Dissertationes Forestales 106

Development of management and cost accounting of wood harvesting in the Republic of Karelia

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Academic dissertation

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ABSTRACT

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During the Soviet Era, in the Karelian Autonomous Soviet Socialist Republic, the harvesting of wood was mainly arranged by state logging companies called *lespromkhoz*. The logging method then was the tree-length (TL) method, which was targeted for full mechanisation. A centralized management system with extremely centralized decision making was used in the whole of the Soviet Union. In this planned Soviet economy, the volumes of wood harvested and the roundwood prices were set by the Ministry of Forestry and Forest Industries, and costs were set according to standard, internally agreed upon, methods.

In the early 1990´s, during the period of transition from the Soviet planned economy to the market economy the logging industry of the newly established Republic of Karelia fell into economic crisis. Wood harvesting in most of the Karelian logging companies had become unprofitable; the major reasons were cost increases and other cost factors due to the markets. In addition, the outdated technology and undeveloped infrastructure also affected the profitability. Many of the state owned *lespromkhozes* changed ownership, becoming joint stock companies, and many small logging companies were established.

Within the context of drastic economic and societal transformations, this study describes and analyses both the changes in the wood harvesting management systems in the Republic of Karelia and the theory and practice of cost accounting for wood harvesting in Karelia and the Russian Federation. At present in Russia, and specifically in the Northwest, both the cut-to-length (CTL) and tree-length (TL) harvesting methods are commonly used. During the last 10-15 years, modern CTL technology has accounted for an increasing share of the harvesting. While there has also been some modernisation in TL technology, the traditional machines and methods still prevail. Harvesting cost calculations for the processes that are involved in the cutting areas and in the delivery to the domestic wood processing industry, or for export, were made for both the TL and CTL methods. All harvesting operations in the forest, as well as work at the logging terminal, are divided into the main activities along a logistic chain. Wood harvesting cost calculations for the TL and CTL methods are based on several work options, including the use of Russian and Nordic mechanisation, as well as manual methods.

As part of the theory of cost-price accounting, the Russian method of cost-price and the Nordic method of wood harvesting cost calculation are studied and compared. Similarities exist in the cost categories of both methods, in that cost accounting is divided into fixed and variable costs, but there are also significant differences. One of the differences between the two is that an exchange value for machinery is taken into account in the Nordic method, but not in the Russian method.

Cost accounting models for 2000-2005 indicate that the cost for harvesting with the CTL and TL methods in Karelia have increased by 2.5 times in real terms. The wood harvesting costs depend on the harvesting method and roundwood transportation distance; in 2005, for the CTL method, they ranged from 11-35 €/m^3, and for the TL method, they were from 13-42 €/m^3. However, it seems that the increasing use of the CTL method with Scandinavian technology in many cases is as much due to the new forms of organisation and management of harvesting work, as it is to cost calculations.

Keywords: Management systems, Soviet cost accounting, Tree-length method, Cut-to-length method, Cost accounting development

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Olga Tyukina

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ABBREVIATIONS

AKSSR- Autonomous Karelia's Soviet Socialist Republic 25.07.1923-05.12.1936

CAC- Cutting area costs

CM USSR- Council of Ministers of Union Soviet Socialist Republic

CPC- The council of People's Commissars in USSR

CPSU - Communist Party of Soviet Union

CTL - Cut -to -length method of wood harvesting

DBMS- Data base management system

EC-extraction costs

GDP- Gross Domesticts Products

JSC- Joint Stock Timber Holding Company in the Republic of Karelia

JSH- Joint-stock holding

KASSR – Karelia's Autonomous Soviet Socialistic Republic 05.12.1936-31.03.1940, 17.07.1956-12.11.1991

KFSSR- Karelo-Finskaya Soviet Socialist Republic 31.03.1940- 16.07.1956

KLPH- multifunktional or compex *lespromhoz*

LLC- Lower landing costs

LPH- *lespromhoz,* specialized state logging company

LTV- Labor theory of value

MKB - Small brigade (2-3 persons). Organisation of logs transportation from upper landing to lower landing .

NEC- National Economy Councils

NEP- New economic policy

POM- Production and Operations Management

RK- Republic of Karelia from 13.11.1991

RWC- railway transportation costs

R&D- Reaearch and development

SC- Skidding costs, EUR or Roubles

SNK RSFSR - Council of People´s Commissariat of Russian Federation in 1918

SV- Skidding volue m^3

SWOT- Strenghts, Weaknesses, Opporturnities and Threats

TC- Transportation costs

TL - Tree-length method of wood harvesting

UC- Unit cost

USC- Unit cost of skidding, EUR or Roubles/m^3

UST- Unit social tags

UKB - Large brigade (8-40 persons). Organization responsible of work on the cutting area during the Sovier time.

1. INTRODUCTION

1.1 The role of wood harvesting in the Republic of Karelia

For almost a hundred years, forestry, logging, and the woodworking and pulp and paper industries have been the key branches of the economy in the area presently known as the Republic of Karelia (RK), (Figure 1). As in the past the role of logging today is as a business element to provide wood for other elements of the forest sector. In 2007, about 88% of the Republic's forests were constituted by 154 long term forest lease contracts *(Strategiya sotsialno-ekonomicheskogo ... 2007)*. The total volume of wood harvested in 2007 was 6.37 mil. m^3, of which 6.0 mil. m^3 was the volume of commercial roundwood, and this accounted for 5.0 % of the total for the whole of Russia (Lesprom Industry Consulting 2008). In 2008, Karelian logging accounted for 6.3 mil. m^3, this was a 6.0 % share of the total Russian logging volume (Lesprom Industry Consulting 2009). The share of the logging industry of the Republic's forest sector was 10-13% from 1997-2004 and 18% in 2006 (Komstat RK 2005, Ministry of Industry and Natural Resources of the RK 2007). Traditionally the share of the forest sector had been about 40% of the Republic's gross output.

Figure1. The Republic of Karelia (RK) on the map of Europe. Source: http://www.gov.karelia.ru/gov/map_e.html)

The logging industry (*lesozagotovitelnaya promyshlennost*) in Soviet and then later in Russian industrial classification (Medvedev 1985, Shegelman 1998) includes a company's activities in logging, long distance roundwood transportation until an upper or lower landing at the mills, and also wood floating. It occupies an important place in the national economy of the Russian Federation. The logging industry is the basic industry for the development of the forest sector because this industry provides the raw materials for the pulp and paper, sawmilling, and plywood industries. The rate of profitability of the forest sector as a part of the national economy depends on the sustainable development of the logging industry. The logging industry has great potential for development, as Russia has the world's richest forest resources. According to the latest accounting of the forest fund, the common stock of forests in the Russian Federation is 81.9 bil. m^3, or more than 20% of world reserves (Rosleskhoz 2003).

Nowadays the logging activity in Karelia or in Russia as a whole is mostly carried out by leaseholders (*arendatory*), they are also an important part of the logging industry, and include logging companies called "*lespromkhoze*" which are responsible for all harvesting

operations from cutting through the transport of roundwood to upper or lower landings up to bucking it there to assortments. In 2007, there were 62 leaseholders in the Republic (Ministry of Industry and Natural Resources of the RK, 2007). In some cases largest logging companies may also have sawmills. Silvicultural work is usually the responsibility of state forestry enterprises (*leskhozes)*, even though sometimes logging companies take care of regeneration and forest road construction. The changes have been coming, when the New Forest Code came into effect at the beginning of 2007. The *leskhoze* has been formed to state unitary company (*lesnichestvo)* and silvicultural costs included in the structure of leaseholders' industrial cost-price. In 2007 in the RK the borders of 11 state unitary companies have been described. The state unitary company "*Lesa Karelii"* and *Lesnoy Soviet* of RK have been organised (www.gov.karelia.ru 01.04.2008).
Traditional division of the logging companies into categories large, medium-size and small has changed in the RK in comparison with the Soviet period. During last years the size of a large company has decreased. Currently «large» logging company is a logging company with 150 000- 200 000 m^3 annual volume of wood harvesting. Logging company with 100 000- 150 000 m^3 annual volume of wood harvesting is «medium-sized» logging company. «Small» logging company means a company with annual wood harvesting volume less than 100 000 m^3. In the RK the biggest number of logging companies are found in the category «small» (Gerasimov et al. 2005). The share of small logging companies in roundwood harvesting is 23% (Kareliastat 2006, Karellesprom 2006). In 2005 there were 30 large and medium-sized logging companies operating in the logging industry. Those create business background for the whole forest sector in the RK. Strategically large companies are the most important for development of management and profitability increasing. According to Gerasimov et al. (2005) the largest logging companies were *Zapkarelles, Pudozhsky Lespromkhoz, Muezersky Lespromkhoz*, *Shujales, Ladenso, Olonetsles, Piaozersky Lespromkhoz, Volomsky Kompleksniy Lespromkhoz, Medvezhegorsky Lespromkhoz* all with annual cutting volume more than 200 000 m^3.

Both tree-length and cut-to-length methods are used in wood harvesting. The tree-length method is the traditional one in Russia. In the tree length method delimbed and topped stems are skidded to intact at least to roadside. The cut-to-length method has been developed in the Nordic countries. In cut-to-length method felled trees are processed into wood assortments in the cutting area and processed wood assortments are then transported to roadside or upper landing. Both methods can be mechanised, and specific machinery can be used for different operations. Russian scientists have contributed to the development of technology of wood harvesting by tree-length method for Russian conditions (Vinogradov 1981, Menshikov 1987, Kochegarov et al. 1990, Gerasimov and Syunev, 1998 and Zgukov et al. 2004). Also technology of wood harvesting by tree-length method has been well developed in Canada and USA. The cut-to-length method has become more common along emergence of mixed capital or foreign capital for logging companies in wood harvesting for export in 1990s. In 2006, the share of cut-to-length method in total volume of wood harvesting for large and medium sized logging companies in the RK 66 % and that of tree-length method already was 34% (Ministry of Industry and Natural Resources of RK 2007).

The logging companies in the RK differ from each other not only in size but both on forest machinery (domestic or Nordic) in their orientation to domestic market or export and the structure of costs in domestic cost price for commercial roundwood. Soviet and later the Russian cost accounting method has been developed over decades, but has not always been implemented effectively. Development of complementary "western" cost accounting methods is therefore necessary. Also the global climate change, with warm winter is an actual problem for logging company's management and time-management in roundwood transportation. The most recent challenge is the establishment of high export tariffs effectively closing the export markets for roundwood. The fundamental milestone result of the 16 years of transition period to market economy in the RK is the elaboration of the Strategy of socio-economic development to 2020 *(Strategiya sotsialno-ekonomicheskogo… 2007)*. According to this document the two parallel ways are found for Republican forest sector development. The first is the creation of large corporations through the increasing capitalisation of large logging companies and continue process of consolidation of large integrated structures in the forest sector. The second way is the development of different types of independent companies. Their development has related to the system of leasing forests and wood export. The term "*lesnoy klaster*" or forest cluster has replaced the traditional similar term *"lesopromishlenniy kompleks"* and also the Russian term *"lesopromishlenniy uzel"* means production chain has start to be used in corporation management in integrated structures. The western investments in the logging industry of

the RK were the start point to western management development in wood harvesting. Modern management systems used for management of wood harvesting integrate all the achievement of domestic and western theories and practice.

1.2 The role of management and cost accounting in the logging industry

Cost accounting (CA) is the fundamental element in all industrial production, and it is also in the logging industry development. The CA of wood harvesting plays a major role in the management of the all operations of the logging company. It provides key information for choosing the optimal method of wood harvesting and increasing of business profitability (Figure 2) are also having the major impact on the organization of whole Russian forest sector.

The traditional for Russia cost accounting method and principles of cost accounting has been well developed for planning economy and than applied Soviet concepts to new conditions. Modern practical utilisation of Soviet/Russian traditional principles of cost accounting have been widely used and dominated. Historically, the Soviet/Russian cost accounting is focused on the interests of a single user - the State - as represented by the tax authorities, statistics, the Pension Fund, the Social Insurance Fund, etc. Therefore, the cost accounting and reporting for the domestic logging companies have a clear tax character.

The ideas of modern "western" theories of cost accounting (Yli-Olli 1981, Riahi-Belkaoui 1991, Jöbstl 1995, Drury 1996, Kaplan and Cooper 1998, Horngren et al. 2000, Penttinen et al. 2001, and Pellinen 2006) have emerged slowly in Russian logging industry and are not yet commonly applied in the Republic of Karelia.

One historical development line for "western" cost accounting theories is the change from a narrow focus to a broader one: for example from single product costing to process and service costing, after that to multiple and mixed product costing. Another similar development line refers to an increasingly detailed and complex cost accounting system, which is due to the improved information management possibility and creation of increasingly large and complex organizations.

"Western" cost accounting is largely a practically orientated activity, which measures financial and non-financial information related to organisation's acquisition or consumption of resources (Drury 1996). It provides information for both management accounting and financial accounting" (Bhimani et al. 2008). Due to this practical orientation, traditional cost accounting theories are usually not very competitive, but are rather complementary theories that often differ only in some very specific focus areas, while sharing most substance with each other. Traditional cost accounting has focused on product costing, which still is important, but the major theoretical problem of the allocation of indirect cost has created different theories – or rather theoretically and conceptually based methods as to how this problem can be resolved. Examples include the single-rate cost allocation method and dual-rate method or incremental and stand-alone allocation methods, among others. According to Bhimani et al. (2008) cost-allocation questions are seldom entirely right or clearly wrong, much depends on the context or availability of resources.

The general principles of Nordic method of logging machine cost accounting for Russian conditions were prepared at the Finnish Forest Research Institute (Sikanen et al. 2004, Ananyev et al. 2005). On the other hand Soviet/Russian such as hybrid of "western"/Soviet principles and theory of cost accounting are not known by western logging companies and Russian logging companies do not know well enough the western practices of machine cost or unit wood harvesting cost calculations. Improved cost calculation process for wood harvesting can contribute future wood harvesting to become more cost effective in Northwest Russia.

Cost accounting has two basic functions at the company level. Primary function of cost accounting is to provide information on actual production cost for production cost monitoring, price setting and production planning. The other function more directly the management of the company and include general cost management, profit centre analysis and investment planning. This function is commonly known as management accounting (Neilimo and Uusi-Rauva 1999).

In Russia state owns forests, and this state property affect to many responsibilities in the logging relation and the whole forest sector economy. The levels of management

accounting should also provide key information for authorities and ministry level for their strategic planning and policy purposes. This is also the cove in the RK. Management accounting measures and reports financial information as well as other types of information are intended primarily to assist mangers in fulfilling the goals of an organization (Bhimani et al. 2008). This is a shift from the traditional monitoring and control perspective to a more business-oriented and support-oriented focus since it links financial considerations with both the operating concerns and the strategic priorities of the enterprise (Scapens and Jazayeri 2003).

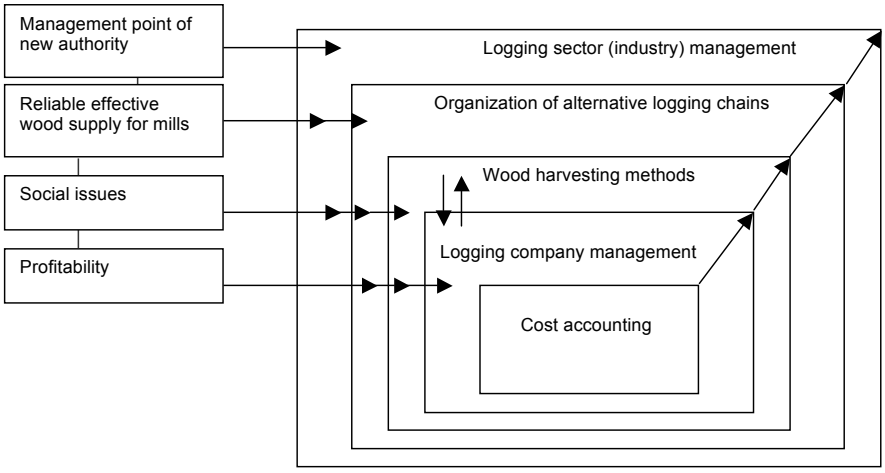


Figure 2. The importance of cost accounting in wood harvesting and management

Therefore cost accounting and management accounting information is needed at the multitude of hierarchic at different levels (Figure 2). During the current financial crisis importance of this aspect has increased. Unprofitable logging industry is key and well-known problem for discussed in government and in the business circles. The global World financial crisis has strong influence in logging industry. Demand on the commercial roundwood has been falls. Logging companies seek to reduce all costs by reducing workers.

1.3 Objectives

A transition from command and administrative system of centralised economy to market economy in Russia has meant and still requires significant changes in the country and in its regions and these changes have to be complemented also in practical level across the sector. The different problems related to transition processes have been influenced mostly negatively in advice ways through profitability of wood harvesting and economical situation of most logging companies during most years of transition has been difficult (Burdin et al. 2000). The recent part of transition period of wood harvesting development could be characterised as the period of great changes and capitalization of logging companies connected with increasing of costs and growing average transportation distances. The effectiveness of wood harvesting should be improved and harvesting cost should be taken better into account for profitability to be raised. This would be also a prerequisite for future investments and modernisation of wood harvesting. The overalls aims of this study are:

Firstly, to examine the development of the management of wood harvesting in the RK under different economic systems connected to its structural development in former Soviet Union and Russia. Secondly, analyse and compare the "western" and Soviet/Russian methodologies of cost accounting for wood harvesting. Thirdly, apply elements from "western" cost accounting to further develop domestic economic theory and to compare wood harvesting alternatives in the RK. Specific objectives of the research are therefore to:

- Describe and analyse wood harvesting management systems and relation in management theories in Soviet period (Chapter 2)

- Describe and analyse changes how wood harvesting has been organised during the transition period until present years (Chapter 3)
- Describe and analyse of cost accounting concepts and theories in wood harvesting during the Soviet period and transition period during which new concepts of cost accounting have gradually adopted (Chapter 4)
- Apply developed cost accounting method for model comparisons of three-length (TL) and cut- to-length (CTL) technologies of different wood harvesting chains based on model calculation in the RK (Chapter 5)
- Discuss the challenges in management and wood harvesting cost accounting in the Republic of Karelia (Chapter 6)
- Draw conclusions of the present state of management and cost accounting of wood harvesting and give recommendations for the future research and practical implementation (Chapter 7)

1.4 Study approaches: Theoretical- conceptual approaches and Empirical-modelling approaches, two methods and data

Two theoretically oriented approaches are used in this study. Management-organisational approach is applied when the development of organisation and management structures and principles are analysed. The purpose is to find the leading principles and rationale behind management-organisational development in different periods. The second orientation and main emphasis in this study is in cost accounting approach; its theoretical fundamentals and practical guidelines are studied to understand the development of cost accounting practical until present times, and used for the analysis and comparison of wood harvesting costs of alternative methods.

Although the two approaches, i.e. management-organisational approach and cost accounting approach have different sub-disciplinary background; they are at the same time closely connected. The organisational management structure of forest sector and its operational units reflects on the structure of the whole sector or individual companies, and largely defines the scope and purpose of cost accounting. During the Soviet time the emphasis of the management of the whole state owners logging sector this has been evident. In the Western market economy-based tradition the focus of cost accounting has been in the enterprises but the wider orientation of the contents can be seen in terminology: as said above cost accounting is nowadays more and also seen as management accounting or an important part of that (Storey 1995). However, regardless of the fundamental differences in the economic system the practical orientation of cost accounting means that many similarities in Soviet/Russian and "western" cost accounting are prevailing and the socio-economically (ideologically) determined differences are assumed less the perhaps expected to be although sometimes important.

Differences in the approaches to cost calculation are connected not only to the prevailing economic systems in each period and theories as well reflecting economic systems but also with practical conditions related to the level of harvesting technology used and the form of the organization of work on a cutting area. Until 1980s and early 1990s in Soviet Union and also in 1990s in Russia the normative methods were used when planning the cost-price. For this purpose all elements of the normative base in logging companies were used according to official normative papers (*Ediniye normy virabotki… 1989, Ediniy tarifno-kvalifikatsionniy … 1985*). Uniform norms and quotations were intended for normalization of workers' labour in all logging companies. The results of timekeeping monitoring, technical characteristics of machinery and average volume of logs were basis of uniform norms. The application of uniform norms and Soviet standards was the fundamental part of planned economy. Under market conditions in Russia the basic purpose for calculation of commercial roundwood cost-price has become the volume of sales. In market economy conditions in Russia each logging company has the right make the decisions about the methods of cost classifications, the types of cost centres and profit centres independently. So, nowadays the accounting, planning and cost-price calculation for round-wood production in logging companies of the Russian Federation are made on the basis of methodical instructions for planning accounting and cost-price accounting for forest industry commercial products *(Metodicheskie rekomendatsii … 2003).* The instruction had been developed by the experts of the Research and Design Institute on Economics, Production Management and Information for the Forest, Pulp and Paper and Woodworking industries JSC "*NIPIEIlesprom*" and Ministry of Industries, Science and

Technology of the Russian Federation in 2003. This document offers the official version of domestic methodology for cost-price accounting is used as a reference point in this study.

The modern "western" theory of cost accounting is largely international (Neilimo and Uusi-Rauva 1999, Horngren et al. 2000, Pellinen 2006). During last 15 years the major research contributions of study in cost accounting have related to the improvement in the profitability calculations in forestry (Penttinen et al. 2001, Niskanen et al. 2002). The academic focus has only a bit been allocated to cost accounting in logging or wood harvesting *(lesozagotovki)* where the development of cost accounting has been closer to practical, and only few academic researches have been made in Europe (Jöbstl 1995). For example, computer-based methods for wood harvesting cost calculation for cut-to-length harvesting have been used in Finland for about 20 years (Mäkelä 1986), and they have also been specified for studying the cost structure of mill-gate price of wood from first thinnings (Salo and Uusitalo 2001). The software cost calculation for forest machinery (Mäkelä 1986), known as Metsäteho model is widely used among individual logging operators (small private logging companies) being contracted for logging in private, state-owned, and corporate-owned forestlands in Finland. The main idea of Metsäteho model for cut-to-length method cost calculation is also used in Canada at present. Sikanen et al. (1996) have used Metsäteho model in a experimental study to compare three harvesting options on the cutting area together, and two forwarding options together only for thinning operation in the RK. The empirical model calculations in the study are also on the Metsäteho model (Mäkelä 1986, Salo and Uusitalo 2001). For the purposes of present calculations amendments have been made in the Metsäteho model for the first time that provide more detailed comparison of economics of different wood harvesting chains for both tree-length (TL) and cut-to-length (CTL) methods with reference to Northwest Russian conditions.

Theoretical and conceptual chapters are based on existing Russian/Soviet and "western" literature, and other public document such as the Presidential Decree, Decrees of the Government and Forest Code.
In empirical part of modelling the data comes from official statistics, existing national and regional (RK) standards and norms, from the manufacturers of logging machinery, in some cases from company sources, and also from research publications and other documents.

2. GENERAL MANAGEMENT THEORY AND ORGANIZATION OF WOOD HARVESTING IN SOVIET UNION AND KASSR

2.1 Socialistic management and organisation theory

During the whole Soviet period from 1917 to 1992, the Socialist theory of management and work organisation was general theory in the Soviet Union. The socialist general management theory was founded by the public property and absence of exploitation of workers. Theoretically the aim of the national management of economy *(narodnokhozyaystvennoye upravlenie*) was to increase performance in GDP, and improve the people's well-being. The control was centralized through territorial industrial-production complex *(territorialnij promishlenno-proizvodstvenniy kompleks)*. The direct centralized management was applied through Soviet planned figures, long term normative and standard limits (Levanov and Sirotov 1983, Chinchenko et al. 1988).

In the KASSR, the present JSH "Karellesprom" played important role of central large functional department during Soviet time. In the 1920s - 1929s these departments were called as the trust *(trest)*, from 1929 to 1960 as autonomous enterprises, from the middle of the 1960s to the end of the Soviet period as production association *(proizvodstvennoje objedinenije*).

Marx's labour theory (Kamaev 1998) was the basis of the socialist model of management theory. The management work is a special type of labour activity, but it possesses all attributes of work in general. The main socialist management law *(zakon upravlenija)* was expressed in the unity of management system of all national economy. *Ekonomicheskiy zakon* in Soviet terminology and in this study mean objective tendency in force without peoples will and consciousness. The public property with the production support formed the economic basis of this unity and allowed to define the uniform purpose of all national economy. Uniform structure of management for all national economy was established and it is tasks were general management and state control from the uniform centre to all socialist activities. The main principle of general management was democratic centralism (*demokraticheskiy tsentralizm)* (Saltykov et al. 1960, Medvedev 1985, Chinchenko et al. 1988). Democratic centralism meant that the central leadership of the state must be coupled with the initiative of local governments and the interests of workers. The general characteristic of democratic centralism in USSR was the electivity *(vibornost)* of all management bodies of a Communist Party from top to bottom, the periodic reporting of the bottom bodies to the top bodies as well as strong execution of decisions of the top bodies for the bottom. The practical essence of democratic centralism was expressed in the strict compliance with state planning discipline for each state company.

The important principles of general management of state company were also the unity *(edinstvo)* of the socialist economic and political leadership and one-man management *(edinonachaliye*). The basic method of socialist planning guidance was self-sufficiency *(hozyajstvenniy raschet)* (Saltykov et al. 1960).

During Soviet time the rational work organisation was the key of management function also in logging industry. For that case, the theoretical scientific principles were formulated. The three most important scientific principles in logging work organisation were based on the Marx's works. They were the scientific principles of proportionality *(proportsionalnosti),* rhythm *(ritmichnosti)* and continuity *(neprerivnosti)*. Also socialistic economic principles of standardisations *(standartizatsii*), principles of mechanisation and automation *(mekhanizatsii i avtomatizatsii),* and principles of efficiency and optimality *(effektivnosti i optimalnosti)* were parts of the prevailing doctrine (Chinchenko et al. 1988).

This principle of proportionality means the strict adherence of proportions between work and resources. The proportions were eliminated through the surplus and shortage of resources and hands in working process. The application of the theoretical principle of proportionality in Soviet forest industry was implemented by developing of specific standards, norms and normative. It should also draw attention to the fact that the concept of "*norm*" and "*normatives*" used in the regulatory practices are not identical in their economic content. The notion of "norm" or "rule" comes from the Latin "norma" - leadership, a model of rule. In economics, a norm is called a statutory, recognized compulsory order (for example, the rule of law). Another interpretation of the term is linked to understanding how the norms limit the consumption of resources for certain purposes. In contrast to the norm, the normative usually reflects a quantitative measure of communication between the various indicators.

The principle of rhythm for Soviet economy meant the synchronisation of production or recurrence of working results between fixed time periods. Production rhythm was the necessary condition for increasing economic efficiency.

During Soviet period was the third Marx's theoretical principle, applied in socialist organisation of work. The principle of continuity meant the constant movement of finished product within the processing chain (Chinchenko et al. 1988).

The term management *(upravlenie)* for forest industry during Soviet period implied political and economic integrity to secure conforming in the society with production process and continuous technical progress (Medvedev 1985). The socialist management and organisation theories studied the influence of objective economic laws of socialism (*ob'ektivnye ekonomicheskie zakony socialisma*), namely socialist law of value (*sotsialisticheskiy zakon stoimosti*), law of supply and demand (*zakon sprosa i predlogeniya*) and law of money circulation (*zakon deneznogo obrasheniya*) and also the results of this influence on each logging company and forest industry. The origins of the socialist theory of management and organisation (*teoriya upravleniya i organizatsii proizvodstva*) and operative management in the Soviet Union was found in Lenin´s theories as further interpreted by proletariat and Communist Party (Levanov and Sirotov 1983, Chinchenko et al. 1988). Lenin´s socialist theory means state planning of economic development of the basis of universal plan for special purposes. First such a plan in Soviet Union was the plan of electrification of the country *(GOELRO)*. In 1920 this plan was adopted at the VIII extreme All-Union Congress of Soviets.

Levanov and Sirotov (1983), and Chinchenko et al. (1988) demonstrated that a typical logging company was production and industrial complex (*prozvodstvenno-khozyaystvenniy kompleks*) and organisation of the Soviet economy in local territories. Operative management *(operativnoye upravleniye)* of typical logging company was a basis for administrative activity. In planning economy the operative management of a logging company meant the development of general plan to carry out more specific plans for example, plan of annual volume of wood harvesting and resource conservation. Scientific management of wood harvesting activity was typical also for logging companies in the KASSR. Scientific management at that time meant that all decisions made in regard to the logging company should be strictly well-grounded and argument. The organisation of socialist competition, scheduling of wood harvesting work, and quality control for commercial wood products were conducted as the result of the concept of scientific management. With the help of common and specific management functions the differentiation of labour in rational form was done for logging companies in KASSR. Typical elements of socialist management cycle (planning, prognostics, economic incentive, coordination, management accountancy and control) were also used.

Theoretical background for socialist work-organisation was the collection of Lenin's theoretical ideas, which included the political principles in the scientific management. The Soviet scientific theory of industries and work-organisation started to develop after Great October Revolution. This theory was based on public ownership of the means of production and on without exploitation man by man. Theoretical approach of socialistic scientific work-organisation was also used in the organisation of forest industries (Chinchenko et al.1988).

Theoretically, the organisation of wood harvesting works means different types of combinations of all material factors in the common production processes. Logging works as a production process had all the attributes of Socialistic specialisation. The first attribute of socialist work organisation was that only one main logging operation (felling, skidding or delimbing) should take place on each working place. The second, was the homogeneous output of logs production *(khlisti)* and round wood assortments *(kruglie lesomaterialy),* which were the main commercial products of Soviet lespromkhoz activity. The third, Soviet wood harvesting technologies had three stages in production processes such as, system of cutting area works *(kompleks lesosechnikh rabot),* round wood transportation *(vivozka drevesiny)* works and system of lower landing works *(kompleks niznesklad skikh rabot).*

The Soviet scientific management theory also included the development of organisation form and level description. According to Chinchenko et al. (1988) socialist logging industry during 1947-1953 represented a line (*potochnaya*) form and since 1953 to the end of socialism as integrated *(kompleksnaya)* form of production organisation. Line form in Soviet logging industry meant as stated above that only one working operation was used on each working place. Skidding was the key operation in Soviet logging industry. The work synchronicity on cutting areas was not accessible during the Soviet time. Practically,

organisation of logging works in lespromkhozes was directed on reduction or liquidation of interoperation idle time *(mezgoperatsionniye prostoiy)*. The formation of integrated multiple–skill logging crews *(kompleksniye brigadi),* was an example of socialist differentiation of labour. As well as for the operative and the same time centralized management the special dispatching-control services were created and widely used in Soviet logging industry.

The economic-mathematical models (Korobov 1974, Shegelman and Kuznitsov 1999, Korobov 2003) and theories (Petrovskiy and Haritonov 1990) of automatic regulation *(avtomaticheskogo regulirovaniya)* and relay and microprocessor control *(releynogo i mikroprotsessornogo upravleniya)* were developed for wood harvesting management process already during Soviet time but little used in real life. Economic-mathematic models (Zdanov 1998) were implicated on the top-management level when there was a need to choose the optimum alternatives of logging company development in the future, or to identify logging company production plan and budget more effectively.

The cybernetics represents the important part of classical management theory. The cybernetics are more common a conceptual framework of management. The fundamental laws from cybernetic were transformed to Soviet scientific management, like the law of a necessary and sufficient variety (*zakon neobhodimogo i dostatochnogo raznoobraziya)*, general principles of external addition *(printsip vneshnego dopolneniya),* principle of feedback *(printsip obratnoy svyazi)*. The main feature of scientific management in the Soviet period was that the vector which was focused on the technical part of operational management. According to Ivanov (1981), modelling of economic processes and use of economic mathematical methods in optimisation of management were usually used for the definition of the management efficiency of wood harvesting. Economic model in the management theory is a scientific abstraction (Ivanov 1981). The key moment in scientific abstraction was the development of a model to the study objects.

The system theory, according to Ivanov (1981) was also elaborated for management activity. The theoretical basis of system theory has kept up its actuality from Soviet times to nowadays. For example, each logging company can be defined as an element of higher rank management systems, for example, a "holding company". The system "holding company" can be defined as an element of the management system "logging industry". The system "logging industry" was an element of the management system "*lesopromishlenniy kompleks*" (forest sector). The system "forest sector" on its part can be defined as an element of management system "national economy". Theoretically each of these management systems has itself a subsystem. Different subsystems, such as logging department *(lesopunkt)*, cutting area, and working team form the system "logging company". The primary management system is a system, where the elements of this system could not be deviated. For a wood harvesting process the primary system is the system "worker – means of production ".

The hierarchy has always been the key characteristic of different types of management systems and also in Soviet time. For the state logging company the hierarchic management system could be defined as administrative management posts of different levels from higher management level to lower. Communication and unitary authority were also very important in hierarchic position building.

The modern concept of management technology includes system of actions, sequence of stages and operations during management processes. The management technology of Soviet forest industry was characterized according to Ivanov (1981) as a common working process with double stage. The first stage was an organisation of wood harvesting technological process and the second was development of systems and procedures of management activity.

2.2 Did the general management theory have any influence in Soviet system?

The term "management" has been used centuries in the "western" management theory. Management theory has been represented in the form of two main directions. The first is strategic management and the second is operational management. A popular method of strategic management is SWOT analysis, which was developed more than 40 years ago (Leraned et al. 1965). From the economic side the main result of management is to receive the maximum profit from activities.

The general tasks of management are optimisation and improvement of productivity. The founder of operational scientific management theory in the Western world was Taylor (Rumyantseva et al. 1995). In 1885 he formulated four scientific management principles for the management of individual workers. They are:

1. Scientific approach of selection, teaching and training of workers.
2. Scientific approach of carrying out every working element.
3. Cooperation with workers.
4. Division of all responsibility for working results between managers and workers.

The influence of "taylorism" was through formulation of the alternative or opposing concept of management. During the Soviet period this ideological tradition continued, perhaps also in the way that if something useful form the capitalist world was found, it could not be mentioned directly (Rumyantseva et al. 1995).

During the period from 1917 to 1955 development of Western management theory for planning economy was not in principle applied in the USSR. There was an ideological policy of Communist Party prevailed in the Soviet society and the state was strictly totalitarian, although as well–known British expert Alec Nove (1968) says, "…homo economicus sovieticus has a close relation of the species found in the west". The "western" general management theory was considered to bourgeois (*burgzuazniye*) and was completely rejected in Soviet Union.

During the "real" socialism from the end of 1950s to the 1970s in Soviet Union was the first step of "western" management applying in the socialist practice on macro level of economy. Motivation of work (Maslow pyramid) as element of "western" management theories has replaced a socialist principle of "naked" enthusiasm *(gologo entuziazma)* and new more pragmatic Soviet scientific management started to develop. The new socialist management theory was developed on two main lines. The first way was the critics of Western management theories (Gvishiani 1962) and second way was development of system method *(sistemniy metod*) and cybernetic. Also the "western" management trends of human behaviour and human relation were partly adopted for Soviet type of macro economy (Rumyantseva et al. 1995).

