cost of compliance procedures in the sector (part of the general governance environment that must be improved to realise all)

Annex Table A2

OPPORTUNITY COST ESTIMATE OF CSM LIVELIHOODS, 2007; US\$				
	Estimated number of stakeholders	Annual average income	Total opportunity cost estimate,	References and key assumptions
CSM Operators	17,000	206	3,500	KSN/Model #
Other hands	53,000	145	7,700	Annual Average rural forestry income of GH¢323 Source:GLSS5 data (adjusted to 60%)*
Head loaders	60,000	167	7,500	KSN/Model #
Transport	200,000	200	40,000	Annual Average rural forestry income of GH¢323 Source: GLSS5 data (adjusted to 60%)*
Integrated re-sawing	20,000	825	16,500	0.67/hr for machine operators (Source: GLSS5) working only 50% of time available (25 days a month)
Brokers, lumber production and selling	350,000	166	58,000	Annual average rural forestry income equivalent working only 50% of the time
Total	700,000	194	133,200	
Foreign Exchange Rate, 2007				
US\$1	GH¢			
1	0.97			

WEIGHTED ANNUAL AVERAGE WAGE ESTIMATE , US\$				
	Number of workforce	% of workforce	Annual Average wage rate	Wt. Annual wage
CSM Operators	17,000	2%	205	4.98
Other hands	53,000	8%	145	10.98
Head loaders	60,000	9%	125	10.71
Transport	200,000	29%	200	57.14
Integrated re-sawing	20,000	3%	825	23.57
Brokers, lumber production and selling	350,000	50%	166	83.00
Total	700,000			190.39
CSM production crew				
CSM Operators	17,000	24%	205	50.03
Other hands	53,000	76%	145	109.79
Total production crew	70,000			159.81

Annex A3:

Definition of Costs

Cost Item	Definition
Raw material cost	The cost of timber in one cubic meter of lumber. Cost includes stumpage fees, payments under Social Responsibility Agreements and informal payments to Traditional Authorities. For sawmills, cost also includes transport from forest to mill
Total labour (production)	Wages and salaries for production crew It includes income tax and social security
Fuel & Power	Costs of fuel, oils and lubricants and electricity charges
Production expenses/overheads (Excl. Engineering)	Costs of materials other than timber used in production, miscellaneous cash expenses on production line, eg chemicals, nails, chalk, binding wire, conveyance of waste, etc.,wages of factory hands and maintenance staff.
Engineering	Cost of spare parts, saws and their treatment materials, maintenance and industrial engineering
Financing (interests)	Interest on borrowed capital
Depreciation	Cost allowance for wear and tear on fixed assets
Insurance & Administration	Costs of Insurance premium on fixed assets, general administrative staff and expenses and management staff
Transport/FOB charges	Transportation of sawn timber to domestic markets or ports, customs charges, port handling and banking charges, export levies, agency fees and others to the point of "Free-On-Board" shipping vessel

Annex Table A3.1: 2007 Base Model

	Unintegrated Processors		Integrated Mills	Chain saw milling
	Sawn wood		Sawn wood	
A FINANCIAL ANALYSIS				
Total No of Firms	85		23	17,000
Intake, m ³	273		637	1,640
Output volume, m ³	109		255	497
Of which:				
Export Volume, m ³	63		147	
Domestic market volume, m ³	46		108	497
Export price, US\$/m ³	425		425	
Domestic price, US\$/m ³	180		180	
Unit cost of production, US\$/m ³	291		276	92
Revenues, US\$,000				
Export sales	26,766		62,453	-
Domestic sales	8,323		19,421	62,622
Total revenue	35,089		81,874	62,622
COSTS, US\$,000				
Raw material cost	12,589		23,500	9,544
Total labour (production)	2,253		5,567	3,480
Fuel & Power	3,540		8,748	7,380
Production expenses/overheads (Excl. Eng'ng)	309		120	7,685
Engineering	1,622		631	-
Financing cost (interests)	631		2,453	-
Depreciation	794		3,086	-
Insurance & Administration	3,152		12,259	-
Transport/FOB charges	6,910		13,992	9,940

		Unintegrated Processors		Integrated Mills	Chain saw milling
		Sawn wood		Sawn wood	
	Head-Transport (chain saw beams/planks)				7,522
	Total cost	31,800		70,356	45,551
	Gross profit	3,289		11,517	17,071
	Margin, %	9%	#DIV/0!	14%	27%
	Less informal payment				8,967.26
	Tax	1,480		-	-
	Net profit	1,809		11,517	8,104
B Socio-Economic Analysis					
	Total Number of firms	85		23	17,000
	Level of Employment (production)	3,485		8,131	17,000
	Chain saw, overhead labour				53,000
	Level of Employment (Head-transport)				60,000
Economic Value added in sawmilling, US\$,000					
	Wages	2,253		5,567	11,212
	Stumpage/levies/payments to forest owners/informal payments/CSM payment to farmers	4,899		11,432	18,512
	Depreciation	794		3,086	0
	Financing cost (interest)	631		2,453	0
	Gross profit	3,289		11,517	17,071
	CSM benefits to Districts				1,910
	Economic adjustment in log cost	-25,098		-64,438	-36,541
	Economic value added	-13,233		-30,382	12,164
	Economic value added per m ³	-121		-119	24

	Unintegrated Processors		Integrated Mills	Chain saw milling
	Sawn wood		Sawn wood	
Value added in transport (beam & lumber handling)/marketing chain, US\$,000				
Transport (beam/ lumber handling)				24,000
Integrated re-sawing				9,900
Brokers, lumber production and selling				58,100
Total value added in marketing chain				92,000
<i>Percentage of Shadow Wage Rate (SWR) to Nominal</i>	60%			
Value added in Inter-sectoral linkage, US\$,000				
<i>Engineering</i>	438		142	0
<i>Insurance and administration</i>	757		2,758	0
<i>Transport/Port</i>	1,969		3,778	2,833
Total	3,164		6,678	2,833
Reference Notes				
Economic cost, raw material	37,688		87,938	46,085
Stumpage fees	2,458		5,735	
Export levies	134		312	
Social Responsibility Agreements	123		287	
CSM Informal payments				8,967
CSM payment to farmers				9,544
CSM contribution to rural economies				1,910
Informal payments to Traditional Authorities	2,185		5,098	

		Unintegrated Processors		Integrated Mills	Chain saw milling
		Sawn wood		Sawn wood	
Institutional cost					
	Forest Management and Regulation	1,365		3,186	
	Timber trade regulation	347		809	
	Total FC	1,712		3,995	
#	Annual average VPA Recurrent cost, US\$m	450		1049	
#	VPA Annual capital cost for 5 Years	221		516	
	Total VPA cost	671		1,565	
	Total institutional cost	2,383		5,559	7,942
2007 CSM livelihood estimate (Ref CSM-CBA Report)					
		Estimated number of stakeholders	Annual average income, US\$	Total income estimate, US\$,000	
	CSM Operatives	17,000	205	3,485	
	Other hands	53,000	145	7,685	
	Head loaders	60,000	125	7,500	
	Transport	200,000	200	40,000	
	Integrated re-sawing	20,000	825	16,500	
	Brokers, lumber production and selling	350,000	166	58,100	
	Total	700,000		133,270	
	NOTE:				
	# - Base Year, 2007				

Notes:

Payments to traditional Authorities by formal sawmilling are part of raw material cost. CSM case is a key issue	
Tax: Integrated mills pay no corporate taxes as they are all Free Zone Enterprises (FZEs). FZEs enjoy 10 year tax holiday. Taxes will be due after 2015	
Economic adjustment in log cost	Includes cost of resource depletion. Assessment of the social cost of negative environmental impact of deforestation has not been included in this research
# - Annual average VPA Recurrent cost	Not applicable to Base year 2007; on stream in yr 7
>- VPA Annual capital cost for 5 Years	Not applicable to Base year 2007; on stream in yr 4
Transport/Port	CSM value added in inter-sectoral linkage relates to transport ex-forest gate to urban markets. It does not include head-loading to forest gate.

Annex Table A3.2: Baseline Model (AAC at 1 Million M³)

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
A FINANCIAL ANALYSIS				
	Total No of Firms	85	23	14,510
	Intake	171	398	1,400
	Output volume	68	159	424
	Of which			
	Export Volume, m ³	39	92	
	Domestic market volume, m ³	29	67	424
	Export price, US\$/m ³	425	425	
	Domestic price, US\$/m ³	180	180	126
	Unit cost of production, US\$/m ³	316	318	90
REVENUES, US\$,000				
	Export sales	16,728	39,033	-
	Domestic sales	5,202	12,138	53,449
	Total revenue	21,930	51,171	53,449
COSTS, US\$,000				
	Raw material cost	7,868	14,688	8,174
	Total labour (production and admin)	1,408	3,479	2,134
	Fuel & Power	2,213	5,467	6,299
	Production expenses/overheads (Excl. Eng'ng)	193	75	6,559
	Engineering	1,014	394	-
	Financing (interests)	631	2,453	-
	Depreciation	794	3,086	-

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
	Insurance & Administration	3,152	12,259	-
	Transport/FOB charges	4,319	8,745	8,484
	Head-Transport (chain saw beams/planks)			6,619
	Total cost	21,591	50,647	38,269
	Gross profit	339	524	15,180
	Margin, %	2%	1%	28%
	Less informal payment			7,653.75
	Tax	153	-	-
	Net profit	187	524	7,527
	Average revenue	258	2,225	
	Average total variable cost per firm	200	1,428	
	Average total fixed cost per firm	54	774	
	Average contribution	58	797	
B SOCIO-ECONOMIC ANALYSIS				
	Total Number of firms	80	20	14,510
	Level of Employment (Production)	2,178	5,082	14,510
	Chain saw, overhead labour			45,237
	Level of Employment (Head-transport)			51,211
Economic Value added in sawmilling, US\$,000				
	Wages	1,408	3,479	9,187
	Stumpage/levies/payments to forest owners/informal payments/CSM payment to farmers	3,062	7,145	15,827

