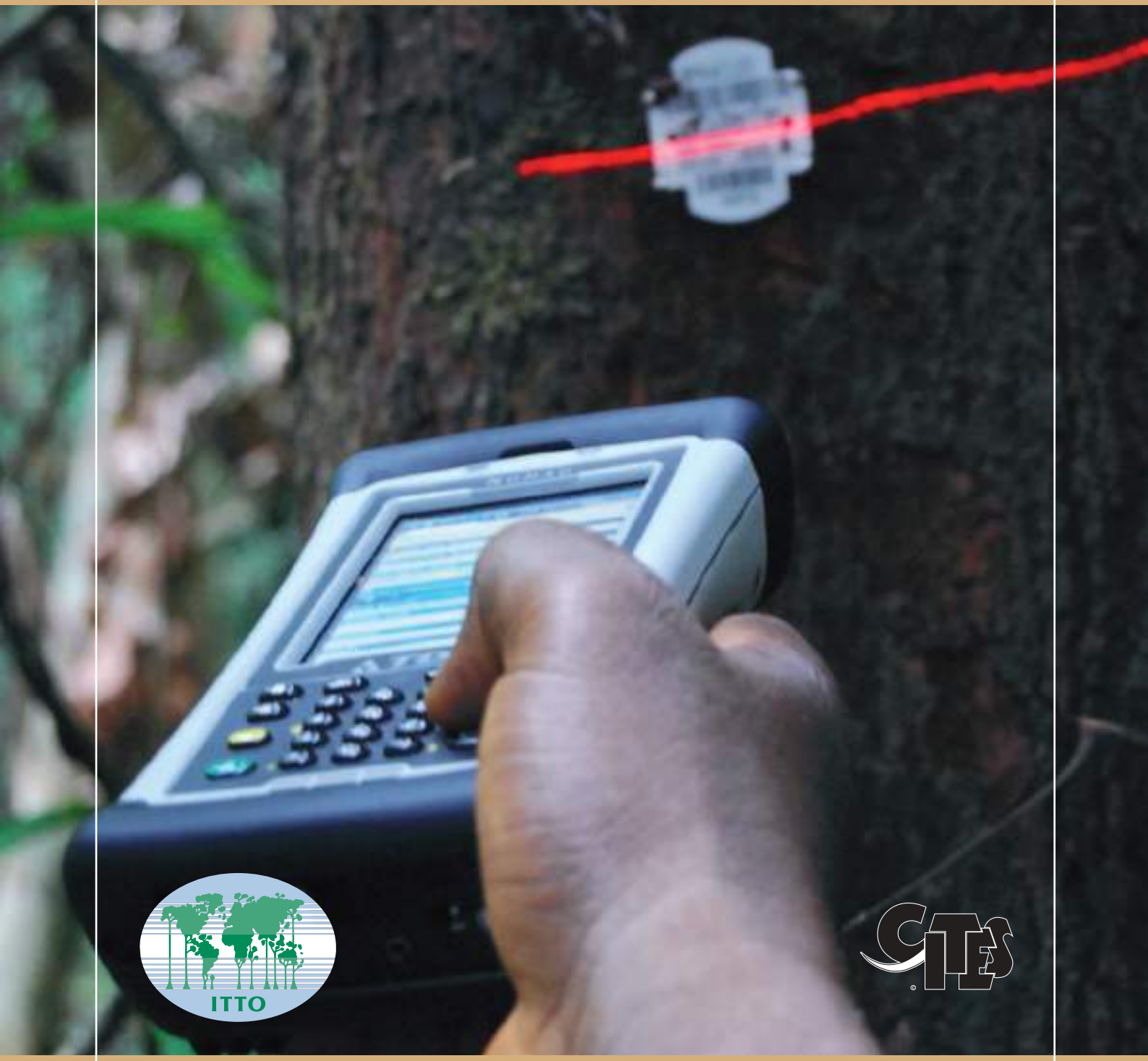
TECHNICAL SERIES
40

# TRACKING SUSTAINABILITY

## Review of Electronic and Semi-Electronic Timber Tracking Technologies

OCTOBER 2012



INTERNATIONAL TROPICAL TIMBER ORGANIZATION

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## Review of Electronic and Semi-Electronic Timber Tracking Technologies

ITTO TECHNICAL SERIES #40

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

**Tracking Sustainability**
Review of Electronic and Semi-Electronic Timber Tracking Technologies

ITTO Technical Series No. 40

By Felix Seidel with Emily Fripp, Annie Adams and Ian Denty

The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its members represent the bulk of the world's tropical forests and of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyzes and disseminates data on the production and trade of tropical timber and funds projects and other actions aimed at developing industries at both community and industrial scales. Since it became operational in 1987, ITTO has funded over 1000 projects valued at around US$350 million. All projects are funded by voluntary contributions, with major donors to date the governments of Japan, Switzerland, the United States of America, Norway and the European Union.

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

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Back cover photo: A. Sarre/ITTO



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ISBN 4-902045-95-8

This document is printed on recycled paper.

# FOREWORD

The evolution of timber tracking systems has been rapid in recent years, both in terms of the technologies employed and the scope of products and forests covered by them. This evolution has been driven by the desire of forest managers and administrations to have reliable information on flows of forest products in order to improve forest management and to ensure that all relevant forest fees and taxes are captured. It has also been driven by a strong desire by many importers to ensure that forest products entering their markets are legally and sustainably produced.

ITTO has a quarter-century of experience in supporting tropical countries to implement sustainable forest management (SFM), defined as the process of managing a forest to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undue undesirable effects on the physical and social environment. Since the early years of its establishment, ITTO has assisted countries to improve statistical systems to monitor timber and forest products flows as an essential component of SFM, initially based on paper-based systems and moving more recently to support for advanced physical (e.g. RFID tags and bar-coding) and chemical (e.g. isotope and DNA analysis) tracking technologies. ITTO's extensive work in this field convinced it that there was a need for a compendium of existing timber tracking technologies to provide countries with detailed information on the features of different systems that are becoming widely available in the forest sector from a range of providers. A generous grant from the government of Japan to ITTO's Biannual Work Programme allowed for the study that led to the publication of this review, and for an expert meeting that reviewed it and contributed to the recommendations contained herein.

ITTO's work on timber tracking has been funded through various windows, including activities under its Biannual Work Programmes, its regular project cycle and under its thematic programme on Tropical Forest Law Enforcement, Governance and Trade (TFLET). Since 2007, ITTO has also been implementing a collaborative program with CITES (funded by the European Commission and other donors) to improve the implementation of CITES regulations for international trade in tropical tree and timber species that are listed in the CITES appendices. This close collaboration (which has included support to countries for tracking CITES-listed timber species) led to an offer from the CITES Secretariat to co-fund the consultancy which gave rise to this report, which was gratefully accepted by ITTO.

CITES has nearly 40 years of experience in ensuring that international trade in species of wild flora and fauna listed in its appendices does not threaten their survival. Its objective is to regulate the international trade in CITES-listed species to ensure it is sustainable, legal and traceable. Effective tracing and tracking systems for monitoring trade in such species are essential for the effective implementation of the Convention.

The number of tree species listed in the CITES appendices has significantly grown from 18 species in 1975 to more than 300 today, the majority of them from tropical countries. Some of these countries face great challenges in demonstrating that they have a robust chain of custody for products derived from their CITES-listed species. Tracking technologies are a key tool to strengthen the quality of the CITES non-detriment finding required for exports of Appendix II listed species. This scientific finding, which is issued by the CITES Scientific Authority of exporting countries, together with the subsequent export permit issued by the CITES Management Authority, assures importing countries that such timber can be regarded as having been sustainably and legally sourced.

As the scope of forest products in international trade continues to increase in tandem with the complexity of global supply chains, timber and forest product tracking technologies will play an increasing role in ensuring sustainable and legal supplies of these essential products. We thank the donors, consultants and service providers who made this report possible and hope that all Parties to CITES and Members of ITTO find it a useful guide to these rapidly evolving technologies.

**John E. Scanlon,** Secretary General, CITES

**Emmanuel Ze Meka**, Executive Director, ITTO

# ACKNOWLEDGEMENTS

We would like to thank Milena Sosa Schmidt (CITES) and Steve Johnson (ITTO) for giving us the opportunity for writing this report. Further thanks go to Jussi Lounasvouri (EFI EU FLEGT) and Phil Guillery (FSC International) for their technical input and helping us to complete the list of electronic timber tracking systems that are available on the market. We would like to thank Thomas Pichet (EFI EU FLEGT) for his technical inputs and update on timber tracking systems used in VPA countries. The input for the needs of the private sector for modern electronic timber tracking systems largely came from Outi Marin and Caroline Stein, Alastair Herd (TFT, TTAP) and Michael Berger (PEFC International). We would also like to thank all private timber tracking companies that responded to questionnaires and who provided inputs through face to face meetings and phone interviews. Finally, thank you to Lucy Cullinane and Liz Betser (Efeca) for their contributions and editing support.

**Felix Seidel, Emily Fripp, Annie Adams and Ian Denty**
September, 2012

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# ACRONYMS

| | |
|---|---|
| ATPF | Forest Product Transport Authorization |
| CITES | Convention on International Trade in Endangered Species of Wild Flora and Fauna |
| CLO | Certificate of Lumber Origin |
| CoC | Chain of Custody |
| CTF | Federal Technical Registry, Brazil |
| CTO | Certificate of Timber Origin |
| DOF | Forestry Origin Document |
| ERP | Equipment Resource Planning Systems |
| EUTR | European Union Timber Regulation |
| FLEGT | Forest Law Enforcement, Governance and Trade |
| FSC | Forest Stewardship Council |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HCVF | High Conservation Value Forest |
| IBAMA | Brazilian Institute for Environment and Renewable Natural Resources |
| INF | Intact Natural Forest |
| ISO | International Organisation for Standards |
| ITTO | International Tropical Timber Organization |
| LAS | Legality Assurance System |
| NGO | Non-Governmental Organisation |
| OR | Official Receipt |
| PEFC | Programme for the Endorsement of Forest Certification |
| RFID | Radio Frequency Identification |
| RPP | Responsible Purchasing Policy |
| SFM | Sustainable Forest Management |
| TFT | The Forest Trust |
| TTAP | Timber Trade Action Plan |
| UNECE | United Nations Economic Commission for Europe |
| VPA | Voluntary Partnership Agreement |

# EXECUTIVE SUMMARY

Timber tracking and timber products tracking technologies are very new and are gaining increasing importance through changing consumer and policy demands.

Key points raised in this review are summarised below:

- When certain attributes such as quality and origin are separately linked with a product made of timber or wood fibre, a timber tracking system needs to be implemented. Electronic timber tracking systems are systems which constantly, during a period of timber material flow in a chain, collect information on timber and timber products and link this information either to a batch of products or to an individual item. Usually the information is stored in a database and can be accessed if needed and reports which present the data in different ways can be generated. The information which is collected depends on the layout of the timber tracking system which is steered by the customer demands, certification schemes or areas binding by local law.
- The nature of timber tracking systems varies according to the technology that is involved from using modern electronic timber tracking systems, semi electronic systems to paper based systems. Currently all of these are being used in one form or another. There is a limited number of companies on the market which offer electronic timber tracking services with each company specialising in different software products and timber tracking applications (e.g. from physical tracking to tracking of finished timber product at a batch level without individual marking). The most complex systems incorporate full Equipment Resource Planning (ERP) systems with timber tracking modules and the more basic systems only use semi-electronic elements if needed.
- Electronic tracking systems have capabilities that make them an asset in tackling illegal logging and the trade in illegal timber. These capabilities also have a wider variety of advantages in business productivity and management. Benefits of implementing an electronic timber tracking system stem from having a greater command over the physical flow and associated information of timber and timber products from point of harvest through to processing and subsequent supply chains. These advantages include providing a mechanism to ensure that processes comply with local and international policies and regulations as well as reducing the risk of illegal or otherwise non-compliant material entering the system and supply chains. They also reduce the likelihood of human error and improve effectiveness and efficiency in harvest and manufacturing.
- There have been frequent trials of electronic systems which are now reaching operational level. Large scale usage of these systems have not yet been achieved due to the delicate balance between costs and benefits in many markets. However, new policies such as the EU Timber Regulation and the revised Lacey Act 2008 are providing renewed impetus for companies to implement timber tracking systems on a large scale as a way to obtain regulation compliance. Several electronic timber tracking systems that will be deployed on regional or even national basis are currently in preparation.
- Some forest owners and some factory owners, together with timber tracking service providers, have undertaken timber tracking trials but there is still a reliance on research and public funding. Only a few companies are currently able to cover their costs completely through customer payments.
- Stand-alone timber and timber products tracking systems do not always make sense. It can be more useful to consider these systems within the broader context of related areas of forestry and timber operations such as forest inventories and other forest management systems, accounting systems, auditing, sales, payment and tax systems. Interfaces between timber tracking software and the software used in the related areas should be planned from inception. During development, actors involved in the verification of timber tracking data need to have access to data and the potential to work with it, either in the software platform, or a simplified version of the timber tracking system.
- The technology and experience of most timber tracking companies is capable of delivering adequate results in countries with simple supply chains and a limited set of involved companies. Countries with larger scales of production and very complex supply chains will represent a new challenge for electronic timber tracking systems in terms of sustained funding and results, requiring new approaches to handle such cases. Currently all timber tracking companies are small scale, an increase in new and large clients might put a strain on the sector requiring it to grow to meet demand (e.g. staff for support services).

# 1. INTRODUCTION

This review is intended to provide guidance to anyone who is planning to implement an electronic timber and timber products tracking system but it also details general information on tracking technologies and the drivers behind it. The audience for this document is expected to be for non-specialists as well as for forest experts. Whilst historically in many areas there have been paper-based methods of timber tracking and forest monitoring, electronic timber tracking is a relatively new development in the forest sector which is being used in order to address many of the inherent limitations of paper-based systems (such as limited data sharing and access, risks of forgery and corruption) and are developing in line with other technological advances. In order to take stock of these rapid developments, there is a need for independent information on a whole array of technologies which are available on the market and that are currently being employed for the use of tracking of timber and timber products; such as physical tracking of logs, the tracking of timber on a batch level, to genetic and isotopic methods used for origin verification.

Today with increasing sustainability concerns, global trade and opaque supply chains, it is difficult to know the source of timber and timber products, however there is an increasing interest to be able to track this information. The reasons why companies or governments implement tracking systems can be very varied. A company in the timber sector may simply wish to know more about their supply chain or there could be a need to reduce the risk of any illegal or unsustainable material entering the supply chain. A timber tracking system can be used to fulfil the requirements of Chain of Custody certification for forest certification schemes and it can also be implemented as part of a due diligence system, to gain knowledge of the supply chain structure (Figure 1). Timber tracking systems are able to link timber with new attributes such as 'sustainably sourced' or 'proof of origin'. Therefore companies can show they are being different (better) than their competitors by using tracking systems. Governments implement timber and timber product tracking systems in order to regain control over their forest and timber sector to increase tax revenue as a positive side effect or to have trade advantages such as increased access to premium markets.

Users of tracking systems are wood producing, transforming, and converting, trading and selling companies. Stakeholders within the product chain include a wide variety of organizations and those involved in verifying information or end-users who scan a code and are able to see a photo of the forest. Access rights secures confidentiality and provides access to as much and as little information as necessary, i.e. actors in the supply chain can simply have access solely to the node underneath, and auditors to full supply chain information or different staff within a company to only the attributes that are of relevance to them.

## Objectives

1. Review and summarise all timber tracking systems currently in use;
2. Develop five timber tracking systems case studies, including at least one from each tropical region (Africa, Asia-Pacific, and Latin America/ Caribbean).

### Scope

The scope of this report considers all electronic timber and timber products tracking systems currently on the market by private service providers which are in use in the global forest sector, including log and finished product tracking systems.

### Methodology

Tracking systems were identified based and selected on knowledge and sector experience. A questionnaire was designed to frame the information requirements for the system review and sent to 23 organizations (Table 1). Out of these 23 companies, 14 replied with completed questionnaires, 3 did not reply and 5 companies had tracking systems which are not currently designed to track timber. Out of the 13 organizations which replied, two (Double Helix, Agroisolab) considered their system not as a standalone timber tracking system but as an additional verification system. Exact Modus has

*Figure 1: Typical supply chain*


*Source: Helveta*

*Table 1: Tracking system information requirements survey response*

| Timber Tracking System for Analysis | Completed Questionnaire |
|---|---|
| Agroisolab | received |
| Ata Marie Group | received |
| Cambium - Log Tracking System | received |
| Delta Informatique | received |
| Double Helix | received |
| Factline | received |
| Global Traceability Solutions | received |
| Helveta | received |
| Historic Futures | received |
| Radian Tekno | received |
| Rainforest Alliance – Credit 360° | received |
| Sipca | received |
| Timbersmart | received |
| Track Record Global | received |
| Exact Modus | no timber tracked |
| ExlmWare | no timber tracked |
| Muddy Boots | no timber tracked |
| One Network | no timber tracked |
| Traceregister | no timber tracked |
| UTZ | no timber tracked |
| Data Concept | no reply |
| GTS Global | no reply |
| Robust AG | no reply |

tracked timber in the past but has now shifted to other areas. The questionnaires were followed up by telephone or face to face interviews to verify information gathered and complete any missing sections of the analysis. Completed questionnaires are contained in the Annex.

Five case studies (Chapter 3) were identified and selected covering all tropical regions and, for consistency, basic information requirements were assessed. However, each case study was structured according to the particular project involved. Information was gathered during the system analysis where possible and bolstered by interviews with other key stakeholders, such as donors and forest sector professionals.

# 2. DRIVERS OF ELECTRONIC TIMBER TRACKING SYSTEMS

## Background

Semi-electronic systems started to be used in forestry in the 1990s when digital technology became more accessible, affordable and portable. One of the first examples of this was the utilisation of digital handheld tablets to record log dimensions after felling operations. The adoption of digital technology had many advantages over traditional techniques in reducing sources of error and increasing efficiency for user operators and businesses. For instance, digital technology provided legible readings where calculations could be automatic and readily stored, transferred or copied. Timber tracking systems largely remained semi-electronic for a variety of reasons including:

- Inconsistency of computer and internet availability throughout the supply chain;
- Large areas of forest lying in very remote areas with weak infrastructures; and
- Forestry being a sector in which manual work input still played a very important role.

Recently, there has been a steadily rising number of systems moving away from paper-based systems towards semi-electronic or fully electronic systems. Although the advantages of electronic tracking systems are widely understood, their uptake has lagged behind in comparison to other sectors such as that of food. This may be in part attributed to the high initial cost of developing a fully electronic timber tracking system in an industry which is being squeezed by the stagnation of timber prices combined with increasing material and labor costs.

Technological advances have been increasingly used as tools for improving forest law enforcement and governance in order to overcome the inherent challenges of monitoring and managing forests from on the ground. Forests are often vast and inaccessible areas where remote sensing technology such as satellite and aerial imagery has been readily employed to provide an increasingly cost effective source of data and information. Geographic Information Systems (GIS) are used to model geospatial data, including those derived from remote sensing, and are increasingly adopted for forestry applications as computer capabilities have increased in power and accessibility. The combination of remote sensing and GIS provide models of the forest area and forest characteristics, which can be used in forest monitoring, management and inventories (e.g. rates of deforestation, timber volume estimates, identifying illegal felling, and species type identification) without the need for infrastructure on the ground. Although these technologies have many useful applications in forestry, particularly in assessing rates of deforestation, they are unable to directly track the flow of timber from forest stands along supply chains, which require data to be inputted directly from the ground. These technologies are increasingly becoming integrated, where timber tracking systems record geospatial information in order to provide an important and centralised tool for forest law enforcement and governance.

## Policy and market drivers

There are increasing legal requirements and market demands on the timber sector to be accountable throughout the whole of the supply chain. The challenge for tracking systems is now not only to be able to track from certain points but to track the flow of timber and timber products throughout the supply chain from the point of harvest, often in highly complex supply chains (Figure 2).

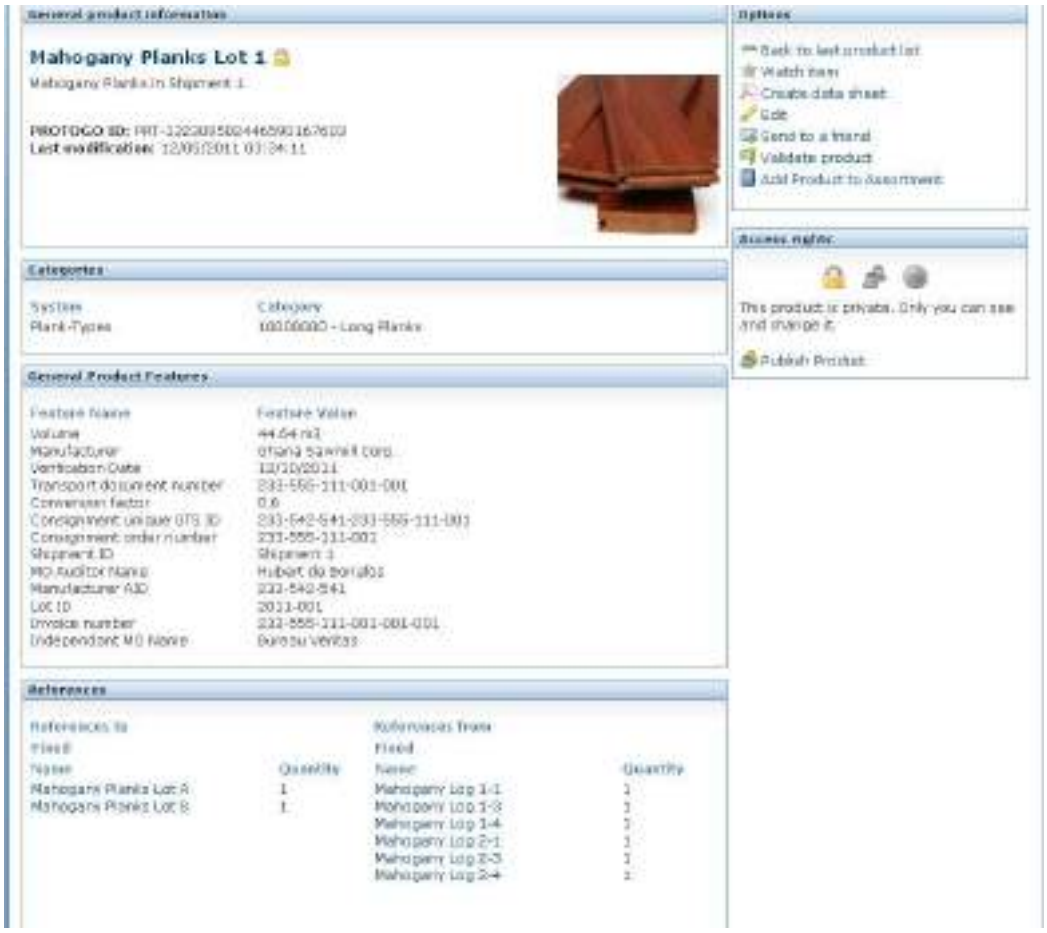
### Legislative approaches

#### *US Lacey Act*

The US extended the Lacey Act in May 2008 to ban commerce from illegally sourced plants and their products, including all timber and wood products. Illegally sourced is defined by the content of sovereign nations' own laws and applies equally to imports and to timber produced in any of the 50 states in the US. The Lacey Act requires importers to provide a basic declaration to accompany every shipment of timber and timber products. The declaration must contain:

- The scientific name of any species used;
- The country of harvest;
- The quantity and measure; and
- The value of the shipment.