Different types of management structure organisation were grounded in the "western" management theory, renamed and then applied in Soviet economy. The hierarchical and organic types of management structure are used for organisation. At the beginning of the 20th century in the Max Weber from Germany formulated a theoretical conception for a hierarchical type. For Weber the term "bureaucracy" was inseparable from the term "rationality". Weber's concept of bureaucracy was call as a "rational bureaucracy" in the Western world (Rumyantseva et al. 1995).

In USSR the hierarchical type was named as bureaucratic. During many decades the hierarchical type was general type for management structure formation in Soviet period. In conditions of centralized planning economy, bureaucratic type developed also two subtypes - line-functional and division. The line- functional type in Soviet time was called as "*shakhtnaya"* organisation, and was used also in the Soviet forest industry complex until the end of 1960s. The main idea of line-functional type was that for each subsystem a hierarchy of departments was formed, which constructed the management structure from top to bottom in one line. The results of each department were estimated indicators of the performance of their aims and objectives. According to Tatsyn (1996), during the period from the end of the 1960s to the end of the 1980s a division type of management structure was also applied as a parallel to the line-functional type in the large sizes all-union production association *(vsesoyuznoe proizvodstvennoye obedineniye).*

In the "western" or general management theory the pyramid, matrix and projects subtypes were included in the organic type of management structure. The pyramid subtype was called as brigade in the USSR. During the period from the end of 1980s to perestroika the brigade form of organic type of management structure was widely used also in logging industry.

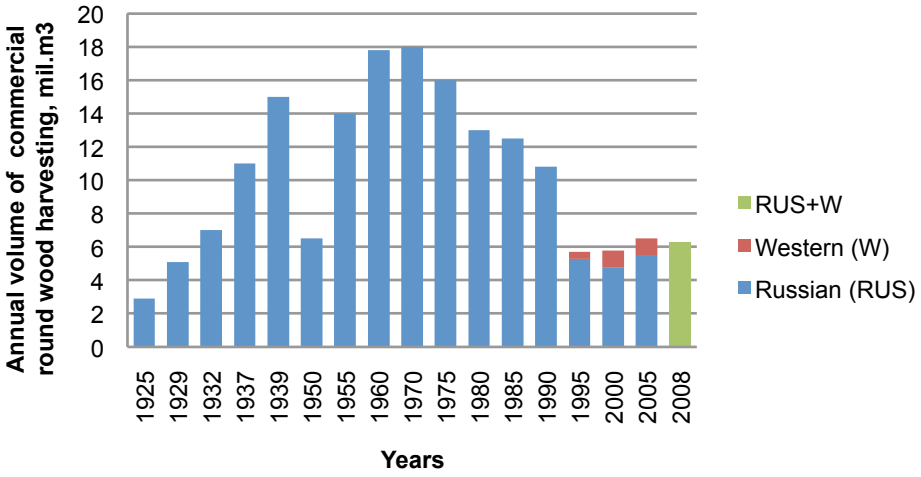
The Soviet economy point of view has drawn nearer with economy of the "western "type has started from the end of 1970s to the whole period of *perestroika*. The beginning of transition to perestroika was in fact the period of stagnation of the management theory. Development of bureaucracy, deformed values (the top managers became richer but in the whole the incomes of logging company did decrease) and nepotism in practice of decision-

making were widely used. Nevertheless in the same time the "western" economic and management books were translated in Russian language in Russia.

2.3. Reasons and principles for mechanization of main logging operations

The starting point for this part of this study is the period since 1917 to *perestroika*. In 1913 in the RK 2.2 mil. m^3 of annual volume of round wood was harvested. For many years after the Great October Socialist Revolution in 1917 the Soviet Karelia was a periphery on the map of the Soviet Union. However, rich forest resources (Algvere 1966) provided a good possibility for commercial round wood harvesting development in this region (Figure 3).

In KASSR the Soviet period of wood harvesting development was determinated by the development needs of the whole national economy of the Soviet Union. Logging industry played a key role in the process of industrialization in the Soviet Karelia. During Soviet time export of commercial roundwood from Republic took a significant part in all the Soviet Union export.



RUS=Annual volume of commercial round wood harvesting of logging companies with domestic capital,
W= Annual volume of commercial round wood harvesting of logging companies with foreign capital
RUS+W= Total annual volume of commercial round wood of logging companies with domestic, foreign and mixed capitals

Figure 3. Development of wood harvesting in the RK between 1925-2008 (Algvere 1966, Myllynen and Saastamoinen 1995, Nemkovich et al. 2000, Kareliastat 2006, Lesprom Industry Counsulting 2009)

In 1920-30s the Finnish migrant loggers from Canada and "Red Finns" from Finland emigrated to Karelian Working Commune (*Karelskaya Trudovaya Kommuna*) (Autio 2002). It was a beginning towards planned economy development and first step of new harvesting technology application in the Soviet Union. According to Arhipov (1930) and Autio (1997) in 1924 there were 14 LPH:s in AKSSR. But at the same year they already were reorganized into larger entities because of new central direction to centralize logging into few biggest trusts in the whole Northern part of Soviet Union. In 1929 there were 18 LPHs in the AKSSR (www.govkarelia.ru) one main trust "Karelles", but in 1932 it already in dated, as there were 15 LPHs in Karelles trust. The name of Republic was KASSR in 1936-1940, KFSSR in 1940-1956. The cutting volumes were growing during the War period (Figure 3). After the World War 2 roughly few mill. ha of forest land from Finland was journeyed to RK.

After the reconstruction period was the first period of logging mechanization and an advanced form of work organisation from the end of the 1950s to the beginning of the 1970s. During 15 years, wood harvesting was developed according to the industrial model (Blandon 1983, Yagodnikov and Mikhaylov 1991). In LPHs the main logging operations on cutting areas were mechanized with using specialized machinery and multiple skill

logging crews. Sharp increase of labour productivity started. In the Karelia Autonomic Soviet Socialistic Republic KASSR, as it was again called since 1956, the average annual output per logging worker (*kompleksnaya vyrabotka*) in 1965 was 459 m^3 (Yagodnikov and Mikhaylov 1991). The Onega Tractors Plant started to produce skidding tractors (KT-12, KDT-40, TDT-40, and TDT-55). They were used for logging work mechanization and tree-length method of wood harvesting was developed considerably by using tractors. At the same time with all Soviet mechanization in LPHs upper and lower landings were constructed in all LPHs.

The term "upper landing" meant the cleared area directly next to the cutting areas where the logs piling was made. Upper landing – or road-side storage – is actually a part of cutting area (*lesoseka).*

The term" lower landing" has been the place for long-term storage and processing of logs harvested. It has developed into central processing yard, where harvested logs or trees have been unloaded debranched (if necessary), bucked into assortiments, sorted and loaded onto means of transport. The both terms have been required to the wood floating works. At the past the lower landing was located in the lower end of the floatable ways.

The industrial logging significantly defined social, cultural and ecological standards of living of the people, ensured development and normal functioning of production in such economic branches as pulp and paper, woodworking, building, and exports (Blandon 1993). Also in period 1950-1964 the plan to move wood harvesting to the western parts of the KASSR began and *Suojarvi- Sukkozero-Lenderi* and *Sukkozero-Borovaya* railways more than 400 km long altogether were constructed. This railway opened a way to the pine forests of these areas. *Lahkolambinsky, Sukkozerskiy, Porosozersky, Novo - Lendersky, Volomsky, Ledmozersky, and Yushkozersky* lespromkhozes with total capacity of about 4 mil. m^3 of annual cut were built adjacent to the railway. Ample standing volume of forest resources of KASSR in Soviet time guaranteed warranty for development of industrial logging . At that time the highest volumes of wood harvesting about 20 mil. m^3 per year were achieved (Figure 3).

New wood harvesting technology was further developed during the period 1972 -1990 alongside the nationwide technology development Plan. The plan, was introduced to increase the productivity of forest works, was called "On the Creation and Introduction of System of Machines and Equipment for the Complete Mechanisation of Production in the Forest Industry for the period Until 1990". Plan covered the years 1972-1990 and consisted of future projections for logging machinery to be invented and logging methods to be used in the Soviet logging industry. The plan was not implemented finally. In 1985, the logging companies in the KASSR had 150 felling and skidding machines (LP-17), 474 delimbing machines (LP-30B). The volume of machine delimbing was 9.7mil. m^3 in 1988, which made 93 % of all delimbing. KASSR was transformed to a region with high efficiency using of machines for wood harvesting (Yagodnokov and Mikhaylov 1991). "During the years 1972-1990 the Soviet fleet of logging machinery. i.e. machines that were used for cutting, skidding and delimbing, grew redard the variety of models, number of machines as well as capacity per machine unit. By the end of the period in 1990, 87 per cent of the trees were still felled by chain saws and 74 per cent of them were skidded by chocker skidder in the 1950s. The projected combi-machine that would fell, delimb, cross-cut and skid the trees form the forest site to upper landing was merely a sketch on the paper and thus never introduced into the Soviet forests." (Karvinen 2005)

The development of national economy has been characterised such as Well-developed Socialism (Table 1) from early 1970s to the end of 1980s. During that time full mechanization of the logging work was one of the key tasks of the Soviet management. Ideological, ergonomical and economic arguments were widely used as reasons for the mechanisation of forest work. The transition to full mechanisation of logging work in planning economy conditions meant of applying specialized machinery on the all cutting areas around the country.

During the period 1930-1990 the ideological work played a great role in this process. The Communist Party and Young Communist organisation (Komsomol) promoted Marxist-Leninist ideas in the lespromkhozes to improve labour discipline and rational using of working time in forest harvesting. The term "stakhanovskiy work" *(stakhanovskiy trud)* was widely used. The propaganda was provided by different means such as the radio transmissions, wall newspapers and urgent leaflets *"boyeviye listki"*. The important forms of political work among working class were different discussions and presentations of new domestic machinery models. The more popular places for Communist Party slogans and posters for in a typical *kompleksniy lespromkhoz* were the main entrance of administrative

building, main forest settlement road and the main entrance gates to lower landing. Also the special agitation collectives *"agitkollektive"* were created for mass political agitations (Chinchenko et al. 1988).

The ergonomic reasons for mechanization of logging were usually employed in two ways. The first, as described earlier in Chapter 2.3 was to replace manual labour with machines for continuous development of technical-scientific progress. The most important moment was the use of the term "combined working machine" (*kombinirovannaya rabochaya mashina*) for logging process. During period 1977-1985 the felling and skidding machine model LP-17, TB-1 and TB-1M were applied in the KASSR, which improved the ergonomics of logging

The second way was the decreasing of the influence of climate factors on forest workers. The forest workers health protection was the central task not only for state logging companies, but also for Soviet government as a whole. The idea of decreasing economic losses due to different kind of occupational injuries of workers and illness was published in Seroshtan (1992).

No doubt, the economic reasons were the most important for applying mechanization on logging work. The increase of economic efficiency (*ekonomicheskaya effektivnost*) of applying new logging machinery models was the main direction in the Soviet forest industries complex. The scientific approach of economic efficiency assessment for new domestic machinery was introduced in the several literature works (Murashkin and Gorishin 1971, Burdin and Evdokimov 1985, Petrov and Murashkin 1988). Also the scientific Soviet economics problems of increasing profitability, price formation, profit distribution and reliability in several *kandidat ekonomicheskih nauk* dissertations (Kozlov 1968, Reshotka 1973, Khusainov 1973, Gorshko 1975, Biryukov 1975, Bogdanov 1976, Anisimov 1987, Chagzengin 1988, Tyukina 1995) and *doctor ekonimitcheskih nauk* dissertations (Sidorov 1971, Slepov 1979, Burdin 1981, Murashkin 1992) were published. An analyzing of effective using of domestic machinery it is possible to note most important points. First of all, in that time in LPHs the low level of work organisation was established and individual training programs for managers and directors was observed. The second was the higher share of domestic machinery standing idle during calendar time and annual plans were not implemented.

2.4 Historical development of the multilevel general management system for wood harvesting in Soviet Union and KASSR

The general management system of wood procurement was developed in parallel with the technological development of wood harvesting.

Table 1. Development of socialism and general management of economy in the Soviet Union **(**adapted from: Algvere 1966, Nove 1968 and Tatsyn 1996)

Time	Economic Period	General characteristics of forest sector development
1917-1921	War Communism *Voenniy kommunism*	There were much private forest areas, but the policy was to make them public. Global centralization (*tsentaralizatsiya*)
1921-1929	New Economic Policy *Novaya ekonomicheskaya politika* (NEP)	Forest concession (*kontsessiya*) was applied in logging industry the first time. Trusts (*tresty*) were created
1929-1934	Young Socialism *Molodoy sotcializm*	Role of central control was increased. Council of Peoples Commissars (*Narkomat*) of forest industry was appeared and self-sufficiency (*khozraschot*) start to operate
1934-1957	Building of Real Socialism *Stroitelstvo realnogo sotcializma*	Deep of centralization management (*tsentralizovannoye upravleniye*). Narkomats was reformated to Ministeries. The management system consist of 3-5 levels
1957-1965	Real Socialism Realniy sotcialism	Territorial management (*Territorialnoye upravlenie*)105 economical administrative regoins (*rayonov*) wer created. Ministeries were liquadated and Sovnarkhozy was formated
1965-1975	Real Socialism *Realniy sotcialism-Zastoy* (stagnation)	Reforms in Ministeries level of management
1975-1985	Well-developed Socialism *Razvitoy sotcializm*	Territorial–branches management (*Tterritorialno-otraslevoye upravleniye*).Management system transition from 3-5 to 2-3 levels

1985-1992	Crisis of well-develop Socialism and Collapse of Soviet planning economy *Krizis razvitogo sotcialisma i likvidatsija planovoy ekonomiki.*	Territorial-production clusters (*Territorialno-proizvodstvenniye obyedineniya) was created*
1992-	Transition to market economy *Perehod k rinochnoy ekonomiki*	Decentralization of management (*Detsentralizatsiya upravleniya*), This privatization or *razgosudarstvlivanie* property, vacation prices, restructuring socialist monopolies, the creation of a new legal framework and "western" management development. Federal and regional level of management system

Search for the optimum distance between top level management and logging companies remained as the key question development of logging industry during the whole Soviet period. From the very beginning the general management was based on multilevel structure. The most important periods of management development of logging industry in the whole country as well as in KASSR linked to the stages of economic development of socialism. The most important periods of Socialism development in the Soviet Union and main characteristic of general management development in the forest industries are listed (Table 1).

The economic periods and development stages of War Communism and New economic policy were contrasting ones: Economic necessities to avoid the collapse of entire economy enforced to return back to more liberal economic policies. In the forest sector the key features of their periods were state appropriation of forests and creation of large forest concessions. Also the constancy young socialism and building of real socialism represented the emergence of strict political and economic transformation of the country into centralized socialistic order led by Stalin included the periods of enforced collectivisation of agriculture, strong violent political "cleanings", the heavy years of the World War II and reconstruction of the economy and building socialism often the was until the end of Stalin period in 1956. All these processes had impacts also in the development of forest sector. Major processes in the forest sector were industrialization (*industrializatsiya)* or using special forest machines in logging works. The economic development of Russian North was through the spirit of modernization, although this term is not used. The sawmill industry development was initiated by an intense demand on the round wood from White Sea regions. Also in its development of significant role was played by foreign capital and that, consequently, the industry has received the North with pronounced of forest slope. Economic reforms 60's years have been incomplete, growth stagnant phenomena in socio - economic development. In forest sector the process of megalomania *(gigantomaniya)* was started.

The above mentioned periods influenced the organisation of wood harvesting. Centralised planned economy, which existed more than seven decades, was based on the state ownership for all types of natural resources and state organization enterprises in forestry and loggings. It is wore wile to emphasize that almost continuing changes have occurred in the formation of the levels of management structure , particularly in the years 1924, 1936, 1946, 1957, 1965, 1968, 1975, 1986 and 1991 (Tatsyn 1996). These changes had a significant influence on the development of Soviet management for wood harvesting. These years can be divided into years of regression and economic boom of the national economy of the USSR Management chain was reformatted many times during the Soviet time. There were two reasons during the centralized planning economy in USSR to reorganize management structure. The first reason was to decrease the company overhead cost, and second was to increase economic efficiency of domestic machinery using.

When the Soviet Power emerged, the supreme executive and administrative body - in compliance with the Constitution of the Soviet Federal Socialist Republics of 1918 - was the Council of People's Commissars *(Soviet Narodnikh Commissarov (CPC*). According to the Constitution of the USSR of 1924, the CPC of the USSR was created by the decision of the Central Executive Committee of the USSR, as well as CPCs of the USSR Union and autonomous republics as their central executive committees. The Council of People's Commissars was also founded in the AKSSR, and wood harvesting was subordinated to the CPC of the Republic (Figure 4). Despite the changes occurring during the study period in the KASSR, the republican body of the top management continued operating. Changes concerned the top level of management; at the level of the Republic the management was

directly subordinate to Karellesprom. The main general management goal was to get export income to "young" national economy of the Soviet Union.

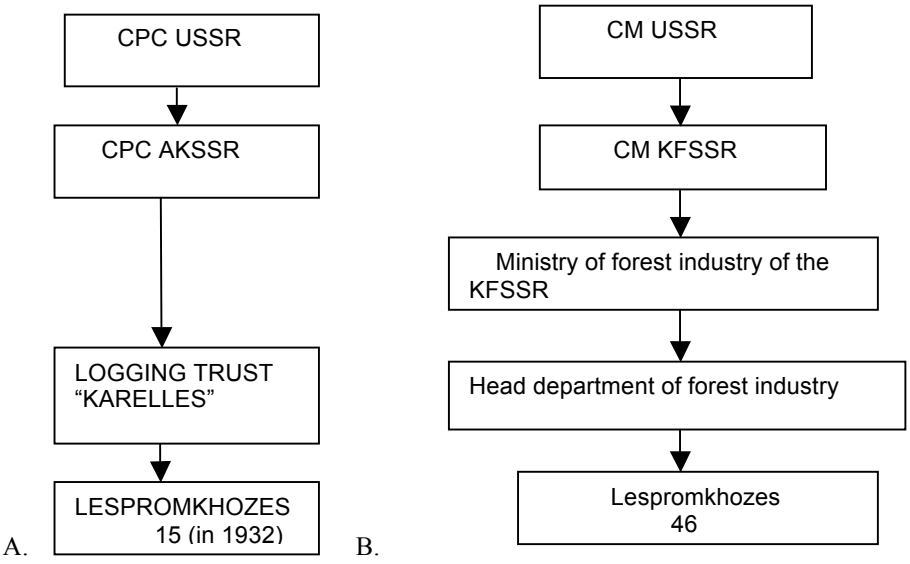


Figure 4. Four level management system of wood harvesting 1923-1936 in AKSSR (A) and five level management system of wood harvesting in 1940-1956 in the KFSSR (B).

In compliance with the constitution of the USSR of 1936, CPCs of the USSR and CPC of the Union and autonomous republics were formed by the Supreme Soviet of the USSR and the Supreme Soviets of the Union and autonomous republics. The round wood export from USSR was the primary goal for wood harvesting in AKSSR according to state plan.

In 1946, the CPC of the USSR was transformed into the Council of Ministers of the USSR, and CPCs of the Union and autonomous republics were reorganized and turned into the Council of Ministries of Union and Autonomous Republics (CM USSR) (Figure 4). Wood harvesting had crucial, important role in the early restoration of national economy. The Council of Ministers of the USSR was a state body. It united and directed the work of the all-Union and republican ministries and departments, took up measures on realisation of state plans, execution of the state budget, strengthening the credit and monetary system, running the public order, protection of interests of the state and protection of rights of its people. The CM USSR was commanded by the Army of the country, and it carried out the general management in the field of economic relations with foreign states. The CM USSR of that period issued decisions and orders, which had obligatory legal force all over the USSR. During the period of functioning of the USSR, Council of Ministers and Councils of Ministers of Union and autonomous republics , the centralised management strengthened, and transition took place to 3-5 levels' management system. The Central Boards and People's Commissariats was extended. In the post-war period, Peoples Commissariats were broken up into smaller units and transformed into branch ministries (Tatsyn 1996). In 1940 the name KASSR was changed to Karelo-Finskaya Societ Socialist Republic (KFSSR) and had that name until 1956. In 1949 the CM USSR passed a resolution «On measures for reconstruction and development of logging in the Karelian-Finnish SSR», which provided for bringing the level of wood harvesting of the Republic up to 20 mil.m^3 in 1955 (p. 21, Figure 3). Achieving this level of logging was provided through exploration of new cutting areas construction of mechanization *lespromkhozes* also forest roads and forest settlements.

In 1957-1965, a new body territorial National Economy Councils (NEC) was established to manage the national economy. For those purposes 105 economic administrative areas were organized in the whole territory of the USSR in 1957. NEC also managed industries includeing forest industry at the republican management level.

Specific features of the industry on the given territory determined the structure of management of a NEC. Every NEC had an advanced linear - functional structure, branch departments, and functional sub-divisions. Thus management was brought as close to production sector as possible. NECs had an approach to developing production sectors. When NEC was in place, the capacities of the national economy were used more

productively, and industries are made of companies participated more actively in managing companies and regional economy. However the status did not allow NECs to influence the development of other branches, which were not equally included into its system. In 1965, there was a reorganisation of management of industry. Instead of the NECs, the Union and republic ministries were organised. In the Soviet Union, the new type of centralised management system of all branches of national economy was created. In the forest sector the Ministry of forest, pulp and paper and woodworking industries was created in 1965.

In 1968, the Ministry of logging, pulp and paper and woodworking industries broke up into smaller units: the All-union and republic ministry of forest and woodworking industries of the USSR and the Union Ministry of pulp and paper industry of the USSR. However, during 20 years from 1956 to 1975 there were no principal changes in management system in the KASSR. These organisational changes occured only at the top and did not change the operational level of management system.

For the purposes of reducing the levels in the management and more precise differentiation of rights and responsibilities among various management structures, as well as increasing efficiency and flexibility in operational management the advanced form of management system was created in forest sector. At the KASSR the advanced management system included three management levels and was introduced in 1975: Ministries - Karellesprom – lespromkhozes (Figure 5).

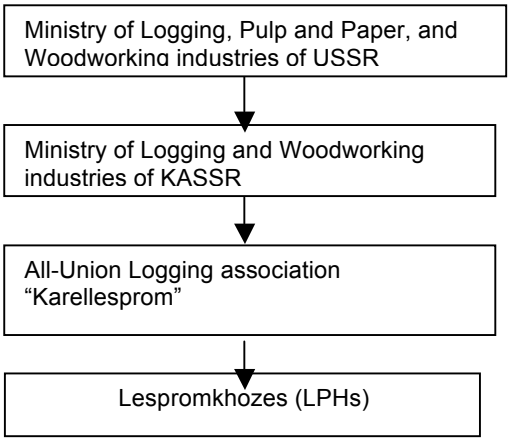


Figure 5. New Soviet management system of wood harvesting introduced in 1975 in the KASSR

Management chain of industrial logging in KASSR as a component of the national economy, first of all depended on functioning of the management system in the national economy of the republic and the country as whole. The All-Union forest industry association "Karellesprom" was responsible for forest sector development to the Ministry of Logging, Pulp and Paper and Woodworking Industries of the USSR through the Ministry of Logging and Woodworking Industries in KASSR

According to the Statute of the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers of the USSR and actions for further perfection of the industry management from 1973 the 23 All-Union industrial associations was created. The Karellesprom was one of them and was also the middle level in the framework of the management system.

Between 1975 and 1985 the territorial - branch principle of management was realised. It meant that higher authorities appointed selection the logging. Diversified territorial and production associations were founded in republics. In 1981, the All-Union Ministry of Logging and Woodworking Industries of the USSR and the Union Ministry of Pulp and Paper Industry were united in one All-Union-republic Ministry of Logging and Pulp and Paper Industry.

In 1986 the Bureau of Chemical-Wood Complex *(Khimiko-lesnoy kompleks)* was created under the Council of Ministers. It included five ministries, i.e. the ministries of

- chemical industries,
- the petrochemical industry (with processing),
- the medical and microbiological industry,

- the mineral fertilisers,
- the forest industry and pulp and paper, and woodworking industries

During the 5 years period 1986-1991 the decentralization of management at all management levels was occurred.
The democratic principles in management were widely introduced. In logging industry the territorial changes in the location of cutting areas were inevitable. In 1991, the Ministry of Logging, Pulp-and-paper and Woodworking Industry of the USSR was liquidated (Tatsyn 1996).

It is also worth noting that during the Soviet period, logging industry was three times united with forestry in (1929, 1942, 1959), and with pulp-and-paper industry in (1948, 1965, 1980). During the last period the general management of branch was executed by the Ministry of Logging, Pulp-and-paper and Woodworking Industry of the USSR, which was created in 1980. Production and administrative departments were the key segments of the Ministry of Forest, Pulp-and-paper and Woodworking Industries. The management system in the period prior to the reforms was based on branch principle. Branch principle of management meant coordination in business activity for only one type of logging companies. Profile for logging company was determinate by dominating commercial products such as commercial round wood.

One type logging company was basis for the middle management level, i.e. of the All-Union production association like Karellesprom. The structure of the top management level – the Ministry – was built in a respective way, and the functions of daily management and planning of the activities of associations and companies were assigned to special units. The main administrative function of the middle and top levels was to develop plans for wood harvesting volumes and control their implementation. Planned economy provided a number of main economic conceptsion and management law. It is reflected in each logging company through organisational and structural composition and management principles. Each logging company was a component of the uniform state system of replenishing the gross domestic products (GDP). Division of work in logging companies was based on the specialisation and internal cooperation. The continuous of organisational changes in particular at the national economy. Note level did disturb the development of logging industry, but that was not that critical as the basic structure at the operational level of management was more permanent.

2. 5 *Lespromkhoz* as an operational management unit for wood harvesting in KASSR

2.5.1 Common characteristic of lespromkhozes

The bacic production element in the one branch of based forest economy of the KASSR was the state logging companies *lespromkhoz (LPH)*. The typical LPH in KASSR operated according to the document "Regulations on the socialist state industrial company".
In Soviet time typical LPH was a specialized state company, which harvested wood raw materials on the cutting areas (Algvere 1966). It was also responsible for woodworking and forest regeneration. A forest area which had to be exploited during a certain period was assigned to a logging company by the General Regional Scheme (*Generalnaja shema razvitija regiona)*. The cutting areas of the *lespromkhoz* was considered as a multivariate legal, economic, and political category at primary and subsequent periods of its exploitation. The cutting areas were assigned from the Russian Forest Fund *(Roslesfond)* to *lespromkhoz* on the grounds of multivariate justification according to economic effectiveness criterion. Woodworking industry developed well in the LPHs with the limited stock *(ogranichennimy zapasami)* of forest resources but logging companies had not got opportunities for selling of round wood. Processing of invaluable wood and wood wastes was well developed. The LPHs at the waterway zones were engaged in initial wood floating besides wood harvesting. The LPHs had all attributes of socialist state enterprise because they were owned by the state. Although the upper levels of management organisations were ofter restructured, *lespromkhozes* of the Soviet period were characterised by certain stability. Differentces existed between LPHs based on the following features:

1. A type of combination
2. Adjacency of lower landing to transportation ways
3. Type of wood transport
4. The form of concentration

By the types of combination all lespromkhozes were divided into two models. Multi-functional or complex *kompleksniy lespromkhoz* (KLPH) had got several main activities identified, uniform technological, economic and organisational schemes of wood harvesting, silvicultural activity and wood processing (Figure 6, Model A). KLPHs were a progressive and massive type of LPHs. In the KASSR larger part of LPHs had worked with several main activities. It was the most common type of lespromkhoz in the Soviet period of industrial logging development. Another type of lespromkozes contained a combination of wood harvesting and simple wood processing (logs sawing), without silvicultural activity (Figure 6, Model B). In KASSR the Model B was applied in *Volomskiy lespromkhoz*, *Pyaozerskiy lespromkhoz and Kostomukshskiy lespromkhoz*.

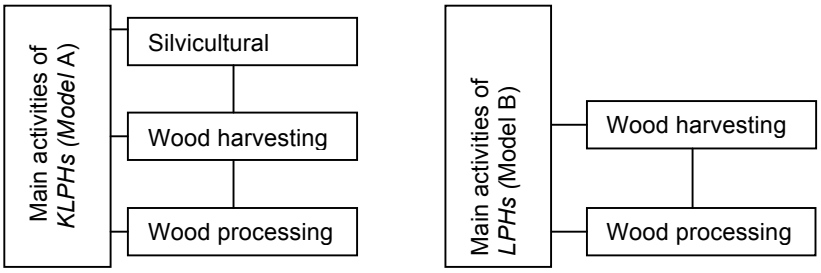


Figure 6. Main differences in work activities between KLPHs and LPHs.

According to Chinchenko et al. (1988), the KLPHs were responsible for the following works:

- Cultivation of seedlings
- Seeding and planting forests
- Main wood harvesting works *(Osnovnije lesosechnije raboty)*, including harvesting works for example felling and intermediate thinning in young forests.
- Supplying commercial round wood to customers
- Processing of wood and its' sub products like wood meal for animals *(khvojno-vitaminnaya muka)* and chips
- Tree breeding and running hunting facilities

During the Soviet period silvicultural activity in KASSR was organized in two ways: by KLPH or by an independent forest management unit *(leshoz)*. The work of these two differed in volumes and in structures of silviculture. The KLPH received from the state a fixed capital, the financing and forest resources with the right of operative management. These logging companies should sell the commercial round wood from growing surplus stocks above its planned capacity of annual wood harvesting volume and lease the forestland. The *leshoz* received from the state the forest resources donated for the forestry work and was not entitled to engage in industrial extraction. Silvicultural activity in KLPH and *leshoz* mostly included three main groups of industrial activities (*proizvodstvennaya deyatelnost*) such as the forest regeneration, forest growing and forest protection.

The both type storeges: upper and lower landings were constucted for wood harvesting processes. Upper landings meant the cleared area near the cutting area, where the seasonal stock of logs was created. The upper landings worked more or less systematically. Lower landings as a part of lespromkhozes were orientated for commercial round wood production and also products manufactured for local needs. In KLPHs the main roads were used rather intensively. Significant volumes of commercial round wood were sold to customers directly at the places of consumption. The Soviet KLPHs conatined industrial activity with the principle of rational forest use.

Depending on the layout of lower landings to transportation ways the following types of Model A (Figure 6) state logging companies were distinguished (Saltykov et al. 1960, Gogzev 1964, Chinchenko et al. 1988):

1. KLPHs, which had lower landings near railroad, transported round wood to customers by the railroads. Characteristic features of the KLPHs connected with railroad had: uniform shipment of production all the year round; conditions for processing of low-grade wood and wood waste into pulp chips; high degree of tree stem bucking; opportunity to complete harvesting of the allocated cutting areas; advanced social infrastructure.
2. KLPHs, which had lower landings near rivers, transported their round wood by floating or on ships. The logging companies located near rivers, first of all, formed wood stock at lower landings and constructed internal from upper landings floating assets for this purpose. Companies close to floatable rivers did not use their forest fund completely and left trees difficult for floating in the forest (larch, deciduous trees). In many cases there was no opportunity to dump low-grade wood and produce pulp chips as in many areas there were no customers linked to KLPHs by automobile roads. Due to the limits use of the forest fund operational periods of the KLPHs located near rivers as a rule were smaller than The specified of technology, seasonal format of transport communications lowered workers wellbeing in the LPHs near rivers.

The consequences were the increase of staff turnover and lack of labour force. Comparing economic parameters of railroad and river lespromkhozes, following patterns were identified. In the view of simplification of technological process due to liquidation of lower landing operations, such as crosscutting and loading on railway cars, lespromkhozes near to the rivers given equal other conditions had have lower cost price for commercial round wood. The widest range of commercial products, higher level of forest fund use and harvested round wood, and higher level of cost price rate was characterized the industrial activity of the KLPHs near the railroads. There were also some mixed type of KLPH where commercial round wood were partly transported by railway and partly by floating or on boats.

Specific particularity of typical LPH was dependence between production structures and sizes of raw-material base (*lesosyrevaja baza)* Saltykov et al. (1960). This particularity cause the different quantity of forest roads and lower landings. Three forms of industrial concentration or raw-materaial base conquest of LPHs were identified (Saltikov et al. 1960, Petrov and Morozov 1984) :

1. The single-spot *(odnoochagoviy)* form had tree-length extraction by lorry from cutting areas to one lower landing
2. The multi-spot *(mnogoochagoviy)* form had tree-length extraction by lorry from cutting areas to several lower landings
3. The network *(setevoy)* form had tree-length extraction by lorry using one forest road to a net of lower landings

According to Saltikov et al. (1960), the dependence to selected form of industial consentration different quantity of cutting areas were established.The single-spot form of industrail consentration in LPHs was simple advanced production structure in Soviet time, where high density of production was ensured, opportunities were for the automation and mechanisation of labor-intensive operations, and processing of low-grade wood and waste products was possible. By the form of tree-length extraction LPHs using motor transport ans LPHs using narrow-gauge railway for logs transportation.

The organisational properties of Soviet LPHs were horizontal (standard sized chips processed on many lower landings) and vertical types (combination of wood harvesting with sawmilling or railway sleeper production) of production combination.

2.5.2 The management structure of LPHs

Accorging to Saltykov et al. (1960), Gozhev (1964), Chinchenko et al. (1988), the management strucrure *(struktura upravleniya)* means the organized set of wholeness' management bodies, relations and subordinations (Figure 7).

Each state logging company at the same time was managed not only by the higher level management bodies (see Figure 7), but also by the management system of the lespromkhoz itself (Figure 8). Thus the lespromkhoz represented the active form of management on the whole. Operational management of each production branch of the lespromkhoz was, in turn, an integral part of administrative activity. It was aimed in the organisation of performance of the current tasks and planned targets by the staff of the company.

Therefore operational management was the system of measures and influence providing performance of current work scheduled for a quarter, a month, a decade, or a day. The principles and techniques in administrative management meant the strong influence to state company staff made the basis for these measures. Terms of work, quantitative and qualitative parameters of tasks, definite executors, discrepancies in work etc. were subject to the management activities. At the same time, the structure of internal relatinsships as a whole was remained stable in long time. The purpose and tasks of operative management of production units were to maintain of stable and timely performance of the working cycle by all sub-divisions of the lespromkhoz with effective utilisation of all economic resources.

