



Chainsaw milling: supplier to local markets — a synthesis

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Introduction

Domestic timber markets in developing countries are often supplied by timber harvested in small-scale forestry operations and processed with chainsaws. Chainsaw milling (CSM) provides socio-economic benefits to local people in the form of improved livelihoods and cheap lumber for (urban) consumers. In some countries CSM is a legal and regulated activity, but in most countries it is illegal. When left unregulated, its positive impacts risk being compromised by the development of corrupt practices, through the rise of conflicts at local or national levels, or through depletion of forest resources.

Domestic timber production and trade are to a large extent unrecorded. Information in this issue of *ETFRN News* shows that in some countries it represents a high percentage of total timber production, ranging from 30–40% (in Guyana, Republic of Congo, Democratic Republic of Congo/DRC and Uganda), to more than 50% (in Ghana, Cameroon and Peru), and almost 100% in Liberia. Wood for timber is only a small part of the total domestic market; most locally traded wood is used for fuel or made into charcoal.

Governments of tropical countries around the world have failed to address the domestic timber demand and struggled to deal with the CSM subsector, which is often informal. International negotiations and agreements on tropical timber production also tend to disregard local timber consumption, although the local timber trade might be affected by these international agreements and vice versa. The European Union (EU) Action Plan for Forest Law Enforcement, Governance and Trade (FLEGT) and the (future) climate change agreements (through Reducing Emissions from Deforestation and Forest Degradation, or REDD+)¹ might be able to provide incentives to regulate local timber trade.

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This synthesis presents an overview of the scale of CSM and its actors, drivers, impacts and local policy responses, as well as the potential effects of international forestry regimes. It is based on the 28 articles in this issue of *ETFRN News* and covers 20 countries: seven in South America and the Caribbean (section 2); four in Asia (section 3); and nine in Africa (section 4).² These articles provide a good overview of the opportunities and challenges of CSM as a supplier to domestic and regional timber markets.³ Through this issue, we wish to firmly establish the scale and impact of CSM in the domestic timber trade, and flag it as an important issue to be addressed by national and international forest policies.

What is chainsaw milling and where does it occur?

Chainsaw milling is the on-site conversion of logs into lumber using chainsaws, i.e., trees are felled and cut into lumber using chainsaws. Several techniques and types of equipment are used (Pasicznik 1.1). A range of products is produced using chainsaw milling: chainsaw millers cut boards and planks that are sold directly to the market and produce blocks or scantlings that are further processed in sawmills.

Chainsaw milling has several advantages:

- it generally requires little investment;
- it can be used in areas that are not easily accessible to conventional milling;
- it can be used for the conversion of isolated trees and for lower-quality logs; and
- it involves less invasive equipment than conventional milling, e.g., tractors or people are used instead of skidders, and hand-held chainsaws are used instead of fixed mills.

Pit-sawing — felling and converting trees to lumber using handsaws — is the predecessor of CSM. In most countries chainsaws were introduced in the 1960s for felling of trees or for agricultural activities. However, operators soon discovered the usefulness of chainsaws for ripping logs (i.e., cutting along its length). Advances were made in the development of chainsaws, and they gradually replaced the labour-intensive work of pit-sawing.

Chainsaw milling is practised in developing and developed countries, with a wide range of resource availability, socio-economic conditions and forest sector development. Our emphasis is on its application in developing countries (Appendix 1 compiles some key statistics on CSM production in the countries presented in this *ETFRN News*).

The supply chain: tree owners, millers, traders and buyers

The supply chain in CSM operations involves many actors, from the tree owner to the end consumer. The organization of the CSM supply chain varies, depending on the status of CSM (legal or illegal), the organization of production (communities, enterprises or individuals), and the degree of integration between the participants in the trade chain.

Chainsaw milling teams are typically small, with an operator and assistants who mill the lumber and transport it from the felling site to access roads or rivers. Operators may work independently or as contractors to someone else, and they may own their own

equipment or operate equipment owned by others. Furthermore, CSM can be a full-time occupation or a component of a diverse livelihood strategy. Timber is sold to the end customer or traded in local markets, where a number of people are employed in handling, loading, further processing, etc. Chainsaw operations are often financed by dealers from urban centres who trade lumber in timber markets. The personnel of regulating and law enforcement agencies are also important participants in the supply chain, although in a different way.

Sources of raw material

Timber production for the local market is sourced from forests or from trees on farm lands. Access to trees varies according to formal, customary and practical tree tenure and use arrangements, and whether or not CSM teams operate legally or with assent. Access to trees is often negotiated between the CSM team and the tree owners, who in many cases (e.g., in the Congo Basin and Ghana) are customary owners, but do not officially have title to the property where the trees are growing. In Guyana CSM is permitted on State Forest lands and regulated through two-year community leases for a maximum of 8,000 ha. In the Congo Basin, the vast majority of timber comes from the non-permanent forest domain, i.e., areas with no obligation to sustainable forest management. In Ghana, farmlands are the most important sources of timber for chainsaw operators, but increasingly, chainsaw operators are entering (permanent) forest reserves because of dwindling resources elsewhere.

