



# LOG TRACKING SYSTEM

## 2005 COMPUTERWORLD HONORS CASE STUDY

### MANUFACTURING

CAMBIUM'S INNOVATIVE "LOG-TRACKING-SYSTEM" PUTS RFID TAGS AND DATABASE SOFTWARE TO WORK FOR FORESTERS, ENSURING A COMPREHENSIVE DOCUMENTATION OF ALL LABOUR AND TRANSPORTATION PROCESSES - FROM THE FOREST, WHERE THE WOOD IS HARVESTED, TO SAWMILLS, WHERE IT IS PROCESSED. [20055245]

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### SUMMARY

The project "Log-Tracking-System (LTS)" provides an intelligent combination of RFID tags and database software with the practical tasks in a forestry operation. This system is able to ensure a comprehensive documentation of all labour and transportation processes - from the forest, where the wood is harvested, to sawmills, where it is processed.

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### APPLICATION

In Germany, approximately 60 million m3 solid measure of timber is harvested (i.e. felled) each year, before the material is transported to sawmills, veneer manufacturers, chipboard mills and paper mills, where it is processed. Based on an average mass per round timber of approx. 0.20 m3 solid measure, this corresponds to a total number of more than 300 million pieces.

As a service provider, the Cambium forestry company cultivates a forest area of 32,500 acres located in Odenwald, a forest region in Southern Germany, close to Heidelberg. This forest area is owned by eight different parties, primarily private owners as well as municipalities. Each year, the Cambium forestry company harvests approximately 80,000 m3 solid measure of timber on behalf of the owners and transports the material (approx. 400,000 pieces) to sawmills etc..

In the past, the company relied on the following process:

In the first step of the harvest process, the trees are felled either manually or using a harvester machine. After this, the tree is measured exactly and the tree-top and the branches are cut off and sorted on the basis of various quality criteria. Using a small hammer, the forest worker attaches a numbered plastic tag to the cut area of the tree log. The number of the plastic tag and the data of the tree log are manually recorded in a notebook. When all harvest work in the forest area is complete, the forester enters the data into his computer using specialised forestry software.

After the trees have been felled, a skidder pulls the tree logs out of the forest to pile them up near the forest road. Sometimes this is done several days after the trees have been felled.

In the third step, the piled logs are loaded onto a truck which transports them to the sawmill.

In the fourth and final step, i.e. at the sawmill, the logs which are delivered by a truck are compiled in a list, and the price specified in the contract is paid to the supplier, e.g. to the Cambium forestry company.

Different problems arise, such as quantity and quality losses which are caused by the fact that some of plastic tags which have been attached to the logs get lost, or are damaged or become unreadable on their way from the forest to the sawmill. As a result, there is not a 100% capability to ensure a complete identification and control of the tree logs harvested in the forest.

The new LTS based process:

LTS makes it possible to close this information gap and to ensure a complete transfer of data for each individual log from the forest to the plant where the material is processed.

After felling the tree, the worker or the harvester machine knocks an RFID nail tag into the log. The only

information contained in this nail tag is an ID number which is wirelessly transmitted to a central database using a hand-held computer, along with the specific data of the tree log (species, length, diameter, quality).

After the skidder has pulled the logs to the forest road, he uses a scanner to scan the tag numbers of each log and transmits the data to the central database by wireless communications. There, the data transmitted by the forest worker is compared to the data scanned by the skidder, resulting in a list which makes it possible to check whether all tree logs felled have been pulled to the forest road or whether some of them have been left in the forest. The skidder must continue to pull the tree logs to the forest road until he has removed and scanned all logs with ID tags which have been attached by the forest worker.

This process is repeated when the logs are transported by truck. After the logs have been loaded onto the truck, the truck driver uses a scanner to collect the ID numbers of the loaded logs and transmits them to the central database via wireless communications. Once again, a real-time list is generated which shows any differences between the logs piled up at the forest road and the logs loaded onto the truck. The truck driver must continue to transport the timber until all the logs on the pile have been transported to the sawmill.

At the last stage of the wood harvesting process, i.e. at the entrance to the sawmill, the same process is carried out a third time. The ID numbers of the logs delivered are scanned by a scanner installed in the mill before they are transmitted to the central database. By comparing the data of the individual process steps (felling, skidding, transport), it is possible to verify the completeness of the consignment or to identify any differences.