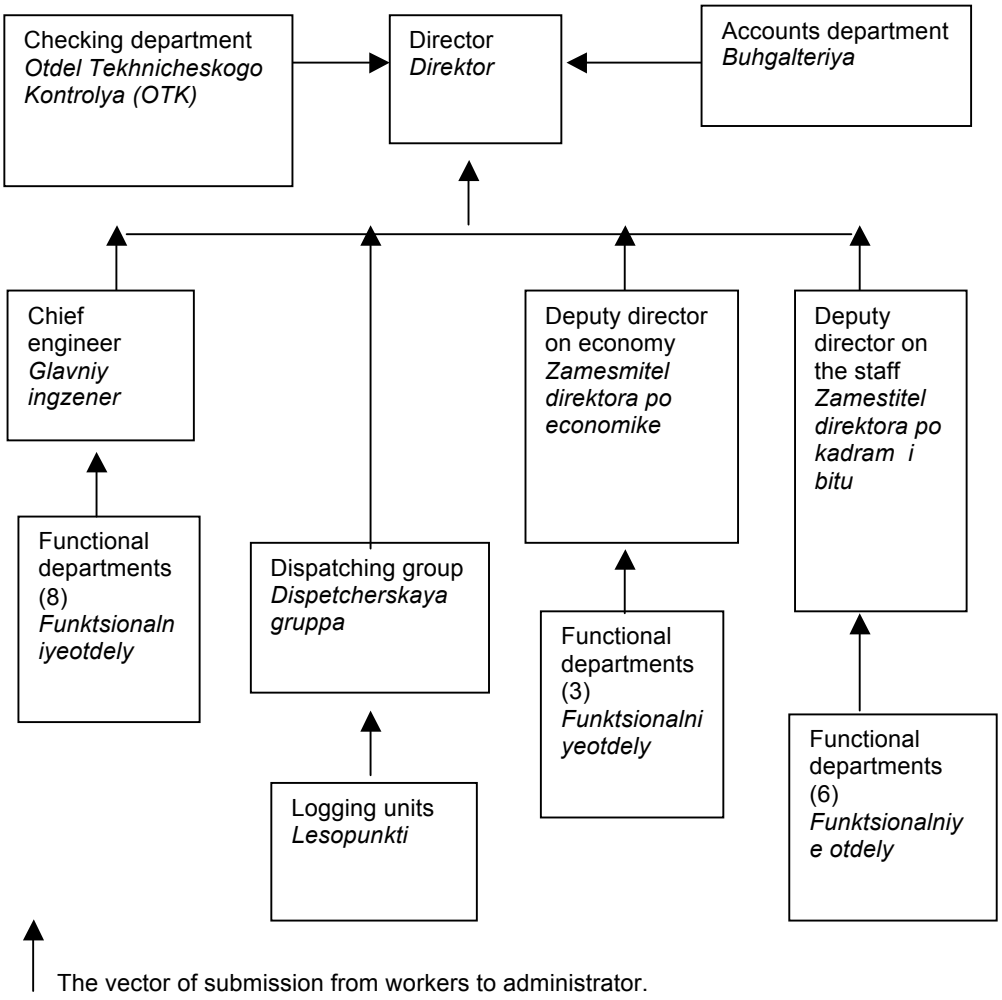


Figure 7. Management structure for typical LPH in USSR during 1985-1987 years (Chinchenko et al. 1988)

The management structure performance needed harmonious work of all departments *(otdelov),* production and management units and crews. Administrative activity was the performance of certain functions, techniques, methods of management at lespromkhoz some form this was a rational form of administrative work. The general standard management functions was: management of technical arrangements of production; organisation of industrial activity and work; management of technological processes; operative production management; measurements management; technical control and testing; organisation of wood supply. Alongside with general functions there were some specific functions. In total there were 17 such functions (GOST 24525.0-80), which were grouped into 7 categories:

1) General management
2) Development and preparation of industrial activity
3) Maintenance of manufacture

4) Economic functions
5) Functions of supply
6) Cooperation and sales
7) Personnel administration

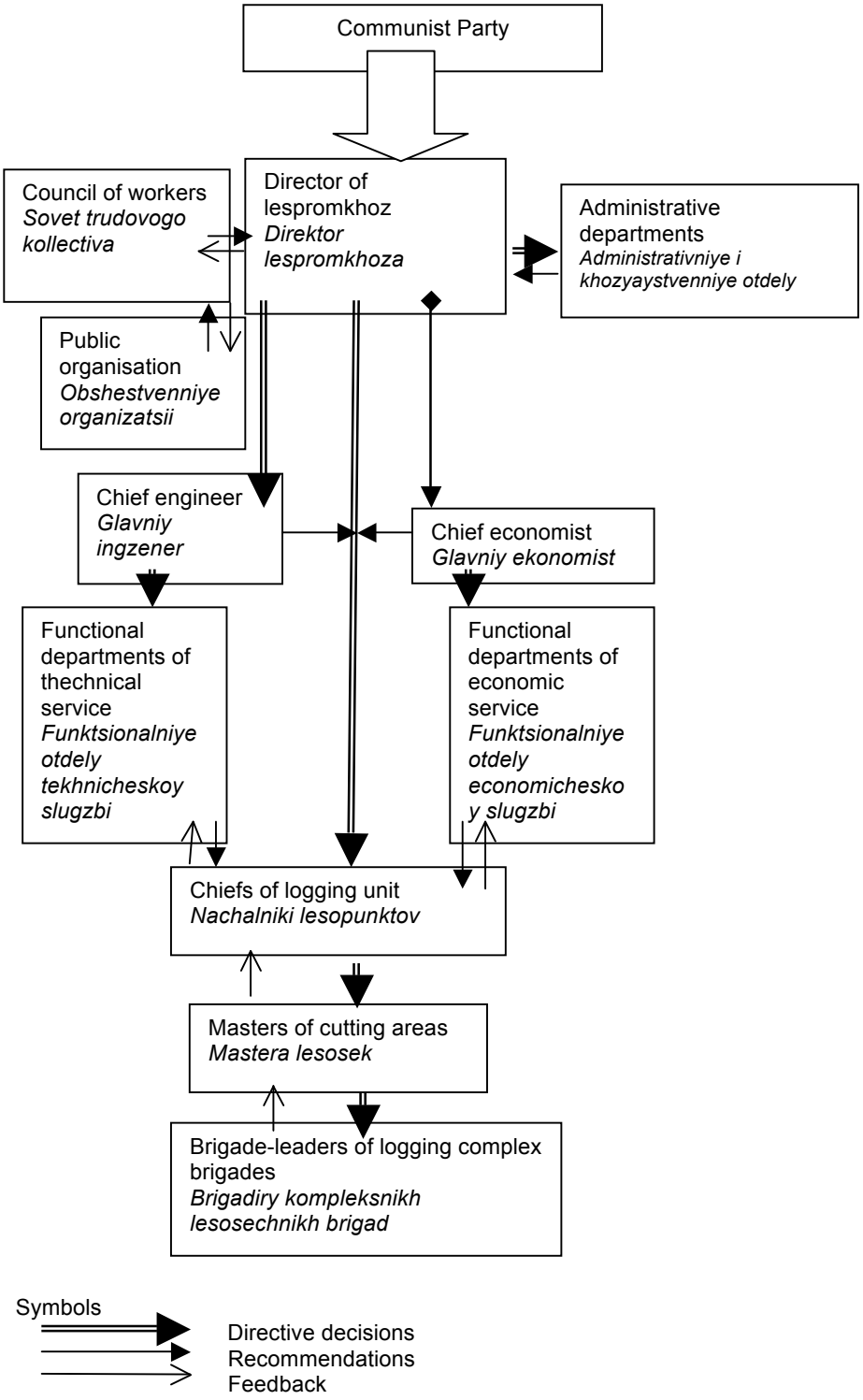


Figure 8. The Common diagram of management in typical Soviet LPH in USSR (Chinchenko et al. 1988, modified by the author

The top managing personnel together with the Communist Party (Figure 8) and public organisations carried out the management of logging company. Administration of the company operated within the framework of organisational management structure or within the whole set of administrative bodies and their interrelation. The generalised management scheme is presented in Figure 8 where it is clearly seen that it has several vertical management levels: all-company; departmental and spatial levels. Horizontally it is divided into functional zones or departments. Accordingly, the administration of the lespromkhoz consisted of the linear personnel: The director, the chief of a department, the chief of a district, the master, and the foreman. They directly managed functional personnel, and specialists of different services and departments, and they also helped the linear personnel and carried out management in separate branches.

The director, who was a member of the CPSU and the authorised representative of the state, headed the administration. He was fully responsible of the conditions and results of work of the logging company both to the higher organisation and to the staff. The director carried out the general management on the basis of undividide authority, but with observation of principles of socialist democracy. According to Nove (1968) speaking generally of Soviet management, the primary task of the director of industrial enterprices was fulfil and overfulfil the output plans, and to utilize the resources placed at his disposal with due regards to economy. In LPH the output plan specified the quantity of the round wood products required in the given month, quarter or year. The aggregate output plan of typical lespromkhoz was frequently expressed in physical mesasure (m^3), or where this could not be done in roubles of gross output. Also there were a number of other plan parametres such as cost reduction, increase in labour productivity, wages, economy of fuel and lubricants. fulfilment of plans expressed in terms of these various indicators carried out with it moral approbation and material benefits, in the form of premia to the director. Overfulfilment of the plancarried with it increased rewards, material and spiritual. Managers of departments, sites, services and similarly supervised their respective sub-divisions.

In the whole country and, respectively, in the lespromkhozes significal improvement in management were made during the period of well-development socialism. The socialist self-management *(socialisticheskoye samoupravleniye*) of workers which findly were legally fixed in the Law of the USSR "About state logging company (association)" in 1980s. Self-management was carried out under the conditions of wide publicity by means of participation of all workers in the major decision-making processes, executing control over .

Answerer the greater power in management was executed the Communist Party organisation and its younger organisation Komsomol. The Communist Party organisation was a political kernel of working collective. Its management function was the general control over activity of administration.

The director was selected by the workers for the term of five years. For this purpose the special workers meetings was organised and the director was chose by voting by open show of hands. The nomination was higher administrative body. Also heads of departments, sites, masters, and foremen were selected collectively for the period of five years and affirmed by the director. This procedure was not applyied for Chief economict, head of law departments and Cief engineer which were directly appointed by the director.

In reality besides specific features of character there were three basic criteria for choosing the management of a logging company: university degree and management experience, membership of the Communist Party or Komsomol and marital status. The preference in selection was always given to a man with a family. Family played a major role in the system of communistic education. The family as a unit of society was the central point of the communist morality.

Operative management in lespromkhoz was carried out by linear heads of all levels, as well as by production, technical, planning and economic services. The organisational structure of company management is determined by its head in accordance with authorised standard structures and with reference to the category of the company and group of a logging unit.

In conclusion one can find that the management structure of typical LPHs were combined three parallel management systems. There were formal state management, Communist Party and LPHs or operational management systems, and it was a typical Soviet production organisation.

2.6 Scientific principles of Socialist management structure building on wood harvesting

According to Rumyantseva et al. (1995), the term "structure" in classical Soviet management theory means the ordered set of the interconnected elements providing functioning of uniform totality. The operational management system were in particular based on what was called the scientific principles of Socialist management. The elements in typical structure based on scientific principles differentials from each other. Basically they included individual workers, workers brigades and administrative departments. Traditionally the relations between structure elements were also divided to the horizontal and vertical relations. The horizontal were one lev*el* relation *(odnourovnevie)* and management played only coordinating role with the other same typical elements. Hierarchical management structure was based on the vertical relations. The function of these relations was direct subordination. The relations in hierarchical management structure had linear *(lineiniy)* and functional *(funktsionalniy)* characters. The linear character relation was used in the same level, for example, deputy directors or chiefs, for running management decisions. The information that moves from lower to top management levels had functional character of relation. The five scientific principles founded the many-sided contents for typical management structure in command-planning economy. These are:

1. General task and objects of the enterprise should be reflected in the management structure
2. Management structure should be submitted to the production process as well
3. Management structure should be reflected by the functional division of labour and administration, plenary power or authority
4. Management structure should be internal relation in the social and cultural environment
5. Management structure should be realized the interrelation between administration power and workers qualification

The Soviet policy, rules and post instructions were determinate by the volume and limits of administrative power. Administrative power was less limited on top management level. The centralized command and control of the culture, traditions and society value were also limited by the administrative power.

The organisation of socialist production determined a rational combination of methods and techniques of all operations, and also expedient arrangement of people. Wood harvesting of the Soviet period belonged to mass production with all principles and the corresponding of forms to different kinds of production. The wood harvesting processes included traditionally following activities in USSR/KASSR:

1. Main cutting area operations
2. Commercial round wood transportation
3. Main lower landing operations
4. Commercial round wood transportation by railway to customers

Principles of the organisation for socialist logging industry listed by Chinchenko et al. (1988), included proportionality *(proportsionalnosti),* rhythm *(ritmichnosti)*and continuity *(neprerivnosti)* also means sustainability*,* parallelism *(parralelnosti),* standard and uniformity*(standartizatsii i unifikatsii),* mechanization *(mekhanizatsii),* production concentration *(kontsentratsii proizvodstva),* efficiency and economy *(effektivnosti i ekonomichnosti)* what means rational use of industrial resources and reserves, observance of financial discipline according to the plan, adherence to efficiency. The two economic principles for profitable wood harvesting were applied in USSR/KASSR.

1. Effectiveness or profitability (in common economics) meant reflects excess of revenue over costs. This is different in western economics. The degree of effectiveness defined the type of development of production. If results grew faster than costs and the specific weight of resources per production unit decreased, then it was intensive type of production development. If the total costs exceed the results of production and for logging industry that was typical, in a planning

economy was called the extensive model of industrial development and was the general principles of socialist national economy development.

2. Optimality was the choice of the best variant of the organisation of manufacture. The three parametrs were used, such as reliability of domestic machinery *(nadegznost tehniki)*; integrated approach *(integrirovannij podhod)*; ergonomics of works *(ergonomika truda)*. Optimal organisation of main cutting area operations consisted of the right choice and substantiation of machinery, organisational patterns, methods of maintenance, organisation in time and space.

The basic commercial product of typical lespromkhozes is commercial round wood, which was the raw material for wood working. During the Soviet period LPHs in USSR/KASSR also produced different kinds of by-products such as wood meal, chips. In comparison to other branches of national economy lespromkhozes as objects of introducing technical progress could were characterised by several special features, Chinchenko et al. (1988):

- Territorial dispersion of wood harvesting and technological operations of forest regeneration.
- High level of labour-intensity of separate operations with a large share of manual work
- Many transportation operations, lower landing operations and also internal auxiliary (repair) services.
- Strong influence of natural climate conditions on the organisation of wood harvesting
- Use of different kinds of wood harvesting methods
- Heterogeneity of the subject of work (trees, logs), that complicates automation of technological processes
- Influence of environment on production process in wood cuttings due to environmental requirement

The listed features resulted in continuous change of the technological process of wood harvesting within the borders of the growing stock of forest fund. Logging units as a rule were separated and were far away from the management offices, lower landings, supply terminals, and central workshops. Second, the forest was a state property and was not transferred to LPHs' property, but was only provided for use on the grounds of relevant rules.

Cutting of allotments and wood transportation were limited by a certain time frame, which did not depend on availability of labour force, equipment or condition of roads. The seasonal nature and influence of climatic factors had a strong influence on the organisation of logging activity. For instance, strong wind could stop fellings, and during severely cold periods breaks were necessary for warming up. During spring and autumn time the impassability of roads stopped logs extraction. Many times the insufficient supply of rail wagons resulted in interruptions of work in the lowel landings. In planning economic activities of the company during spring or autumn bad condition of forest roads, mean *rasputitsa* in Russian, was a specially concern. The positive side of the seasonal nature of the work as there was a necessity to find it was the possibility to apply the socialist principle of thrift and economy *(beregzlivosty i ekonomii)* which able the companies to concentrate on work like:

- Maintenance of forest roads.
- Maintenance of domestic forest tractors
- Protection of health of workers

Operators of skidding tractors were involved in repair and preventive maintenance of forest machinery in mechanical-repair workshops. Other workers spent the extra holidays. The maintenance of forest road was the specific part of the forest road management policy. The maintenance of forest road during *rasputitsa* included two types of activities, such as concrete slabs covering the forest roads and temporary forest road closures. The extra work of forest road improvement was basic and serious problem for Soviet/Russian logging industry development.

The economic methods of management were also taking in to accounting in process of decision-making. This part of management has estimated in general figures of state orders, long-term economic norms and limits.

2.7 Principal labour force for the logging operations

The principal and core labour force for logging operations was consisted of the high skilled workers, such as chain-saw operators, choker setters and skidding tractor and delimbing machine operators. The highly effective work of the best logging brigades has been described in literature (Glotov et al. 1975, Yagodnikov and Mikhaylov 1991). High wages were paid for the best chain-saw operators. The Soviet bonus system and respectful attitude towards workers were a part of state policy as a whole. Also different kind of diplomas and travelling tickets with accommodation in rehabilitation centres were widely used for bonus system development. Traditionally the incentive system consisted of material and moral incentives. Usually the working conditions of cutting areas with manual harvesting have been considered as heavy and ever dangerous.

2.8 Specific labour force for logging works

In addition to above also some specific groups of hired labour force have traditional been used in logging. The first specific group was migrants from different Republics of the former USSR. This category of labour force was called the "cheap labour force" *(deshevaya rabochaya sila)*. Usually they used simple working instruments, such as old models of domestic chain-saws on felling operations, old skidding tractors TDT-55 and axes for delimbing operations.

The second specific group was called "forced labour force" *(prinuditelniy trud)* and meant the prisoners. In old Russia the use of prisoners as a labour force has a long history and has been a necessary part of national economy development. The development of this process in the USSR was adopted in 1926 in document "About prisoners work using in logging activity" and applied in practice since 1929 (Tokmyanina 2006). Exploitation of "forced labour force" was needed to increase harvesting volume and also it was a way for decreasing round wood cost price as a whole. During Soviet time logging work was a usual punishment for political prisoners. Prisoners used as a labour force in logging, forest road construction and round wood transportations on narrow-tracked railways. Some times prisoners had been used for firewood production and the female prisoners for collection of branches after logging work.

The Ministry of Interior had the right to do logging activities. Term of imprisonment *(srok zaklycheniya)* was the basic criterion for a choice of place and type of living conditions on a prison camp. The prisoners who had short imprisonment terms went to camps in Northwest part of USSR and Komi SSR. These groups lived in special barracks at the outskirts of traditional forest settlements. Special machines were used for transportation of prisoners to cutting area. There was no special guarding around cutting areas. Prisoners used in logging work cut-to-length (CTL) harvesting method with manual equipment and domestic skidding tractors. The production norms for prisoners were the higher than norms used in LPHs. The most dangerous prisoners with long term or imprisonment for live were brought to Ural regions (Perm and Sverdlovsk regions), Kemerovo region and also in Siberia. The living conditions of these groups of prisoners were harder and strenuous (Tokmyanina 2006).

The square form of a cutting area was used for dangerous *(opasniye)* prisoners in logging work (Figure 9). Usually the length of a square side was 250 m. Between the forest site and barbed wire *(kolychaya provoloka)* was a special barren territory. The standard width of the barren area was 6 m. There were no trees or stumps on this territory. Usually four guards with fire arms and some times with dogs were used for guarding. CTL method with using of manual equipment and axes was prevailing.

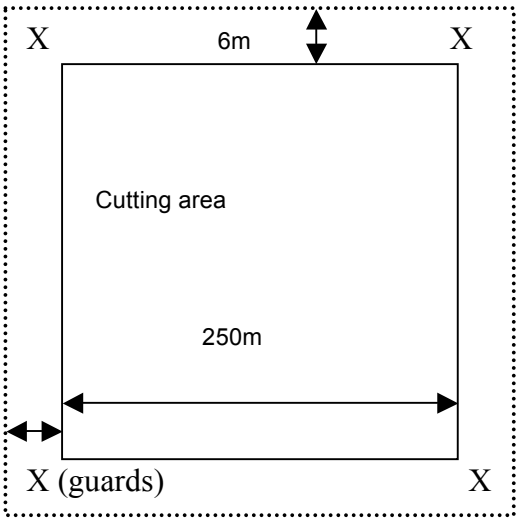


Figure 9. The scheme of a cutting area with barbed wire for dangerous prisoners

Although called additional or specific logging work in the 1930s was dominated. In 1930s the share of prisoner's wood harvesting volume was as high as 50% in total wood harvesting volume in USSR. In 1953 this share was decreased to 13%. For example, in 1951 the number of prisoners in Ural regions (Perm and Sverdlovsk regions) was 135 126 peoples and that of guards 178 439 people (Tokmyanina 2006).
The new order № 1499-p from 27.10.2007 has been started to operate. The Government has approved the list of the basic kinds of prisoners' activity connected with forest sector. This list included forestry, logging for wholesale trade *(torgovlja na lesnikh birgzah)* of round wood and machinery for forestry.

2.9 Conclusions for period of industrial logging in USSR/KASSR

The system of planning economy was started to be developed in the USSR in 1917. Socialist model of economy during the whole period of development from 1917 to 1992 was a total alternative to the all models of market economy .

Scientific approach to the design of management structure in the soviet system was developed from top level to the bottom level of hierarchy. For a typical management system of LPH this process included three steps in consecutive order:

- Division of the typical management structure into a wide blocks corresponding to the major directions of main activities of LPHs
- Active control between different levels of hierarchy
- Clear definition of authoritative powers and their transfer to the persons

Only one type of collective of work organization was adopted and widely applied in national economy and also in the Soviet forest industry. Main characterictics of logging industry economy were:

- The state system of cost planning, which did not allow specific features of cost accounting of individual logging company
- There was no flexibility for normative method of cost planning and cost calculation
- Centralized control in wood harvesting process

Studying of practice was the basis for the formation of development stages and a condition of objects of management and their role in the development of economy of the Republic. Management systems of the logging industry, existing in the USSR and the KASSR, was for long term focused opened their orientation to performance of already generated scheduled tasks. The established typical actions for administrative works were the basis of the command and control - management system with observance of

principles of socialist democracy. However, the elective body council of workers and public organisations served as, means of attraction of the collective to manage the development of actions for performance of planned targets of the logging companies. Therefore it was established the Soviet period for wood harvesting in the system of Minlesprom of the USSR, which had industrial character. The significant growth of large mechanization of lesptromkhozes, and commercial round wood extraction by lorry for long distance to the lower landing was observed. In the number of cases, commercial round wood was transported directly from upper landing to customers. There appeared to be a tendency to the formation of the integrated logging companies. On the other hand,there was very unstable upper mainly (ministeries) level management system during the whole period of the formation of logging industry in Soviet time. In the economy of KASSR the logging industry occupied the leading position.

The management system for state logging companies was uniform. In all lespromkhozes it was directed according to performance of industrial, economic and other planned targets, which were received from the higher organizations. Also development of cost budget plans for logging activity was presented in detail in the Chapter 4, carried out by tasks received from the higher organizations. Providing necessary resources for the performance of the state industrial planned target were carried out by the state through the system of the state supply of the USSR. The sale of commercial round wood in lespromkhozes was carried out also through this system.

The central - planned economy in the logging industry did not created necessary conditions for effective logging activity, partially due to the absence of market competition. Within the socialist economy the purpose of lespromkhozes consisted of output of the certain nomenclature and assortment. In different plans the production volumes were established quantitatively in figure for one year and for the period of five years .

As said, under the plans the necessary resources and concrete supplies were allocated to each logging company. Customers were similarly established. All was planned and decided by the Committee of State Planning *(Gosplan SSSR)* and the Committee of the State Supply *(Gossnab SSSR)* through the higher organizations.

The lespromkhozes in planned economy worked according the circle: forest resources (1) – commercial round wood production (2) – to customers (3). Rich forest resources were the main basis of output. In planned economy the volume of wood harvesting basically depended on the opportunities of the state to provide the necessary resources to the lespromkhoz. The logging company in this situation did not know what bankrupt mean. Fulfilling of the timber procurement plans in socialist economy was the most important criterion for assessment of logging activity. By this criterion activity of the director, work of public organizations and collective as a whole were estimated.

3. DEVELOPMENT OF GENERAL WOOD HARVESTING MANAGEMENT STRUCTURES IN THE REPUBLIC OF KARELIA UNDER THE CONDITIONS OF ECONOMY IN TRANSITION

3.1 Analysis of economic crisis of the 1990s in wood harvesting in Russia

Transition of the forest sector of Russia to market economy was and yet criticises to be difficult and long process (Kozlov 1998, Kozukhov and Masliy 1999, Saastamoinen et al. 1999, Sikonen and Saastamoinen (eds.) 2000, Tyukina 2000). Especially, period 1992-2001, was determined as crisis and catastrophe for Russian forest sector (Petrov 1995, Levanov 1999, Carlsson et al. 2000, Nilsson and Kleinhof 2001, Barinov et al. 2003). There were also problems in other countries (Bakhaus 2000).

Since 1992, landslide type of falling volumes of production of the whole forest sector of Russia was observed (Burdin et al. 2000). Falling volumes of production of timber cuttings was the basic determinant for the crisis. Conditions for the crisis were created by the former economic system. During the Soviet times the planning of harvesting volume in the logging industry was carried out by calculating mainly or solely physical parameters with application such concept as nominal cubic meter of round wood often without much estimation of the cost of the end production directly consumed by the population or exported. Since the moment when the state ceased to be the customer of the round-wood materials, and accordingly the payer for those forest products, they were presented on the market for payment to the population. The lump of the population owing to poverty was not able to pay for the wood based goods being sold offered with prices without taking into account the demand. Forest products were given less priority at the consumer market than food products, clothes and other essential commodities.

In the socialist economy all transport charges were paid by the state, therefore the process of escalating of distances and volumes of transportation was not given due attention at drawing up of general schemes of development and allocation of logging industry. In the economy in transition, wood consumers started to pay dramatically increased transportation costs. Such high transport costs happen to be too expensive not only for domestic woodworking companies which domestic orientation was at the edge of bankruptcy, but also for many foreign companies. According to Petrov (1995), the additional reason of the crisis came up from the former system of the prices on forest products, submitted in the Govermental price-list 07-03(1988). The principle of single wholesale prices *(optovaya tsena)* was out of date because it was below the rate of costs.

Also forestry financing suffered badly during the economic crisis. During the whole period of Soviet time the forestry got money from the State budget. A residual *(ostatochniy)* principle of forestry financing was applied everywhere. It meant that this branch of national economy was minor importance and achieved in the last turn in money distributed from state budget. The former financing order was the weakest point in the whole Soviet financing system. The use of this principle in forested regions meant small partial financing or total absence money from the State budget for many years. According to an expert report (Rantapuu 1999) during the period of economic crisis the leskhozes did not have the necessary own monetary resources. Economic activity in leskhozes can be characterized as totally unprofitable with the low level of labour productivity. In particular the traditional thinnings *(rubki ukhoda)* in leskhozes were replaced by income thinnings *"rubki dokhoda"* (Rantapuu 1999). This term meant that in practice the best quality trees were cut and low quality trees were left growing preserved for future against the official standards.

Spontaneous process of splitting of state property and its privatization happened to bring big financial losses both for the state and for the logging companies. In some cases technical policy of the branches of forest sector turned to be ineffective, as in the beginning of the reforms labour intensity was high and productivity was low, therefore, the share of salaries in the cost price of products was quite high. In the middle of the 1990s the logging returned to using manual motor-tools and in some cases round wood was harvested without machinery. Only 30 % wood harvesting work was provided with machinery (Development of forestry… 2002).

The crisis led to a dramatic depreciation of the rouble in 1998 after that the export of roundwood became very attractive. The foreign investment in logging and other forest

industries in Russian economy played an important role in economic development after 1998. The national economy development has been started thought the fragmentary (*fragmentarniy*) modernization (Brikin 2008).

Within the general crisis of economy this was explained as a temporary phenomenon. The erroneous estimation of industrial conditions and the choice of types of machines have resulted in the fact that machine technologies became unprofitable. The allowed miscalculations can lead to direct consequences resulting in liquidation of production. It is quite clear that the final choice of technology will be done by experts of each logging company; however, it is necessary to pay attention to the general conditions. Efficiency and applicability of technology and machines cannot be estimated without connection with the conditions of their application. It is known that both conditions of forests and their quality determine the structure and availability of roads, processing capacities, basic soil - taxation characteristics, and distance of commercial round wood transportation.

Changes of proprietors of lespromkhozes as a result of privatisation led to the increase of the number of small companies. It turned out that a great variety of economic organisations were involved in wood harvesting without any optimization of production volumes, combination of industrial resources and, naturally, without relevant results which would meet the requirements of market economy. It on its part resulted also in occurrence of corruption in the logging industry. The different reasons for the occurrence of corruption in wood harvesting have not been thoroughly studied to this date. Some experts see the reason in denationalisation of LPHs, (Levanov 1999, Burdin et al. 2000), but others have a different view that corruption has stemmed from leskhozes which have remained not privatized.

During privatisation traditional lespromkhozes, which had been formed in the Soviet period, naturally ceased to be the property of the state. In the RK only one logging company, "Sukkozyorskiy lespromkhoz", remained in the state ownership after 1998. The great bulk of lespromkhozes are now open joint-stock companies and an insignificant part are closed joint-stock companies, and firms with limited liability. The state had some shares of 32 lespromkhozes in 1999. An average size of the state share holding in logging industry was 18%. Before 2000 the state had influence through the state share holdings in authorised capitals of providing about 30 % of the volume of wood harvesting (Nemkovich et al. 2000).

Dynamic of wood harvesting for the period of an economic crisis as a whole on the RK is also presented on Figure 3. Wood harvesting volume collapse in the RK observed during 1990 -1998. After the devalvation in 1998 the wood harvesting volume has stabilised step by step.

3.2 Development of management shemes for logging industry at the regional level (general forms and law concern all county)

As mentioned above, privatization started since 1992 in whole Russian Federation and joint-stock companies were established around country (Myllynen and Saastamoinen 1995, Dolgopyatova 1995, Prusak 1995). At the same time parallel with privatization state logging companies LPHs changed their form of ownership. The first form of ownership was a state logging company, which means that the founder and the organizer of activity is the state on behalf of federal, regional or municipal bodies.

Legal forms of private logging companies are the following:

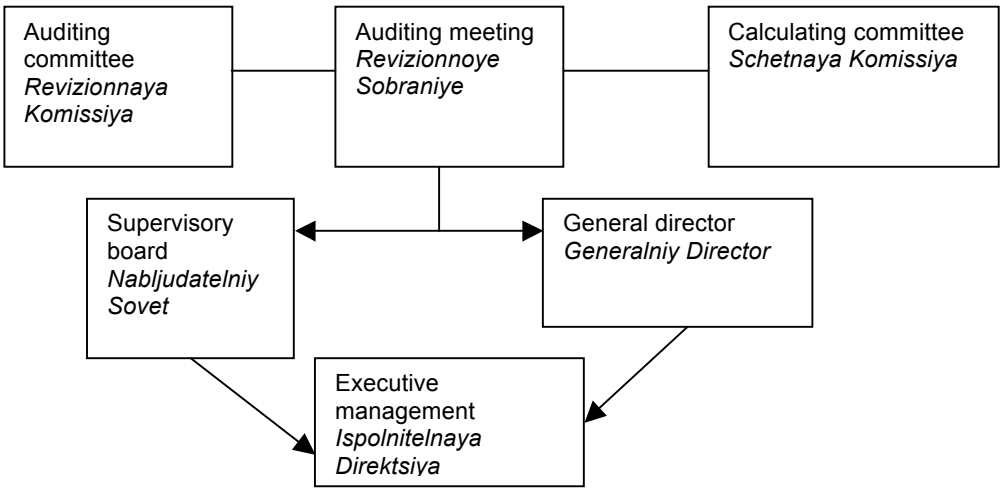
1. In individual logging companies the proprietor of the capital is one person who independently operates it, receives all profit (the residual income) and bears the personal responsibility about all obligations of the company.
2. Joint-stock company, where the number of shares, and the shareholders responsibility confirms the share of each shareholder is limited by the contribution to the given company. Holders of shares receive a part of the income (dividend) and cause risk only for the sum, which they have paid for the shares (Piipponen 2000).
3. Corporations have the legal status; hired professional managers carry out management by corporation. Joint-stock companies are divided into closed and open type. In a closed joint-stock company all shares belong to the founders and they are not in open sale. Shareholders bear the responsibility only within

the limits of the brought capital. According to Kotumäki et al. (1999), this is a most common type of logging companies in the Republic of Karelia.

The shares of an open (public) joint-stock company are freely sold to the public and can be bought without restrictions on the stock market. Joint-stock company and shareholders bear the responsibility for the work. An activity of open joint stock companies is regulated by the Federal law N208-95 "About joint-stock companies "(*Ob aktsionernikh obshestvskh)*. If in the authorized capital a joint-stock company including a share of the state capital, it refers to mixed form of ownership.

A joint-stock company can have the shares capital of other companies (Bulatov and Shegelman 2004). On the basis of the above law any joint-stock company can choose itself the optimum structure of management and rationally distribute its powers. In the RK three types of management structures were generated for joint-stock companies (Kotumäki et al. 1999) (Figure 10).