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
	Depreciation	794	3,086	0
	Financing cost (interest)	631	2,453	0
	Gross profit	339	524	15,180
	CSM benefits to Districts			1,630
	Economic adjustment in log cost	-15,686	-40,273	-31,070
	Economic value added	-9,453	-23,586	10,755
	Economic value added per m ³	-138	-148	25
Value added in transport (beam & lumber handling)/marketing chain, US\$m				
	Transport (beam/lumber handling)			20,485
	Integrated re-sawing			8,450
	Brokers, lumber production and selling			49,590
	Total value added in marketing chain			78,524
	Percentage of Shadow Wage Rate (SWR) to Nominal	60%		
Value added in Inter-sectoral linkage, US\$m				
	<i>Engineering</i>	274	89	
	<i>Insurance and administration</i>	851	2,758	
	<i>Transport/Port</i>	1,166	1,968	2,418
	Institutional cost			
	Forest Management and Regulation	853	1,991	
	Timber trade regulation	217	505	
	Total FC	1,070	2,497	
	VPA Recurrent cost	512	1,195	

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
	VPA capital cost	403	940	
	S/Total, VPA	915	2,135	
	Total institutional cost	1,985	4,631	
Reference Notes				
	Economic cost, raw material	23,555	54,961	39,244
	Stumpage fees	1,536	3,584	0
	Export levies	84	195	
	Social Responsibility Agreements	77	179	
	CSM Informal payments			7,654
	CSM payment to farmers			8,174
	2007 CSM contribution to rural economies			1,630
	Informal payments to Traditional Authorities	1,365	3,186	

Annex Table A3.3: Baseline Model (AAC at 700,000m³)

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
A FINANCIALANALYSIS				
	Total No of Firms	85	23	8,499
	Intake	123	286	820
	Output volume	49	114	248
	Of which			
	Export Volume, m ³	28	66	
	Domestic market volume, m ³	21	48	248
	Export price, US\$/m ³	425	425	
	Domestic price, US\$/m ³	180	180	126
	Unit cost of production, US\$/m ³	343	362	90
REVENUES, US\$,000				
	Export sales	12,011	28,026	-
	Domestic sales	3,735	8,715	31,306
	Total revenue	15,746	36,741	31,306
COSTS, US\$,000				
	Raw material cost	5,649	10,546	4,787
	Total labour (production and admin)	1,011	2,498	1,250
	Fuel & Power	1,589	3,926	3,689
	Production expenses/overheads (Excl. Eng'ng)	139	54	3,842
	Engineering	728	283	-
	Financing (interests)	631	2,453	-
	Depreciation	794	3,086	-

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
	Insurance & Administration	3,152	12,259	-
	Transport/FOB charges	3,101	6,279	4,969
	Head-Transport (chain saw beams/planks)			3,877
	Total cost	16,793	41,384	22,415
	Gross profit	-1,047	-4,643	8,891
	Margin, %	-7%	-13%	28%
	Less informal payment			4,482.91
	Tax	-471	-	-
	Net profit	-576	-4,643	4,409
	Average revenue	185	1,597	
	Average total variable cost per firm	144	1,025	
	Average total fixed cost per firm	54	774	
	Average contribution	42	572	
B SOCIO-ECONOMIC ANALYSIS				
	Total Number of firms	80	20	8,499
	Level of Employment (Production)	1,564	3,649	8,499
	Chain saw, overhead labour			26,496
	Level of Employment (Head-transport)			29,995
Economic Value added in sawmilling, US\$,000				
	Wages	1,011	2,498	5,381
	Stumpage/levies/payments to forest owners/informal payments/CSM payment to farmers	2,199	5,130	9,270

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
	depreciation	794	3,086	0
	Financing cost (interest)	631	2,453	0
	Gross profit	-1,047	-4,643	8,891
	CSM benefits to Districts			955
	Economic adjustment in log cost	-11,263	-28,916	-18,198
	Economic value added	-7,676	-20,392	6,299
	Economic value added per m ³	-157	-178	25
Value added in transport (beam & lumber handling)/marketing chain, US\$m				
	Transport (beam/lumber handling)			11,998
	Integrated re-sawing			4,949
	Brokers, lumber production and selling			29,045
	Total value added in marketing chain			45,993
	<i>Percentage of Shadow Wage Rate (SWR) to Nominal</i>	60%		
Value added in Inter-sectoral linkage, US\$m				
	<i>Engineering</i>	197	64	
	<i>Insurance and administration</i>	851	2,758	
	<i>Transport/Port</i>	837	1,413	1,416
Institutional cost				
	Forest Management and Regulation	613	1,430	
	Timber trade regulation	155	363	
	Sub-total, FC	768	1,793	

		Unintegrated Processors	Integrated Mills	Chain Saw Milling
		Sawn wood	Sawn wood	
	VPA Recurrent cost	368	858	
	VPA capital cost	403	940	
	S/Total, VPA	770	1,798	
	Total institutional cost	1,539	3,590	
Reference Notes				
	Economic cost, raw material	16,912	39,462	22,986
	Stumpage fees	1,103	2,574	0
	Export levies	60	140	
	Social Responsibility Agreements	55	129	
	CSM Informal payments			4,483
	CSM payment to farmers			4,787
	CSM contribution to rural economies			955
	Informal payments to Traditional Authorities	980	2,288	

Annex Table A3.4: Scenario 1 Sawmills Only Supply Lumber to Domestic Market (AAC at 1M m³)

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS
		Sawn wood	Sawn wood
A FINANCIAL ANALYSIS			
	Total No of Firms	85	23
	Intake	498	1,162
	Of which		
	Domestic harvest	171	398
	Imports	327	764
	Output volume	274	639
	Of which		
	Export market	94	219
	Domestic market	180	420
	Export price, US\$/m ³	425	425
	Domestic price, US\$/m ³	310	310
	Unit cost of production, US\$/m ³	355	338
REVENUES, US\$,000			
	Export sales/Illegal cross-border trade	22,499	52,498
	Domestic sales	12,049	28,115
	Total revenue	34,549	80,613
COSTS, US\$,000			
	Raw material cost	55,983	125,578
	Total labour (production and admin)	5,648	13,957
	Fuel & Power	8,875	21,932
	Production expenses/overheads (Excl. Eng'ng)	775	301
	Engineering	4,067	1,581
	Financing (interests)	631	2,453

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS
		Sawn wood	Sawn wood
	Depreciation	794	3,086
	Insurance & Administration	3,152	12,259
	Transport/FOB charges	17,324	35,080
	Total cost	97,248	216,227
	Gross profit	-62,700	-135,614
	Margin, %	-181%	-168%
	Less Informal payment		
	Tax	0	0
	Net profit	-62,700	-135,614
	Average revenue	406	3,505
	Average total variable cost per firm	1,090	8,627
	Average total fixed cost per firm	54	890
	Average contribution	-684	-5,122
B SOCIO-ECONOMIC ANALYSIS			
	Total Number of firms	85	23
	Level of Employment	2,929	6,835
Economic Value added in sawmilling, US\$,000			
	Wages & salaries	5,648	13,957
	Stumpage/levies/payments to forest owners/ informal payments/CSM payment to farmers	3,091	7,212
	depreciation	794	3,086
	Financial cost (interest)	631	2,453
	Gross profit	-62,700	-135,614
	Economic adjustment in log cost	-12,735	-34,765
	Economic value added	-65,272	-143,670

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS
		Sawn wood	Sawn wood
	Economic value added per m ³		
Value added in Inter-sectoral linkage, US\$m			
	Engineering	1,098	356
	Insurance and administration	851	2,758
	Transport/Port	4,677	7,893
	Total	6,627	11,007
Institutional cost			
	Forest Management and Regulation	853	1,991
	Timber trade regulation	516	1,205
	S/Total, FC	1,370	3,196
	VPA Recurrent cost	1,494	3,486
	VPA capital cost	708	1,652
	S/Total, VPA	2,202	5,138
	Total Institutional cost	3,572	8,334
Reference Notes			
	Economic cost, raw material	68,718	160,343
	Stumpage fees	1,536	3,584
	Export levies	112	262
	Social Responsibility Agreements	77	179
	CSM Informal payments		
	CSM payment to farmers		
	CSM contribution to rural economies		
	Informal payments to Traditional Authorities	1,365	3,186

Annex Table A3.5: Scenario 1 Sawmills Only Supply Lumber to Domestic Market (AAC AT 700,000m³)

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS
		Sawn wood	Sawn wood
A FINANCIAL ANALYSIS			
	Total No of Firms	85	23
	Intake	450	1,050
	Of which		
	Domestic harvest	123	286
	Imports	327	764
	Output volume	247	577
	Of which		
	Export market	67	157
	Domestic market	180	420
	Export price, US\$/m ³	425	425
	Domestic price, US\$/m ³	310	310
	Unit cost of production, US\$/m ³	366	353
REVENUES, US\$,000			
	Export sales/Illegal cross-border trade	22,499	52,498
	Domestic sales	12,049	28,115
	Total revenue	34,549	80,613
COSTS, US\$,000			
	Raw material cost	52,932	119,883
	Total labour (production)	5,102	12,607
	Fuel & Power	8,018	19,812
	Production expenses/overheads (Excl. Eng'ng)	700	272
	Engineering	3,674	1,429

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS
		Sawn wood	Sawn wood
	Financing (interests)	631	2,453
	Depreciation	794	3,086
	Insurance & Administration	3,152	12,259
	Transport/FOB charges	15,649	31,689
	Total cost	90,651	203,490
	Gross profit	-56,102	-122,877
	Margin, %	-162%	-152%
	Less Informal payment		
	Tax	0	0
	Net profit	-56,102	-122,877
B SOCIO-ECONOMIC ANALYSIS			
	Total Number of firms	85	23
	Level of Employment	2,929	6,835
Economic Value added in sawmilling, US\$,000			
	Wages & salaries	5,102	12,607
	Stumpage/levies/payments to forest owners/ informal payments/CSM payment to farmers	2,251	5,252
	Depreciation	794	3,086
	Financial cost (interest)	631	2,453
	Gross profit	-56,102	-122,877
	Economic adjustment in log cost	-9,144	-24,961
	Economic value added	-56,469	-124,438
	Economic value added per m ³	-228	-216
Value added in Inter-sectoral linkage, US\$m			
	Engineering	992	321

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS
		Sawn wood	Sawn wood
	<i>Insurance and administration</i>	851	2,758
	<i>Transport/Port</i>	4,225	7,130
	Total	6,068	10,210
	Institutional cost		
	Forest Management and Regulation	613	1,430
	Timber trade regulation	371	865
	S/Total, FC	983	2,295
	VPA Recurrent cost	1,349	3,149
	VPA capital cost	708	1,652
	S/Total, VPA	2,057	4,801
	Total Institutional cost	3,041	7,096
	Reference Notes		
	Economic cost, raw material	62,076	144,844
	Stumpage fees	1,103	2,574
	Export levies	112	262
	Social Responsibility Agreements	55	129
	CSM Informal payments		
	CSM payment to farmers		
	CSM contribution to rural economies		
	Informal payments to Traditional Authorities	980	2,288

