Final Report

Contributing to a more profitable biomass division within Intech

Conclusions and recommendations from NORSKOG to the SINBIO project.

Project GII00101

SINBIO - Sustainable Innovation In Bioenergy

Cooperation with common values

Biomass – our energetic future

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Foreword

Norskog and Intech met for the first time during the launching of the Green Industry Innovation program in Bratislava in April 2013. During the next 18 months, Intech visited Norskog in Oslo, and a project application was sent to then Slovakian Government. In November 2014 the application was approved and funded. Our part of the project work, started in January 2015.

Under the Norway Grants, Norway has set aside €804 million for the current funding period. In the period 2009-14, the Norway Grants support 61 programmes in 13 countries in Europe. The Norway Grants are available to the 13 EU member countries that joined in 2004, 2007 and 2013. The decision-making body for the grant scheme is the Norwegian Ministry of Foreign Affairs.

The SINBIO-project (Sustainable INnovation in BIOenergy - Program No.: SK07 Project No.: GII01001) is co- financed by Norwegian Grants. SINBIO consist of several sub-projects. Norskog is partner in one of them; Contributing to a more efficient and profitable Biomass division.

The total budget for the SINBIO-project is approx. 10 mill EUR, while this sub- project has a budget of approx. 192,000 Euro.

Norway grants covers 80 % of the cost of this activity, while the remainder of the budget is covered by Norskog.

Norskog has enjoyed a good partnership with Intech personnel, both at the headquarter in Bratislava and the office for the Biomass division in Hrinova. We will especially give our thanks to CEO of Intech, Ivan Dudak and SINBIO project manager Jana Lukacova. Without their close cooperation, it would have been impossible for us to fulfil our obligations.

Oslo/ Bratislava 15.05.16

Erling Bergsaker

Sigurd Ole Ruud

May 15, 2016

Content

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Summary

Norskog has conducted this project in the period from January 2015 until May 2016. The analyses and report has mostly been implemented through 10 visits, both in Bratislava and in Hrinova.

Intech has given Norskog relevant and necessary information to carry out thorough analyses regarding costs and productivity in Intech Biomass Division. In addition to this, Norskog has initiated and implemented 3 field surveys over all together 6 days to get a clearer understanding of how the harvesting and chipping activities are implemented.

Intech Biomass Division's only task is to provide Intech owned heating plants with chips to a competitive price.

Norskog has focused on the performance in 2014. In this year, Intech Biomass Division produced chips with a loss. Intech provides chips through three different ways:

1. Intech Biofuel division buy chips - CIF or transported with their own trucks. This seems to be the cheapest way of providing Intech heating plants with energy, and gives profit to Intech.
2. Intech Biofuel division buy stacks of whole trees roadside, and implements the chipping and transportation activities themselves. This production gives profit to Intech.
3. Intech biofuel division buys cutting rights and implements all activities (harvesting, chipping and transportation). This production produces a significant loss for Intech, and makes the whole division unprofitable in 2014.

Norskog have pointed out several measures Intech can take to improve its profitability and ensure the supply of chips for the future:

Short-term measures.

- Introduce productivity based salaries
- Introduce drying of chips
- Improve planning processes
- Improve reporting of productivity and profitability figures

Medium term measures

- Reallocate some of the investments in equipment

1. Introduction

This report describes the results from the NORSKOG component of the SINBIO project. The implementation period has been from January 2015 to May 2016.

The project team from NORSKOG has been;

Mr. Sigurd Ole Ruud	Forest management and bio energy production
Mr. Erling Bergsaker	Forest economy, management and operations.
Mr. Jens Kolstad	Forest management and IT solutions
Mr. Øystein Aasaaren	Project management and overall forest management.

NORSKOG and Intech agreed that the most efficient use of parts of the project resources was to engage a local IT company to assist Intech for some of the IT components of the project.

The work has been done in close cooperation with professionals from Intech, to ensure a good result, based on the best experience from both partners.

NORSKOG

NORSKOG is a forest owner association in Norway. Their members represent 10% of the forests in Norway. NORSKOG sells 15% of all timber sold in Norway, and are also involved in forestry certification, forest planning and forest consultancies.

NORSKOG Consulting is working in the true creative consulting spirit of catalysing and enhancing knowledge with the client's best interest in mind. As an independent company with integrity as a key principle, NORSKOG Consulting helps Clients expand their awareness, their forest values and their efficiency. The sustainable use and improvement of forest resources based on long-term international experience are our speciality.

NORSKOG Consulting provides services in: forest management planning, silviculture, nature based tourism, climate change and forest, forest certification and forest appraisals - economy and analysis.

Intech

Intech Slovakia, s. r. o. (ltd.) is a Slovak company running business in the field of energy efficiency. It was founded 1996 and is established in Bratislava. Since its founding, it has been dedicated to the optimisation of energy resources, energy distribution and consumption, and to the preparation of studies and energy audits.

Intech pay big attention to the use of renewable energy sources. Intech consider biomass utilisation for energy purposes a highly prospective and noteworthy trend in terms of energy efficiency. In this respect, Intech have rich experience in biogas utilisation and biomass combustion.

Given the high biomass consumption of the Intech facilities, the BIOFUEL Division was established in 2006 with the aim of ensuring the supply of biomass for energy purposes. The BIOFUEL Division disposes today complex technical equipment, and provides all services for biomass procurement, from collection of wood in forests through mechanical processing, transport and storage. Besides fuel supply to Intech facilities, the BIOFUEL Division also guarantees stability of biomass supply to other customers who have been delivered boilers for biomass combustion by our company.

With regard to combined power and heat generation, Intech has specialised in cogeneration units based on gas combustion engines. Intech have implemented dozens of successful projects of combined power and heat generation in Slovakia. The cogeneration units installed by our company use natural gas, biogas, mine gas and propane as fuel.

Intech provide complex services in the field of cogeneration: advising, technical and economic input analyses of the efficiency of deploying cogeneration units, preparation of project documentation, instalment, commissioning, and servicing.

Intech`s aim is to provide the highest quality services related to the optimisation of energy systems in order to achieve benefits for its customers in the field of cost saving, operation reliability, and environment protection.

1.1 Main components

The main components of the NORSKOG assignment in the project have been:

1. Bilateral knowledge exchange, assistance in development of Intech Slovakia business strategy and technical assistance to individual activities
2. Assessment of current logistics operation of Intech Slovakia - from raw material resources to the heating plants, development of manuals and guidelines
3. Assessment of Intech's current IT situation and possibilities for further development
4. Assessment and development of Intech's organisational set up with regard to results from activity No 1-3
5. Training of staff aimed at implementation of proposed innovative solutions

The approach for solving each tasks is described below.

1.1.1 Bilateral knowledge exchange,

Assistance in development of Intech Slovakia business strategy, technical assistance for individual activities.

During assessments, NORSKOG has in mind the overall business concept of Intech with the view of identifying possibilities for improvement. So also for subjects that are described in the components below.

This component has the following sub tasks;

1. Overall analyses of the business concept and production line.
2. Suggestions for improvements in addition to those from the tasks below.

1.1.2 Assessment of current logistics operation of Intech

Assessment of the production line from raw material resources to the heating plants, including development of manuals and guidelines, focusing;

1. Evaluations of Intech business activities from forest to heating plant. All analyses have been based on data provided by Intech
2. Benchmark analyses
3. Proposals to improve the efficiency and profitability in the logistical operations.
4. Based on the results, work out manuals and guidelines where this is useful, in close cooperation with professionals from Intech.

1.1.3 Assessment of Intech's IT situation.

Norskog and Intech agreed to change this component from the initial project description. Norskog has according to this agreement assisted in developing the background for procurement of software, development services and hardware that should improve Intech's logistical performance. Norskog has focused on;

1. General layout of database
2. How data is to be collected
3. Which data to be collected in general.
4. Information needs assessment - participation in a workshop with representatives from Hrinova and HQ to determine what type of data is required to fulfil Intech's needs and how it should be collected.

1.1.4 Assessment and development of Intech's organisational set-up

This task is based on the results from the activities 1-3

The starting point for this task is the current logistical organisation of Intech, which consists of 38 people plus administration at the Head Office in Bratislava. The main tasks of this component have been;

1. Get a complete overview of the current organisational set up.
2. Benchmarking the productivity of the different units.
3. Identify any organisational limitation to increased productivity.
4. Identify possible organisational adjustments for increased productivity.

1.1.5 Training of staff

The training has been aimed at the implementation of proposed solutions from the activities 1 – 4, with the starting point that the resources for training in this project are limited, and the most efficient and sustainable way of doing the training is training of local trainers or key personnel.