Chainsaw milling: supplier to regional markets

Although primarily destined for domestic markets, there are indications that chainsaw milled lumber is increasingly being traded on a regional scale. For example, markets for timber originating in the Tanimbar Islands of Indonesia have shifted from Java to destinations such as the Philippines, Vietnam and South China in response to the Indonesian government's efforts to curb the illegal trade (Roda, Langbour and Shantiko 2.3). In Africa, very effective ethnic business networks are active in trading illegal Cameroonian chainsaw milled lumber with Nigeria, Niger, Chad, Sudan, Egypt, Libya and Algeria (Langbour and Koffi 4.2). There is also some evidence that lumber is being transported from Ghana to neighbouring countries (Quartey 4.6), and from DRC to Rwanda, Burundi, Kenya and beyond (Vundu dia Masamba and Kiyulu N'yanganga 4.4).

Policies on chainsaw milling

CSM regulations are often incomplete or absent (Appendix 1), because forest laws tend to focus on the industrial timber sector. Three general models exist: CSM is permitted; it is permitted under certain restrictions (i.e., regulated); and it is not permitted (but it still takes place). Some countries have restricted CSM to domestic use only (e.g., Indonesia, Bolivia or Ghana) and/or to areas that are difficult to reach by industrial operations (Peru and Bolivia). Other countries allow CSM for small-scale commercial production (Guyana, Kenya and recently, Uganda). Where CSM is regulated, the licensing procedures for small-scale producers can be difficult, costly and time-consuming, with no incentives to comply

(Lao PDR, Indonesia, Cameroon, DRC, Gabon, Bolivia). As a result, operators often prefer to work informally than to comply with burdensome bureaucratic procedures.

In most countries chainsaw milling is associated with illegal forest activities. Even when CSM is authorized, its activities are often difficult to monitor due to the large number of people involved and the small size and mobility of its operations. The absence of CSM regulations and limited enforcement capacity exacerbate the problems of insufficient monitoring. In some countries, unclear or randomly enforced regulations give rise to illegal and corrupt practices where government officials derive personal benefits from CSM activities (Philippines 2.6; DRC 4.1 and 4.4; Ghana 4.5; Cameroon 4.1).

Guyana is an example where CSM is a legal and important subsector of the forest industry that supports rural livelihoods. The government has set up a relatively simple and workable regulatory system for small-scale producers (Office of Climate Change 3.5; Marshall and Kerrett 3.6).

In Bolivia illegal CSM activities decreased significantly after the introduction of the 1996 forest law. The legislation offered chainsaw millers a legal framework and gave land-owners the chance to benefit from their forest resource. This access allowed for the development of small-scale processing of logs transported by tractors. The processing requires less capital than conventional logging and is more efficient and less strenuous than CSM (Benneker 3.1).

In some countries (Liberia, Nigeria), CSM is not allowed but is considered quasi-legal and is tolerated in practice, because of the lack of economic incentive to invest in the formal sawmill industry due to the depletion of timber resources (Nigeria) and the unavailability of other sources of timber (Liberia).

Main drivers of chainsaw milling

Demand for cheap wood in local markets

The local demand for cheap lumber was identified as the main driver of CSM in each country covered in this *ETFRN News*. This demand is not being met by other sources of lumber.

In countries where CSM is illegal, it is still viewed as a legitimate practice by the majority of the stakeholders involved in the wood-based industry at the local level (Andrianto, Obidzinski and Komarudin 2.2; Marfo 4.5; Kamara et al. 4.8). Consumers accept low-quality chainsawn lumber because of its low price (Palacios and Malessa 3.4; Quartey 4.6; Kambugu, Banana and Odokonyero 4.11). The lack of incentives — such as price premiums for legal, higher-quality timber on the local market — and the abundance of logs keep CSM prices low and discourage people from using milling attachments (Pasicznik 1.1; Palacios and Malessa 3.4). It remains unknown whether higher requirements would result in a sustained demand for better quality products or just foster more illegal harvesting, as in Cameroon (Lescuyer et al. 4.1).

In some cases, low timber prices are a major disincentive for export-oriented formal sawmills to supply the local market. Klassen (2.1) calculated that timber prices on the domestic market in Indonesia are less than half of the timber production costs in the formal sawmill industry. Domestic prices are also far lower than export prices: in Liberia the domestic price for CSM lumber ranges from 26–54% of the export price; and in Cameroon CSM prices are 80% lower than export prices (see also Appendix 2).