Annex Table A3.6 : Scenario 2 (Sawmills and Artisanal Millers Supply Legal Lumber to the Domestic Market Under Conditions of a Lumber Export Ban (AAC at 1M m³))

		Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
A FINANCIAL ANALYSIS				
	Total No of Firms	85.00	20.00	601
	Intake, m ³	177.87	287.25	317.25
	Of which			
	Domestic harvest	177.87	287.25	317.25
	Output volume	97.83	157.99	158.62
	Of which			
	Export market	-	-	-
	Domestic market	97.83	157.99	158.62
	Domestic price, US\$/m ³	310.00	310.00	310.00
	Unit cost of production, US\$/m ³	232.74	200.29	119.34
REVENUES, US\$,000				
	Export sales	-	-	-
	Domestic sales	30,327.61	48,976.64	49,173.34
	Total revenue	30,327.61	48,976.64	49,173.34
COSTS, US\$,000				
	Raw material cost	11,274.61	4,506.19	4,524.29
	Total labour (production)	2,017.52	3,450.41	4,473.65
	Fuel & Power	3,170.39	5,422.07	5,670.28
	Production expenses/overheads (Excl. Eng'ng)	276.69	74.47	
	Engineering	1,452.61	390.98	
	Financing (interests)	630.90	2,453.49	

		Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
	Depreciation	793.60	3,086.22	1,089.81
	Insurance & Administration	3,152.39	12,259.29	
	Transport/FOB charges	-	-	3,172.47
	Head-Transport (chain saw beams/ planks)			2,400.77
	Total cost	22,768.70	31,643.12	18,930.49
	Gross profit	7,558.91	17,333.52	30,242.85
	Margin, %	0.25	0.35	0.62
	Tax	3,401.51	-	13,609.28
	Net profit	4,157.40	17,333.52	16,633.57
B SOCIO-ECONOMIC ANALYSIS				
	Total Number of firms	51	23	
	Level of Employment (Production)	3,121	5,040	601
	LOGOSOL, overhead labour			16,916
	Level of Employment (Head-transport)			19,150
	Total employment	3,121	5,040	36,666
Economic Value added in sawmilling, US\$,000				
	Wages	2,017.52	3,450.41	3,575.26
	Stumpage/levies/payments to forest owners/informal payments/AMs payment to farmers	2,999.75	4,844.36	4,658.20
	Depreciation	793.60	3,086.22	1,089.81
	Financing cost (interest)	630.90	2,453.49	866.38
	Gross profit	7,558.91	17,333.52	30,242.85
	CSM benefits to Districts			-

		Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
	Economic adjustment in log cost	(13,272.08)	(35,134.73)	(4,389.16)
	Economic value added	728.60	(3,966.73)	36,043.34
	Economic value added per m ³			
Value added in transport (beam & lumber handling)/marketing chain, US\$,000				
	Transport (beam/lumber handling)			12,766.49
	Integrated re-sawing			5,266.18
	Brokers, lumber production and selling			18,543.33
	Total value added in marketing chain			36,576.01
	<i>Percentage of Shadow Wage Rate (SWR) to Nominal</i>	60%		
Value added in Inter-sectoral linkage, US\$,000				
	<i>Engineering</i>	392.21	87.97	-
	<i>Insurance and administration</i>	851.15	2,758.34	0.41
	<i>Transport/Port</i>	-	-	2,475.02
	Total	1,243.35	2,846.31	2,475.43
Institutional cost				
	Forest Management and Regulation	889.37	1,436.27	1,586.24
	Timber trade regulation	-	-	-
	Sub-total FC	889.37	1,436.27	1,586.24
	VPA capital cost	305.27	492.99	544.47
	VPA Recurrent cost	533.62	861.76	951.74
	Sub-total, VPA	838.90	1,354.75	1,496.21
	Total Institutional cost	1,728.27	2,791.02	3,082.45

	Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
	Sawn wood	Sawn wood	
Reference Notes			
Economic cost, raw material	24,546.69	39,640.92	8,913.44
Stumpage fees	1,501.67	2,425.08	2,678.30
Export levies	-	-	
Social Responsibility Agreements	75.08	121.25	133.92
CSM Informal payments			-
AMs payment to farmers			1,846
CSM contribution to rural economies			
Informal payments to Traditional Authorities	1,423.00	2,298.02	

CSM-From Base Model-2007			
	Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
Forest operation			
CSM Operatives	17,000	3,485	205
Other hands	53,000	7,685	145
Head loaders	60,000	7,500	125
Total	130,000	18,670	
Marketing chain			
Transport	200,000	40,000	200
Integrated re-sawing	20,000	16,500	825
Brokers, lumber production and selling	350,000	58,100	166
Total	570,000	114,600	

LOGOSOL Model				
		Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
	Forest operation			
	CSM Operatives	601	1,112	1,851
	Other hands	16,916	2,453	145
	Head loaders	19,150	2,394	125
	Total	36,666	5,959	
	Marketing chain			
	Transport	63,832	12,766	200
	Integrated re-sawing	6,383	5,266	825
	Brokers, lumber production and selling	111,707	18,543	166
	Total	181,923	36,576	1,191

**Addendum To Annex Tables A3.6: Model Scenario 2 (Policy Option 2):
Sawmills and artisanal millers supply legal lumber to the domestic
market under conditions of a lumber export ban**

**Quota System to Support Domestic Lumber Supply by Sawmills and
Artisanal Mills**

Harvest distribution, 000m ³ Roundwood equivalent (RWE)							
	Integrated mills	363			INTs	NINTs	AMS
	sawmill share		206		206		
	AMs 50% OFR Quota		100				100
50%	Small FR operators sales to small sawmills (NINTs)		78			78	
50%	Small FR operators sales to AMs		78				78
50%	Small OFR operators sales to NINTs		50			50	
50%	Small OFR operators sales to AMs		50				50
	Total RWE of domestic market lumber				206	128	228
					37%	23%	41%

Summary						
			m ³ saw mill input	Share		Lumber production, m ³
		INTs	206,248	37%		113,436.22
		NINTs	127,714	23%		70,242.67
		AMs	227,784	41%	0.4054928	113,891.81
		Total	561,745	100%		97,570.70

Annex Table A3.7 : Scenario 2 (Sawmills and Artisanal Millers Supply Legal Lumber to the Domestic Market Under Conditions of a Lumber Export Ban (AAC AT 700,000 m³))

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL+ ATTACHMENT
		Sawn wood	Sawn wood	
A FINANCIAL ANALYSIS				
	Total No of Firms	85	20	431
	Intake, m ³	128	206	228
	Of which			
	Domestic harvest	128	206	228
	Output volume	70	113	114
	Of which			
	Export market	-	-	-
	Domestic market	70	113	114
	Domestic price, US\$/m ³	310	310	310
	Unit cost of production, US\$/m ³	251	245	122
REVENUES, US\$,000				
	Export sales	-	-	-
	Domestic sales	21,775	35,165	35,306
	Total revenue	21,775	35,165	35,306
COSTS, US\$,000				
	Raw material cost	8,095	3,235	3,248
	Total labour (production)	1,449	2,477	3,212
	Fuel & Power	2,276	3,893	4,071.26
	Production expenses/overheads (Excl. Eng'ng)	199	53	
	Engineering	1,043	281	
	Financing (interests)	631	2,453	
	Depreciation	794	3,086	1,090
	Insurance & Administration	3,152	12,259	

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL+ ATTACHMENT
		Sawn wood	Sawn wood	
	Transport/FOB charges	0	0	2,278
	Head-Transport (chain saw beams/planks)			1,724
	Total cost	17,639	27,739	13,899
	Gross profit	4,137	7,426	21,407
	Margin, %	19%	21%	61%
	Tax	1,861	0	9,633
	Net profit	2,275	7,426	11,774
B SOCIO-ECONOMIC ANALYSIS				
	Total Number of firms	51	23	
	Level of Employment (Production)	2,241	3,619	431
	LOGOSOL, overhead labour			12,145
	Level of Employment (Head-transport)			13,750
Economic Value added in sawmilling				
	Wages	1,449	2,477	2,567
	Stumpage/levies/payments to forest owners/informal payments	2,154	3,478	3,345
	depreciation	794	3,086	1,090
	Financing cost (interest)	631	2,453	866
	Gross profit	4,137	7,426	21,407
	Economic adjustment in log cost	-9,529	-25,227	-3,151
	Economic value added	-366	-6,305	26,123
	Economic value added per m ³	-5	-56	229
		60%		

	UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL+ ATTACHMENT
	Sawn wood	Sawn wood	
Value added in transport (beam & lumber handling)/marketing chain, US\$,000			
Transport (beam/lumber handling)			9,166
Integrated re-sawing			3,781
Brokers, lumber production and selling			13,314
Total value added in marketing chain			26,262
Percentage of Shadow Wage Rate (SWR) to Nominal	60%		
Value added in Inter-sectoral linkage, US\$,000			
<i>Engineering</i>	282	63	0
<i>Insurance and administration</i>	851	2,758	0
<i>Transport/Port</i>	-	-	1,724
Total	1,133	2,822	1,724
Institutional cost			
Forest Management and Regulation	639	1,031	1,139
Timber trade regulation	0	0	0
Sub-total FC	639	1,031	1,139
VPA capital cost	305	493	544
VPA Recurrent cost	383	619	683
Sub-total, VPA	688	1,112	1,228
Totla Institutional cost	1,327	2,143	2,367

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL+ ATTACHMENT
		Sawn wood	Sawn wood	
Reference Notes				
	Economic cost, raw material	17,625	28,462	6,400
	Stumpage fees	1,078	1,741	1,923
	Export levies	-	-	
	Social Responsibility Agreements	54	87	96
	CSM Informal payments			0
	AMs payment to farmers			1,325
	CSM contribution to rural economies			
	Informal payments to Traditional Authorities	1,022	1,650	

CSM-From Base Model-2007					
		Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$	Annual average income, \$
	Forest operation				
	CSM Operatives	17000	3485		205
	Other hands	53000	7685		145
	Head loaders	60000	7500		125
	Total	130000	18670		
	Marketing chain				
	Transport	200000	40000		200
	Integrated re-sawing	20000	16500		825
	Brokers, lumber production and selling	350000	58100		166
	Total	700000	133270		