The main tasks of this component have been;

1. Make a more detailed plan for the training.
2. Create training course
3. Carry out training course.

2. Exchange of Knowledge

Exchange of knowledge has taken place throughout the entire project period. Norskog consultants have conducted most of its work with this project, in Slovakia in close cooperation with representatives from Intech. In such working processes, exchange of knowledge will take place almost continuously, especially during meeting and field trips. More systematically, exchange of knowledge will take place in the training component, further described under chapter 6.

2.1 Overall analyses of the business concept and production line.

The business concept and production line has been analysed. We have gone through the overall concept but mainly focused on the raw material procurement. We have broken down the wood flow into a series of smaller steps. Each of them have been further analysed for its productivity, costs and profitability. From these analyses, Norskog has identified possibilities for improvement.

Benchmarking of both technology, productivity and costs are done, with comparison to Scandinavian best practice, based on results from research of similar aspects, and own professional experience. Scandinavian forestry with its high level of mechanisation, has over a period adapted to a higher level of costs in general, especially labour costs, but still kept a relatively low level of production costs, due to efficient organisation and improved productivity. It is likely that Slovakia will meet similar challenges in the years to come. Therefore, the Scandinavian experience is relevant to Slovakia.

The results of these analyses are given in chapters 3 and 5.

2.2 Suggestions for improvements in addition to those from the tasks below

Our specified suggestions for improvements are given in matrixes at the end of each chapter.

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3. Assessment of the logistics operations

3.1 Overall description of the business concept and production line

Intech's business concept is to supply Intech owned heating plants with suitable chips. This is to be done in the cheapest possible way - under the precondition that supply must be guaranteed.

3.1.1 Methodology

Norskog has analysed the production line step by step, to identify fields of improvement. We have tried to establish a complete understanding of how the activities are organised, what is done, the productivity and costs of each step. The analyses are based on figures for costs and production received from Intech. Based on the received information, a calculation model describing the volumes and economy of the raw material procurement from different sources was built. We have also tried to describe the most important parameters influencing on the productivity and costs of each production. The model gives a possibility to do simulations of different strategies as well as benchmarking.

There could be other reasons for choosing a strategy than just finding the cheapest solution. The wood supply is a crucial factor when producing bioenergy based on wood. Security for sufficient supply is an aspect, which has to be considered when choosing the strategy. This aspect is further elaborated in the analyses.

3.1.2 Procurement strategies.

Intech is involved in operational activities in all steps of this production line, but are not carrying out all the operations by themselves. In both theory and practice, we see different strategies for involvement in the value chain of the heat production. This is in fact a significant part of the procurement strategy for a heating plant.

In one end of the scale, a heating plant may buy all their raw material CIF, delivered at the industry yard. This is common for heating plants in Scandinavia. The procurement is often out-sourced to one or more contractors, who do the harvesting, chipping and transportation.

The opposite procurement strategy in the other end of the scale, would be to buy all wood in the forest, and take full responsibility for all the steps of the production line from harvesting to delivery at the heating plant. In a market where the competence and access to capital limit the market to function effectively, involvement in the whole production line may be a way of reducing risk in the raw material procurement.

The heating plants of Intech that are part of this project are currently involved in all steps along the production line. However, the level of engagement declines as one move closer to the stump (forest, to the beginning). Other heating plants owned by Intech buy their chips delivered to heating plant (CIF).

Figure 3.1 shows the share (%) of raw material for Intech produced by Intech´s own staff for different components of the production line.

Not disclosed

More detailed the wood procurement to the following heating plants of Intech; . Poltárska energetická, s.r.o., Hriňovská energetická, s.r.o., Hriňovská energetická – Revúca, Rimavská energetická, s.r.o., Tlmačská energetická, s.r.o. , Hontianska energetická, s.r.o. and Žarnovická energetická, s.r.o. could be shown as:

Not disclosed

Figure 3.2: Different strategies of acquiring raw material for Intech Heating Plants in 2014

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3.1.3 The production line

The wood procurement is done by a team of 40 persons. This group is responsible for all the wood procurement, both in the cases where Intech is carrying out all the operations themselves and where the wood is bought roadside. Some of the employees are work part-time .

The table shows the number of employees involved in Intech Biofuel division in 2014

Not disclosed

For these operations, Intech is using the following heavy machines 2014:

Table 3.4 shows the machines used by Intech Biofuel Division in 2014

Not disclosed

Text not disclosed

3.2 Assessment of each component of the production line

3.2.1 Harvesting

Text not disclosed

The most important parameters affecting the level of the harvesting costs are:

- Mean size of the trees harvested
- Density of trees per area unit
- Amount of snow in winter

The harvesting costs increases exponentially with reduced mean diameter. Generally, areas dominated by small trees should not be harvested. . In cases where this is not possible, it should be considered to use technology more suited for cutting such dimensions, such as brush saws.

Figure 3.6 shows the principle correlation between diameter of a small tree and the harvesting cost per volume unit. The figure is made from the assumption that the time it takes to cut each tree is the same for all trees in the size interval, and that all the trees are of equal height. In reality, this is not completely the case, but the figure illustrates clearly how the costs increase for the small dimensions.

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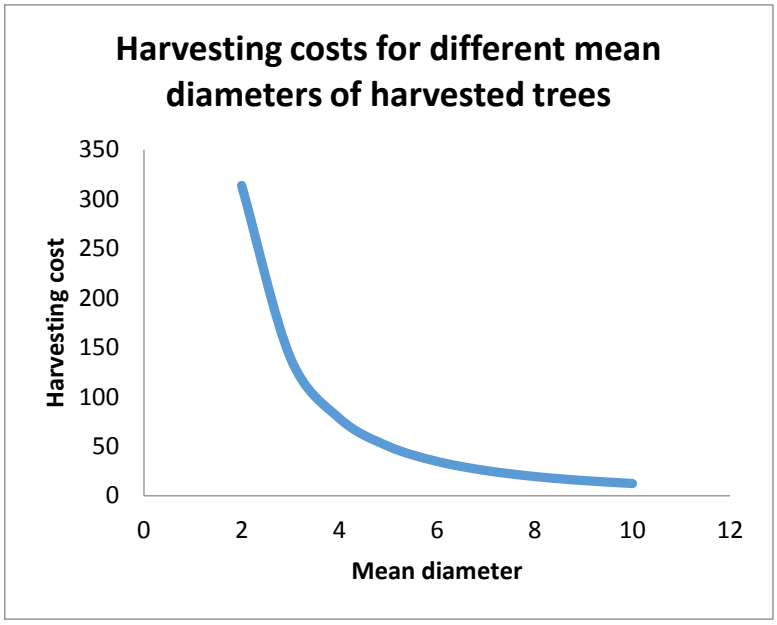

Figure 3.6 shows the principle correlation between diameter of a small tree and the harvesting cost per volume unit.

Picture 3.7 shows a brush saw in use. These are especially efficient for cutting stems with diameter smaller than 8 cm. The equipment could however be used for bigger stems, but the efficiency compared to a chain saw significantly drop when the average diameter exceeds 8 cm.

Cutting of trees could also be done more mechanically by using a harvesting head, mounted at the tip of the crane of a tractor or forwarder. This enables the operator to perform operations similar to those of a combined harvester and forwarder.

Naarva-Grip E25 is smaller harvesting head for cutting and collecting wood. The weight is 320 kg. The equipment is used for both cutting and loading the wood, and is made to be mounted at the tip of a crane.

Pictures 3.8 shows a Naarva-Grip E25 (upper) and Naarva Grip EX32 (below)

Naarva Grip EX32 is especially suited for harvesting smaller dimension trees. Such equipment will still be sensitive to low volume per ha.
Other comparable products and manufacturers are available in the market.

An additional option is to use a fully mechanized harvester (processor). One of the main benefits of a harvester is the high efficiency of the debranching operation. When harvesting without debranching trees, one cannot fully utilize the potential of a harvester. Mechanized tree cutting results in the harvested trees compiled in (bunching). This contributes significantly to improved productivity of the forwarding.

Picture 3.9 A Ponsse harvester at work

Buying a new harvester is an investment of approximately 450,000 EUR. When harvesting, debranching and bucking, the daily production will be in the range of 100 – 200 m^3. Smaller harvesters exist, which might be more suitable where the tree dimensions are small.

3.2.2 Forwarding

Text not disclosed

3.2.3 Reasons for low productivity

The productivity of a tractor with trailer or a small forwarder depends on several factors:

1. The skills of the driver
2. The produced quantity of whole-tree ready for transportation at any time
3. How the biomass is made ready for effective loading on the trailer
4. The design of the tractor- trailer - crane concept
5. Terrain conditions, steepness
6. Mean size of the trees harvested
7. Driving distance in the field

The impression after some visits in the field and discussions with the involved staff is:

The skill of the driver: The drivers visited, seems to know quite well how to drive and operate their tractors, and how to fully utilize the capacity of the machine, including both the crane and the winch.