Type1



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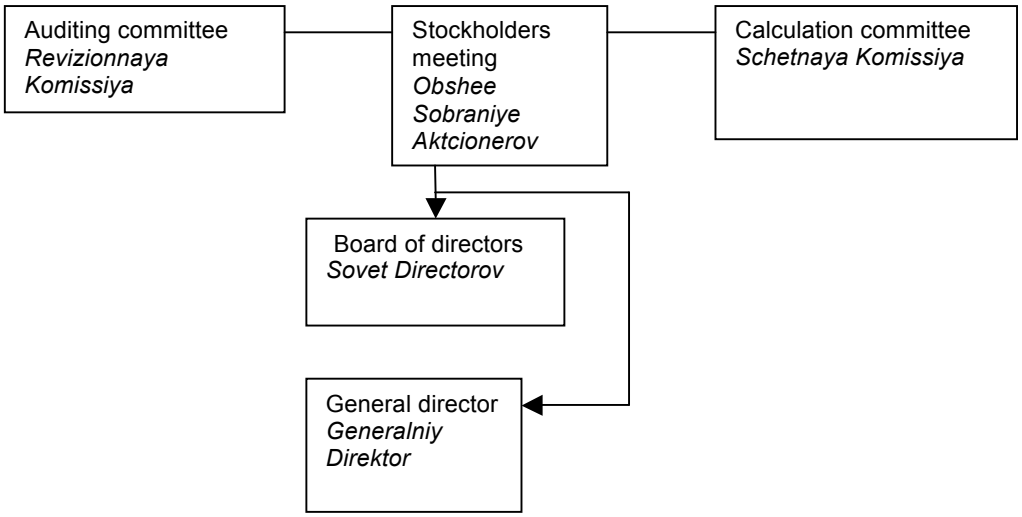

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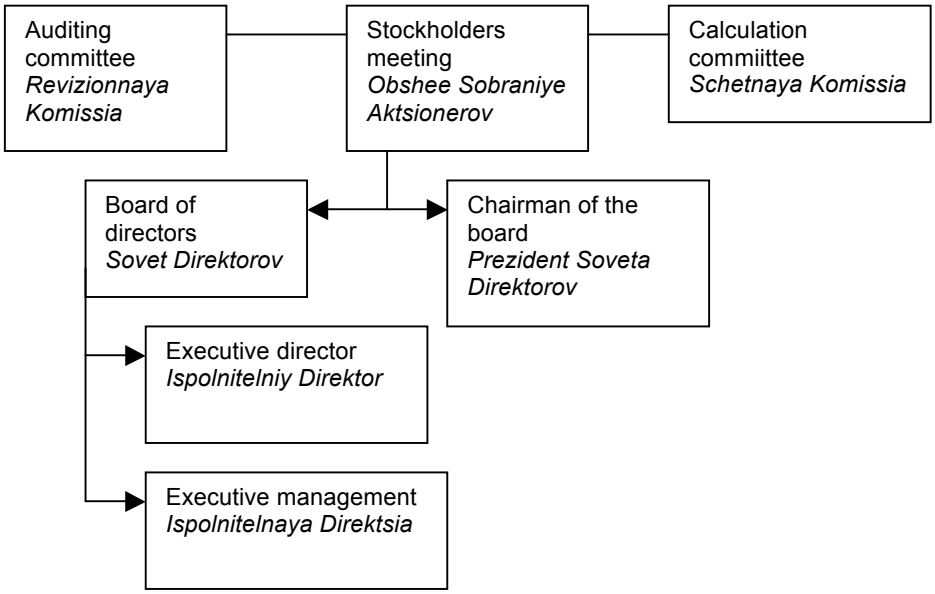


Figure 10. Typical management bodies for different type joint stock logging companies in RK (Kotimäki et al. 1999 and modified by the author.)

Types 1, 2 are characterised by the presence of a General Director. Term of an Execution for General Director is five years. The Stockholder meeting selects the Board of Directors and chairman of the board for a period of only one year in type 3. The Board of Directors assigns the Executive Director and Executive management also for one year. Basic element of administrative regulation is the participation in different management bodies, including the management of security share in Figure 10.

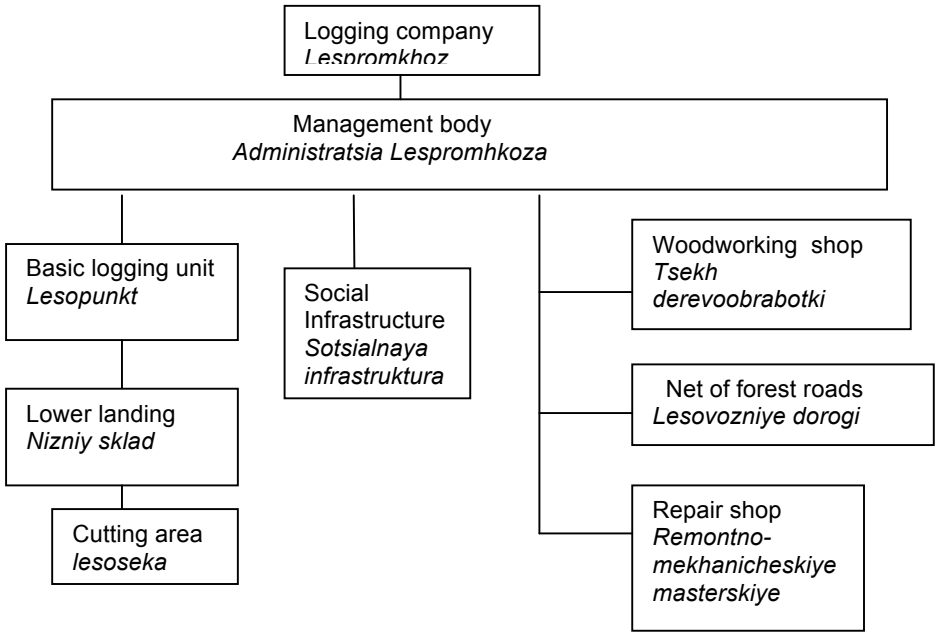


Figure 11. The organisation structure of a typical logging company in the RK using tree-length technology of wood harvesting (Kotimäki et al.1999)

In the period before 2000 the typical organisation structure of logging industry in the RK (Figure 11) was that of a company using tree-length method of wood harvesting.

The institutional transformations occurring in the forest sector of Karelia are natural by processes connected primarily with general economic and political changes in the country. Market transformations rendered strong influence on the change of the management system in the logging industry in the regional level. First of all it was reflected in the activity of territorial production associations through which the regional state forest sector management policy was implemented. In many regions of Russian Federation these associations have changed their status and functions, and in some cases they were even liquidated. In the Republic of Karelia region production association "Karellesprom" was transformed into the logging industry joint-stock holding (JSH) "Karellesprom". The JSH "Karellesprom" consisted from 27 logging companies.

The joint-stock company *"Segezhabumprom*" has existed from 1996 the RK (Burdin et al. 2000, Bulatov and Shegelman 2004). The structure of the company was based on the principle of integrated use of all wood raw materials, and it consisted of 7 logging companies: Joint-stock company *"Segezhskiy wood-sawing logging company",* Joint-stock company *"Valday lespromkhoz"*, Joint-stock company *"Segezhsky lespromkoz"*, Joint-stock company *"Medvezhegorsky lespromkoz"*, Joint-stock company *"Padanskiy lespromkhoz",* Joint-stock company *"Pyalmales"*, Joint-stock company *"Sukkozerskiy lespromkhoz"* and the head joint-stock company *"Segezhabumprom"* headquarters plant.

The structure of the holding company allowed to provide raw materials for timber processing and independently to solve current tasks and strategic problems. However the management of headquarter plant set absolutely different tasks, namely to purchase of holding head stake. As a result, in 1998 "Segezhskiy pulp and paper plant", the largest manufacturer of paper was at the edge of bankruptcy. The plan of financial improvement was produced at the headquarters and was submitted to the government of Russia including measures of state support of 200 million US dollars. The most interesting part of the plan was the proposal to deliver wood raw material from Tyumen area more than 1000 km from Segeza with price of 50 US dollars per per m^3. At the same time, pulpwood from Karelian lespromkhozes was exported to Finland for 35 US dollars per m^3. In a short period of time the control of share holding has changed three times. Untill 1999 the plant has been in a very difficult situation, what influenced also the social environment among the workers. Due to importance of this logging company to economy of the republic, the Government of Karelia was engaged in resolving the issue of overcoming the crisis of the company *"Segezhabumprom"* (Burdin et al. 2000, Bulatov and Shegelman 2004). In 2002, a JSC "Continental Karelia" was founded. This company was the branch of a big Russian company "Continental Management". *"Belomorskiy"* and *"Lednerechenskiy"* LPHs were merged in JSC "Continental Karelia".

At the republican level the State Committee of forest sector in the management structure RK was an executive power. The formal authority of State Committee of forest sector was regional. (Figure 12) The goals of the Committee were carrying out in territory of the RK a state policy concerning logging, woodworking and a pulp and paper industries and creation of conditions for development of the logging companies and sustainable forest management.

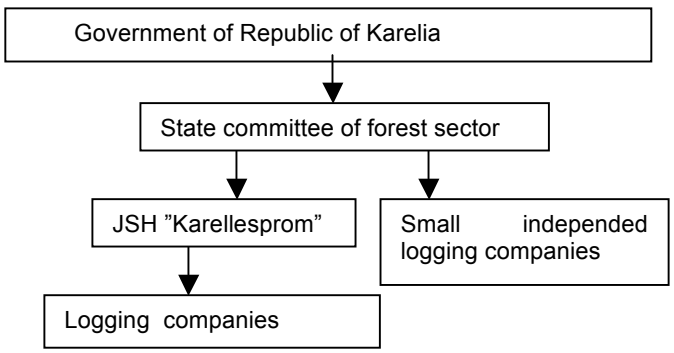


Figure 12. General elements from management structure for logging industry in the RK in 2000 (Kotumäki et al. 1999, Nemkòvich et al. 2000).

The RK owns the control share holding of the joint-stock holding company “Karellesprom”. The Chairman of the Board of Directors of the company is the First Vice Chairman of the Government of the RK. On behalf of the Government of the RK the JSH “Karellesprom” was carried out the following functions of management (Nemkovich et al. 2000):

- Coordination work for activities large and middle-scale logging companies
- Data accumulation and analysis
- Development of new proposals for development
- Increasing of efficiency of forest management
- Participation in the execution of law and acts
- Participation in the work of the governmental commissions
- Organisation of preparation and realisation of republican meetings for heads of forest sector
- Organisation of preparation and realisation of exhibitions of forest production.
- Organisation of the republican competitions of lumbermen *(valshiki)* in work skill
- Promotion for application of the new harvesting technologies
- Participation in realisation of investment programs.
- Security of forest fund for logging companies undergoing the procedures of bankruptcy

The public organisations also participated in the process of management including, trade unions, union of lumbermen of the RK, union of employers of the RK, Commercial and Industrial Chamber of the RK, association of economic interaction of the regions of Northwest of the Russian Federation "Association Northwest" (Nemkovich et al. 2000).

Management structure described above and demonstrated the non-centralised connections between the logging companies and state bodies, the coordination complicated. This structure was developed with the purpose of creation of effective management system including state regulation by means of development and coordination of the logging companies.

According to data from Nemkovich et al. (2000) and Maslyakov et al. (2000) the management system for logging industry in the RK in the period 1992-2000 included following state agencies (Figure 13). The First Vice Chairman of the Government of the RK supervises the questions of development of forest sector in the RK. The Ministry of Economy of the RK, in accordance with its authorized position, ensures the implementation of the state policy in the area of forest management, wood processing, and mechanical engineering of logging industry on the territory of the RK. It also coordinates the activity on licensing, carried out by the bodies of the regional government and institutions of local government. There were at least four departments at the Ministry of Economy that supervise the work of forest sector companies. These departments have no command power; they basically analyse the situation and develop general conceptual directions of their development.

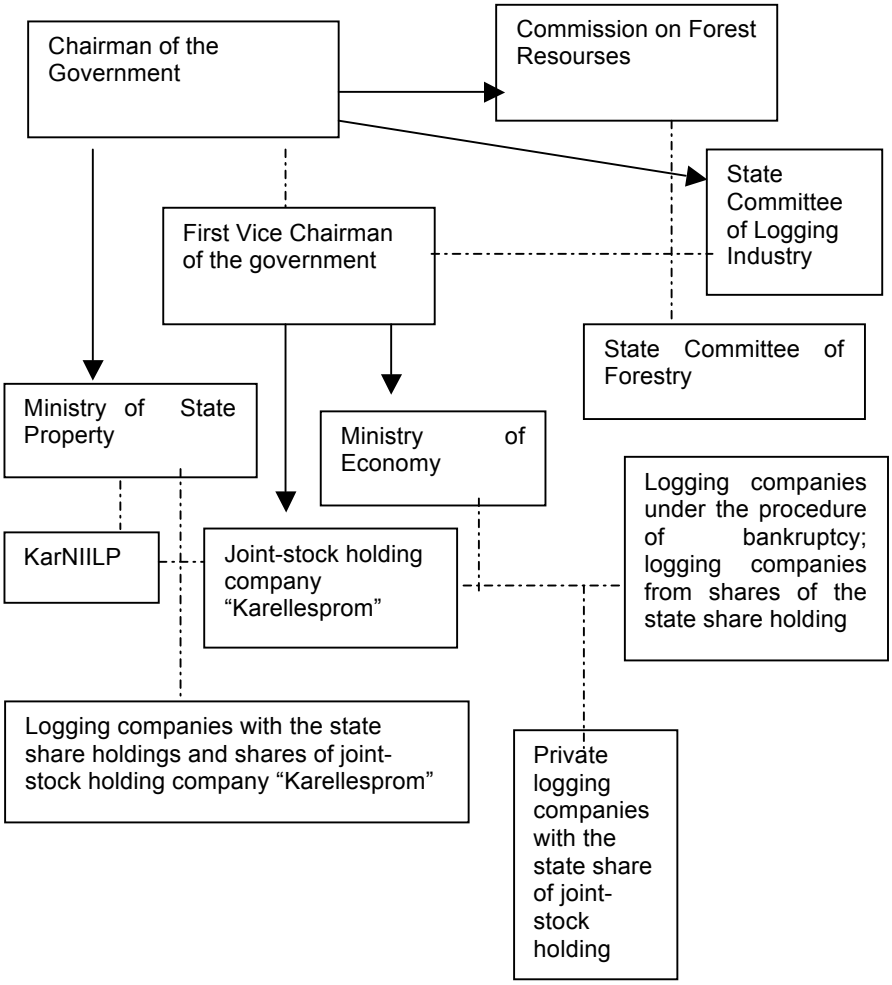


Figure 13. The management system of logging industry during 1992-1999 years in the RK (Nemkovich et al. 2000 and modified by the author

3.3 Development of regional management in logging industry

During last 17 years the transition period of economy the management theory has developed. Radical change in modern management theory multiple scientific studies have mixed some elements of socialist management theory with elements from western management theory. The game theory, different models of queuing theory and philosophy of continuous improvement (Stevenson 1999) came from "western" world to Russia. Also the management culture and management technology were constantly changed. "Western" *production and operations management* (POM) in logging companies gives a big attention to the role of the human factor during the production process. The classical cybernetics theory was developed during many years in the former USSR (Ivanov 1981) and after that in Russia economic cybernetics in management theory (Murashkin and Tyukina 1999, Murashkin et al. 2010). Nowadays in "western" world the term (POM) is used and it is widely applicable also in the current process of wood harvesting in the RK. Utilization of

POM in current logging companies is near to the western understanding of management directed to gaining profit from the work.

Teamwork has become active in the process of decision-making. Posts for directors of management were opened in logging companies.

The innovative management and the theory of leadership had been developed in the 1980-90s and also actual nowadays in management activity on Western logging companies working in the RK.

The modern management paradigm in the Western world, i.e. the views and opinions of management, which are based on the use of the systems theory, based on the use of situational approach for general management and the recognition of social responsibility. The efficiency of a company as a system depends firstly the main kind of its resources - the person. The important point of the new approach for management - in recognition of the conditions of information era in manufacture is formed new social class: cognitariat. The term cognitariat meant intellectuals and workers exclusively engaged in mental work, usually also as "creative proletariat", and the role of cognitariat is character as primary and sociocultural role (Bell 1999). The power of cognitariat this based on knowledge, on the use of intelligence, instead of muscular force. The cognitariat, having admission to the information and allocated by high culture, cannot be considered only as one of the economic forces of manufacture. It is the key resource, the effective using and escalating of which becomes the central problem of management. It is necessary to take into consideration, that the management science corresponds to practice ever less. Both traditional administrative forms, and methods, already have appreciably settled themselves. The output on a new level - break in virtual sphere - demands enormous means and attraction of the best brains (Prusak 1995 and Pugashev 2000).

Management style is main differences between Russian and Western world management technology. Management style means the whole set of methods and manner of behaviour of the logging company top management in relation to subordinates. The three key points characterizing the management style in Russian logging industry are: tone of voice when issuing an order, logging company top-managements behaviour and due regard for subordinates' opinions, their professional potential and abilities.

The three basic types of management style are included in modern management theory (Pugashev 2000). The first type is authoritarian style *(avtoritarniy)* with the head of the logging company makes decisions autocratically and do not consult with subordinates and colleges. Administrative methods are used influence to workers, such as monetary rewards or compulsion. The negative sides of the first management style are the high turnover of workers and becoming the full responsibility for results on one person. In Russia, true so far little attention has been given to the following management concepts.

The second type is democratic style *(demokraticheskiy)* characterized as a combination of one-man management with subordinates drawn in to process of decision-making. Giving responsibility and trusting on the professionalism of subordinates are general characteristics of the democratic type of management style. This type has both positive and negative sides. The positive side is the forming of a benevolent and good atmosphere between logging company head and workers. Some times the extra discussion time increases the management time costs and decreases management efficiency.

The third type of management style is the delegating style (*delegiruyushiy)*. Transferring of responsibility on management to subordinates and giving an opportunity to full freedom in working are used in the delegating style. This type of management style can be applied only in highly effective logging companies with highly professional workers.

The first type of management style was used in the Soviet period of wood harvesting development in KASSR. The combination of first and second types of management styles was widely applied in management activity from 1992 to nowadays in the RK. In the Western world the combination of the second and third types are usually used for management activity.

The connection between the changing in management style and development of new element of the management culture was the increasing of logging companies' capitalization through the development of integration processes. The management culture has also changed during transition from command-administrative to market economy. Nowadays the term "management culture" means the key characteristic of the management work (Figure 14).

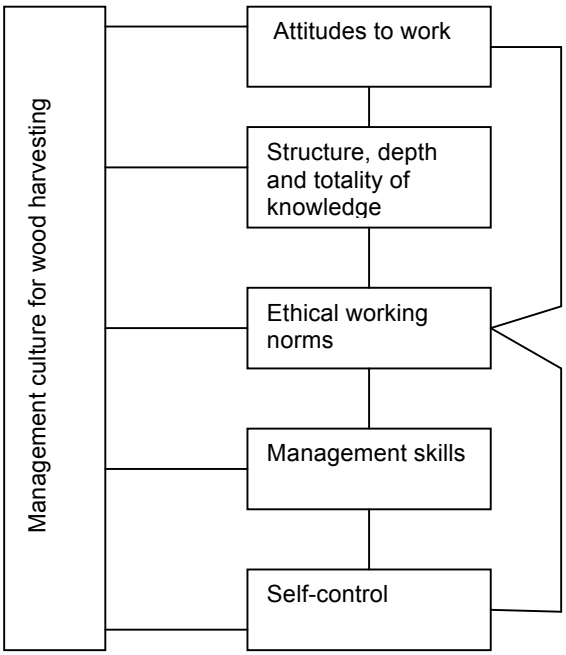


Figure 14. The key characteristics of structure of management culture

Nowadays the global financial crisis has changed forced the management culture throughout of right attitudes to work. The right attitudes to work some times focused to the term "good work". In the practice the terms "good work" or "good job" included the combination of the three main components, such as opportunity to fully utilize professional skills, spiritual comfort, and motivation for quality work. During the transition to market economy the psychology of work has changed and Soviet principle of full employment *(polnoj zanjatosti)* has not been actual in to current condition of market development in the logging industry.

The next block "Structure, depth and totality of knowledge" is the general criteria of performance management skill. Depth of knowledge has replaced the Soviet breadth of knowledge.

The block"Ethical working norms" included two blocks "Attitudes to work" and "Self-control". The work ethic is the part of internal control of organizational behaviour and modern management culture has a closed connection with labour moral in logging industry. The restructuring of traditional work ethic for the modern became an objective necessity in the current period of modernization of logging industry.

The key of management skills: business negotiation, delegation, time management, and motivation of subordinates. A formation of management skills is carried out on various levels during the implementation of a specially developed system of professional and personal development of managers.

The block "Self-control" is a best instrument with has been widely used in time-management and also the specific part of modern management culture. In wood harvesting self-control has activated and motivated self-esteem and the potentialities of the individuals, increases productivity of work. The improvement in self- control development can be the beginning of controlling development for logging industry.

The modern computerization contributed to the improvement of the automatic control systems *(Avtomatizirovanniye sistemi upravleniya)* which were known from Soviet time Chinchenko et al. (1988) for management work especially in the logging industry.

The modern management work in the logging companies is more complicated than the role of management work on LPHs in Soviet time. The role of management work for logging activity is constantly growing. A process of integration and expansion of the juridical rights and responsibility of the logging companies are influenced on process of decision making in the RK. During 17 years of transition period the new mission, new purposes and problems, which were not solved earlier independently had existed in modern management work in the logging companies.

The logging companies, in contrast to the companys of other industries, are standing in front of the choice of new places because there is happening exhaustion of forest resources

in the RK. The choice of a better place for the logging companies is an integral part of the process of strategic planning practically in all companies of the forest sector. At first it may seem that this the one-time problem pertinent only to new companies, however, this issue is even more acute for an existing companies. At present, operating logging companies have the problems of allocating new production facilities (KarNIILP 1995, KarNIILP 1996). The presentationed problem should become a part of the marketing strategy of these companies. Solution of the given problem requires the creation of new companies in addition to those already existing.

Such a situation arises when a working lespromkhoz "expects" the increase of demand for its products, which cannot be met by the expansion of the already existing company. Creation of a new company in order the supplement the existing system frequently turns out to be a reasonable variant.

The strategy of allocation of logging production facilities of forest sector companies contains a combination of competitive and technological factors on the territory of the RK. According to Burdin et al. (2000) one of the major tendencies for modern development of forest sector is the creation of vertically integrated structures with further transformation to large corporations. The vertical integrating structure is interested in reducing production costs; improve product quality and organization of an effective system of marketing and sales (Bulatov et al. 2001, Voronin and Shegelman 2003, Bulatov and Shegelman 2004).

In the Soviet time the vertical integration had created the gigant state enterprices of forest industries complex. In current conditions the capitalization of large holding companies strenghten capital consolidation. A vertical integrated structure includes the companies representing the elements of a single production chain. The holding companies with vertical integration primarily are interested how to ensure a reliable supply of resources and manufactures of high quality at a reasonable price. Often was necessary to invest heavily in the modernization of production equipment and to ensure that their products meet all technical requirements. In vertical integrating structure the strategic decisions was centralized to the holding company.

The management-controlled logging companies were carried out mainly through the preparation of the annual budget. Centralized management of financial and commercial issues in the holding company are controlled by the main enterprise. Actually the traditional «Soviet» appointments as a production-oriented workforce are plays. The process of planning and control system in the form, which holding companies were organized from, is also vividly recalling their analogues of the former Soviet Union. In this regard, binding holding company and controlling by the enterprise, is very similar to the traditional relationship between the company and the Ministry.

Besides the forest companies with horizontally integrated this category belong to the companies, which sought to achieve a monopoly position at the regional market. The main purpose of the holding company with horizontal integration has been to establish the impact on the regional markets and decrease their costs by streamlining the production process into sub-control facilities. These tasks are performed by concentrating production at those independent logging companies where it requires the lowest costs, but also due to the concentration of management functions in the hands of a holding company. The role of controlled companies was to provide the industrial base. Main object of some export-oriented holding companies with horizontal integration is to completely control supply and to ensure compliance with quality standards in the world markets.

Usually the combining vertical and horizontal integration is the diversified holding companies take the form of industrial groups. The industrial groups include several holding companies with the vertical and the horizontal integration. Diversified companies are primarily interested in maximizing the profits of enterprises under their control. Performing development of these enterprises in the long term for the future will increase shareholder value (Bulatov and Shegelman 2004).

Development of the companies under new conditions and their integration in various economic, financial and industrial structures will be succesful if they comprehend that they will not survive locally without changes. The newly integrated structures are to help their components in solving the questions which the latter cannot solve locally. Therefore, there will be united companies of different patterns of ownership able to form holdings and corporations. Now all the abovementioned types of economic activities are used in practice in forest sector in the RK.

When forming an integrated structure in wood harvesting the following economic criteria are identified (Burdin et al. 2000):

- Type and number of subjects of the integrated structure.
- Structure and size of initial integration expenditures[1].
- Structure and size of the current expenditures.
- Sources and conditions of receiving production means.
- Volumes and structure of invested means in various kinds of activity.
- Predicted levels of income by each kind of activity of the subjects.
- Level of taxes.
- Level of economic efficiency of activity of association and its subjects.

[1] Expenditure means reduction in economic benefits during the reporting period, and also a part of cost when money resources are leaving from a company.

One of the basic conditions is the availability of complete and credible information about the nature of interactions among the companies within the association, their economic and financial situation before and after integration, to the company which is assigned the function of the leading managing company.

The key point of organizing an integration association of logging companies is the process of selection of contractors within the framework of the technological chain. Competitive selection is possible. The integrated structure represents voluntary association of the companies working in the sphere of production of goods and service.

The integrated structure, as any complex organizational system, has the aspiration to preserve its own structure. Another valid purpose and aspiration is, for realization and implementation of which an association of companies within an integrated structure is formed, is obtaining individual benefit on the basis of increasing the increment of common benefit. The Government of the RK support an integrated companies on the grounds of law *(Osnovnie napravlenija deyatelnosti… 2001)*. It aspires to achieving certain is interested in goals in the area of economic development of the Republic. Proceeding from the considered goals, the following basic elements of efficiency are determined:

- Industrial efficiency
- Cooperative efficiency
- Functional efficiency

The industrial efficiency for integrated structure means ability to organise and provide all production process in more cost effective ways. For logging companies integrating the industrial efficiency means finding wood harvesting model that achieve the certain tasks with less production cost. The cooperative efficiency means ability to cooperate different manufactories in common production process. This element of efficiency is used for organisation integrating structures in pulp and paper mills. The functional efficiency means ability to provide qualitative performance of administrative functions and realize better results of management in usage (Burdin et al. 2000).

It is necessary to take into account, that integration is an evolutionary process where those integrated forms and trans-national unions survive which select the best system of adaptation to the varying economic environment and thus provide efficiency and stability necessary for continual development.

Modern trend is allocation of a number of small logging companies on the territory of the RK. In 2000 the State Committee of the forest sector of the RK (Figure 15) developed and adopted the plans of small logging company (200-300) geographical location. Foundation of small logging companies is such an industrial approach, which to a certain degree encourages suppliers and manufacturers to be located close to each other in order to reduce the time of manufacture and delivery. For "fast reaction", highly specialized small micro-companies were established in close proximity to the main sales markets. During the period of financial crisis the big share of small logging companies with export orientation had worked with economic losses or some companies was closed. A new form of organisation of work is a traditional for western world contract method *(kontraktniy metod)* can be recommended to apply in Russian logging industry. The owners of small family companies of Nordic machinery for wood harvesting should also become in sight in near future. Effective performance of such an company is possible if modern technologies are used. The main advantage of the small logging companies is the skill of effective organization of work all year round on the basis of a long-term contract. The second trend can have several versions. Their main features are:

- Use of Finnish contractors for logging operationsof a one-year-long contract,
- Appying the modern Nordic harvesting machines
- The widely using of a shift metod *(vahtoviy metod)* for seasonal works in cutting areas. This metod has been used from 1974 in logging industry. According to Blandon (1983) "*vahtoviy metod"* is a word that does not easily render itself into normal English but the technique is easily decribed: instead of settling permanently in an area, a series of small camps are set up with accomondation only for the workers employed in the area and the workers are transported there to work a one, two or three week shift.

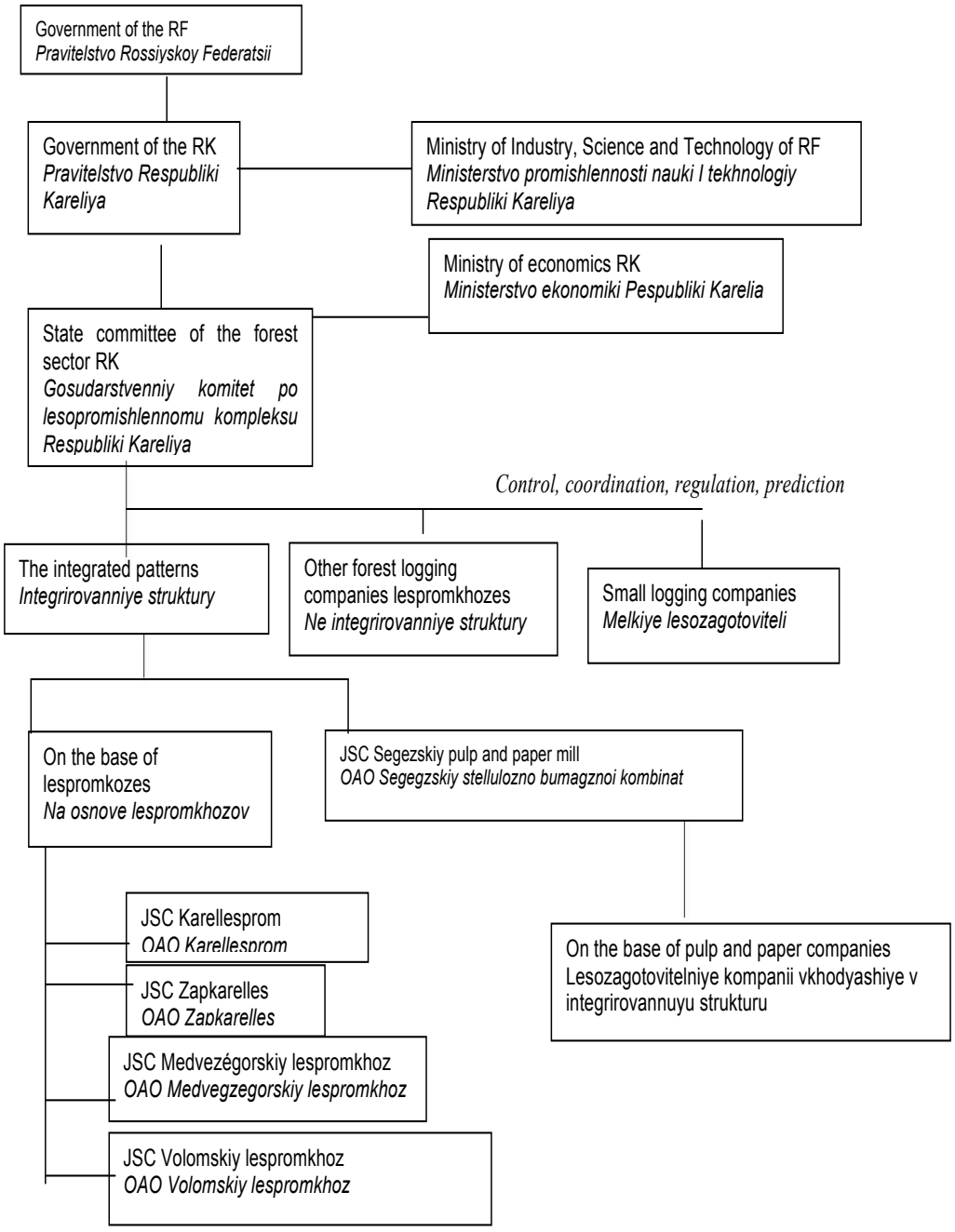


Figure 15. Managemant structure for logging in the RK in 2000 (Osnavnie napravleniya deyatelnosti… 2001 and motified by author).

3.4 System of logging by foreign companies in the Republic of Karelia

During the privatization period the wood harvesting technology started to change in the RK. The Nordic cut-to-length method were applied into industrial use after 1994 (Figure 16). According to Harstela and Asikainen (2009) the CTL method is most common and popular in Nordic countries. The theoretical background for tehnical policy realisation in the logging industry development was to two Federal programs: Federal programme 1123 and Programme of restructarization *(Federalnaja programma… 1995, Programma restrukturizatsiy… 1998*). The Federal programme (1995) constructed a balance in development of the tree-length method and modern Nordic cut-to-length method.

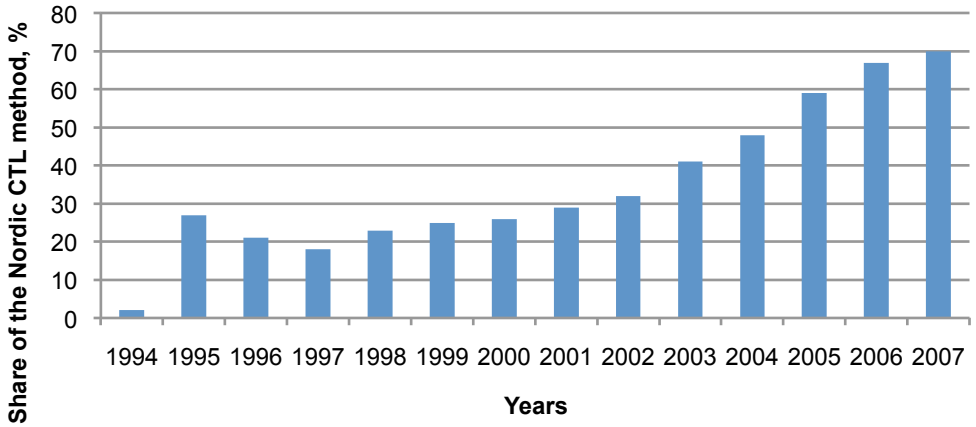


Figure 16. Development of cut-to-length metod (CTL) in wood harvesting in the RK (Gerasimov et al. 2005, Karjalainen et al. 2007, www.gov.karelia.ru 6.05. 2007 and 01.04.2008).

The Nordic cut-to-length method of wood harvesting started were in large scale with Finnish harvesting machines although KARNIILP what developed Russian CTL method in KASSR. Technological operations of felling, debranching and cross-cutting (bucking) were made by one machine, harvester. Cut-to-length materials were transported by self-loading forwarders. Alongside with cut-to-length method with the use of domestic machines and mechanisms also traditional tree-length method was used. In 2006, about 70 % all of the volume of actual cutting was made by using Nordic cut-to-length technology in the RK. According to the data from Gerasimov et al. (2005), the Nordic CTL method was used by 20 logging companies (18 Russian JSC logging companies and 2 JSC with "western" capital) in 2004. The use of Nordic CTL harvesting method depends on the set of various factors and conditions, such as:

- characteristics of forest resources *(lesnoy fond)*
- geographical conditions
- financial status of logging company
- technological level of production
- an opportunity to integrate logging companies with pulp and paper mill and also sawmill
- development of transport networks
- location of different forest stands and level of their concentration on larger areas
- possibilities of roundwood export

From the ergonomic view the Nordic cut-to-length method has some advantages over the tree-length method. However, when introducing new progressive technologies or replacing one method with another, it is necessary to take into account all factors influencing the expediency and profitability of the change. Western machines are also used in traditional Russian logging method.

Wood harvesting activity of small and middle scale foreign logging companies, especially Finnish, and joint-stock logging companies with the share of foreign capital investments more than 10 %. The companies started their activities on the territory of the

RK also from the beginning of 1990´s (Figure 3). The term "western" used in this study for these two groups of joint-stock companies. According to official data from www.gov.karelia.ru in 2000 the share of "western" forest companies involved in the forest sector was 28.8% of the whole economy of the republic.

Modern wood harvesting activity of foreign logging companies was also adjusted on the basis of two Federal laws. The first Federal law was *Federalniy zakon No. 160-FZ* (1999) with additions, and the second Federal law №129 -FZ in 08.08.2001 with additions. Depending on the annual wood harvesting volume, the foreign logging companies can be divided to the similar types as the Russian logging companies: large (2) and middle and small scales ones. According to statistic data from Goscomstat Karelia (2002), the quantity of the middle and small Finnish logging companies, which were registered in territory Russian Federations during the period of nine years from 1996-2004, were abolished from 20 to 14 companies. The quantity of small and middle Finnish logging companies has been changing constantly.

