EUTIST-IMV Final Report

SEESAW

System to Improve the Efficiency of European Sawmills

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Summary This document is the final report of the SEESAW project

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V0.1	7 Jan 2002	First draft based on the project	DRAFT	Project members

Abstract

SEESAW is a system for monitoring and optimising the usage of saw machines and sawblades in a sawmill.

SEESAW enables a sawmill to get better information on sawing process and consequently to manage their production process, saw machines and sawblades better. This results in significant gains in the quality and volume of timber sawn, together with a reduction in costs.

Synopsis

The breakdown of logs to sawn timber is one of the core processes in sawmilling. Each log and its cutting process are unique. Although the control of sawblade behaviour determines quality, yield and consequently profitability, most European sawmills have no real-time means of getting information about the cutting process and take only infrequent manual control measurements.

The central objective of the SEESAW development was to develop a control and monitoring system for the optimal usage of sawblades in a sawmill. The project integrates a real-time data gathering, management and reporting system into an automatic vision-based control system. The principal objectives of the work were:

- improved sawn timber size control
- integration of automatic sawblade measurement
- integration of sawn timber length measurements
- integration of a visual reporting system.

Optimal yield comes from a correct combination of saw feed speeds and sawblades for each log size, state of season and saw machine. Moreover, well maintained sawblades lead to improved accuracy in sawing resulting in raw material savings and better timber quality. Improved knowledge of sawblade behaviour leads to better filing and maintenance with resultant improved yields.

SEESAW measures the thickness of all pieces of timber leaving a saw machine. When sawn length and log diameter data are integrated into sawn size data, the total ‘picture’ of the sawing event becomes available. In SEESAW, a line-speed encoder and saw set-up controller gather data which are integrated with the size data. The resulting information is used to control and optimise the saw and sawmill operations.

Project Members

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Executive Summary

The problem

The breakdown of logs to sawn timber is one of the core processes in sawmilling. Each log and its cutting process are unique. Although the control of sawblade behaviour determines quality, yield and consequently profitability, most European sawmills have no real-time means of getting information about the cutting process and take only infrequent manual control measurements.

The most basic sawmill process is the breakdown and resawing of logs and cants. The developments of the SEESAW system have resulted in a real-time measuring and control system which directly addresses this process. However, during the marketing and installation of SEESAW systems, further new requirements have arisen. The most important of these is the measurement and reporting of the surface area (which depends on log length) sawn by an individual sawblade. This information is essential for the efficient operation of a sawmill. Currently there are no such monitoring systems commercially available on the market.

The central objective of the SEESAW development was to develop a control and monitoring system for the optimal usage of sawblades in a sawmill. The project integrates a real-time data gathering, management and reporting system into an automatic vision-based control system. The principal objectives of the work were:

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Optimal yield comes from a correct combination of saw feed speeds and sawblades for each log size, state of season and saw machine. Moreover, well maintained sawblades lead to improved accuracy in sawing resulting in raw material savings and better timber quality. Improved knowledge of sawblade behaviour leads to better filing and maintenance with resultant improved yields.

The solution

SEESAW is a control and monitoring system for the optimal usage of sawblades in a sawmill during the log breakdown process. SEESAW integrates a real-time data gathering, management and reporting system into an automatic vision-based inspection system.

InX developed the original SeeCon system to control the size of rough sawn timber leaving the saw. SeeCon operates reliably in the demanding conditions of a sawmill. SeeCon measures the thickness of all pieces of timber leaving a saw machine. This data helps the sawmill to make decisions on saw set-up adjustment.

When sawn length and log diameter data are integrated into sawn size data, the total ‘picture’ of the sawing event becomes available. In SEESAW, a line-speed encoder and saw set-up controller gather data which are integrated with those from SeeCon. The resulting information is used to control and optimise the saw and sawmill operations. SEESAW provides information on:

- log usage
- sawn timber length by size

- sawblade behaviour
- the yield of the sawmill.