The produced quantity of whole-tree ready for transportation at any time: The tractor driver seemed to have enough logged wood to load, and did not waste time waiting for the loggers.

How the whole-tree biomass is prepared for effective loading on the trailer: Felled trees could have been better oriented for efficient loading onto the forwarder. The size of each grapple load is crucial for loading efficiency. Some directional felling was practiced but this could have been done more. Hand bunching could have been used for trees of small dimensions. As long as the tractor driver does not have to wait for the loggers, hand bunching is a mean to improve the productivity of the entire harvesting team.

Tractor - trailer - crane concept design: The LKT is equipped with crane, winch, clam bunk (grapple) and trailer with hydraulic engines powering the front wheels. The winch is operated via a remote control. The remote control could also be used to steer the engine and to drive the tractor from the outside.

At a location visited by Norskog, the transportation distance was approximately 200 meters. Production per day was estimated to be 30 tons. The driver seemed to be a skilled driver, who knew well how to handle the tractor. In addition to the actual machine work, he also did most of the strapping while operating the winch.

The crane is mounted on the tractor behind the tractor cabin. Its full range is 5.9 meter or approximately 4 meter from the tractor measured along the terrain. Its slewing angel is 200^{o}, which means it cannot work in front of the tractor. The consequence of these limitations is that a high share of the loading time is used for moving the tractor and trailer into position.

As the felled stems are not bunched, the limited crane length also has the impact that the load will have stem-ends distributed in the front half of the trailer. This property of the load is also influencing the property of the piles, which will influence the chippers capacity negatively. The chipper must hold on to the crane load until all ends has been grasped by the chipper.

A tractor – trailer concept would be far more competitive if it was used in ordinary harvesting operations in a dense forest with a high yield per hectare and easy terrain. Under such conditions, Intech's equipment would load the trailer quite effectively without to many movements. Dealing with small dimensions and even selective cutting, the number of movements needed to fill the trailer is too high to make it effective.

To minimize this disadvantage it is necessary to increase the hand bunching and directional felling. This would be important even if Intech chose to change equipment to bigger forwarders with bigger cranes.

Terrain conditions, steepness: It is well known that steep terrain affects productivity of forest operations. Steep terrain is more common for the Intech operations than for Scandinavian harvesting of bio-energy wood, including Norwegian. This has to be taken into consideration when assessing the productivity and benchmarking. Terrain conditions should also be taken into consideration when choosing technology for the operations. Parts of the harvesting operations cannot be carried out without using a winch.

Forwarding in steep terrain is an inevitable part of Intech's operations. Norskog observes that the pricing could be adjusted to the reduced productivity of such operations.

Mean size of the trees harvested: It is well known that the mean size of the trees to harvest is a significant parameter affecting the cost of harvesting. Intech has not yet defined a lower average size (diameter) limit as a measure of stands/crops/fields allowed to be cut. The company informs that competition for wood to some extent forces buying smaller dimensions of wood than actually wanted, and that it is hard to fully compensate the increased harvesting costs in the end product pricing.

Is the machinery optimal?

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Introducing bigger forwarders for wood transport in the field, with higher carrying capacity, more efficient cranes and improved abilities for terrain movement (both forward and backwards), may be an alternative to tractor and trailer or small forwarder The average driving speed will then increase and the loading time will decrease.

The crane length of a medium-sized forwarder is 9 – 10 meters. The crane rotates 360˚. Compared to the LKT with a crane length of approximately 6 meters and rotation of 200 ˚, the loading operation of the forwarder is far more efficient than that of the LKT.

A forwarder with expandable load area is particularly suitable to forwarding whole-tree biomass.

Picture 3.13 Forwarder with a load of whole-tree

When forwarding whole-trees, it will be a challenge to fully utilize the carrying capacity of the tractor. One way to improve this is to use a bundler to compress the trees.

Picture 3.14 John Deere 1490D Energy Wood Bundler for Biomass Harvesting

It is also possible to put a saw for cutting the trees at the tip of the wood bundler crane. However, the productivity of the bundling may then decrease to the extent making this unprofitable.

Bundling increases productivity of forwarding significantly. When the wood is bundled , if is most

efficient to transport them to the heating plant. The chipping should be done at the plant. The equipment for bundling is expensive, approximately 440,000 EUR; investment demands high production in order to be profitable.

Picture 3.15 Ponsse forwarder collecting bundles of forest waste

3.2.4 Chipping

Text not disclosed

3.2.5 Reasons for low chipping productivity

The reasons for low production must be connected with :

- How the chipping and transportation part of the value chain is organized.
- Size of the average stem that goes into the chipper.
- How well the piles of biomass are arranged for effective chipping

Norskog believes that waiting for trucks and containers leaving the chipper idle may explain the share of work time spent for reasons undocumented. Lack of containers and trucks are also mentioned as an important bottleneck for the productivity by personnel in Hrinova.

The chipping capacity would be at its highest when logs are the raw material. Due to the current high log prices, they are not a preferred commodity today.

Norskog has not studied in detail the performance of the chipper driver while chipping. Based on observations, there is reason to believe that the chipper productivity is at a normal level.

Picture 3.19 shows a pile of whole-tree outside Rhinova.

Chipping capacity increases when the operator can feed the chipper in a continuous stream of biomass. Picture 3.19 shows a pile of whole-tree were the root ends are not

arranged for effective chipping. For optimal capacity and quality of the chips, it is important that the operator can overlap the top-end of the grapple load with the root-end of the next grapple load into the chipper. In this way the chipper processes more or less the maximum continuous feed of wood. Moreover, this creates the most homogeneous chips. It also allows the chipper to change to screens that allows more material to run through the chipper. This also increase the capacity.

3.2.6 Needed chipping and transportation capacity

As long as Intech chose to depend on their own chipper capacity, the needed capacity is determined by these factors:

- Maximum biofuel consumption in heating plants (per day or week)
- Buffer capacity at heating plants (chips in stock)

Text not disclosed

3.2.7 Transport,

Text not disclosed

3.3 Benchmark analyses of productivity

Text not disclosed

3.3.1 Experienced productivity from similar productions in other countries

Figure 3.21 shows forwarding productivity, using a medium sized forwarder in Finland

The figures for the loose whole trees are most similar to Intech. The hourly production is in the range of 7 to 17 tons per hour.

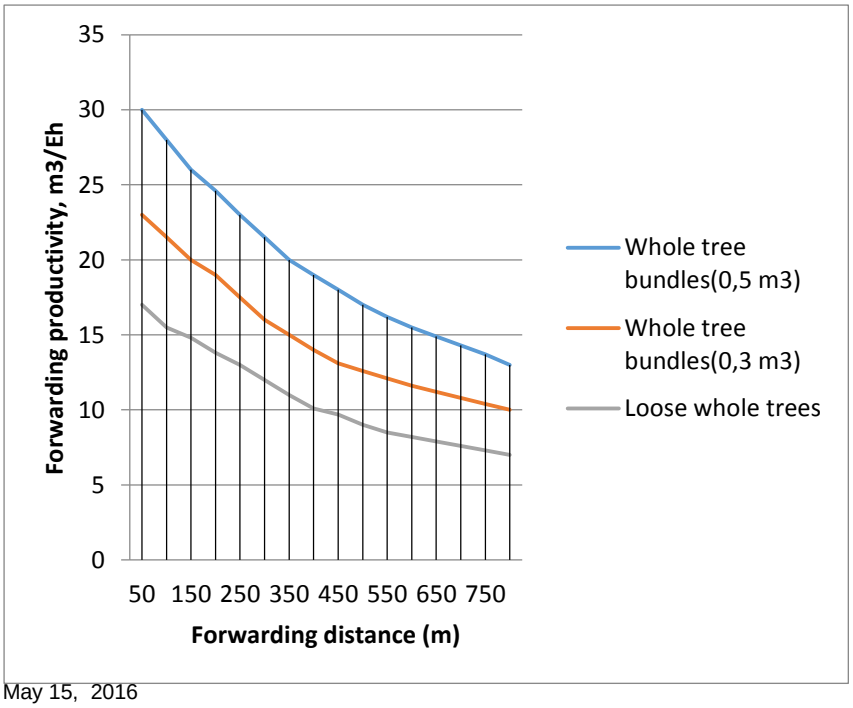

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Figure 3.21 Forwarding productivity, using a medium sized forwarder in Finland. (Source: Metla).