*Figure 2: Timber tracking software showing the origin of timber*




*Source: Global Traceability Solutions*

All timber and timber products and, since April 2010, all paper and furniture products are subject to the declaration of these requirements. Penalties vary depending on whether the operator 'knowingly' or 'unknowingly' engages in trading of illegal timber and timber products. Consequently it will become increasingly important for importers to demonstrate that they required and received adequate evidence of legality.

### *EU Timber Regulation*

The EU Timber Regulation (EUTR) makes it illegal to place illegally harvested timber and timber products on the EU market, the requirements come into force as of 3rd March 2013. The regulation requires 'operators' who first place timber on the EU to put in place due diligence systems in order to mitigate the risk that the product does not contain illegally harvested timber. The components of the due diligence system must include:

- Information on the description of the type of product and species of the wood used, country of harvest and where applicable sub-national region and concession of harvest, unit quantity by weight or volume, contact details of supplier, contact details of the purchaser of the material, any other documentation indicating the legality of the timber;
- Risk assessment measures to interpret the information collected about the product against relevant risk criteria such as assurance of compliance with applicable legislation, prevalence of illegal logging of tree species, or country of harvest, UN and EC sanctions and complexity of the supply chain; and
- Risk mitigation procedures that must be put in place to tackle risk identified from the risk assessment.

For traders who buy and sell timber and timber products already placed on the EU market the regulation requires them to maintain a 5 year record of transactions of timber and timber products that detail the operator or trader who supplied the timber and timber products and where applicable the trader to whom the timber and timber products were sold.

To facilitate the adoption of the regulation, Monitoring Organizations will provide operators with ready-made due diligence systems, and act as a mechanism for evaluating their performance. Monitoring Organizations had to be formally recognized by the European Commission by March 2012.

Each Member State will designate a Competent Authority who will act as the leading authority on the regulation and will be responsible for monitoring its implementation and its enforcement. FLEGT-licences or CITES export permits (Figure 3) automatically meet the requirements of the legislation.

### *EU Forest Law Enforcement Governance and Trade Voluntary Partnership Agreements (FLEGT VPA)*

Voluntary Partnership Agreements (VPAs) form a key component of the EU FLEGT Action Plan and are bilateral agreements with the EU and producer country partners. VPAs aim to guarantee that wood exported from partner countries to the EU is legal in origin. This is achieved by developing robust legal frameworks which are enforceable and that reflect the social, economic and environmental objectives of the partner country. A fundamental component of the agreement is a Legality Assurance System (LAS) with the function to identify, monitor and license legally-produced timber, ensuring that only timber of legal origin is exported to the EU market. Mechanisms of controlling the supply chain and its verification are core to the LAS where timber tracking systems can demonstrate the legality of timber at each stage and mitigate the risk of unverified timber entering the supply chain. Currently 6 countries are developing systems agreed under the VPA, with 4 countries negotiating with the EU and 15 countries from Africa, Asia and Central and South America are expressing an interest in the process.

*Figure 3: CITES permits provide proof of timber identification*


## Purchasing policies

### *Public procurement policies*

Public procurement accounts for between 15 and 25% of all timber products purchased in most EU Member States. Several Member States have developed public procurement policies for timber and timber products: Belgium, Denmark, France, Germany, the Netherlands and the UK with other European countries in the process of developing a policy. These public procurement policies are mandatory for most central government departments and agencies, while local governments and authorities are encouraged to follow them. Outside of the EU, the Norwegian Government has prohibited the import and use of tropical timber by the Government and in Switzerland there is a mandatory declaration requirement to give full transparency in the trading of timber and timber products. Japan, Australia and New Zealand also

have public procurement policies. The minimum requirement for all current procurement policies is for the timber to be proven legal in origin, although some encourage or require proof that the timber is derived from sustainable sources.

#### *Private sector policies or Responsible Purchasing Policies (RPPs)*

Many private sector companies and timber trade associations have also developed purchasing policies. In some consumer countries such as the UK, companies and the Timber Trade Federation (UK TTF) have worked closely with the Government to ensure a degree of consistency and alignment in the requirements of policies. Many large retailers such as B&Q, IKEA, Walmart, Home Depot, Castorama, Carrefour, and traders such as Danzer and DLH have developed company level purchasing policies, with 'legally verified' frequently used as the minimum contract requirement. This is often the beginnings of a 'stepwise approach' to gradually eliminate unwanted timber and increase the proportion of certified timber.

### NGO pressure

Directly, environmental NGOs such as WWF in the early 2000s started to explore timber tracking systems as a tool to combat illegal logging, where the technology could provide a solution to some of the many problems inherent to operations in forests of poor governance and communication infrastructure. The trialling of this technology, largely with the financial support of international donors, demonstrated its viability as a management tool, where continued improvements in technology such as the availability of handheld GPS devices improved operations in the field, such as linking spatial data with that of the quantity and characteristics of timber being harvested. Indirectly, the campaigning and scrutiny conducted by some NGOs provides continual pressure on companies and governments to exhibit accountability and transparency in business throughout timber supply chains at the risk of their reputations and image.

## Scope and scale of timber tracking systems

Timber tracking systems vary in their scopes and scales. They can be implemented on a company level only being pushed into the upstream supply chain. The company can either choose an existing system from a timber tracking service provider (Table 1) or self-develop its own company system (Box 1). A timber tracking system can also be implemented by a service provider on a national level (e.g. Africa case study, page 21) or can be self-designed and operated by country authorities (Box 2). A mix between the two where both agree what the government authorities cover and what the service provider covers is also possible. Any system has to comply with the existing national laws and regulations. A government can adopt new laws and regulations or adapt the existing ones before implementing a timber tracking system. Systems also vary in the intensity the products are being followed ranging from physical tracking systems where each item is being traced, to systems where only sample checks in the case of doubt are taking place. These are the so called 'additional verification methods' which can be combined with physical tracking systems to make them even more secure.

### Overview of current technologies

The role of technology involved in timber tracking systems is to provide a means of modelling and recording the physical flows of timber and timber products throughout the supply chain. These have developed to cater for a range of different niche functions whilst serving specific client needs. Current timber tracking technologies vary in complexity, being governed by funding, project objectives and the technology that is available. For example, a tracking system might be a simple database recording paint markings and represented in an Excel spread sheet, or custom built software simulating complex international flows of timber, based on electronic or DNA sampling. In either case, a key function of tracking systems is to link the physical timber or timber products to the database model. In many situations documentation accompanying timber and timber products alone does not satisfy market requirements; there is a need to directly trace the movement of material through the supply chain and this is largely achieved by product identification mechanisms.

### Overview of types of systems

#### *Mass balance*

The mass balance (also known as inventory management methods) is one method employed to monitor the flows of timber throughout production, based on a systematic understanding of inputs, outputs and accumulations of timber material without physical tracking (Figure 4).

## Box 1: Example of two self-developed company systems

**Metsä Group**

Whether the wood originates from certified or non-certified forests, the origin is always known at Metsä Group through certified Chain-of-Custody systems and the ISO 14001 environmental system. Metsä Group's internal auditing procedures and wood origin tracing system are implemented for all wood suppliers and harvesting contractors. It is adapted to the needs of the different operating environments:

Most of the wood used in Metsä Group originates from Finland and from privately owned, mostly PEFC certified forests, harvested by entrepreneurs working for Metsä Group. In Finland, wood origin can be traced by GIS by the harvesters and mobile devices of Metsä Group forest specialists responsible for the harvesting operation or controlling the logging.

In Russia, Metsä Group purchases wood from its own forest lease areas, certified against both PEFC and FSC, and from external wood suppliers. In the case of external suppliers, Metsä Group includes requirements concerning the origin of wood in the contract. The contract clause excludes certain forest origins, i.e. where environmental values are being damaged. The contract obliges the wood supplier to provide wood origin information to Metsä Group.

Based on the wood supplier lists and wood origin information, an annual supplier audit plan covering the whole supply chain from the logging company to Metsä is established for all wood supplier companies. The audits are undertaken by Metsä Group's experienced auditors, who have access to the GIS system. They can verify that the logging sites are outside protected areas, where logging is prohibited. Results of the audits are used in the evaluation of wood suppliers and are the basis for further negotiations.

The wood origin tracing system allows Metsä Group to identify the legal and sustainable origin of the wood and officially define the share of certified wood in the wood raw material used in the Group's production units.

**IKEA**

IKEA has developed its own forestry standard that all suppliers using wood in IKEA production are required to fulfil. The standard covers both solid wood and wood based-panels, and applies to the wood material as well as supplier's procurement routines.

Minimum requirements are to avoid wood material which originates from forests: where the timber has been illegally harvested; with forest related social conflicts; are uncertified and recognized as Intact Natural Forests (INF) or other geographically identified High Conservation Value Forests (HCVF); in tropical and sub-tropical regions being converted to plantations or non-forest use; which are officially recognized and geographically identified commercial Genetically Modified (GM) tree plantations.

"Preferred" wood requirements are voluntary and comparable to FSC.

IKEA suppliers are required to transfer IKEA demands up their supply chains, maintain an incoming wood register that includes documented wood origin data, analyze risks in accordance with IKEA guidelines, make verification of wood compliance if risks are high, and separate noncompliant wood from IKEA production.

For each new business relationship, wood origin information is requested and evaluated by one of the 15 IKEA forestry specialists. Every supplier signs a legally binding compliance commitment.

Every ongoing supplier provides data about sub-suppliers, materials, species, country/region of origin, and volumes used in the IKEA Forest Tracing Survey three times a year. Suppliers sourcing from high risk areas are included in the auditing plan. IKEA audits do not only cover the 1st tier suppliers but follow a selected supply chain all the way to the logging site. Where non-compliant wood is discovered, deliveries are stopped and termination of business with IKEA may be the consequence. At least one audit a year in each of the 15 Trading Areas is performed by a 3rd party. Suppliers sourcing from low risk areas are audited by IKEA every 2 years. These audits are only done at supplier premises and involve incoming wood register checks. The overall costs which arise are being estimated by IKEA for the region of the Russian Federation of €0.06 - €0.10 per cubic meter of wood.

Mass balance analysis monitors whole batches of timber rather than tracking individual products. The advantage of the mass balance method is that small sized products can be tracked (e.g. wood chips) and because of the batch basis this is usually at lower tracking cost. Although mass balance is the most commonly practiced method for monitoring the movement of timber and timber products, where tracking the individual product or lot back to its physical origin is required mass balance systems are inappropriate, particularly where there is a possibility that high risk material could be inadvertently included.

### *Physical product identification methods*

Physical tracking is usually carried out with larger sized timber items such as roundwood and usually ends at the first processing facility; from this point the mass-balance method is typically applied. Physical tracking has the advantage that individual items can be linked with attributes and can be sold individually. The disadvantage is the higher running costs of such a system since these methods are generally more labor

**Box 2: Timber tracking system operated by a government agency**

Since 2011 permit holders of wood processing plants in the Philippines have been required to install a close circuit television (CCTV) camera system at their factory gate which is then broadcasting the images over the internet to the Department of Environment and Natural Resources (DENR).

In addition, all wood processing plants can only process logs or timber covered by a valid Certificate of Timber Origin (CTO) and a confirmation order to proceed with the transport. The wood processing plant holder records the entry of timber or logs and keeps the CTO. Shipments of round timber or logs or lumber must always be accompanied by a valid Certificate of Lumber Origin (CLO) or CTO. All CTOs and CLOs must be accompanied with a supporting document called tally sheet detailing the quantity, volume, species being transported and the Official Receipt (OR) for payment of forest charges for naturally grown trees or trees harvested in natural forests. Finally, all wood processing plants must submit monthly reports of logs or timber delivered into the processing plant as well as the lumber disposition to the nearest DENR Field Office. The monthly reports include clear photocopies of CTOs and CLOs and a summary of timber and lumber stocks in the wood processing plant yard duly signed and attested by the wood processing plant, the authorized officer and the DENR Field forest officer. This enables DENR Field Offices to closely monitor the entry and disposition of legal timber into and out of all the wood processing plants.

The export of finished wood or semi-finished wood products requires an Export Compliance Certificate that the exporter needs to obtain from the DENR Community Environmental and Natural Resources Office responsible for the port of export.

intensive. Where physical tracking is achieved by marking all timber items individually, the following marking methods are available:

### Paint markings

Paint markings are the mostly commonly used identification technique because of its low cost, easy application and durability. This typically uses a serial number hand painted or stamped onto individual logs and timbers. However, the practice is labor-intensive and prone to misreading and forgery. These systems are increasingly being used in collaboration with electronic systems.

### Plastic tags

Plastic tags are cheap and easy to apply to timber and have advantages compared to paint markings. Each plastic tag is printed with its own unique identification number which increases legibility and avoids duplication in issuance of identification numbers (Figure 5). Despite the unique identification numbers, plastic tags are still prone to forgery and lack the durability of paint markings where they can become damaged or detach from the timber.

### Barcoding

Barcodes are fixed to the timber or timber products and provide a scannable identification number where the readings can be readily transferred electronically to the timber tracking database (Figure 6). The system requires trained staff to operate the readers and often connection to the internet or mobile phone networks. They offer a relatively low cost mechanism which is difficult to forge however the barcodes themselves often become detached from the product that they are meant to identify.

### Radio Frequency Identification (RFID)

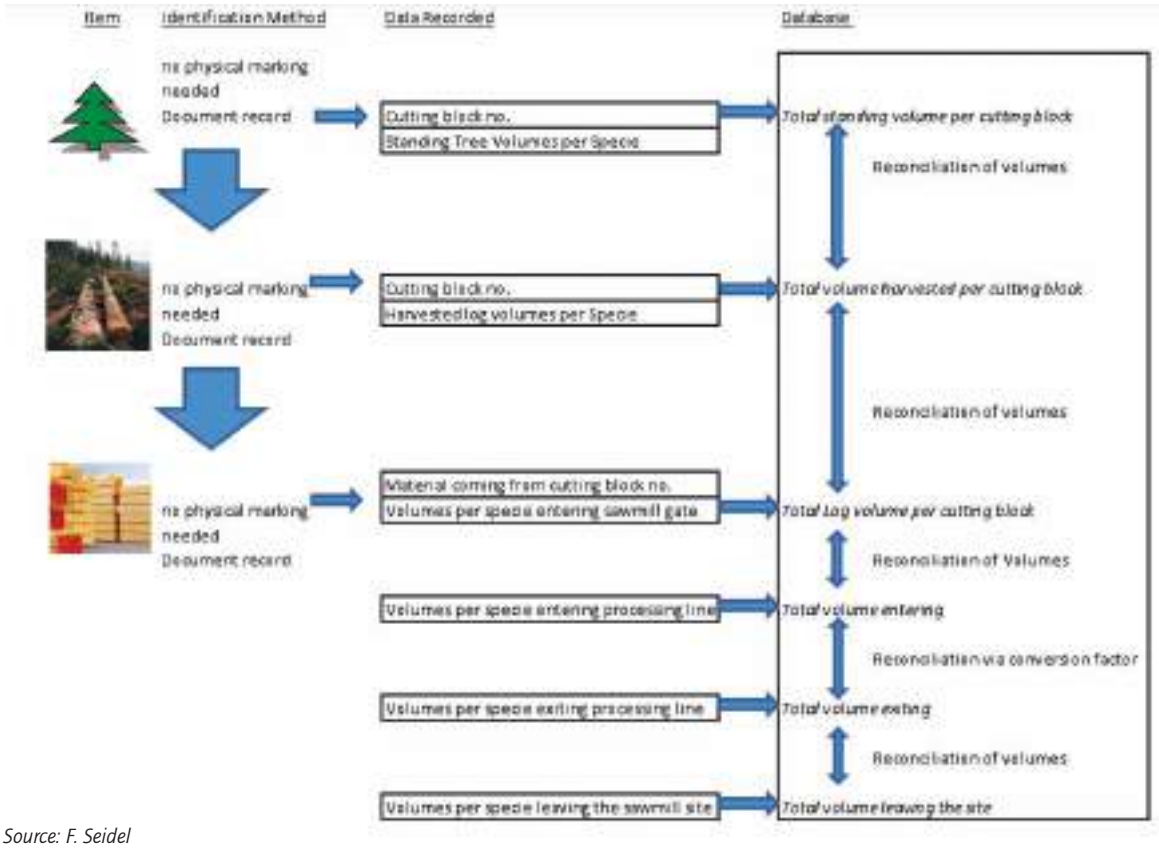
Similar to barcoding, RFID systems offer a way of providing uniquely referenced timber products where the ID number and other product data is wirelessly transmitted between the tag and the RFID reader. The mechanism is resistant to forgery. However it is relatively expensive and requires trained staff and often connection to the internet or mobile phone networks.

### *Chemical identification methods*

### DNA sampling

DNA sampling, unlike other product identification methods, does not require direct physical tagging of the timber product, but uses the genetic information contained within the timber as the method of identification. This makes the technique very resistant to forgery and is not affected by the inherent problems associated with tagging. DNA samples can be taken at any stage in the supply chain. There are two approaches to using DNA. Firstly, the DNA sample is compared with genographic maps in order to establish the material's area of origin. This approach is relatively expensive and data intensive, requiring a reference database to be established for all species of interest. The second approach is to take wood samples from the same tree and its timber at various control points in the supply chain. These samples are physically paired and tested to verify that they come from the same tree. This approach can help to verify and strengthen a paper-based or electronic tracking

*Figure 4: Illustrated concept of a mass balance system*




*Source: F. Seidel*

*Figure 5: Plastic tag applied to the face of a log*


*Source: F. Seidel*

system and has the advantage of not requiring a genetic database to be developed.

### Isotopic sampling

Just like DNA sampling, isotopic sampling does not require physical marking of timber products. Isotopes found in the soil are analysed to identify an isotope profile for a geographic area. Samples taken from timber products can then be traced to the location by analysing the isotope profile. The tracking or additional verification method has to fit the purpose. If tracking of Non Timber Forest Products is required, one of the easiest methods to use is the isotopic method. Isotopes originate from the soil and are specific to a certain region. Plants take isotopes from the soil and store them in all plant material, e.g. leafs, oil, bark. Identifying isotopes in plant material is therefore an effective way of identifying the region of origin. The precondition for using the isotopic method is that the isotopes of the respective region are already known, defined and registered. The isotopic method is already in use in the agricultural sector, when for example supplier A contests that a certain

*Figure 6: Examples of paint marking and barcoding*

*Source: E. Fripp*

product such as potatoes is from a certain field on their farm, but the final product is labelled in store as being from Supplier B's farm supplier B's name. The isotopic method could then be used to act as a proof of origin. For animals that feed on plants, certain parts of the animal body e.g. ivory from elephants can also be used to identify where the animal lived using the isotopic method[1]. Due to the wide range of applications for plants, animals and parts of them, the method could be used for many CITES listed species.

## Description of a generic typical timber and timber products electronic tracking system

At each control point in the supply chain the product information (such as length, species, value etc.) will get recorded and transferred to the database. A staff member enters all details either into a handheld device or records it on paper and, later, enters it into the database via a web browser into a web based timber tracking software. Once the data is stored on the database, it can be analysed. The analysis of the data detects any non-conformities, verifying that the timber items and /or the volume flow is logical and ensures that the volume does not increase at any time. This safeguards that no timber can enter the chain at a later stage where the source is unknown. The main steps are shown in Table 2.

*Table 2: Core elements of an electronic timber and timber products tracking system*

| Steps | Description |
|---|---|
| 1. Data collection | The product information is collected at each stage of the supply chain. |
| 2. Data transfer | The data is transferred into the database. |
| 3. Data storage | Data storage in database in order to generate reports and reconcile the data. |
| 4. Data Analysis | Non conformities are detected through reconciliation of the data. |

*Note that genetic and isotopic systems function in a different way than to the above systems described in Table 2.*

### System constraints

Electronic timber tracking systems have several potential constraints including:

- Weak infrastructures (e.g. roads, communications, network and internet connectivity, controls);
- Weak staff training (Levels of IT and literacy);

1 TRAFFIC, 2010 . *Development of a spatial reference library for ivory.* TRAFFIC Bulletin Vol. 23 No. 1.

- Low governance capacity/verification through the government systems;
- Tracking systems incur additional costs without the guarantee of higher revenues or price premiums;
- Poorly designed or overly complex timber tracking systems which hinder work by operators (e.g. confusing interface, or tracking model poorly represents reality on the ground);
- Interrupted processing chains and chains which use different tracking systems and ERP systems that do not allow for adequate compatibility and articulation; and
- During the planning phase IT and forestry experts need to work together. There is a risk that there is a compromise toward the dominant party rather than creating a balanced timber tracking solution.

## System advantages

Electronic timber and timber product tracking systems have capabilities that make them an asset in tackling illegal logging and the trade in illegal timber. These capabilities also have a wider variety of advantages in business productivity and management. Key advantages in the use of electronic timber and timber product tracking systems include:

- *Mechanisms to comply with local and international policies and regulations.* Tracking systems can be configured to support stakeholders in achieving their aims, from governments and NGOs wishing to reduce illegal logging, to private companies wishing to mitigate the risk of non-compliance with regulations and policies;
- *Reducing the risk of illegal or otherwise non-compliant material entering the system and supply chains*. Electronic tracking systems aim to monitor the exact flow of material entering the production and supply chains. They can ensure that only designated legal or otherwise designated acceptable (e.g. certified sustainable) timber enters the system from the point of harvest. Where applied throughout the supply chain, they can ensure that only compliant timber enters the system during processing and in subsequent supply chains;
- *Coordination between authorities and relevant bodies.* Tracking systems can facilitate the flow of information to relevant authorities and designated bodies (e.g. tax, export and transport authorities), increasing the transparency and confidence between various actors at all stages of timber harvesting, processing and trade;
- *Automatic reconciliation of batches and volumes available*. Provides up-to-date and reliable information whilst identifying discrepancies;
- *Reducing levels of fraud and theft.* Tracking systems can give greater command over both the flow of the physical timber and timber product but also the associated information and data. These systems provide tighter securities and reduce the risk of fraud and theft;
- *Digital CoC footprint.* CoC (e.g. FSC CoC or PEFC CoC) is not only recorded and shown on paper but the transfer and reconciliation of volumes between the different suppliers can be done digitally as mentioned above;
- *An available method of stock control and monitoring.* Data gathered in the tracking processes can be used as a method of stock control identifying product volumes and locations within the system;
- *Real-time alerts of non-compliance*. Tracking systems can be developed to automatically alert managers and operators when the rules of tracking system are breached, requiring appropriate steps in order to resolve the issues of non-compliance;
- *Reduced likelihood of recording errors.* The transfer of digital data reduces the risk of human error from inputting or reading CoC information;
- *Improved effectiveness and efficiency.* Tracking systems are able to report on a variety of statistics which provide an overview of timber harvesting and processing. This can be used to identify areas where raw material efficiency maybe improved, minimising waste and improving productivity and quality. In addition, the digitisation of processes can save time and labor thereby increasing human resource efficiency;
- *Remote verification and monitoring*. Data and information associated with the flow of timber

and timber products can be accessed remotely using the internet which can be useful for a range of applications by companies with operations outside the region or country, by third parties in data validation, and in the exchange of information with appropriate authorities;

- *Increased transparency.* Timber tracking systems can provide product information to other actors in the supply chain such as suppliers and retailers; and
- *Company integrity.* Credible tracking systems provide an indication that significant measures are being taken to tackle illegal logging and the trade in illegal timbers, whilst also demonstrating operations meet local and international laws.

