Abstract

During this decade forest companies have been diversifying their operations and product ranges from traditional forestry, timber and pulp and paper both to energy and biofuels and to RFID technologies, labels, wood and plastic composites, and biochemicals. Basic products and high tech products are developed side by side. Each company desires new profitable products in order to survive and prosper in the fast changing markets. In this rat race environmental, socio-cultural and economic sustainability issues have been pushed aside. The sustainability card is laid on the table only to promote the products. Both the already known and potential unsustainable impacts are hidden under the table. Yet there is a huge variety of sustainability lacks in the products and operations of these companies. This paper examines the environmental, socio-cultural and economic sustainability lacks of three major European forest product companies in their business areas of forests, timber, pulp and paper, biofuels, energy, labels, RFID tags, wood plastic composites and biochemicals – and suggests sustainable solutions to the indentified lacks.

Keywords

Forest management, sustainability, Europe, forest product companies, solutions

1. Introduction

There exist some rather holistic sustainability evaluation instruments that analyze economic, social and environmental dimensions of sustainability: for instance the G3 Guidelines of the GRI Sustainability Reporting Framework for any corporation (GRI, 2010) and the Tool for Sustainability Impact Assessment (ToSIA) for the EU forestry sector (Lindner, 2008; Lindner et al., 2009; Palasuo et al., 2010). However, they do not take account of the increasingly diverse range operations and products of forest industry. Nowadays the forest product companies seem to diversify into two opposite directions: basics (forests, timber, pulp and
paper, biofuels and energy) and high-tech (RFID technologies, labels, wood and plastic composites and biochemicals). As yet no sustainability evaluation measure covers such a wide range of activities comprehensively. This paper explores the sustainability lacks of contemporary multi-range forest product conglomerates. The study reaches out to the new sustainability problems and risks high technology brings to forest industry in addition to pinpointing the unsolved and changing sustainability problems and risks in basic forest industry. In this paper the environmental, socio-cultural and economic sustainability lacks of three large European forest companies, Stora Enso, UPM, and Metsäliitto, will be investigated and possible solutions will be suggested.

2. Methodology

The five largest forest product companies in Europe are: Svenska Cellulosa (SCA) from Sweden, Stora Enso from Finland/Sweden, UPM from Finland, Smurfit Kappa from Ireland and Metsäliitto (including Metsä-Botnia, M-real and Metsä Tissue) from Finland (PricewaterhouseCoopers, 2009). In the following sections cases of the sustainability lacks of the three Finnish-based companies, Stora Enso, UPM and Metsäliitto will be investigated. The companies were selected because they belong to the five largest forest companies in Europe, their Finnish origin gives them the same starting point, and the study was conducted in Finland by a Finnish researcher with plenty of knowledge about and experience on them. The companies' websites and websites of several non-governmental organizations (NGOs) were used to obtain information on the sustainability lacks. The sources of this information are the case companies' websites (Metsä-Botnia, 2010; Metsäliitto, 2010; Metsä Tissue, 2010; M-real, 2010; Stora Enso, 2010; UPM, 2010) and their critics (Ahonen, 2006; Fig, 2007; Greenpeace Finland, 2010; Greenpeace International, 2010; Hirschberger, 2008; Lang, 2009; Myllylä, 2010; Myllylä & Takala, 2010; Mäkelä & Näsi, 2010; Pyyhtiä, 2008; Volmari, 2009; WRM, 2008a, 2008b; WWF Finland, 2010a, 2010b). A total of 44 websites were analyzed: 23 forest product company websites and 21 other websites.