The hourly forwarding production in Finland is calculated per efficient working hour. If we assume 7 efficient hours per working day, the figures for 750 m forwarding distance shows a daily production of 40 tons. This indicates that Intech should have possibilities for significant improvements of the productivity in the field of forwarding.

Figure 3.21 also shows the impact of bunching. The productivity increases with 40 % when changing from loose whole trees to 0,3 m^3 whole tree bundles. Bundles of this size should be possible to achieve through hand bunching, and illustrates the potential by introducing more hand bunching for Intech. Whole tree bundles of 0,5 m^3 is more likely to achieve when using mechanised harvesting.

Comparison to Norwegian production figures.

Not disclosed

Table 3.22 Benchmarking average daily production in Norway and in Intech

Norwegian figures cannot be directly compared to Slovakian. The level of mechanisation is different, especially for the harvesting operation and to some extent for the forwarding. The terrain conditions might also be some different. The share of steep terrain in Norway should be at the same level as for Slovakia, but harvesting wood for bio energy in such steep terrain, seem to be some more common for Intech than in Norway in general. The figures for Intech do also include some harvesting with skidding operations, which is some less efficient than plain forwarding.

The figures indicates however a potential for improved productivity. Figures for the other Scandinavian countries are similar to Norwegian cost.

Not disclosed

Figure 3.23 shows differences in productivity between Intechs present situation and Intech with improved practice (same technology) and Scandinavian highly mechanized system. The assumptions for Current system - improved practice are.

- Productivity based salaries
- Better cooperation between cutters and drivers - hand bunching of logs/ whole trees (Assumes that one finds the bottleneck in the production within the forwarding process - especially in the loading sequence)
- More containers to reduce inactivity - both during chipping and for the transportation.

The figure illustrate that Intech should not only focus on the harvesting and forwarding part, but also the chipping and transportation.

Text not disclosed

3.4 Comparison of different technological solutions for the wood procurement

The analyses above indicate needs for improvement of the productivity of the wood procurement operations. Different strategies could be chosen, but which solution that is optimal depends on a number of factors, like:

- *The level of labour costs*, increased labour costs will make it more profitable to invest in more efficient equipment.
- *The mean tree size*. Smaller trees are any how expensive to harvest and process, but when small trees are the normal situation the technological solution should not be too expensive and adapted to such dimensions.
- *The field conditions*. Steep terrain and terrain where the access for the tractor is challenged, it will be more efficient to use a stronger forwarder with 6 or 8 wheel drive. When the terrain is too steep for forwarders, various type of winching systems are needed.
- *Distance to the loading place*
- *Density of wood*. Higher volumes of wood available for harvesting per ha, gives lower production costs, than areas where the available volume per ha is lower.
- *Distance from the harvesting lot to the heating plant.* The longer distance from the field to the heating plant, the more important will it be to increase the transport load.

One solution will be to keep the current technology. It should be possible improve the daily production by improved planning, economical encouragement for improved productivity etc. We have below in addition described 5 different possible technological solutions, as possible alternatives to the current. All solutions assumes that Intech conduct all activities in the value chain - from harvesting to deliverance of chips to the heating plants. In the cost below no administration cost are included, only fixed and variable costs connected to the production and deliverance of chips from forest suitable for bio energy (forest with uneven and mostly small dimensions)

Text not disclosed

3.5 Coordination of chipping and transportation

Text not disclosed

An example of transport planning I shown in figure 3.28 below

Figure 3.29 Example of transport planning with 2 simultaneous chipping operations

The assumptions for figure 3.29 is:

- Working hours is from 07.00 to 17.00.
- One hour in the morning and in the afternoon is used for transportation of chipper driver and/or moving the chipper from and to the landing.
- 50 minutes to fill two containers.
- 2 hours are used for maintenance.
- 2,5 hours transportation time from landing to heating plant and back to the landing again.

Before the chipper arrives, two containers must be in place. This will make it possible for the chipper driver to start chipping immediately. Every 50 minutes new containers must be delivered and filled containers transported to heating plant. There will be breaks in the production due to lunch and maintenance. In this example 2 hours maintenance is included. To make maximal utilisation of both chippers, trucks and containers, the time for maintenance is allocated different for the two chippers, and the trucks must serve both chippers during the day. This example demands 5 trucks and 14 containers.

3.6 Drying of biomass

Text not disclosed

Picture 3.32 show to different places were biomass could be stored. The drying conditions are better in the right picture.

The drying improves if the stack gets some cover for rain. It is most important to cover the middle section of the stack as picture ww shows

Picture 3.33 shows how the cover sheets are put on the stack.

When the cover is in place, it is important to weigh it down with some of the biomass. This will prevent the cover to be blown away.

Picture 3.34 shows how a forwarder puts on the cover and how it should look after some month of storing.

Picture 3.34 shows how covering is done with a forwarder and how a covered stack should look after some month, if the covering is properly done.

To achieve this drying, every stack must be allowed to dry through the summer season. This will influence the production process.

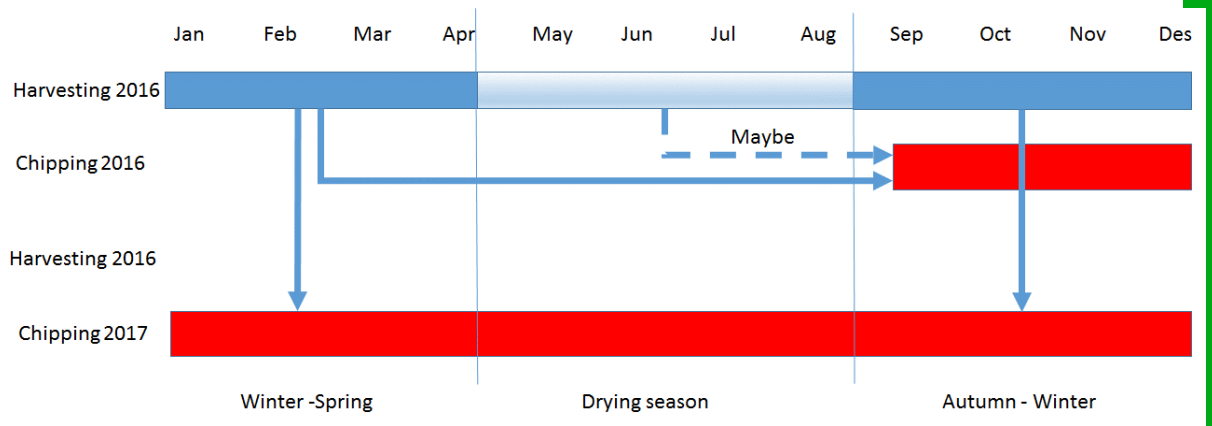

Figure 3.35 shows how biomass harvested at different time of year, can be chipped first after a summer season.

To implement a drying season, will mean that Intech the first year must produce some more biomass that they do today. Figure 3.35 shows the prinsiple of this. Wjhat is harvested the second halv of the each year will have to dry over the next summer befor it has got its wanted humidity.

3.7 Planning of wood procurement

Smooth and effective wood procurement demands well established routines and planning. This work could be structured into the following main phases:

- Procurement phase and contracts
- Planning of a single harvesting operation
- Planning of succession of harvesting operations

3.7.1 Procurement phase and contracts

This is the initial phase for the wood procurement and will include

- Custom relations and communication with seller of wood.
- Field survey (purchase of cutting rights and roadside biomass)
- Contracting,

In this phase, it is of great importance that the representatives from Intech are able to act trustworthy, establish reasonable contracts with the seller, which give a predictable and profitable business situation for both parties. For this purpose, the representative from Intech

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needs access to basic information from the head quarter of Intetech describing the acceptable level of procurement costs for wood and correlation between the different parameters and costs. In addition, he/she will need suitable standard contracts that simplifies the formal part of the work.

The middle managers or representative for Intech should be made able to estimate the cost and quantity of each contract when negotiating with the seller, and be responsible for any signed contract and its profitability.

Standard contract should exist covering the following different ways of buying biomass:

- Chips delivered at the heating plant (CIF)
- Chips delivered roadside
- Biomass delivered roadside
- Cutting rights for harvesting done by Intech

This could very well be one standard contract with the different options.