### System costs

The costs of timber tracking systems can be considered in terms of investment costs and operating costs. These costs are dependent on a range of variables relating to the nature and role of the tracking system, existing levels of infrastructure, training and support requirements.

Investment costs include installing hardware such as computer workstations, GPS devices and developing communications infrastructure in order to transfer and store information. Hardware will need to be periodically replaced or updated when it deteriorates or if technology significantly advances. Software is vital in operating the tracking system and prices vary significantly depending on the task required. Specialised and custom software may incur considerable initial and subscription costs whereas smaller scope projects may be able to use software that is commonly available on standard PCs. The implementation and development of systems is likely to incur many associated costs such as the design and configuration of the test as well as a monitoring phase in order to test the system's effectiveness. Costs for staff training in the system's operation will also need to be considered in the initial set-up and maintained in order to uphold skill level and system performance.

Operating costs, which include the labor involved in operating the tracking systems such as tagging time and recording and analysing data, are adapted into existing practices. The type of product identification used can have a significant impact of overall operating costs. For example, RFID tags or genetic testing, because of the level of technology involved, is likely to be significantly more expensive than painting or using plastic tags. System maintenance and support is likely to be an intermittent operating cost. Many of these costs will depend upon the scale of operations and the system efficiency which are likely to be major factors in influencing overall cost-effectiveness.

Calculating a cost per $m^3$ has historically been primarily conducted retrospectively. For countries where infrastructure was very basic and training needs were high, timber tracking system costs reached nearly $5 USD per $m^3$. In developed countries with a good infrastructure and skilled staff, the figures were between $2 and $3 USD per $m^3$. However, the figure calculated per $m^3$ depends on the volume of timber which is flowing through the traceability system. If the volume increases significantly the costs of the timber tracking system remains almost stable. This is why most timber tracking companies no longer charge prices per $m^3$ but either charge monthly connection fees or require an annual license fee for their software.

The system costs are mainly dependent upon the following factors:

- Type of tracking system;
- Scale of the operation;
- Specific customer needs;
- Intensity of verification;
- Infrastructure required;
- User friendliness and ability to integrate into operations;
- Training needs; and
- Support and maintenance needs.

## Considerations for choosing a timber tracking service provider

It is not the purpose of this report to judge the different service providers, and give recommendations if one or another is better. What all the companies have in common is that they already have some proven expertise and are established companies. They vary however in their regional scope, the level of technical support and training provided, the scale of implementation (national systems versus company systems), language and software and gear used. Service providers are differently well suited for different

purposes. Therefore it is important to take some time in selecting the service provider who is best prepared to respond to specific needs.

- Write a project description. What is it you are intending to achieve? Describe the external conditions well.
- Talk with a number of different service providers. Share with them your project idea and requirements. Specify how the project is likely to develop in the future.
- Ask them to show you their system. Does it feel "right" for your purposes? It should be as close to your requirements as possible. Ask them important questions:
  - In which languages is the system and support available?
  - Find out about other clients. (Watch out: have other clients got similar regional needs and asked for a similar scope you are looking for?)
  - Is there regionally available technical and support staff?
  - Does the software and related equipment have a track record of successful usage in your regional context and scope?
  - Does the service provider work with any local partners?
  - What level of remote and physical training and support will be provided?
  - How is data security been assured? Where is the data stored? Make sure the data remains in your ownership in any circumstance.
  - Does the service provider only provide the technology and support, or also the verification of the data? If this is of advantage, depends on the context.
  - How will the service provider respond to potentially changing needs in the future (changing concept, growing data volumes, growing user numbers)?
- If possible, contact other clients and get references.
- Shortlist a number of service providers and invite them to a tender. Ask for proposals that include budgets, and projections of costs for the future.
- Be as specific in the tender as possible: describe challenges, external conditions, bottlenecks. Who will be the users, what capacities, what are the technical conditions? Be very clear about fundamental requirements that have to be fulfilled, and aspects that would be of added value. How is the system supposed to develop in the future? Involve a multidisciplinary team in writing the tender and choosing the applicants.

When choosing the service provider remember that the software is not everything. Perhaps even more important is the technical support, training and the service to make it all functional. A system using cutting edge technology is of no use, if nobody can use it.

# 3. CASE STUDIES

Case studies have been submitted by timber tracking service providers and are presented here to illustrate the range of previous and current projects from around the world.

## Africa case study (Liberia)

### Aim

The Liberian Forest Development Authority (FDA) wanted a nationwide system for the monitoring and verification of forest logging and timber ownership in the supply chain. This system had to include the development of a computerised platform to manage traceability through the supply chain, from the forest to the point of export (and for sales in the domestic market) and to administer the collection of forest charges relating to timber trade.

### Partners

Liberian Forest Development Authority, USFS, SGS, Helveta

### Scope of project

Liberia's valuable tropical forests are an essential source of revenue for a nation recovering from years of civil war. As is the case in many tropical timber producing nations, illegal logging is a significant threat to the sustainable development of the sector as well as to the hard currency revenues critical to Liberia's economic recovery. SGS and Helveta entered into an agreement to deploy Helveta's CI WorldTM supply chain management solution providing database technology, software applications and hardware components to operate an end-to-end traceability system for timber and timber products for the FDA. CI World is the engine of the Chain of Custody Information System (CoCIS), LiberFor, which provides the FDA with "back-to-stump" traceability for all timber products as well as data validation and integration with the Government's financial and regulatory reporting framework. In this way, CI World will enable comprehensive timber supply chain control and revenue collection from the Liberian timber sector. A key feature of the CI World deployment in Liberia is the accurate estimation of tax revenues due from each operator and the assurance of revenue collection and compliance with other regulations. CI World also supports future efforts to attain legality certification for Liberian timber.

### Functionality

LiberFor is based on the Helveta Platform, CI World. The main function components are:

1) CI Earth (Mapping) for block maps, stock surveys and plantation compartment maps;
2) Chain of Custody for tree felling, cross-cutting, dressing and log registration, and transport of logs and wood products;
3) Performance Management for data reconciliation, data verification and random sampling and inspection;
4) Document Management for concession registration, invoicing and regulatory documents and management tag control.

### Costs

The project was made possible by seed funding of approximately $1.5 million USD provided by the US Government and was developed under the technical guidance of the US Forestry Service. The seed funding was used to support the nationwide implementation of systems. The aim is for the LiberFor system to be self-financing through on-going and improved forest and export tax collection, with the ultimate objective of handing over the national system and management capacity to the FDA under a Build, Operate, Transfer (BOT) model.

### Outcomes

By 2010, approximately 440,000 trees have been tagged and located, and approximately 180,000 trees have been verified in the system. Up to May 2012 the combination of stumpage and export fees had reached $7.3 million USD and the total exported volume reached nearly 170,000 cubic meters of wood. The LiberFor system will also enable the Liberian FDA to:

- Manage the chain of custody for all wood products from the forest point of origin to the export gate or domestic markets;
- Manage the conditions for release of timber export permits;

- Ensure the collection of forest charges related to timber production and trade;
- Invoice and monitor payments by logging companies to the government through an information system involving the forest administration, Ministry of Forestry and the Central Bank;
- Assist in building the capacity of the Liberian forest administration.

### Tracking system description

Business information is captured in the forest or on the factory floor using hand-held devices (PDAs) equipped with Helveta's proprietary mobile device management software – CI MobileTM. CI Mobile combines handheld data entry with data entry from GPS, RFID and barcode readers to gather accurate records of how assets are being managed and processed in forest or factory. CI Mobile transmits data from the forest or factory to CI World servers via any available means of internet connection – from satellite, through Wi-Fi, cellular, Bluetooth and dial-up modem. On receipt of inbound data, CI World provides immediate visibility on operations. Processed reports and analysis are available directly from CI World through internet browser-based access by authorised users anywhere in the world. In Liberia, CI World is deployed at field inspection points, ports and borders to provide continuous timber flow control, providing a nationwide control system (using forestry-grade bar-coded tags attached to logs) and document management based on regulatory declaration forms being uploaded in soft copy and made available to view online through the CI World interface. SGS and FDA use CI World to facilitate physical and documentary checks at critical control points in the supply chain, ensuring that production, product movements and changes of ownership are continuously monitored and verified. CI World also provides the ability for SGS and FDA monitoring staff to carry out sample field checks at points throughout the supply chain and will facilitate the verification of block maps, way bills and timber entering and exiting sawmills.

## Asia/Pacific case study (Indonesia)

### Aim

DNA Verified Chain-of-Custody is a scientific, fully independent monitoring and verification system for existing Chain-of-Custody or Wood Tracking Systems, be they paper-based or electronic. It is used to deter fraud and increase confidence in the Chain-of-Custody whilst lowering the overall cost associated with third party monitoring and verification.

### Partners

CertiSource (Legality Verification System), Simmonds Lumber Pty Ltd (buyer), Indonesian sawmills (various)

### Scope of project

DNA Verified Chain-of-Custody has been applied as part of the CertiSource Legality Verification System in Indonesia since 2007. In 2009, the ITTO supported a project to formally evaluate the scientific and practical viability of this approach. The project was conducted on a Merbau (Intsia spp.) supply chain, with logs harvested in Papua, Indonesia then transported to a mill in Java for processing into solid wood products including flooring, decking and furniture. The product was then imported into Australia and New Zealand by Simmonds Lumber Pty Ltd. This service continues to this day, with DNA Verified product exported from Indonesia to buyers in Australia, New Zealand, the European Union and the Middle East.

Wood samples are taken from trees prior to harvest, during the forest inventory process. The samples are recorded and stored so that they can be tested and analysed at a later date. During harvesting and processing, a second set of wood samples are taken from the logs and/or timber derived from the sampled trees by referring to the Chain-of-Custody documentation. This second set of samples is physically matched with the samples taken during the inventory. If the Chain-of-Custody system is working correctly, then the paired samples should come from the same trees. DNA fingerprinting scientifically verifies this claim by comparing their individual genetic profiles. If the genetic profiles do not match, then a breakdown in the system has occurred and auditors can take targeted action to correct the problem. Not all samples need be paired and tested. Using ISO sampling standards, only a

small number of paired samples, typically 30 – 80 per period, need to be tested to provide a level of statistical confidence exceeding 95%.

DNA verification can be applied to any part of the supply chain where Chain-of-Custody documentation is at risk of fraud, from pre-harvest inventory through to harvest, log movements within concessions, primary cutting and log/sawn timber transportation to primary sawmills. If required, DNA verification can be extended to verify Chain-of-Custody documentation associated with movement of secondary product through to point of import and beyond.

## Functionality

DNA verification of the Chain-of-Custody can be used by third parties tasked with independent monitoring of Chain-of-Custody systems that are an integral part of voluntary timber Certification and Legality Verification Systems, EU VPA Timber Legality Assessment Systems and other mandatory timber traceability systems. It can also be used to verify a concession operation's internal or second party audit systems.

DNA verification is not designed to replace existing Chain-of-Custody systems, rather simplify and lower their cost whilst strengthening them. Genetic mis-matches highlighted by DNA testing can act as a 'red flag' to system monitors, who can then conduct thorough investigations in person.

This has the advantage of being quick and cheap to implement and is more likely to be viable for national take-up. It also builds upon previous initiatives to implement timber tracking systems rather than attempting to replace or side-line them.

Primary users are Certification Bodies, government forestry departments assigned with timber validation and resource management, enforcement agencies and production forest owners.

## Costs

Costs can be broken down into three components.

1. Supply chain analysis and integration planning: Cost based on industry standard consultancy fees

The first step is to conduct a thorough analysis of the supply chain and existing Chain-of-Custody systems. This information is used to identify the most appropriate times to conduct sampling, and by whom, with the least impact on forest operations and costs. In most cases, existing resources can be utilized to conduct sampling in the forest and the sawmill, with only a 1-2 day training period required.

2. Genetic marker development: $15,000 – 20,000 USD per species

Preliminary scientific research is required to identify suitable genetic markers that enable discrimination between individual trees of the same species. This is a one-off cost per species. If the same species are harvested in other concessions or regions, the same genetic markers can be used with no further development required.

3. Implementation and ongoing DNA testing: $0.50 - 1.50 USD per $m^3$ depending on volumes and recovery per tree.

The number of samples tested is calculated based on ISO sampling standards and the desired level of statistical confidence. As gaps in the Chain-of-Custody are identified through DNA testing and closed, the required level of testing will decrease, leading to lower costs in later years.

Costs will continue to fall in line with advances in DNA technology.

## Outcomes

DNA fingerprinting of timber provides a truly independent, scientific verification of any wood tracking system. Introduction of DNA testing is not only an effective measure to deter document fraud, cutting off log laundering channels, but also a means to lower cost, facilitate uptake, increase transparency and protect voluntary certification system brands. The scientific, accurate nature of DNA testing also enables timely and targeted action by auditors and enforcement agencies.

Though basic paper-based or electronic systems are still needed to match samples back to their source logs, the incentive to abuse these systems on the part of any company or individual is removed, since it will be exposed by DNA verification.

The targeted nature of DNA verification also allows auditors to reduce the intensity and frequency of physical inspections. Since independent monitoring makes up a significant proportion of certification and legality assessment costs, it follows that a reduction in auditing time and effort along the supply chain will reduce the overall cost and burden to the industry.

Not to be underestimated is the potential of DNA to enhance the credibility and trust associated with a brand and the industry as a whole. Popular knowledge of DNA technology applied to criminal forensics means that consumers and buyers recognize the capabilities of DNA testing, increasing trust in and awareness of associated certification schemes whilst at the same time deterring illegal timber laundering through DNA verified supply chains.

DNA verified Chain-of-Custody system has been subjected to scientific peer-review and publication. Full details can be found in Lowe, A.J., Wong K.N., Tiong Y.S., S. Iyerh, Chew F.T. (2010) A DNA Method to Verify The Integrity of Timber Supply Chains; Confirming The Legal Sourcing of Merbau Timber From Logging Concession to Sawmill. Silvae Genetica 59: 263-268.

### Tracking system description

Wood samples are taken from trees prior to harvest, during the forest inventory process. These samples are stored so that they can be tested and analysed at a later date. During harvesting and processing, a second set of wood samples are taken from the same trees and logs, according to the Chain-of-Custody documentation. This second set of samples is physically matched with the samples taken during the inventory. If the documentation is correct, then the paired samples should come from the same trees. DNA fingerprinting will scientifically verify that they are from the same trees by comparing their individual genetic profiles. If the genetic profiles do not match, then a breakdown in the system, accidental or deliberate, has occurred and the system auditors take targeted, direct action to identify and correct the problem. Not all samples need be paired and tested – only enough to provide the required level of statistical confidence.

## South America case study (Brazil)

### Aim

The Forestry Origin Document (DOF) is an electronic system with a centralised database applied to control the transport and storage of Brazilian native forest products and by-products. The system increases efficiency and control, as well as transparency of information on the exploitation, transport, storage and consumption of forest products.

### Partners

Environmental state agencies, Federal Police, Prosecuting Council

### Scope of project

The DOF is a monitoring and control system operated by the Brazilian Institute for Environment and Renewable Natural Resources (IBAMA). Since its implementation in 2006, the DOF system has been used as a tool for the management of forest resources, control, monitoring activities and inspection of transport, storage and consumption of Brazilian forest products and by-products.

The DOF operates online, managed through a centralised database and allows integration with other state systems for control of transport documents. The electronic document is required for all transportation and storage of products and by-products from Brazilian native ecosystems (such as wood in logs, bolts, posts, bracing, stump, sleepers, poles, fence posts, logs, chips, boards, blocks, firewood, charcoal, laminates, as well as flooring, parquet, decking). With the exception of the forest products cited, all finished goods are exempt. Therefore, doors, windows, panelling, furniture and other finished goods, characterised in the final stage of manufacturing, do not need the DOF for transportation or storage. The transportation and storage of some non-timber products are also controlled by the DOF, such as fresh hearts of palm, tree ferns, essential oils, ornamental, medicinal and aromatic plants, roots, bulbs, vines and leaves of native or planted species listed in the official Brazilian list of plant threatened species and in the appendix of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). DOF also controls all the processes of transformation of forest products and their consumption, for example, the use of wood as a raw material in the furniture industry, use in construction, use of charcoal in the steel industry, and the use of wood to generate thermal energy. In the DOF system, credits can originate from Sustainable Forest Management Plans or deforestation authorisations and are recorded by state or federal environmental agencies. All transactions from emission to reception, conversion and final destinations of forest products are recorded in real time, allowing IBAMA to characterise the native products based forestry industry.

The DOF system is fully integrated with other systems from IBAMA, particularly the Federal Technical Registry (CTF). This requires users to register with IBAMA and prevents users with environmental irregularities from using the system.

### Functionality

The DOF system can be used by all federal environmental agency (IBAMA) offices and by state agencies, working as a bureaucracy-free management tool that is transparent, with low operating costs and providing improved security information. It is a support tool for both IBAMA law enforcement actions, the state agencies, prosecuting counsel, federal and state polices. The system provides a management scenario of shared information.

### Costs

The cost of development in terms of Information Technology varies from region to region and country to country. IBAMA has been working on policies of transferring the DOF System through Bilateral Cooperation Agreements with the countries concerned. The procedure for this should be conducted through the Brazilian Foreign Ministry. The development cost of the system are estimated by IBAMA to be around $261,000 USD. This figure does not include hosting hardware and services. Before the system's launch, in early September 2006, the transport of goods, originating from native forests, was controlled by a paper-based license system called ATPF (Forest Product Transport Authorization). This ATPF license was printed on a special paper, similar to banknote paper, and was charged at R$5 each to users in the wood extraction and processing business. Considering that nowadays up to 12,000 DOF are issued daily, we may assume that the DOF system saves companies and landowners about R$60,000 (or $30,000 USD) a day, representing up to R$22million or $11 million USD a year.

### Outcomes

The DOF system combines data on the number of documents issued each year and the number of users of the system, showing that it has contributed to the legalisation of the sector. Data on the volume by species and the number of marketed species may indicate the pressure they suffer in their natural habitat, their trade value and help the environmental agencies setting species-specific policies. DOF is a management system that is both a tool for law enforcement actions, as it provides information that enables real-time analytical decision making as well as serving to field check activities. DOF also controls the volume of products and by-products marketed from transportation to conversion, including storage. The DOF system has been integrated with various systems like the National Registration System of IBAMA for persons and businesses with potentially polluting activities (CTF). Modules have been provided for the monitoring of wood processing and the registration of reforestation credits. Other benefits to be mentioned are the rapid emission of transport licenses and, due to the large amount of data generated in the process, elaborating reliable statistics has become much easier.

## Genetic fingerprinting case study (South America and Central America)

### Aim

In a pilot study, financed by the von Thünen-Institute, Germany, a tracking method based on DNA fingerprints for mahogany (*Swietenia macrophylla*) was tested. The aim was to develop a genetic reference database to be used as a control for determining the country of origin for *Swietenia macrophylla*. The resolution and performance of the database was assessed by blind testing of two sets of mahogany wood samples using a multilocus assignment procedure.

### Partners

a) Johann Heinrich von Thünen-Institut (vTI), Institut für Forstgenetik, Sieker Landstrasse 2, D-22927, Grosshansdorf, Germany; (Bernd Degen - co-ordination);

b) Mahogany For The Future Inc, San Juan, PR 00928 USA; (Sheila Ward);

c) Laboratório de Genética e Biologia Reprodutiva de Plantas (LabGen), Instituto Nacional de Pesquisa da Amazônia (INPA), Av. André Araújo 2936, CEP 69083-000, Manaus, AM, Brazil; (Maristerra Lemes);

d) Universidad Nacional, Calle 9, Avenidas 0 y 9, Costa Rica; (Carlos Navarro);

e) Centre for Ecology & Hydrology, Penicuik, Midlothian Scotland, EH26 0QB; (Stephen Cavers); and

f) Instituto Florestal de São Paulo, CP 1322, São Paulo, SP, 01059-970, Brazil; (Alexandre Sebbenn).

### Scope of project

In order to check the country of origin for traded timber the target area of this study was the natural distribution range of *Swietenia macrophylla* from Mexico in the North to Bolivia in the South. Thus we used samples from the following countries: Belize, Bolivia, Brazil, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, and Panama.

### Functionality

In this study, six nuclear microsatellites were used to generate DNA fingerprints for a genetic reference database characterising the populations of origin of a large set of mahogany (*Swietenia macrophylla* King, Meliaceae) samples. For the database, leaves and/or cambium from 1,971 mahogany trees sampled in 31 stands from Mexico to Bolivia were genotyped. More than 181 different genetic variants (alleles) were found, showing strong genetic differentiation and clear correlation between genetic and spatial distances among stands. We used the genetic reference database and Bayesian assignment testing to determine the geographic origins of two sets of mahogany wood samples, based on their multilocus genotypes. In both cases the wood samples were assigned to the correct country of origin.

### Costs

The application of genetic fingerprints to control declarations on the country of origin has fixed costs and variable costs. The generation of the genetic reference data (gene marker development, sampling in the natural species-range, genotyping) represents the fixed costs. In this case this was an amount of about 200,000 Euros. The variable costs include the genotyping to control the origin of traded timber. Here we have costs per wood sample between 50 Euro and 300 Euros.

The setup costs for the above mentioned mahogany project are $250,000 USD. This is based on gene marker development at $50,000 USD per species; sampling of reference material at $3,500 USD per plot x 30 = $105,000 USD; and genotyping of 2,000 sampled reference individuals = $95,000 USD).

Maintenance costs: $1,000 USD per year. This is only to store standard and reference plant material in a freezer. This is necessary if in the future more or new gene markers are identified and further analysis of the plant material would be useful.

Running costs reach $60 USD up to $500 USD per genotyped control sample. This depends very much on the number of samples that a laboratory can screen. If one laboratory can screen more than 500 samples, then the lower estimated cost of $60 USD per genotyped control sample may be achievable. It depends also on the quality of the DNA in the samples, as freshly sawn timber is cheaper than processed old timber because it requires less effort to extract a DNA sample.