LOGOSOL Model					
		Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$	Annual average income, \$
Forest operation					
CSM Operatives		431	799		1851.187123
Other hands		12,145	1,761		145
Head loaders		13,750	1,719		125
Total		26,326	4,278		
Marketing chain					
Transport		45,832	9,166		200
Integrated re-sawing		4,583	3,781		825
Brokers, lumber production and selling		80,206	13,314		166
Total		130,620	26,262		

Annex Table A3.8: Scenario 3 (Sawmills and Artisanal Mills Supply Legal Lumber to the Domestic Market Under Regime of Domestic Harvest Quotas And Fiscal Incentives For Ints(AAC at 1M m³)

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
A FINANCIAL ANALYSIS				
	Total No of Firms	85	20	709
	Intake, m ³	178	230	374
	Of which			
	Domestic market (RWE)	178	46	374
	Export market (RWE)	0	184	0
	Output volume	98	152	187
	of which			
	Domestic market , m ³	98	25	187
	Export market, m ³	0	126	0
	Domestic price, US\$/m ³	310	310	310
	Unit cost of production, US\$/m ³	233	248	118
	REVENUES, US\$,000			
	Export sales	0	53,697	0
	Domestic sales	30,328	7,836	58,008
	Total revenue	30,328	61,534	58,008
	COSTS, US\$,000			
	Raw material cost (25% stumpage rebate adjusted for INTs)	11,275	3,841	5,337
	Total labour (production)	2,018	3,312	5,277
	Fuel & Power	3,170	5,205	6,689.06
	Production expenses/overheads (Excl. Eng'ng)	277	71	
	Engineering	1,453	375	
	Financing (interests)	631	2,453	

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
	Depreciation	794	3,086	1,090
	Insurance & Administration	3,152	12,259	
	Transport/FOB charges	0	6,938	3,742
	Head-Transport (chain saw beams/planks)			2,832
	Total cost	22,769	37,542	22,136
	Gross profit	7,559	23,991	35,872
	Margin, %	25%	39%	62%
	Tax	3,402	0	16,143
	Net profit	4,157	23,991	19,730
B SOCIO-ECONOMIC ANALYSIS				
	Total Number of firms	51	23	709
	Level of Employment (Production)	3,121	4,032	709
	LOGOSOL, overhead labour			19,955
	Level of Employment (Head-transport)			22,590
	Total employment			43,254
Economic Value added in sawmilling, US\$,000				
	Wages	2,018	3,312	4,218
	Stumpage/levies/payments to forest owners/informal payments	2,606	2,164	5,495
	depreciation	794	3,086	1,090
	Financing cost (interest)	631	2,453	866
	Gross profit (+ Stumpage rebate)	7,934	23,991	35,872
	Economic adjustment in log cost	-13,272	-27,872	-5,178
	Economic value added	710	7,136	42,364
	Economic value added per m ³	7	56	226

	UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL + ATTACHMENT
	Sawn wood	Sawn wood	
Value added in transport (beam & lumber handling)/marketing chain, US\$,000			
Transport (beam/lumber handling)			15,060
Integrated re-sawing			6,212
Brokers, lumber production and selling			21,875
Total value added in marketing chain			43,148
<i>Percentage of Shadow Wage Rate (SWR) to Nominal</i>	60%		
Value added in Inter-sectoral linkage, US\$,000			
<i>Engineering</i>	392	84	0
<i>Insurance and administration</i>	851	2,758	0
<i>Transport/Port</i>	0	1,561	2,832
Total	1,243	4,404	2,833
Institutional cost			
Forest Management and Regulation	889	230	1,871
Timber trade regulation	0	695	0
S/Total, FC	889	925	1,871
VPA Recurrent cost	534	138	1,123
VPA capital cost	305	395	643
S/Total, VPA	839	533	1,765
Total Institutional cost	1,728	1,457	3,637
Reference Notes			
Economic cost, raw material	24,547	31,713	10,515

		UNINTEGRATED PROCESSORS	INTEGRATED MILLS	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
	Stumpage fees (Net of 25% INTs Stumpage Rebate)	1,126	1,455	3,160
	Export levies	0	268	
	Social Responsibility Agreements	56	73	158
	CSM Informal payments			-
	AMs payment to farmers			2,178
	CSM contribution to rural economies			
	Informal payments to Traditional Authorities	1,423	368	

CSM-From Base Model-2007				
		Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
	Forest operation			
	CSM Operatives	17,000	3,485	205
	Other hands	53,000	7,685	145
	Head loaders	60,000	7,500	125
	Total	130,000	18,670	
	Marketing chain			
	Transport	200,000	40,000	200
	Integrated re-sawing	20,000	16,500	825
	Brokers, lumber production and selling	350,000	58,100	166
	Total	570,000	114,600	

LOGOSOL Model				
		Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
	Forest operation			
	CSM Operatives	709	1,312	1,851
	Other hands	19,955	2,893	145
	Head loaders	22,590	2,824	125
	Total	43,254	7,029	
	Marketing chain			
	Transport	75,301	15,060	200
	Integrated re-sawing	7,530	6,212	825
	Brokers, lumber production and selling	131,777	21,875	166
	Total	214,609	43,148	

**Addendum to Annex Tables A3.8: Model Scenario 2 (Policy Option 2):
Sawmills and artisanal millers supply legal lumber to the domestic
market under conditions of domestic harvest quotas and fiscal
incentives for INTs**

Harvest distribution, 000m3							
				Distribution (RWE)			
Harvesters				Export (INTs)	Domestic		
Integrated mills		505			INTs	NINTs	AMs
Of which sawmill share		287					
Other producers		495					
Total Harvest, m³		1,000					
FOREST RESERVES		721	Distribution to production agents				
80%	INTs own processing (lumber), RWE	230					
20%	INTs sales to AMs (Logs)	57		57			57
20%	Domestic lumber market sales (INTs), RWE			46	46		
80%	Export (INTs), RWE			184	184		
	INTs (own veneer/plywood processing)	218	218				
50%	Small FR operators sales to small sawmills (NINTs)	108	108		108		
50%	Small FR operators sales to AMs	108	108			108	
Total FR							
OFF RESERVES		279					
50%	AMs 50% OFR Quota		139			139	
50%	Small OFR operators sales to NINTs		70		70		
50%	Small OFR operators sales to AMs		70			70	
Total RWE of domestic market lumber					46	178	374
Total RWE of Export market lumber				184			
Total harvest (FR + OFR) and distribution		1,000	1,000				

Summary				
		m ³	Share	Lumber Production, m ³
	INTs	45,960	8%	25,278
	NINTs	177,875	30%	97,831
	AMs	374,247	63%	187,124
	Total	598,082	100%	310,233
National Log harvest (RWE) destination, 000m ³				
	Formal sawmilling (domestic market)	224		
	Lumber export	184		
	Veneer/plywood processing	218		
	AMs lumber processing	374		
	Total	1,000		

Annex Table A3.9: Scenario 3 (Sawmills and Artisanal Mills Supply Legal Lumber to the Domestic Market Under Regime of Domestic Harvest Quotas And Fiscal Incentives (AAC at 700,000 m³))

		Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
A	FINANCIAL ANALYSIS			
	Total No of Firms	85	20	510
	Intake, m ³	128	165	269
	Of which			
	Domestic market (RWE)	128	33	269
	Export market (RWE)	0	132	0
	Output volume	70	109	135
	of which			
	Domestic market, m ³	70	18	135
	Export market, m ³	-	91	-
	Domestic price, US\$/m ³	310	310	310
	Unit cost of production, US\$/m ³	251	357	121
REVENUES, US\$,000				
	Export sales	-	38,555	-
	Domestic sales	21,775	5,626	41,700
	Total revenue	21,775	44,181	41,700
COSTS, US\$,000				
	Raw material cost (25% stumpage rebate adjusted for INTs)	8,095	9,692	3,837
	Total labour (production)	1,449	2,378	3,794

		Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
	Fuel & Power	2,276	3,737	4,808.53
	Production expenses/overheads (Excl. Eng'ng)	199	51	
	Engineering	1,043	269	
	Financing (interests)	631	2,453	
	Depreciation	794	3,086	1,090
	Insurance & Administration	3,152	12,259	
	Transport/FOB charges	0	4,982	2,690
	Head-Transport (chain saw beams/planks			2,036
	Total cost	17,639	38,909	16,219
	Gross profit	4,137	5,272	25,481
	Margin, %	19%	12%	61%
	Tax	1,861	0	11,466
	Net profit	2,275	5,272	14,015
B SOCIO-ECONOMIC ANALYSIS				
	Total Number of firms	51	23	
	Level of Employment	2,241	2,895	35,308
Economic Value added in sawmilling, US\$,000				
	Wages	1,449	2,378	3,032
	Stumpage/levies/payments to forest owners/informal payments	1,871	1,554	3,950
	Depreciation	794	3,086	1,090
	Financing cost (interest)	631	2,453	866
	Gross profit (+ Stumpage rebate)	4,137	5,272	25,481
	Economic adjustment in log cost	-9,529	-13,078	-3,722
	Economic value added	-649	1,666	30,697
	Economic value added per m ³	-9	18	228

	Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
	Sawn wood	Sawn wood	
Value added in transport (beam & lumber handling)/marketing chain, US\$,000			
Transport (beam/lumber handling)			10,826
Integrated re-sawing			4,466
Brokers, lumber production and selling			15,725
Total value added in marketing chain			31,017
<i>Percentage of Shadow Wage Rate (SWR) to Nominal</i>	60%		
Value added in Inter-sectoral linkage, US\$m			
Engineering	282	61	0
Insurance and administration	851	2,758	0
Transport/Port	0	1,121	2,036
Total	1,133	3,940	2,036
Institutional cost			
Forest Management and Regulation	639	165	1,345
Timber trade regulation	0	499	0
S/Total, FC	639	664	1,345
VPA Recurrent cost	383	99	807
VPA capital cost	305	394	643
S/Total, VPA	688	493	1,450
Reference Notes			
Economic cost, raw material	17,625	22,770	7,559
Stumpage fees (Net of 25% INTs Stumpage Rebate)	809	1,045	2,271
Export levies	0	193	
Social Responsibility Agreements	40	52	114