Economic decline and other external calamities

In some countries (e.g., DRC, Nigeria) economic decline made the poor rural population turn to CSM as a source of income. In Peru, reduced activity from formal sawmills — a downturn associated with the international financial crisis — led to a lower availability of rejected lumber from formal sawmills on the market, increasing the occurrence of CSM (Brotto 3.8). The opposite trend could be seen in Cameroon, Ghana, Central African Republic, Congo and Gabon, where economic growth boosted the building sector and greatly increased the urban demand for lumber.

Beyond economic factors, several authors reported natural calamities as a factor that contributed to the rise of CSM. In many countries in the hurricane belt, CSM was introduced after heavy storms. When hurricanes toppled large numbers of trees and destroyed houses, an immediate demand for construction timber was created (Eckelmann et al. 3.7). The devastation prompted governments to issue chainsaw permits to salvage any available timber.

Similarly, armed conflicts in Suriname, DRC, and Liberia prompted the expansion of CSM to satisfy lumber demands in the face of the collapse of the formal sawmill industry and post-war reconstruction needs (van Kantén and Matai 3.9; Vundu dia Masamba and Kiyulu N'yanga 4.4; Kamara et al. 4.8).

Inadequate policies, policy restrictions and bans

In most countries local timber demand is not being adequately met by the formal industry, because it prefers to sell to the export market. Often, the regulatory framework is insufficient to regulate domestic timber production and trade in such a way as to satisfy the local demand for timber (e.g., in Indonesia, Ghana, Cameroon and Uganda). In Ghana, the government has directed sawmills to reserve 20% of their production for the local market, part of a policy intended to ban CSM and supply the local market from the formal industry. In Cameroon and in Gabon, community forests are supposed to supply the local timber market. Even if these quota are supplied, it would not be enough to satisfy the local demand in these countries, leaving a large gap to be filled by CSM.

A common response to CSM is to ban it, but banning can have mixed results. In Kenya, CSM increased after a ban on wood harvesting in government plantations resulted in acute timber shortages (Muthike et al. 4.7). The export-oriented timber industry in Liberia collapsed as a result of the international ban on Liberian timber products in 2003 and the subsequent cancellation of concession agreements by the government in 2006. This created a gap in the local timber supply. As a result, CSM is currently the only source of

lumber in the Liberian local market (Kamara et al. 4.8). The CSM ban in Ghana coincided with a log export ban, which unintentionally created a favourable environment for CSM; an increase in CSM capacity and profitability due to an excess supply of logs resulted in decreasing domestic prices (Quartey 4.6). The log surplus on the Indonesian market — due to the decentralization of issuing logging licences — drove down domestic log prices to the point where most concessions could no longer operate economically within the law (Klassen 2.1).

In Uganda the effectiveness of the CSM ban varied across forest types; on plantations and in natural forest reserves the policy has been largely successful in reducing CSM, but on private lands it has been compromised by corruption, political interference and lack of enforcement capacity (Kambugu, Banana and Odokonyero 4.11). In Cameroon the 1994 forest policy reform caused formal forest companies to shut down or to reduce their legal and sustainable production, and as the national economy improved, informal chainsaw operations filled the timber gap (Lescuyer et al. 4.1, Langbour and Koffi 4.2).

Corruption and political interference

Corruption and weak institutional governance have been cited in many cases as factors that foster CSM (Lescuyer et al. 4.1; Marfo 4.5; Kamara et al. 4.8; Kambugu, Banana and Odokonyero 4.11). In various cases, CSM is banned or discouraged on paper but tolerated, or even indirectly promoted, in practice.

In Ghana (Marfo 4.5), there is overwhelming evidence that corruption is prevalent among the frontline staff of law enforcement agencies. Corrupt practices and weak law enforcement have facilitated illegal chainsaw milling and made it attractive. Political interference has also greatly facilitated the drivers of chainsaw milling in Ghana. Enforcement of the ban at the operational level has not been effective due to political interference, particularly by chiefs and local politicians. Informal payments to government officials in Ghana were estimated to be US\$ 1.2 million in 2007. This is, however, only a portion of the amount that the government may be losing (estimated at up to US\$ 18 million per year) by not collecting stumpage fees from chainsaw operators (Marfo 4.5).

Tenure arrangements and inequitable benefit sharing of forest resources

Several articles mention insecure tree tenure as one of the main factors that prevents customary owners from protecting, replanting or regenerating trees (Cameroon, Ghana). In Ghana, for example, the tree tenure system effectively vests tree ownership and management rights in the state. This alienates farmers and communities from income from timber even though they decide the fate of trees on their lands. In addition, timber revenue accrues exclusively to district assemblies and traditional authorities (chiefs), not farmers. These factors have served as the impetus for farmers and community members to connive with CSM operators who pay for the right to harvest trees on farms (Marfo 4.5).