### Outcomes

Genetic reference data for S*wietenia macrophylla* that can be used as a control to determine the country of origin for timber harvested from natural stands.

### Tracking system description

Genetic fingerprints are inherent and cannot be manipulated. This explains the success of genetic fingerprinting in forensics. The history of the tree species creates a spatial genetic pattern. The sampling in the distribution area aims to represent this pattern in a reference database. The genetic fingerprints of wood samples are compared to the reference data and can determine whether a declaration on the country of origin is reliable or not.

## South Pacific case study (New Zealand)

### Aim

TaranakipineTM is a privately owned manufacturer of value added wood products sourced from sustainably managed New Zealand radiata pine plantations. They wanted a system that would give them control over their various business processes; sales, inventory, production, finances. In particular, they wanted to be able to track timber flows from FSC certified logs versus flows from those that were non FSC certified.

## Partners

Taranakipine (the customer), TimberSmart Ltd (the timber tracking system provider), and Assure Quality (certifier and auditor).

## Scope of project

Some TimberSmart sites record individual logs and attribute these to specific stands, coupes, forests etc. However at Taranakipine the role of TimberSmart commences at the mill gate. Taranakipine receives saw logs into its sawmill from a number of plantations in the lower North Island of New Zealand. A precise record is maintained of the percentage of FSC certified logs received into the sawmill in the TimberSmart log inventory module where log docket data is logged against relevant log supply agreements. Taranakipine manages its operations to ensure that the percentage of FSC certified product sold is consistent with the FSC percentage of log input. Sawn timber output created by the Taranakipine sawmill is subject to one or more additional manufacturing processes depending upon its destination as a finished product. Processes downstream of the sawmill include kiln drying, band sawing of boards, cut line, planning, optimising, finger jointing, preservative treatment, laminating, packet wrapping, dispatch, freighting, and export shipping. Some of these processes are through processes - in which packets maintain their makeup through the process (i.e. the packets have the same boards coming out of the process as go into the process). However many of these processes result in incoming packets being broken up and new packets being created from several of the packets which go through that process – this is called a 'dispose and create' process. The TimberSmart tracking system provides a reliable mechanism for tracking packets through each of these processing situations and hence maintaining a documented chain of custody.

## Functionality

This timber tracking solution is based on the TimberSmart sawmill/timber processing system. The main functional capabilities of this system as deployed at Taranakipine are;

- **Chain of custody system** which provides transparency from saw log receipt through the various processing operations to the point of despatch, sale, and receipt to the customer;
- **Document management** which ensures establishment of all relevant documents and capture of relevant performance against them e.g. log sales agreement, customer sawn timber sales order, work center works order, despatch dockets, debtor invoices;
- **Performance management** – performance management at all levels of processing (e.g. log input vs. sawn timber output, FSC log input versus FSC sawn timber output, and volume in versus volume out through all processes); and
- **Efficiency and decision making** – extensive use of technology enables data entry at the work centers which means
  - efficient data collection;
  - enriched jobs because of immediate feedback;
  - accurate and timely data; and
  - enhanced decision making.

## Costs

All costs for this tracking and compliance system are borne by Taranakipine and as such are private and confidential.

Hardware prices are relevant to local conditions, and are trending downwards. Indicative retail prices in the New Zealand market in mid 2012 are printers $1300 USD and hand held image scanners $2,800 USD.

Software pricing relates to the number of users, the time involved in implementing the system, and an annual license fee based on 18% of the capital license fee. These issues vary according to specific circumstances.

## Outcomes

As a result of this project, Taranakipine has a chain of custody timber tracking system which enables it to comply precisely with its FSC obligations. Of equal importance, the system enables efficiencies in all areas of the business and greatly enhanced management decision making capability. Taranakipine after using the system identified the following benefits:

- Timber is always shown on the system, never "loose". This means that we always know what we have and where it is located. This is

invaluable for production planning and minimising work in progress stocks. This in turn increases stock turns, lowers the physical stocks required, and frees up cash;

- Improved understanding of losses in process. This means that our budgeting, costing, decision making and process efficiencies have improved; and
- Stock taking – We now have fewer stock "losses" associated with stock taking, and more ability to place reliance on stocks being accurate. This improves production planning and taking sales orders.

## Tracking system description

Data related to logs received at the mill is entered as a log receipt against relevant log agreements setup in TimberSmart. In some circumstances this information is contained on bar codes and can be entered by scanning. However, in this case it is entered by manual keying.

Boards exiting the sawmill are graded, and pieces of like grade are accumulated into packets of about 2.5m$^3$. Comprehensive reporting shows production of sawn timber products out, versus log products in, for specified date ranges. Information on the makeup of individual packets is collected entered manually into the TimberSmart database. Bar code labels are added to the created packets.

Packets which move through to processes - such as kiln drying - are scanned into the process, processed, and then scanned out of the process with immediate update of the TimberSmart system.

Alternatively, packets which move to 'dispose and create' processes such as bandsaw, planer, laminator, optimiser, and finger jointer are scanned into each process with immediate update of the TimberSmart system. New packets created from these processes are entered into TimberSmart via 'winterms' (terminals) located at work centers, with immediate update of the TimberSmart system.

Packets entering and leaving processes which require travel beyond a central point - such as dispatch - are scanned by handheld computers which are connected wirelessly to the TimberSmart database. This information is available both on site and remotely using standard Microsoft technologies.

When the packet leaves Taranakipine, the detailed breakdown of each packet is sent electronically to approved recipients, enabling it to be downloaded into the recipient's inventory system without the need for rekeying of the data. This uses the TimberXchange system; a feature of which is that product codes and other nomenclature are received in the convention of the receiver and not the sender. Use of this system eliminates clerical work, eliminates errors, and means that the data is available on the receiver's system before the actual product arrives. The TimberXchange system can in turn be used to send this data from the receiver's system to a third party system.

This live ability to track timber through a number of processing operations provides a transparent real-time means of compliance with FSC certification requirements – chain of custody.

# 4. CONCLUSIONS ON SYSTEMS

## Commonalities

Almost all of the systems reviewed in this report are electronic timber tracking systems. The product is electronically recorded and a set of information is added to the product ID. This is followed by a data upload either by physical movement of PDA or USB stick, or simply via an internet data uploads. Two companies, TimberSmart and Microbois, included in this project as providing electronic tracking systems are able to offer Enterprise Resource Planning (ERP), for customers whose information management needs go beyond tracking requirements Table 3 provides an overview of the features of tracking system service providers reviewed in this report.

## Enabling factors (those highlighted as a Strength or Opportunity in two or more systems)

- Factline, Credit 360 and Historic Futures systems monitor CoC certificates and do not provide methods for physical tracking, therefore they do not use any physical marking of individual goods;
- The companies registered in the tracking software themselves go on to the webpage to register their products and yield and can invite their suppliers and retailers to log onto the system;
- Most companies have the ability to use a variety of physical marking methods such as barcodes and RFID (e.g. Factline, Helveta, Radian);
- Most systems are web based and require internet (meaning only minimal software is needed on the client such as an internet browser) e.g. Factline, Global Traceability Solutions, Helveta, TimberSmart;
- Factline, the basic version is free of charge and Global Traceability Solutions is considering paying people in the forest to collect data instead of charging them for handheld or software use;
- Most of the companies have systems that require communication infrastructure (e.g. mobile phone, internet, satellite);
- Most systems have monthly or annual costs (e.g. Global Traceability Solutions, Factline, Historic Futures);
- Software is used as a flexible tool, with most systems being adapted to customer needs (e.g. TimberSmart, LTS).

*Table 3: Overview of service providers*

| Service Provider | HQ Country | Existing since | Office Staff | Field Staff | Software Developers | Existing clients | More on page |
|---|---|---|---|---|---|---|---|
| Agroisolab | Germany | 2003 | 9 | 0 | 0 | 700 | 34 |
| Ata Marie Group | Indonesia | 1997 | 5 | 4 | 0 | 30 | 35 |
| Cambium - LTS | Germany | 2007 | 2 | 15 | 2 | 1 | 37 |
| Delta Informatique | Cameroon | 1987 | 50 | n/a | 250 | 10 | 38 |
| Double Helix | Singapore | 2008 | 9 | 2 | 7 | 1 | 39 |
| Factline | Norway | 2009 | 5 | 2 | 3 | 12 | 41 |
| Global Traceability Solutions | Germany | 2010 | 8 | 15 | 32 | 10 | 44 |
| Helveta | United Kingdom | 2004 | 80 | 20 | 25 | 15 | 46 |
| Historic Futures | United Kingdom | 2003 | 36 | 0 | 11 | >20 | 48 |
| Radian Tekno | Indonesia | 2010 | 9 | 2 | 2 | 3 | 49 |
| Rainforest Alliance – Credit 360° | United Kingdom | 1987 | 350 | >70 | 2 | 3 | 51 |
| SICPA | Switzerland | 1927 | >100 | >1200 | >200 | >500 | 54 |
| Timbersmart | Australia | 1996 | 14 | 12 | 12 | 120 | 56 |
| Track Record Global | United Kingdom | 2005 | 6 | 3 | 3 | >2000 | 58 |

### Limiting factors (those highlighted as a Weakness or Threat in two or more systems)

- Currently only one system provider, Helveta, is piloting national VPA LAS timber tracking systems. As the market matures it is expected that competition will develop increasing the diversity of tracking solutions.
- During the development phase of a tracking system, IT specialists have to carefully listen to the practical needs of forestry experts. IT specialists have the tendency to lose contact with the needs of people working in the field and design a system without fully respecting their needs. This could lead to reluctance to properly implement the system, which in turn affects productivity and performance;
- Tracking systems need to sustain funding in order to stay operational (e.g. equipment has to be updated and non-working devices need to be exchanged and software migrated to new platforms). A lack of funding has the potential to undermine tracking systems;
- The IT and technology sector is evolving rapidly with new technology applications appearing regularly. Electronic timber tracking systems need to stay up-to-date and incorporate new technologies in order remain compatible with state of the art software and technology developments;
- To implement a tracking system either on a company basis or even up to a national basis involves many stakeholders to accept changes in practices to incorporate a new way of handling timber and timber products. If timber tracking systems are not accepted by the involved stakeholders then there is a strong risk that the systems implementation will be significantly impeded or possibly halted;
- Poorly designed timber and timber product tracking systems can lead to dysfunctional and ineffective systems. A trial phase carefully monitored and evaluated by timber tracking experts is therefore an important tool to evaluate that the design of a tracking system is capable to cope with the field challenges;
- Electronic tracking systems are flexible to a certain extent as software features can be reprogrammed. However, if there are frequent policy changes related to the forestry and timber sectors, then timber tracking systems may not be able to respond in time or scope to incorporate all aspects of new laws and policy requirements;
- Tracking systems need to be incorporated into existing structures; management systems, ERP, accounting and payment systems. If they are designed as stand-alone systems there is the risk that work could be duplicated leading to additional costs.
- Tracking systems map supply chains and increase transparency between all stakeholders. Intermediate suppliers could be concerned about confidentiality and fear that they might be omitted from supply networks, de-incentivising participation in timber tracking systems;
- A certain level of confidentiality needs to be maintained in timber tracking systems in order that all suppliers participate. If a system fails to give suppliers a sufficient level of confidentiality protection (e.g. data fraud, insufficient data security) then this will reduce confidence and will compromise the whole system;
- Companies with very large and complex supply chains may use different tracking systems or some aspects of those chains may not see the benefits of implementing tracking systems. The pressure from retailers at the end of a supply chain to use traceability systems may diminish towards the beginning of the chain. There is a risk that timber tracking may only be properly implemented by some members of the chain, rather than the full traceability of goods from the forest to the store.
- There may not be the necessary incentives for a complete tracking system throughout the timber supply chain to be realized.

# 5. RECOMMENDATIONS

## Recommendations for choosing a timber tracking system

- Timber and timber product tracking systems are embedded into existing physical infrastructures and need to be adapted to conditions present on the ground. It is therefore important in the planning phase of implementing systems that developers have a good understanding of these on the ground conditions (e.g. quality and availability of internet connections) and whether any considerations need to be made before the tracking system can start to be implemented;
- The self-development of a system requires a long trial phase before it can be operational. Therefore the implementation time can be accelerated by choosing a company with experience in the timber tracking sector and whose system has been proven;
- The ideal solution to tracking timber products would involve an industry wide consensus, where systems of different service providers could adapt to a baseline standard. This would more readily allow for the facilitation of data exchange between service and timber tracking software providers;
- There will be periods where older (mainly paper based) systems and new systems will overlap and run side by side. This will create additional but necessary costs. However, whilst the transitional period between systems should be reduced to a minimum, it is important to allow sufficient time for staff training and to fully trial the new systems. An abrupt change to a new system could cause problems in the functionality of the timber tracking processes;
- The security measures required for systems and additional verification methods need to be chosen according to the situation in-country and locally on the ground. Additional verification methods such as genetic and isotopic sampling may become necessary if the instances of fraud encountered are high;
- Timber tracking systems using barcodes and handheld PCs for data capturing processes are well developed and have reached the operational stage in forestry and many other sectors. This standard method should always be considered before moving to more advanced methods.

## Recommendations for supporting the development of timber tracking systems

- International donor funding is necessary to gain more experience with new timber tracking methods on a larger scale, e.g. genetic and isotopic methods on an fully operational level for most timber commodities;
- Funding and close monitoring of national systems by independent NGOs and experts is necessary;
- Countries should take advantage of all available information sources when developing tracking systems, including:
  - Lessons learned from trials, e.g. VPA wood tracking system Ghana;
  - Publications such as this document;
  - Conferences;
  - Workshops in order to transfer knowledge;
  - Website library with resources on timber tracking subjects;
- Where developing countries cannot meet the commercial expectations of private timber tracking providers a shareware version of a simple timber tracking system could be a solution funded by international donors (e.g. ITTO, FAO, EC, UNEP); and
- Timber tracking systems cannot overcome weak governance. They are embedded into the legal system of each country. If the legal systems are weak timber tracking systems alone will not be able to reduce fraud and combat illegal logging.

# 6. OUTLOOK

As a next step, a decision tree for companies choosing a timber and timber products tracking system or governments wanting to implement a national system would provide additional guidance. The tree would show the user resolutions to a set of questions to indicate the best solutions suitable for their demands.

In the past, few service providers, mainly small companies working in the IT sector with fewer than 10 staff members, specialised in timber tracking as their main business area. Some companies moved away from developing and implementing these technologies because, despite NGO pressure to use such systems, most potential clients did not see the need to use them as there was little legal or regulatory requirement to do so.

This situation is now changing, creating market conditions that are favourable for a growth in timber tracking system specialist companies. Providers with diverse business interests in chain of custody and other commodities are likely to be most highly competitive.

It is anticipated that in the next decade, national tracking systems will be implemented in most tropical countries with significant forestry or timber consuming industries. Furthermore, local service providers are likely to develop in most countries and will either become resellers for larger international providers or will sell self-developed software. It is likely that the data generated from national systems will be used for national statistics (e.g. sales statistics for certain species and products, with data being used by government related agencies such as taxation offices or forestry departments).

It can also be expected that introducing tracking systems alone will not be a panacea to resolve all associated issues with illegal logging. Timber tracking systems are one component of a wider collaborative response that includes developing legal frameworks and infrastructure, adequate enforcement and good governance.

Trading legal timber must be feasible and not unreasonably hindered by official procedures which are difficult for forest and timber sector organizations to implement. If the trade of illegal timber is easier to conduct than legal timber, then the implementation of tracking systems alone will be unable to change the situation. They can only assist in identifying what is legal and what is illegal, rather than resolving the issues of poor governance in itself.

Over the next few years standards will be developed for the timber tracking sector which will facilitate data exchange between companies using different systems. These standards will also aim to assure the quality of timber and timber product tracking systems (e.g. data completeness and format). The standards are most likely to be developed by either national or international bodies such as United Nations Economic Commission for Europe (UNECE) and ISO. In the short term, some systems will be implemented at the project level but it can be expected that the majority of timber tracking systems in future will be implemented at a national level. Systems at the national level can also be implemented by different system providers if they allow standardised data exchange with each other, but it is most likely that only one service provider will provide the service for a whole country or even region.

Consequently, it is possible that only a handful of service providers may grow from small sized tracking companies into medium sized companies or that larger companies from other sectors will start competing in the timber tracking sector. The tracking systems will improve in efficiency and will evolve from being able to track timber into complete ERP systems that are able to manage not only the goods, but also all other transactions related to them such as warehouse management, tax payments and salary payments.

Paper based systems will shift to become either semi-electronic systems, or directly become fully electronic. The IT hardware is expected to drop in price where the greatest change in hardware functionality could be expected in portable devices such as barcode readers or data loggers taken into the field. Handheld PCs can be used in the field where it is often logistically challenging. In utilising current and developing technology, handsets will become increasing portable with extended battery life and displays which can be read in direct sunlight. This technology is quickly evolving where

portable devices such as mobile camera phones can be combined with barcode reading software and are able to send data over the mobile phone network straight from the field.

Timber tracking software will have to cope with changing operating software platforms and be able to migrate from older operating systems to new operating systems across workstations and portable devices. This is especially evident in the operating platform of pocket PCs and other mobile devices which have changed rapidly in recent years. The compatibility of timber tracking software will often necessitate the guidance of professionals in reprogramming before it can be used on different operating systems.

Projects such as Indisputable Key have shown that it is possible with applied research to develop new tagging methods for commodities that have previously been difficult. One example of this is roundwood used for pulp and paper processes, where it is impractical to use plastic tags or RFID due to the nature of processing techniques. Wooden RFID tags using nanotechnology tags were being developed in order to minimise the electronic components which enter the dissolving process. It can be expected that new identification methods will appear for bulk material or commodities composed of a composite of wood material and fibre, where currently only a very few uneconomical marking methods exist. High resolution cameras are being trialed to determine whether tracking of sawn timber is possible using the tree rings as the identification mechanism, which if successful would negate the need for physical identification methods.

Whilst the price per unit of some physical identification techniques is currently relatively high (e.g. RFID), it is anticipated that if production reaches higher volumes, the price will of these technologies will further decrease. In the case of RFID, the quality of the tags may also improve, which could mean the RF signal could be detected from greater distances, or in case of plastic tags they could be applied on wood faster using automatic attaching devices.

Additional verification methods will further be integrated into timber and timber product tracking systems meaning both will be used side by side to reinforce one another. It is likely that the role of chemical identification methods will expand to perform tasks which are currently incredibly challenging (e.g. kiln dried timber).

# ANNEX. QUESTIONNAIRES RECEIVED

| Tracking Service Provider Assessment Sheet | |
|---|---|
| Organizational overview | |
| Company Name | *TÜV Rheinland Agroisolab GmbH* |
| Established year | *2003* |
| Office HQ | *Prof. Rehm Str. 6, 52428 Juelich, Germany* |
| Office country & city | *1 office: HQ (Germany)* |
| Office staff | *9* |
| Software Developers and Software Architects | *0* |
| Field sites | *0* |
| Field site country & city | *0* |
| Field staff | *0* |
| Field expertise | *Germany* |
| Clients | *Laboratory, specialised on the field of tracking with stable isotopes, mainly food, approx. 700 customer* |
| Countries | *Germany* |
| Partner companies | *Genetic ID* |
| Experience | *Origin of food* |
| Technology - Product name | |
| Name | *Stable isotope methods* |
| Marking Methods used | *n/a* |
| Data transfer methods used | *n/a* |
| Data security | *n/a* |
| Reconciliation | *n/a* |
| User friendliness | *n/a* |
| Stages | *The whole chain of custody, forest, sawmill, paper mill, retailer* |
| Commodities | *see above* |
| Data storage | *In the laboratory* |
| Operating software | *windows* |
| Physical vs. Input Output | *n/a* |
| Planning data capability | *n/a* |
| Stock management capability | *n/a* |
| Monitoring capability | *After the development of reliable reference database consisting of stable isotope signature, the laboratory is able to verify timber sample.* |
| Ability to identify discrepancies | *Independent, accredited laboratory* |
| Ability to resolve discrepancies | *Controls are part of the accreditation* |
| Audit capacity | *n/a* |
| Remotely | *n/a* |
| Fraud | *Checking the origin signature of the nature (stable isotopes), hard to counterfeit* |
| Interface | *n/a* |
| Extent of trials | *System was tested in several projects, as GTZ-EU-project: Verifying the origin of timber from a concession in Cameroon, DBU-project: Developing an international database for tracking teak and mahogany produced in several countries worldwide.* |
| Hardware requirements/ used | *Stable isotopic mass-spectrometers (IRMS).* |
| Software requirements/ used | *n/a* |
| Field user requirements | *Only relevant when the countries develop their own laboratory. Estimated training session: approx. 2 weeks* |
| Field infrastructure requirements | *Only relevant in that reliable sample collection and the equipment to support this is necessary.* |
| High-tech vs. Low-tech | *n/a* |

| | |
|---|---|
| System costs | *Analysis cost round about € 350, per sample.* |
| Adaptation | *n/a* |
| CITES | *Not yet, the international database (ITTO-project) will be established in 2015. After that it could be used routinely* |
| Associated costs | *n/a* |
| Summary Strengths and Opportunities | |
| Strengths | *Developing new stable isotopic tools to track the origin of timber* |
| Opportunities | *Stable isotope method is an independent system working with the information included on the elementary level (isotope). Therefore very hard to counterfeit.* |
| Comments: | |
| *One of the main scientific tools to trace back the origin of plants and their products (including timber) is the stable isotope method. It is a universal, non-radioactive analytical tool to differentiate the geographical origin of biological materials. As there is a well-known pattern of isotope ratios D/H and 18O/16O in meteoric water (and in other forms of ground water), every material including plants and animals effectively has a specific fingerprint within the tissue water, which reflects the origin of the plant and animal. If the water has been changed or lost by drying, the organically bound forms of oxygen and hydrogen can also serve as indicators.*<br>*The pattern of D/H and 18O/16O in the meteoric water depends mainly on the temperature, the landscape altitude and the distance from the sea (i.e. the continental effect). Soils show different isotope ratios of 15N/14N and 34S/32S depending firstly on the natural geological composition and secondly on the anthropogenic influence. Plants implement these isotope ratios in their organic tissue. The 13C/12C isotope ratio depends on the type of metabolism and of local climatic influences as water stress under heat.*<br>*Over the few last years, the stable isotope method proved its reliability in the determination of the geographical origin of timber in several European projects.* | |