		Unintegrated Processors	Integrated Mills	LOGOSOL + ATTACHMENT
		Sawn wood	Sawn wood	
	CSM Informal payments			0
	AMs payment to farmers			1,565
	CSM contribution to rural economies			
	Informal payments to Traditional Authorities	1,022	264	

CSM-From Base Model-2007			
	Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
Forest operation			
CSM Operatives	17,000	3,485	205
Other hands	53,000	7,685	145
Head loaders	60,000	7,500	125
Total	130,000	18,670	
Marketing chain			
Transport	200,000	40,000	200
Integrated re-sawing	20,000	16,500	825
Brokers, lumber production and selling	350,000	58,100	166
Total	570,000	114,600	
LOGOSOL Model			
	Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
Forest operation			
CSM Operatives	510	943	1,851
Other hands	14,345	2,080	145
Head loaders	16,239	2,030	125
Total	31,094	5,053	

CSM-From Base Model-2007			
	Estimated number of stakeholders	Total annual income estimate, US\$,000	Annual average income, \$
Marketing chain			
Transport	54,131	10,826	200
Integrated re-sawing	5,413	4,466	825
Brokers, lumber production and selling	94,730	15,725	166
Total	154,275	31,017	

Addendum to Annex Tables A3.9: Financial and Cost Analysis

BASELINE	1600									
YEAR:	1	2	3	4	5	6	7	8	9	10
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Financial analysis (Key Forest Stakeholders)									2015	
Industry										
Incremental investments (sawmills)	4,442	4,442	4,442	4,442	4,442	4,442	4,442	4,442	259	259
Financing cost	3,084	3,084	3,084	3,084	3,084	3,084	3,084	3,084	3,084	3,084
Total cost, industry	7,526	7,526	7,526	7,526	7,526	7,526	7,526	7,526	3,343	3,343
Sawmilling net profits+ depreciation	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	12,117	12,117
CSM profits #	8,104	8,104	8,104	8,104	8,104	8,104	8,104	8,104	7,527	7,527
Total benefits, Industry	25,310	25,310	25,310	25,310	25,310	25,310	25,310	25,310	19,643	19,643
Net benefit/ (Loss), Industry	17,784	17,784	17,784	17,784	17,784	17,784	17,784	17,784	16,300	16,300
Forest owners										
SRAs	410	410	410	410	410	410	410	410	256	256
Informal payments										
Traditional Authorities (Industry)	7,283	7,283	7,283	7,283	7,283	7,283	7,283	7,283	4,552	4,552
CSM payments to farmers	9,544	9,544	9,544	9,544	9,544	9,544	9,544	9,544	8,174	8,174
Other CSM informal payments	8,967	8,967	8,967	8,967	8,967	8,967	8,967	8,967	7,654	7,654
District level benefits	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,630	1,630
Total benefits, Forest owners	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114	22,265	22,265

1000/1400				718/820							
	11	12	13	14		15	16	17	18	19	20
	2017	2018	2019	2020-2026	2020	2021	2022	2023	2024	2025	2026
	259	259	259	0	0	0	0	0	0	0	0
	3,084	3,084	3,084	21,591	3,084	3,084	3,084	3,084	3,084	3,084	3,084
	3,343	3,343	3,343	21,591	3,084	3,084	3,084	3,084	3,084	3,084	3,084
	12,117	12,117	12,117	21,483	3,069	3,069	3,069	3,069	3,069	3,069	3,069
	7,527	7,527	7,527	30,860	4,409	4,409	4,409	4,409	4,409	4,409	4,409
	19,643	19,643	19,643	52,343	7,478	7,478	7,478	7,478	7,478	7,478	7,478
	16,300	16,300	16,300	30,752	4,393	4,393	4,393	4,393	4,393	4,393	4,393
	256	256	256	1,287	184	184	184	184	184	184	184
				0		0	0	0	0	0	0
	4,552	4,552	4,552	22,877	3,268	3,268	3,268	3,268	3,268	3,268	3,268
	8,174	8,174	8,174	33,512	4,787	4,787	4,787	4,787	4,787	4,787	4,787
	7,654	7,654	7,654	31,380	4,483	4,483	4,483	4,483	4,483	4,483	4,483
	1,630	1,630	1,630	6,684	955	955	955	955	955	955	955
	22,265	22,265	22,265	95,740	13,677	13,677	13,677	13,677	13,677	13,677	13,677

BASELINE	1600									
YEAR:	1	2	3	4	5	6	7	8	9	10
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Net benefit/ (Loss), Forest owners	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114	22,265	22,265
Livelihoods in production, transport and marketing	133,270	133,270	133,270	133,270	133,270	133,270	133,270	133,270	113,749	113,749
Net benefit/ (Loss), Livelihoods	133,270	133,270	133,270	133,270	133,270	133,270	133,270	133,270	113,749	113,749
Institutions										
Institutional costs	5,707	5,707	5,707	6,443	6,443	6,443	7,942	7,942	6,616	6,616
Total costs, Institutions	5,707	5,707	5,707	5,707	5,707	5,707	5,707	5,707	6,616	6,616
Stumpage fees/ TIDD levies	8,639	8,639	8,639	8,639	8,639	8,639	8,639	8,639	5,399	5,399
Corporate taxes	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	153	153
Total benefits, Institutions	10,119	10,119	10,119	10,119	10,119	10,119	10,119	10,119	5,552	5,552
Net benefit/ (Loss), Institutions	4,412	4,412	4,412	4,412	4,412	4,412	4,412	4,412	-1,064	-1,064
Net Benefit/ (Loss), Sector	183,580	183,580	183,580	183,580	183,580	183,580	183,580	183,580	151,250	151,250
NPV, Net Benefit/(Loss), Sector @ 20%				837,734						
ECONOMIC ANALYSIS (NATIONAL)										
COSTS										
Incremental investments	4,442	4,442	4,442	4,442	4,442	4,442	4,442	4,442	259	259
Institutional costs	5,707	5,707	5,707	6,443	6,443	6,443	7,942	7,942	6,616	6,616

1000/1400				718/820							
	11	12	13	14		15	16	17	18	19	20
	2017	2018	2019	2020-2026	2020	2021	2022	2023	2024	2025	2026
	22,265	22,265	22,265	95,740	13,677	13,677	13,677	13,677	13,677	13,677	13,677
	113,749	113,749	113,749	466,370	66,624	66,624	66,624	66,624	66,624	66,624	66,624
	113,749	113,749	113,749	466,370	66,624	66,624	66,624	66,624	66,624	66,624	66,624
	6,616	6,616	6,616	35,904	5,129	5,129	5,129	5,129	5,129	5,129	5,129
	6,616	6,616	6,616	35,904	5,129	5,129	5,129	5,129	5,129	5,129	5,129
	5,399	5,399	5,399	27,137	3,877	3,877	3,877	3,877	3,877	3,877	3,877
	153	153	153	0	0	0	0	0	0	0	0
	5,552	5,552	5,552	27,137	3,877	3,877	3,877	3,877	3,877	3,877	3,877
	-1,064	-1,064	-1,064	-8,766	-1,252	-1,252	-1,252	-1,252	-1,252	-1,252	-1,252
	151,250	151,250	151,250	584,095	83,442	83,442	83,442	83,442	83,442	83,442	83,442
	259	259	259	0	0	0	0	0	0	0	0
	6,616	6,616	6,616	35,904	5,129	5,129	5,129	5,129	5,129	5,129	5,129

BASELINE	1600									
YEAR:	1	2	3	4	5	6	7	8	9	10
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total cost	10,148	10,148	10,148	10,885	10,885	10,885	12,384	12,384	6,875	6,875
BENEFITS										
Wages, sawmilling	7,820	7,820	7,820	7,820	7,820	7,820	7,820	7,820	4,887	4,887
Wages, CSM operatives	11,212	11,212	11,212	11,212	11,212	11,212	11,212	11,212	9,187	9,187
Livelihoods in transport+ marketing chain	92,000	92,000	92,000	92,000	92,000	92,000	92,000	92,000	78,524	78,524
Depreciation	3,880	3,880	3,880	3,880	3,880	3,880	3,880	3,880	3,880	3,880
Financing cost (interest)	3,084	3,084	3,084	3,084	3,084	3,084	3,084	3,084	3,084	3,084
Gross profit	31,877	31,877	31,877	31,877	31,877	31,877	31,877	31,877	16,043	16,043
Stumpage fees/ TIDD Levies/SRAs	9,049	9,049	9,049	9,049	9,049	9,049	9,049	9,049	5,655	5,655
Informal payments (T/Auth., farmers and other CSM)	25,794	25,794	25,794	25,794	25,794	25,794	25,794	25,794	20,379	20,379
District level benefits	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,630	1,630
Economic adjustment in log cost	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077	-87,030	-87,030
Inter-sectoral linkages	12,675	12,675	12,675	12,675	12,675	12,675	12,675	12,675	9,523	9,523
Sawmilling	9,842	9,842	9,842	9,842	9,842	9,842	9,842	9,842	7,106	7,106
CSM	2,833	2,833	2,833	2,833	2,833	2,833	2,833	2,833	2,418	2,418
Total economic value added	73,224	73,224	73,224	73,224	73,224	73,224	73,224	73,224	65,764	65,764
Net benefit/(Loss), national	63,076	63,076	63,076	62,339	62,339	62,339	60,840	60,840	58,889	58,889
NPV, Net Benefit/Loss), national @ 20%				289,919						
Social Wage Rate as % of nominal	60%									
Institutional costs										

1000/1400				718/820							
	11	12	13	14		15	16	17	18	19	20
	2017	2018	2019	2020-2026	2020	2021	2022	2023	2024	2025	2026
	6,875	6,875	6,875	35,904	5,129	5,129	5,129	5,129	5,129	5,129	5,129
	4,887	4,887	4,887	24,563	3,509	3,509	3,509	3,509	3,509	3,509	3,509
	9,187	9,187	9,187	37,669	5,381	5,381	5,381	5,381	5,381	5,381	5,381
	78,524	78,524	78,524	321,948	45,993	45,993	45,993	45,993	45,993	45,993	45,993
	3,880	3,880	3,880	27,159	3,880	3,880	3,880	3,880	3,880	3,880	3,880
	3,084	3,084	3,084	21,591	3,084	3,084	3,084	3,084	3,084	3,084	3,084
	16,043	16,043	16,043	22,406	3,201	3,201	3,201	3,201	3,201	3,201	3,201
	5,655	5,655	5,655	28,424	4,061	4,061	4,061	4,061	4,061	4,061	4,061
	20,379	20,379	20,379	87,769	12,538	12,538	12,538	12,538	12,538	12,538	12,538
	1,630	1,630	1,630	6,684	955	955	955	955	955	955	955
	-87,030	-87,030	-87,030	-408,643	-58,378	-58,378	-58,378	-58,378	-58,378	-58,378	-58,378
	9,523	9,523	9,523	52,751	7,536	7,536	7,536	7,536	7,536	7,536	7,536
	7,106	7,106	7,106	42,838	6,120	6,120	6,120	6,120	6,120	6,120	6,120
	2,418	2,418	2,418	9,914	1,416	1,416	1,416	1,416	1,416	1,416	1,416
	65,764	65,764	65,764	222,320	31,760	31,760	31,760	31,760	31,760	31,760	31,760
	58,889	58,889	58,889	186,416	26,631	26,631	26,631	26,631	26,631	26,631	26,631