In Kenya farmers own the trees, which provide them with additional income. Trees outside forests have become important in meeting local timber demand. Farmers are now negotiating with operators over price, depending on tree quality and accessibility, urgency of cash need, and knowledge of the farmer about the value of the species (Muthike et al. 4.7).

The 1996 forest law in Bolivia is a good example of legislation that provides improved access and benefit sharing to local people, which in turn decreases illegal logging (Benneker 3.1).

Socio-economic impacts

Profitability of chainsaw milling

In many countries there is a considerable scope for profits from CSM due to the strong demand for lumber. The main determinants of profitability are market prices, investment costs, productivity, recovery, distance to market, resource characteristics, type of ownership and the nature of the market (Andrianto, Obidzinski and Komarudin 2.2; Eckelmann et al. 3.7; Popoola 4.9). CSM profit margins range from 15% to more than 50%. The evasion of taxes makes chainsaw milled lumber cheaper, although unofficial charges often increase production costs (Lescuyer et al. 4.1; Marfo 4.5). Appendix 2 provides an overview of production costs, market prices and profitability of CSM as cited in the case studies in this issue.

Adding value to rough-sawn lumber is frequently proposed as a way to increase profits and retain them at lower levels in the product chain. In Papua New Guinea (PNG), Keenan, Grigoriou and Yosi (2.5) show, however, that value adding is not always an option in mobile sawmill production; it is profitable only at a certain scale of production. Production for the local market with limited processing requirements proved to be more lucrative for owners of small sawmills than for export markets, with their higher requirements.

Employment opportunities

The possibility of making a reasonable living from CSM and the scarcity or lack of other viable livelihood alternatives in rural areas are cited by many authors as powerful drivers for people to get involved in the practice (Andrianto, Obidzinski and Komarudin 2.2; Terrazas and Gutierrez 3.2; Palacios and Malessa 3.4; Marshall and Kerrett 3.6; van Kanten and Matai 3.9; Marfo 4.5). Chainsaw milling is often seen as a means to quickly earn cash income in areas where this is scarce.

Employment figures for CSM are not readily available since in most countries it is practised in an informal way. For some countries, CSM employment is estimated to form a substantial part of the total forestry workforce (Table 1). A great deal of indirect employment is also created through CSM employment.

Table 1. Estimated CSM employment in four countries

country	estimated employment	note	article
Cameroon	45,000	three times as much as in the industrial timber sector	4.1
Ghana	97,000	comparable to the formal industry	4.5
Guyana	8,000	one third of total forestry work force	3.6
Liberia	1,500–3,850		4.8

Income generation for local people

CSM generates income for a range of participants in the trade chain, including rural people, transporters and urban traders. In some cases, the income from chainsaw operations represents a substantial proportion of household income; many examples provided by the authors show that it may be much higher than income from alternative work. In Ghana it can be as much as 24 times higher than the income from traditional agriculture (Marfo 4.5). In Cameroon the CSM revenue that remains in rural economies is four times as high as that provided by the area fee, a tax paid by industrial loggers and redistributed to local councils and communities (Lescuyer et al. 4.1). The favourable wages of CSM activities compared to other employment activities are also mentioned in the case of Liberia, the Caribbean islands, Indonesia and the Philippines.

The income generated by CSM activities also stimulates a secondary economy and can help communities purchase new chainsaws or mobile mills (e.g., in Suriname). In most countries CSM income has led to the development of services and trade in manufactured goods. In Liberia, for example, the presence of chainsaw millers has promoted the construction and repair of schools, town halls and roads. Alternatively, this income can be spent in other ways, such as on alcohol, tobacco and prostitutes (van der Ploeg 2.6).

Very often communities have limited organizational capacity to collaborate in harvesting, processing and marketing timber; this is a basic requirement for increasing local benefits from CSM and access to forest resources. As illustrated by the example of a CSM cooperative on Dominica, forming an effective collaborative organization — one that supports improved harvesting, processing and fair trade of wood — can be a real challenge. This initiative failed because of internal disputes and the dumping of low-quality timber through the cooperation (Eckelmann et al. 3.7).

The impact of CSM on indigenous communities varies according to differences in market access. Better market access may weaken traditional social structures and distribute revenues more widely in the community (Roda, Langbour and Shantiko 2.3).