## Tracking Service Provider Assessment Sheet

| | |
|---|---|
| Organizational overview | |
| Company name | *Ata Marie Group Ltd* |
| Established year | *2007, previously operating under Forestech Research and Development Ltd from 1997.* |
| Office HQ | *SEQUIS Centre 10th Floor, Jl. Jend. Sudirman No.71, Jakarta, Indonesia* |
| Office country and city | *1* |
| Office staff | *5* |
| Software developers and software architects | *All software developed by partner company* |
| Field sites | *30* |
| Field site country and city | *New Zealand, Australia, Fiji, Philippines, China* |
| Field staff | *4* |
| Field expertise | *The company has been involved in the design and development of IT systems for forestry organizations in 4 continents* |
| Clients | *30* |
| Countries | *New Zealand, Australia, Fiji, other Pacific Islands, China* |
| Partner companies | *All our software development, support and maintenance is outsourced to our partner companies SSI Ltd and Jade Software Corporation Ltd.* |
| Experience | *IT systems development for timber, agriculture, food manufacturing, engineering, finance.* |
| Technology - Product name | |
| Name | *1. Forest Management System.*<br>*2. Jade Master Terminal.* |
| Marking methods used | *Barcode labelling / Manual log labelling* |
| Data transfer methods used | *Data loggers, RF, electronic data transfer, cloud computing.* |
| Data security | *Comprehensive configurable industry level system security.* |
| Reconciliation | *We offer full log and lumber stock taking facilities.* |
| User friendliness | *The system utilizes computer industry standards for interface design.* |
| Stages | *Full supply chain - forest, log transportation, wood processing facilities, retailer* |
| Commodities | *Logs and most forms of processed wood products* |
| Data storage | *Options are local area networks and remote servers (cloud computing)* |
| Operating software | *The database applications run on Windows and Linux Redhat. Mobile applications can run on Windows 7 mobile, iOS, or Android.* |

| | |
|---|---|
| Physical vs. input output | *Our systems focus on individual item tracking - of logs and processed products. Sources can be classified as certified or non-certified and volumes tracked accordingly. Our experience is limited to companies with 100% certified source so we do not have experience with percentage based tracking.* |
| Planning data capability | *Our systems include full integration of company financial systems - i.e. it is already a full ERP system. We can also link the system financials to external financial systems.* |
| Stock management capability | *Our system is a complete stock management system with inventory management as the core function.* |
| Monitoring capability | *Our systems can track timber production from standing tree inventory, through the harvesting and log distribution phase, through processing, to the final sales and delivery of finished products.* |
| Ability to identify discrepancies | *Our stock taking systems identify discrepancies in stock on hand.* |
| Ability to resolve discrepancies | *Our stock taking systems allow for adjustments to stock on hand records.* |
| Audit capacity | *We can establish system access that allows 24 hour auditing including remote system access. Recording of audit results is not a function we currently support.* |
| Remote access | *The system can be configured to allow remote access through the internet that provides the external user to full system functionality.* |
| Fraud | *The system supports full transaction logging including all data creation, editing, and deletion transactions. The identity of user who has implemented the transaction is recorded. Auditors can access the transaction records and identify all transactions and the identity of users who implemented the transaction.* |
| Interface | *We have developed interfaces with various electronic systems including POS, electronic banking, barcode scanners, etc.* |
| Extent of trials | *All our systems are commercial deployments. We don't do trials.* |
| Hardware requirements/ used | *Standard PC, server and communication equipment. We have new mobile applications systems that support Windows 7, iPhone and Android.* |
| Software requirements/ used | *Windows or Linux server OS. Windows OS for client PC's. Windows 7, iOS and Android for mobile devices. Otherwise we provide all other software required to operate our systems.* |
| Field user requirements | *2 weeks or more is required for the system to become fully operational, including training.* |
| Field infrastructure requirements | *The system can be installed on standalone PC or LAN. Internet connectivity is advantageous (but not necessary) for external systems access and support and maintenance purposes.* |
| High-tech vs. low-tech | *We can install separate systems that can support separate parts of the supply chain. The data can then be reconciled to the level possible.* |
| System costs | *The base cost of the system is $25,000 USD per server installation. Costs of configuration, installation and training are additional. Annual support and maintenance cost is 18% of purchase price.* |
| Adaptation | *We make system adaptations on request. Most adaptations are associated with log and lumber scaling and grading, custom reports, multi-language configuration, financial accounting configuration.* |
| CITES | *No* |
| Associated costs | *We have only sold our systems for fixed fee plus optional support and maintenance. We have offered a monthly fee / rental option but never sold systems on that basis.* |
| Summary Strengths and Opportunities | |
| Strengths | *1) Integrated ERP solution incorporating full COC from forest through to final product.*<br>*2) Flexible configurable to specific needs of the user.*<br>*3) Flexible deployment options including PC / Client Server / Cloud / Mobile solutions* |
| Opportunities | *1) Building capacity of companies and institutions through provision of robust and cost effective solutions.*<br>*2) Innovative use of IT and communications technologies to enable companies implement true real time COC.* |
| Comments | |
| *Our timber tracking system is a module of our business management suite called Forest Management System (FMS). The system includes the following modules:*<br>*1) Forest asset register recording all the forest management units under the control of the organization.*<br>*2) Operations management module for controlling forest management operations including silviculture, infrastructure development and harvesting and logistics.*<br>*3) Log tracking which includes log labelling, log scaling and stock control, production monitoring, and transportation monitoring.*<br>*4) Mill management and timber marketing.*<br>*5) Financial accounting.* | |

| Tracking Service Provider Assessment Sheet | |
|---|---|
| Organizational overview | |
| Company name | *Cambium – LTS GmbH* |
| Established year | *2007* |
| Office HQ | *Gerhard Friemel, Im Mühlengrund 1, 74864 Fahrenbach-Robern Tel: +49 6267 92 95 40; Fax: +49 6267 92 95 42; E-Mail: info@cambium-lts.de* |
| Office country and city | *1 office see detail under HQ above* |
| Office staff | *2* |
| Software developers and software architects | *2* |
| Field sites | *1* |
| Field site country and city | *Czechoslovakia, Prague* |
| Field staff | *15* |
| Field expertise | *Development and field use of RFID to track round wood from the forest into the sawmill* |
| Clients | *1* |
| Countries | *Czechoslovakia* |
| Partner companies | *Yes - Woodslock-Praha; Firma AutoCont – CZ* |
| Experience | *Yes* |
| Technology - Product name | |
| Name | *Log Tracking System (LTS)* |
| Marking methods used | *Three different marking methods are currently being trialled. Past experience was built up using RFID nails hammered into logs.* |
| Data transfer methods used | *Mobile Phone, landline phone as default and internet (remote locations)* |
| Data security | *Encrypted Data* |
| Reconciliation | *Output Input reconciliation with functions to flag discrepancies which are outside the allowed range* |
| User friendliness | *Tough screen which is simple to use, RFID reader can detect any RFID tags affixed on timber located with a distance of up to 2-3 meters* |
| Stages | *Forest, Factory Gate, Factory Storage, Store* |
| Commodities | *Round wood, sawn timber, semi-finished products, finished products* |
| Data storage | *Always at the client site* |
| Operating software | *XP, Windows 7 and all relevant others if requested by a client* |
| Physical vs. input output | *All Volumes are reconciled using the Input Output method (allowed are discrepancies under 2% otherwise flagged up). Laser measurements in sawmills are directly taken into account for reconciliation. Physical segregation is used where necessary but not a must for the LTS system.* |
| Planning data capability | *All relevant ERP systems, management system, best cloud system with many users connected factory forest etc.* |
| Stock management capability | *Yes, the LTS system can help to reduce the time goods spent in CoC chain before being paid by the customer of companies and can help therefore to improve the immediate cash flow situation.* |
| Monitoring capability | *Trees, round wood or a batch of round wood or timber is marked by an RFID tag and can therefore be monitored through the CoC Chain using RFID Readers that submit their information to a central database. If the client wishes an independent audit process the LTS system can help the auditor to quickly get an overview of the timber flow and the timber amount stored at any location which is part of the LTS system.* |
| Ability to identify discrepancies | *Discrepancies are detected with a rule engine automatically by the software.* |
| Ability to resolve discrepancies | *The users need to treat each discrepancies or non-compliance. A user has to decide how to deal with a discrepancies or non-compliance.* |
| Audit capacity | *Currently do not have a partner for audits. The client can choose one if an independent audit is decided. We will facilitate the remote access to the LTS for the auditor* |
| Remote access | *Yes* |
| Fraud | *Reconciliation is done between each stage wherever possible and this should help to reduce fraud to a minimum level or even to make fraud impossible* |
| Interface | *We use the German interface ELDAT so customs or any other body which is granted access can connect to the LTS system.* |
| Extent of trials | *Approximately 300.000 $m^3$ in Germany, Tschienen currently trial pilot on-going* |
| Hardware requirements/ used | *RFID tags which can be used for forestry purpose that can be read with distance of 2-3 meters, RFID Readers (Readers can be used with gloves in bad weather conditions) with GPS module and central data storage* |

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|---|---|
| Software requirements/ used | *Operating system, operating system mobile devices* |
| Field user requirements | *Between 1-3 days depending on user skills* |
| Field infrastructure requirements | *Internet, mobile phone network, GPS coverage* |
| High-tech vs. low-tech | *Readers can collect the data offline and once back in the office they can submit the datasets using telephone lines* |
| System costs | *2.50 Euro per $m^3$* |
| Adaptation | *Yes DDR/Timber Trade Regulation* |
| CITES | *Currently we mainly work in central Europe and have no CITES listed timber in our system.* |
| Associated costs | *Hardware costs, software license fees no additional costs* |
| Summary Strengths and Opportunities | |
| Strengths | • *RFID tags adapted and specially made for the forestry field*<br>• *Tested gear to affix the RFID tag on timber*<br>• *Mobile devices for the data collection and data transfer, stationary data readers used in factories*<br>• *Self-development of RFID tags with experienced partner company*<br>• *Knowledge about removal and disposal and recycling of RFID tags*<br>• *Data transfer from remote locations is possible* |
| Opportunities | • *Worldwide unique identification through RFID tags adapted to forestry industry needs*<br>• *Linkage with GPS data*<br>• *Storage optimization, reduction of losses in quantity and quality,*<br>• *Reduction of the time the material spends in the CoC chain resulting in an improved cash flow situation of company using the system*<br>• *Service improvement for the small scale forest user*<br>• *Exact and up to date documentation of timber use* |

| **Tracking Service Provider Assessment Sheet (Responses translated into English)** | |
|---|---|
| Organizational overview | |
| Company name | *Delta Informatique* |
| Established year | *1987 (established in Gabon)* |
| Office HQ | *Libreville BP 3986 Tel:+(214) 74 48 02* |
| Office country and city | *8 offices or subsidiaries. France (Tours, Paris, Lyon), Morocco, Senegal, Ivory Coast, Cameroon, Gabon* |
| Office staff | *50* |
| Software developers and software architects | *250* |
| Field sites | *n/a* |
| Field site country and city | *Cameroon, Gabon, Congo* |
| Field staff | *n/a* |
| Field expertise | *Software used by our clients* |
| Clients | *Approximately 10 for forest management software* |
| Countries | *Cameroon, Gabon, Congo* |
| Partner companies | *Partnership with Oracle* |
| Experience | *Banking, human resources, pay modules, accounting software and other business management software* |
| Technology - Product name | |
| Name | *Gestion forestière (Gesfor) /Delta-Bank, Delta-Applications* |
| Marking methods used | *Traceability via an unique barcode fixed on standing trees and also on all planks coming from that tree* |
| Data transfer methods used | *Data transfer methods in use by the market e.g. email, USB-key etc..* |
| Data security | *User accounts are password protected. Use of standard database software (Oracle, Informix)* |
| Reconciliation | *n/a* |
| User friendliness | *Graphical interface and application used with web browsers* |
| Stages | *Pre-harvest, harvesting, transformation and sales* |
| Commodities | *Simplified forest management covering harvesting activities up to timber trade activities with the integration of costs and stock management* |
| Data storage | *Server hard disk via a database (Oracle, Informix). Update of information in real time. Saving of data done via client request.* |
| Operating software | *Windows, Unix* |

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| Physical vs. input output | *Data can be either centralised (where all posts have a link with the network server) or decentralized on different sites (in this case regular transfers must be made to update the central database)* |
| Planning data capability | *No standard direct link to other applications for other providers. All interfaces are realized in functions of the tools used.* |
| Stock management capability | *Trace of the transformation of timber either via export or via cross-cutting. Traceability is maintained all along the chain.* |
| Monitoring capability | *Monitoring of activities (production and sales) either in volumes or in monetary values* |
| Ability to identify discrepancies | *Every figures entered into software can be identified through a unique key which will allow traceability of all actions done to a tree (from position data at the pre-harvest stage up to sale stage).* |
| Ability to resolve discrepancies | *Control that all actions are grouped into a data entering* |
| Audit capacity | *Partnership with Oracle* |
| Remote access | *State or extraction of data with all information and tracing operations* |
| Fraud | *Dealt with through tractability with unique information key* |
| Interface | *Interface developed by our company based on information requested by the recipient* |
| Extent of trials | *Data manipulation is logged in software package during data entering phase* |
| Hardware requirements/ used | *Server and workstations* |
| Software requirements/used | *Gestion forestière (Gesfor)* |
| Field user requirements | *Five days per module, ten days in total for the modules production and sales* |
| Field infrastructure requirements | *Network if centrally administrated, network and internet connection (one or the other) if local administration is requested* |
| High-tech vs. low-tech | *Planning for an interface in order to gather the data outside our software is needed* |
| System costs | *The costs are linked to the license fees (software package and database) and to the number of days needed for installation and setup of all applications. The system costs will vary depending on the size of the operator and type of management requested by the client. A Support and Maintenance contact is issued and the annual fees are 15% of the catalogue price of the license fees.* |
| Adaptation | *n/a* |
| CITES | *n/a* |
| Associated costs | *Purchase of computers, installation of network infrastructure or other means who will help the software package to function* |
| Summary Strengths and Opportunities | |
| Strengths | • *Software package is already installed and working at many client sites*<br>• *Local offices in different African countries*<br>• *25 years presence in Africa*<br>• *Experience in the field of forest management*<br>• *Reliability of data through the use of recognized standard databases*<br>• *Adaptation of our software to meet client needs as we programmed it and can adapt it as needed*<br>• *Reliability of our company as we belong to a large international group (Sopra Group with over 13.000 employees)* |
| Opportunities | *Currently in discussion to install the system at different sites* |
| Comments | |
| *Beginning with georeferencing, each tree is identified in the software package with a unique code. All attributed data of that tree interlinked with that unique code with the help of unique keys. For each attribute the key will identify its origin.* | |

## Tracking Service Provider Assessment Sheet

| Organizational overview | |
|---|---|
| Company name | *Double Helix Tracking Technologies Pte Ltd* |
| Established year | *Jul-08* |
| Office HQ | *96A Club Street, Singapore 069464* |
| Office country and city | *2 locations. Singapore & Surabaya (Indonesia)* |
| Office staff | *9* |
| Software developers and software architects | *Double Helix employs 2 scientists directly. These 2 scientists each have a team of full and part-time laboratory technicians working for them. Total number of people working on technology development and testing is 7.* |

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|---|---|
| Field sites | *DNA CoC verification is currently applied in 6 FMUs and 9 mills in Indonesia. 3 new sites in Africa to be rolled out in 2012.* |
| Field site country and city | *Papua and West Papua province, Indonesia.* |
| Field staff | *2 field staff involved in collecting wood samples* |
| Field expertise | *First field trials in 2006. First pilot 2007 (as part of CertiSource Legality Verification System)* |
| Clients | *1 - CertiSource, but applied to several timber supply chains with multiple buyers.* |
| Countries | *Indonesia* |
| Partner companies | *Technical work is outsourced to various laboratories.* |
| Experience | *No. Double Helix is focused solely on the timber sector.* |
| Technology - Product name | |
| Name | *DNA Verified Chain-of-Custody* |
| Marking methods used | *Genetic markers. These are inherent within the wood itself so no external marking is required.* |
| Data transfer methods used | *Not applicable* |
| Data security | *Genetic markers are completely tamperproof.* |
| Reconciliation | *DNA verification is the method used to reconcile and validate data in a traditional paper-based or electronic wood tracking system.* |
| User friendliness | *No field technology is required. Local staff only need training in wood sampling procedures and wood sample storage protocols* |
| Stages | *DNA is extracted and analysed from trees, raw timber, sawn timber and solid wood products (furniture, flooring, decking and components).This means DNA verification can be applied to verify harvesting, log transportation and primary sawmill chain-of-custody. It can currently be applied in later processing stages only for solid wood products. As technology improves, it will be applied to downstream stages for further processed products like veneers and plywood.* |
| Commodities | *Not applicable* |
| Data storage | *Double Helix and partner laboratory servers* |
| Operating software | *Not applicable, but genetic data could be stored in any existing database software* |
| Physical vs. input output | *DNA verification is a physical audit test to monitor and validate paper-based or electronic wood tracking systems.* |
| Planning data capability | *As part of electronic wood tracking systems* |
| Stock management capability | *As part of electronic wood tracking systems* |
| Monitoring capability | *As part of electronic wood tracking systems* |
| Ability to identify discrepancies | *DNA testing identifies discrepancies between the genetic profiles of two wood samples as a way to validate wood tracking system data.* |
| Ability to resolve discrepancies | *Targeted physical audit and inspection* |
| Audit capacity | *DNA testing replaces physical audit requirements* |
| Remote access | *DNA testing is a form of remote auditing* |
| Fraud | *DNA testing detects fraud by comparing the genetic profile of the wood itself.* |
| Interface | *Genetic data can be incorporated into other system interfaces (e.g. customs or enforcement agencies)* |
| Extent of trials | *Indonesia since 2006* |
| Hardware requirements/ used | *Wood sampling equipment (cambium extractor), plastic bags and silica gel* |
| Software requirements/used | *None* |
| Field user requirements | *The ability to take wood samples from the cambium of a tree and store it correctly.* |
| Field infrastructure requirements | *No special requirements* |
| High-tech vs. low-tech | *Wood sampling records can be paper-based. Any attempted fraud will simply produce a sampling/genetic mismatch.* |
| System costs | *Set up cost:*<br>*Genetic analysis of timber species: $30,000 USD per species (this is a one-off cost can be spread across all concessions and regions where that species is harvested).*<br>*Variable cost:*<br>*Average cost of DNA verification: $750 USD per 1000m$^3$ of raw timber.* |
| Adaptation | *DNA can be adapted to any paper-based or electronic wood tracking system. The data generated can also be used by customs at point of import to help enforce the Lacey Act and EUTR.* |
| CITES | *Not currently but could be easily applied.* |
| Associated costs | *None* |

| Summary Strengths and Opportunities | |
|---|---|
| Strengths | *1) A simple 'plug-in' to validate, secure existing paper-based or electronic wood tracking systems*<br>*2) Detects fraud*<br>*3) 100% Tamperproof*<br>*4) Lowers overall cost of wood tracking system by replacing physical audits*<br>*5) Easy field implementation (no field technology)*<br>*6) Deters attempts at fraud because DNA is well-known as a criminal forensics tool* |
| Opportunities | *1) Eliminate fraud (species misdeclaration, log swapping, etc.) from supply chains*<br>*2) Establish import controls to verify declarations of country of harvest and species*<br>*3) Increase value of forest areas by generating genetic inventory data from collected wood samples*<br>*4) Support, strengthen and lower cost of FLEGT VPA Timber Legality Assessment Systems as well as CITES monitoring and enforcement*<br>*5) Build genetic testing capacity in developing countries* |
| Comments | |
| *DNA fingerprinting of timber provides an independent, scientific verification of any wood tracking system. Introduction of DNA testing is not only an effective measure to deter document fraud, cutting off log laundering channels, but also a means to lower cost, facilitate uptake, increase transparency and protect voluntary certification system brands.*<br>*The process is very simple to implement. Wood samples are taken from trees prior to harvest, during the forest inventory process. These samples are stored so that they can be tested and analysed at a later date. During harvesting and processing, a second set of samples are taken from the same trees and logs, according to the tracking system documentation. This second set of samples is physically matched with the samples taken during the inventory. If the tracking documentation is correct, then the paired samples should come from the same trees. DNA fingerprinting will scientifically verify that they are from the same trees by comparing their individual genetic profiles. If the genetic profiles do not match, then a breakdown in the system, accidental or deliberate, has occurred and the system auditors can take targeted, direct action to identify and correct the problem.*<br>*Though basic paper-based or electronic systems are still needed to match samples back to their source logs, the incentive to abuse these systems on the part of any company or individual is removed, since it will be exposed by DNA fingerprinting.*<br>*The targeted nature of DNA fingerprinting also allows auditors to reduce the intensity and frequency of regular physical audits. Since CoC audits make up a significant proportion of certification costs, it follows that a reduction in auditing time and effort all along the certified supply chain will reduce the overall cost of timber certification.*<br>*Not to be underestimated is the potential of DNA to enhance the credibility and trust associated with a brand. Popular knowledge of DNA technology applied to criminal forensics means that consumers and buyers recognize the capabilities of DNA testing, increasing trust in and awareness of associated certification schemes whilst at the same time deterring illegal timber laundering through DNA verified supply chains.* | |