All the contracts should describe:

- **Total volume** delivered at one or more specific location for delivery.
- **Delivery plan**
- **Quality specifications** (size, humidity)
- **Price** - fixed prise due to delivery according to contract, with rules for reductions (and additions) in prices due to deviations from delivery according to contract
- **Responsible for chipping**
- **Responsible for harvesting**
- **Scaling,** how to define the volume delivered.
- **Other specifications**:
  - Rules for when deliveries will be rejected.
  - Consequences of deviation from delivery plans
  - Consequences of deviation from quality demands
  - Consequences of damages on landing and private roads

Contracts for cutting rights should in addition have the following specifications:

- Location of harvesting area and landing place.
- How to deal with damages on landing and private roads.
- How to deal with damage on skidding roads.
- Smallest diameter to harvest.
- Copy of the approval and conditions given by the forest authorities.
- Clarification of rights to chip and store biofuel on the landing.
- Clarification of rights to transport the biofuel from the landing to public road.

Demands for contracts are further described in chapter 5.6.

3.7.2 Planning of a single harvesting operation

When planning a harvesting operation a number of initial estimations have to be done, to be able to estimate the harvesting costs and suggest the most suitable harvesting method and technology. These are estimations like:

- Volume to harvest.

- General harvesting conditions
- Location of landing place.
- Forwarding distance
- Mean tree size/no of trees per m3 or ton
- Dominating tree species.

Especially the volume estimation is of importance. This could be done based on Information from forest owner or forest management plan or information from field survey where the volume is assessed directly from experience or measured using

- **Basal area**
- **Mean tree heights**

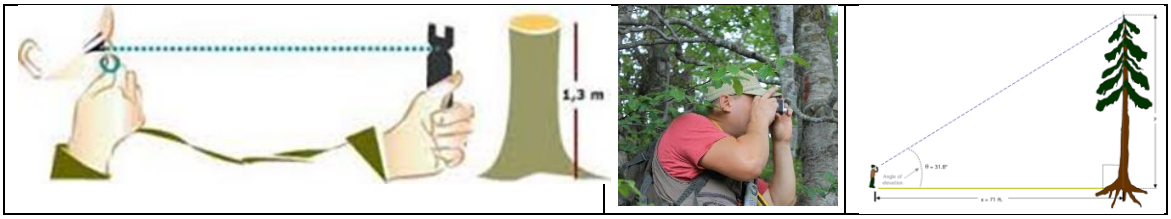

Figure 3.36; measurement of basal area and tree heights.

Issue to clarify	Parameter to identify and method
General harvesting conditions	• Steepness • Branching • Bearing capacity of the soil • Snow conditions • Accessibility • Volume per ha.
Location of landing place	• Accessibility with bigger trucks • Space for efficient organization of the operations and storing needs.
Forwarding distance and conditions	• Distance measured from the map or with GPS. • General conditions assessed in the field • Steepness assessed or measured in the field.

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Mean tree size	• No of tree per ha, measured in the field. • Calculated from volume/ha and no of trees/ha. • Estimated directly in the field.

Choosing the most suitable technology

Different machines are suited for different conditions. When you have different technological solutions available, you need to optimise also the use of the machinery. From the collected information, the most suitable technology should be identified. Central parameters for this assessment will be:

- Could all the volume be reached with tractor and crane, or will any winching be needed.
- Is the diameter distribution suitable for a small forwarder, or is a bigger tractor needed.
- Is the forwarding distance long, it will normally be most efficient and best for the wood quality to use a forwarder or bigger tractor with trailer, rather than skidding?
- If the total volume of the contract is small will be in favour of using cheaper equipment.

Calculation of harvesting costs.

Cost matrixes should be established, that simplifies the calculation of harvesting costs. Such matrixes could be derived from the collected forest parameters and experienced production level and costs.

Creation of operational plan

A simple operational plan for doing the harvesting operation should be made. This plan should include:

- Work description
- Volumes to harvest
- Preferred technology
- Expected productivity
- Any special considerations
- Map showing harvesting area, forwarding tracks and landing place.

3.7.3 Overall production planning

The overall production planning is focusing optimisation of the total wood procurement to the heating centrals. In a simplified version, this could for the overall production planning, be like the following matrix. In a real case this should be specified for each heating plant.

	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	All year
Stock day 1.	10000	6549	4313	2966	3336	6476	10096	11575	13054	16524	15479	13359	10000
Needs for the month	9951	8736	7347	5130	1860	1380	1271	1271	1530	6045	7620	9517	61658
Wood harvested and delivered roadside	1500	1500	1500	1500	1500	1500	750	750	1500	1500	1500	1500	16500
Wood bought delived roadside	3500	3500	3500	3500	3500	3500	2000	2000	3500	3500	3500	3500	39000
Production by own chippers and transported by own trucks	5000	5000	5000	5000	5000	5000	2750	2750	5000	5000	5000	5000	55500
Wood bought and deliverd CIF	1500	1500	1000	500	0	0	0	0	0	0	500	1500	6500
Total wood procurement	6500	6500	6000	5500	5000	5000	2750	2750	5000	5000	5500	6500	62000
Stock at the end of the month	6549	4313	2966	3336	6476	10096	11575	13054	16524	15479	13359	10342	10342

Table 3.37; Possible simplified procurement plan for wood to the heating plants, showing the sources for wood and stocking

The figures in the table 3.37 could graphically be shown like the table below, which clearly illustrates when the stock is built up and when it is a necessary source for covering the needs.

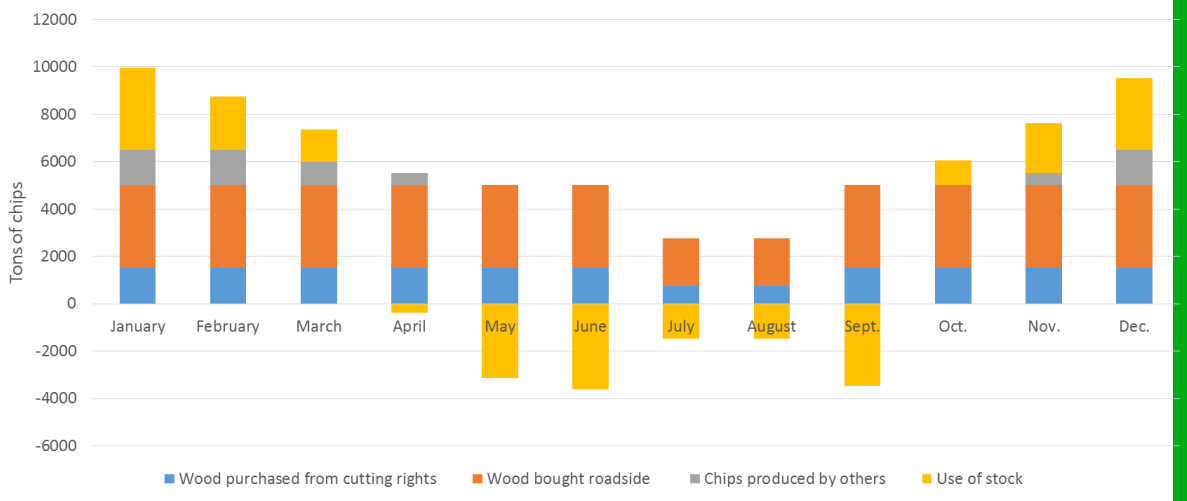

Figure 3.38; procurement plan similar to 3.37.

A complete procurement plan needs to specify the procurement to the different heating plants. In such specification, also the transport aspect has to be included, in a way that minimizes the transport costs.

3.8 Suggestions for improvements in addition to those from the tasks below.

Challenges	Proposals
Low productivity by cutters. Reasons for low productivity can be found in: • Wage system based on fixed salary • Small dimensions Small density per ha	1. Implement a productivity based wage system per team. 2. Not to accept contracts based on too small dimensions/low density. In stands with mixed dimensions/ density, parts with low dimensions/density should be left untouched
Low productivity in forwarding. Reasons for low productivity can be found in: • Wage system based on fixed salary • Small dimensions • Small density per ha • Wrong equipment Lack of cooperation between loggers and drivers.	In addition to the proposals for to improve the logging operations: 1. Implement hand bunching to reduce the time used for loading 2. Exchange some of the tractors with 1 forwarder with expandable load area. 3. Exchange cranes of the IKT tractors with cranes with longer loading range and preferable slewing angel of at least 360^{o}
High machine costs (tractors). The operating cost per tractor is high compared to Norwegian experience. This is not investigated further in this project.	1. Reduce the number of tractors due to higher production per day. 2. Implement maintenance procedures for each tractor (checklist, lubrication plan, fuel quality, etc.)
High chipping costs due to low productivity	1. Reduce the number of chippers. Simultaneously increase the number of containers to ensure that both the chipper and the trucks can work without stop.
High transportation costs	1. Increase the number of containers. 2. Optimize the transport systems in a way that ensure highest possible chips production on the landings. This means e.g. that empty containers shall be at the landing when the chipper arrives.