Revenue distribution

It is believed that the benefits generated by chainsaw milling are distributed more widely within communities than those provided by conventional logging. This notwithstanding, from stump to market, the trading, financing, transportation and marketing processes

in the chainsaw timber supply chain can be exploitative, skewing the distribution of profits towards the urban timber dealers who sponsor the operations (Ghana, Philippines, Guyana). Customary tree owners tend to get less than 10% of the value of the timber from the standing trees they sell (Uganda, Ghana, Cameroon and Gabon).

Roda, Langbour and Shantiko (2.3) mention that CSM activities in communities do not guarantee equitable distribution; in their example, the savings and profits are not shared among the workers of the whole community, but are kept by the chainsaw owner.

In some cases the rural poor do not benefit much from chainsaw milling activities. In the Philippines (van der Ploeg 2.6) financiers, in collusion with government officials, reap the most benefits, while in DRC local chainsaw bosses, not the local people, benefit most (dia Massamba and Kiyulu N'yanga 4.4).

Income lost to government

Since CSM activities are very often practised in an informal context, substantive potential tax revenues are being lost by the state. In some countries the government may be losing more from CSM than they collect from the formal industry. The amount of foregone taxes has been estimated for several countries (Table 2).

Table 2. Lost stumpage revenue (US\$) due to illegality of CSM

country	lost stumpage revenue	article
Cameroon	13.1 million	4.1
Gabon	2.4 million	4.1
Ghana	18.0 million	4.5
Liberia	18.0–42.0 million	4.8

Health and safety

Freehand CSM is generally viewed as unhealthy and dangerous for operators. Several authors (Pasicznik 1.1; Palacios and Malessa 3.4; Marshall and Kerrett 3.6; Eckelmann et al. 3.7; Muthike et al. 4.7; Kambugu, Banana and Odokonyero 4.11) acknowledge the need for training to increase operators' health and safety and improve quality and efficiency. Chainsaw operators do not always apply the techniques they have learned, however. Examples are given from Ecuador (Palacios and Malessa 3.4) and the Caribbean (Eckelmann et al. 3.7), where operators do not apply improved techniques even when they risk contractual infringements. Several reasons are given for this reluctance: changing habits is difficult (Palacios and Malessa 3.4); it costs more to pay the assistant needed for improved production methods (Palacios and Malessa 3.4); chainsaw operators think that freehand milling is faster and as precise as using a guide bar (Eckelmann et al. 3.7); and appropriate safety and milling equipment is not always available (Pasicznik 1.1). In many cases, ignorance about improved techniques (e.g. reduced-impact logging), technologies and the illegal status of CSM are the drivers for not improving practices.

Conflicts

In many countries CSM is associated with conflict. Conflicts arise because chainsaw activities involve a multiplicity of overlapping interests and a complex network of actors in the CSM and marketing chain.

Frequently, conflicts are closely related to restrictions or bans on CSM. Forestry officials in Ghana, for example, face violence when enforcing the CSM ban. Conversely, in Ghana, Cameroon and Gabon chainsaw millers and timber dealers complain about administrative harassment and abuses of power by authorities.

The informal nature of CSM activities stimulates the development of exploitative business relations by means of which a large proportion of the revenues remains with the timber dealers or chainsaw owners; see Uganda (Kambugu, Banana and Odokonyero 4.11), DRC (Lescuyer et al. 4.1, Vundu dia Massamba and Kiyulu N'yanga 4.4), Ghana (Marfo 4.5), Indonesia (Roda, Langbour and Shantiko 2.3) and the Philippines (van der Ploeg 2.6). This imbalance may give rise to conflicts about payments. In Cameroon the relations between communities and small-scale operators are mentioned as being often unequal and difficult (Smith 4.3).

Conflicts also arise between chainsaw millers and the formal industry. In Guyana (Marshall and Kerrett 3.6) some conventional sawmillers feel that CSM has created unfair competition, given that the operating costs of conventional sawmills are much higher than those of chainsaw millers. On the other hand, many conventional sawmillers are purchasing chainsawn lumber to reprocess and export.

The case study in Merauke, Indonesia (Andrianto, Obidzinski and Komarudin 2.2) indicates that there are fewer conflicts in areas with chainsaw milling than in those with conventional logging operations, because customary land-owners are in a stronger position to negotiate with operators than when dealing with managers of large companies. Conflicts in this region are mainly due to technical issues and are easily resolved.

Environmental impacts

The impacts of CSM on the environment are mixed. The lightweight equipment used in CSM causes less damage than the equipment used in regular logging operations (no skidding trails are needed and waste wood is left in the forest), but uncontrolled or illegal CSM harvesting can lead to overharvesting, depletion of timber species, intrusion into protected areas and other adverse effects.