## Tracking Service Provider Assessment Sheet

| Organizational overview | |
|---|---|
| Company name | *Factline AS* |
| Established year | *2009 (continued from more than 10 years of leading work in global traceability)* |
| Office HQ | *O: Christian Krohgs gt 32A, 2nd floor, N0-0186 Oslo, Norway*<br>*P: P.O. Box 2193 Grünerløkka, NO-0505 Oslo, Norway*<br>*T: +47 482 03 000*<br>*E: post@Factline.com* |
| Office country and city | *HQ: Norway; Office in Germany/Berlin; Global network of Partners/Agents* |
| Office staff | *5* |
| Software developers and software architects | *3* |
| Field sites | *2 (the rest covered/handled through partners)* |
| Field site country and city | *South Africa/Cape Town; Thailand/Bangkok* |
| Field staff | *2 (the rest organised through partners)* |
| Field expertise | *The Factline team represents continued development, innovation and operations from more than 10 years of experience in the field of global traceability; including delivering traceability systems to Fortune 500 companies, WHO (combating Avian Flu), global supply chains and more in the seafood sector and several EU-projects.* |
| Clients | *12* |
| Countries | *Norway, Germany, South Africa* |
| Partner companies | *Several.* |
| Experience | *Factline and the core team has experience from global projects within whole chain traceability in the seafood sector; fine chemicals; agricultural sector; poultry; etc.* |

| Technology - Product name | |
|---|---|
| Name | *Factline.* |
| Marking methods used | *The system integrates (manually or automated) with internal traceability systems, and Factline supports all known marking methods like barcodes, RFID, numeric etc. Should the customer not have internal traceability systems implemented, we provide this through a close partner with market leading solutions.* |
| Data transfer methods used | *FTP and/or web based file upload. Encrypted whenever necessary.* |
| Data security | *Professional hosting. Secure firewalls. Follow up on all security patches. Encrypted data whenever necessary.* |
| Reconciliation | *Coherent and robust data model. Well tested links and relations between objects.* |
| User friendliness | *We have launched a system that gives access to all three levels of traceability, but where it can be started at the basic level in a matter of minutes. We create visualised traceability chains by applying the logics and methodology known from social network solutions; the users part of the job is done as soon as the relevant information is entered ("Inform once, accepted everywhere"). There is traceability and is ready to distribute your profile. Everything is done in a graphical user interface with no need of dedicated software or hardware to be installed (a browser does it all) and utilizing simple drag-and-drop functionality. We also offer API's for streamlined automated data imports and exports.* |
| Stages | *Factline is a whole-chain visualisation service, covering all stages and participants.* |
| Commodities | *The Factline service is in its architecture generic and may be adapted to all kinds of value-chains; be it food-production, forestry, manufacturing or any other chain-of-custody.* |
| Data storage | *With professional hosts. DB based and/or file based. Distributed hosting when relevant. Standard backup schemes.* |
| Operating software | *Linux (server). Any OS (client).* |
| Physical vs. input Output | *Factline supports input/output, percentage claims, and physical separation. As an example; all CoC claim methods in the FSC standard are supported.* |
| Planning data capability | *Factline serves as an open platform where the users can add applications (both Factline provided and third party provided). Examples of existing applications are Factline Storefront (application used to present chain information about the products to consumers); Factline CSR Monitor (system to manage CSR issues throughout the whole supply chain); etc* |
| Stock management capability | *The stock management features in Factline are built mainly to support mass balance CoC, and not primarily to basic stock management. For that purpose, we integrate with a close partner who provides a fully featured stock management system (The open API's can also integrate with other third party solutions).* |
| Monitoring capability | *The strong visualisation tools in Factline make it easy to visualise the whole supply chain for every single product throughout the chain, both graphically and table based. In addition, you can monitor the mass balance, and CoC claims applied at every stage of the chain. The system can also provide flag-reports for compliance/noncompliance throughout the chain.* |
| Ability to identify discrepancies | *The monitoring features of the Factline system enable– among other features–mass balance control system, and also flag-reports for non-compliance (see item above). In addition, the system also includes a whole chain system for Self-Assessment Questionnaires (SAQ's), where all suppliers in a supply chain can declare their degree of compliance to different (customisable) compliance schemas.* |
| Ability to resolve discrepancies | *Factline includes an action plan follow-up system, where action plans and corrective actions are managed and visualised to involved parties in a supply chain. (Data visualisation security system embedded, securing that only the relevant involved parties in the chain are granted access to the information)* |
| Audit capacity | *Factline has a dedicated log-in for audit companies, where online audits can be executed. Audit reports can be stored directly in the system, and related to the relevant entities (e.g. at company level; product level etc).* |
| Remote access | *The whole system is web-based, and can be accessed from wherever internet is available. Auditors can be granted separate log-in and access profiles.* |
| Fraud | *The strong monitoring and visualisation features will prohibit fraudulent activities in the supply chain. The risk management features will also help the 'chain masters' to surgically address where in the chain to carry out on-site audits and additional control measures.* |
| Interface | *Through a flexible and secure API giving access to all functionality.* |
| Extent of trials | *Trials have been made in the agricultural sector, in the wine sector, and within the paper industry. Trials have been carried out in 2010 and 2011.* |
| Hardware requirements/ used | *Server side (provided as Software as a Service/SaaS): Any X86 based hardware. Client side: platform independent - PC, MAC, Mobile etc.* |
| Software requirements/used | *Server side: Apache, Resin, PHP. Client side: Any web browser.* |
| Field user requirements | *The Factline system is built to be very easy and intuitive to use, and normally a half-day training session is sufficient; in combination with user documentation.* |
| Field infrastructure requirements | *The basic terminal is a normal PC with an internet browser (Factline supports Internet Explorer; Safari; Firefox etc.), but smartphones and hand terminals can be used for most features.* |

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| High-tech vs. low-tech | *Web based or mobile uploads are possible. If this connectivity is not present, a number of off-line registration methods may be used. Excel with export routines to our standard XML input format - or any other registration unit with similar export facilities. In the worst case hand writing with postponed digital transfer (possibly OCR aided) may be used.* |
| System costs | *All registration of data is free of charge to customers/users. Subscription payments apply to upgrades (functionality, capacity) and add-ons (services, applications). There are no requirements for installation of dedicated hardware or software; internet access and a standard (or mobile) browser is all that is needed. Subscription form more advanced versions run from 100 to 2.500 per year. The Factline-service—even in its basic version—is focused on simple, intuitive and efficient information handling. And even the basic version meets the requirements of traceability and CoC.* |
| Adaptation | *Coming from a generic, sector independent, chain traceability angle, we have monitored different timber CoC regimes in order to help easy adaptation for timber users. We chose to use the FSC CoC standard as the main benchmark for the system adaption to the timber sector, and combined with the generic CoC features in the Factline platform, we expect the features to be sufficient to support more or less all the processes mentioned.* |
| CITES | *Not directly (however, indirectly through our users within the European paper industry).* |
| Associated costs | *Not inherently; but it depends to a certain degree on the intended utilisation of the system. Though not necessary in order to use the service, dedicated in-the-field equipment may optionally be useful. These would be standard off-the-shelf devices and/or interfaces with in-house traceability/chain-of-custody or manufacturing/production support systems. We can facilitate the incorporation and integration of such systems/devices through partners or in cooperation with the customers' own IT departments.* |
| Summary Strengths and Opportunities | |
| Strengths | *1) Deep experience of internet related technology development, particularly on traceability and information exchange.*<br>*2) Focused on simple, intuitive and efficient information handling, with a user friendly interface that makes it easy to get started and at an unbeatable price: The basic solution is there for you to use—free of any charge!*<br>*3) The solution is based on modern principles of participation in professional networks making it non-proprietary as regards where and how you want to utilise your information*<br>*4) Security and Transparency – safety of your data is of vital importance to us and our solution safeguards the information on a level that is on par with what you have in your own networks or with your operations provider. Only the participants (and auditors qualified for access by the chain) in your supply chain may have access to the underlying information in the value chains.*<br>*5) Scalability – our solutions are capable to satisfy demands of scalability both in terms of sophisticated add-on functionality and automated use; we can meet the demands from anyone—from primary producers to the largest multinational manufacturers and retail chains.* |
| Opportunities | *1) Partnering – Factline offers a full "core engine" for end-to-end visual overview and information exchange in supplier networks. Ideally suited as an add-on for solution providers within: ERP, SCM, PLM, MES, CRM etc. Easy set up as an integrated extension for solutions and services; inexpensive, yet powerful and sophisticated. Use of coupon codes and eco-system affiliations facilitates acknowledgement of preferred partners' conditions and allows for regulation of partner's commission etc.*<br>*2) Architecture – the Factline platform is built as an open system, with API's for both imports and exports of data using REST as a standard (xml, JSON). All API's are openly distributed and documented, in order to secure that 3rd party interests are free to communicate with the Factline system, and also to facilitate their building of their own value adding applications to complement and enhance the service. For even more advanced integrations we have developed a framework in form of a "data laundry machine" that facilitates easy integration with your own systems (ERP, MRP, internal traceability, etc.) Flexible, agile, open, yet secure, scalable and robust.*<br>*3) Corporate Social Responsibility (CSR) applications including Supplier Relationship Management.* |
| Comments | |
| *There are basically three levels of traceability: Linking companies (value chain traceability) linking products or projects (COC) and linking batches. Our solution encompasses all three levels, starting at the simplest level and scaling to fit client needs as they develop. All the time the client only pays for what they need.*<br>*Most requirements today involves chain-of-custody (i.e. product or project level), in order to achieve overview of supply chains. This is essential for: Control over ethical/social conditions with your suppliers (and your suppliers' suppliers), simplified overviews of all elements pertaining to sustainable production (as in forestry and fisheries) and easy verification of certificates and compliance grids.*<br>*We have designed and developed our solution based on requirements gathered over a period of more than 10 years from demanding customers. The core functionality of the system is to connect all entities in whole chains, and utilise the links to visualise global supply-chains, enabling easy and cost efficient exchange of information. The result is solutions covering Product Integrity; COC; whole chain visibility; etc. The timber tracking system encompasses an architecture built around the Factline core platform for Supply Chain Mapping and with three –optional– role based applications on top of it: the Mass Balance Calculator (incl. volume control functionality), e-Audit (certificate management, volume controls, risk assessment functionality) and the Admin module (supply chain risk assessment, reports and statistics etc).* | |

| Tracking Service Provider Assessment Sheet | |
|---|---|
| Organizational overview | |
| Company name | *Global Traceability Solutions* |
| Established year | *2010* |
| Office HQ | *Im Kaisergarten 25, 67159 Friedelsheim, Germany* |
| Office country and city | *London, UK; Sao Paulo, Brazil; Jakarta, Indonesia* |
| Office staff | *8* |
| Software developers and software architects | *30/2* |
| Field sites | *4* |
| Field site country and city | *Friedelsheim, Germany; London, UK; Sao Paulo, Brazil; Jakarta, Indonesia* |
| Field staff | *15* |
| Field expertise | *GTS is a leading provider of global traceability solutions, delivered through a unique combination of professional consulting services, innovative software applications, product identification tools, and data capturing technologies.*<br>*Our core business strategy is to build relevant technologies and solutions for commercial clients and individual consumers around the world enabling them to aggregate and organise information in order to make it accessible and useful. Using this strategy, we strive to provide solutions making people and companies more efficient and help sustainable development.*<br>*Traceability is embedded in multiple business processes and functions. While some business objectives may be achieved with the simplest system, many others require a tailored multidisciplinary approach:*<br>• *Sustainability, product labelling and consumer dialogue*<br>• *Branding, competitive positioning, product differentiation*<br>• *Safety, quality, authenticity, integrity, certification*<br>• *Chain of custody, product recall and mobile phone apps*<br>• *Supply chain visibility and optimization*<br>*With an expert team of traceability professionals, GTS can implement and customise traceability systems to meet the needs of any business or entity along the supply chain. Services cover every step from "forest to consumer" and include business scoping, project management, software development, and training. The system has been tested in Europe, Asia and South America* |
| Clients | *10* |
| Countries | *The system is used globally* |
| Partner companies | *Bureau Veritas* |
| Experience | *Timber, food, agricultural commodities, chemicals, bio fuel* |
| Technology - Product name | |
| Name | *Timber Tracking Platform (TTP)* |
| Marking methods used | *The system is designed in a way that it can use any marking method* |
| Data transfer methods used | *Web based, mobile technology, satellite technology* |
| Data security | *The platform contains security measures that allow companies to share product information with retaining control over the type and quantity of information that others can view. The platform collects and aggregates only the information that is needed to route messages between the connected companies. Therefore, the business critical data is always kept within the reach and control of each individual company. A role based, layered security system is the basis for guaranteeing data security for all users.* |
| Reconciliation | *From real time data upload to periodical upload schemes depending on local conditions and requirements* |
| User friendliness | *Users access the platform through the online interface using any modern browser such as Mozilla Firefox or Microsoft Explorer. Through individual identification codes, users can view dynamic charts showing the companies involved and the path that the product components took from the source to the final retail store. The availability of information for each product depends on the user's privileges. Starting in the implementation process, companies can determine which product information they would like to share and with whom. The user friendliness is guaranteed through a constant adaptation of the interfaces towards the needs of our clients.* |
| Stages | *Whole supply chains from forest to retail and all stages in-between. Consumer interfaces can be easily attached to the platform.* |
| Commodities | *The system is not specific to any commodity, it can trace whatever product is relevant* |
| Data storage | *Data are stored in a professional hosting environment but can also be stored in a local environment if necessary.* |
| Operating software | *The platform is web based. Therefore the requirements on local software availability are limited. Internet access or mobile phones can be used for data upload or view of information but the platform is also able to seamlessly connect to existing IT infrastructure such as ERP systems for data upload.* |

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| Physical vs. input output | *The system is able to cover all currently relevant CoC methods such as input and output, percentage based claims, physical separation, or transaction based systems.* |
| Planning data capability | *Standard APIs support the connection to other software components from simple Excel sheets to sophisticated ERP systems. The system also provides reporting tools and business intelligence functionalities. In addition several applications for specific business requirements are available.* |
| Stock management capability | *The system provides real time overview and access to inventory information. This functionality can be also used for planning and executing replenishment action.* |
| Monitoring capability | *The system documents the actual physical flow of goods through the supply chain. Depending on the role, supply chain stakeholders or auditing organizations can get access to relevant information and monitor the flow of goods through the supply chain.* |
| Ability to identify discrepancies | *An automated alert system informs stakeholders/auditors on any discrepancies* |
| Ability to resolve discrepancies | *The automated alert system plays a major role in solving noncompliance issues by informing the relevant stakeholders such as users, auditors or certification bodies to take corrective actions. Furthermore, processes on the platform can be blocked unless corrective actions are taken and documented.* |
| Audit capacity | *GTS has a partnership with Bureau Veritas* |
| Remote access | *Audit, legality verification, issue of transaction certificates, product movement, inventory balance checks.* |
| Fraud | *The combination of IT system features and functionalities with legal verification and auditing mechanisms reduces the risk of fraud significantly. The automation of data input without any manual interference is an additional security feature to prevent data manipulation. Plausibility checks involving upstream supply chain stakeholders prevent unwanted products entering the chain.* |
| Interface | *The system links seamlessly with other IT systems in terms of data input or data output.* |
| Extent of trials | *Trials have been done and are currently on-going in Asia, South America and Africa.* |
| Hardware requirements/ used | *Laptop, PC, tablet PC, hand held devices, PDAs, mobile devices such as phones* |
| Software requirements/used | *Internet browser, no other specific software requirements* |
| Field user requirements | *Less than 1 day in case of manual data upload. The requirement for system integration depends on systems used but is generally easy to achieve through predefined APIs* |
| Field infrastructure requirements | *Internet access or mobile phone access. Satellites are an option as well.* |
| High-tech vs. low-tech | *Instead of an IT infrastructure mobile phones can be used as an alternative way of capturing data. If there is no technology available at all, data can be captured at the next level in the value chain where systems become available* |
| System costs | *Subscription cost to the platform is comparable to the cost involved for a high speed business internet connection. Implementation and integration with existing IT infrastructure can create additional one off cost.* |
| Adaptation | *The system is built on processes such as the Lacey Act, FLEGT, DDR and the EUTR. These requirements are frequently updated to accommodate any changes in these programs.* |
| CITES | *The system can track any type of timber or any type of flora and fauna as long as basic traceability criteria are met.* |
| Associated costs | *There can be consultancy cost and system integration cost depending on the specific situation and the needs of the client.* |
| Summary Strengths and Opportunities | |
| Strengths | *1) Modern system architecture, system built on specific requirements of the timber industry, flexibility in the system, user friendly.*<br>*2) Cost efficiency and return on investment for clients.*<br>*3) Specific timber platform built on the needs of the industry.* |
| Opportunities | *1) New applications that address specific industry needs and drive return on investment.*<br>*2) In competitive markets typified by low margins, traceability can provide product differentiation and increase margins - at the same time as delivering enhanced consumer value.*<br>*3) Growing understanding and acceptance of consumer trust as a tangible global brand and business asset that needs to be protected and enhanced.*<br>*4) Contribute to sustainable development and protection of forests.* |

| Comments |
|---|
| *GTS Global Traceability Solutions provides, by utilising its deep expertise in the field of traceability and software development, solutions to meet the requirements of the Lacey process, FLEGT, DDR, and EUTR.*<br>*The objective is to provide an open electronic common platform for operators to retrieve product information in line with their requirements. It is built upon existing Chain of Custody (CoC) and Forest Management (FM) processes to make the information both richer and more widely accessible to all necessary timber supply chain stakeholders. A key philosophy of GTS' software solutions is the use of open standards and protocols to enable all external stakeholders to get easy access to data. APIs are also provided to enable organizations to create their own customised tools to use the data for additional purposes.*<br>*System outline:*<br>*1) Web based platform.*<br>*2) Predefined data formats for different stakeholders in the supply chain.*<br>*3) 'Click of a button' access to product data.*<br>*4) Standardized reporting and business intelligence facilities.*<br>*5) User friendly and intuitive interfaces.*<br>*6) Industry specific functionalities.*<br>*7) Costs of participation negligible.* |

## Tracking Service Provider Assessment Sheet

| Organizational overview | |
|---|---|
| Company name | *Helveta Ltd* |
| Established year | *2004* |
| Office HQ | *90 Milton Park, Abingdon, Oxfordshire OX14 4RY United Kingdom* |
| Office country and city | *Oxford, UK and Delaware, USA* |
| Office staff | *80* |
| Software developers and software architects | *25* |
| Field sites | *21* |
| Field site country and city | *Ghana (national), Cameroon (national), Democratic Republic of Congo (national), Republic of Congo (national), Liberia (national), Bolivia (various sites), Honduras (various sites), Peru (various sites), Malaysia (various sites), Indonesia (various sites). Papua New Guinea (various sites), Guatemala (various sites), Uganda (various sites), Nigeria (Afi Mountains)* |
| Field staff | *20* |
| Field expertise | *Implementing national wood tracking systems, timber supply chain tracking, community mapping, fresh produce and food commodities tracking and LULUCF/REDD+ projects* |
| Clients | *15* |
| Countries | *Ghana, Cameroon, Democratic Republic of Congo, Republic of Congo, Liberia, Uganda, Bolivia, Peru, Honduras, Guatemala, Papua New Guinea* |
| Partner companies | *Yes* |
| Experience | *Yes - food commodities, LULUCF/REDD+* |
| Technology - Product name | |
| Name | *CI World™* |
| Marking methods used | *Preferred method is barcode (using unique identifiers) but can use alternative unique identifiers, e.g. Chalk or paint (using composite keys) and RFID tags.* |
| Data transfer methods used | *FTP, CSV, Microsoft ActiveSync, ETL* |
| Data security | *Helveta is ISO 27001 accredited. CI World is a role-based system which manages data security and access.* |
| Reconciliation | *CI World reconciles data through its internal rules engine.* |
| User friendliness | *User-configurable, full Graphical User Interface (GUI), interactive dashboards, easy to use reporting* |
| Stages | *CI World can be configured to manage all stages, from inventory mapping through all stages of the supply chain to export and beyond if required.* |
| Commodities | *Timber, food commodities (e.g. cocoa, coffee, soy), bio fuels, minerals, livestock (e.g. Fisheries, bovine) and carbon.* |
| Data storage | *In CI World, the data is stored either in the central online database (per customer), or temporarily offline until next connected to the central database. Database servers (SQL Server) are hosted by a third party data management company.* |
| Operating software | *CI World is a web-based system accessed through a browser.* |
| Physical vs. input output | *CI World can be configured to work with all Chain of Custody methods including input/output, percentage based claims and physical separation.* |

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| Planning data capability | *Helveta can develop APIs if required to integrate with most third party applications.* |
| Stock management capability | *CI World tracks all movements of assets through the chain of custody therefore information on stock can be reported on at any point within the supply chain. Stock takes can be also be accommodated if required.* |
| Monitoring capability | *CI World monitors timber through the chain of custody and produces notifications, e.g. Email and alerts, whenever configurable parameters are triggered.* |
| Ability to identify discrepancies | *A rules engine identifies discrepancies and can be configured including self-checking and verification. Asset information is compared to its last record in the CoC and is checked for discrepancies which can triggers alerts.* |
| Ability to resolve discrepancies | *CI World alerts specified users to review and take corrective action if necessary, e.g. withdraw an asset from the supply chain pending further investigation.* |
| Audit capacity | *CI World enables external auditors to review supply chains.* |
| Remote access | *CI World is a web-based solution so all information is available anywhere and anytime without the need to directly access the server.* |
| Fraud | *CI World alerts specified users to review and take corrective action if necessary, e.g. withdraw an asset from the supply chain pending further investigation.* |
| Interface | *CI World can provide information for third party systems, e.g. feeds for export systems or invoicing.* |
| Extent of trials | *CI World can be implemented as a pilot in the first instance, either as a subset or reduced number of supply chains, of the whole project.* |
| Hardware requirements/ used | *CI World can be delivered as a hosted system accessed via a web browser or customers can host the system themselves which requires an application server and a web server. In addition, PDAs are required to run the field data collection module, CI Mobile.* |
| Software requirements/used | *CI World software licences.* |
| Field user requirements | *Train the trainer and end-user training provided. Training requirements depend on role.* |
| Field infrastructure requirements | *Internet browser, PDAs, mobile telephone network or if poor connectivity either store data locally or collect on a USB stick for postal delivery.* |
| High-tech vs. low-tech | *CI supports both high-tech and low-tech capabilities, from real-time online connectivity via PDA to paper-based data collection for later input into the system.* |
| System costs | *Costs are dependent on requirements of each project however typically CI World can cost from $0.50 to $1.00 per cubic metre of tropical timber.* |
| Adaptation | *CI World can be configured to accommodate legislative or compliance requirements such as the EU's Timber Regulation, Lacey Act, FLEGT or certification standards. Currently CI World is being implemented as the national wood tracking system for the FLEGT pilots in Ghana, Cameroon and the Republic of Congo.* |
| CITES | *CI World can be used to track CITES listed timber.* |
| Associated costs | *PDAs are required to run the field data collection software, CI Mobile.* |
| Summary Strengths and Opportunities | |
| Strengths | *CI World is a unique technology platform that provides fully auditable traceability, automated CoC management and Legality Assurance System functionality for extended natural resources global supply chains. Helveta has proven experience working in emerging markets transforming natural resources sectors, such as timber, and enabling compliance with new legislation such as the EU's FLEGT program.* |
| Opportunities | *Helveta will continue to support tropical timber producing countries, as they sign VPAs with the EU, and enable them to comply with FLEGT requirements, by providing them with national wood tracking systems. Helveta will also provide compliance software solutions for new and existing legislation, such as the US Lacey Act, the EU Timber Regulation and in other natural resources such as minerals and bio fuels.* |
| Comments | |
| *Helveta has developed CI World™ supply chain assurance software for timber, agricultural commodities and extractive industries. CI World™ is a unique technology platform that provides fully auditable traceability, automated Chain of Custody management and Legality Assurance System functionality for global supply chains. For example, CI World is used to monitor over 2.7m hectares of forest across the Congo and Amazon basins and in South East Asia, delivering complete traceability and transparency to better manage illegal logging, recover lost timber duty, increase price premiums and empower local communities, as well as meeting import/export restrictions. There is an increasing demand – both from consumers and from governments – for legally sourced commodities, as demonstrated by the recent extension of the Lacey Act in the US and the FLEGT initiative in the EU means that supply chain management must become more rigorous. The weaknesses of paper-based systems are well-documented (they are difficult to oversee and audit properly, the data can be compromised and the records easily altered) and the safeguards provided by fully automated processes, such as CI World, will have to replace them so that suppliers, producers and importers can ensure their supply chains meet these new mandated standards.*<br>*CI World improves environmental management and supply chain governance by using technology in place of traditional paper-based systems or indeed no system at all. The CI World platform provides supply chain management and asset (materials or products) tracking through an integrated modular suite of software and enables real time end-to-end tracking of assets across any complex supply chain possible. Having been designed around the particular challenges posed by emerging markets, the system goes far beyond traditional chain of custody solutions. CI World provides complete traceability and transparency at every stage of the supply chain, leading to better management of illegal logging or harvesting, the recovery of lost taxes and compliance with import/export restrictions. It also allows producers to levy a price premium for guaranteed sustainability and empowers local communities.* | |