BASELINE	1600									
YEAR:	1	2	3	4	5	6	7	8	9	10
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Private sector re-investment, % of gross profit	30%									
Depreciation on new investment (%)	10%									
District level benefits, US\$,000	1,910	Ref: EU-CSM-CBA Technical Report								

CSM Livelihoods in supply/marketing chain (outside CSM production) in 2007					
	Estimated number of stake holders	Annual average income, US\$	Total income estimate, US\$,000		
CSM Operatives	17000	205	3485		
Other hands	53000	145	7685		
Transport	200000	200	40000	114600	
Integrated re-sawing	20,000	825	16500	133270	
Brokers, lumber production and selling	350,000	166	58100		114600
	700000				
^ : Social Wage Rate applied to nominal wage in economic valuation (ie 60% of nominal wage)					
NPV Discount Rate	20%				

1000/1400				718/820							
11	12	13	14		15	16	17	18	19	20	
2017	2018	2019	2020-2026	2020	2021	2022	2023	2024	2025	2026	

SCENARIO 1 (OPTION 1) SAWMILLS ONLY

	1,600						
YEAR:	1	2	3	4	5	6	7
	2007	2008	2009	2010	2011	2012	2013
FINANCIAL ANALYSIS (KEY FOREST STAKEHOLDERS, US\$,000)							
Industry							
Incremental investments (sawmills)	4,442	4,442	4,442	4,442	4,442	4,442	4,442
Financing cost	3,084	3,084	3,084	3,084	3,084	3,084	3,084
Total cost, industry	7,526	7,526	7,526	7,526	7,526	7,526	7,526
Industry net profits+ depreciation	17,206	17,206	17,206	17,206	17,206	17,206	17,206
CSM profits #	8,104	8,104	8,104	8,104	8,104	8,104	8,104
Total benefits, Industry	25,310	25,310	25,310	25,310	25,310	25,310	25,310
Net benefit/(Loss), Industry	17,784	17,784	17,784	17,784	17,784	17,784	17,784
Forest owners							
SRA's	410	410	410	410	410	410	410
Informal payments							
Traditional Authorities (Industry)	7,283	7,283	7,283	7,283	7,283	7,283	7,283
CSM payments to farmers	9,544	9,544	9,544	9,544	9,544	9,544	9,544
Other CSM informal payments	8,967	8,967	8,967	8,967	8,967	8,967	8,967
District level benefits	1,910	1,910	1,910	1,910	1,910	1,910	1,910
Total benefits, Forest owners	28,114	28,114	28,114	28,114	28,114	28,114	28,114
Net benefit/(Loss), Forest owners	28,114	28,114	28,114	28,114	28,114	28,114	28,114

	1000 /1400	718/820				
8	9	10	11	12	13	14
2014	2015	2016	2017	2018	2019	2020-2026
4,442	0	0	0	0	0	0
3,084	3,084	3,084	3,084	3,084	3,084	21,591
7,526	3,084	3,084	3,084	3,084	3,084	21,591
17,206	-194,434	-194,434	-194,434	-194,434	-194,434	-1,225,695
8,104	0	0	0	0	0	0
25,310	-194,434	-194,434	-194,434	-194,434	-194,434	-1,225,695
17,784	-197,518	-197,518	-197,518	-197,518	-197,518	-1,247,285
410	256.03	256	256	256	256	1,287
7,283	4,552	4,552	4,552	4,552	4,552	22,877
9,544	0	0	0	0	0	0
8,967	0	0	0	0	0	0
1,910	0	0	0	0	0	0
28,114	4,808	4,808	4,808	4,808	4,808	24,163
28,114	4,808	4,808	4,808	4,808	4,808	24,163

SCENARIO 1 (OPTION 1) SAWMILLS ONLY

	1,600						
YEAR:	1	2	3	4	5	6	7
	2007	2008	2009	2010	2011	2012	2013
Livelihoods in production, transport and marketing	133,270	133,270	133,270	133,270	133,270	133,270	133,270
Net benefit/(Loss), Livelihoods	133,270	133,270	133,270	133,270	133,270	133,270	133,270
Institutions							
Institutional costs	5,707	5,707	5,707	6,443	6,443	6,443	7,942
Total costs, Institutions	5,707	5,707	5,707	6,443	6,443	6,443	7,942
Stumpage fees/TIDD levies	8,639	8,639	8,639	8,639	8,639	8,639	8,639
Corporate taxes	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Total benefits, Institutions	10,119	10,119	10,119	10,119	10,119	10,119	10,119
Net benefit/(Loss), Institutions	4,412	4,412	4,412	3,676	3,676	3,676	2,177
Net Benefit/Loss), Sector	183,580	183,580	183,580	182,843	182,843	182,843	181,344
NPV, Net Benefit/Loss), Sector @ 20%				502,973			
	2007	2008	2009	2010	2011	2012	2013
	183,580	183,580	183,580	182,843	182,843	182,843	181,344
ECONOMIC ANALYSIS (NATIONAL), US\$,000							
COSTS							
Incremental investments (sawmills)	4,442	4,442	4,442	4,442	4,442	4,442	4,442
Institutional costs	5,707	5,707	5,707	6,443	6,443	6,443	7,942
Total cost	10,148	10,148	10,148	10,885	10,885	10,885	12,384
BENEFITS							

	1000 /1400	718/820				
8	9	10	11	12	13	14
2014	2015	2016	2017	2018	2019	2020-2026
133,270	0	0	0	0	0	0
133,270	0	0	0	0	0	0
7,942	11,905	11,905	11,905	11,905	11,905	70,956
7,942	11,905	11,905	11,905	11,905	11,905	70,956
8,639	5,496	5,496	5,496	5,496	5,496	28,361
1,480	0	0	0	0	0	0
10,119	5,496	5,496	5,496	5,496	5,496	28,361
2,177	-6,410	-6,410	-6,410	-6,410	-6,410	-42,595
181,344	-199,120	-199,120	-199,120	-199,120	-199,120	-1,265,717
2014	2015	2016	2017	2018	2019	2020
181,344	-199,120	-199,120	-199,120	-199,120	-199,120	-180,817
4,442	0	0	0	0	0	0
7,942	11,905	11,905	11,905	11,905	11,905	70,956
12,384	11,905	11,905	11,905	11,905	11,905	70,956

SCENARIO 1 (OPTION 1) SAWMILLS ONLY

	1,600						
YEAR:	1	2	3	4	5	6	7
	2007	2008	2009	2010	2011	2012	2013
Wages, sawmilling	7,820	7,820	7,820	7,820	7,820	7,820	7,820
Wages, CSM	11,212	11,212	11,212	11,212	11,212	11,212	11,212
Livelihoods in transport+marketing chain	92,000	92,000	92,000	92,000	92,000	92,000	92,000
Depreciation	3,880	3,880	3,880	3,880	3,880	3,880	3,880
Financing cost (interest)	3,084	3,084	3,084	3,084	3,084	3,084	3,084
Gross profit	31,877	31,877	31,877	31,877	31,877	31,877	31,877
Stumpage fees/TIDD Levies/SRAs	9,049	9,049	9,049	9,049	9,049	9,049	9,049
Informal payments (T/Authorities)	25,794	25,794	25,794	25,794	25,794	25,794	25,794
District level benefits	1,910	1,910	1,910	1,910	1,910	1,910	1,910
Economic adjustment in log cost	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077
Inter-sectoral linkages	12,675	12,675	12,675	12,675	12,675	12,675	12,675
Sawmilling	9,842	9,842	9,842	9,842	9,842	9,842	9,842
CSM	2,833	2,833	2,833	2,833	2,833	2,833	2,833
Total economic value added	73,224	73,224	73,224	73,224	73,224	73,224	73,224
Net benefit/(Loss), National	63,076	63,076	63,076	62,339	62,339	62,339	60,840
NPV, Net Benefit/Loss), national @ 20%				39,771			
Institutional cost							
Private sector re-investment, % of gross profit	30%						

	1000 /1400	718/820				
8	9	10	11	12	13	14
2014	2015	2016	2017	2018	2019	2020-2026
7,820	19,605	19,605	19,605	19,605	19,605	123,967
11,212	0	0	0	0	0	0
92,000	0	0	0	0	0	0
3,880	3,880	3,880	3,880	3,880	3,880	27,159
3,084	3,084	3,084	3,084	3,084	3,084	21,591
31,877	-198,314	-198,314	-198,314	-198,314	-198,314	-1,252,853
9,049	5,752	5,752	5,752	5,752	5,752	29,648
25,794	4,552	4,552	4,552	4,552	4,552	22,877
1,910	0	0	0	0	0	0
-126,077	-47,500	-47,500	-47,500	-47,500	-47,500	-238,736
12,675	17,634	17,634	17,634	17,634	17,634	113,946
9,842	17,634	17,634	17,634	17,634	17,634	113,946
2,833	0	0	0	0	0	0
73,224	-191,308	-191,308	-191,308	-191,308	-191,308	-1,152,403
60,840	-203,214	-203,214	-203,214	-203,214	-203,214	-1,223,359

SCENARIO 1 (OPTION 1) SAWMILLS ONLY

	1,600						
YEAR:	1	2	3	4	5	6	7
	2007	2008	2009	2010	2011	2012	2013
Depreciation on new investment (%)	10%						
District level benefits	0	Ref: EU-CSM-CBA Technical Report					

60% of nominal wage rate calculated as social wage rate (see Baseline notes)

See Baseline notes

SCENARIO 2 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH BAN ON EXPORTS)