In Merauke, Indonesia, CSM operations have had relatively slight environmental impacts compared to the extensive deforestation and degradation associated with large-scale forest concessions in the region. In other areas, such as the Tanimbar Islands of Indonesia and Ghana, Uganda, Nigeria and Bolivia, chainsaw millers harvest selectively, searching for the best trees; this is said to lead to genetic depletion. Depending on the circumstances (e.g., level of enforcement, resource availability, accessibility of the terrain), on-site processing can have less ecological impact than other forms of logging.

Chainsaw milling can be carried out in areas that are not suitable for mechanized logging, such as steep slopes (e.g., in the Caribbean and Bolivia) and swamps (Indonesia). Chainsaw millers are, however, also entering areas that are off-limits to logging, such as buffer zones, protected areas and areas with protected tree species.

Recovery and waste

Freehand CSM is generally considered inefficient. The lumber quality is poor and the process produces large amounts of wood waste. There are several reasons for this inefficiency: the width of the kerf; the allowance for planing; and the fact that usable parts of the trees are left behind if lumber is cut to order. In addition, trees may be cut at night, which increases inaccuracy; and boards may be left behind due to interruption of illegal activities. Several authors list recovery data for CSM (Table 3). The figures vary greatly; recovery data are difficult to compare because of the variation in dimensions, species and methodologies used.

Table 3. CSM recovery rate (%)

country	recovery rate	article
Bolivia	33	3.2
Cameroon	34	4.1
Caribbean Islands	40	3.7
Ghana	27–40	4.5
Guyana	19–44	3.6
Kenya	23.3 (untrained) – 30.2 (trained)	4.7
Liberia	31–35	4.8
Nigeria	46	4.9
Uganda	20–25	4.11

Although figures vary greatly, timber recovery appears to increase when milling attachments are used, especially carriage mills (Pasciecznik 1.1). If CSM operators used improved techniques and technologies, they might substantially increase production efficiency and quality, and reduce the health and safety risks associated with freehand CSM. In Uganda (Kambugu, Banana and Odokonyero 4.11) a pilot project using a chainsaw mill with a frame showed that improved CSM increased the recovery rate from 25 to 55%. In Kenya, recovery rates increased by 7% after operators were trained in improved CSM (Muthike et al. 4.7). In PNG (Keenan, Grigoriou and Yosi 2.5) the average return on sales of lumber from portable mills increased from 0.4 to 8.15%, with an increase in productivity of 6% (from 44 to 50%).

The portable sawmill as used in PNG and Suriname is clearly a more technically advanced successor to CSM. Governments and other institutions very often see this technology as

an alternative to CSM. In general, CSM production capacity averages 0.5 to 1.0 m³ per day, while the output of a portable sawmill is 3 to 5 m³ per day (Keenan, Grigoriou and Yosi 2.5).

Some standard specifications used in the timber industry (e.g., the 4.2-metre board length in Uganda and Liberia) add to the inefficiency of timber production. In Liberia this requirement reduces the conversion rate from logs to planks from 35% to about 31%.

Impact of international policies on chainsaw milling

The domestic timber trade is primarily seen as a national concern and international policies pay little attention to it. To date, international initiatives have had a limited effect on domestic trade. Two recent international developments could change this: the European Union (EU) Action Plan for Forest Law Enforcement, Governance and Trade (FLEGT) and (future) climate change agreements (through REDD+). Both initiatives address the same underlying causes of deforestation and forest degradation that could affect the domestic timber trade; the domestic trade in timber can also affect deforestation and forest degradation. Small-scale timber harvesting needs to be considered in these forest governance initiatives in order for them to lead to sustainable forest management.

FLEGT/VPA

FLEGT, the EU's response to illegal logging, aims to facilitate trade in legal timber and improve forest governance. Voluntary Partnership Agreements (VPAs) between the EU and timber-exporting countries are being developed to implement FLEGT. In the three VPAs that have been signed so far (with Cameroon, Ghana and the Republic of Congo), the producing countries decided to include production and trade for the domestic market in their Legality Assurance System that will be put in place.

Apart from addressing illegal logging through law enforcement activities, FLEGT can put pressure on governments to recognize, legalize and organize the informal timber sector (Lescuyer et al. 4.1). The consequences of a strict VPA implementation for local forest dwellers and small entrepreneurs whose livelihoods depend on informal forest use may be significant.

Wiersum (5.1) argues that current programmes to stimulate legality in the formal forestry sector may have negative consequences on chainsaw lumber producers, because the latter very often operate under informal, and sometimes illegal, arrangements. Tightening the rules also leads to stricter technical and administrative requirements, which demand more of the administrative and organizational capacities of forestry operations. This acts as a bias against small loggers, even if they operate legally. Wiersum advocates a change in focus on legality from "hard" law enforcement, based on strict legal considerations, to "soft" enforcement, with a stronger focus on social aspects and decentralized governance. Social safeguards will be needed to mitigate the potential adverse social impacts of enforcing the present laws on people who depend on CSM.