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4. IT situation and possibilities for further development

4.1 Description of present logistical chain of information

Intech emphasises the following purposes of a biofuel information system:

- Provide the management with useful information to avoid Intech heating plants never run out of chips during heating season.
- Provide the management with useful information to increase the profitability in the business area Biofuel (covering the value chain from the forest via the storehouse into the heating centrals).
- Control the costs in each step of the value chain
- Prepare for incentive based salaries (100 % or partly) - if possible
- Reduce error in data put into databases.

The present IT system is based on five sources:

Text not disclosed

4.2 Task adjustments

The tables above shows that the need for information very much depend on the chosen strategy for salaries. Intech may choose to implement some kind of productivity based salaries for harvesting and forwarding.

During visit in March 2015 Norskog and Intech agreed to adjust support to the IT solution task: In order to improve Intech's logistical performance, Norskog will prepare the background documentation for procurement of IT hardware, and software development services . Norskog will focus on:

- General layout of database
- How data is to be collected
- Which data to be collected in general.
- Participate in a workshop with representatives from Hrinovo and HQ to determine what type of data is required to fulfil Intech's needs and how it should be collected.

Ing. Ľubomír Plančár is hired by Intech to develop a bidding document consisting of comprehensive specification for the need of integrated IT systems, based on the results from Norskog's work. The report is attached (Slovakian language - Attachment 2). The bidding document assumes that Intech shall establish an integrated IT system.

5. Assessment and development of Intech's organisational set up

Text not disclosed

5.3.1 Different strategies for chip procurement

There are several ways to buy chips. In Slovakia it seems that there are 3 alternatives that are common:

1. Buying cutting rights - implement the whole value chain from harvesting to transportation to heating plant
2. Buying whole tree stacks or logs roadside and implement the value chain from chipping to transportation to heating plant
3. Buy chips CIF heating plant

Buying cutting rights gives the possibility to control the supply 100%. The challenge is to get enough contracts with landowners and to implement the activities within the value chain with acceptable cost. In principles the activities could be done with employed people and own technical equipment. All activities could also be implemented with contractors. This would reduce the risk for to high cost, but demand long term contracts with contractors and higher stocks of chips to reduce risk for unstable or not fulfilled contracts.

In Slovakia there is also an issue that not all employers are paying fair salaries and fulfilling their obligations regarding taxes and public fees. The risk of contributing to illegal praxis increase when contractors are used.

Buying whole tree stacks or logs roadside, reduces the risk for to high prices because the most time-consuming and complex part of the value chain are outsourced. On may reduce the risk for unstable and not fulfilled contracts by contracting several suppliers and accepting higher stocks. The issue of social dumping will be as described over.

Purchase of chips means outsourcing all handling of the biofuel until it is delivered to the heating plant. In principles one can contract terms with suppliers that ensure that storage cost is largely at their cost (just in time deliverance). This is common in many industries like e.g. the car manufacturing industry. To succeed with this, the value chain must consist of professional enterprises, which are trustworthy regarding price, quality and ability to deliver. According to Intech this seems to be difficult to achieve in Slovakia to an acceptable price. The issue of social dumping will be as described over.

Text not disclosed

5.3.2 Is outsourcing an option?

What influence on when to outsource the various logistical activities?

There is important to time outsourcing correct. Done without the correct timing it can reduce Intech's ability to deliver chips in time to its clients, influence negatively on Intech's cost, or lead to more social dumping.

Text not disclosed

5.3.3 Impact of competence and knowledge

Good competence at all levels normally contributes to reduced needs for detailed management and reduced administration costs. When the workers know how to do the work, they do not need detailed instructions telling what they already know. Training of staff and preparation and dissemination of relevant information for their work, will then contribute to reduced administration costs.

5.4 The Scandinavian model

In Scandinavia there have for the last 50 years been a clear development in the direction from having all services "inhouse", in own company with own staff and machinery, to outsourcing most services. The development is below described and some simplified into tree steps.

• Low level of mechanisation. Use of tractors with winch or trailers, no use of harvesters. • All workers employed by the company and most of the machinery owned by the company. • Low competence among forest workers and no delegation of responsibility. • Production based salaries. • High administration cost.	• Increased mechanisation. Harvesters introduced and forwarders are common. • Low level of outsourcing. • Increased competence by forest workers and increased delegation of responsibility. • Production based salaries • The administration costs are some reduced, but still relatively high.	• High level of mechanisation, forwarders and harvesters are dominating. • Almost all machinery are sold to the workers, who have established contractor companies. • High competence at the contractor level. • High degree of mechanisation. • Low administration costs.
1960 – 1975	1975 - 1990	1990 - 2015

In the transition period from having the forest workers employed and machinery owned by the companies, the companies offered some assistance to the forest workers when they reorganised into contractor companies and took over the ownership of the machinery.

5.5 Monitoring costs and productivity

If the middle managers were better informed about the impact of their own performance, and costs and income from their own activities, it would be easier to improve and reach the goals. Each manager should know which parameter that have impact to the costs, productivity and economic result of the production under their responsibility. They should also know the correlation between changes in the different parameters and productivity.

Updated knowledge about how the company performs and which parameters that explain the result is imperative for proper management and improved economic results. Such information is necessary for all management levels of the business, but adapted to the needs of each level. The reporting should be given both in physical terms and economic, but will to some extent demand some additional collection of information, from the different services or operations.

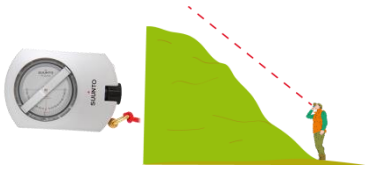
Intech personnel tends to think of productivity as “what is possible” rather than “what is produced”. This may very well cover the real productivity figures that so much influence Intechs financial result negatively.

5.5.1 Parameters

To improve the costs and productivity and to manage the production line efficiently, information about what is produced and the different parameters that influence the productivity and production costs will be needed. Knowledge about productivity and how this is influenced by variation in different parameters is also imperative for correct pricing of the provided services. To achieve such information, monitoring specified parameters and doing some relevant data collection for all the operations planned and conducted, will be necessary.

The parameters should be collected at each phase or strep in the production. Relevant parameters could be:

Phase	Parameter	Unit	Frequency	Method and justification
Planning the operations	Harvesting area	Ha	Per contract	Estimated in the field, combined with measurements in the map. Could also be measured directly in the field by using GPS.
	Expected harvesting volume	M^3	Per contract	Could be derived from expected harvesting volume per ha and harvesting area.
	Number of trees to be harvested per hectar	No	Per contract	Estimated in the field from a number of sample plots, using a telescopic stick giving a radius of 3,99 m. The circular sample plot you get by turning around 360˚ will cover the area of 50 m^2 . The number of trees counted on this plot multiplied by 200 gives the number of trees per Ha. The number of trees per ha and per m^3, are crucial parameters for the productivity.
	Expected harvesting volume to harvest per hectar	M^3 or tons	Per contract	Estimated in the field directly from experience or by measuring the basal area and mean tree heights at some sample plots. Estimation of basal area is easily done by using a relascope/bitterlich. 

<table>
<tr><td></td><td>Steepness of harvesting area.</td><td>% or pre-defined classes.</td><td>Per contract</td><td>The steepness could easily be measured by using clinometer, but could also be assessed by experience into the relevant classes.
 
Relevant classes could be
<table><tr><td>Steepness</td><td>Conditions</td></tr><tr><td>0 – 20 %</td><td>Easy terrain</td></tr><tr><td>20 – 35 %</td><td>Some difficulties</td></tr><tr><td>>35</td><td>Hard terrain</td></tr></table></td></tr>
<tr><td></td><td>Steepness of skidding road</td><td>% or predefined classes.</td><td></td><td>As above.</td></tr>
<tr><td></td><td>Expected forwarding distance</td><td>m</td><td></td><td>The average distance for the tractor to drive from the logging area to the storing.</td></tr>
</table>

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Harvesting operations	Number of trees cut	No		Number of trees cut by each logger. Could be counted continually, or as a sample for one hour worked. This could easily be counted by using a counting tool.  This should just be counted per day, and accumulated for the contract. This give the possibility to calculate number of trees per ton or per m^3 which are relevant parameters for assessing both productivity, costs and pricing.
	Number of effective hours worked in the field (Eh_0)	No		This should be the normal hours of a working day minus any time spent for transportation, lunch break and other breaks, time spent for waiting for any reason etc.
	Any problems			Any unexpected problems with the logging, explaining reduced productivity.
Forwarding	Number of hours worked in the field	No		This should be the effective working hours of the machine. Time spent for maintenance should not be included.
	Number or tractor loads transported	No		This should just be counted per day, and accumulated for the contract. This gives the first preliminary figure for the production.
	Any problems			Any unexpected problems with the forwarding, explaining reduced productivity. Such problems could be: technical problems with the equipment, reduced bearing capacity of the ground due to heavy rainfall, unexpected demanding accessibility in the field (more problematic than identified in the planning process), etc.
Chipping	Number of hours worked in the field	No		This should be the effective working hours of the machine. Time spent for maintenance should not be included.
	Number of containers produced	No		This is a more accurate figure for the production, and should be of a higher accuracy than the number of tractor loads. This should be recorded at a daily base.
	Any problems			Any unexpected problems with the logging, explaining reduced productivity.
Transport	Number of containers transported	No of containers		Recorded at a daily basis.
	Distance transported	Km transported		Measured by the internal GPS system for the monitoring system for the trucks.
	Tons transported	Tons		Normally registered by scaling. If necessary, this could also in special occasions be calculated.
	Number of hours worked with transport			This should be the effective working hours of the truck. Time spent for maintenance should not be included.
	Any problems			Any unexpected problems with the logging, explaining reduced productivity.