3. Current sustainability lacks of some of Europe’s largest forest companies

There are great many environmental, socio-cultural and economic sustainability issues that are not properly addressed by forest companies. Table 1 lists sustainability lacks indentified in three major European forest companies: Stora Enso, UPM and Metsäliitto. This is by no means an exhaustive list, but gives a fair picture of the magnitude of the problems.
Table 1: Sustainability lack issues of major European forest product companies

<table>
<thead>
<tr>
<th>Sustainability Lack Issues</th>
<th>Environmental sustainability lacks</th>
<th>Socio-cultural sustainability lacks</th>
<th>Economic sustainability lacks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forests</strong></td>
<td>Biodiversity destruction: huge, industrial monocultural plantations, clear-cutting, and disregard for protection of forest animal and plant species.</td>
<td>Social and cultural diversity destruction: destruction of local traditional livelihoods and indigenous cultures.</td>
<td>Economic diversity destruction: profits from forest exploitation do not benefit local communities but go to multinational companies, intermediaries in cities and shareholders abroad, accelerating the polarization of wealth and poverty.</td>
</tr>
<tr>
<td><strong>Timber</strong></td>
<td>Ecologically unsustainable origin: from primeval forests or from non-certified or PEFC-certified forests.</td>
<td>Socio-culturally unsustainable origin: from forests traditionally belonging to indigenous peoples who lose them; hence land rights and beneficiary issues.</td>
<td>Economically unsustainable origin: illegally logged wood. Economically unsustainable practices: illegal wood purchasing cartels that lower the price.</td>
</tr>
<tr>
<td><strong>Pulp and paper</strong></td>
<td>Ecologically hazardous methods: use of bleaching method ECF (elemental chlorine method) in mills in developing countries.</td>
<td>Socio-culturally unsustainable policies: Closing down mills that directly or indirectly employ most of the town in developed countries. Establishing fully computerized mills that employ very few people next to monocultural plantations on indigenous people’s lands in developing countries.</td>
<td>Economically unsustainable origin: illegally harvested and traded timber.</td>
</tr>
<tr>
<td><strong>Biofuels</strong></td>
<td>Biodiversity damage: collection and use of harvest residue, such as small trees and stumps, as raw material for biofuels seriously threaten forest biodiversity.</td>
<td>Socio-cultural diversity damage: harvest residue, e.g. small trees and stumps, taken away from forests, deprive local people ecosystem products and services.</td>
<td>Economic diversity damage: with harvest residue communities and nations lose valuable ecosystem products and services, the values of which are still only partially understood or unknown altogether.</td>
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<td><strong>Energy</strong></td>
<td>Biodiversity damage: collection and use of harvest residue, such as small trees stumps and roots, as raw material for bioenergy seriously threaten forest biodiversity.</td>
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</tr>
<tr>
<td><strong>Labels</strong></td>
<td>Massive waste: abundant use of paper as raw material and immense amount of leftover material.</td>
<td>?</td>
<td>Financial expenses: thick labels require much costly material and are expensive to transport; high disposal costs of leftover material.</td>
</tr>
</tbody>
</table>
3.1 Forests

During the past two decades forest product companies have been establishing huge, industrial eucalyptus mono-cultural plantations in South America (Brazil, Uruguay) and Asia (China, Indonesia). Many of them, particularly in Brazil and Indonesia, are established on former rainforests, the richest forests in biodiversity. The Finnish forest product companies have not destroyed rainforests themselves, but have purchased already clear-cut former rainforests (Metsä-Botnia, 2010; Stora Enso, 2010; UPM, 2010). Animals find no shelter or food among the tall plain trunks of eucalyptus trees (WRM, 2008b). Plants cannot grow on the mono-cultural eucalyptus fields, and if anything tries, pesticides, herbicides and fertilizers will kill them – and pollute waterways (Lang, 2009). A commonly used herbicide, glyphosate, irritates skin and eyes and may have long-term health effects (Pyyhtiä, 2008).

With plantations local people often lose their traditional land rights (Fig, 2007; Lang, 2009; Myllylä, 2010; Myllylä & Takala, 2010; WWF Finland, 2010b) and the ecosystem products and services provided by the original forests (Pyyhtiä, 2008). Mono-cultural plantations require irrigation, which may lead to water shortages in the local area (Lang, 2009; Pyyhtiä, 2008). Local decision-making shifts from local chiefs to foreign corporations. Transportation to and from plantations requires roads, which cause noise, pollution and accidents, and bring trash to formerly peaceful areas (Pyyhtiä, 2008). Plantations attract masses of immigrant workers whom they usually do not need, but who cause unrest (Myllylä, 2010). The plantations employ few local people, and their labour rights, health and safety depend on the benevolence of the corporations (Pyyhtiä, 2008). The eucalyptus trees grow very fast and