In 2006 12 Finnish small and middle logging companies registered only in North Karelia region of Finland were working cutting areas near to the Finnish border in RK in 2006. Their wood harvesting work is totally mechanized, and "Ponsse" and "John Deere" harvesters and forwarders are used. Key economic factors, which have had major influence on the value of the unit wood harvesting cost for foreign logging companies, are listed in the Table 2.

Table 2. The key economic factors for cost management in foreign logging companies

Decreasing factors	Increasing factors
Low price for diesel and petroleum products	Long term of the registration of the logging license (*lesorubochniy billet*)
Large cutting areas	Customer politics
High skills of machinery operators	Visa and medical working licence

A personal efficiency and high working motivation are playing key role in the foreign logging companies' profitability**.** The profitable small- and middle-sized Finnish logging companies are using delegating management styles. The main distinctive feature of work in the foreign logging companies compared with domestic companies was to achieve low wood harvesting costs while maintaining the high quality of timber.

The actual roles of the foreign companies in the RK have brought modern technologies facilitating larger-scale thinning and also demonstrating the effectiveness of small-scale operations.

3.5 SWOT analysis for wood harvesting in present phase of the transitional economy

The term "SWOT" is abbreviation of words strengths, weaknesses, opportunities and threats (Leraned et al. 1965, SWOT analyses… 1999). The SWOT analysis will be used for positive strategy development in wood harvesting. According to Gerasimov et al. (2005) the basis for SWOT analysis is the qualitative data acquired from questionnaires and the personal options of interviewed managers of the logging companies. The seasonal characters of logging and low productivity in wood harvesting are really clamping for profitability increasing of wood harvesting. A main strengths, weaknesses, opportunities and threats of the wood harvesting are listed in the Table 3 as a combination of studies (Dudarev et al. 2002, Bulatov and Shegelman 2004, Gerasimov et al. 2005, Shishkin et al. 2006).

Table 3. Results of a SWOT analysis of wood harvesting in the RK during the present phase of transitional economy

Strengths	Weaknesses
• EU-market • Initialives of new forest users (*lesopolzovateli*) • Good quality wood • New Nordic machinery • Cut-to-length method dominated • Interpared structures • A few highly profitable companies • Geographic location in the Western part of RK	• High unit cost in wood harvesting • Old machinery in the lower landing • Low productivity of labour • Weak forest road network • Long wood transportation distances in the Eastern part of RK
Opportunities	**Threats**
• Machinery leasing development • Development of business and training labours • Small logging companies • Further mechanisation of wood harvesting • Western ownership • No state system of cost planning	• Mass bankruptcy of logging • Lack of interested new personnel • Capitalization of forest resources • Weak development of silviculture and management • Weak national development of infrastructure outside Moscow and St.Petersburg

Source: Dudarev et al. 2002, Bulatov and Shegelman 2004, Gerasimov at al. 2005, Shishkin et al. 2006

The logging activity in the RK declined in the period of economical crisis in Russia. The principal causes of the crisis in the logging industry of the RK appeared to be the same as in the country on the whole.

In the period of reorganization of all national economy the form of ownership for logging companies has drastically changed. Different types of joint-stock companies were established. In the RK there were 160 logging companies in 1997. The share of the small logging companies was about 32% (Nemkovich et al. 2000). The state owned LPHs were not efficient enough compared with joint-stock companies in private ownership. In reality, operation as a private logging companies were encouraged for the reason of improving performance in the joint-stock companies, and in the hope that privatization was also the result of investments in updating the worn out infrastructure.

The integration process and transformation in corporative structures of the forest sector in the RK will improve the development of logging industry. JSH "*Karellesprom*" was the coordinating structure in the management system of wood harvesting in period from 1991 to 2006. In 2006 the new role of JSH "*Karellesprom*" such as forest users *(lesopolzovatel)* started to operate. Profitable logging companies, like JSC "*Zapkarelles*" and JSC "*Muezerskiy lespromkhoz*" increased their capitalization in the new economic conditions due to national management. The former has later on brought into foreign ownership and the latter has changed domestic ownership.

As mentioned, Nordic CTL method was rapidly used in RK (Gerasimov et al. 2005, Gerasimov et al. 2009). Share of Nordic CTL technology was constantly increasing (Figure 16). Since 2006 the CTL method of wood harvesting dominated in the RK. Widespread use of the method can be considered as the beginning of modernization of wood harvesting. The advantage of the new Nordic machinery and harvesting concept has been proven by its large-scale adoption in practices.

The monopoly of Russian forest machinery has practically ended and western companies have brought the traditional Karelian logging machinery production into very difficult situation. Even further development of new Russian machinery for wood harvesting from economical point of view is possible only in conditions of strong competition with new Nordic machinery. At least so far the hopes for effective joint cooperation between foreign and Russian machinery manufactures have not realised.

3.6 Conclusions for 17 years period of transition economy in Karelian wood harvesting

The transition period of Russian economy during last 17 years can be divided in four sub periods.

1. 1992-1999 Post-Soviet shock
2. 2000-2001 Russian wake-up
3. 2002-2006 Civilized cooperation
4. 2007- New domestic markets development

Development of wood harvesting in the Republic of Karelia for the period of economical crisis (1998) had had both positive and negative characters. Positive characters were the following:

- Development of progressive cut-to-length method of wood harvesting with the use of Nordic machines. During 1990-1999, the use of the Nordic machines made from 0 up to 1.1 mil.m^3 , what makes 23 % of the total wood harvesting volume.
- Manageability of the logging industry had been retained on the basis of the coordinating structure of the Joint-Stock Company "Karellesprom" with the control share holding being the property of the state.
- Highly profitable logging Joint-Stock Companies "Zapkarelles" and "Muezersky lespromkhoz" had been emerged maintained and although the recent drastic decreases in wood export had made install.
- Export orientation was caused by closed to border location, which brough aconsiderably higher price level for wood sold.
- The number of small logging companies is increasing.
- North coefficient *(severniy koeffitsient)* for wages had been beneficial to local economy
- Leading position of forest industries in republican economy
- Reorganization of forestry and new form of state unitary companies (*lesnichestvo)* had been created in the each administrative district of the RK

Negative characters were follows:

- Decrease of wood transportation volume by 60 % during 1998-1999 years Discontinuance of construction of forest roads for year-round use.
- High percentage of new Nordic harvesting machines depreciation and acute necessity for investments for their updating.
- More than 90% of traditional logging companies had become unprofitable by 1998. Long-term planning of logging operations has been stopped.
- Devalvation of the rouble in 1998 caused the increasing the round wood export volume but helped to restore also logging economy
- Management system depended from logging company size
- Long time looking period for new customers

On cutting areas a new form of logging work organisation can be seen. The 2 and 3 shifts of logging work have started to operate. The personal efficiency of Nordic machinery operators is slowly increasing. Logging work in the cutting areas as a harvesting team is warmly welcomed and appreciated. The new management approach through working contract makes the main difference between harvesting team with “a brigade”. Also business has increased the demand on professional skills of wage labour, especially for operators of harvesters. Hiring of manpower for main logging operation has stopped.

Therefore the mission usually does not specify gaining profit as the main goal, though it is an important factor in activities of the company only short-term profit of logging companies as their mission may limit the ways and directions of their future development. The key functions of state management was changed from strong state control to monitoring and audit of logging companies activity and profitability as well as in the timely change the taxes and export duty.

The Soviet political economy in transition period allowed prices freely develop in the market as the main element of the mechanism of maintenance of balance between a supply and demand.

After 1992 the traditional low prices for diesel and petroleum products were changed to free market prices in domestic markets. The level of market prices for diesel and petroleum products has been between EU "high" level and planning economy's "low" level during transition period. The traditional state price control was replaced the price observation in logging industry as well. The general republic strategy of forest sector development was used in wood harvesting as the important management object, at the same time the each logging company has their own development strategy. In the new development of company strategies and operation cost and management accounting has played more important role than in the part. This will be the topic of the other main part of this study.

4. CONCEPTS AND THEORIES OF COST PRICE ACCOUNTING ON WOOD HARVESTING

4.1 Labor theories of value as the basis Soviet theory of cost price accounting

The labor theories of value (LTV) were developed in 18th century as a part of classical political economy. In the regarded labor as primary cost factor "The Wealth of Nations " (Smith 1776). This book was revised (Smith and Skinner 1979). The classical Concept and definition of capitalism were established (Richardo 1817), while David Ricardo emphasised also the role of land in production it in his Principles of Political Economy…-book. According to LTV (Meek 1973) the value of an exchangeable good or service was equal to the amount of labor required to produce it, including the labor required to produce the raw materials and machinery used in the process. The most classical economists often Smith and Ricardo more or less relied on it until the emergence of marginal value theory. Some have seen marginal theory of value (Black et al. 1973) as a new law in the price theory, while some have claimed it as a counteract for the political use of LTV due to theoretical work and social mobilization by Karl Marx and Friedrich Engels and V.I. Lenin.

Within the field of political economics, Karl Marx in "Capital" (1867-1894) had is own version which he used as a tool for understanding the social relations between workers, as owners of labor power, and the owners of capital; as such, the labor theory of value is important to Marxism, but more as an institutional theory for understanding exploitation, alienation, class and crises. Much of the work surrounding the labor theory of value has centred on explaining the relation between "value" and "price". The term "cost-price" also was formulated by Karl Marx in his book (Capital) for capitalism, and represent with "k". Two parts of cost price constant and variable capital represented by "c" and "v". Thus k=c+v.

During the whole Soviet period, the theoretical basis of economy was the Marxist - Leninist theory of socialist political economy. The labour theory of value one of the foundations traditionally established on Marxist - Leninist political economy. The interpretation of political economy in such a way was a dogma for socialist condition. The economic laws according to Marxist- Leninist doctrine were regarded as absolute in the USSR.

Nevertheless it is necessary to allocate the periods of the development of economic laws in the USSR. During the 1917-1921 years in period of "Young Socialism" the "End of economics "period has observed. In that time "the all basic problems" of political economy, such as price, value and profit not did apply. The contrast between the term "plan" and "market" was adopted. The terms "economics "and "economic" were used in their more general sense of dealing with material resources and means *(khozyaistvo)…*" Nove (1968). The determination of term "calculation" (*kalkulyatsiya*) was carried out and Soviet theory of cost price accounting start to developed roughly after Great October Revolution (Chernoukhov and Sukhanovskiy 1959).

In 1921-1928, the introduction of NEP, the science of collectively organized production *(nauka o kollektivnoy organizatsii proizvodstva)* replaced the theory of political economy of capitalism. However, according to Nove (1968), during 1928-1954 in USSR there was the "liquidationist tradition" (*likvidatsionnaya traditsiya*) in Soviet economics i.e. stop of development, no economic textbooks were published. Yet, some other economic laws (Nove, 1968) such as the basic law of socialism, law of planned development of economy and law of the necessary conformity of productive forces and productive relations, were applied in Soviet economy during the same period of Stalin's political leadership. The special attention of political forces has been given to correct bookkeeping (*pravilnomu schetovodstvu*) and actual definition of the cost price for state products. Thus there was development related to cost accounting. The two basic notions like cost accounting (*uchet zatrat*) and "cost price calculation" for state products *(kalkulirovaniye sebestoimosti produktsii*) have been added to the Soviet theory of cost price accounting during that time. The *normativniy method* started to operate as the general method of cost accounting in the whole economy as well as in logging industry. It says that only active Soviet logging organisation shall be adopted for cost accounting. The whole shift machinery standing

idles *(tselosmenniye mashinniye prostoy)* has been completely excluded from cost calculations.

During 1950s the term ”calculation object” *(obyekt kalkulirovaniya)* was developed as a new element of the Soviet theory of cost accounting. In 1955, the *Gosplan* of the USSR, Ministery of Finances of the USSR and Central Statistic Department of the USSR *(Tsentralnoye Statisticheskoye Upravleniye)* were confirmed by the document “The main provisions of the planning, accounting and calculation of the cost of industrial production” (Osnovniye *pologzeniya po planirovaniyu, uchety i kalkulirovaniyu sebestoimosti promishlennoi produktsii).* In 1956-1957 years, the term “consumer’s goods” replaced the earlier term “commodity*” (tovary)* in the soviet economic policy. During this time the law of value had general application throughout the economy; the term “value” meant the “some real measure of relative cost” (Chernousov and Sukhanovskiy 1959).

According to Nove (1968), during the period of 1950-1960s the basic formula of Soviet economy, the Marxian classic formula (c + v + m), was presented as sum of two parts (c + v) and (m). The first part (c+ v) meant a prime cost including materials, depreciation of basic capital and acquisition of labour. The second part (m) was defined and calculated as a national income. In more details: c- means constant capital spent on acquisition of means of production, v- variable capital expended on the acquisition of working forces, another part of capital, and m- added value.

In the Soviet economy (Chernousov and Sukhanovskiy 1959) all costs of different types of activity and also cost of logging activity resulted from labour and social production costs (*obshestvennye izderzki proizvodstva*). The value of commercial round wood was also composed of labour and other social production costs. Social production costs consisted of three parts. The first part of social production costs was the value of means of production *(stoimost sredstv proizvodstva)*; the second part of social production costs was the value of consumer’s goods for itself *(stoimost tovara “dlya sebya”)*, and the third part of social production costs was the value of consumer’s goods for Soviet society *(stoimost tovara “dlya obshestva”).* For example, the cost price of commercial round wood for typical LPH during the 1950s and 1960s was also calculated such the sum of the first and second parts of social production costs.

Department cost price *(Tsekhovaya sebestoimost)*
+
Overhead cost
=
Production cost price *(Fabrichno- zavodskaya sebestoimost*)
+
Cost of sales
=
Full cost price *(Polnaya sebestoimost)*
↓
Average industrial cost price (*Promishlennaya sebestoimost)*

Figure 17. Average industrial cost price form in planning economy

The cost price had four forms (Figure 17) that were applied on economic activity of typical LPH. The first form of cost price was the department cost price (*tsekhovaya sebestoimost)* included the production cost of the given department for production, which meant the specific logging area. The second form of cost price was the production cost price (*fabrichno-zavodskaya sebestoimost,),* which included sum of total production cost and overhead cost. The overhead costs included the cost of managing the enterprise, for example staff salaries of the state LPH. The third form was the full cost price (*polnaya sebestoimost),* which was characterised by sums of costs not only for production but also added cost of the sales of commercial products. The fourth form was the average industrial cost price (*promishlennaya sebestoimost*), which was depended on two results of the work, to the separate logging company and also to the organization of the production in logging industry in whole country. In the other words it is an arithmetical average cost price in logging industry. The cost price was distributed into to parts: individual and average industrial logging cost prices. The individual cost price was used for planning in one logging company, and the average industrial cost price for logging industry, because it had

the state importance and used in the state statistic. The average industrial cost price was the background for price forming, which used the products value.

In the USSR the cost accounting, cost price planning and cost price analysis were already well developed and widely applied on the economic activity of typical logging companies in the end of 1950s .The process of cost accounting and cost price planning in logging industry meant grouping costs by different economic indicators as show on the Table 4. The term full cost price *(polnaja sebestoimost gotovoj produktsii)* means the aggregate costs for one LPH compare to industrial cost, which mean aggregate cost for several LPHs in same region.

Table 4. Distribution of full cost price by economic performances and categories

Economic performance	Economic categories
1. Method of costs distribution (*Metod raspredelenija zatrat*)	Direct (*pryamiye*) costs
	Indirect (*kosvenniye*) costs
2. Economic contests (*Ekonomicheskoje sodergzanije*)	Prime (*osnovniye*) costs
	Burden (*nakladniye*) costs
3. Total wood harvesting volume (*Objem zagotovlennoj drevesiny*)	Fixed (*uslovno-postoyanniye*) costs
	Variable (*peremenniye)* costs
4. Degree of generalization (*Stepen obobsheniya*)	Element (*elementniye*) costs
	Integration (*kompleksniye*) costs
5. Using time (*Vremja ispolzovanija*)	Current year (*tekushego perioda*) costs
	Future periods (*buduyushikh periodov*) costs

Source: Chernousov and Sukhanovskiy (1959) and modified by author.

According to Chernousov and Sukhanovskiy (1959), Medvedev et al. (1968), and later on Petrov and Morozov (1984) and Medvedev (1985), depending on the method used for cost distribution *(metody raspredeleniya zatrat),* costs were classified as direct and indirect costs. Direct costs were a sum of cost of straight and immediate use of raw materials and other materials, fuel and wages of production workers. Indirect costs (also known as overhead) are called all the costs incurred by the state logging company, excluding cost of labour and material costs. This is the cost of maintenance and operation of fixed assets, management, organization, maintenance of production, for travel, training workers and so-called non-productive expenditures, for example losses from downtime and damage to property.

Among the indirect costs allocated costs for the maintenance managers and staff costs for the organization of production, work.

The economic contest refer to prime cost consisted of wages, fuel, materials and raw materials. It can be seen that direct and prime costs (and other categories) may often be the same although looked from different economic scope. The burden cost consisted two costs: a section overhead costs of a LPH (*tsekhoviye)* and factory overhead costs (*obshezavodskiye*). The basis of fixed and variable costs is the dependent on the changes in wood harvesting volume. Variable costs include for example, materials, raw materials, fuel and wages, the quantity of which changes depending on harvesting volume. Fixed costs do not change directly according to the logging volume, but usually only when the capacity of production unit is enlarge by the investments share of fixed cost in unit cost price structure for wood harvesting was about 30% in the 1980 s. Cost elements means the costs, which are homogeneous in their economic contents. The integration costs include several cost elements. The section overhead costs of a LPH (*tsekhoviye)*, and factory overhead costs (*obshezavodskiye)* and social costs in cost price structure were representing such complex costs. Current year costs included all costs, during the operational year which the logging company includes in cost price structure for round wood production. Future period costs traditionally meant the costs which, took place during current period, but were to be the include in cost price structure in future period, for example the costs of preparation work on cutting areas for wood harvesting in next calendar year.

In 1971 the document for cost accounting "The main directions…" (*Osnovniye napravleniya po ... 1971)* was improved, developed, and it replaced the earlier document "The main provisions…" (*Osnovniye pologzeniya po… 1970*, Gosplan SSSR *1979*. The uniform *(edinaya)* and compulsory *(obyazatelnaya)* structure of cost price calculation and normative order of cost accounting were established. The specific branch features were added into standard cost price structure. Since that time of planning economy development of the normative method was used for cost accounting, but norms were changed to be progressive norms (Petrov and Morozov 1984, Medvedev 1985).

A well-developed socialism was constructed in USSR at the beginning 1980s. The classical Marxian formula c + v + m was changed to format c + v + m'. There was set to contact between m and m' in the form m'>m in the well-developed USSR, because well-developed USSR spent many times digger share of budget to workers social insurance, for example medicine and education were free, than during the young socialism and capitalism. The level of national income (m) was on maximum level in well-development socialism, and that mention was written as m' in the formula. At the same time on microeconomics level for forest industries were the same effect as on macroeconomic level, as showed in Petrov and Morozov (1984) in their formulations such as (c + v + m'), which was called a cost price *(sebestoimost)*. The term *sebestoimost* included fixed variable costs in the form (c + v), for example material costs and wages and also elements of surplus products *(elementy pribavochnogo produkta*) in the format m'. According to Ilyin (1993) the cost price element m' for logging industry included profit from logging activity and forest rent.

However, Kamaev et al. (1998), Pabuzin and Pabuzina (1999) claimed that, the cost value and distribution mechanism of social manpower was not well developed by the Soviet economic theory as it was in the norm method. Sometimes higher costs price due to excessive labour costs has been the basis for high product price. But in the other situation high real cost was underestimated (long distance of round wood transport). This lack of well-developed mechanisms, during the period of socialist economy in USSR, has had significant consequences for the current state of national economy. Therefore, the higher of cost price has been the value and price of all goods. Emphasis was placed within the framework of economic theory mostly the development of economic laws. The key progressive economic laws of socialist economy (Medvedev 1985) were the systematically cutting of cost price and self-supporting *(khozraschet)*.

4.2 The concepts and nomenclature of cost price planning

Wood harvesting activity from economic point of view highly had been mechanized already from early 1970s and therefore was regarded as industrial *(promishlennaya)* economic activities in contrast to "manually working" of logging companies. The industrial cost price took a central place of early times in the system of economic parameters of Soviet national economy. The industrial cost price as already shown (Figure 18) was used in all economic branches and also for comparison cost price of different branches in the structure of Soviet forest industry complex (*lesopromishlennogo kompleksa)*. The nomenclature and the structure of industrial cost price for logging industry from economic point of view was the fundamental task in the planning of cost price. It provided basis for the systematic study of the specific weight of costs included in the cost price calculation (Figure 18). Traditionally the industrial cost price or full cost price these concepts mean almost the same, structures are estimated on cost items (*statyam kalkulyatsii)* and cost elements (*elementam)*. In western management accounting instead of economic term cost item is used term the type of cost. The type of cost is seen as a bridge between western cost accounting and traditional domestic cost accounting. The relation between type of cost and cost element is presented in the form of table matrix (Figure 23). During many decades of the Soviet period there has been in use the specific work quota *Otrasleviye ukazaniya…(1983)* for the systematic cut of cost price in the logging industry branch.

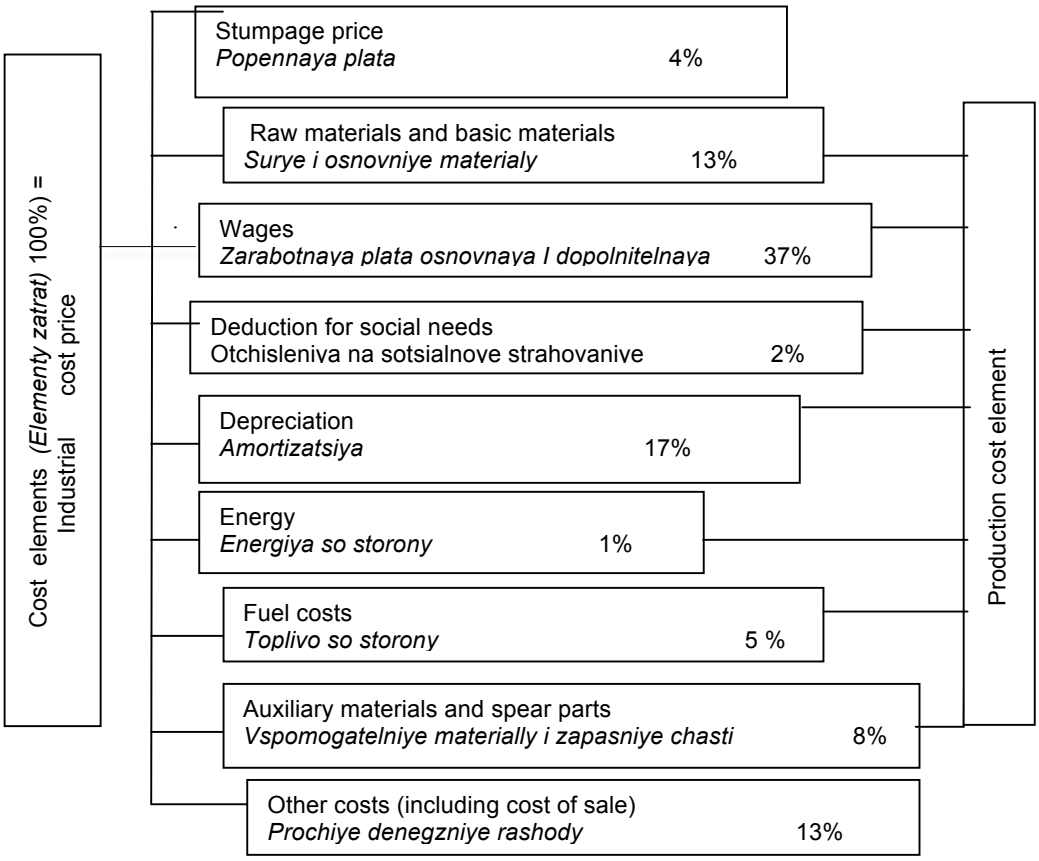


Figure 18. The Structure of major cost elements of industrial cost price for logging industry and they relative weight according to the data of Minlesbumprom USSR in 1980 modified (Petrov and Morozov 1984), modified author in 2007.

Drawing up *(sostavleniye)* the planning calculation (*planovaya kalkulyatsiya)* of the full cost price for commercial round wood was the basis of planning process in the logging companies' economic activity. The State norms for planning the costs for full cost price have been followed in the planning calculation. The full cost price accounting and definition of size and the structure of the costs different kind of commercial products has been made for State control security. Five specific demands have been required in drawing up in the planning calculation (Petrov and Morozov 1984, Medvedev 1985):

1. The structure and concepts, and norms should correspond with state plan
2. Planning calculation should be drawn up for one year and four quarters
3. Planning calculation should be drawn up on one page long
4. Planning calculation should be drawn up for all kinds of planned commercial products
5. Strict nomenclature of cost items was used for drawing up the planning calculation

The defrayment of different losses from disturb balance of imperfect technological process should not be included in drawing up of planning calculation. For different kinds of commercial products with were not included in the state plan, the estimate calculation *(smetnaya kalkulyatsiya)* was drawn up. In the next they are discussed following the order of Figure 18, production costs correspond to the sum of all materials, depreciation and salaries. Usually the cost price included the sum of production costs and other costs. According to (Petrov and Morozov 1984) for condition of planning economy the cost price was the basis for commercial products price formation. There was relative relationship between cost price and price for commercial products. This bridge was the necessary element in cost price analysis and planning. All unit costs were grouped by different items in the process of cost price accounting and planning. The relationship of different type of

costs was grouped in the structure of full cost price for state LPHs. Cost budged for state LPH meant the full cost price classification by cost elements.

The cost element stumpage price did not have production cost character as shown in Figure 19. Stumpage price (*popennaya plata*) was a specific element in the cost price structure of the logging industry (Shkatov 1965). The term *popennaya plata* began to be used from the beginning of the 19th century in Czarist Russia (Algvere 1966) and it was used during the whole Soviet period in the USSR. From economic point of view this element of cost price structure for the state logging company was a payment in State budget of USSR (100%) only for forest fund used for wood harvesting. In 1993, the basic document for forestry The Basic Principles of Forest Legislation *(Osnovy lesnogo zakonodatelstva)* started to operate. The growing trees have been estimated as a commodity. The term *lesnaya podat* was replaced by the term *popennaya plata* and all lots of forest land were transferred to the five years rent *(arenda)*. *Lesnaya podat* has also been a payment, but it paid into two budgets. The first payment has been done in Federal budget (60%) and second payment into Regional budget (40%). This important element of cost price was also constructed of two parts. The first part of stumpage price was the payment of value for commercial wood *(stoimost drevesiny*) that was used for wood harvesting. The second part of stumpage price was the value of forest land through the forest rent in the form of tax rate for rent of forest land *(nalog na lesnuyu zemlju)*. The state forest tax *(lesnaya taksa*) was guaranteed standard minimum rate of cost of forestry activity. The Soviet term forest tax (*stavka lesnoy taksy)* was changed in 1993 and became new term "new forest tax" (*stavka lesnoy podaty);* this change is illustrated in Figure 19. The forest resources in the whole period of Soviet time were in state ownership as they are also practically nowadays. In 2006, the new redaction Forest Code *(novaya redaktsiya lesnogo koda)* was adopted, and federal ownership *(federalnaya sobstvennost)* was replaced by state ownership, this meant that the state property belonged rightfully to the property of the subjects of the Russian Federation. Also Forest Code, the term new forest tax (*lesnaya podat)* abolished, introduced the term concept of payment under the contract of purchase and sale of forest plantations (*plata po dogovoru kupli-pradashi lesnih nasazdeniy*) and rent (*arendnaya plata*). The period of forest site rent was established from 1 year to 49 years. It can be seen as the first step to development of new ideology in the Russian forest.

Before 1993 the cost element stumpage price was collected on the basis of the state price-list *(preyskurant)*, after 1993 the order and necessary terms for stumpage price accounting of the legislation of Russian Federation was established (Petrov and Soldatova 1993, Government of Russian … 1999). Rates were differentiated on the variable size of degree of trees (large, average, small), species of trees, to regions of the country and distance of wood transportation. The sum of this type of payment was defined by leskhozes on the basis of forest tax and data of forest inventory. According to Petrov and Morozov 1984) the stumpage price was about 2 Rub/m^3 from cost price sum, which was about 50 Rub/m^3 in the early of 1980s, and during the 2005 – 2006 it was about 100-200 Rub/m^3 from industrial cost price sum, which was of about 650-800 Rub/m^3. The relative weight grew in average from 4% to 15-20%.

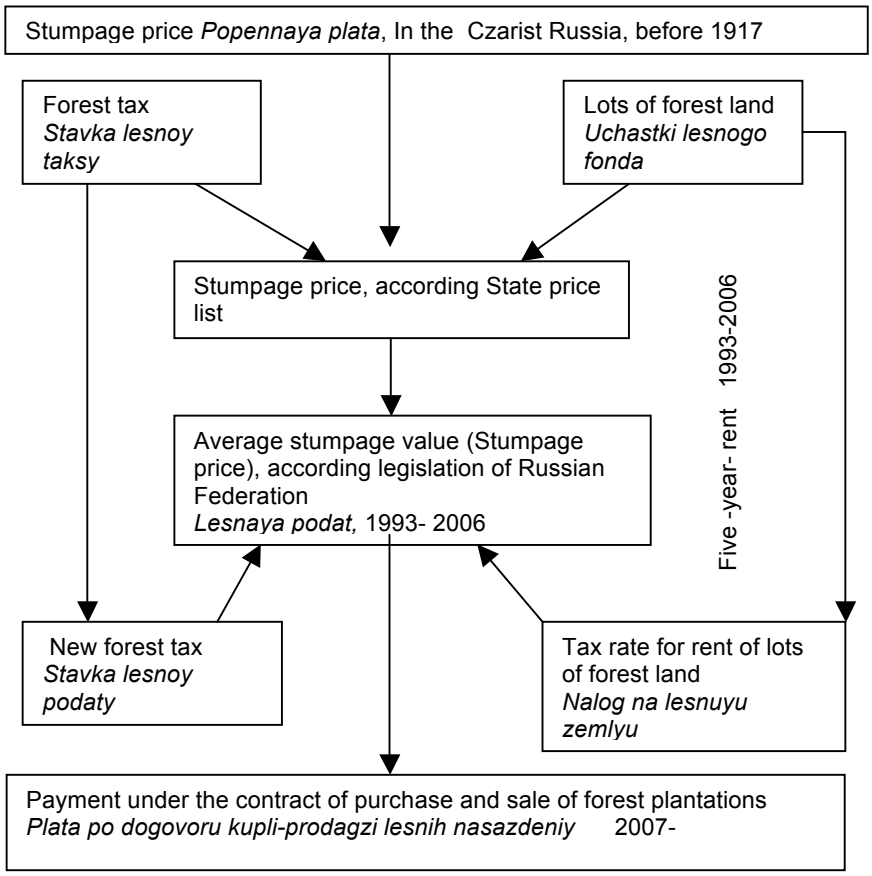


Figure 19. The conceptual development of the industrial cost price element "Stumpage price"

The cost price element "Raw materials and basic materials" included the charge of raw material and basic materials which were formed on the basic of commercial products or which are necessary components in the production of commercial products. In this element the costs of sleeper *(shpalnoye*) logs and saw logs, wood particles *(struzgka)* and also roofing and pegs *(derevyaniye gvozdi)* for wood houses production were traditionally calculated for state logging companies.

The cost price elements "Wages" included the sums of basic and additional part of salaries for main productions workers, like chainsaw workers (*valshiki)* and production worker's assistant (*pomoshnik valshika)*. The term "basic wage for main production and auxiliary workers" means the cost of salary of the work which has been directly connected with the production of commercial products. It is the set in the form of tariff rates and piece rates for workers and salaries for employees. There are two different concepts: real and nominal wages. Nominal wage was the amount of money received by the workers for the labour expended. Real wages were the amount of goods and services, which can be purchased for the nominal wages; in other words, real wages are the purchasing power of nominal wages. The structure of basic salary included nine different kinds of additional payments (Medvedev 1985), such as:

1. Additional payment to the piece-workers *(sdelshik)* for changes on working terms
2. Payment of the piece-work *(akkordnaya)*
3. Additional payment to the piece-workers according to progressive salary system
4. Bonus *(bonusy)*
5. Additional payment for the extra working time

6. Additional payment for the work in holidays
7. Increment for unhealthy conditions of work
8. Increment for excellent skill *(doplata za masterstvo)*
9. Increment for brigade-leader

The additional salary for main and auxiliary workers included payments for the work in holidays also, compensations when regular holidays were not used, extra payments for teen-agers and for long -term service for pensioner-age workers. Every month the special reserve sums were planned for the payments of regular holidays and long-term service workers.

The cost price element "Deduction for social needs" during the period 1950-1960s was 4.7% from cost price element "Wages" and was increased to 8% during 1980s. Each logging company had wages fund and social security fund. This sum of the cost price element was transferred from social security fund to State budget.

The cost price element "Depreciation" was included to the every year annual amortization sums of fixed capital according to the operating depreciation norms. The rate of depreciation was usually 20% of purchase price.

The cost price elements "Energy ", "Fuel costs" and "Auxiliary materials and spare part " were calculated by technical norms using wholesale prices. Energy cost calculation was the same when energy was bought from outside. If energy was produced in own power station with energy source, most of the cost was transmitted into salary. The term "auxiliary materials" means the purchase materials for production needs. The classification of auxiliary materials included wide spectre of different kind of purchase materials, such as lubricant and washable materials, different kind of line (rope, cord and string), chalk and paint for logs marker. Different type of spare parts and repair materials were used for current or capital repairs of buildings and machinery, and they were also consequently included into this cost price element.

Other cost included postage, training cost, safety technique cost and travelling costs. The major costs were related to travelling costs for managers.

The cost price grouping by cost elements illustrated (Figure 18) the sum of total costs on the state logging companies or at whole in forest industry without divisions by kinds of commercial products. The cost price grouping by two parallel ways: type of costs (*statyi zatrat*) and costs elements, were widely used by state logging companies for different kinds of commercial products cost calculation.

4.3 The development of the cost price structure in logging industry

Term "cost-price structure" (*struktura sebestoimosti)* (Rodin 1973, Sadovina 1974) meant the ratio of individual costs among themselves and their share in industrial cost-price. The cost standard book (smeta zatrat) was the key document in the process of cost price accounting by cost-price elements. The cost-price classification by type of cost (*statyi zatrat*) meant cost-price calculation (*kalkulyatsiya sebestoimosti*) (Petrov and Morozov 1984). The Figure 20 presents the development structure of industrial cost-price for commercial round wood of state logging companies according to the standard of Minlesbumprom USSR. The majority of each type of costs is integrated, consisting to the sum of several elements of cost price.