The implementation of FLEGT/VPAs depends on an effective and legitimate system for timber legality assurance. Irregularities in the domestic market might affect the export trade when they compromise the integrity of forest law enforcement (Marfo 4.5; Andrianto, Obidzinski and Komarudin 2.2). Shifts in trade patterns of illegal CSM have been observed in Indonesia in response to the government's efforts to curb illegal trade; the market for Tanimbar Islands timber shifted from Java to other destinations such as the Philippines, Vietnam and South China (Roda, Langbour and Shantiko 2.3).

REDD+

REDD+ is the United Nations Framework Convention on Climate Change (UNFCCC) mechanism to lower carbon emissions through reducing deforestation and degradation. In this way, REDD+ promotes sustainable forest management and governance and may therefore lead to changes in timber production and trade, with likely impacts on both formal and informal economies. Brotto (3.8) gives a clear example of how REDD+ projects have an impact on timber harvesting, particularly on CSM. He concludes that neglecting the local demand for timber jeopardizes the implementation of REDD+ projects, and that timber harvesting needs to be incorporated in any REDD+ programme. Harvesting restrictions within REDD+ project areas could increase illegal CSM activities if they result in less timber being available from formal sawmills. In order to maintain benefits and forest resources for forest users in the long term, forests must be managed for multiple products and services and forest managers need to be prevented from focusing exclusively on carbon subsidies (Brotto 3.8).

When practiced efficiently and administered effectively, CSM could be a low-carbon subsector of the forestry industry and contribute to climate change mitigation. Guyana's Low Carbon Development Strategy considers CSM to have a potentially smaller carbon footprint than conventional milling (Office of Climate Change 3.5). In the Caribbean, CSM is seen to be an important part of supporting sustainable forest management, and as being easily integrated into a national REDD+ concept (Eckelmann et al. 3.7).

Reflections on how to address chainsaw milling

The articles in this issue demonstrate that CSM is widespread in developing countries and that it supplies domestic and regional timber markets. It offers socio-economic benefits to local people by providing low-cost lumber and livelihood opportunities in areas where employment is scarce. The low capital investment requirements of CSM make it an easily accessible business. Limited access to forest resources by small operators — coupled with limited enforcement capacity in most countries — invites illegality. CSM can be profitable, at least to some participants in the production chain; its profit margin is estimated by some authors to range from 15 to more than 50%.

In some countries forest cover has decreased to such a level that large-scale milling and logging have become inefficient and small-scale logging and milling, including CSM, are the best alternatives for processing trees into timber.

This issue demonstrates that CSM can make a considerable contribution to local economies, although its benefits are not always equitably distributed. Despite its importance, CSM is unaccounted for in international and, to some extent, national policies.

National policies: how to manage local demand for cheap timber

Governments of tropical countries have struggled to deal with the CSM subsector, and policy responses that effectively address CSM are rare. Where the practice is legalized, it is often associated with abuse and illegalities. Where it is banned, it still flourishes and control is difficult and compromised. Enforcement tends to be more effective in cases where CSM has been legalized. Because of CSM's mobility, the commitment of local communities would be key to an effective control system, provided that tree tenure was secure.

Most national timber production policies and legislation are primarily concerned with regulating logging and processing for exports, and forestry is regulated for foreign currency earnings and job generation. But how can an export-oriented activity satisfy the local timber demand? In many countries, timber production for local purposes is as high or higher than that for export. National governments need to start addressing this local demand. Ignoring it will lead to distortion of the market and domestic timber prices, and to an increase in illegal activities, conflicts, unsafe practices, loss of revenue to the state, corruption and a loss of forest resources.

In most cases better regulation is needed that considers local access rights to forest resources (tree tenure), taxation, enactment of legislation and policies that are perceived as fair by stakeholders, effective law enforcement, the organization of chainsaw millers, use of improved CSM technologies, and the equitable distribution of revenues. Procedures need to be simple so that local people are able to comply with their requirements.

Policies addressing domestic timber trade can have adverse effects that need to be acknowledged. Timber traders look for options that maximize their benefits, and increasingly restrictive regulations can operate as a disincentive that will cause traders to shift their markets rather than reduce their illegal practices. It is important that any policy addressing domestic timber trade be designed in a comprehensive way. The main challenge is to design an effective set of incentives for stakeholders (civil servants, sawyers, traders) to comply with the law. Regulations must be simple and easily enforceable, but incentives should be put in place to convince stakeholders that they will earn more from legal activities over the long term than from illegal practices.

Tenure and benefit sharing

National forest authorities need to put a system in place to improve the process of resource allocation. Cases presented in this *ETFRN News* show that secure forms of access to forest resources — at a reasonable cost and with equitable sharing of benefits — are needed so that forest communities and small-scale loggers can develop sustainable resource-based livelihoods and avoid unsustainable short-term logging practices.