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<th>RFID tags</th>
<th>Fire hazard: RFIDs can be destroyed in microwave ovens, if consumers and other clients wish to stop them from working, but some types of RFID may catch fire.</th>
<th>Infringement of privacy if clients or consumers are not aware of the RFID tag in their product or cannot detach it or stop its reading – can be made possible, but if authorities forbid it, their movements and actions can be monitored when they wear the tag. Human rights violations and health risks when implanting RFID chips in humans.</th>
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<td>Biochemicals</td>
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</table>
are harvested by clear-cutting. Even in naturally growing forests in Europe and North America clear-cutting is still commonplace. It destroys biodiversity effectively by leaving the areas bare and vulnerable to erosion. Nowadays even branches, stumps and roots are collected after clear-cutting, leaving no opportunities for any life at all. Stumps and roots are forests' biodiversity banks (Hermy et al., 1999). Both the underground and over-ground forest activities with ingenious symbioses between trees, other plants, insects and other animals are wiped out. Forest companies show disregard for the protection of species of forest animals and plants through their intensive, highly effective industrial forestry that aims at maximizing short-term profits.

The United Nations declared 2010 as the International Year of Biodiversity. The UN Convention on Biological Diversity (CBD) entered into force already in 1993 (CBD, 2010). Forest product companies need to start protecting biodiversity. One of the three major European forest product companies, UPM, signed the Leadership Declaration of the Business and Biodiversity Initiative for the implementation of the CBD in 2008. To this effect UPM has drafted a Global Biodiversity Programme. UPM calls itself the Biofore company, and, therefore, says that it must think as broadly as possible about the new forest industry and its products: “By safeguarding biodiversity, we are also safeguarding core business areas for present and future generations” (Timo Lehesvirta, UPM’s Director of Sustainable Forestry, in Similä, 2010a). This company’s intention is good, but it has amounted only to show cases while the corporation as a whole is continuing its business as usual. True forest biodiversity programmes learn from assessments (Spanos & Feest, 2007).

Forest companies own hundreds of millions of hectares of forests all over the world. An increasing share of them are plantations in South America and Asia, but they also own hundreds of millions of hectares of naturally growing forests in Europe and North America. Moreover, they lease tens of millions of hectares of forests in many parts of the world. The biodiversity of naturally growing forests can be restored by removing from clear-cutting to individually selected tree cutting and by leaving branches, stumps and roots in the forest. Instead of monocultural tree plantations, the forest product companies should start establishing multicultural forest gardens. Forest gardens are sources of a wide variety of products from trees and other plants to natural remedies. If forest gardens are managed sustainably, they will bring good but not excessive income, maintain biodiversity and help to combat climate change.

This kind of biodiversity business strategy should be integrated into cultural diversity strategies by cooperating with indigenous peoples in the establishment and management of forest gardens. Local tribes have in-depth knowledge of their ecosystem services passed on
from one generation to another. For instance, instead of appealing against the Brazilian federal court's order to replant, with native trees, all its eucalyptus plantations, Stora Enso should, with local people, turn these 96,000 hectares of monocultural fields into forest gardens (WRM, 2008a).

An example of forest gardens tended by indigenous peoples can be found in West Kalimantan, Indonesia, where intensive clearing and burning of woodland and commercial logging by large forest product companies have destroyed primeval forests for decades (Marjokorpi, 2006). There, forest gardens grown by local Dayak tribes maintain tree species that correspond to the original rainforest species in their ecological and functional characteristics. The total area of these forest gardens is still too small to maintain vital plant and animal species but even a small expansion of these areas increases their protective value. The new income sources from these forest gardens improve the livelihood of villages and further the restoration and biodiversity of the forests.