Usually the industrial or full cost price accounting by type of costs, listed on the Figure 20, was used for determination of the main calculation of economic performance, like actual *(fakticheskaya)* cost price. Actual cost price has all the attributes of objective truth of economic parameter used for operative management on state logging companies and for Soviet taxation system. The number of cost items in cost price has changed. Theoretically there was a tendency to continuous simplification and reduction of the number of cost items included in cost price structure, but in practice the number of cost items increased. One can see that during a period from 1933 to 1999 (approximately 66 years) the number of cost's types doubled from 6 cost types in 1933-1940 to 12 types of costs in 1999.

In Soviet time stumpage price was used in two calculations; calculation for cost price accounting by type of costs, and by cost elements. The calculation technology by type of costs was analogical with the calculation technology by cost elements in Soviet cost

accounting. The standard forest tax *(lesniye taksy)* tables were used for sum of stumpage price *(popennaya plata)* calculation.

According to Chernoukhov and Sukhanovskiy (1959), Rodin (1973), Sadovina (1974), Kozhin and Novikov (1976), Petrov and Morozov (1984), and Medvedev (1985) the wages and salary type of costs were divided into two parts included basic *(osnovnaya)* and addition *(dopolnitelnaya)* parts for workers and managers of wood harvesting process. In the basic part of wages for workers of wood harvesting process according to piece-rate system *(sdelno-premialnaya sistema)* were included the piece wage *(sdelniy zarabotok),* different bonuses *(premii, nadbavki za klassnost)* and additional payment for work on holidays. In sum of the addition parts of wages were included payments for regular holidays *(oplata otpuskov),* long service *bonus (oplata za vislugu let)* and different types of compensation. During the early 1980's, the annual growing of type of cost "wages and salary" was in average 2.5-3.0% per year in the logging industry (Medvedev 1985).

An integrating item of service and repair cost for cost price accounting included salary costs for service workers and salary for managers of service workshop *(remontniye masterskie),* deduction for social insurance, energy and fuel cost, depreciation cost of machinery and depreciation cost for service buildings and cost of spare parts for machinery.

Cost of wood transport service and cost for forest road maintenance and building (*Uslugi lesovoznogo transporta na vivozke i rashodi po sodergzaniyu lesovoznikh dorog)* included wages for service workers and salary for managers of wood transport workshop *(transportniy tsekh),* deduction for social insurance, energy and fuel cost for transport workshop, cost of lorry depreciation and depreciation of forest road, cost of spear parts for repair of forest roads.

Two basic categories of terrestrial transport ways *(sukhoputniye)* for round wood transportation were traditionally used in logging industry in Soviet time. The first category is automobile roads for forest lorries *(lesovozy)* and second category narrow-gauge railroads. Nowadays in the Northwest part of Russia the narrow-gauge railroads *(uzkokoleyniye zelezniye dorogi)* are used for round wood transportation only in Vologda and Arkhangelsk regions. Two types of automobile roads, such as asphalt roads and simplified *(uproshenniye*) automobile roads have been used. There are also three different types of simplified automobile roads: natural soil road *(gruntoviye)*, improved soil roads (road strengthened with gravel, metal and logs) *(gruntoviye uluchshenniye)* and winter *(zimniye)* roads (Ilyin et al. 1971, Ilyin and Kuvaldin 1982).

During the Soviet period some asphalt roads were used only in logging companies where the annual volume of wood harvesting was more than 500 000 m^3. The annual amount of asphalt road building was 300 km in average for the Soviet forest industry as whole. Traditionally new asphalt road building has been very expensive; nowadays the building cost is about 3.5-6 mil.RUR/ km (about 100 000-190 000 EUR/km). The sum of annual maintenance cost is about 300 000-700 000 RUR/yr (about 9 000-20 000 EUR/km). The building costs of all automobile roads is directly included in the sum of production cost price of logs. Usually, in Russia as whole, the costs of asphalt road building are also included costs of site preparation, removal communications and resettlement the peoples who live on the adjacent land. In the lower landing when the commercial round wood assortments has been loaded on the railroad cars the sum of total production cost price for state logging companies by using tree-length method and full-tree method has finally formed.

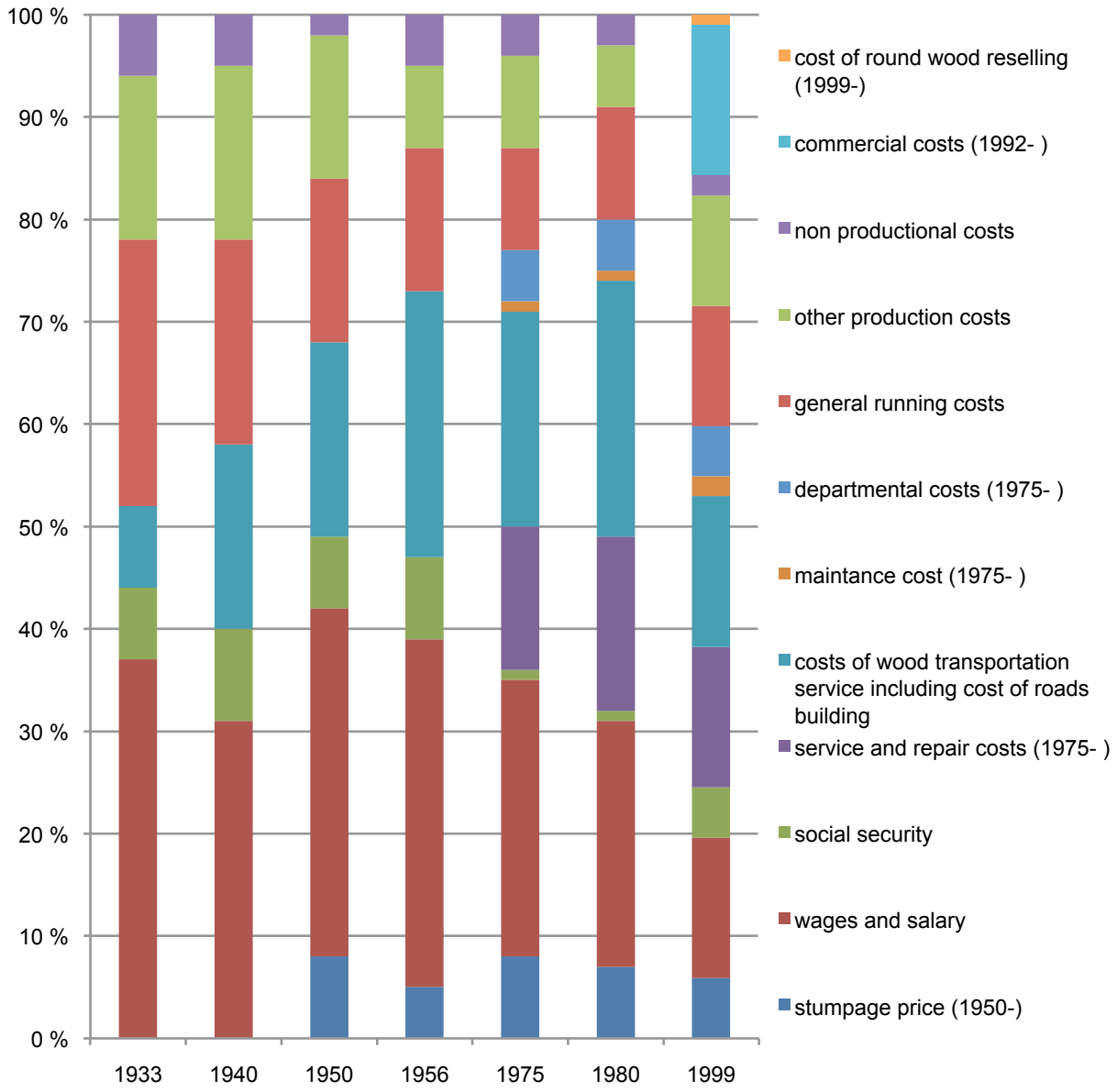


Figure 20. Development of industrial cost-price classification for commercial round wood by types of costs, according the data of Chernoukhov and Sukhanovskiy (1959) for 1933-1956, Minlesbumprom USSR 1975 and 1980 in Petrov and Morozov (1984) and for 1999 by Styazhkin (2001).

The simplified automobile roads are divided into main and season roads. The term "main roads" *(osnovniye lesovozniye dorogi)* in Soviet and then in Russian conditions consisted main forest roads *(magistrali)* and branch or temporary roads *(vetki)*. Usually in the KASSR the coverage of main forest road was gravel or macadam coverage. This forest road coverage types are used in modern Russian conditions with annual harvesting volume of 150 000-200 000 m^3. In average the building cost of main forest roads were 1.5 - 2 mil.RUR / km (about 30 000 EUR/ km). Every year the road building costs increased.

The structure of season road is illustrated in Figure 21 during Soviet time. Season roads meant forest roads with a service life less than a year. Usually they are called summer or winter roads. According to Yagodnikov and Mikhaylov (1991), the share of season's roads *(usy)* in forest road network structure was 80%. The special seasonal character of road exploitation was one of the basic ways for lowering the industrial cost price of commercial round wood. In normal practice, the logging companies have widely used natural soil roads as season roads with the aim of lowering the level of type of costs in cost price structure. Often the clay *(glina)* is the main reason for the bad conditions of

season forest road during the spring and late autumn. Building costs of simplified automobile roads are included in the cost price in proportional to the volume of round wood transportations. The costs of season road building are one-time costs, not for permanent used.

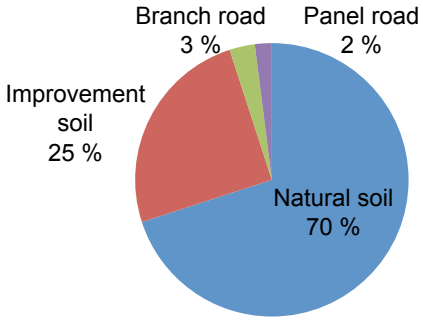


Figure 21. Distribution of seasonal roads by different types (Ilyin et al. 1971, Ilyin and Kuvaldin 1982)

In 2008 the two key strategic documents: The strategy of forest sector development until to 2020 *(Strategiy razvitiya … 2008)* and Transport strategy of Russian Federation until to 2030 *(Transportnaya strategia… 2008)* were confirmed. According to this two strategies the term "main forest roads" (*magistrali*) were changed to term "double relevance roads" (*dorogi dvoinogo naznatsheniya*). This change means that forest road network will get two meanings: social and industrial. The roads will over cover as usually and by asphalt, and a passenger transport could also use forest roads unlike previously.

Departmental costs *(tsekhoviye raskhody)* consisted of salary for middle level managers *(nachalniki tsekhov),* deduction for social insurance, and costs of capital consumption. General running costs *(obshekhozyaystvenniye raskhody)* included cost of general management of the logging company costs with social security costs. This expenditure was a cluster and consisted of the following four sections (Petrov and Morozov 1984):

1. Costs of the repairs and depreciation of buildings *(Raskodi na codergzanie, remont i amortizatsiyu zdaniy)*
2. General postal stationery (*Pochtovo-kantselyarskiye raskhodi)*
3. Training costs (*Zatrati na podgotovku kadrov*)
4. Penalty *(Shtrafi)*

The general running type of costs in industrial cost price was distributed proportionally based on volumes into the sums of the production costs, without taking into account costs of raw materials and stumpage prices.

Non-production costs *(Vneproizvodstvenniye rakhodi)* included charges on storing and packing of production, transport charges of production sales, charges of research work, bonus of Head office of Logging industry and Pulp and paper industries of Commercial products selling (*Glavlesbumsbit) at* a rate of 0.4% of the sum of proceedings for realized production. Every logging company in KASSR had the typical forms of standard tables for costs calculation. In the 1980s, for cost calculation computers software was not used.

Thus, the USSR had a centralized state system for cost price *(sebestoimost)* planning for commercial round wood. All activities for logging companies both in the KASSR and in whole USSR were based on the Plan of economic and social development of USSR (*Plan ekonomicheskogo i sotsialnogo razvitiya SSSR).* This plan was formulated for each five years period of USSR development.

Each logging company had to develop a cost price plan, profit and profitability of wood harvesting as a part of the technical industrial financial plan for wood harvesting cost planning. This document was part of the state economic plan, which had to be followed. According to Petrov and Morozov (1984), Medvedev (1985), and Medvedev (1989) the process of cost price planning for commercial round wood was divided into three parts:

1. Cost budgeting
2. Cost price calculation for commercial round wood

3. Balance of standard cost price process

The cost budget for logging activity was the main document for the calculated full cost price. In LPHs cost budget included costs of all activities in all departments of LPHs.

The most important moments in a typical LPH in RK for cost price planning were:

1. Control of economic parameters for five year plans
2. The Karellesprom tasks for cost saving during planning year
3. Profitability analysis for accounting period
4. Progressive wage tariff and daily norms of production, depreciation norms, norms of fixed capital utilization

The procedure for full cost price planning for quarters of a year and year period started to operate in LPHs in KASSR since 1954. By the old technique, the average annual cost price was planned for an average cubic meter only. During the about 40 years period of planning economy, from 1954 to 1991, there was the struggle for decreasing of full cost price in state logging companies. In 1970s around whole country was mass economize activity in using different kinds of raw materials, like oil or diesel and electricity. The problem of cost savings was solved by means of saving in raw material and other materials, and reduction of certain payments, such as additional wages.

During the period of a planned economy from 1933 to 1956 the "classical" Soviet industrial cost price structure was used. According to Petrov and Morozov (1984) in 1960s some type of costs, like percent for the bank credit and different penalties had been excluded from types of costs structure.

In 1970s the new type of cost, such as cost of building seasonal forest roads, were included in the cost price. This cost element had been made for better performance of planned targets and correct use of forest resources. The Main directives from Gosplan USSR, Minfin USSR, Central Statistics Committee (Goskomtsen) of the USSR, for planning account and cost price accounting for industrial logging companies, were the basic documents after 1970.

In 1971 were established standard *"Normi truda…"* (1971).

In the end of 1970s, on the basis of the decisions of the Communist Party of USSR, the Government of the USSR and Gosplan published the document "Standard Techniques …" (*Tipovaya metodika… 1979*). According to *Tipovaya methodika…* (1979), the cost price accounting of production was calculated with using the progressive norms of fixed capital depreciation, standard norms for raw material and materials, energy, fuel, and wage tariff. The sum of the unit costs for commercial wood products were ratified by the Gosplan USSR, Minfin USSR, and Central Statistics Committee. The main key questions at planning the industrial cost price for all logging company in the Soviet time was question about the optimization balance calculation (Efimov et al. 1967) and of increasing the economic performance of new domestic machinery utilization.

At the end of 1980s there was an idea to include in the industrial cost price to ecological costs, like costs of young growth forests protection and costs for soil erosion liquidation, but it was not applied in practice (Belyaeva 1990). The maintenance cost was divided into two parts at the same time, such as costs of wood harvesting machinery exploitation and service cost. During the period 1980-1990s, according to Belyaeva (1990), the different types of economic losses, like losses of natural calamity and hopeless or bad debts (*beznadyeshnie dolgi*) put a veto for including on cost price structure. The bad debts meant debts, which were impossible to obtain back. The needs for cost management in 1917-1991 played a significant role in cost accounting development. The socialist idea about continuous cost price cuttings and savings *(idea postoyannogo snigeniya sebestoimosti i ekonomii resursov)* was widely propagated in economics of logging company activity. However, the practical implementations of this idea were some time very difficult.

Two groups of natural and organizational-technical factors influenced essentially to the cost price structure, which traditionally was taken into accounting. According to Petrov and Morozov (1984), natural factors, such as climate, grounds and relief topography, were given fixed and did not depend on the efforts and desires of the logging activity. Organisational-technical factors, such as wood harvesting technology, lower landings turnover and distance of wood transportation were also influenced on cost price structure through the sum of investments of fixed capital. The fixed costs were also reduced caused by influence of the organizational-technical factor and lowered the cost price during 1980-1990s.

Here are main conclusions to summarize the whole Soviet period of cost accounting development. The political global confrontation between capitalism and socialism was clearly seen on economical level. In socialistic USSR economists thought that the Soviet Union was the first state in the World, which started to develop standards, plans not only for individual economic actors, but also across the whole national economy. The process of cost price planning and decision-making during Soviet time was a little "clipped". Because the rule-ridden centralized economy would take care of all the function of determining the prices, limits, areas of capital investments and research. Autonomy was reduced, narrowed the field of management decisions. But with all this “deformation” of the planning methodology and seventy years ago, workers knew how to endure "Tehprom-finplan" (Gosplan SSSR 1979) to each machine and working brigade.

The capitalists thought, for many global political reasons, contrariwise. According to Schumpeter (1942) future of socialist society, that was in USSR which production was under central control, must be followed the same basic principles of economic logic, as a capitalist.

4.4 Changes in cost accounting during the emergence of the market economy

In the period of economic reform in Russia from 1992, the subject of economic theory has changed. In the Russian forest sector the current economic studies focused on production efficiency and pricing of products, with a target of accessing maximum profit within the conditions of current limited economic overtake forest resources. Transition period from 1992 to 1998, was complicated and difficult for the whole Russian forest sector and especially for logging industry development. The idea of Soviet economic mechanism for full or industrial cost price cutting had proven to be imperfect in the new condition. Industrial cost price has been increasing continuously as the state regulation of energy and transport costs ceased. Western methods of management accounting and financial accounting were slowly adopted by the Russians logging industry.

During the period of more effectual emergence *(stanovleniya)* of market economy from 1998, the intensity of capitalization of logging companies has been increased (Figure 22). Firstly, the modernization or “westernization” made processes stronger through out using Nordic CTL method in wood harvesting, especially in RK. The full-tree and TL methods were used in KASSR and they still compete with Nordic CTL in present time.

Secondly, logging companies in Karelia have started to operate under a new kind of forest users (*lesopolzovatel*) status. In 2006, the important forest user (*lesopolzovatel)* in the Republic of Karelia was JHC “Karellesprom”. According to Shishkin et al. (2006) and Mazalov et al (2006) a real system Authority-Business-Wage labour (*vlast-biznes-najomnij trud)* was formed for logging industry management during the period.

Thirdly, new models of Nordic machinery have come to be available use through leasing. The different leasing schemes were developed especially for Russian logging companies. For the Karelian conditions the most common leasing repaying scheme was as follows. The first payment in 2006 was not more than 25% of the machine purchase price, every quarter an equal sum was to be paid according to the leasing contract with leasing interest more than 10% per every leasing year. In 2006 the share of leasing cost was 40% from wood harvesting costs for CTL method of wood harvesting, when using Nordic machinery (Syunev et al. 2006). The depreciation costs have increased considerable.

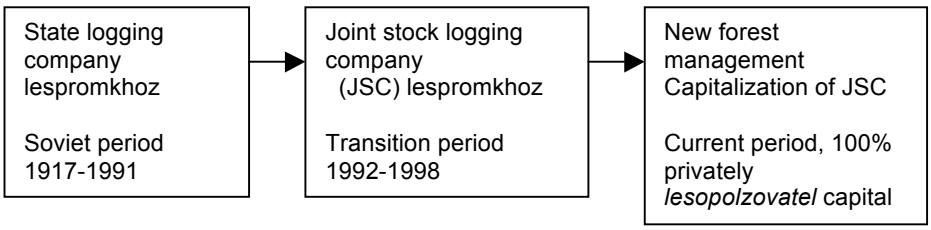
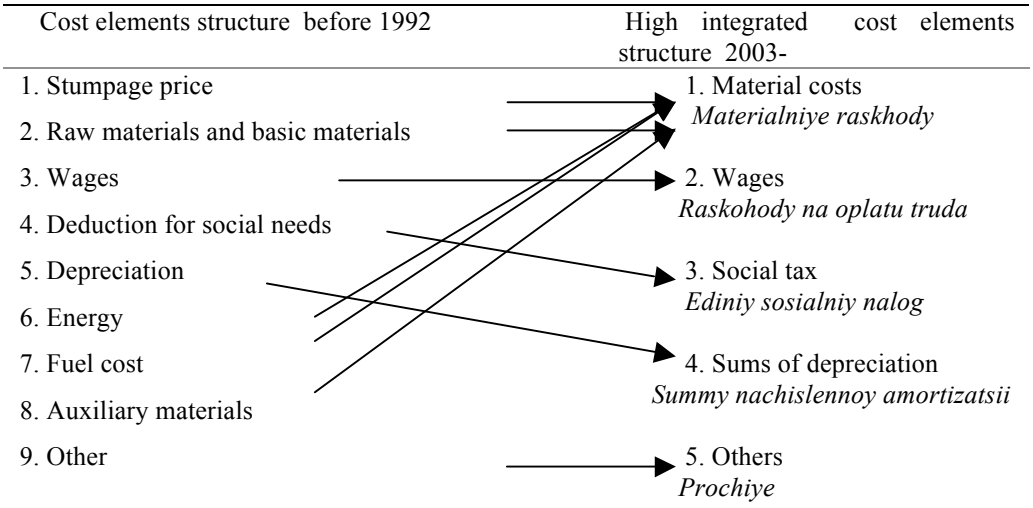


Figure 22. Development of the new role of a logging company in the national economy.

The current “attitude” to cost price has changed. The calculation parameter of factual cost price on logging companies has a character of commercial secret and it is interpreted as a taxation attribute and varies greatly in different logging companies. The quantity of cost elements in structure of industrial cost price has been decreased from 9 to 5, but quantity of sub-elements has been increased and costs become higher integrated (Table 5).

Table 5. Development of the order of cost elements in the structure of industrial cost price



From the economic point of view, the current strategy of large scale logging companies in Karelia is the increasing of wood harvesting profitability. There has been a weak of the profitability of wood harvesting in Soviet Union and then in Russia before 1999 (Burdin et al. 2000). During the last five years wood harvesting has in general been unprofitable in Russia in period 2001-2005. According to Petrov (2004) in the beginning 2000s the average profitability was about 9% in Northwest Russia in compared with data from NIPIEILesprom during the period 1990-2003 profitability of logging companies in Russia was between -20% and +10%. The wood harvesting cost and price dependent demand limits the real economic capacity of harvesting. In reality many traditionally run Russian logging companies operating in Karelia have not reached appropriate profit levels since the start of economic reform, and have thus suffered considerable operational losses. However, this situation has not followed the pattern of unfavourable market conditions. Due to the increasing demand of forests for alternative uses and products, which will limit harvesting volume, it is crucial for the Russian logging companies to improve motivation of the empirical part of study their methods for wood harvesting cost accountings.

The current limitations on forest resources in wood harvesting in Karelia need to choose optimal harvesting technology and therefore more sophisticated methods for cost calculation. Now with Nordic technology the capital cost is higher than profitability level, which decisively depends on harvesting volume. In practise, the current harvesting cost distribution into fixed cost and variable cost still has some elements of the characteristics and rating factors from the previous system used during Soviet times.

4.5 New national recommendations for cost price accounting

Nowadays in the logging companies the cost price accounting for commercial round wood is calculated using the Methodical Recommendations (Guidelines) on Planning, Accounting and Estimating Cost Prices for the Products of the Forest sector *(Metodicheskie rekomendatsii…* 2003). This official document replaced the previous document *(Metodicheskie rekomendatsii…* 2000), and was developed by the experts of the *Open JSC "NIPIEIlesprom*" and the Department of industrial and innovation policy of the forest sector at the Ministry of Industry, Science and Technology of the Russian Federation. The Minstry approved this document on 26.12.2002. The main target of this document was the securing of uniform *(edinoobraziye)* of factual industrial cost price

structure and costs accounting of full cost prices for commercial round wood through application of single method in cost price planning in all logging companies of the Russian Federation. The official structure of industrial cost price for commercial round wood was used for logging activity and presented in the *Metodicheskie rekomendatsii…* of 2000 and 2003. The Present *Metodicheskie rekomendatsii*…(2003) was added to the standard and changed according to the decisions of the government during 1996-2002.

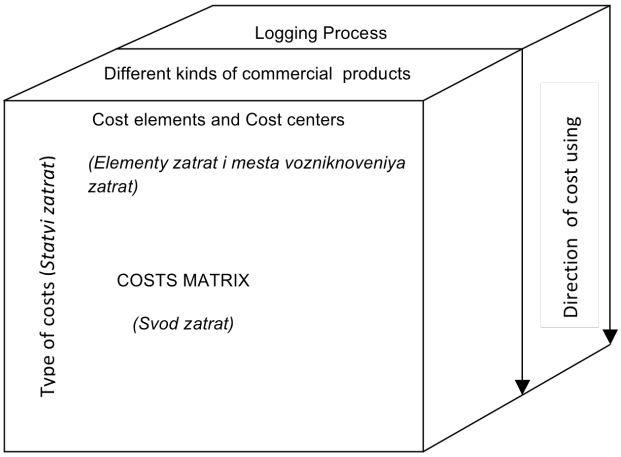


Figure 23. Connection between nowadays cost elements and type of costs in cost matrix (Metodicheskie rekomendatsii… 2003)

Grouping of the cost of economic elements necessary in order to determine what resources are spent and what proportion of individual types of costs in their total amount. Grouping of the type of costs is needed to calculation and to analyzing, for what purpose resources are spent. Grouping of the cost of process (Figure 23), the costs are grouped according to the directions of their use - in the production, sales or business management.

Traditionally the cost price accounting for commercial round wood is calculated in monetary form. The list of logging company costs which was included then in industrial cost price in the full cost price and was established by present *Metodicheskie rekomendatsii…(2003)* in conformity with instructions of State taxation. New elements of recommendations included: economic use of the basic material should be provided; financial resources had to be taken into account, as well as the necessity of more effective technical use of equipment, development of the technologies for protection of air, land and water bodies from pollution by industrial wastes.

Logging companies used the calculations of the full cost price for profit planning on the whole, for interim planning and also for establishing round wood market prices. Time factor is an important part the cost price estimate. The actual wood harvesting costs calculation and actual rate of round wood cost price were also done to control the labour and material resources and money resources both for the whole logging company, and for specific units or sites of manufacture. The data on costs accounting was used for estimation and analysis of economic results of wood harvesting process. Therefore, it is necessary to ensure comparability of the scheduled and registered data by application of recalculation factor, which includes inflation.

4.*5.1 Present cost price accounting with universal integrating cost elements and applications in the Republic of Karelia.*

The Soviet method for cost price grouping by elements have been preserved and developed during the transition period to market economy in the Russian forest sector. The present cost elements in the structure of industrial cost price have higher integrated economic content. Also, the cost elements included in the structure of industrial cost price are divided by homogeneous types and economic contents, and have a character of high integration. The list of five higher integrating costs elements of industrial cost price for all logging companies in Russia, according to Styazhkin (2001) and the *Metodicheskije*

rekomendatsii… (2003), is presented early in Table 5 and in the Figure 23. Traditionally logging industry in Russia has the all attributes of wood procurement *(dobivayushaya)* branch of national economy, with a big share of material costs. Material costs as a high-integrated element of industrial cost price structure had branch specific features for commercial round wood and a key role in cost accounting. During the last ten years, from 1995 the share of material costs (Figure 23) in industrial cost price for commercial round wood of Russian logging industry constantly increased and it was 55.5% in 2006.

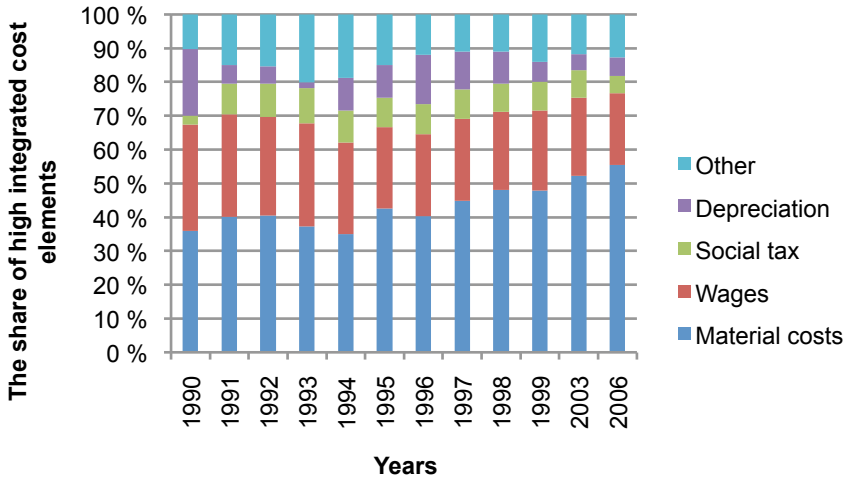


Figure 24. Development of industrial cost price structure for commercial round wood by high-integrated cost elements in the Russia (Burdin et al. 2000 for period 1990-1999 and data from JSC "NIPIEIlesprom", 2007 for 2003 and 2006 years)

According to the *Metodicheskije rekomendatsii…* (2003) the five high integrated subcost elements used for state taxation control, and they included into the high integrated cost element "Material costs" and also reduced into list of five integrating subcost elements include :

1.1 Raw material and materials purchased from outside which are a part of the production, forming its basis, or which are a necessary component during the manufacturing process *(Priobreteniye sirya obrazuyushikh osnovu proizvodstvennogo protsessa)*.

1.1.1 Purchased materials used for packing of wood (*Priobretenie materialov ispolzuemikh dlya upakovki)*

1.1.2 Spare parts used for repairs of equipment and tools *(Zapasniye chasti i komplektuyushiye)*

1.1.3 Purchase cots of fuel and water for technological needs (*Priobreteniye topliva,vody dlya tekhnologicheskikh nuzd)*
1.1.4 Nominal value and short-term-use items *(Tovarno-materialniye tsennosti)*

1.1.5 Transport services of other organizations on transportation of cargoes inside the company. (*Transportnie uslugi drugih organizatsiy po perevozke gruzov vnutri kompaniy)*

1.2. Stumpage price and lease payment for forest sites (*Plata za lesnie podoti I arednie plateshi za ispolsovanie uzatskov lesnogo fonda)*

1.3 Payment for using water objects (*Oplata za ispozovanie vodnih objektov*). Fuel *(toplivo)* of all types purchased from other organizations and used for technological purposes; generation of all kinds of energy, transformation and transfer of purchased energy to consumers. Heating of buildings, transport services for production purposes, which are provided by the transport of the company.

1.4 The cost of material resources included in the multifunctional cost element "material costs" is a payment for transportation services *(transportniye uslugi)*, storage and delivery carried out by oanother organization proceeding from the prices of purchase including broker services and customs.

1.5 Cost of returnable waste *(vozvratniye othody)* excluded from the costs of material resources, and included in the full cost price. The higher the cost of waste used then the lower level of full cost price. Returnable waste products of manufacture are the remaining raw material obtained during production. Remaining material resources, which - according to the established technology - are transferred to other workshops as a high-grade material for manufacture of other kinds of production, are not considered to be returnable waste products. Returnable waste products are assessed according to the price of probable use. Usually it is the lowered price of an initial material resource, such as logs with different mechanical defects and rot (More details see p. 21-23 from the *Methodicheskiye recomendatsii ..., (2003).*

Current *Methodicheskiye recomendatsii ...(2003)* assume that the technology losses *(tekhnologichskiye poteri)* and costs of nature protection for logging companies gave the same status as "Material costs" and included in the multifunctional element "Material costs".

According to the *Methodicheskiye recomendatsii ... (2003)* more than 25 complex subcost elements were included in the high integrated cost price element "Wages". The list of the three largest complex subcost elements:

2.1 The basic and additionary salaries to the permanental company stuff including different kind of bonuses to the employees for production results.
2.2 Differents money compensations, established by the legislation of the Russian Federation. For example, when normal holidays were not spent.
2.3 Additional payment for extra working time and shift work *(mnogosmenniy,* expecially for wages laboure (*nayemniy trud*). This additional payment has a stimulating economic character.

Additional payments are made in compliance with regional regulations including payments for regional factors. According to dokumet *Ob uporyadochenii kompensatsiy…1990.* (On streamlining compensation…), this kind of additional payments are widely applied in the Northern parts of Russia from 1991. The RK from Northwest part of Russia had been given the same status as North. For the logging companies of Karelia the regional additional coefficient *(Severniye)*, established within the limits of 1.15-1.40. In the southern and central parts of the RK the "regional additional coefficient" of 1.15 is used. *Louhskiy, Kalevalskiy and Kemskiy* territories are equal to the regions of the Far North and regional factor is increased up to 1.60 (Labor Code 2001).

The high integrating cost price element "Social tax" in Russian language called as *"Ediniy sotsialniy nalog"* is an obligatory duty to the Federal budget and three State non-budget funds, such as Pension Fund of Russian the Federation, Fund of Social Insurance of the Russian Federation and Fund of Obligatory Medical Insurance of the Russian Federations. The rate of Social tax is differentiated by the types of taxpayers but the same in each category. The sum of these payments cannot be more than 12 % from the cost element "Wages". In 01.01.2010 the term *"ediniy sotsialniy nalog" (UST)* ceased to have effect *(ytrachivaet silu)* and it replaced to the term *"sotsialniye vznosy"*. In 2003 the rate of Social tax in cost price structure was on the average 8.3% but only 5.2 % in 2006 for Russian logging industry. However, logging companies had right to use preferential rate of social taxes of workers. There were two reasons why companies did not use their right; firstly it influenced to the workers pension, and secondly there came considerable complicates in the accounting of UST.

The high-integrated cost price element "Depreciation" is an important cost element and also one of the most interested element for taxation. The document *Methodicheskiye recomendatsii ...(2003)* described the term depreciation property (*amortiziruemoye imushestvo)*, which included more than 12 months of gross-effective time and the sum of initial cost to be more than 10000 RUR. All depreciation property is grouped to depreciation groups, which correspond to the period of gross-effective time. Procedure or order for determining the depreciation of the value of the property has been installed. According to the *Methodicheskiye recomendatsii ...(2003)* depreciation property value includes three different types of value, such as initial value (*pervonachalnaya stoimost*), replacement value *(vosstanovitelnaya stoimost)* and residual value (*ostatochnaya stoimost)*. The depreciation should be calculated by two mathematical methods linear *(lineyniy)* and non-linear *(nelineyniy)*. The linear method had been recommended to be used for calculating depreciations sums of buildings. In present time the logging

companies in Russia have a right to choose the method of depreciation calculation for other fixed capital depreciation groups. Logging companies carrying out activities on the basis of leasing within an element "Depreciation" reflect depreciation charges on full reconstruction both on their own, and rented fixed capital.

For example, since 2005 the JHC "Karellesprom" from the RK has applied leasing *(lizing*) machinery and used the calculation of non-linear truncated *(ysechennoy)* depreciation, especially for new Nordic machinery. The gross effective time was shorted from 6-7 years to 3.5 years and the share of annual amortisation was increased two times on the average. The capital cost is high but can be deducted in taxation.