In addition to specific timber data such as species, length, diameter and quality, LTS can also be used to collect additional information generated in the course of the process chain, e.g. personnel data, geographic data, date, time, weather conditions as well as other data.

## **BENEFITS**

### 1. Benefits

#### · Comments:

· LTS is currently in a pilot study phase; the first process studies were initiated during the past few months. The results of these studies will be incorporated into future test runs and evaluated. During the first half of 2005, further planning and development of project components for both hardware and software will be carried out. The test version will be developed in such a way that it can be used by selected timber customers by the beginning of the felling season in the winter of 2005/2006.

Has your project helped those it was designed to help?

· The idea of LTS was to designate individual logs in such a way that they can be unambiguously identified at all subsequent processing points. Provided the technical components of the RFID system and the software function in an error-free way, such an identification system will be possible and guaranteed.

· The new identification system will result in numerous benefits for forest owners, for timber-processing companies and for sawmills. These are briefly described below:

· Prevention or minimizing the loss of timber; currently, this is estimated to be 5 – 10% on average. The use of LTS should reduce this to practically 0%.

· Prevention or minimizing quality loss; long periods of storage lead to loss of moisture and/or change in colour. For special processing methods (e.g. wood pulp = moisture; building timber = colour), maintenance of these parameters is essential. Such losses mean loss of income for the forest owners and lower yields for the sawmills. Quality losses average between 10 and 20 % as storage in the forests is usually too long. LTS should be capable of reducing these losses by half.

· Process optimization during storage in the forest and at the sawmill. If adequate data is available, resources (workers, capital) can be optimally organized and utilized.

· Process optimization of the logistics chain for the transport companies involved. Losses frequently occur here as logs are left in the forests due to the transport trucks being full.

· Lowering of warehouse inventories and hence improvement of liquidity due to less and shorter periods of advance financing.

- Control mechanism for measurement and evaluation of performance of the companies involved, e.g. forestry workers and skidders.
- Control mechanism for the maintenance of sustainability for particular forest areas.
- Control mechanism for the maintenance of criteria necessary for the certification of forest areas.
- Unambiguous allocation of sales income from small quantities to individual forest owners. Up to now, individual logs from a particular forest could not be identified amongst logs from other owners. Individual logs, regardless of their particular data, have to be evaluated based on the average values of a particular truckload.

In your opinion, how has this affected them?

- Practice employed to date, has prevented unambiguous identification already during the second process step (skidding). Once the log has been stacked in the forest, it is often no longer possible to clearly identify the data and quality of this log. Control is mostly limited to simply checking the total number of items involved.
- As working procedures are frequently interrupted for days at a time (e.g. due to inclement weather), it is practically impossible to maintain a precise overview of all the processes involved.
- However, with LTS, each log is clearly identified at the point where it is felled. Identification is by means of a unique worldwide RFID tag; misidentification is thus not possible.
- The RFID tag can be read with an appropriate reader at any point during the process chain, hence enabling individual logs to be traced throughout the process chain.

What new advantage or opportunity does your project provide to people?

- The decisive advantage of LTS is the fact that all data (including GEO data and any possible further information such as storage) concerning a particular log are complete and available at all times.
- Thus, for all participants in the production chain, there are clear benefits in obtaining spontaneous and precise control of all processes. The forest owner e.g. is able to fell precisely the amount of logs required by his customer.
- The forestry workers and skidders also know precisely the amount of timber that has been processed and are able to establish records quicker and more accurately.
- The processing company, e.g. the sawmill, can adjust its timber requirement to the amount of timber available in any particular forest; supplementation or reduction of an order is then possible. In this way, unnecessary inventory at different points can be avoided, hence improving liquidity.

Has your project fundamentally changed how tasks are performed?