The Success Story

The European sawmill industry has a total annual turnover of around 10 billion Euros, producing some 65 million m^3 of wood and employing some 100,000 people. There are several thousand sawmills in Europe which vary greatly in size. Most sawmills are SMEs, with even the larger producers employing only about 20 staff. Most timber is produced in the larger mills producing over 10,000 m^3/year. There are about 400 sawmills in the EU with a production capacity of 30 to 50,000 m^3/year.

The timber industry at large provides jobs in rural areas where employment opportunities are often poor. Europe is an important producer of timber, both for its internal use and for export. As the market for construction materials continues to become more competitive, timber must be as good or better than other materials in terms of its usability, that is it must be sawn to dimensional tolerances as good as those of steel or brick. With increasing global competitive pressure, European sawmills need to produce wood of superior quality. A prerequisite for good quality is sawing accuracy. When this is under control, given various production conditions, it is possible to use smaller sawing allowances, and thus increase yield and profitability.

An important part of the conversion of logs into sawn timber planks takes place in breakdown saws. In these saws, a major consideration is the optimal use of sawblades to maximise the yield from a piece of timber and to avoid expensive blade breakages. This short article describes a system for optimising the use of sawblades thereby improving the quality of timber and increasing the profitablity of the sawmills that produce it.

SEESAW enables a sawmill to get better information on log feed speeds and consequently to sharpen and use sawblades better. This results in significant gains in the quality and volume of timber sawn, together with a reduction in costs. SEESAW enables a rapid return on investment due to:

- fewer unplanned stoppages due to sawblade breakage or wear
- improved sawing accuracy and precision
- improved filer room practices
- increase in production volume.

For a sawmill with a capacity of 30,000 to 50,000 m^3/year, every hour of lost production costs 3,000 to 5,000 Euro. A broken bandsaw blade can stop production for up to two hours. If 10 unplanned blade changes could be prevented, the SEESAW system would pay for itself. Sawblade related downtimes can amount to as much as 100 hours per year representing a potential return on investment in less than three months.

Full Technical Text

State of the Art

European sawmills face increasing global competition. Timber buyers demand a quality product and sawing accuracy is a prerequisite for good quality. Timber must be as good or better than competing materials in terms of usability. This means that it must be sawn to dimensional tolerances as good as those in steel or brick. Moreover, downtimes of sawmachines and inefficient use of material generate costs which need to be avoided to increase a mill's profitability.

See-Contro (Project No. 28460) resulted in a SeeCon machine-vision system to control sawblades in a sawmill. SeeCon improves the accuracy of sawn timber compared to manual inspection which is still current practice in most European sawmills. Over sixty SeeCon systems have already been sold in Europe.

However, during the marketing and installation of these systems, further new requirements have arisen. The most important of these is the measurement and reporting of the surface area sawn by an individual sawblade. This information is essential for the efficient operation of a sawmill. Currently there are no sawn-area monitoring systems commercially available on the market. The successful integration of such a capability into the SeeCon system resulting in the enhanced SEESAW system creates a significant market opportunity for its producers and would contribute substantially to the competitiveness of sawmills using this technology. As most European sawmills are SMEs, this would directly benefit their market potential.

Sawmills have always kept records of sawblade events, such as sharpening, blade change, and sawing times. These records have been gathered manually on paper and in an unsystematic manner which makes drawing conclusions and analysing problems for individual sawblades or saw machines difficult. It is essential for efficient operation that a sawmill knows which sawblades can be used, are worth using, and how long each sawblade can be used. With computing technology, each sawblade's "life-cycle" can be followed from start to scrap. Details detected during blade change, filing history, true sawing time, feed, cutting speeds and sawn area can be collected into same machine-readable data files. In particular, the sawn area, i.e. the real area cut by a sawblade, directly affects its durability, as do log/cant size and length, and saw feed and cutting speed. Computing technology makes effective sawblade tracking possible as most data can be recorded automatically. In an integrated system, sawing related data, such as sawing time, sawn area and feed speeds could be sent to an overall reporting database from which clear information necessary for the efficient operation of a mill could be obtained.