Addressing corruption

Corruption is viewed as a key factor fostering illegal chainsaw milling practices. What would make actors in the chain change to legal practices? Chainsaw loggers will switch to legality only if the cost of doing business legally will not be significantly higher than the costs they currently incur.

Many options exist to reduce the possibility of corrupt behaviour in the chainsaw milling production chain. Chainsaw loggers must be provided with legal and financial incentives to make them switch from informality to formality and legality. Access to timber needs to be simplified with legal logging titles that do not burden the bureaucracy, and eventually formal taxes must be applied. Technical innovations will prove ineffective unless they are coupled with strong political messages that corrupt behaviour on the part of public officials will not be tolerated and will be effectively sanctioned. This will only work when it is combined with other measures, such as decent salaries for government officials and effective monitoring of law enforcement officers.

Low recovery rates

Freehand milling is a widely used technique that is inefficient as well as unhealthy and dangerous. Several authors acknowledge the need for training in improved chainsaw milling techniques to improve the health and safety of operators and increase efficiency. But how can the practice of chainsaw milling be improved when the market does not demand better quality timber? Buyers need to be convinced to pay more money for better and legal timber. Governments could play a role in this through initiatives such as procurement policies and a code of practice. It is open to question whether buyers would actually pay more for legal timber, or if a rise in price and quality would create an incentive for illegal logging.

Although the low recovery rate and wastefulness of CSM are often used as reasons to ban it, recovery data are not unambiguous. Pasicznik (1.1) recommends more research that compares CSM with other techniques, including portable mills, while considering available capital, availability of sawmilling equipment, accessibility of the site, environmental considerations, operators' health and safety, desired productivity and end products. But, again: as long as the market does not demand higher quality lumber and resources are freely available, it will be difficult to change production methods. Furthermore, Eckelmann et al. (3.7) state that waste in processing is normally the result of low timber prices, and that establishing higher prices for raw material is likely to be more successful in reducing waste than any recommendation issued by the national forest authorities. The standard specifications used in the timber sector could also be adapted to allow shorter board lengths, so that more timber can be recovered from a log.

International policies addressing local timber production

Domestic timber production has important impacts on local economies, rural livelihoods, forest resources and forest governance. These facts merit more attention from national and international policy-makers. As long as there is no clear framework that regulates domestic timber production and trade to satisfy demand for timber, there is little hope

that the illegal timber trade can be eliminated. Pressure from outside — e.g., through international agreements such as VPAs or REDD+ — is needed to support efforts to regulate the local timber trade. Pressure can include providing incentives for governance reforms and reducing illegal timber trade.

The three existing VPAs, in Cameroon, Ghana and the Republic of Congo, include timber production for the domestic market. Although it is good that these trade agreements address the whole timber sector, it also poses a challenge; studies have shown that illegal chainsawn timber supplies the majority of the domestic market in these countries (Appendix 1).

A strict application of VPA measures, without providing equivalent alternatives for local lumber consumption and livelihoods, could lead to the end of informal but well-established CSM. Bridging the numerous conflicting local and global interests that characterise CSM requires a meaningful and inclusive dialogue among all stakeholders. The voices of weaker and illegal actors easily go unheard when decisions are made, in spite of the influence they exert over what happens in the forest.

A multi-stakeholder dialogue will not solve all the problems associated with illegal logging and the domestic market, but it is critical for negotiating agreements over the difficult trade-offs between livelihoods and forest management and for introducing additional measures on capacity building and local governance — besides strict enforcement — to solve underlying problems of illegality and inefficiency. Ignorance of these factors only forces CSM further into illegality.

This is also true for REDD measures. If applied efficiently CSM could qualify as a low carbon activity, but if not, it could lead to forest degradation and have serious socio-economic impacts that would jeopardize attempts to establish a sustainable timber industry. All stakeholders need to be ready to openly and transparently debate the costs and benefits of a transition to low carbon development, and to jointly agree on scenarios to make the best use of the opportunities available.

The articles in this *ETFRN News* show that addressing CSM adequately is a challenge due to the multiplicity of overlapping interests and the wide range of actors involved. When these characteristics are effectively addressed, however, CSM can generate substantial socio-economic benefits to local people, while sustaining forests resources.

Endnotes

1. REDD+ = Reducing Emissions from Deforestation and forest Degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.
2. Information from the articles in this *ETFRN News* is referenced through the name of the author and article number or the country name and article number.
3. In most countries more advanced technologies, such as portable sawmills, are also used to convert timber for the domestic market. This issue does not consider mobile milling, except in a few specific cases.