The high integrated cost price element "Other" includes the wide spectre of different kind of costs, for example charges on research and development (R&D), taxes, costs to payment of interests on bank credits, payment of certification of production, and costs for repair fund.

The structure of the cost price elements for industrial cost price structure in the Republic of Karelia (Figure 25) is material-intensive. The share of material in the cost price structure for period 1991-2000 in wood harvesting was about 60% and higher than during the same period in all Russia.

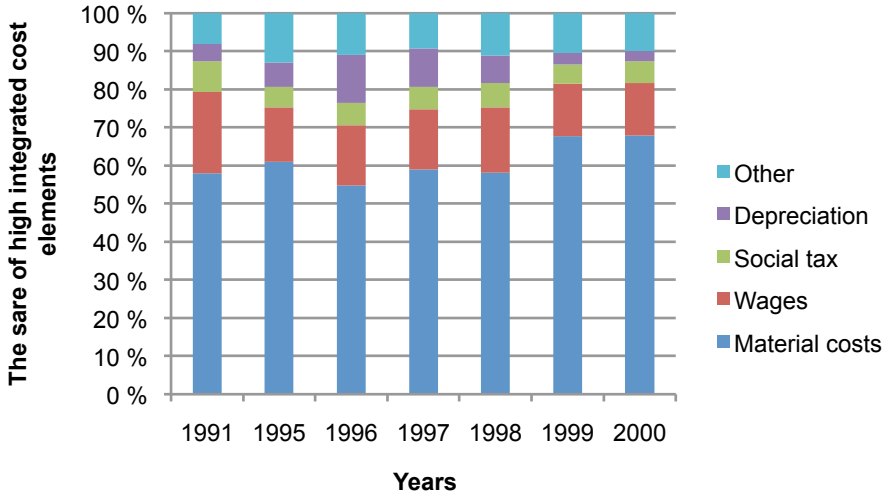


Figure 25. Development of industrial cost price structure for commercial round wood by high integrated cost elements in the RK Source: *Osnovniye napravleniya…* (2001).

The rate of costs in the cost price structure for wood harvesting in the logging companies of Karelia depends on many factors, such as:

- Method of wood harvesting
- Nomenclature of commercial products
- Geographical conditions
- Type of wood transportation

During the period of economical crisis 1998-1999 the prices on commercial round wood had been increasing. The cost price structure of commercial round wood for Karelian forest sector for the period of 1991-2000 changed. The share of material costs in logging had increased by 18.6 %. At the same time the share of deductions for social needs decreased to 5. 7% and depreciation of the fixed capital to 2.0 % in 2000 compared to 2.6 % and to 4.6% in 1991. Leasing of new Nordic machinery not included.

The increasing of the industrial cost price for commercial round wood was caused by the following factors:

1. Deteriorating forest fun
2. Increasing stumpage price
3. Increase in average distance for wood transportation

4. Increasing of the machinery purchase price
5. Increasing of the prices for fuel and energy
6. Use of cut-to-length method
7. Leasing of new Nordic machinery
8. Improving of work organization
9. Decreasing of the annual harvesting volume of commercial roundwood

Certain technical and economic factors also had their consequences in the process of wood harvesting cost price accounting in the RK.

4.5.2 Present cost value grouping by types of cost (cost items)

The economic principle of cost price grouping by types of cost (cost items) has not been changed after the Soviet times. However, the term "cost value" corresponds better to economic situation of nowadays than earlier term "costs price". The two basic documents, such as the company accounting policy and Tax Code of Russian Federation have regulated this process after 1998. The order of cost price grouping by types of cost was published in the *Methodicheskiye recomendatsii… (2003).* The classical distribution of direct costs *(pryamiye)* and indirect costs *(kosvenniye)* form the cost price for commercial round wood. The content of these costs have also remained their economic significance since the Soviet times. Direct costs are those which are directly included in the cost value, such as material costs, depreciation and wages. Indirect costs mean the other kinds of costs including in the cost value structure.

Table 6. Development of the order of high-integrated cost types in the structure of production cost value

Type of cost structure after 1992	High integrated types of cost structure 2003-
Stumpage price	Average stumpage value (Stumpage price) *Plata za drevesinu otpuskaemuyu na korny*
Wages	Cost of purchased round wood *Stoimost pokupnogo syrjya*
Social security	Production Wages *Raskhody na oplatu truda proizvodstvennikh rabochikh*
Service and repair costs	Social tax *Cymmi edinigo sotsialnogo naloga proizvodstvennikh rabochikh*
Costs of wood transportation service including cost for forest road building	Preparing and assimilation costs of new kind of commercial products *Raskhody na podzotovku i osvoeniye proizvodstva*
Maintenance costs	Costs of maintenance and operation of equipment *Raskhody na sodergzaniye i ekspluatatsiyu oborudovaniya*
Departmental costs	Costs on the log truck service and costs for the maintenance of forest roads *Uslugi lesovoznogo transporta na vivozke i raskhody no sodergzaniyu lesovoznikh dorog*
General running costs	Departmental costs *Tsekhoviye raskhody*
Other production costs	General running cost *Obshekhozyaystvenniye raskhody*
Non production cost	Other *Prochye proizvodstvenniye raskhody*
Commercial costs	

The production cost value i.e the sum of point 1 to 10, was called a production cost value of gross output (*proizvodstvennaya sebestoimost valovogo vipuska)*. The full own cost price can be called also "own cost value of production". It includes the production cost price, can also be called as "own cost value", and cost of comercial products sales.

Together these two costs are called "full cost value of commercial products" (*polnaya sebestoimost tovarnoy produktsii)*.

1. Average stumpage value such as cost type included (see Figure19) total payments for forest fees *(lesniye podati)* and lease payments for leasing forest areas. The minimum rate of stumpage price was approved by the Decree no 867 (Government of the Russian Federation… 1999), but regions had a right increase the stumpage price. The term "stumpage value" is more correct term for present conditions than Soviet term "stumpage price". In 2004 the stumpage value in the Republic of Karelia was about 2-5 USD/m^3. Also in the Leningrad region (Petrov 2004) the average rate of a stumpage value was about 2 USD/m^3 in 2004, and the share of the same economic parameter in the structure of cost price was about 10-12 %. In 2005 the minimum rates of stumpage value were defined on the basis of the Governmental resolution the Russian Federation from 2001 №127 with a general raising factor of 1.5 for all regions and one more additional rate specific to each region. The Decree no. 867 was changed to Governmental resolution no.127 (Government of Russian Federation 2001). This specific rate varies within the limits 1- 6.6.

2. Cost of purchased wood is a new cost type. This type used for calculating the production cost value of forest harvesting. Also this item includes the payment by the bodies of forestry for timber harvested in the process of thinning and transferred from a cutting area for further transportation and processing by the logging company, or payment for wood bought in a cutting area from other loggers. Compared to Finland: the logging companies buy round wood in the cuttings areas for transportation to processing in mill in future.

3. The high-integrated type of cost production "wages" includes six payments, such as:

- payment to the workers engaged in the main (*osnovnikh)* logging operations in the cutting area, and payment for auxiliary works on acceptance of forest fund
- preparation of cutting areas and clearing of felling sites
- facilitation of parking and maintenance areas for machines
- making storages for fuels and lubricants
- installation of warm houses, electric network and communication facilities
- installation of other equipment of upper landings *(verhniy sklad)*

4. The type of cost "Social tax" includes payments for state social insurance, provision of pensions, state employment agency, and obligatory medical insurance of industrial workers.

5. The preparing and assimilation costs of new kind of commercial products for forest logging companies are given in Table 7.

Table 7. The nomenclature of preparing and assimilation costs (*Metodicheskie rekomendatsii… (2003) and modified by the author)*

Preparing and assimilation costs	Characteristics and contents of costs
Costs for the development of new small companies (start-up costs).	Social payments for the workers participating in assimilating process, expenditures on fuel, energy, and lubricants
Construction of a forest cutting area: • warm small houses • short-time dining houses (*kotlopunkt*) • Short-time filing workshops.	Social payments for the workers for the aforesaid work
Facilitation of constructions at loading terminals (*nizniy sklad* [lower landing])	Social payments for the workers for the aforesaid work, costs on fuel, energy, lubricants
Preparatory work on the collection of resin	Social payments for the workers for the aforesaid works and other costs

The cost of preparatory work of wood harvestings is included in the production cost value item for relevant calendar time but no more than two years since starring actual harvesting.

6. The cost type "Costs of maintenance and operation of equipments" for logging industry includes the costs connected with the work of forest machinery and consists of:

- Depreciation
- Operation cost
- Repair cost
- Machinery leasing

7. The cost type "Costs on the log truck service and costs for the maintenance of forest roads" included the costs for operation and maintenance of carrying equipment of narrow-gauge railways, hauling automobiles and trailers, as well as the costs for the construction of all types of forest roads.
The type of costs eight and nine Departmental cost and General running cost included different kinds of costs of the companies connected with the management and general management as a whole.

- Payment of management facilitation, means management salary and social costs
- Official journeys and business trips
- Costs for maintenance of vehicles
- Workers' transportation to forest cutting areas and back to forest settlements
- Working according to shift method (*vakhtoviy methot)*
- Costs for upgrading technologies and organization of manufacture of non-capital character
- Work safety

10. The high integrated cost type "Other" includes the sums of contractors costs for the work of wood harvesting and costs of petroleum products storing.
The present domestic *Metodicheskie rekomendatsii… (2003)* has been applied as a necessary theoretical background for controlling construction in the forest sector holdings.

4.6 Cost accounting, cost management and management accounting in cost value of wood harvesting

The cost accounting, the terms cost management and management accounting were also introduced into Russia and applied on logging companies' economic activity, but as seen earlier by analyzing different cost items and categories and cost structures, has a major role in the control and management of the costs. According to Horngren et al. (2000) and Bhimani et al. (2008) the term cost management means the management activity in operational and strategy planning and control of cost. The cost management in Soviet and Russian condition was and is also actively used for the process of cost value planning and for making decision. During Soviet period in logging industry gained much experience in the normative cost accounting method and cost price calculation in different branches of national economy. The "branch" vector of cost accounting transfers to management accounting applying in Russia. Accounting literature often sees cost accounting as a part of management accounting.

The purpose of planning of the cost price was in Soviet time the economically justified amount of the necessary costs in a planned period for wood harvesting and commercial round wood selling. In transition for market economy, as there is no plan given from the higher management levels and flexible prices, the basis for planning the cost price is often the volume of sales for commercial products for the next year. This parameter is formed on the basis of volumes and prices of contracts with customers and usually also based for earlier of sales. In market economy countries typically market give starting point of pricing.

Volume of sales is determined for the initial period of planning, i.e. for a year, in the divided for a quarter, or a month. The cost estimate for production is developed for one year including estimations by quarters. Budgeted cost calculation is made usually for one quarter. On the basis of these accountings and for the purposes of calculation of a sale price for one quarter, budgeted cost calculations further are made monthly or with other periodicity. When developing budget cost, calculations the contractual prices with extra charges and discounts for consumed resources are used as well as perspective prices. The contractual prices are identified as a result of projected calculations.

In management accounting the standard cost method is more often used. For this purpose in Russia all elements of normative base are used including the norms developed by the companies and established by official normative documents.

Another important parameter describing the level of profitability used for management accounting on logging company is unit cost value. For successful production for

management it is necessary to know size of unit cost of different harvesting operations as well for whole harvesting process. For example, unit cost (UC) for skidding operation which using domestic machine can be calculated by formula (1):

$$UCS=SC / SV \quad (1)$$

where, UCS - unit cost of skidding, EUR or RUR/m^3
SC - Skidding costs, EUR or RUR
SV – Skidding volume, m^3

Unit costs are calculated in all stage of the value chain of a cutting area of customers. Value chain means sum of costs from cutting area to customers. Unit cost is also called (Hongren et al. 2000) an average cost.

As widely discussed the features of cost value (cost price) of commercial round wood represents cost estimation of forest resources, fixed capital, raw materials, fuel, energy, manpower and other costs of manufacture and sales in the process of wood harvesting in the Republic of Karelia. According to *Metoditshekie rekomendatsii… (2003)* the two specific economic components are used in cost value calculation:
- costs connected with the maintenance of food camps for supplying forest workers with hot meals, including labour costs on a cook.
- costs connected with the maintenance of health centres located in temporary forest settlements and being on the balance of logging companies.

According to the Regulations on Bookkeeping and Reporting of the Russian Federation the four specific features also took into accounting for management accounting:

- seasonal forest roads and spur
- temporary buildings in the forest (for a two year period)
- mobile small houses included in the structure of fixed capital
- chainsaws and delimbers (in the logging companies and not related to the fixed capital).

This is a form of management accounting in specific conditions of Russia.
As seen in Russia as in Soviet period the federal government / ministries have a firm approach in guiding the implementation of cost accounting in logging as well as in other industries. In the Nordic and other old market economy countries there are no such recommendations as the development of cost accounting in any industry or company is their internal affair, and only may reflect the new methods and approaches produced in the accounting and management sciences. What are the other differences between cost accounting in Russia and Nordic countries are discussed in the next paragraph.

4.7 Russian method of cost value accounting in comparison with Nordic method

In Russian method calculation of cost value for commercial round wood is made for the whole harvesting chain instead of each separately taken mechanism in each separately taken operation. Cost value accounting using Russian method is usually calculated as said about for a one calendar month, for three months, or for one year, but when using Nordic method for wood harvesting cost calculations the order is next: total annual costs, cost per a working hour of the machines and unit cost per one m^3. One basic difference in Soviet/ Russian and Nordic cost calculation traditions is that machine cost calculation is done in much more details than in Russian method, and there are not also costs for machinery insurance, commercial risks and payments % of bank credits in Russian method. However, for cost calculation the costs of machinery insurance have a big share in the total sum of wood harvesting costs in Nordic method (Tyukina 2004, Tyukina 2007).

In the Nordic method for unit wood harvesting cost calculation starting parameter is machinery purchase price. In this study, cost calculations were made more precisely for a machinery unit than for a changing number of multifunctional harvesting machines.

The method of gradual rising of the rate of costs (*narashivaniye*) has often been used for cost price accounting. However it is applicable also for tree-length method for traditional "Soviet" technology of forest logging. The account of diesel fuel and petroleum products is made in litres instead of kg as in Russian method that simplifies calculations. In the RK, as well as in the whole Russia, the transportation costs for cut-to-length technology are calculated since Soviet time in RUR /m^3.

When the Nordic method is used for transportation cost calculation, transportation cost is calculated in EUR/ton, because this more common and easy in practical testing. In Russia transportation costs are calculated using railway and road tariff in RUR/ton.

In Nordic method of wood harvesting cost calculation bonuses and payments for due to geographical location of a region are not calculated, because there are nowadays no such in the Nordic countries. However, for defining unit costs for manual cutting the system of work difficulty conditions where employed in Finland which included, for example the thickness of snow. In the Russian method, the amount of bonuses can considerably exceed the amount of wages, for example one can notice that. It is necessary to notice that cost value per m^3 of commercial round wood for conditions of the Republic of Karelia in 2001 was by 60% higher than in Leningrad region only due to the account of the regional factor (Tyukina 2001). From the economic point of view it means higher level of wage costs for logging companies and higher wages for workers and salary for other personnel in the Republic of Karelia in comparison with other Russian regions with more cold climatic conditions.

In the conditions of market economy becoming, exchange value price and the most of logging machine employed are the very important parameters for the wood harvesting cost calculation. The calculation of this parameter has widely been used in Finland (Mäkelä 1986) and often in Nordic countries. In the Soviet/Russian practice this parameter was much more unknown than during transition period in Russia. Logging companies now try to use all harvesting machines and equipment until their final discard. However, in this study the Nordic method of calculation of this parameter is applicable also for the Russian conditions of logging.

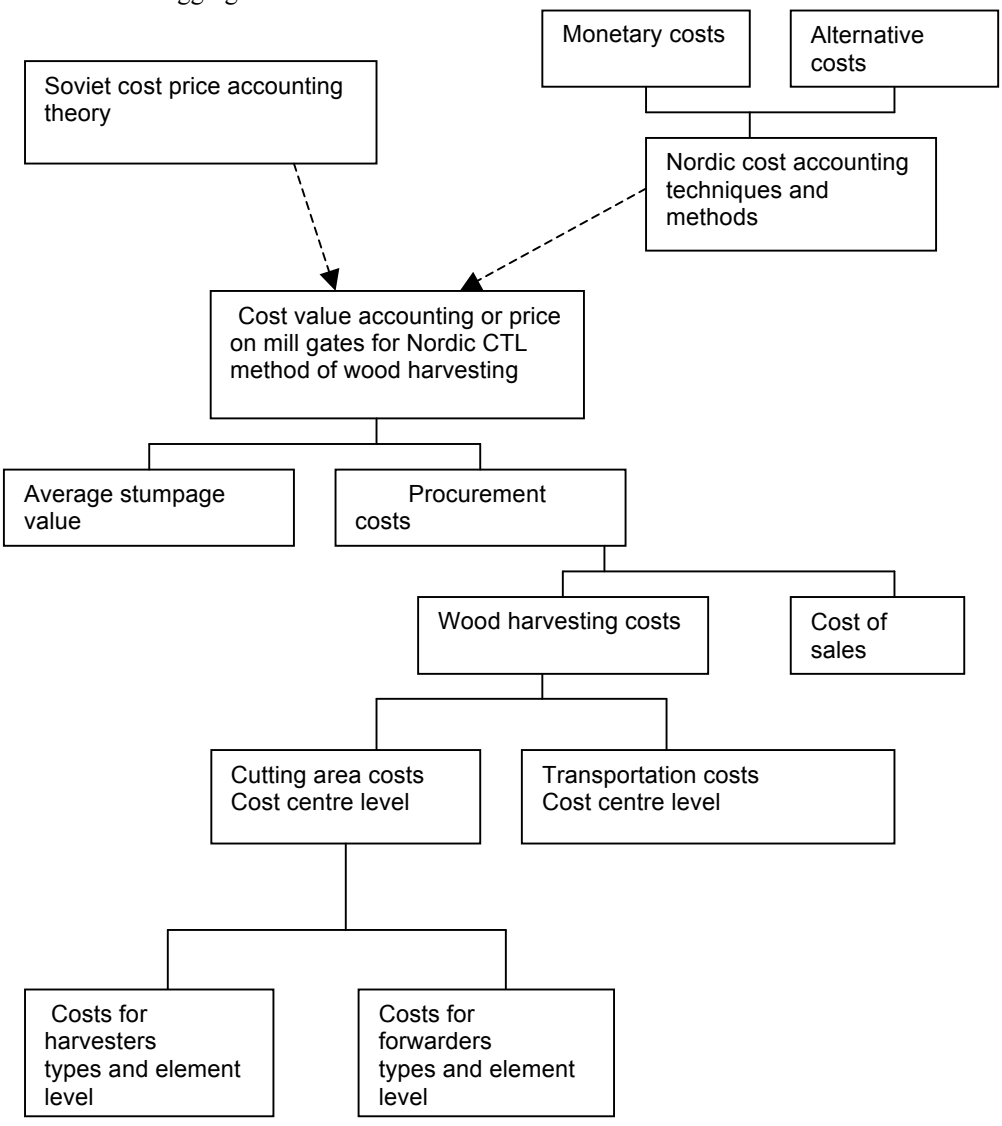


Figure 26. The applied concept of cost price accounting for cut to length method (Pellinen

2006, two blocks for Nordic cost accounting techniques and methods, Harstela and Asikainen 2009, wood procurement and modified by author

The methodical concept of cost price accounting can be described such as the "tree of costs" illustrated in Figure 26 form consisting of three cost levels. The first level of costs includes the cutting area costs and short round wood transportation costs. Cutting area costs include harvestering costs (EUR / m^3) and forwarding costs (EUR / m^3). The sum of cutting area costs and short round wood transportation costs form the second level of costs so called wood harvesting costs. More detailed description about wood harvesting cost calculation can be read in the next chapters of this study. Cost of sales can be established on the second level and calculated as a total sum of costs, which arise during the sales of short round wood to customers. The sum of wood harvesting costs and costs of sale form the procurement costs. Cost value can be established as the sum of procurement cost and average stumpage value.

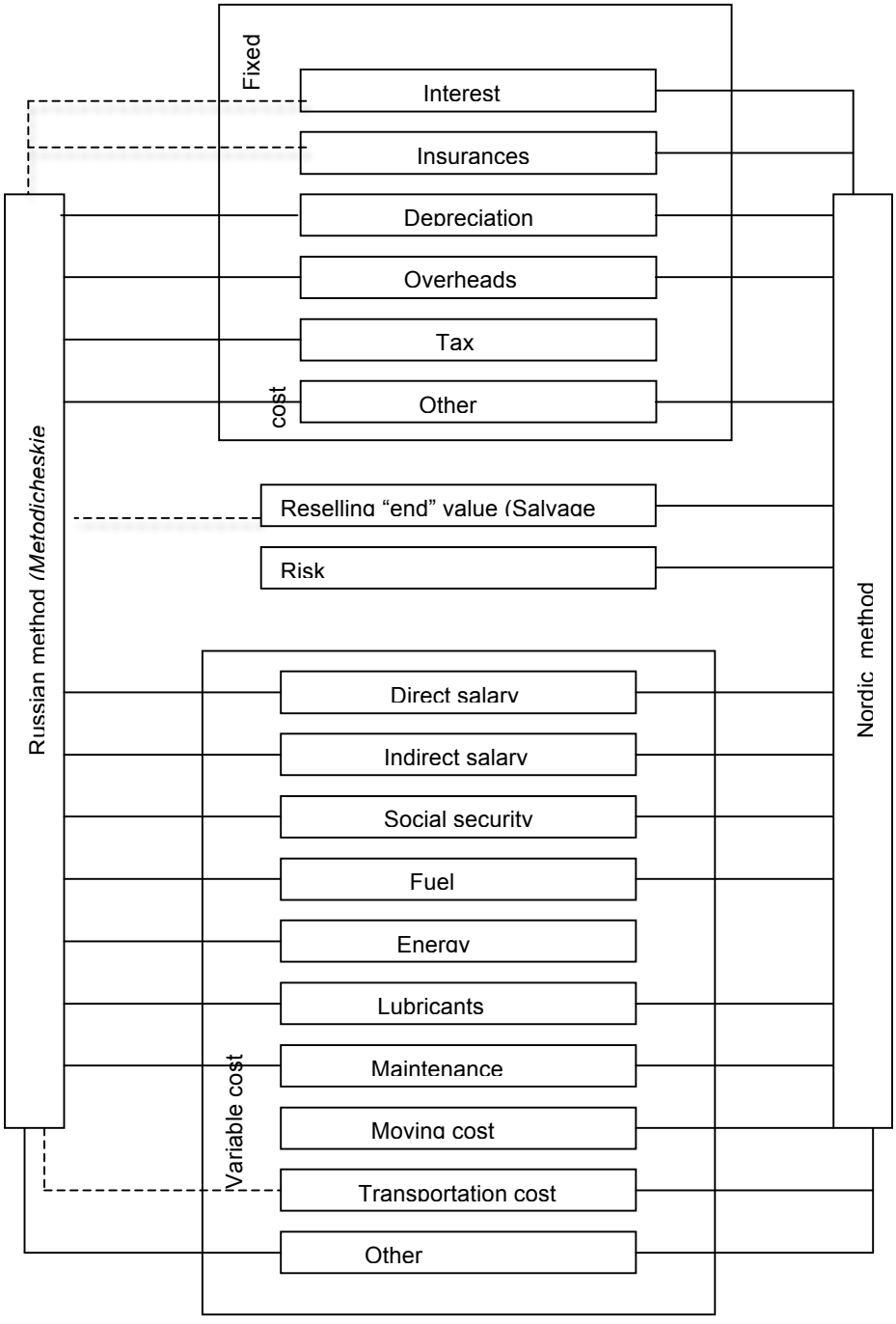


Figure 27. Wood machine cost frames for wood harvesting according to Russian and Nordic methods.

It has been discussed earlier that some that some differences exist in the concept of wood harvesting cost accounting between Russian and Nordic methods. However, there are more conceptual similarities than differences. In both systems, wood harvesting costs are divided into fixed and variable ones the illustrated in Figure 27. However, Nordic method of wood harvesting cost calculation includes fixed capital cost i.e. interests on the bank credit, payments of various insurances, depreciation costs, overheads costs. Variable costs for wood harvesting cost calculation include the costs of fuel and petroleum products, the costs of repair and maintenance service, wages and social security costs and business trip costs. Machinery insurance and the interest of bank credits in Russian method can be called as "retro innovation", because these costs were used about 50 years ago in Soviet time. According to RF Government Degrees (1996, 1998), the total size of machinery insurance cannot be more than 1% from the volume of sales. In *Methodicheskie* rekommendatsii… *(2003)* these costs are not marked. In traditional Russian/Soviet method transportation cost is larger concept than it is in Nordic method, because the concept includes costs for roads building and maintenance.

The term "cost centre" is widely used for cost accounting of logging activity in the Western literature Jöbstl (1983, 1995), Penttinen (1992) and Penttinen et al. (2001). The cost centre in Soviet cost accounting theory has been used as cost places *"osnovnoye proizvodstvo"* and *"dopolnitelnoye proizvodstvo"* during whole period of development from Soviet time to nowadays. In current period of market economy development cost places means actual the same as the term "cost centre" applying in modern Russian practice of wood harvesting cost accounting. According to Jöbstl (1983), cost centre usually means the places, work phases and reference areas from where costs usually originate. The three well-known accounting criteria, such as functional, geographical and organizational criteria have been used in the cost centre classification. In conditions of Russian wood harvesting the cost centres have been introduced as the main phases of wood harvesting process. The relation between cost centres and complex cost types in general for CTL method of wood harvesting has been illustrated on the Table 8.

Table 8. The analytical plane for mapping relation between elements integrated costs and cost centres for CTL wood harvesting method in Russia (recommended and model form)

Cost centres		Integrated cost elements															
		Material cost		Wages		Unit social cost		Depreciation		Leasing		Other		Risk		Total	
		EUR/m^3	%	EUR/m^3	%	EUR/m^3	%	EUR/m^3	%	EUR/m^3	%	EUR/m^3	%	EUR/m^3	%	EUR/m^3	%
CAC	HR	1.21	34.9	0.26	7.40	0.10	2.90	1.08	31.3	0.57	16.5	0.07	2.0	0.17	5.0	3.46	100
	FW	0.94	41.8	0.24	10.5	0.09	4.15	0.49	22.1	0.33	13.2	0.07	3.20	0.1	5.0	2.26	100
TTC		4.76	64.5	0.42	5.74	0.17	2.26	0.90	12.2	0.66	8.9	0.10	1.38	0.37	5.0	7.38	100
Total		6.91	52.7	0.92	7.1	0.36	2.70	2.47	18.9	1.56	11.9	0.24	1.80	0.66	5.0	13.1	100

CAC= Cutting area costs, FW= Forwarding, HR= Harvesting, TTC= Transport to customer

Modernisation of logging works and changes in the management and organisation structure of logging companies should give preference to such accounting and calculation system, which will bring the most objective and realistic results. More widely using of Nordic CA method for costs accounting is needed. Wood harvesting costs will become higher integrated and more manageable; it is possible to find the most effective levers to reduce it.

5. WOOD HARVESTING COST CALCULATION WITH TREE-LENGTH AND CUT-TO-LENGTH HARVESTING METHODS

5.1 Method

The Russian term *lesozagotovki* has been understood and applied in different way in the Western context. According to Harstela and Asikainen (2009), "timber procurement" (*lesozagotovki*) is a primary function in forest, comprising wood harvesting and the activities necessary to supply timber from the forest to mills or other consumers". For the scientific study *lesozagotovki* has usually been transited into the term harvesting and the term logging has been used for practical applications (Sikanen et al. 2004). Wood harvesting cost is the value of the cut-to-length wood harvesting method and tree-length wood harvesting methods inputs needed to produce commercial round wood. Of course, this economic parameter has to be measured in money. Economic models are used for cost calculation and comparison of wood harvesting cost between alternative logging chains in this put of the study. Both cut-to-length methods and tree-length methods are taken for wood harvesting cost calculation. The basis of methodology (*Methoditsheskie rekomendatsii… 2003*), used in this study, is the theory of wood harvesting cost accounting as presented in chapter 4. The basic method of cost calculation as used in Nordic cost accounting approach was described in Mäkelä (1986), and in Russian language in Sikanen et al. (2004).

In the next formulas related to the cost calculation are presented first for cut-to-length (CTL) method and then for tree-length method (TL). Wood harvesting costs (WHC) are calculated for cut-to-length method of wood harvesting in formula (2) by three forms: annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3.

$$WHC_{id}=CAC_i+TC_d \quad (2)$$

where, CAC = Cutting area costs (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
TC= Transportation cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
i= Number of a harvesting options
d= Average transportation distance from upper landing in the road-site storage to customers, calculated for 50, 100, 200 and 300 km (see 5.13)

Transportation costs (TC) for cut-to-length method of wood harvesting in this study means the costs for wood assortimets moving from upper landing to customers by short log truck. Nordic method of cost calculation (Oijala et al. 1994a, 1994b and 1994c) is used also for transportation costs calculation.

The cutting area costs (CAC) is calculated for three forms: annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3. The CAC for CTL method include costs of main logging operations, which are depended on machinery type (Soviet/Russian machinery or Nordic machinery). The CAC for CTL method include costs of main logging operations with using traditional Russian machinery and chainsaws (1-3, 6 from Table 10), and include main logging operations as felling, bunching, skidding, delimbing, cross-cut, loading and off road hauling. The CAC for Russian machinery have been calculated by formula (3).

$$CAC_i=FC_i(FBC_i)+SC_i+DCCC_i+LORHC_i \quad (3)$$

where, $FC\ or\ FBC$ = Felling cost or felling and bunching cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
SC= Skidding cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
$DCCC$= Delimbing and cross-cutting cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
$LORHC$= Loading and off road hauling cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
i=Number of the harvesting options (from Table 9)

The main mechanized logging operations for Nordic CTL using Nordic machinery (options 4 and 5 from table 10) can be called as harvester operations, which include (felling, delimbing and cross-cutting) and forwarding operations, which include (loading

and off road hauling). The CAC for options 4 and 5 (Table 10) are calculated by formula (4).

$$CAC_i = HC_i + FWC_i \quad (4)$$

where, *HC*= Harvestering cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
FWC= Forwarding cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
i=Number of the harvesting options

The calculation of machinery hourly costs for the Russian machines and mechanisms, which are used during harvesting process, was made with the Metsäteho model ”Metsäkoneiden kustannuslaskenta” (Mäkelä 1986). Computer-based methods for wood harvesting cost calculation for cut-to-length harvesting has been used in Finland for about 20 years (Mäkelä 1986) and have been constantly improved (Salo and Uusitalo 2001). The cost calculation for the unit machinery cost, which includes a harvester and a forwarder working in the forest, was made with the Metsäteho model softwares “Puutavaran koneellisen hakkuun kustannusten laskentaohjelma” “MOTO” and Puutavaran metsäkuljetuksen kustannusten laskentaohjelma ”KUORMATRAKTORI” (Oijala et al. 1994a, 1994b and 1994c). In study literature this software is used the second time for cost calculation of wood harvesting utilising in Northwest Russia conditions. Earlier Sikanen et al. (1996) has done cost comparisons using Metsäteho model only for thinning technology. For the purposes of present calculation several amendments were brought in the parameters. Amendments include more detailed comparison of economics of different wood harvesting chains for both tree-length and cut-to-length methods specifically to Northwest Russian conditions.

The unit cost is calculated with the use of the principle of time distribution according to The Nordic Forest Study Council (NSR) in Harstela (1991, 2001 and 2002) and also in Sikanen et al. (2004). From economic point of view the use of this method for cost calculation is more effective.

Traditionally in TL method are used transportation brigades for log extraction from the upper landing to lower landing in Soviet/Russia. Usually there are in average three or four workers in transportation brigade. This piece of this study is based on the Russian method of transportation cost calculation and this methods' practice. Unit extraction cost (UEC) in (RUR/ m^3) and changed to EUR/m^3 has been calculated, with using the formula (5).

$$UEC = EC/H \quad (5)$$

where, *EC* = Extraction cost, (RUR/ workers)
H =Integrated manufacturing standard, the norm (m^3/workers)

The calculation formulas (6-10) are based on the Russian method for round wood extraction cost calculation which was illustrated in *“Ediniye normy virabotki …”* (1989), Lododo (1990) for integrated manufacturing standard *H* (m^3/workers) of transportation brigade *(kompleksnaya norma virabotki*).

$$H = H_5 / R \quad (6)$$

where , *H* = Integrated manufacturing standard of log extration *(kompleksnaya norma virabotki)*, (m^3/workers)
H_5 = Transportation brigade daily production, (m^3)
R = Number of workers in brigade, (workers)

$$H_5 = n \times K_{tg} \times P \times k \quad (7)$$

where , *n* = Quantity of daily log extraction trips
K_{tg} = Coefficient of technical readiness (*koeffitsient tekhnicheskoy gotovnosti)*. A major indicator of the willingness of the rolling stock to transport work, and can be counted as one day of the logging company, and for any other period (week, month, quarter, year). It defines a simple division of the number of serviceable vehicles in balance number of cars.
P = Working shift production (m^3)
k = Shift factor (Quantity of working shifts per day)

$$P = H_v \quad (8)$$

$$H_v = [420 - (T_{pz} + t_0 l_0)] \times Q / K \times l_m t_m + l_u t_u + L \times T_1 + T_2 \quad (9)$$

where, H_v = Standard of working shift production (m^3)
420 = Working hours (min)
T_{pz} = Shift work preparation time *(podgotovitelno-zakljuchitelnuyu rabotu),* (min)
t_0 = Unit time of zero run *(nulevoy probeg),* (min)
l_0 = Distance of zero run (km)
Q = Logs volume of trip (*nagruzka na reys),* (m^3)
L = Total transportation distance from upper landing to lower landing (km)
l_m = Main road distance (km)
l_u = Season road distance (km)
t_m = Running time of main road distance in both directories (min)
t_u = Running time of seasons road distance in both directions (min)
T_1 = Unit transportation time in both directions (min)
T_2 = Standing time of loading and unloading (min)
K = Coefficient which account the effect of extraction distance on running time. (no dimensions) (*Ediniye normy virabotki… 1989)*

$$K = 7.37 / l_m + 0.81 \quad (10)$$

Usually formula (10) used for transportation distance from upper landing to lower landing more than 40 km.
The distance (l_0) of zero run and time (t_0) of zero run *(nulevoy probeg)* means distance and running time from garage to lower landing (*Ediniye normy virabotki… 1989).*
Usually the extraction cost (EC) with using Soviet/Russian lorries has been calculated with used the standard table forms and included five integrated costs elements. They are:

1. Wage
2. Cost of diesel fuel and petroleum products
3. Maintenance machinery cost
4. Spear parts (*zapasnie chasti*)
5. Depreciation

The wood harvesting cost (WHC) for TL method of wood harvesting id calculated by using formula (11).

$$WHC_{klm} = CAC_k + EC_l + LLC + RWC_m \quad (11)$$

where , CAC= Cutting area cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
EC= Extraction cost (EUR/m^3)
LLC = Total cost for lower landing operation (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
RWC = Cost for commercial round wood transportation by railway (EUR/m^3)
k= Number of a harvesting options
l=Extraction distance (km)
m= Railway distance (km)

The cutting area costs for tree-length method of wood harvesting include main logging operation costs, such as felling costs, delimbing costs, skidding costs, bunching and loading costs. The extraction cost is the cost for moving logs from upper to the lower landing by lorries. Logs extraction by lorries (Blandon 1983) includes short distance transportation on season roads and log distance transportation by main roads. The CAC (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3) for Soviet/Russian TL method of wood harvesting is calculated by the formula (12).

$$CAC_k = FC_k + SC_k + DC_k + LC_k \quad (12)$$

where, FC = Felling cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
SC = Skidding cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
DC = Dellimbing cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
LC = Loading cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
k= Number of a harvesting option

In calculation of the log extraction cost (EC), EUR/m^3 by lorry for tree-length method from the upper landing to the lower landing is assumed that

$$Annual\ logging\ volume \geq Annual\ volume\ of\ logs\ extraction \quad (13)$$

This is obsered from the annual balance of logs extraction, Lododo (1990). It is to be remarked decreasing average volume of logs and increasing average distance of logs extraction for two specific factors for Republic of Karelia.