The central objective of the SEESAW project was to develop a control and monitoring system for the optimal usage of saw machines and sawblades in a sawmill. The project integrated a real-time data gathering, management and reporting system into an automatic vision-based inspection system using a component-based approach. SEESAW developed a prototype which will improve the efficiency of European sawmills.

The consortium comprised of EPCC, a technology transfer organisation, and two SMEs, Callander, a Scottish sawmill, and inX, the Finnish machine vision system suppliers who developed the successful See-Contro system in EU Project No. 28460.

EPCC, the project coordinator, is acknowledged as Europe's leading high-performance computing centre. EPCC has extensive experience in software development on a variety of platforms and environments and for a wide range of applications. Moreover, EPCC has a demonstrable track record in technology transfer and management of European projects. EPCC will be responsible for the management and coordination of the project, will assist and control the technical development work at site and will be responsible for investigating and utilising dissemination and exploitation routes in order to ensure maximum European-wide and cross-industrial awareness of the project results. EPCC will liaise with the European Commission and with the Machine Vision Cluster (EUTIST-MV).

InX, the technology provider, is the leading developer and integrator of machine vision and control systems in Scandinavia. It is also an experienced project partner in EU projects, including the See-Contro (EU Project No. 28460). In this inX developed SeeCon and since July 1999 they have sold over sixty systems in Europe. inX will played the leading role in system integration and installation, encoder interface development and software development. They will also play an important role in exploiting project results, for which they can make use of their established marketing and sales channels throughout Europe and the world. They will work with EPCC to identify further exploitation opportunities for the technology developed within the project.

Callander, the end-user, is a sawmill and SME, which has always been at the forefront of technical and market developments. Its principal activity is the conversion of logs into sawn timber for the construction market. Callander currently addresses quality control by manual inspection as do most European sawmills. It was involved in the integration of a See-Contro system, subsequently to be enhanced, into their existing computing infrastructure. Callander's staff was trained in operating the system. They tested the system and measured and evaluated results from a technical and business perspective. Their input will be vital for the dissemination and exploitation efforts of the other two partners.

The principal objectives of the work were: The improvement of the existing See-Contro system through the integration of an automatic sawblade measurement and reporting system resulting in a new prototype which is called SEESAW. The results of SEESAW has direct and measurable economic benefits to all partners in the consortium. The partners are strongly committed to exploiting the results of the trial both internally and externally.

Callander is a direct beneficiary of the results of the trial. The company was able to evaluate the effectiveness of the system in a production environment. The benefits of the system are more efficient operation of the plant which will enable the company to be more competitive. Consequently the company has better potential to expand its business and thereby safeguard and create employment. After successful completion of the activity, there was a permanent installation of the machine vision system at the company's sawmill. The time to recover this investment was three months, and the subsequent savings is around 5% of total production. In terms of the local economy this installation has created 1 - 2 jobs. The economic benefits have been felt during the project and will continue afterwards.

inX is able to develop further their machine vision products and will receive valuable insight into end-user requirements and capable of being productised for European and world markets. inX will have a working prototype tested against user requirements.. These benefits are of value in pursuing the longer term goals of exploitation which are to expand the inX's market share. The objective will be to commercialise the SEESAW system within one to two years of the end of the project. There is a total market of thousands of sawmills in the EU. The partners will focus effort on the Scottish, Swedish, Finnish and German markets. Much of the benefit of this will be felt after the project completes.

EPCC has developed its application specific skills in machine vision. These skills will enable EPCC to work with Ekspansio to exploit machine vision technology in other markets. Much of the benefit of this will be realised after the project completes.