Indigenous peoples can manage small forest gardens, but if the gardens are very large, thousands or tens of thousands of hectares, forest product companies could act as guardians or employers. Forest product companies must respect the land rights of indigenous peoples. The rights of indigenous peoples have been confirmed by the United Nations (UN, 2008). Land rights and work opportunities enable local people to act ecologically sustainably and appreciate their indigenous culture. Large forest gardens employ many more people than mechanized eucalyptus plants. Tending forest gardens and collecting the harvests are handwork. Forest gardens also employ indirectly: e.g. sustainable small-scale logging provides timber for local carpenters to work on; and vegetables, herbs, fruit, berries, mushrooms and honey give ingredients for local food production. In this way income from forest use benefits local communities, thereby reducing poverty and spreading wealth equally.

3.2 Timber

One of the most controversial issues for Stora Enso, UPM and Metsäliitto has been the origin of some of their procured wood from primeval forests, uncertified sources and illegal sources (Hirschberger, 2008). After having been caught using illegally logged timber by Greenpeace in 2006, they set up wood traceability systems, which are either FSC- or PEFC-certified. Stora Enso (2010), UPM (2010) and Metsäliitto (2010) require the wood they procure to be only certified through the Finnish Forest Certification System (FFCS), which was created by the forest companies themselves (“fox keeping the geese” syndrome), and belongs to the Pan European Forest Certification Scheme (PEFC), which allows the cutting of protection-
wise valuable forests such as primeval forests. The environmental organizations have demanded that the forest product companies should use the independent international Forest Stewardship Council's (FSC) certification system (Greenpeace International, 2010; Greenpeace Finland, 2010; Pyyhtiä, 2008; WWF Finland, 2010a, 2010b), which does not allow the cutting of protection-wise valuable forests such as primeval forests, but these corporations ignore their demands. Moreover, the wood the forest product companies procure and use is often originated from forests traditionally belonging to indigenous peoples, whether Sami people in Lapland or South American Indian tribes. The only responsible way to buy wood from such forests is to make fair, sustainable contracts directly with these indigenous peoples (Lang, 2009).

Economically unsustainable practices include also illegal wood purchasing cartels that lower the price. When UPM realized in autumn 2004 that the authorities would catch it from violating competition laws in the purchasing of roundwood in Finland during the period 1997–2004, the company surrendered to the authorities, made a full confession and informed on its accomplices, Metsäliitto and Stora Enso (Helsingin Sanomat, 2006). By taking the initiative in helping to solve this crime it had been committing with the other two forest companies, UPM avoided the 30 million euro fine payable for such a crime. After being charged with this crime, Metsäliitto confessed and was given a 30 per cent reduction on its fine, thus having to pay only 21 million euro. Only Stora Enso firmly denied having done anything wrong, and even after having been imposed the fine of 30 million euro, continued to protest its innocence (Helsingin Sanomat, 2009), but in the end decided not to appeal against the ruling (Helsingin Sanomat, 2010).

Metsäliitto is a cooperative of forest-owners. As the purchasing cartel was directed against forest-owners, Metsäliitto acted against its own owners. That violates even the norms of strictest owner-focused ideology of neo-classical economics, which sees that the only responsibility of companies is towards their shareholders (Husted & Salazar, 2006). Economic sustainability requires fair and equal prices to be paid for different kinds of timber.

### 3.3 Pulp and paper

In pulp and paper mills some environmentally hazardous methods are still in practice. Greenpeace has forced the forest product companies to change the bleaching method of their pulp and paper mills in developed countries. However, like with logging, once the companies have changed the method into an environmentally friendly one in developed countries, the problem remains and escalates in their operations in developing countries. The bleaching method ECF (elemental chlorine method) used by Stora Enso in its Brazilian
subsidiary Veracel and by UPM’s mill in Uruguay is a good example. The environmentally better option TCF (totally chlorine free) is used in their mills in developed countries. Ecological sustainability would require the companies at least to change into TCF also in their mills in developing countries. Preferably they should produce only unbleached or at least totally chlorine-free bleached products.

Forest product companies should take advantage of independent sustainability measures, such as the WWF Paper Score Cards, which help to calculate the ecological footprint of paper products, including measures for issues such as fibre (preferable recycled or from FSC-certified forests), ISO 14001 and EMAS standards in production, CO₂ emissions, bleaching, oxygen-consuming organic waste and waste material dumping (WWF, 2010).