	1,600					
YEAR:	1	2	3	4	5	6
	2007	2008	2009	2010	2011	2012
FINANCIAL ANALYSIS (KEY FOREST STAKEHOLDERS, US\$,000)						
Industry						
Incremental investments (sawmills)	4,442	4,442	4,442	4,442	4,442	4,442
Financing cost	3,084	3,084	3,084	3,084	3,084	3,084
Total cost, industry	7,526	7,526	7,526	7,526	7,526	7,526
Industry (Sawmilling+Artisanal) net profits+ depreciation	17,206	17,206	17,206	17,206	17,206	17,206
CSM profits #	8,104	8,104	8,104	8,104	8,104	8,104
Total benefits, Industry	25,310	25,310	25,310	25,310	25,310	25,310

	1000 /1400	718/820				
8	9	10	11	12	13	14
2014	2015	2016	2017	2018	2019	2020-2026

		1000/1400					718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
4,442	4,442	0	0	0	0	0	41,433
3,084	3,084	3,951	3,951	3,951	3,951	3,951	27,655
7,526	7,526	3,951	3,951	3,951	3,951	3,951	69,088
17,206	17,206	32,374	32,374	32,374	32,374	32,374	130,267
8,104	8,104	0	0	0	0	0	0
25,310	25,310	32,374	32,374	32,374	32,374	32,374	130,267

SCENARIO 2 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH BAN ON EXPORTS)							
		1,600					
YEAR:		1	2	3	4	5	6
		2007	2008	2009	2010	2011	2012
Net benefit/(Loss), Industry		17,784	17,784	17,784	17,784	17,784	17,784
Forest owners							
SRAs		410	410	410	410	410	410
Informal payments							
Traditional Authorities (Sawmills)		7,283	7,283	7,283	7,283	7,283	7,283
CSM/Artisanal millers' payments to farmers		9,544	9,544	9,544	9,544	9,544	9,544
Other CSM informal payments		8,967	8,967	8,967	8,967	8,967	8,967
District level benefits		1,910	1,910	1,910	1,910	1,910	1,910
Total benefits, Forest owners		28,114	28,114	28,114	28,114	28,114	28,114
Net benefit/(Loss), Forest owners		28,114	28,114	28,114	28,114	28,114	28,114
Livelihoods in production, transport and marketing		133,270	133,270	133,270	133,270	133,270	133,270
Net benefit/ (Loss), Livelihoods		133,270	133,270	133,270	133,270	133,270	133,270
Institutions							
Institutional costs		5,707	5,707	5,707	6,443	6,443	6,443
Total costs, Institutions		5,707	5,707	5,707	6,443	6,443	6,443
Stumpage fees/TIDD levies		8,639	8,639	8,639	8,639	8,639	8,639
Corporate taxes		1,480	1,480	1,480	1,480	1,480	1,480

		1000/1400					718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
17,784	17,784	28,423	28,423	28,423	28,423	28,423	61,179
410	410	330	330	330	330	330	1,660
7,283	7,283	3,721	3,721	3,721	3,721	3,721	18,702
9,544	9,544	1,846	1,846	1,846	1,846	1,846	9,278
8,967	8,967	0	0	0	0	0	0
1,910	1,910	0	0	0	0	0	0
28,114	28,114	5,897	5,897	5,897	5,897	5,897	29,640
28,114	28,114	5,897	5,897	5,897	5,897	5,897	29,640
133,270	133,270	43,450	43,450	43,450	43,450	43,450	218,382
133,270	133,270	43,450	43,450	43,450	43,450	43,450	218,382
7,942	7,942	7,602	7,602	7,602	7,602	7,602	40,857
7,942	7,942	7,602	7,602	7,602	7,602	7,602	40,857
8,639	8,639	6,605	6,605	6,605	6,605	6,605	33,197
1,480	1,480	16,471	16,471	16,471	16,471	16,471	78,716

SCENARIO 2 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH BAN ON EXPORTS)							
		1,600					
YEAR:	1	2	3	4	5	6	
	2007	2008	2009	2010	2011	2012	
Total benefits, Institutions	10,119	10,119	10,119	10,119	10,119	10,119	
Net benefit/(Loss), Institutions	4,412	4,412	4,412	3,676	3,676	3,676	
Net Benefit/Loss), Sector	183,580	183,580	183,580	182,843	182,843	182,843	
NPV, Net Benefit/(Loss), Sector @ 20%				785,538			
ECONOMIC ANALYSIS (NATIONAL), US\$,000							
COSTS							
Incremental investments (sawmills)	4,442	4,442	4,442	4,442	4,442	4,442	
Institutional costs	5,707	5,707	5,707	6,443	6,443	6,443	
Total cost	10,148	10,148	10,148	10,885	10,885	10,885	
BENEFITS							
Wages, sawmilling+ Artisanal	7,820	7,820	7,820	7,820	7,820	7,820	
# Wages, CSM	11,212	11,212	11,212	11,212	11,212	11,212	
* Livelihoods in transport+ marketing chain	92,000	92,000	92,000	92,000	92,000	92,000	
Depreciation	3,880	3,880	3,880	3,880	3,880	3,880	
1 Financing cost (interest) (Add back)	3,084	3,084	3,084	3,084	3,084	3,084	
Gross profit	31,877	31,877	31,877	31,877	31,877	31,877	
Stumpage fees/TIDD Levies/SRAS	9,049	9,049	9,049	9,049	9,049	9,049	

		1000/1400					718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
10,119	10,119	23,076	23,076	23,076	23,076	23,076	111,913
2,177	2,177	15,474	15,474	15,474	15,474	15,474	71,056
181,344	181,344	93,245	93,245	93,245	93,245	93,245	380,256
4,442	4,442	0	0	0	0	0	41,433
7,942	7,942	7,602	7,602	7,602	7,602	7,602	40,857
12,384	12,384	7,602	7,602	7,602	7,602	7,602	82,290
7,820	7,820	9,043	9,043	9,043	9,043	9,043	45,451
11,212	11,212	0	0	0	0	0	0
92,000	92,000	36,576	36,576	36,576	36,576	36,576	183,831
3,880	3,880	4,970	4,970	4,970	4,970	4,970	34,787
3,084	3,084	3,951	3,951	3,951	3,951	3,951	27,655
31,877	31,877	43,875	43,875	43,875	43,875	43,875	174,196
9,049	9,049	6,935	6,935	6,935	6,935	6,935	34,857

SCENARIO 2 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH BAN ON EXPORTS)							
		1,600					
YEAR:		1	2	3	4	5	6
		2007	2008	2009	2010	2011	2012
	CSM/Artisanal millers' payments to farmers						
	Informal payments (T/ Authorities)	25,794	25,794	25,794	25,794	25,794	25,794
	District level benefits	1,910	1,910	1,910	1,910	1,910	1,910
	Economic adjustment in log cost	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077
	Inter-sectoral linkages	12,675	12,675	12,675	12,675	12,675	12,675
	Sawmilling+Artisanal	9,842	9,842	9,842	9,842	9,842	9,842
	CSM	2,833	2,833	2,833	2,833	2,833	2,833
	Total economic value added	73,224	73,224	73,224	73,224	73,224	73,224
	Net benefit/(Loss), National	63,076	63,076	63,076	62,339	62,339	62,339
#	60% of nominal wage rate calculated as social wage rate						
*	Gross returns to re-sawyers, brokers etc						
	NPV, Net Benefit/Loss), national @ 20%				300,878		

		1000/1400					718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
		1,846	1,846	1,846	1,846	1,846	9,278
25,794	25,794	3,721	3,721	3,721	3,721	3,721	18,702
1,910	1,910	0	0	0	0	0	0
-126,077	-126,077	-41,536	-41,536	-41,536	-41,536	-41,536	-208,759
12,675	12,675	6,565	6,565	6,565	6,565	6,565	39,749
9,842	9,842	6,565	6,565	6,565	6,565	6,565	39,749
2,833	2,833	0	0	0	0	0	0
73,224	73,224	75,946	75,946	75,946	75,946	75,946	359,746
60,840	60,840	68,345	68,345	68,345	68,345	68,345	277,457

SCENARIO 3 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH FISCAL INCENTIVES)							
	1,600						
YEAR:	1	2	3	4	5	6	
	2007	2008	2009	2010	2011	2012	
FINANCIAL ANALYSIS (KEY FOREST STAKEHOLDERS, US\$,000)							
Industry							
Incremental investments (sawmills)	4,442	4,442	4,442	4,442	4,442	4,442	4,442
Financing cost	3,084	3,084	3,084	3,084	3,084	3,084	3,084
Total cost, industry	7,526	7,526	7,526	7,526	7,526	7,526	7,526
Industry (Sawmilling+Artisanal) net profits+ depreciation	17,206	17,206	17,206	17,206	17,206	17,206	17,206
CSM profits #	8,104	8,104	8,104	8,104	8,104	8,104	8,104
Total benefits, Industry	25,310	25,310	25,310	25,310	25,310	25,310	25,310
Net benefit/(Loss), Industry	17,784	17,784	17,784	17,784	17,784	17,784	17,784
Forest owners							
SRAs	410	410	410	410	410	410	410
Informal payments							
Traditional Authorities (Sawmills)	7,283	7,283	7,283	7,283	7,283	7,283	7,283
CSM/Artisanal millers' payments to farmers	9,544	9,544	9,544	9,544	9,544	9,544	9,544
Other CSM informal payments	8,967	8,967	8,967	8,967	8,967	8,967	8,967
District level benefits	1,910	1,910	1,910	1,910	1,910	1,910	1,910
Total benefits, Forest owners	28,114	28,114	28,114	28,114	28,114	28,114	28,114
Net benefit/(Loss), Forest owners	28,114	28,114	28,114	28,114	28,114	28,114	28,114

	1000/1400						718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
4,442	4,442	0	0	0	0	0	41,433
3,084	3,084	3,951	3,951	3,951	3,951	3,951	27,655
7,526	7,526	3,951	3,951	3,951	3,951	3,951	69,088
17,206	17,206	42,777	42,777	42,777	42,777	42,777	185,315
8,104	8,104	0	0	0	0	0	0
25,310	25,310	42,777	42,777	42,777	42,777	42,777	185,315
17,784	17,784	38,826	38,826	38,826	38,826	38,826	116,227
410	410	287	287	287	287	287	1,603
7,283	7,283	1,791	1,791	1,791	1,791	1,791	9,000
9,544	9,544	2,178	2,178	2,178	2,178	2,178	10,958
8,967	8,967	0	0	0	0	0	0
1,910	1,910	0	0	0	0	0	0
28,114	28,114	4,255	4,255	4,255	4,255	4,255	21,561
28,114	28,114	4,255	4,255	4,255	4,255	4,255	21,561