Approach

Sawblade is the tool that cuts the wood. It is essential to knows which sawblades are worth using, and how long each sawblade has and can be used, Fig. 1. Integration of kerf size, saw line feed speed, and log size and length with the Seecon system, to measure and report the actual volume of wood cut by each individual sawblade. Thus, each sawblade's 'life-cycle' can be followed from brand-new to scrap using the 'true' sawing work done by each sawblade

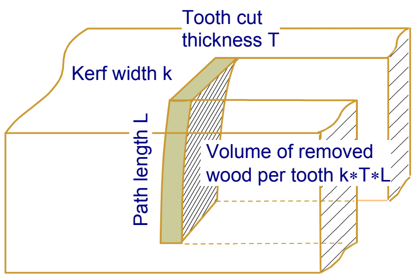


Fig. 1.

The novelty is the real-time measurement, recording and reporting of true sawblade load and wear in sawing process. The breakdown of logs to sawn timber is the core process in sawmilling. It determines the profitability of a sawmill. Previously only occasional manual inspection of sawn timber has been possible. A measuring device with special optics, connection to the saw line feed speed and saw control system, and software was developed for real-time control in the sawing process. High Performance Computing was imperative to process the huge real-time quantity of image and saw machinery data. The result of the project is a unique real-time measurement system SEESAW that is connected to the saw machine system.

With SEESAW a sawmill can:

- analyse real-time usage of sawblades
- optimise sawblade usage time based on wear and tear
- optimise adjustment of sawblade set-ups
- optimise line speed
- monitor saw machine condition and operation
- monitor effects of alignment and maintenance activities.

The architecture of the SEESAW approach is presented in Fig. 2.

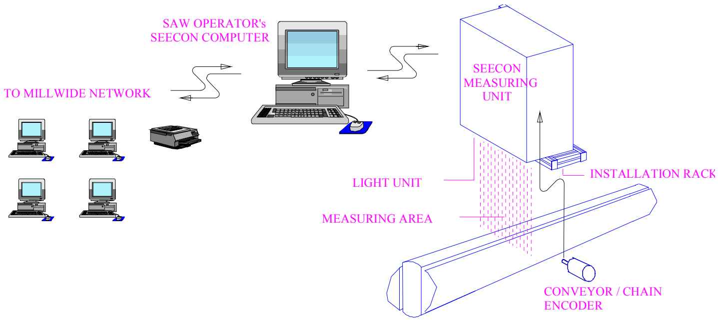
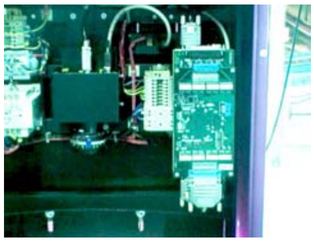


Fig. 2.

The SEESAW trial protoype was installed at R.B. 3 (saw group 3) on the sawline at Callander during 23-25 April, Fig. 3. First readings were gained. However, the programme did not operate quite as expected due to cant slippage and/or conveyor speed-up at the measuring location. Further some parameters needed to be added to allow compensation for the above.

SEESAW installation at saw group 3

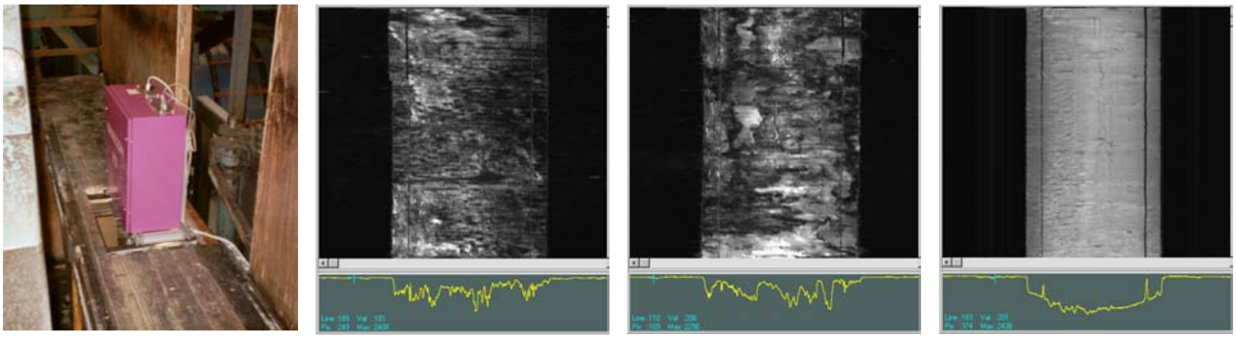
Encoder unit



Encoder and SEESAW electronics

Figure 3.