A socio-culturally unsustainable policy that forest companies have in developing countries is closing down mills that directly or indirectly employ most of the town. Pulp and paper mills were established in many small towns more than a hundred years ago and they provided work for local people both in the mills and in giving services to the mills and people working there. The towns were dependent on the mills. Now that these mills are closed down and their production is transferred to low-income countries with lax labour and environmental laws, the towns die (Ahonen, 2006; Mäkelä & Näsi, 2010; Volmari, 2009). On the other hand, the forest product companies are establishing fully computerized mills next to their monocultural plantations on indigenous people’s lands in developing countries. These mills employ very few people (Lang, 2009). The World Bank (WB), European Investment Bank (EIB) and Nordic Investment Bank (NIB) have been involved in financing these operations and they, too, have prioritized the economic gains over the environmental and social problems.

The solution to change the companies’ socio-culturally unsustainable policies into sustainable policies is two-fold. In developed countries they should not close down mills that directly or indirectly employ most of the town, even if they could get a cheaper deal in developing countries, as long as some profit is made. Holistic sustainability requires some trade-offs between economic and socio-cultural needs. If no profit at all can be made and it is absolutely necessary to close down a mill, the forest product companies should establish and provide employees work in higher-level wood processing works: why not refine their wood into something more valuable than pulp or paper? In developing countries the forest companies should help indigenous peoples to establish small and medium-sized craftwork enterprises (SMEs) that employ many people near their forest gardens. This can be made profitable also for forest companies as long as they are satisfied with moderate profits. The economic sustainability problem, which the forest companies have had in their pulp and
paper mills, is the origin of their wood: they have used illegally harvested and traded timber (Hirschberger, 2008). In 2006 Greenpeace raised a question about the origin of wood imported from Russia by Stora Enso and UPM and gave photographic evidence showing timber being logged illegally in a Russian forest, transported by trucks from Russia to Finland and entering the gates of the mill owned by UPM – the same truck with the same licence plates in the forest, on the road and by the mill gate. After a long public debate both companies set up wood traceability systems at the end of 2006, including chains of custody, which are either FSC- or PEFC-certified.

3.4 Biofuels
Forest product companies have embraced biofuels as a major new line of business. They are cooperating with companies who have complementary expertise: e.g. Stora Enso with Metso and UPM with Neste Oil. They produce or plan to produce second-generation biodiesel and bioethanol. Raw materials for biodiesel include logging residues, such as small trees, wood chips, stumps and bark. Collection and use of small trees and stumps threaten the biodiversity of forests (WWF Finland, 2010b). This causes also socio-cultural diversity damage as these harvest residues, taken away from forests, deprive local people their ecosystem products and services. This leads to economic diversity damage because with harvest residues communities and nations lose valuable ecosystem products and services, the values of which are still only partially understood or unknown altogether. That is why it would be more sustainable to use only wood chips and bark and complement them with and pulp process waste.

Bioethanol is already made from pulp-based products that have been separated from waste flows. Turning organic waste flows into bioethanol can be a sustainable option if toxic substances are handled properly. While there is still plenty of pulp waste available, in the future raw material shortage may reduce bioethanol production as pulp production is decreasing. On the other hand, such pulp and paper mills will not be closed easily that operate adjunct to bioethanol or other biofuel plants. This symbiosis gives employees a better job security. In addition to this social sustainability boost, biofuel refined from pulp waste implements the cradle-to-cradle approach (Ketola & Salmi, 2010), which is rare among biofuels and boosts its environmental sustainability.

3.5 Energy
Forest product companies need vast amounts of energy particularly in pulp and paper production. They have their own power generators, usually combined heat and power plants.
operating on paper mill sites and recovery plants of pulp mills. They are also co-owners in energy companies with nuclear power plants (Metsäliitto, 2010; Stora Enso, 2010; UPM, 2010). Hence their energy supply is not carbon-intensive, but, all the same, unsustainable because of nuclear power hazards. Forest product companies are busy developing biomass-based bio-oils for heating and power generation (Stora Enso, 2010; UPM, 2010). The raw materials of the bio-oils are wood harvesting residues and sawdust, a by-product of the forest industry. Using industry by-products to make energy is an environmentally, socially and culturally sustainable alternative: it creates a waste-free cradle-to-cradle loop, maintains the industrial plants operative and workers employed and keeps up traditional lines of business, such as sawdust production. However, using harvesting residues, such as branches, bark and, particularly small trees, stumps and roots, for energy production, poses a serious threat to the biodiversity of forests. On the other hand it creates new lines of business, such as pellet industry. It would be advisable to leave the small trees, stumps and roots in the forest and use only the branches and bark of logged timber.