- LTS has a dramatic effect on the organization and management of forestry and the production of timber. Exchange of data via a specific interface (ELDAT) enables information that can have immediate effects on production to be obtained on quantities and qualities on an international basis. Production can thus be better attuned to the specifics of processing than was previously the case with corresponding positive effects on the financial results obtained.
- Those owners of small areas of forest who themselves may not have the necessary know-how tend to leave their forests unattended, thus dispensing with potential income from the timber. LTS enables these small owners to partake of a service that documents comprehensively all the processes in their forests including the sale of any of the timber. This would be unambiguously identified and provided with GEO data.
- In the special cases of catastrophes (e.g. hurricanes), processing and marketing can take place considerably better as there is spontaneous access to the production status via the database.

How might that change take place?

- LTS is currently undergoing a pilot study in a forest near Cambium. As soon as the tests have been completed, scheduled for the end of 2005, and a stable hardware and software system is available, the results will become available at various locations for reference.
- Further development of the LTS system is also being carried out in cooperation with one of the leading sawmills in Germany that has expressed considerable interest in this particular application. It is also planned to utilize the LTS data obtained for further processing within the sawmill; this will enable data to be obtained on origin, quality and yield of the various batches. This will be of advantage to the sawmill in its purchasing policy.
- As soon as the effects of LTS have been made known to a wider circle of customers, the internationally networked purchasing areas will have a positive effect on the growth potential of the sawmill far above what has been possible up to now.

Does your work define new challenges for society? If so, please describe what they may be?

- For the population in general and forestry in particular, the principle of sustainability and maintenance of ecological standards for the forests (air, water, recovery) in Germany and neighbouring countries will continue to play an increasing role. Fears about the state of health of the forests and the effect on habitat are also becoming increasingly important. Society is placing more and more value on what is occurring in the forests and in forestry and is particularly interested in ensuring that nature protection is taken fully into account.
- LTS provides the necessary instruments to fully document and control the production of timber at all times. The applications of LTS in forestry are almost infinite, e.g. documentation of new plantations, monitoring of the distribution and marketing of plants, the documentation of particularly valuable trees, the description of certain biotopes etc. In all of these areas, the identification and documentation of particular conditions and any changes are of significant importance for society.

## **IMPORTANCE**

### 2. The importance of technology

How has information technology contributed to this project?

- The IT used in LTS is of essential importance for the success of the project. As production in forestry takes place under natural conditions with no control over electricity supply, temperature or moisture, we have to be absolutely certain that the IT used is capable of transferring the data in the proper way. True real-time documentation can only be achieved by having data for the individual production steps transferred in the wireless mode. The software must be adapted to the conditions and to the know-how of those involved so that, even under extreme conditions, there will be no errors. The conditions must be clear, unambiguous and suitable for off-road use.

In your opinion, have you developed a technology that may lead to new ways of communicating or processing information?

- The special aspect of the IT components used in LTS is their being able to be used under extreme conditions and being processed centrally. The individual components of the hardware and software have to be defined and developed anew. The hardware components are not yet available on the marketplace. In addition, the system concept is of considerable importance as IT solutions already exist for individual working steps but not necessarily following the logic of the production chain nor adapted to an international data system.

Describe any new technologies used and/or cite innovative uses of existing technology. For example, have you found new ways of using existing technology to create new benefits for society? Or, have you identified a problem and developed new technology to solve it?

- Both the use of RFID tags and the transfer of data in conjunction with the ID number of the tag are already being used in various branches and companies. These components must now be combined to form an

intelligent LTS system. The necessary hardware has to be developed, however, as in the forestry sector only stand-alone instruments rather than system solutions are being used.

## **ORIGINALITY**

### 3. Originality

What are exceptional aspects of your project?

- The special aspect of LTS is the use of recognized IT technology in forestry applications that can be applied not only locally, e.g. in Germany, but worldwide. The production steps involved in forestry are essentially identical worldwide; hence, LTS can be used in all cases.
- This can be the documentation of forest reserves in South America but also the control of production cycles of Eucalyptus trees for the paper industry. LTS can be developed for various applications on a worldwide basis.

Is it original? How? Is it the first, the only, the best or the most effective of its kind?

- Within the forestry and timber sectors, LTS is a completely new and innovative process. In our opinion, there is no other technology available capable of combining high-tech components with the extreme conditions of the forest and where a complete system has been developed with the capabilities described above. The effects resulting from the successful application of LTS are unique and revolutionary.