The SEESAW was moved to R.B. 1 (saw group 1) from the R.B. 3 location during 10-13 September. This activity was performed by Callander personnel under supervision of Ekspansio technician. The installation was successful and SEESAW operated technically well. However, the very dark colour of the log surfaces led to a situation where reliable measurement and recording of size data was not possible, Fig. 4. The colour of the log surface is practically the same as the colour of the kerfs. Therefore light intensity differences are not sufficient for reliable measurement.



SEESAW installation at saw group 1 | Good log image at Callander | Typical log image at Callander | Normal log image in Seecon applications

Figure 4.

Accuracy and Precision

Sawn boards have no true exact measure. Therefore, manual or optical readings cannot be compared with any true reference. A comparison must be made between the measuring results of the two methods. Means for three along the length segments are used, thus each manual segment value is an average of ten readings and each optical segment value an average of 100 readings.

One of the testing and verification tests of the trial prototype took place on 13 September 2001 in Falkirk at James Callander & Sons sawmill. The testing was performed by Mr. Gordon Callander (Callander) and Mr. Marko Kulmala (Ekspansio).

Two pieces of sawn timber were first measured by the SEESAW system and the average thickness of the pieces was recorded: After this the pieces were removed from the saw line and they were measured by hand. The manual measurement imitated the SEESAW measurement in such a manner that the pieces were first divided into three reporting segments (modules), and ten manual measures were recorded for each segment. These ten measures were used to calculate the segment average which was compared with the SEESAW results. The results are presented in the following table.

The difference between manual and segment measures is typically some hundredths of a millimetre. The minimum variation was 0.00mm and the maximum 0.15mm. The total average difference between manual and SEESAW results was 0.03mm.

The repeatability and accuracy of the SEESAW is satisfactory.

Availability of the Device

The device was isntalled at the Callander sawmill on the 25th of April 2001. There were some problems on the week starting 7 of May, but they were rectified by Callander themselves. For the past five and a half months since then, with the exception of the relocation of the device to another station and back to its original site, no other downtime has been experienced.

Lessons learned

The observed problems were:

- Logs and cants may slip on encoder and cause errroneous results in length. Therefore particular notice should be given that the encoder readings are as correct as possible

- In some cases the log surface may be so dark that it causes erroneous readings. Potential solutions to this problem are shorter logistical supply chain from forest to process, improved debarking and removal of dark surface fibre, or adding of external light sources to produce higher intensity of light at the measuring area. The latter one was chosen in this project.

Results, Achievements and Benefits

This paragraph is concerned with determining the effectiveness of the SEESAW device from the business perspective. The parameters determined are as follows:

- Value of reduction in time to set-up blades;
- Value of improved usage of blades;
- Value of reduced manpower needed for quality control;
- Value of improvement in quality;
- Value of reduction in waste;
- Time to recover investment cost.

From the data gathered by the end-user we can deduce the following facts:

- Assuming an hourly production of 50m^3 at 160EUR per m^3, it takes 0.2 of a year to make up for the cost of purchase of a SEESAW device;
- The system also offers non-measurable benefits, like enhanced market reputation through increased quality of sold timber;
- The end-users are very satisfied with the SEESAW device. It is their conclusion that the system is now an indispensable part of their sawmill.

We will now discuss the benefits from the use of SEESAW in a sawmill.

Value of reduction in time to set-up blades

Saw blade change or set-up without the use of SEESAW takes a certain number of minutes per day. There are 48 working weeks per year in this calculation.