| Tracking Service Provider Assessment Sheet | |
|---|---|
| Organizational overview | |
| Company name | *Historic Futures Ltd* |
| Established year | *2003* |
| Office HQ | *Carpenters' Workshops, Blenheim Palace Sawmills, Combe, Witney, OXON, OX29 8ET, England, Phone: +44 (0) 1993 886420* |
| Office country and city | *5 offices: HQ (UK), India (Bangalore), China (Shantou), Bangladesh (Dhaka), Turkey (Izmir)* |
| Office staff | *36* |
| Software developers and software architects | *11* |
| Field sites | *0* |
| Field site country and city | *0* |
| Field staff | *0* |
| Field expertise | *0* |
| Clients | *>20 (mixture of global brands, retailers and labelling initiatives)* |
| countries | *See above* |
| Partner companies | *FSC* |
| Experience | *Textiles / mining and minerals / timber / leather* |
| Technology - Product name | |
| Name | *String* |
| Marking methods used | *String provides a mechanism for batch level production information to be shared between actors in the supply-chain, making use of existing identification mechanisms (e.g. batch / lot #, invoice #, shipment ref # etc.) to provide traceability from raw material to finished goods, including through complex transformational processes.* |
| Data transfer methods used | *Secure web user interface and bi-directional API, automated e-mail dropbox* |
| Data security | *ISMS in place. ISO 27000 later this year* |
| Reconciliation | *Each organisation in the chain is responsible for entering data relating to the processes they carry out themselves. Customers and suppliers use a 'handshake' mechanism to confirm that the data already entered by the previous organisation is correct before entering their own data.* |
| User friendliness | *As an online service it is essential that the system is readily available even in areas where bandwidth is restricted. HF has partnered with CDNetworks to improve the speed of connection by 300% in remote locations.*<br>*A spreadsheet processor has also been introduced allowing data entry to be completed offline. The spreadsheet can then be emailed to a unique dropbox address for processing at the server. This system reduces data entry time by 80%, simplifying adoption of the system through the use of familiar spreadsheet and email tools.* |
| Stages | *Each stage of the supply chain can use the system, from retailers back to the forest level.* |
| Commodities | *The system is designed to be used with any product but can be tailored for specific markets (e.g. products derived from forests / textiles etc.). It is able to maintain traceability through transformational processes, blending processes and through complex extended supply chains.* |
| Data storage | *Fully hosted, secure web application* |
| Operating software | *The system is web-based with no software to install. Supported on IE and Firefox browsers* |
| Physical vs. input output | *String joins inputs and outputs of processes throughout the chain to maintain traceability.* |
| Planning data capability | *A recording tool, not a planning tool, but can be interfaced to other planning tools via the API.* |
| Stock management capability | *The system can be used to maintain stock control if it is used to record all products within an organisation, as it maintains an inventory of product that is depleted as products is allocated to production processes.* |
| Monitoring capability | *n/a* |
| Ability to identify discrepancies | *The system enables customers at all stages in the supply chain to request specific information from their suppliers. If this data is missing, or if certain validation rules are not met (for example, validity dates on a certificate), then the data will be marked as incomplete or invalid. Reports can be run against data from the whole supply chain to give a complete picture of the available data.* |
| Ability to resolve discrepancies | *String is a data recording tool, enabling suppliers to record their production information, and for customers at all stages in the chain to view this data. Any discrepancies will need to be resolved between customer, supplier and auditor, however, String makes pinpointing these issues and accessing the data to resolve them a much simpler process.* |
| Audit capacity | *Built-in audit tools for the third party audit* |
| Remote access | *String is an ideal tool for remote auditing. The Marine Stewardship Council (MSC) is using String as a basis for the Online Assessment tool (OLA) for independent restaurants. This has dramatically reduced the cost of certification and broadened the network of companies who are able to obtain MSC certification.* |

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| Fraud | *String does not prevent fraud, but it does make it much more difficult, and much easier to identify if it occurs. The 'handshake' mechanism between customer and supplier means that collusion along a whole supply chain would be necessary in order to enable deliberate falsification of data. Tracing products at batch level, and maintaining inventory levels within String, makes it much more difficult for quantities of certified product to be falsified, and as each organisation is responsible for their own data there is a clear record of who recorded what and when, on a continual basis. This gives a level of confidence in the data that can support the audit process.* |
| Interface | *Web user interface and API* |
| Extent of trials | *String has been piloted in a number of industries including timber, textiles, and minerals. The system is now being rolled out at scale for major retailers, and is being adopted by the FSC to support the Chain of Custody standard.* |
| Hardware requirements/ used | *None* |
| Software requirements/used | *None (web-based system)* |
| Field user requirements | *A user can be trained in a 1-2 hour online training session* |
| Field infrastructure requirements | *Each user must have access to the internet, although much of the data entry can be managed offline if necessary, with an internet connection required only to email the data to the system.* |
| High-tech vs. low-tech | *Can be low-tech (simple use of web interface) or high tech (fully integrated to back office systems)* |
| System costs | *String costs relate to the number of 'sites' and 'users' required, not to the volume of product being recorded. String is available to organizations within the supply chain for a one off setup fee of £500, and a yearly subscription fee of £720. This includes training, and access for up to three users, recording data for up to three production sites.* |
| Adaptation | *String is highly customisable, and can be configured to record any data about any type of product. To do this, a new 'dataset' will be created, enabling organizations within the chain to request specific data that relates to the latest compliance requirements.* |
| CITES | *Identification of CITES relevant product flows could be enabled through species identification via the custom data mechanism in String* |
| Associated costs | *Additional fees for technical integration work, change / project management dependent on the requirements.* |
| Summary Strengths and Opportunities | |
| Strengths | *The core strength of String is the ability to trace any product, through complex extended supply chains and through transformational processes. This enables the traceability not just from forest to timber or rough planks, but on to finished furniture, paper or other wood products, giving a complete supply chain history for each batch of the product.* |
| Opportunities | *Help collect and validate data, on-line assessments, identify supply chains, country of origin, forest of origin, inputs and outputs to a process /organization.* |

## Tracking Service Provider Assessment Sheet

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|---|---|
| Organizational overview | |
| Company name | *Radian Teknoinfo, PT* |
| Established year | *2010* |
| Office HQ | *The Classic Building, Jl Bonavista Raya No 1, Lebak Bulus, South Jakarta 12440* |
| Office country and city | *HQ in Jakarta, Indonesia* |
| Office staff | *9* |
| Software developers and software architects | *2* |
| Field sites | *4* |
| Field site country and city | *Surabaya, East Java, Indonesia; Bekasi, West Java, Indonesia; Muara Beliti, South Sumatera, Indonesia; Empat Lawang, South Sumatera, Indonesia* |
| Field staff | *2* |
| Field expertise | *ERP Implementation* |
| Clients | *3* |
| Countries | *Indonesia* |
| Partner companies | *n/a* |
| Experience | *Distribution, Food and Beverage, Seafood Industry, and Network Architecture* |
| Technology - Product name | |
| Name | *Microsoft Dynamics AX 2009* |

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| Marking methods used | *Manual marking, GIS integrated, Barcode, RFID* |
| Data transfer methods used | *Client Server* |
| Data security | *VPN over internet* |
| Reconciliation | *Using centralised database* |
| User friendliness | *Business Process re-engineering is part of the implementation process, user training and support (onsite and remote)* |
| Stages | *Primary to Retailer (all processes)* |
| Commodities | *Timber and non-timber forest products* |
| Data storage | *Centralised database server* |
| Operating software | *Microsoft Windows Server and Workstation* |
| Physical vs. input output | *Depend on the input method, major CoC standards requirements e.g. FSC, PEFC, legality are embedded into the system* |
| Planning data capability | *All integrated, Microsoft Dynamics AX itself is an ERP class software* |
| Stock management capability | *Stock management module is integrated with tailored reporting and overview, based on client's preference* |
| Monitoring capability | *The system sets certain parameters of multiple category of materials where it can be tracked down individual claim categories* |
| Ability to identify discrepancies | *Yes, The system tracks all the transaction for each process and can be reviewed by report* |
| Ability to resolve discrepancies | *The system itself checks for the possibility of discrepancies and ability to adjust the transaction based on organizational policies.* |
| Audit capacity | *n/a* |
| Remote access | *Database management, functionality support, modules upgrade/maintenance, performance monitoring, data entry -all function, except physical stock opname process* |
| Fraud | *Volume input is set as baseline of production conversion factor e.g. it will halt the system for related data, if the data entry does not follow the system logic* |
| Interface | *It uses Microsoft user interface* |
| Extent of trials | *It's being implemented with our current client* |
| Hardware requirements/ used | *Server Grade Computers for database and application server(s); meet the requirement Microsoft Windows 7 for user workstation* |
| Software requirements/used | *Dynamics AX Client, Windows Server, Windows workstation* |
| Field user requirements | *2 weeks* |
| Field infrastructure requirements | *Internet Connection between sites* |
| High-tech vs. low-tech | *The system can be accessed manually or through web-based application to connect with upstream supplier and/or downstream buyer* |
| System costs | *Vary upon size and complexity of the scale* |
| Adaptation | *FSC CoC, PEFC, CoC legality standard requirements have been built into the system* |
| CITES | *n/a* |
| Associated costs | *Hardware and peripheral needed* |
| Summary Strengths | |
| Strengths | *An ERP class software that has the ability to do timber tracking compliance with international based CoC standard* |
| Comments | |
| *RADIAN provides IT services and solutions to companies that wish to leverage their competitive advantage by initiating business process transformation supported with sophisticated information technology; Microsoft Dynamics AX. It is a comprehensive enterprise resource planning (ERP) solution for midsize and larger organizations that empowers people to work effectively, manage change, and compete globally. It makes it easy to operate across locations and countries by standardising processes, providing visibility across the business organisation, and helping to simplify compliance.*<br>*These are sample of lists of Microsoft Dynamics AX modules which can be tailored to the client's business best practices:*<br>*• Company Setup*<br>*Multi-currency, Multi-sites*<br>*• Financials*<br>*General Ledger, Account Receivables, Account Payables, Bank Management, Cash Management, Expense Management*<br>*• Order to Cash*<br>*Sales Quotation, Sales Order, Sales Order-direct delivery, Delivery Order, Goods Delivery/packing slip, Invoicing, Payment, Sales Return, Pricing/Promotion/Discount*<br>*• Procure to Pay*<br>*Purchase Quotation, Purchase Order, Receipt List, Goods Receipt/Packing slip, Invoicing, Payment, Purchase Return, Pricing/Discount*<br>*• Logistics*<br>*Item Master, Batch Management, Item Transfers, Item Scrap, Item Counting, Warehouse Management, In-transit Goods Management* | |

| Tracking Service Provider Assessment Sheet | |
|---|---|
| Organizational overview | |
| Company name | *Rainforest Alliance- Credit 360°* |
| Established year | *1987* |
| Office HQ | *Rainforest Alliance, 665 Broadway, Suite 500, New York, NY 10012 USA*<br>*Phone: +1 (212) 677-1900 Fax: +1 (212) 677-2187 Email: info@ra.org* |
| Office country and city | *20 Offices: North America; Indonesia; Central America, South America, Mexico, Africa, Europe* |
| Office staff | *350* |
| Software developers and software architects | *2* |
| Field sites | *70* |
| Field site country and city | *Indonesia; Costa Rica; Ghana; Guatemala; Netherlands; Bolivia; Mexico; United Kingdom; Ecuador; Canada; Honduras; Peru* |
| Field staff | *>70* |
| Field expertise | *The system is in final stages of development and has been trialled with 3 clients to date (August 2011)* |
| Clients | *3* |
| Countries | *Planned worldwide* |
| Partner companies | *NEPCon and Imaflora* |
| Experience | *Yes - Climate, Agriculture and Tourism* |
| Technology - Product name | |
| Name | *SmartSource Platform* |
| Marking methods used | *n/a* |
| Data transfer methods used | *The Rainforest Alliance SmartSource Platform is a managed web-based application. It is accessed over the internet through a secure website (HTTPS) using just a web browser. All data is entered using the web application interface.* |
| Data security | *Full security whitepapers are available however in summary all hardware is in a secured data center in London Docklands (Telecity). Access requires PAC tag, photo ID and user must be on approved list. All visits must be approved in advance.*<br>*All servers are located behind a load-balancing firewall. The firewall is equipped with external and internal intrusion detection systems (Snort and Tripwire). By default we lock-down all ports apart from port 80 and 443, and only open ports where necessary. In the case of physical failure of one of the firewalls, the second automatically takes its place.*<br>*We have standard hardened server specification documents (in cvs\csr\doc\tech) which are used for all new server builds. All front-facing server operating systems are automatically patched using APT for Debian, Unbreakable Linux Network for Oracle Enterprise Linux servers and Microsoft's Automated patching service. Non front-facing servers (such as the databases which are on a separate sub-net), are not automatically patched. This is because they are typically more sensitive to change and we only apply patches if they are applicable, and once they have been sufficiently tested in a development environment. Our managed service architecture includes fail-over equipment at all levels: switches, firewalls, webservers and database servers.*<br>*Offsite backups are encrypted and taken over an IPSEC VPN to a separate facility*<br>*User Access:*<br>*The system supports authentication via a strong-password, or can be configured to require users to authenticate via X509 certificates along with a number of policies and a full audit log is available.* |
| Reconciliation | *n/a* |
| User friendliness | *The system is designed to guide users through the full data collection process required for participation in the Rainforest Alliance SmartSource program. Potentially complicated tasks are simplified, with extensive use of wizards to walk users through step-by-step.*<br>*This is important when accommodating novice and occasional supplier users down the chain. The system also provides video walkthroughs showing users what to do on a given page or section and provides relevant links to helpful resources and guidance documents.* |
| Stages | *All stages can be assessed using the system from the Forest through to the Retailer.* |
| Commodities | *Any commodity containing wood or pulp based products* |

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| Data storage | *All data collected through the Rainforest Alliance SmartSource Platform web application is stored in a central Oracle database located in a secure cage at Telecity in London Docklands. The hosting center and location provides us with an industry leading environment in which to host equipment. Docklands is the main peering point in the UK and as such provides excellent connectivity to Europe, the Americas and the rest of the world. Redbus provides fully redundant power, fire suppression and physical security systems, as well as engineers on site 24 hours a day. TeleCity is ISO-27001 and ISO-9001 accredited.*<br>*Our Oracle database runs DataGuard which means that all transactions are committed to two slave databases at the same time as the master database. In the event of failure, a slave machine can be promoted to master within a few minutes.*<br>*Additionally database archive logs are continuously moved to a secondary database server at our disaster recovery site in Cambridge via a secure point-to-point connection. In the event of a disaster at Telecity, all services can be resumed from the disaster recovery site within hours and with no data loss.* |
| Operating software | *The system is delivered as 'Software as a Service' (SaaS) and therefore the end users only need a web browser.* |
| Physical vs. input output | *Our system is not a physical tracking system. The reporting relies on existing CoC Certification systems as meeting requirements for physical tracking and certification claims.* |
| Planning data capability | *The SmartSource Platform is specifically designed to capture all data required for Rainforest Alliance SmartSource program participation. As such inputs from external systems are not required.*<br>*The system automatically manages the data capture workflow from a purchasing company (the SmartSource member company) down the supply chain back to the forest and the majority of data entry is done by suppliers via the web application interface. This paradigm is designed to be a "low-administration" approach down the supply chain. As such a requirement to integrate with external systems down the chain would increase the level of management of suppliers and mitigate these benefits.*<br>*SmartSource member companies only need to record what they buy and from whom. As well as a web interface for entering this data, we can also offer them assistance uploading initial product data in order to "kick-start" their data collection process.* |
| Stock management capability | *The Rainforest Alliance SmartSource program is not (by design) a system that relies on integration with stock control systems. Data collection is driven by an initial entry / request for data from a SmartSource member company about products they purchase. They record the amount they purchase and who they purchase each product from.*<br>*This initiates a request to their suppliers to enter data. Those suppliers – as well as entering certification details about their company - are required to breakdown each product supplied into its component parts and materials; with supplier details for each one. This initiates a request to their suppliers in turn and this process repeats, right down the supply chain.*<br>*At each level companies are required to record:*<br>*How wood/fibre materials are harvested where they are the "harvesting" company (e.g. they harvest wood materials from the forest);*<br>*The details of each supplier where they are not the "harvesting" company (and buy in parts and materials that they use);*<br>*A tailored set of documents and supporting information based on any provenance or accreditation claims made.*<br>*This data allows reports on the breakdown of wood and fibre in products purchased by the SmartSource member company to be produced and allows provenance to be tracked and audited down the supply chain.* |
| Monitoring capability | *n/a, monitoring of timber flows is not the objective of the system.* |
| Ability to identify discrepancies | *Through a second or third party validation of supplier claims down the supply chain.* |
| Ability to resolve discrepancies | *Through the issuance of Corrective Actions proposed by Rainforest Alliance and enforced by the Client Company.* |
| Audit capacity | *We have international audit capacity.* |
| Remote access | *All validations are conducted via desk, relying on third party certifications for those that require it.* |
| Fraud | *All system users are provided unique login details: username and password. The password is only known by the user, who can only see their own information (different user rights levels)* |
| Interface | *The system is designed as a standalone platform* |
| Extent of trials | *Trials are currently in progress* |
| Hardware requirements/ used | *None as the system is delivered as 'Software as a Service' (SaaS) and therefore the end users only need a web browser.* |
| Software requirements/used | *A web browser* |
| Field user requirements | *The system has inbuilt help and training guides. For a field user if a training session was required then 15 minutes would be adequate.* |
| Field infrastructure requirements | *Internet access is required.* |

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| High-tech vs. low-tech | *The SmartSource platform is a managed web-based application. It can be accessed over the internet using just a web browser. No additional software is required, which is highly desirable for a system that relies on collecting data from a range of companies, users and locations.*<br>*The SmartSource web application is designed to capture all data required for the Rainforest Alliance SmartSource program. This includes asking Rainforest Alliance specific questions and guiding users through a step-by-step process of classifying wood and fibre materials into Rainforest Alliance accreditation categories. As such companies need to enter information using the system, to follow the correct assessment and classification workflow.* |
| System costs | *n/a; the system is for a company to use at the end of a supply chain (large retailer, for example)* |
| Adaptation | *Our system is updated with most pertinent legislation and information related to timber/fibre extraction.* |
| CITES | *Yes* |
| Associated costs | *No* |
| Summary Strengths and Opportunities | |
| Strengths | • *The Rainforest Alliance is an internationally recognized NGO with a reputable knowledge and experience of forestry issues for more than 25 years. The SmartSource program brings this expertise to retailers and brand companies that want to comply with timber legislation or with their Responsible Timber Purchasing Policies.*<br>• *The SmartSource platform has been designed to be user friendly. The interface is easy to understand and takes users step-by-step through the data collection process, in order to ensure that all required information has been answered fully.*<br>• *The tool's wood and paper accreditation wizard will ask only the pertinent questions based on the risk perception of the sources.*<br>• *Initial validation is made from the moment the data is entered: supporting documentation for all claims made is uploaded onto the system.*<br>• *The tool collects information right down the supply chain to the forest level. Information can then easily be checked and any inconsistencies in claims made can be identified.*<br>• *Confidentiality is maintained all throughout the system: each user (with the exception of Rainforest Alliance SmartSource staff) only sees their own data and the basic information of their direct customers and direct suppliers.*<br>• *Once the information has been gathered customized reports can be extracted: e.g. timber categories per product, per country, countries of origin of paper based products, forest footprint etc.* |
| Opportunities | • *The SmartSource Platform is the only system of its kind in the market: a friendly, robust and detailed web based tool built to collect information for timber based products down to the forest source and with the reliability of an internationally recognized forestry expert NGO, the Rainforest Alliance.*<br>• *The ability to use just one tool to:*<br>*a. collect data from suppliers into a central data repository*<br>*b. carry out a first risk assessment of timber sources, by categorizing them into different timber categories according to Rainforest Alliance's Responsible Timber Sources and identifying risks and opportunities in the supply chain*<br>*c. perform a first validation of category claims made by asking for supporting documentation from all suppliers in the supply chain - all while respecting confidentiality. (This is unprecedented and has already been very well received by international corporate retailers during an initial pilot process)*<br>• *Another good opportunity will be the ability for supplier companies to keep a "pool" of product information. For example, if a supplier has already entered information for a product purchased by one client, the tool will not require them to enter the same information again if another client on the system is buying that product.*<br>• *The SmartSource Platform sees the opportunity of serving retailers and brand companies worldwide with just one system, which will ensure that the same standards are met for the different companies. The more companies that join our SmartSource Platform, the more efficiencies and shared knowledge will take place - which will be an asset to both retailers (and brand companies) and timber suppliers.* |
| Comments | |
| *The SmartSource platform provides a framework and workflow for collecting data right the way down a given supply chain.*<br>*The system is specifically designed to meet the wood and paper sourcing data collection requirements of the Rainforest Alliance SmartSource program. At each level in a supply chain, provenance and accreditation data is collected from supplier companies about the products they sell, as well as data about the suppliers themselves.*<br>*The platform is a managed web-based application. It can be accessed over the internet using a web browser without installing additional software, which is highly desirable for a system that relies on collecting data from a range of companies, users and locations.*<br>*The system provides a central data collection repository. Users access the system by logging into a secure website with a username and password. They then enter all requested data directly. This centralised web-based approach avoids the pitfalls and time-cost of managing a data collection process via more traditional means - such as emailing spreadsheets back and forth between yourself and your suppliers.* | |

| Tracking Service Provider Assessment Sheet | |
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| Organizational overview | |
| Company Name | *SICPA* |
| Established year | *1927* |
| Office HQ | *Avenue de Florissant, 41; 1008 Prilly; Switzerland* |
| Office country & city | *28 locations - on all continents.* |
| Office staff | *100+* |
| Software Developers and Software Architects | *200+* |
| Field sites | *n/a* |
| Field site country & city | *n/a* |
| Field staff | *1200+ (deployment and customer service teams)* |
| Field expertise | *Thanks to its extensive experience in product identification, product flow monitoring and product traceability across various industry sectors, SICPA has accumulated a thorough expertise in ID creation, in code and data capture, in large scale data management and hosting, in business intelligence, data mining and reporting, and in software, hardware and IT design and integration. SICPA has contributed to the definition of user requirement specifications on numerous occasions, and has developed a strong expertise in end-to-end project management applied to complex projects. SICPA has devised a detailed project plan and roll-out methodology that drives projects to completion in a responsive, cost-efficient and timely manner.* |
| Clients | *500+ (public and private sector)* |
| Countries | *On all continents* |
| Partner companies | *SICPA welcomes any forms of partnership with third parties. SICPA can also act as sole contracting partner for project management, solution design, development, testing, validation and deployment. Once up and running, the solution can be transferred to the customer and/or be operated by SICPA or partners.* |
| Experience | *From small to very large and complex track and trace systems in industries such as food and beverage, healthcare, agri-chemicals, agricultural commodities, luxury goods, fast moving consumer goods.* |
| Technology - Product name | |
| Name | *SICPA has developed a framework platform called GREENZONE®, used as core development for each specific business solution. SICPA Timber tracking solution is based on this framework.* |
| Marking methods used | *Each item is serialized and fully tracked through events such as aggregation, disaggregation, storage, distribution... Each component could be marked with any usual method. Today we integrate RFID tags, 1D barcode & 2D datamatrix coded labels or tags, as well as direct marking on products with inkjet, laser or mechanical processes.* |
| Data transfer methods used | *Various means using web services, thin client & data collection, Remote data synchronization through narrow bandwidth communication support (satellites, GSM network, modem, etc). Automated upload of captured data* |
| Data security | *Access control based on user/role management. Secured and encrypted communication (SSL, HTTPs, eToken for 3rd party). Server-side protected by a firewall and access controlled through an isolated front-end server.* |
| Reconciliation | *GREENZONE® platform is based on EPCIS standards where each event entered into the system is time-stamped according to the actual event timing. Reconciliation is performed through a configurable rule-based system.* |
| User friendliness | *Compliant with any personal computer running on a standard & up-to-date web browser. For ergonomic reason, each interface was designed to be used on a tactile device with graphical interface. The system is open to mobile phones and tablet technology.* |
| Stages | *The system is fully configurable and scalable. Adding/removing stages and actions, like check points along the chain of custody can be performed "on the fly" without having to restart the backend. Workflows are modeled into the system to ensure that each step transition is valid. Workflow changes or additions could be accommodated even in operational mode.* |
| Commodities | *Any commodity or container that can be individually identified by marking or by any other mean. This includes logs and wood products, food products, natural products, manufactured goods, or any valuable product which need to be traced at different granularity levels along its supply chain.* |
| Data storage | *The infrastructure is distributed as standard 3-tier architecture. Services and business logic are on the server-side. Servers are connected to the internet through the front-end web services. Server-side is protected by a firewall.* |
| Operating software | *Any operating system running a recent web-browser can accommodate the client web-based application. Specific application for field equipment is designed to comply with standard modern platform like Windows Mobile, IOS or Android and include geo-localisation capabilities.* |