How did your project evolve? What is its background?

- LTS is currently in the pilot phase. The schedule is for a 2-year development period after which a professionally designed product will be available.

## **SUCCESS**

### 4. Success

Has your project achieved or exceeded its goals?

- The degree of achievement of the set goals of LTS cannot be fully assessed at this point in time.

Is it fully operational?

- The functions of LTS have been assessed during the test phase of the pilot study. Under the working conditions met up to now, the LTS system can be said to be fully functional.

How many people benefit from it? If possible, include an example of how the project has benefited a specific individual, enterprise or organisation. Please include personal quotes from individuals who have directly benefited from your work.

- In Germany alone there are more than 60,000 forestry enterprises comprising more than 10 hectares of forest. There are over 200,000 enterprises and forest owners with less than 10 hectares.
- In the timber trade in the widest sense (wood processing, wood craftsmanship, cellulose and paper manufacture), some 500,000 people are employed.
- For a forest owner with only a few hectares e.g., LTS can enable him to utilize his property much more than ever before and generate benefits both for himself and for society.

How quickly has your targeted audience of users embraced your innovation?

- We are convinced that LTS will find a wide variety of users and that these will be enthused as LTS quickly shows its effect due to its being extremely practice-oriented. The problems that LTS can solve are well-known in the industry. The effective, economic and practice-proven solution using complete and comprehensive system technology will soon find a wide range of users.

Describe future plans for the project.

- LTS is currently undergoing pilot study testing in a company using standard technology. In the course of the coming year, it will be further developed with both hardware and software modules to such an extent that it

will be able to be put into operation in the winter of 2005/2006. Full unlimited use is then scheduled for the summer of 2006. From this point, marketing is scheduled to begin via the Cambium forestry.

## DIFFICULTY

### 5. Difficulties

What are the most important obstacles that had to be overcome in order for your work to be successful? Technical problems? Expertise? Organisational problems?

- The main difficulties that faced LTS during its development were connected with the external application of the system, i.e. electricity supply under extreme weather conditions and poor light.
- First, an RFID tag had to be developed that could be attached to a log without causing damage, even under extreme conditions such as frost. It should not get lost even when being manoeuvred by the skidder. It also has to remain legible and undamaged after being loaded onto the truck by crane and stacked with other logs.
- The forest worker requires an instrument with which he can attach the RFID tag to the log. This instrument must be light and easy to use but it must also be stable enough to attach the tag firmly to the log.
- An instrument is also required for entering and transferring data. This must also be easy to use and be able to function over longer periods outdoors without electricity and subject to cold, moisture and vibrations.
- The same conditions apply to the reader; this has to be used by the skidder, the truck driver and by those sawmill people who require the data.
- The software must be of the wireless type and be able to convert the data, without loss, into an international format and transfer it onwards for further use.

Often the most innovative projects encounter the greatest resistance when they are originally proposed. If you had to fight for approval and/or funding, it would be useful to include a summary of the objections you faced and how you overcame them.

- The greatest obstacle encountered for the application of LTS was the basically conservative attitude of the forestry industry. Projects incorporating a high degree of IT components are traditionally met with much scepticism.
- The positive effects of LTS only appear once basic changes have been made to current control systems and once processes are running. However, this means that users have to be open to innovation and ready to adopt new working structures. For this to happen, much mistrust has to be counteracted on the part of those who have to restructure processes and implement a new system.
- Most of the objections encountered were in connection with the safety aspects of data transfer and the use of readers and transmitting instruments in a forest environment. Prejudice against the use of such instruments in a forest and the idea that they are too sensitive and unsafe for such an environment first had to be eliminated by the use of practice-oriented results already obtained.

Did you encounter any unanticipated challenges?

- One particular technical problem encountered was the nature of the RFID tag. The tag had to be stable enough to be attached to wood but had to be extremely economical as it could only be used once.
- One additional difficulty was fulfilling the requirements of the cellulose and paper industries with respect to the RFID material. As the tags should not be able to enter the production process involving paper mills (possible damage to the rolls of paper), they have to be removed prior to entering the production process. To date, the problem has not been solved with respect to whether this removal should be mechanical (e.g. magnetic), chemical (dissolution) or other type of removal.