Capacity per hour	50	m^3
Sales price of lumber	160	EUR per m3
Saw blade change time	15	min
No of changes per day	1	pcs
Shifts per day	1	pcs
The earned production per day	**12,5**	m^3 per day
This corresponds to earned lumber of	**3000**	m^3 per year
This is equivalent to	**480000**	EUR per m3 of lost/earned revenue per year
Assuming profitability of marginal production at 20%, this yields		
	96000	EUR additional profit per year

Value of improved usage of blades

The historic information contained in the short-term histograms of SEESAW allows the performance of a blade to be easily monitored. Without SEESAW the blade would have been changed after a fixed number of hours whether it was performing well or not. However with

SEESAW changing can be delayed until there is a marked drop in performance below an acceptable level. This gives savings in the following two areas:

- Less time spent changing blades;
- Less time spent on unnecessary work in the saw shop.

These savings are very difficult to quantify. In the first case saw changes are usually scheduled to be carried out outside production time i.e. saws would only be changed during production if there were a noticeable problem. In the second case the more sawing a blade does the greater the work in the saw shop and visa versa.

Value of reduced manpower needed for quality control

This is a very real saving. SEESAW allows a level of control and monitoring which simply would be impossible otherwise. Acquiring an equivalent amount of information manually would have been a full time post at least. In reality of course SEESAW allows the supervisor time to take on other responsibilities while improving his control of sawing accuracy. This is the equivalent of at least a few hours per day. Therefore:

Pay rate per hour	16,5	EUR
No of hours less in inspection work per day	1	
Earned working time (5 day week * 48 working weeks per year)	**3960**	EUR per year

This is the saving without taking into account the full-time post that would be necessary so as to collect the information that SEESAW offers.

Value of improvement in quality

SEESAW's contribution to quality can be divided into the following two areas:

- Target dimension;
- Tolerance accuracy.

Target Dimension

The target green thickness for most of a mill's production is often oversized. This allows a margin of error for underthickness cutting. SEESAW's greater control allows a mill to reduce the oversizing with f.ex. by 0.5mm i.e. a saving of 0.5mm. The saving can be calculated as follows:

Estimated reduction of oversizing	0,5	mm
Sales price of lumber	160	EUR per m^3
Typical board length	4	meters
Typical board width	150	mm
No of pieces per log	3	pcs
No of sawn logs per day	4000	pcs
Raw material savings per board	**0,0003**	m^3
Raw material savings per day	**3,6**	m^3
Raw material savings per year (5 day week * 48 weeks per year)	**864**	m^3
The earned production per year	**138240**	EUR per year

Tolerance

Sawmill's image and reputation rests to a considerable extent on its ability to produce accurately sawn lumber. SEESAW's real-time monitoring capabilities and instant alarming of problem situations increase mills' ability to produce accurately sawn lumber at a high level of consistency. For example, the SeeCon control system enables saw operator now to change saw machine's servo setworks by intervals of 0.1 mm, rather than 0.3 mm, which was the case before without the SEESAW system. The resulting economic benefit here is perhaps the greatest in the long run and is, unfortunately, very difficult to quantify.

Value of reduction of waste

A certain amount of lumber is externally and internally rejected every year because of inaccurate sawing. This material is often mixed with lumber that is rejected for other reasons (e.g. rot and insect damage). This may make it difficult to accurately quantifying the actual benefit. The greater control and early alarms provided by SEESAW reduce the amount of lumber being inaccurately sawn virtually to nil. The table below does not take into account the additional expenses related to returns/rejects, such as re-shipping arrangements, alterations in production planning, claims handling and potential damages to supplier's image.

Total annual external/internal rejects due to size issues	118	m^3
Sales price of lumber	148,00	EUR/m^3
Additional annual profit from reduced rejects	17464	EUR

The combined effect of smaller target size and thinner kerf enables sawmills to cut longer full edged outer pieces, i.e. reduction of trimming losses. The economic benefit from reduced trimming losses depends on several variables, such as log taper, length and diameter of logs, number and size of sawn outer waned pieces and trimming practices. Studies in this particular area show that SEESAW enables sawmills to achieve approximately 1.6% increase in production of full edged pieces from outer cut pieces, assuming that the average log taper is 9 mm per meter. The smaller the taper is, the more significant is the economic benefit. Due to the large number of variables needed to accurately calculate the related savings, we suggest you only to notice that the SEESAW system provides benefits in this area as well. In case a measurable value of these savings is available, include the data in the summary table below.