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| Physical vs. input output | *A specific module of the system is dealing with the CoC requirements, based on business intelligence rules and reporting. This module can be configured to generate processed wood waybill or deal with percentage based claims, for example.* |
| Planning data capability | *GREENZONE® platform is designed to be integrated or interoperable with third party systems like ERPs. Integration can be done through service oriented architecture or formatted files exchange like xml, iDocs, CSV. The main objective is to link tracking information with enterprise resource processes and documents, such as delivery documents, waybills, invoices... The second objective is to avoid entering the same information into two different systems: the ERP and the tracking system. Data exchange is used to bridge the 2 systems and collect information from one system only.* |
| Stock management capability | *Stock management can be done in an effective manner by collecting all in and out event information for a given location and by reconciliation of the actual vs. logical information.* |
| Monitoring capability | *A flow of each individual item can be reported through reporting tool or graphically though a Geographic Information System. Such flow is constructed based on time-based event capture. Flows can also be reported per group of individuals (same time period, same geographical relation, same batch, and same delivery).* |
| Ability to identify discrepancies | *The workflow component is responsible for keeping track of the state of different ongoing workflows. Together with predefined standard expected flows, an alerting system automatically reports on any suspicious or inconsistent flow.* |
| Ability to resolve discrepancies | *Monitoring tool can be used for the legitimate user to analyze further the identified discrepancy and help on decision about corrective action. Error correction tool allows legitimate users to correct invalid information in a fully auditable manner.* |
| Audit capacity | *SICPA GREENZONE® solution includes audit tools, reporting and accounting functionalities. Audits can either be performed by the product owner, an external audit or inspection company, or by SICPA. Various levels of audit functions are implemented to answer all usual case of auditing. Dedicated access to the data is provided to the users to allow them to carry out the reconciliation of collected data with audited reality.* |
| Remotely | *Any action can be done remotely through the web-based interface. Access is subject on having the legitimate user-right access and sometimes subject on being on the right infrastructure for security reasons.* |
| Fraud | *On the field: through the workflow component and together with the automated alerting system, as described previously. The system also controls the fraud through the strict user control management linking any event or action to a user. Any action and data entered into the system is being logged and could be audited.* |
| Interface | *Same as for ERP: GREENZONE® system provides means to exchange information in various manners. Service Oriented Architecture solution or standardise data exchange format (XML) are available and usually used to communicate with heterogeneous systems. To the other extreme, reporting tool can also be used to generate paper documents serving various administrative needs.* |
| Extent of trials | *So far, no trials have been made in the forestry sector, but the GREENZONE® platform has already been the corner stone of many traceability projects in various industry sectors.* |
| Hardware requirements/ used | *Front end, back end and database can be hosted and managed by SICPA or by the customer. End-users can access the system with standard computer equipment connected to internet via a simple web browser.* |
| Software requirements/used | *The entire core infrastructure is provided with proper software installed and configured by SICPA. End user doesn't need specific software to access the system. All interaction can be done through web browser.* |
| Field user requirements | *Our standard procedure follows a "train the trainer" approach. A training session can take from one day to one week depending on the complexity of operations provided within a given implementation. The training is focused on a user-role approach because each user type has a different access and different interactions with the system.* |
| Field infrastructure requirements | *To operate on the field a dedicated handheld platform will be provided. This platform is a portable scanner capable to operate in connected and disconnected mode. When operating in disconnected mode, all the data will be kept on the device until its next connection to a network (GPRS / internet)* |
| High-tech vs. Low-tech | *Our system provides means to connect to heterogeneous system. When no IT infrastructure is available at all, paper information can be extracted from the system and imported manually through templates documents. Field scanner can also be used for many basic operations.* |
| System costs | *Cost is subject to the project specifications and to the service level agreement. It includes the front-end, the SaaS, the maintenance and support services costs. Our pricing model is adaptive and can for instance be in the form of an annual flat service charge or established per cubic meters.* |
| Adaptation | *Timber specific modules have been added to our core system and its flexible process workflow. As such, GREENZONE® meets the FLEGT, Lacey Act and Timber regulation requirements. Further levels of configurations can be carried out based on project specifications.* |

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| CITES | *Even though it has not yet been used to track CITES listed timbers, the GREENZONE® Timber platform has been designed after a thorough analysis of the needs and requirements of the forestry sector and could easily be integrated in this environment's operations.* |
| Associated costs | *None, SICPA offers a full solution in a SaaS (Software as a Service) package.* |
| Summary Strengths | |
| Strengths | *modularity, flexibility, adaptability, all inclusive service, time to implement, compliance with regulations, global footprint for deployment, maintenance and support services, demonstrated experience in design, development and implementation of complex and large-scale track and trace projects.* |
| Comments | |
| *SICPA has developed a framework platform called GREENZONE®, used as core development for each specific business solution. The system is fully configurable and scalable, and has already been used as a serialisation and traceability platform across various industry sectors.*<br>*SICPA being familiar with the requirements of the wood and timber industry, its supply chain needs and related SOP's, timber specific modules have been added to the GREENZONE® core system. As such, GREENZONE® meets the FLEGT, Lacey Act and Timber regulation requirements, thus providing legality and origin assurance to the forestry and timber management, processing and trading organizations.*<br>*Besides providing forest management as well as end-to-end track and trace functionalities, GREENZONE® manages aggregation, disaggregation and exceptions, which are all critical to enable visibility throughout the timber processing and transportation stages.*<br>*GREENZONE® is offered as a Software as a Service (SaaS) and is based on EPCIS standards meaning that each event entered into the system is time-stamped according to the actual event timing.*<br>*GREENZONE® is designed to easily integrate or be interoperable with third party systems like ERPs. Graphic interfaces are very intuitive and user-friendly.*<br>*GREENZONE® provides means to connect to heterogeneous systems. When no IT infrastructure is available at all, paper information can be extracted from the system and imported manually through templates documents. Field scanner can also be used for many basic operations.*<br>*GREENZONE® includes audit tools, reporting and accounting functionalities. Audits can either be performed by the forest management organisation, an external audit or inspection company, or by SICPA.* | |

| **Tracking Service Provider Assessment Sheet** | |
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| Organizational overview | |
| Company name | *TimberSmart Ltd* |
| Established year | *1996* |
| Office HQ | *PO Box 140, Albany Village, Albany, Auckland, New Zealand* |
| Office country and city | *2 locations; Auckland, New Zealand and Melbourne, Australia* |
| Office staff | *14* |
| Software developers and software architects | *12* |
| Field sites | *130 sites* |
| Field site country and city | *New Zealand; 70 sites and Australian 60 sites* |
| Field staff | *12 staff; our software developers and software architects are also involved with field implementation and maintenance* |
| Field expertise | *We have extensive experience throughout the supply chain from forest, processing, distribution, to timber retail* |
| Clients | *120 clients* |
| Countries | *Australia, New Zealand, and Papua New Guinea* |
| Partner companies | *Yes, we partner with suppliers of handheld computers, bar code printers, and GIS systems* |
| Experience | *TimberSmart Ltd is involved exclusively with the timber industry* |
| Technology - Product name | |
| Name | *TimberSmart* |
| Marking methods used | *Product marking is undertaken with system generated barcoded labels* |
| Data transfer methods used | *Data transfer is accomplished in a number of ways including direct file transfer, barcode scanners, email, FTP, HTTP.* |
| Data security | *Standard Microsoft security - password and user name driven* |
| Reconciliation | *The system has in-built functionality which allows easy reconciliation of physical vs. system* |
| User friendliness | *The TimberSmart system has been developed for timber industry participants; it has been designed for ease of data entry, and has a number of in-built error checking routines* |
| Stages | *The TimberSmart system can be accessed at any stage down the supply chain* |
| Commodities | *The TimberSmart system is user configurable and can be setup for any commodity and method of measurement* |

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| Data storage | *Data is ultimately stored on a server, though some data may be stored short-term on a hand-held computer* |
| Operating software | *Standard Microsoft systems - including Windows Server 2008 R2, SQL server, Biztalk Server, Office 2010, Windows 7* |
| Physical vs. input output | *The system works well with CoC processes and procedures and is used by the majority of sawn timber producers in Australia and New Zealand to provide the underlying system for FSC certification* |
| Planning data capability | *The TimberSmart system comprises base functionality with a number of "clip-on" modules which can be added to meet the requirements of specific supply chain entities* |
| Stock management capability | *The TimberSmart system enables stock management at each stocking point by enabling a measure of current stock (by appropriate stocking unit) and modifying that stock level as stock items are added or removed.* |
| Monitoring capability | *Specific reports within the system make timber flows transparent* |
| Ability to identify discrepancies | *Purpose developed reports highlight where potential non-compliance may have occurred* |
| Ability to resolve discrepancies | *The TimberSmart system highlights potential areas of non-compliance. The local monitoring entity uses this information to identify the basis for the reported non-compliance and takes corrective action* |
| Audit capacity | *TimberSmart Ltd has external audit partners who can be utilised if required* |
| Remote access | *Standard internet technologies enable the TimberSmart system to be available locally or remotely* |
| Fraud | *The TimberSmart minimises fraudulent activity in a range of ways. These include system design, data encryption, password protection, lockdown on specific parts of the system, transparent audit trail* |
| Interface | *The TimberSmart system is able to interface to other systems e.g. Electronic customs system?* |
| Extent of trials | *Extensive trials have been undertaken in the Australian hardwood industry* |
| Hardware requirements/ used | *Standard server, hand-held computer, and barcode printer technology* |
| Software requirements/used | *Standard Microsoft systems - including Windows Server 2008 R2, SQL server, Biztalk Server, Office 2010, Windows 7, and TimberSmart applications* |
| Field user requirements | *The number training sessions/days to train a user will be dependent upon the speed of uptake, and the complexity of the task. In general, we would undertake 1 days training prior to that user being involved in the "live" system. Once using the live system, the user would be encouraged to utilise the help desk for any additional training. At the end of the first month a further review would be undertaken. At this time, the user would be expected to be autonomous.* |
| Field infrastructure requirements | *TimberSmart Ltd will configure the system to meet whatever infrastructure exists. In an ideal world there would be access to the internet through both wired and wireless gateways. In reality this access might be constrained. In these circumstances the TimberSmart system will use the memory capacity of hand-held devices, or local PC to store data on a temporary basis with updating of the server with some form of periodic batch process.* |
| High-tech vs. low-tech | *We are experienced in data transfer between disparate entities particularly where there are differences in technology. We are confident that we are able to design workable systems in most conceivable circumstances* |
| System costs | *Costs will be proposed on a case by case basis* |
| Adaptation | *The system has not had any current integration or association with processes like Lacey, FLEGT, DDR, timber regulation. This capability will be developed as required* |
| CITES | *The system is not currently being used to track any CITES listed timber* |
| Associated costs | *Are there any additional costs which are not directly linked with your system?* |
| Summary Strengths and Opportunities | |
| Strengths | • *Experienced in databases developed specifically for the timber industry*<br>• *Culturally well disposed to work with timber industry personnel in all parts of the supply chain*<br>• *A good understanding of the business processes and technical challenges at all parts of the supply chain* |
| Opportunities | *Opportunities in this area will flow from the trend towards COC certification requirements for forest products output from world indigenous forests* |
| Comments | |
| *The TimberSmart timber tracking system begins with a 100% survey of the relevant forest area to be harvested. Trees which meet harvesting criteria are marked, identified with a unique tag, and mapped per handheld GPS system. At the time of harvesting the logs created from each marked tree are identified with tags which are related to the initial tag on the tree. This data is captured either by hand held or paper based system, and eventually loaded into the TimberSmart database. The unique log identifier follows the log through the log transport system, to the point of stocking at the next processing point. The log inventory system at that point will dispose of the log and output as units (e.g. packets) of the primary processed forest product. Each of these units will have unique identifiers which will be related back to the original log/tree. This primary processed product may be subject to several secondary processing steps, some of which may dispose of the original stocking unit. The TimberSmart system maintains the linkage back to the originating primary processing stocking unit. At some stage, the forest product will be sold and distributed.* | |

| Tracking Service Provider Assessment Sheet | |
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| Organizational overview | |
| Company name | *Track Record Global Ltd* |
| Established year | *2005* |
| Office HQ | *Old Farm, 30 High Street, Finstock, Oxfordshire, UK 0X7 3DW* |
| Office country and city | *UK, Oxford* |
| Office staff | *6* |
| Software developers and software architects | *3* |
| Field sites | *2* |
| Field site country and city | *UK - Oxfordshire (headquarters) and Brighton (customer support center)* |
| Field staff | *3* |
| Field expertise | *nil (online training via website plus call centre telephone, email and VOIP Skype helpdesk support)* |
| Clients | *2000+ including non-timber* |
| Countries | *Approximately 58* |
| Partner companies | *None* |
| Experience | *Non-timber experience is: compliance monitoring and assessment processing for retail* |
| Technology - Product name | |
| Name | *Track Vision* |
| Marking methods used | *Primarily repeat business and customer recommendations based on reputation.* |
| Data transfer methods used | *Web forms; Excel spreadsheet upload; excel spreadsheet over email; email to customer services; letter-post hardcopy (manual processing surcharge)* |
| Data security | *All user access is password protected over HTTPS (256bit SSL); we undergo 6-monthly independent security reviews and have an active security policy and procedures updated twice a year.* |
| Reconciliation | *The data is reconciled in two stages: (1) automatically by the Track Vision workflow system which guides users to enter all varying information required; secondly by our expert assessors which verify and crosscheck the submitted elements which cannot be checked automatically (e.g. scanned documents)* |
| User friendliness | *Track record has a constant commitment to improving the software experience. We employ usability experts and constantly review with our customers the overall experience. TrackVision features a contextual online training and help system to assist users with guided videos and help boxes and customer support chat windows/phone numbers to our customer support center.* |
| Stages | *We support all stages of the Chain of Custody process. By Volume we are most experienced in the retail-end of the chain (UK, Denmark, France, Sweden, Finland, China, etc). However, by number, most of our customers are actually suppliers from around 40 countries worldwide.* |
| Commodities | *All retail products and timber* |
| Data storage | *TrackVision data can be stored in any standard JDBC database. We currently use PostgreSQL for its enterprise capabilities and efficient cost model. All our servers are hosted in a leading physically secure independent hosting facility.* |
| Operating software | *Our server environment runs on Linux. TrackVision users need only a modern HTML5 compliant internet browser, e.g. latest versions of Internet Explorer, Google Chrome or Mozilla Firefox. HTML5 browsers are available on virtually all operating systems for desktops and mobile devices.* |
| Physical vs. input output | *Track Vision supports all methods of process monitoring, e.g. input/output, shift-based, physical separation. The most appropriate method must be implemented in consultation with the customer as a trade-off of practicality vs. requirements/goals.* |
| Planning data capability | *Track vision, for example, automatically gathers data on forthcoming consignments. This is an example of its generic workflow management capability. We also integrate with Geolocation systems (ArcView and Google Earth), financial systems for invoice generation, and with export permit generation systems. Data from/to all these peripheric systems is integrated into the system for planning, etc.* |
| Stock management capability | *Track Vision accomplishes stock management by introducing three critical control points: (1) Check-in - information is entered when product arrives; (2) Check-out - information is entered when the product leaves; (3) Stock-take - information is entered periodically about items in stock, on a sampling, summary or exhaustive basis which can then be reconciled automatically.* |
| Monitoring capability | *Timber flows are effectively monitored through TrackVision by viewing data gathered on critical control points along the chain of custody. Data can be viewed or reported on a raw, summary or customer-configured basis.* |
| Ability to identify discrepancies | *Discrepancies are effectively monitored through TrackVision by automated data reconciliation between critical control points along the chain of custody.* |
| Ability to resolve discrepancies | *Once identifies as explained above, discrepancies are corrected through the built-in workflow system though a mixture of sample-based, exhaustive or manual audited data correction.* |

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| Audit capacity | *The system allows for full auditability. All modifications are logged, tracked and able to be reported upon. In addition, all data entered into Track Vision is automatically checked and reconciled against declared data by users of the system.* |
| Remote access | *All functions can be done remotely via the web interface. The only exception to this is field-based activities where the system must be accessed in offline mode (e.g. through handheld computers) that are subsequently synchronised to the web system.* |
| Fraud | *Track Vision is a computer implementation platform for chain of custody. It prevents fraud by enforcing a formal chain of custody process while enabling all of the data gathering, exception handling, workflow management, audit keeping and documentation to be kept in a computer system. In addition, most of the reconciliation for the chain of custody is automated.* |
| Interface | *We are open to developing specific interfaces as required by customers on a needs basis. We currently integrate with Geolocation systems (ArcView and Google Earth), financial systems for invoice generation, and with export permit generation systems. We have a generic import/export capability in CSV format (spreadsheet) which can be used for other applications.* |
| Extent of trials | *Our web-based system Track View is currently used by buyers and sellers in around 50 countries worldwide.* |
| Hardware requirements/ used | *Mobile phone or normal terminal* |
| Software requirements/used | *TrackVision users need only a modern HTML5 compliant internet browser, e.g. latest versions of Internet Explorer, Google Chrome or Mozilla Firefox. HTML5 browsers are available on virtually all operating systems for desktops and mobile devices.* |
| Field user requirements | *Field users will need half a day training to use the system. TrackVision users need only a modern HTML5 compliant internet browser, e.g. latest versions of Internet Explorer, Google Chrome or Mozilla Firefox. HTML5 browsers are available on virtually all operating systems for desktops and mobile devices.* |
| Field infrastructure requirements | *A mobile device suited to the environmental conditions with appropriate charging/powering mechanisms (car-adaptor, spare batteries, rechargeable batteries, etc). If field-based data synchronisation or reporting is required, IP-based mobile telecoms (GPRS, EDGE, 3G, and Satellite) may be appropriate on a cost-benefit analysis. Track Record makes every effort to make communication traffic small to optimise the experience and reduce operating costs. There is also a capability to work offline, which can be enhanced to customer requirements.* |
| High-tech vs. low-tech | *Track Vision caters for all levels of technology. We have experience in transitioning paper-based systems to computer-based, so we cater for all gradients. Paper based records can be submitted and are processed manually by data entry clerks. The right level of technology for different control points may differ. Track Vision support different levels of technology at different control points driven by customer and deployment requirements and project efficiencies.* |
| System costs | *Assumptions: Estimate in $USD/1000m$^3$ assumption concession in country like Cameroon export volume per annum 30,000m$^3$, round wood export only, 1 pre-harvest team and 2 logging team and 1 log yard (one workstation only) then be equipped with your system. Configuration cost (not inclusive of intellectual property): $2 USD per m$^3$ ($60,000 USD). Deployment cost (inc. server hardware, handheld computers and office laptops, UPS, networking equipment for offices, printing, scanning) $1 USD per m$^3$ ($30,000 USD). Yearly maintenance, service and support (inc. hardware) $2.5 USD per m$^3$ ($75,000 USD)* |
| Adaptation | *At a broad level, the system is already based on capturing information, risk rating it and mitigating risk to fulfil the EUTR and FLEGT. Track Vision's critical control points can be configured (adapted) to suit chain of custody requirements for specific implementation that meet regulations like for example, Lacy Act, DDR, etc.* |
| CITES | *Our system currently tracks some volume of CITES listed timber.* |
| Associated costs | *GIS license (if provided by Track Record), online training, escrow (depending on intellectual property arrangement), tags and tagging mechanisms (depending on project specific requirements), security stationary, electronic documents (e.g. USB keys, RFID labels, etc), integration with existing external systems.* |
| Summary Strengths and Opportunities | |
| Strengths | • *Proven system running since 2005 with retailers*<br>• *Track Record has 100% customer retention and repeat business*<br>• *Dedicated helpdesk support*<br>• *No-nonsense approach driven by strict objectives*<br>• *Reliable royalty-free technology*<br>• *Innovative solutions*<br>• *Integration with existing systems*<br>• *Project management*<br>• *Change management* |
| Opportunities | • *National traceability projects*<br>• *Governmental information systems for due diligence*<br>• *White-brand due diligence, traceability, invoicing and permit issuing service provisions* |

| Comments |
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| *At present, Track Record works for retailers and importers. We expect to be working for Governments, sawmills and concessions holders in the near future. Our team has vast experience in Chain of Custody Systems and due diligence for responsible businesses from both ends of the supply chain*<br>*The Track Record service provides:*<br>• *Traceability*<br>– *Verifying geographic origin of products*<br>– *Critical Control Point product reconciliation*<br>– *Chain-of-Custody for products in locations with limited regulatory capacity*<br>• *Compliance checking for responsible businesses through assessment of internal policies, third party certificates Product and supplier compliance*<br>• *Service for administering due diligence process*<br>– *Administer all compliance checking of supply chain actor performance*<br>– *Fast, efficient, wide ranging reporting of levels of compliance, risk & required mitigation actions* |

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