SCENARIO 3 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH FISCAL INCENTIVES)							
		1,600					
YEAR:		1	2	3	4	5	6
		2007	2008	2009	2010	2011	2012
Livelihoods in production, transport and marketing		133,270	133,270	133,270	133,270	133,270	133,270
Net benefit/(Loss),Livelihoods		133,270	133,270	133,270	133,270	133,270	133,270
Institutions							
Institutional costs		5,707	5,707	5,707	6,443	6,443	6,443
Total costs, Institutions		5,707	5,707	5,707	6,443	6,443	6,443
Stumpage fees/TIDD levies		8,639	8,639	8,639	8,639	8,639	8,639
Corporate taxes		1,480	1,480	1,480	1,480	1,480	1,480
Total benefits, Institutions		10,119	10,119	10,119	10,119	10,119	10,119
Net benefit/(Loss), Institutions		4,412	4,412	4,412	3,676	3,676	3,676
Net Benefit/Loss), Sector		183,580	183,580	183,580	182,843	182,843	182,843
NPV, Net Benefit/(Loss), Sector @ 20%					814,833		
		2007	2008	2009	2010	2011	2012
		183,580	183,580	183,580	182,843	182,843	182,843
ECONOMIC ANALYSIS (NATIONAL), US\$,000							
COSTS							
Incremental investments (sawmills)		4,442	4,442	4,442	4,442	4,442	4,442

	1000/1400						718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
133,270	133,270	51,257	51,257	51,257	51,257	51,257	257,929
133,270	133,270	51,257	51,257	51,257	51,257	51,257	257,929
7,942	7,942	7,857	7,857	7,857	7,857	7,857	40,857
7,942	7,942	7,857	7,857	7,857	7,857	7,857	40,857
8,639	8,639	6,009	6,009	6,009	6,009	6,009	33,414
1,480	1,480	36,872	36,872	36,872	36,872	36,872	78,716
10,119	10,119	42,882	42,882	42,882	42,882	42,882	112,130
2,177	2,177	35,025	35,025	35,025	35,025	35,025	71,274
181,344	181,344	129,364	129,364	129,364	129,364	129,364	466,990
2013	2014	2015	2016	2017	2018	2019	2020
181,344	181,344	129,364	129,364	129,364	129,364	129,364	66,713
4,442	4,442	0	0	0	0	0	41,433

SCENARIO 3 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH FISCAL INCENTIVES)							
		1,600					
YEAR:		1	2	3	4	5	6
		2007	2008	2009	2010	2011	2012
	Institutional costs	5,707	5,707	5,707	6,443	6,443	6,443
	Total cost	10,148	10,148	10,148	10,885	10,885	10,885
	BENEFITS						
	Wages, sawmilling + Artisanal	7,820	7,820	7,820	7,820	7,820	7,820
#	Wages, CSM	11,212	11,212	11,212	11,212	11,212	11,212
*	Livelihoods in transport + marketing chain	92,000	92,000	92,000	92,000	92,000	92,000
	Depreciation	3,880	3,880	3,880	3,880	3,880	3,880
0.79	Financing cost (interest)	3,084	3,084	3,084	3,084	3,084	3,084
	Gross profit	31,877	31,877	31,877	31,877	31,877	31,877
	Stumpage fees/TIDD Levies/SRAs	9,049	9,049	9,049	9,049	9,049	9,049
	CSM/Artisanal millers' payments to farmers						
	Informal payments (T/ Authorities)	25,794	25,794	25,794	25,794	25,794	25,794
	District level benefits	1,910	1,910	1,910	1,910	1,910	1,910
	Economic adjustment in log cost	-126,077	-126,077	-126,077	-126,077	-126,077	-126,077
	Inter-sectoral linkages	12,675	12,675	12,675	12,675	12,675	12,675
	Sawmilling + Artisanal	9,842	9,842	9,842	9,842	9,842	9,842
	CSM	2,833	2,833	2,833	2,833	2,833	2,833
	Total economic value added	73,224	73,224	73,224	73,224	73,224	73,224
	Net benefit/(Loss), National	63,076	63,076	63,076	62,339	62,339	62,339
#	60% of nominal wage rate calculated as social wage rate						

	1000/1400						
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026
7,942	7,942	7,857	7,857	7,857	7,857	7,857	40,857
12,384	12,384	7,857	7,857	7,857	7,857	7,857	82,290
7,820	7,820	9,548	9,548	9,548	9,548	9,548	48,011
11,212	11,212	0	0	0	0	0	0
92,000	92,000	43,148	43,148	43,148	43,148	43,148	217,121
3,880	3,880	4,970	4,970	4,970	4,970	4,970	34,787
3,084	3,084	3,951	3,951	3,951	3,951	3,951	27,655
31,877	31,877	67,798	67,798	67,798	67,798	67,798	244,230
9,049	9,049	6,296	6,296	6,296	6,296	6,296	31,666
		2,178	2,178	2,178	2,178	2,178	10,958
25,794	25,794	1,791	1,791	1,791	1,791	1,791	9,000
1,910	1,910	0	0	0	0	0	0
-126,077	-126,077	-46,322	-46,322	-46,322	-46,322	-46,322	-184,305
12,675	12,675	8,480	8,480	8,480	8,480	8,480	49,762
9,842	9,842	8,480	8,480	8,480	8,480	8,480	49,762
2,833	2,833	0	0	0	0	0	0
73,224	73,224	101,836	101,836	101,836	101,836	101,836	488,886
60,840	60,840	93,980	93,980	93,980	93,980	93,980	406,596

SCENARIO 3 (OPTION 2) SAWMILLS & ARTISANAL MILLS (WITH FISCAL INCENTIVES)							
		1,600					
YEAR:		1	2	3	4	5	6
		2007	2008	2009	2010	2011	2012
*	Gross returns to re-sawyers, brokers etc						
	NPV, Net Benefit/Loss), national @ 20%				324,923		

Summary of Cost Benefit Analysis Results

COST BENEFIT ANALYSIS RESULTS OF POLICY OPTIONS: NPVs DISCOUNTED @ 20%, (US\$,000)				
	Baseline	Sc.1 (Option 1)-Sawmills Only	Sc.2 (Option 2)-Sawmill & Artisanal millers (with lumber export ban)	Sc.3 (Option 2)-Sawmill & Artisanal millers (with fiscal incentives)
Financial	837,734	502,973	785,538	814,833
Economic	289,919	39,771	300,878	324,923
INCREMENTAL NPV of OPTIONS (OVER BASELINE), US\$,000				
	Baseline	Sc.1 (Option 1)-Sawmills Only	Sc.2 (Option 2)-Sawmill & Artisanal millers (with lumber export ban)	Sc.3 (Option 2)-Sawmill & Artisanal millers (with fiscal incentives)
Financial		-334,760	-52,196	-22,900
Economic		-250,148	10,958	35,003

	1000/1400						718/820
7	8	9	10	11	12	13	14
2013	2014	2015	2016	2017	2018	2019	2020-2026

Annex Table A4: Assessment of Technical Sawmilling Alternatives for Artisanal Milling

Technology	Feasibility	Limitation	Conclusion
<p><i>Logosol 48"</i></p> <p>Chain saw mill with rail</p> <p>Weight: 111kg; [rz113: ??? way too much] chain saw and rails can be separated and transported by 2 men</p>	<p>Portable</p> <p>Small scale –0.7m³ per day output</p> <p>Low investment</p> <p>Easy to maintain</p>	<p>Bigger kerf rz112: the kerf is not the main waste factor (but usage of tree, inaccuracy, quality loss, ...)</p> <p>]generates high rate of wastage</p> <p>Accuracy of cutting and quality of cutting is limited</p>	<p>Would be the ideal choice in situations of no previous experiences with mobile or dimension mills</p>
<p><i>Lucas 8" Mill</i></p> <p>mobile dimension mill (rotary sawmill); circular saw</p> <p>Weight: 308kg; largest 75kg; transportable with 4 men</p>	<p>Portable</p> <p>medium kerf (5mm)</p> <p>Small scale 1.5m³ per day output</p> <p>a minimum further processing is needed for dressed all- round quality</p> <p>Low investment</p> <p>Easy to maintain</p> <p>Stelliting possibilities, bringing opportunities to cut high density materials</p>	<p>Cannot cut product wider than 8". Wider slabbing attachment produces 12" wide planks [rz114: in practice it is not as mobile, so additional equipment is needed to take the log to the mill]</p>	<p>Combines market (quality of products), scale and environmental and engineering possibilities. Successes recorded in Australia, Papua New Guinea and Vanuatu.</p> <p>A number of mills have been introduced to Ghana since 1996.</p>
<p>Woodmizer LT15</p> <p>Band saw technology</p> <p>Weight: 923 kg; mounted on trailer</p>	<p>Portable</p> <p>Higher quality material</p> <p>Thin kerff (3mm) results in higher yield</p> <p>High output rate: 16m³/day</p>	<p>High capacity runs risks of over-harvesting (or excess capacity)</p> <p>Requires specially trained skills (professional saw doctors) for treatment and maintenance of saws</p>	<p>Will be more appropriate to source raw material from a planned timber rotation, rather than depending on logging residues.</p>

- 1 These costs were reviewed with Industry for the 2005 VLTP study (Birikorang et al., 2007). A change in cost of fuel affected haulage to port and export charges which were adjusted from a total of 12% of cost to 22% of cost in the VLTP study. The export cost in 2004 also included a 7% National Reconstruction Export Levy (NREL) on lumber which was deducted at the port. According to Ghana Timber Millers Organization (GTMO), this reduced their profits by 8%. In 2005, the NREL was abolished by the 2005 Government Budget. So industry's profit was restored at 15% in 2005.

This report was produced within the framework of the EU Chainsaw Milling Project “Supporting the integration of legal and legitimate domestic timber markets into Voluntary Partnership Agreements”. The project aims to find sustainable solutions to the problems associated with the production of lumber for local timber markets by involving all stakeholders in dialogue, information gathering and the development of alternatives to unsustainable chainsaw milling practices. In Ghana, the project is being carried out by Tropenbos International (TBI) in collaboration with the Forestry Research Institute of Ghana (FORIG) and the Forestry Commission (FC).