Regardless of the size, shape, species, density, moisture, irregularities, debarking or dirtiness of the material; or season and temperature, the SEESAW system enables saw operators to optimize the production parameters (feed speed, cutting speed, etc.), feed set-up, etc. for maximum production volume, productivity and efficiency. All these benefits are based on SEESAW's capabilities of monitoring, controlling and minimizing sawing variation and allowance in different production conditions for different raw materials.

Time to recover investment cost.

When the above values are used to calculate the ROI for a SEESAW investment, the result is as follows.

Profit improvement from increased process uptime	121409	EUR per year
Additional profit from improved blade use and mgmt	4450	EUR per year
Savings in labor from elimination of manual methods	16800	EUR per year
Profit increase by reduced oversizing/sawing variation	198912	EUR per year
Profit increase from reduced rejects and returns	17464	EUR per year
Profit increase from reduced kerf size	179021	EUR per year
Value of other quantifiable benefits, EUR	3000	Annual total
TOTAL PROFIT IMPROVEMENT	541056	EUR per year

From this calculation follows that the pay-back time of a SEESAW investment is about one month.

Summary on Benefits: Maximized Recovery, Productivity and Profits

The use of SEESAW will lead to:

- **Quick pay-back:** Typical pay-back time of the investment is 4 to 6 weeks. SEESAW users may expect up to 7.5% increase in productivity and production efficiency.
- **Maximized recovery**: SEESAW minimizes sawing variation and allowance that enables sawing pieces within tighter tolerances, almost always with a smaller kerf. This results in reduced green size that fully complies with the specifications. Trimming losses are reduced (saw longer full edge boards when smaller green size and kerf). In addition, SEESAW helps in optimizing production planning and minimizing grading losses.
- **Maximized production output**: Regardless of the size, shape, species, density, moisture, irregularities, debarking or dirtiness of the material; or season and temperature, the SEESAW system always enables saw operators to optimize the production parameters (feed speed, cutting speed), feed set-up, smallest possible kerf, etc. for maximum production volume, productivity and efficiency. Considerations: size variation, blade wear, downstream.
- **Minimized set-up times**: After saw blade changes, etc., SEESAW enables production at full speed instantly. No longer need to wait until pieces are manually measured and approved.
- **Immediate response to process problems with information of source**: The system's alarm enables immediate correction of process problems caused by defected or dull saw blade, etc. SEESAW is installed immediately at the exit of the saw - its information indicates the nature and blade(s) causing the problem, which enables operator immediately to look at source of the problem, instead of spending valuable production time in searching and system check-ups.
- **Improved saw blade management, life-time and process uptime**: Helps in selecting the most suitable saw blade for each run and to use it until it really needs replacing/filing.
- **Savings in labor costs**: SEESAW eliminates the need for traditional, time consuming and impractical manual measurements. It also reports and archives results automatically without operator attention.
- **Improved quality**: SEESAW's automatic alarm feature ensures that the product is always within the pre-set limits. It reduces production of lower grade or sub-quality lumber. SEESAW's reports can be used as quality certificates. SEESAW eliminates customer claims and costly product returns and it is an important component of modern quality management systems.
- **Reliability of process control information**: The sawn pieces are measured over the whole length at short intervals via a high-speed, non-contact, highly accurate method. Feed speed, variation in the distance of the pieces, sawdust and vibration do not affect the results. Alternate methods do not provide statistically significant amount of data for adequate process control. New studies prove that caliper based methods are not sufficient in lumber size control In addition, manual methods are vulnerable to operator variability and user errors.

Dissemination

The main dissemination activities are listed below. The target audience that was addressed in all events has been the sawmill industry.