At the same time as developing their wood-based biomass energy production Stora Enso (2010), UPM (2010) and Metsäliitto (2010) are worried about the Finnish government’s plans to support large-scale burning of wood for energy generation. They say that wood is such a valuable raw material that it should processed into high-quality products, and not burnt. This sounds sustainable talk, but naturally the forest product companies also wish to promote their own energy production methods on competitive markets.

3.6 Label materials
With label materials waste reduction is considered the main challenge by forest product companies. They are waiting for waste in label materials production, such as liner materials, to become valuable raw material. For example, unlike conventional glassine liner materials, which must be disposed of at a cost after use, PP30 polypropylene liner can be sold for a profit to recycling companies after use and can even be reutilized by the forest product companies themselves as a raw material for wood plastic composite products (UPM, 2010). In addition, label materials are becoming thinner and more technical, and this reduces the usage of materials, leading also to reduced transportations. About 75-80 per cent of labels are still paper labels; their thinner and more technical versions mean great material savings. Biobased plastic materials for labels and label adhesive will be the future (UPM, 2010). This can improve the sustainability impacts.
3.7 RFID tags
The sustainability challenges of Radio Frequency Identification (RFID) tags differ from those of other forest industry products. The issues focus on data security, infringement of privacy, violation of human rights, health risks and fire hazards (UPM, 2010). RFID tags have major data security problems as confidential information stored in the RFID tag, in the reader or in the server, or transferred between the tag and reader may be tracked, stolen, damaged, abused, cloned or infected with a bug. Infringement of privacy takes place, if clients or consumers are not aware of the RFID tag in their product or cannot detach it or stop its reading. This can be made possible, but if they are forbidden to do so by authorities, their movements and actions can be constantly monitored as long as they wear the tag. RFIDs can be destroyed in microwave ovens, if consumers and other clients wish to stop them from working, but some types of RFIDs may catch fire. Health risks and, particularly, human rights violations are acute when RFID chips are implanted in humans. While companies address the legal data security, fire hazard and health issues actively and can at least partially solve them, they are not interested in solving the issues of infringement of privacy and violation of human rights, which give them and their client companies’ power over individuals.

3.8 Wood plastic composites
Wood plastic composites combine the characteristics of wood fibres and plastic. They are manufactured mainly from recycled material. The principle raw material is surplus from label stock production: self-adhesive label materials made of paper and plastic (UPM, 2010). The composites can be disposed of by incineration or recycled back into the production process (UPM, 2010).

However, the life cycle of wood plastic composites has not been as long as expected because wood in them causes the composite expand, shrink, bend or split (Schut, 2005). In addition wood attracts moisture that causes mould (Schut, 2005) and the ingredients of plastic are toxic, both of which create health risks. The maintenance and health problems and shorter than expected life cycles make wood plastic composites economically unsustainable as well.

The companies could use organic bioplastics to avoid toxic substances and the health risks they cause. It would also be possible to choose better-quality recycled wood to minimize the maintenance and extend the life cycle of wood plastic composites.
3.9 Biochemicals

Biochemicals are potential future products for forest product companies. Wood has a huge variety of chemical possibilities that are still researched. Biochemicals may, for instance, be able to replace oil-based products. Most forest product companies are interested in biochemicals whose production can be integrated into the manufacture of pulp and paper – despite the fact that pulp and paper production is decreasing. As yet, forest product companies do not aim at highly processed fine chemicals (Similä, 2010b), but they may provide opportunities later on. Different kinds of biochemicals pose different types of environmental, socio-cultural and economic sustainability challenges, all of which need to be examined in detail when the forest product companies choose their biochemical lines of business. Since biochemicals is a novel future area for forest companies it is difficult to predict the forthcoming sustainability lacks precisely. The problem is compounded by the fact that biochemicals will be a highly competitive area and the companies are developing their products in the strictest secrecy. University researchers have little access to their plans.