Table 5.2 Parameters that could be collected to improve Intech performance

All such information collected have to be given with a specific project ID, as well as IDs that make it possible to link the information to each harvesting team, tractor, chipper or truck, when relevant.

When having collected and reported such information the following key-figures describing the progress of the production and productivity could be derived and distributed to managers at different level in the organization:

- Production of tons
- Number of tons produced, compared to expected in the contract.
- Number of tons in average per tractor load
- Number of tractor loads per day.
- Number of tons transported per day by the tractor.
- Number of ton-kilometres transported per day by the tractor
- Forwarding cost per ton
- Forwarding cost per ton-km.
- Total harvesting cost per ton.
- Total harvesting volume per effective man hour.
- Total harvesting cost per effective man hour.
- Number of tons chipped
- Number of containers chipped
- Average efficient working hours/day of forwarder
- Average efficient working hours/day of chipper
- Average efficient working hours/day of truck
- Number of tons transported in total
- Number of tons transported in total
- Number of tons transported per truck
- Number of ton-kilometres per truck.

All the key figures could be compared with similar budget figures for the year, some kind of target figures for each operation, or average so far. The variation in the key-figures could be explained by some additional information that could be derived from the collected figures.

- Correlation between forwarding cost and skidding distance.
- Correlation between forwarding cost and mean tree volume.
- Correlation between forwarding cost and steepness of the skidding road.
- Correlation between total harvesting cost and mean tree volume.
- Correlation between harvesting cost and steepness of the logging field.
- Correlation between forwarding cost and steepness of the skidding road.
- Correlation between harvesting cost and volume to be harvested per ha.

Such key figures and information should contribute to improving their possibility to monitor the progress and profitability of each projects, as well as identification of fields

for improvement and relation between different parameters and productivity, which will give input to more exact pricing.

This kind of information should give the possibility to monitor the delivery, adjust the capacity to the needs and identify any bottlenecks in the supply chain.

Some of the information suggested for collection, will to some extent be overlapping. For the monitoring purpose this could show useful. If some mistake occurs or some volume is missing, it will then give a better possibility to track and verify the delivery and identify possible mistakes in any of the steps.

5.5.2 Reporting

Key figures for operational management support.

The information collected could be reported for each contract or mission, statistically for each month and accumulated for the year, like:

The tables below suggest examples of a simple key figure report.

Total overall report

Parameter	Unit	Last month	Accumulated for the year	Budget goal For the year
Production of tons	Tons			
Number of tons produced, compared to expected in the contracts	%			
Number of tons in average per tractor load	Tons			
Number of tractor loads per day.	No			
Number of ton-kilometres transported per day by the tractors, in average.	Tons			
Forwarding cost per ton	EURO			
Forwarding cost per ton-km.	EURO			
Total harvesting cost per ton.	EURO			
Total harvesting volume per effective man-hour.	Tons			
Total harvesting cost per effective man hour	EURO			
Number of tons chipped	Tons			
Number of containers chipped	No			
Average efficient working hours/day of forwarder	Eh_0			
Average efficient working hours/day of chipper	Eh_0			
Average efficient working hours/day of truck	Eh_0			
Number of tons transported in total	Tons			
Number of tons transported per truck in average	Tons			
Number of tons transported per truck in average	Tons			

Specified figures for each logger team

Parameter	Unit	Last month	Accumulated for the year	Budget goal For the year
Tons logged	Tons			
Trees logged	No			
Number of tons produced, compared to expected in the contracts	%			
Average efficient working hours/day of the logger team	Eh_0			
Logging volume per effective man-hour.	Tons			
Number of trees logged per effective man hour				
Total logging cost per effective man hour	EURO			

Specified figures for each tractor

Parameter	Unit	Last month	Accumulated for the year	Budget goal For the year
Tons transported	Tons			
Number of tons transported, compared to expected in the contracts	%			
Number of tons in average per tractor load	Tons			
Number of tractor loads per day.	No			
Number of ton-kilometres transported per day by the tractors, in average.	Tons			
Forwarding cost per ton	EURO			
Forwarding cost per ton-km.	EURO			
Total forwarding volume per effective man-hour.	Tons			
Total harvesting cost per effective man hour	EURO			
Average efficient working hours/day of forwarder	Eh_0			

Specified figures for each chipper

Parameter	Unit	Last month	Accumulated for the year	Budget goal For the year
Tons chipped	Tons			
Number of tons produced, compared to expected in the contracts	%			
Number of containers chipped	No			
Average efficient working hours/day of chipper	Eh_0			

Specified figures for each truck

Parameter	Unit	Last	Accumulated	Budget

		month	for the year	goal For the year
Tons transported	Tons			
Average efficient working hours/day of truck	Eh0			
Number of tons transported per truck in average	Tons			
Number of ton-kilometres transported	Ton-km			
Number of ton-kilometres transported per day	Ton-km			

5.5.3 Reports to improve information about financial situation of Intech

Improvement of the flow of information up and down within Intech hierarchy is an important measure to ensure better decisions on all levels. For all practical means, this information must be generated from information given in the accounts and/or assembled by the new information system.

NORSKOG suggest the following reports

Name of report	Justification
Cost - accounting per contract	This report is meant for the management and for middle leaders within the Biofuel division. It shall make it possible to evaluate each contract, and help management and middle leaders to learn from experience. When the cost accounting for a contract shows bad results, it should be followed up by report from the middle leaders to the management explaining why. In this explanation other data from the Biofuel Information System should be of use (density, dimensions, terrain (roughness, steepness)) It would be difficult to find exactly financial results per contract. We suggest 1. Contract margin comprising of real data for purchase cost (raw material), salaries (incl. taxes) and tons, and budget numbers for operational costs (fuel, services, maintenance). The management must give a level (€/ton) that indicates that it is satisfactory or not. This level must be set to cover both a profit margin and fixed cost. That means the level must be different varying of if the contract is about chips bought CIF, stacks of whole tree bough roadside or cutting rights bought from a forest owner. 2. Performance data showing production per hour for the various parts of the production line
Monthly Financial results per business area and for Intech	This report should be sent to all middle leaders in all business areas or divisions within Intech. It should give the middle leaders and management information about the profitability in all sectors of Intech. All cost must be included. This report demands at least estimates of changes in inventory and depreciations. The report should be followed by comments from the management, focusing on trends and future market expectations and financial demands.

Relevant parameters could be:

Report	Parameter	Unit	Source
Cost accounting per contract	Contract or mission ID		Accounts (A) – must also be integrated in the Biofuel Information System (BIS)
	Customer	Name of heating plant or interim storage	BIS
	Produced tons	Tons	BIS
	Salaries for involved personnel while working on mission/contract	Euro	BIS
	Logged tons per hour	Tons per man-hour	BIS
	Transported tons per hour	Tons per man-hour	BIS
	Chipped tons per hour	Tons per man-hour	BIS
	Transported tons per hour	Tons per man-hour	BIS
Monthly Financial results	Financial result for the last 3-6 periods	Euro	A
	Production for the last 3-6 periods	Tons or Kwh	A + BIS

Examples of specified templates:

Post-calculation of contracts

Supplier				
Supplier nr:				
Customer				
Customer nr:				
				Euro/ton
Contract nr			**Sales value**	
			Costs	
Produced tons	1		Purchase of rawmaterial (I)	
			Logging (salaries incl tax) (II)	
			Estimated operational cost machinery - logging (III)	
Activity	**Hours used**		Forwarding (salaries incl tax) (IV)	
Harvesting			Estimated operational cost machinery - forwarding (V)	
Forwarding			Chipping (salaries incl tax) (VI)	
Chipping			Estimated operational cost machinery - chipping (VII)	
Transportation			Transportation (salaries incl tax) (VIII)	
			Estimated operational cost machinery - trucks and containers (IX)	
Productivity	Tons /hour			
Harvesting	0		Sum cost per contract - per ton (Sum I-IX)	0
Forwarding	0		Sum cost per ton logging and forwarding (Sum (I-V)	0
Chipping	0		Sum cost per ton chipping (Sum VI-VII)	0
Transportation	0		Sum cost per ton transportation (Sum VIII- IX)	0
			Contract margin per contract ((Sales value - Sum cost per contract) x produced tons)	0
			Contract margin per ton (Contract margin per contract / Produced tons)	0
			Budgeted margin per ton	
			Deviation from budget (Contract margin per ton -budgeted margin per ton)	0
Explanation of deviation from budget				
Comments to input:	Estimated cost to be given from the accounts			
	Salaries includes all all cost regarding the actual employees, and are to be given from the accounts			
	By contract nr. means contract between supplier and Intech Biofuel Division			

Key information of Intech

Period:	-4 period	-3 period	-2 period	-1 period	This period
Finacial results Intech					

Key information of Intech Biofuel Division

Period:	-4 period	-3 period	-2 period	-1 period	This period
Contribution margin (IBD)					
Financial result					
Production (tons)					
Average harvesting cost					
Average chipping cost					
Average procurement costs					
Harvesting rights					
Roadside					
Chips					
Volumes					
Harvested volume					
Chipped volume					
Transported volume					
Procured volumes					
Harvesting rights					
Roadside					
Chips					
Chips in stock at heating plant					
Chips in stock at interim stock					
Biomass ready for chipping					
Backlog of orders - meaning contracts not produced or partly produced					
Harvesting rights					
Roadside					
Chips					

5.6 Contracts

Norskog have been given some examples of contracts in Slovak language. These has been partly translated. Our impression is that they recognizes the most important needs Intech might have. The biggest challenge seems to be that this written contracts are not commonly used when Intech buy cutting rights[1].

It seems that all contracts meets the demands according to Slovak legal regulations. We will not consider these part of the contracts.

5.6.1 Contracts for purchase of chips

These contracts should recognize the following needs:

- Total volume delivered at one or more specific heating plants
- Delivery per heating plant per week - per month or per month in low season and per week in high season
- Chip properties (size, humidity)
- Price - fixed prise due to delivery according to contract, with rules for reductions and additions in prices due to deviations from delivery according to contract
- Rules for when deliveries will be rejected and who is going to pay for it.

5.6.2 Contracts for purchase of stacked biofuel roadside

These contracts should recognize the following needs:

- Quality of biofuel (species and estimated mean diameter)
- Price - fixed prices due to delivery according to contract, with rules for reductions and additions in prices, due to deviations from delivery according to contract.
- Rules for how the number of tons should be measures (by scale, by number of containers or a combination of these)
- Estimated number of tons stocked roadside. Rules for when a final estimation should be given if the stock is nu there yet at the contract date.
- Specific location of loading place. Rules for how a change of loading place should be negotiated.
- Rights to chip and store biofuel (for a given period) on the landing must be included in the contract as attachment. (Agreement between seller and owners of the landing)
- Rights to transport the biofuel from the landing to public road. (Agreement between seller and owners of the private road)
- Rules for how to deal with damages on landing and private roads.

5.6.3 Contracts for purchase of cutting rights

These contracts should recognize the following needs:

[1] According to Intech personnel in Hrinova.

- Conditions given by the municipality or the Government should be attached to the contract.
- Price - fixed prices due to delivery according to contract, with rules for reductions and additions in prices, due to deviations from delivery according to contract.
- Rules for how the number of tons should be measures (by scale, by number of containers or a combination of these)
- Specific location of loading place. Rules for how a change of loading place should be negotiated.
- Rights to chip and store biofuel (for a given period) on the landing must be included in the contract as attachment. (Agreement between seller and owners of the landing)
- Rights to transport the biofuel from the landing to public road. (Agreement between seller and owners of the private road)
- Rules for how to deal with damages on landing and private roads.
- Rules for how to deal with damage on skidding roads.
- Smallest diameter Intech must cut and/ or remove from the cutting site

5.7 Challenges and cures

In the table below, we have pointed out some challenges in Intech's organisation and some proposals how to meet these challenges:

Text not disclosed

6. Training

Norskog has for the training focused on:

Design a plan for the training, which give the best results with the limited resources in the project.

Adapt the training to the needs of the different professions in the company.

Where useful, work according to the principle of training of trainers.

According to our findings, the understanding of the economics of the total production line as well as the impact of each component to the profitability of the company, is some limited.

Proper training is a crucial parameter in achieving results of changing processes. This project shows the necessity of a change in the business culture within the business area of the Biofuel division and in its interaction with the HQ.

Biofuel division needs to see their place in the value chain and act relevant and independently according to the challenges set by the CEO/Management team.

Plan for training

To help with this Norskog suggest the following training activities:

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Understanding of Intechs business strategy, and important parameters to succeed.

Target group is all employees. Norskog will develop a template, that can be used by Intech

Understanding of financial reporting.

Target group is middle and senior managers. Norskog will develop templates for financial reports and implement one training session with middle and senior managers.

How to collect efficiency parameters.

Target Group is middle and senior managers responsible for harvesting operations and chipping and transportation operations, and workers in the same areas. Norskog will develop a template for information gathering together with Intech personnel in Hrinova.

Norskog suggest to focus training of the middle managers of the biofuel division with the following training activities:

- The production costs of each activity or step in the production line.
- The cost components and the total costs?
- Contribution to profitability, what are acceptable costs
- Means to reduce the costs?
- Means to improve the productivity and profitability
- Salary based costs.
- Needs for information to manage the costs.

This is especially important for middle managers, that should be the main focus for the training.

The training will be provided as a seminar, with a mixture of lecturing and discussions.

6.1 Broad program for the training

The training has been planned as a seminar addressing key findings addressing possibilities for improved productivity and profitability of the wood procurement of Intech.

A training seminar has been designed with the following schedule:

IMPROVEMENTS IN INTECH'S CHIPS SUPPLY

Location: Hrinova (13. April 2016)

Target group: Middle managers at Hrinova, management team of Intech

Time	Subject	Responsible
09.00	**Introduction** • Why do we have this seminar, and what do we want to achieve.	**Intech**
	Starting point – the value chain • How to analyze the situation? • How do we describe the production line? • What figures do we have? • Quality of information	**NORSKOG**
	The current situation of our value chain • How is our performance? • What do we cost? • How do we perform compared to competitors in Slovakia and to other countries?	**NORSKOG**
10.30	**Break**	
10.45	**More detailed about logging and forwarding** • Which are the cost factors? • Is our technical setup optimal? • Is the organization of the work optimal? • How could we improve the performance?	**NORSKOG**
12.00	**Lunch**	
12.45	**More detailed about chipping and transport** • Which are the cost factors? • Is our technical setup optimal? • Is the organization of the work optimal? • How could we improve the performance?	**NORSKOG**
	Information needs • What information do we need to manage the improvement? • Who need what kind of information? • How do we collect the information? • How do we process and distribute information?	**NORSKOG**
14.00	**Break**	
14.15	**Planning** • Procurement phase and contracts • Planning of a single harvesting	**NORSKOG**

	operation • Planning of succession of harvesting operations	
	Production based salaries • At what level? • How should it be calculated? • How to collect the parameters for calculation? • Who should own the machinery?	**NORSKOG**
16.00	**Break**	
16.15	**Final conclusions** • Wrap up the previous discussions • Agree on conclusions • How to follow up?	**Intech/NORSKOG**
16.45	**Closing remarks**	**Intech**

The presentations are attached (attachment 3)

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7. Recommendations

1. Intech must believe in their own ability to increase the productivity in their forest operations and chipping activities to continue with these activities.

   Text not disclosed

2. Intech must make employees more responsible for their own salary.

   Text not disclosed

3. Intech must optimize productivity in a value chain perspective.

4. Text not disclosed

5. Intech must higher its focus on the productivity of the most costly machines - such as chippers.

   Text not disclosed

6. Intech should - as present – sell chipper(s) and buy transportation equipment like trucks, containers and forwarders(s).

   Text not disclosed

7. Consider exchanging LKD-tractors with forwarders.

   Text not disclosed

8. Intech must establish routines of post-calculations after forest operations.

   Text not disclosed

9. Drying of biomass before chipping.
   Drying of wood would mean that less biomass must be gathered for the heating plants. Less biomass means lower cost and due to less procurement of biomass, lower investments and financial cost, lower operational cost and lowe salaires.