Exhibitions / Fairs	Target Group:	Type / Distribution:	Rated Response:	Lessons learned:	
Ligna, Germany. Tha main European fair for sawmill industry	*Samills*	*6 sqm booth with Finnpro*	*Fair*	*Advance contacts and publicity has good results*	*Sufficient contacts (27)*
Wood and Forest 2001, Finland. The main fair in Finland for sawmill industry	*Samills*	*24 sqm booth*	*Fair*	*Advance contacts and publicity has good results*	*Sufficient number of visitors (>100)*

Mailings	Target Group:	Type / Distribution:	Rated Response:	Lessons learned:	
Continuous business mailing in Europe	*Potential sawmills*	*Quatation + brochure*	*Poor*	*Personal contact is required*	*Without visits not good responce*

Public Presentation / Conferences	Target Group:	Type / Distribution:	Rated Response:	Lessons learned:	
Sixteenth Annual Workshop on Design, Operation and Maintenance of Circular and Band Saws at Wood Machining Institute in Portland, Oregon, USA	*Sawmill industry*	*Presentation*	*Good*	*Personal presentations in trade seminars is a good way to attract interest.*	*10 interested contacts*
Automaatio 2001	*Automation industry*	*Presentation*	*Poor*	*Paper automation only*	*No successful contacs*
Wood and Forest 2001	*Sawmill industry*	*Presentation*	*Fair*	*Right audience*	*Successful contacs 7*

Scientific Papers / Publications	Target Group:	Type / Distribution:	Rated Response:	Lessons learned:	
Forest Products Journal	*Sawmill technologists*	*Article / 9 Pages*	*n/a*	*Awaits publication*	*n/a*

Papers / Publications	Target Group:	Type / Distribution:	Rated Response:	Lessons learned:	
Puumies 2/2001	*Sawmill industry*	*Article / 4 Pages*	*Fair*	*A doog way to inform indusrty*	*15 interested contacts*

Summary: The quality yield capability equation of a sawing process reveals the sawing variation, proper intervals of sawblade change and the most productive feed speeds for various log sizes based on sawblade wear. The accuracy of lumber size depends on the saw set-up, the sawing variation and on the reproducibility of the sawing process. The process mean is adjusted with the saw set-up. The sawing variation will determine how many of the sawn pieces will have a mean size that is below the lower limit. The reproducibility tells how consistently the saw cuts from lot to lot. Production of accurate lumber size requires thus both correct saw set-up, good control of sawing variation and process reproducibility. These three factors determine the quality yield capability of a sawing process. Because the sawing variation, the total standard deviation of the process, depends on log size, type of set-up, feed speed, sawblades and sawing time, the standard deviation must be known in varying process conditions.					

Other (i.g. Videos, CD-Rs) - Specify	Target Group:	Type / Distribution:	Rated Response:	Lessons learned:	
CD	*Sawmills*	*Demo software and videoclip*	*Poor*	*Difficult to asses use*	*Good response when used during personal presentations*
Web-page on http://www.spt.fi/eutist/	*Sawmills*	*Sucess story*	*n/a*	*No feedback*	

Conclusions

From the technology provider point of view the SEESAW project has been a success. New software, hardware and a reference application for the new technology have been finished. The developed technology is being integrated in the normal sales pallet of products at present and the SEESAW technology will be available on the regular sawmill market during spring 2002. Because the new technology can also be integrated in the `old´ SeeCon units on the market, the new application will be marketed to all current SeeCon users first, and it will naturally be marketed to all potential, new customers, too.

Despite some technical problems in applying the technology the developed method has shown its potential in improving significantly sawmill profitability. The technology as such will have potential in other wood processing industries as well. However, these new applications of the developed technology will require further modification of the system, due to different control requirements e.g . in planing and secondary wood processing industry.

Contact details

(1 page), including the roles of the participants, details of the contact persons, and any relevant URLs s. The start date and duration of the project, the overall cost and the Commission financial contribution should also be included.

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