4. Conclusions: solution suggestions to sustainability lacks

There is a wide range of sustainability lacks in European forest product industry. This paper focussed on three major forest product companies: Stora Enso, UPM and Metsäliitto. While the sustainability lacks were indentified among them, other forest product companies face similar problems. Table 2 suggests some solutions to the identified sustainability lacks based on the above discussion.

<table>
<thead>
<tr>
<th>Sustainability Issues</th>
<th>Environmental sustainability solutions</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Forests</td>
<td>Biodiversity enhancement: establishment of forest gardens tended by local communities, individually selective tree cutting and corporate-community biodiversity programmes that focus on protection of forest animal and plant species.</td>
<td>Social and cultural diversity enhancement: support of local traditional livelihoods and indigenous cultures: e.g. local carpentry and traditional handicraft.</td>
<td>Economic diversity enhancement: cooperation with local communities so that profits from forest use benefit them, thereby reducing poverty and spreading wealth equally.</td>
</tr>
<tr>
<td>Timber</td>
<td>Ecologically sustainable origin: only from FSC-certified forests</td>
<td>Socio-culturally sustainable origin: not from forests belonging to indigenous peoples unless fair, sustainable contracts made directly with them.</td>
<td>Economically sustainable origin: only legally logged wood Economically sustainable practices: fair prices for different kinds of timber.</td>
</tr>
<tr>
<td>Pulp and paper</td>
<td>Ecologically less hazardous methods: change in developing country mills into bleaching method TCF (totally chlorine free), which is used in mills in developed countries. Preferably production of unbleached or totally chlorine-free bleached products.</td>
<td>Socio-culturally sustainable policies: not closing down mills that directly or indirectly employ most of the town in developed countries. If absolutely necessary to close, establish and provide employees work in higher-level wood processing works. Help indigenous peoples to establish craftwork SMEs that employ many people near their forest gardens in developing countries.</td>
<td>Economically sustainable origin: only legally logged wood.</td>
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<tr>
<td>Biofuels</td>
<td>Cradle-to-cradle approach: turning organic pulp waste flows into biofuels.</td>
<td>Symbiotic pulp and biofuel production is an assurance against closure, securing employment.</td>
<td>Enhancement of financial sustainability: symbiotic pulp and biofuel production.</td>
</tr>
<tr>
<td>Labels</td>
<td>Reduction of material need: thinner labels. Recycling or reutilization opportunities of new label materials.</td>
<td>?</td>
<td>Financial savings: thinner labels require less material and are, therefore cheaper to transport; low disposal costs as leftover material can be sold or reutilized.</td>
</tr>
<tr>
<td>RFID tags</td>
<td>Minimization of fire hazard: RFID tags can be developed not to be inflammable.</td>
<td>Reduction of health risks of RFID implants by studying and addressing them. Infringement of privacy should be eliminated. Human rights violations should be eliminated.</td>
<td>Minimization of data security violations through continually updated security measures.</td>
</tr>
<tr>
<td>Wood plastic composites</td>
<td>Extending the life cycle and minimizing maintenance by choosing better quality recycled wood.</td>
<td>Reduction of health risks by using organic bioplastics and better quality recycled wood.</td>
<td>Extending the life cycle and minimizing maintenance improve economic sustainability.</td>
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The sustainability solutions cover as wide range of activities as the sustainability lacks in operations and products. Forest product companies prefer voluntary action and self-regulation to legal instruments. So far, at least the case companies have fulfilled the minimum legal requirements and taken some voluntary action of their own, but these
measures have followed only the letter of the law without solving the real causes of unsustainability. In order to turn forestry truly sustainable the forest companies need to adopt a holistically sustainable approach (Ketola, 2007a). They should reconsider their mission and make sustainability their business strategy (Ketola, 2007b), if they wish to sustain themselves in the future world.

References