- Decreasing average volume of logs
- Increasing average distance of logs transportation

According to Shegelman et al. (2003) average extraction distance from the upper langing to the lower landing in RK at the beginning 2000s wasin average about 60 km. According to Tatsyn (2007), the average extraction distance increased in the RK to 70 km in 2006. In this study this distance is used and included 3 km of seasonal road and 50 km on main road as model average distance. The same model average distance 53 km was used for cost calculation 2000, 2003 and 2005.

A special case was the same as average transportation distance with a narrow-gauge railway using domestic diesel locomotives and car couplers. In the RK only one narrow gauge railway was in operation until 2003. This railway was located in *Pudozhskiy* area in *Krivetskiy lespromkhoz*. The length of the railway was about 50 km. This old option of round wood transportation is now left to the history.

Soviet/Russian equipment traditionally was used in typical lower landings (Burdin 1985). Lower landing cost (LLC), annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3, for Russian tree-length method is also divided into main lower landing operations, such as unloading, dragging, cross-cutting, piling and loading and calculated by the formula (14).

$$LLC = ULC + DRC + CCC + SRC + PC\&LC \quad (14)$$

where , ULC= Unloading cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
DRC= Dragging cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
CCC= Cross-cutting cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
SRC= Sorting cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)
$PC\&LC$= Piling and loading cost (annual 1000 EUR/yr, hourly EUR/h and unit EUR/m^3)

Usually in the Karelian conditions the commercial round wood is transported from the lower landing to customers by railway. Unit railway transportation cost is calculated with using railway tariffs for domestic and export markets.

As discussed earlier in chapter 4, share of variable costs is part of wood harvesting costs. Fixed cost does not depend on the level of commercial roundwood production in the different supply chains of wood harvesting. The balance between fixed and variable shares in wood harvesting cost need observation. They may be used for developing logging logistics in Northwest Russian regions to make them more cost-effective in the future.

5.2 Alternative technological options

The use of Nordic machinery in Northwest Russia can be seen as an important part of progressive forest sector development which has developed voluntarily by the choices of logging companies acting is made conditions. However, the Finnish large forest companies gave the first experiences and small logging contractors improved in logging round wood imports to Finland. The climatic conditions are similar to Finland and effective use of machinery in wood harvesting provides basis of logging activity. Improvement of technological quality and reliability of new options of both Russian and Nordic machinery promotes the opportunity for machinery application. In Russia, and specifically in its

Northwest regions, both cut-to-length (CTL) and tree-length (TL) harvesting methods have been commonly used already many years.

CTL method with using Nordic machinery is the harvesting method Harstela and Asikainen (2009) in which delimbed steps are into logs. In the other words wood assortments are produced already in the cutting area. A tree-length or stems method is the harvesting method in which delimbed stems or stems with laps cut-of are transported to a wood ride landing or to the mill Harstela and Asikainen (2009). Specific for TL is logs extraction from upper landing to lower landing where wood assortments are produced. Difference here is cross-cutting is done. For CTL method cross-cutting can produce in two ways. The first way, at stump when used Nordic machinery, and the second cross-cutting could also make at stump or later in road-site storage, when used Russian machinery or manual mechanisms. Traditionally, in RK for TL method the cross-cutting actualizes in lower landing.

Although there are also other harvesting methods, like full-tree method, tree-section method and chipping method, TL and CTL methods are the most the most common in the world. TL method with load-putting tractors (skidders) is the most common in industrial operations but CTL method is becoming more popular, especially because of the growing interest in thinnings, say Harstela and Asikainen (2009). Harstela and Asikainen (2009) also include the comparison of several factors influencing the profitability of there to methods to different conditions.

Depending on the industrial development it is possible to find modern TL and CTL technologies as well as traditional machines and methods. The RK has traditionally been considered as a special region for Russian domestic machinery. During many decades only the different models of forest machinery from JSC "Onega tractor plant" were used in logging operations. However, starting from perestroika time the updating of machinery has been observed. Many logging companies have used domestic machinery, new modifications of this machinery as well as Nordic machinery. The Tables 9 and 10 are economic models for cost accounting development, which include the standard options (Murashkin et al. 1996). The single-line and basic domestic forest tractors and Nordic machinery of wood harvesting process represent the basic indicators for alternative technological options 1-4 and 1-6 for TL and CTL harvesting method (Tables 9 and 10).

The felling wedge has been traditionally used in Northwest Russia in combination with "URAL" chainsaw of different models. Chainsaw was used in options 1, 2 and 3 for felling standing trees for tree-length harvesting method, and in options 1, 2 and 6 for cut-to-length method. At present, different modifications of caterpillar forest tractors of the basic option TDT-55A with chokers and TB-1 with manipulator were used for log or full tree skidding. After 2000 forest tractor with chokers TLT-100A replaced older model TDT-55A, and forest tractor with manipulator TB-1MA-15 replaced older model TB-1. Soviet felling-skidding machine LP-17 made two operations felling and skidding, but it abolished from manufacturing after 2000. Domestic loading tractors PL-1G replaced older model PL-1V also after 2000.

Table 9. Alternative technological options for TL harvesting method for period 2000-2005

Option	Main harvesting operation			
	felling	skidding	delimbing	loading
1	Chainsaw	(TDT-55A)	Chainsaw"TAYGA-245"	(PL-1V)
2	Chainsaw	(TDT-55A) TLT-100A	LP-30G	(PL-1V) PL-1G
3	Chainsaw	(TB-1) TB-1MA-15	LP-30G	(PL-1V) PL-1G
4		(LP-17)	LP-30G	(PL-1V)

Table 10. Alternative technological options for CTL harvesting method for period 2000-2005

Option	Main harvesting operations					
	felling	felling& bunching	harvestering	skidding	delimbing& cross-cutting	loading& off road hauling	forwarding
1	Chainsaw				Chainsaw "TAYGA-245"	TB-1M-16	
2	Chainsaw			(TDT-55A) TLT-100A	(LO-120)	TB-1M-16	
3		LP-19		LT-154A	(LO-120)	TB-1M-16	
4			John Deere 1270 D operator from Finland				John Deere 1010 D
5			John Deere 270D operator from Russia				John Deere 1010 D
6	Chainsaw "HUSQVARNA 365 SP"						John Deere 1010 D

The six options for CTL technology are described as follows (Table 10). Options 1-3 include only Russian forest machinery. Options 4 and 5 are based on Nordic machinery. Option 4 includes the work of an operator from Finland working in Karelian logging companies under an annual contract. Option 5 represents the use of the Nordic machinery in the RK by an operator from Russia.

In cut-to-length method transportation is made by Nordic truck directly from a roadside storage to the mills at various distances and destinations.

Until 2000, the rate of capital consumption was about 52% in the logging industry of the Northwest part of the Russian Federation. The use of Russian machinery in large and average LPHs' activities i.e. felling saws, skidding tractors, delimbing machines, felling-bunching machines, timber fork loaders, and log trucks, has remained at the level of the 80s (Burdin et al. 2000). During study period 2000-2005 the fragmental technical and technological modernization in wood harvesting was started in RK. In some logging companies of Karelia like, *JSC "Kondopogskiy LPH", JSC "Olonetskiy LPH", JSC "Muezerskiy LPH", JSC "Medvegzegorskiy LPH", JSC "Pudozgiy LPH", JSC "Lenderskiy LPH", JSC "Lahdenpohskiy LPH", JSC "Ladenso", JSC "Shuya-les"* the modernization was partly been done to 2006. The use of Nordic machine replaced traditional domestic machinery and from economic point of view modernization is also called "westernization".

5.3 Capital costs and purchase prise for machinery unit

Increased attention to mechanization and modernization of harvesting including present has brought in increased altering to the concepts of capital costs in this sector The conceptual consideration and practical treatment of capital costs are therefore an important part of business and investment planning as well as cost accounting in logging (Tyukina 2009).

From the investor's point of view, capital costs can be seen as the opportunity cost of the funds employed as the result of an investment decision. Capital costs in logging for CTL wood harvesting methods, for example, the purchase of new Nordic machinery will increase production. Capital costs do not include labour costs, and they are one-time costs

although payment may be spread out over many years in financial reports and tax returns. Capital costs are fixed and therefore they are independent of the level of output (Tyukina 2009). The starting parameter for cost accounting is machinery purchase price (Sikanen et al. 2004).

The wood harvesting cost calculation for each forest machine based on the real purchase price for machinery, petroleum products, actual level of wage and deductions on social insurance and depreciation used on the territory of Northwest of Russia in 2000, 2003 and 2005.

The product technical information of fuel and lubricants for Russian machines and the equipment with the engine of internal combustion comes from the standard *(Mashini i teknologiya 1981*, and Mironov et al. 1990).

Integrated norms of productivity and unit wage tariff in logging operations *(Ediniye normi virabotki…*1989*)* were used to identify the hourly productivity of Russian machinery. Technological progress in the Russian forest logging industry is influenced by the trends of changes in pricing policy. According to Fedoseev and Kulikov (2001), and the data given JSC "Onega tractor plant" for the period of 2000-2005, the purchase prices for new Russian domestic harvesting machinery doubly increased in average. Russian brand harvesting machinery still prevails in timber cuttings in Karelia. Investments in purchasing domestic machines remain an optimum variant for logging companies in RK.

Purchase prices for Russian skidding tractors TDT-55, TLT-100A and TB-1MA-15 and other special forest machinery, for example loaders PL-1V or PL-1G, delimbing machines LP-30G, and short log truck TB-1M-16 are given according to the price-list of JSC "Onega tractor plant" from 17.10.2005 also from *LESBUMresurs* office in Petrozavodsk as of 18.12.2000, and *JSC "Mashlesservis*" in 2003.

It is necessary to note that all present calculations are made in EUR. For this purpose the unit purchase price for Russian machinery acting in the end 2000 has changed into EUR through FIM.

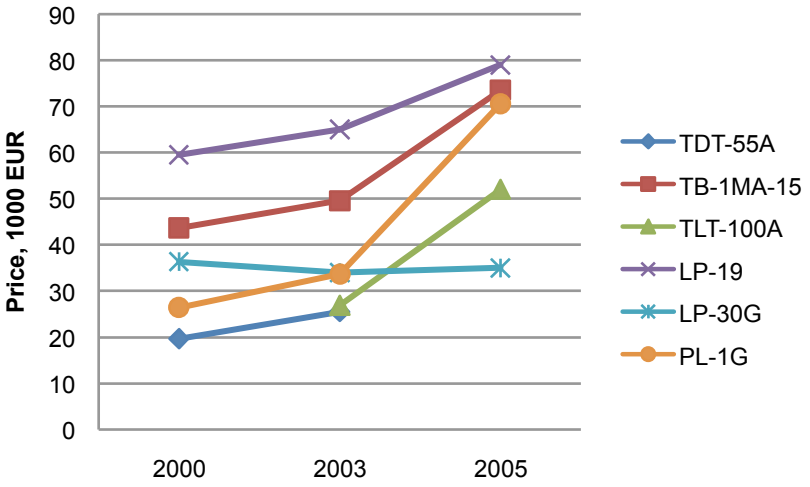


Figure 28. Purchase price for Russian harvesting machinery**.**

Purchase prices on the Russian chainsaws "Ural", hydraulic wedges and "Taiga-245" are those of the average wholesale prices for Northwest Russia. A level of purchase price was also increased in period from 2000 to 2005. For example, the purchase price for one chainsaw "Ural" in 2000 was about 171 EUR, and in 2005 about 284 EUR. The price for one chainsaw "Husqvarna 365 SP" in 2005 was 501 EUR. JSC "Onega tractor plant", the basic manufacturer of Russian harvesting machinery in the Republic of Karelia, in 2004 stopped producing a skidding tractor TDT-55A and introduced. The TLT-100A is a basic caterpillar skidding tractor of new generation for Russian machinery.

The purchase prices for new Dohn Deere 1270D harvesters and Dohn Deere 1010D forwarders are very high in comparison wich Russian machinery. For example, in 2003 purchase price for Timberjack 1270D was 350 000 EUR and Timberjack 1010 was 185 000 EUR. In 2005 the purchase prices were on 2.5 % higher. Nordic machinery was very

expensive for mass use in logging companies in Nortwest Russia before 2003. Only 10 logging companies in the Republic of Karelia used Nordic machinery for wood harvesting in 2003 (Ananiyev et al. 2005)
Now situation is completely different. The logging companies buy or rent the Nordic machinery. Leasing is widely used in the Republic of Karelia. In 2005 more than 20 large and average size companies in the Republic of Karelia used Nordic machinery for cut-to-length method of wood harvesting (Gerasimov et al. 2005).

5.4 Efforts to optime working time

Increased capital costs of harvesting have made it necessary to consider more through the working time allocations. Since 1.1.2005 in the all territory of the Russian Federation the new version of State Law of holidays are started to operate. Some amendments were made in paragraph 112 of the Labor Code (2001) including a detail that the term ”New year” was replaced with the term of “Christmas holidays”. In 2005 there were 252 working days. Logging companies using Nordic machinery in wood harvesting has two- or three- shift working models with duration about 12 hours of working shift.

The real operational experience of JSC "*Zapkarelles*" in 2002-2003 is chosen here as a basis for analysing the optimum annual operating mode. Calculations are made with consideration of the annual standard of 269 working/machinery operation days in 2003 for all types of whole-tree harvesting method and types 1-4 and 6 for cut-to-length harvesting method. Logging companies work in one shift for 6 months, and 6 months in two shifts. Duration of one working shift is 10 hours and on average there are 3456 working hours in a year. Traditionally Saturday was a working day in logging companies in RK for forest workers; this is specific case in Russia. Nowadays the situation is brought up with the European level. Logging workers have 5 working days per week when using cut-to-length technology for wood harvesting. In this study, there have working 21 days per month cost calculation during the period 2000-2005.

The optimal annual schedule for a Finnish contractor working with harvesters or forwarders was follow: in one shift for 5 months, in two shifts for 6 months plus one summer holiday month, when machines are not in work. Normal duration of a shift is 8 hours, but sometimes in practice a shift lasts for about 10-12 hours for one person. There are 21.1 working days in average per month. In total the operating time for one year makes 2870 hours. The total operating time for the same Nordic harvesting technology in Finland in 2003 was 2400 hours per year for harvesters, and 2000 hours per year for forwarders. Special feature in the organization of work of Finnish contractors in the Republic of Karelia is significant unpurposeful idle time. The two major factors for are: there is not always an opportunity to purchase fuel and lubricants, nether an opportunity to know in advance the size, and place of the next cutting areas. For example, in reality contractors worked about 15 days out of 21 per month in 2003.

The cost per productive hour or hourly machine cost for Russian and Nordic machinery for different harvesting operations was calculated with the use of the standard principle of time distribution. The following a schematic time concept illustration according to the Nordic forest study council (NSR) is illustrated in Figure 28.

Table 11. Work place time distribution for Russian and Nordic machinery in 2000-2005

Russian and Nordic Machinery	Work place time distribution				
	Gross-effective time	Moving time 2000-2003	2005	Change-over time 2000-2003	2005
		%			
TLT-100A,TB-1MA-15,PL-1G,LP-30G,TB-1M-16, LT-154A	70	2	5-7	28	23-25
LP-19	75	2	7	23	18
John Deere 1270D Operator from Russia	80	5	5	15	15
John Deere 1010D Operator from Russia	85	5	5	10	10
John Deere 1270D Operator from Finland	70	30			
John Deere 1010D Operator from Finland	75	25			

Source: Sikanen et al. 2004 and Ananiyev et al. 2005 and modified by author.

Apparently there are differences how the total time of various harvesting machinery is divided between operating time and other categories. Some of the time concepts (Figure 28) are presented in the Table 11.

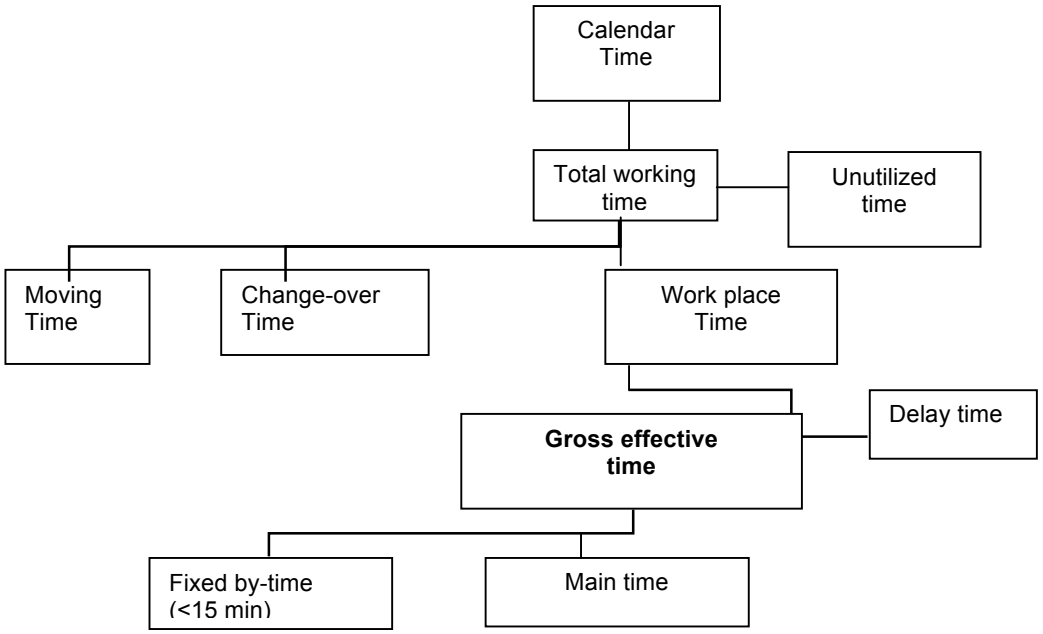


Figure 29. Time distribution for wood harvesting based on the Nordic study (Harstela 1991, Sikanen et al. 2004).

The changeover time for Russian domestic machinery is more than twice as high as that of the Nordic machines. Nevetheless, the time for moving from one cutting area to another did not exceed 2% the calendar time for tree-length harvesting in period from 2000 to 2003. Traditionally for Republic of Karelia the simple reasons for increasing of moving time has been connected with difficult access to cutting areas and has the absence of

necessary length of all-seasons forest roads. In Karelia, the cutting areas are located at significant distances from each other. Average time for moving from one cutting area to another has increased in last two years. In period 2000-2003 it was not less than 3 hours and 1-3 times per calendar month. In 2005 moving time was more than 12 hours and 1-3 times per calendar month. During last years 2004-2005 moving time increased more than three times. From economic point of view the share of changeover time in calendar time for harvesting chain (harvester + forwarder) is maximum 5% of calendar time in Northwest Russia. Practical experience of Finnish contractors in the Republic of Karelia in 2000-2003 showed that duration of one move from one harvesting site to another makes not less than 12 hours on the average.

5.5 Depreciation and exchange value

Depreciation means annual reduction of machine purchase price by the amortisation rate in percent as a result of deterioration. Nowadays the basic capital means are classified in ten groups depending on term of service life in Russia (Tax Code of Russian … 2009). The capital of logging company -meaning is understood as property over 1 year of operation and over 10000 RUR. In the groups 1-7 linear and non-linear methods of depreciation cost calculation can be used. For buildings, roads and bridges of group 8-10 the linear method is only used (Murashkin et al. 2009).

Each logging company makes decision itself that what kind of accounting method needs to be used for depreciation cost calculation. During the period of Soviet planning economy the four different methods were used: linear, non-linear, accelerated depreciation and units of production methods. Usually the calculation was made for the period of 5 years on 20 % of annual amortisation rate, then forest machinery was written off from companies balance. Nowadays the calculation is made for forest machinery a maximum for 10 years.

Depreciation norms are accepted as annual percentage in equal shares for the whole economically effective period of tractors' use. The annual depreciation value can be calculated by formula (15) from Oijala et al. (1994a) and Väätäinen et al. (2006) and modified by author.

$$D = (H - R)/n \qquad (15)$$

where , D= Annual depreciation value (EUR)
H= Purchase price (EUR)
R = Residual value (EUR)
n = Depreciation live (yr)

Depreciation value is widely used as in Soviet/Russia as in western studies, like in Akay and Sessions 2004.

Practical experiences and literature suggest a certain difference between operational times for different kind of machinery. It would be expedient to reduce the use time of Russian skidding caterpillar tractors (TDT-55A, TB-1MA-15) and forest machines (PL-1G, TB-1M-16) to 3.5 - 4 years (Murashkin 1992). The use time of skidding caterpillar tractors of TLT-100A type, taken for this study, is also about 4 years. As said, the term "depreciation" means annual reduction of machine purchase price by the certain depreciation rate in percent as a result of deterioration. Depreciation norms are accepted as annual percentage in equal shares for the whole economically effective period of tractors' use (Table 12). The straight-line method (Jöbstl 1995) for depreciation cost calculation was used in this study for Russian caterpillar machinery and Nordic machinery. Rates for depreciation cost calculation are accepted corresponding to the third category in paragrap 5 of President Degree No 685 (1996) at rate 15-25%.

Table 12. Depreciation cost for Russian and Nordic machinery

Machinery	Utility period, h	Depreciable life, yr		Amortisation rate, %	Residual value	
		2000-2003	2005		2000-2003	2005
TDT-55A	7525	3.5		25	4624	
TLT-100A	7525	3.5	3.5	25	6450	9367
TB-1MA-15	7525	3.5	3.5	25	8994	13328
PL-1V (G)	7525	3.5	3.5	20	5204	10934
LP-30G	7525	3.5	3.5	25	6165	6346
LP-17	11520	5.0		25	11317	
LT-154A	7525	3.5	3.5	25	5440	6890
LP-19	11520	5.0	5.0	25	9122	12112
TB-1M-16	7525	3.5	3.5	25	10582	14144
JohnDeere 1270D (operator from Russia)	15000	6.5	4.0	25	48902	58891
JohnDeere 1010D (operator from Russia)	16000	6.1	4.0	22 - 25	24265	28682
JohnDeere 1270D (operator from Finland)	15000	8.4	8.4	25	41080	42164
JohnDeere 1010D (operator from Finland)	16000	8.4	8.4	22	19556	20079

The sharp rise in purchase price of the new skidding tractor TLT-100A and traditional two-shift mode of work-place time have caused necessity to increase by one year its depreciation life. During past years the new models of Nordic machinery should be bought and used the different schemes of leasing contracts. The utility period was calculated by method of accelerated depreciation. For example, according to the data from the Table 12 the period of depreciation life for harvester John Deere 1270D and forwarder John Deere 1010D has dropped from 6 years to 4 years when this machine has been used all the year round day and night in 2-3 shifts.

The term "residual value" means the untransformed value after the end of period of service life. Residual value can calculate by formula (16) from Oijala et al. (1994a) and Väätäinen et al. (2006) and modified by author.

$$R = H \times (1 - Vp/100)^n \quad (16)$$

where, R = Residual value (EUR)
H = Purchase price (EUR)
Vp= Annual amortization rate (%)
n = Depreciable life, yr

There are some differences in economic context for residual value calculation between Soviet /Russian theory and Western theory of cost accounting. During the period of planning economy residual value *(ostatochnaya stoimost*) was written off from accounting balance and also included the costs of major repair, and techniques did not resale. Nowadays the residual value can be used in form salvage value when forest machinery could be necessary to resale. Residual value is not used for capital cost calculation.

The economic parameter exchange value (Oijala et al. 1994a and Oijala et al. 1994c) for forest machinery (Figure 28) was calculated according to Nordic method and formulas (17-18) .

$$EV = k / 100 \times H \quad (17)$$

where,
EV= Exchange value (EUR)
k = Exchange value factor
H= Purchase price (EUR)
Exchange value is used when forest machine is re-selling. The exchange value can be the same as residual value (EV=R), and then the value gets same character as salvage value. Traditionally in Russia the second-hand market of forest machinery is not well developed, and usually machinery is used as long as residual value is zero (R=0). Then the forest machine is utilized or fully renovated.

$$k = (1- n / 100)^{ET} \times 100 \quad (18)$$

where, k = Exchange value factor
n = Depreciation norm
ET =Effective time (h)

The depreciable life estimated period of time over which a capital asset is or can lawfully be depreciated. For effective time in this study is used term gross effective time means the actual annual machine working time in main operations. Effective time is always less then depreciable life.

In real activity of logging companies exchange value is not calculated. There is no resale for Russian machinery.
Leased contract Nordic machinery does not change hands in Karelian logging companies.

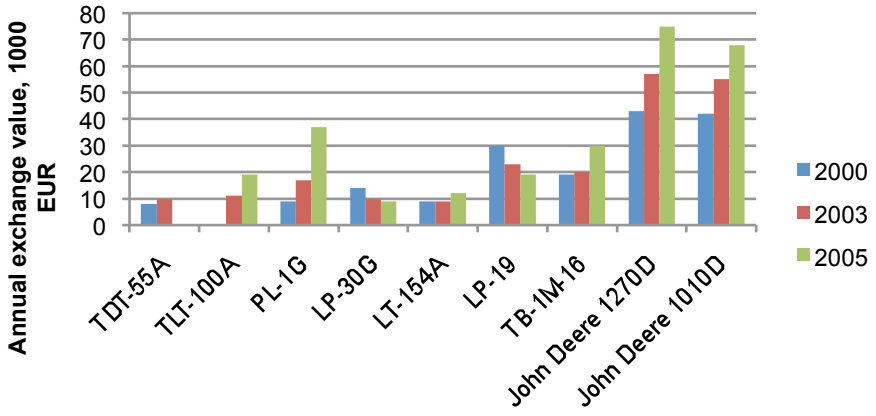


Figure 30. Annual exchange value for Russian and Nordic machinery in 2000-2005

The annual exchange value calculation depended from purchase price as for Russian as for Nordic machinery. For Russian machinery used for tree-length method the exchange value was 13 - 46% in period from 2000 to 2005. The exchange value for Russian machinery working by cut-to-length technology has constant rate 23-36.5% for calculation period. In period from 2003 to 2005 an exchange value for Nordic machinery increased tendency from 15-22 % up to 30-35%.

Interest is an important economic indicator for the capital cost calculation. This indicator was known by Soviet theory of cost accounting, but it was seldom used in practice. Soviet LPHs did not need to use the bank credits for new domestic machinery buying. According to Petrov and Morozov (1984) the Soviet bank interest rate was 2 %. In that time the centralised distribution of new domestic machinery was used and LPHs had their own money resources. Since the beginning of 2000 years, when the Nordic machinery entered Russian forests, the logging companies have been needed the extra interest loan for buying new expensive machinery. Nowadays two types of interest, such as bank interest or lease interest have been used. Each logging company makes its own decision which type of loan they are using. The formula (19) (cf. Väätäinen et al. 2006) can be used for interest calculation.

$$K=(p/100)(H+R)/2 \quad (19)$$

where, K = Annual interest (EUR)
p = interest rate (%)
R= Residual "end" value

5.6 Russian standards for cost calculation of diesel fuel, other fuels and lubricants

Traditionally in all lespromkhozes of Russian Federation and in the Republic of Karelia all costs for fuel and other petroleum products were calculated in kg per hour. This Russian system of cost calculation was used here. For all Russian forest machinery the charge for fuel, lubricants and hydraulic fluids for machines and equipment with the internal combustion engines comes from the previous norms (Serdechniy 1987*)*. For Nordic machinery available data is given in liters. Therefore, one had to transfer fuel and lubricants consumption measurements from liter per hour to kg per hour. For this purpose the following approciate factors, which include the density of substances are used:

- Fuel - 0.845 kg/l
- Motor oil - 0.850 kg/l
- Transmission oil - 0.868 kg/l
- Hydraulic oil - 0.92 kg/l
- Chainsaw oil - 0.885 kg/l

In 1992 the liberalisation of prices *(liberalizatsiya tsen)* was started in Russia. In market theory the liberalisation of prices means their release from administrative control. The price liberalisation policy has been conductive to the price advances on fuel and petroleum products and main and an important cause of losses in logging industry in the Republic of Karelia.

Prices for fuel and petroleum products given in this research correspond to the average free sale prices in Karelia in 2003 and 2005. In the Republic of Karelia during the investigated period with 2000 till 2005 prices of the fuel, petroleum products and lubricants have increased constantly. For example, during 2003-2005 market prices for the fuel, petroleum products and lubricants increased 2.7 times on the average.

The market prices for 2000 , 2003 and 2005 for fuel, motor oil and other necessity petroleum products in Northwest Russia are from this years price lists. The coefficients for changing liter per hour to kg per hour fuel and petroleum lubricants are used from product technical information Shell Ltd (www.shell.com).

The harvesting option 7 using chainsaw "Husqvarna 365 SP" for cut-to-length technology had highest unit fuel and lubricants EUR/m^3 (Table 13). This is due to influence on prices the high gasoline quality and the lowest productivity of manual work. According to Gerasimov et al. (2005), for typical Republic of Karelia conditions of average productivity per one working shift is about 10 m^3, when using CTL technology.

Table 13. Fuel and lubricants costs for the wood harvesting chains

Harvesting operations	Costs					
	EUR/yr		EUR/h		EUR/m^3	
	2003	2005	2003	2005	2003	2005
Tree-length method						
1."Ural"+TDT- 55A +"Tayga-245"+PL-1V	15685		6.21		0.63	
2. "Ural"+TDT -55A +LP-30G+PL-1V	18599		7.67		0.67	
3. "Ural"+TB-1MA-15 +LP-30G+PL-1G	21266	46436	8.08	21.2	0.69	1.96
4. LP-17+LP-30G+PL-1V	18934		7.7		0.61	
5. "Ural" +TLT-100A +LP-30G+PL-1G	20399	49793	8.15	22.83	0.79	2.14
Cut-to-length method						
1."Ural"+"Tayga-245" +TB-1M-16	10317	24929	4.02	10.68	0.55	0.98
2."Ural"+TDT-55A +LO-120+TB-1M-16	21054		8.34		1.04	
3.LP-19+LT-154A	34638		14.04		1.17	

+LO-120+TB-1M-16						
4. John Deere1270D + Dohn Deere1010D (operator from Russia)	21077	85091	7.93	22.8	0.53	1.52
5. John Deere 1270D + Dohn Deere1010D (operator from Finland)	18320	38318	7.92	20.8	0.53	1.38
6."Ural"+TLT-100A+LO-120+TB-1M-16	22854		9.34		1.16	
7. "Husqvarna 365 SP"+John Deere 1010		47882		12.99		2.88

5.7 Cost calculation for maintenance service and repairs

The general levels of maintenance service and repair costs for tree-length method of wood harvesting in Northwest Russia are traditionally high. Logging companies using TL method have special repair shops for carrying out of repairs and maintenance service indented from Soviet period. Sometimes different types of repairs are done in the cutting areas which used the manual refuelling of tractors and chain saws.

During past years using cut-to-length technology has also changed the quantity of the given costs in concern. The new trend for wood harvesting is exploitation of the new Nordic machinery for period of depreciation time in current conditions without practicing heavy repairs.

In Karelia, the costs for repair of Russias machinery have been enormous, which is evidently visible (Table 14). For example, maintenance and repair costs for LP-19 were more than 4 times higher than the covesponding costs for Timberjack 1270D in 2000. Russian type of machinery for forest harvesting has a few competitors in the world, but it was often regorded economic and reliable for Russian conditions (Tyukina 1995), although having high maintenance and repair costs.

Comparing the maintenances costs for chosen technologies according to the Table 14 it is possible to give following comments. The average level of maintenances costs for tree-length method of wood harvesting is higher than for cut-to-length method of wood harvesting, when the tree cutting is carried out using chainsaws. Costs for spare parts of mechanized wood harvesting using John Deere machinery are high.

Table 14. Maintenances and repair costs for the wood harvesting chains

Harvesting options	Maintenances costs					
	EUR/year		EUR/hour		EUR/m^3	
	2003	2005	2003	2005	2003	2005
Tree-length method						
1."Ural"+TDT55A +"Tayga245"+PL-1V	9281		4.48		0.38	
2. "Ural"+TDT-55A +LP-30G+PL-1V	16436		7.19		0.58	
3."Ural"+TB-1MA-15+LP-30G+PL-1G	16735	20542	7.33	9.7	0.58	0.8
4. LP-17+LP-30G+PL-1V	18934		8.1		0.64	
5."Ural"+TLT-100A +LP30G+PL-1G	16436	18123	7.19	8.6	0.58	0.67
Cut-to-length method						
1."Ural"+"Tayga-245" +TB-1M-16	5559	7155	2.63	3.35	0.35	0.42
2."Ural"+TDT-55A +LO-120+TB-1M-16	12798		5.44		0.68	
3.LP-19+LT-154A +LO-120+TB-1M-16	20248		8.47		0.67	
4.John Deere 1270 D + John Deere 1010 D (operator from Russia)	35000	35000	13.22	10.7	0.88	0.72

5.John Deere 1270 D+John Deere 1010D (operator from Finland)	30000	30000	16.43	16.42	1.1	1.09
6.”Ural”+TLT-100A+LO-120+TB-1M-16	12798		5.44		0.68	
7. Husqvarna 365 SP+ John Deere 1010D		15150		5.24		0.39

5.8 Cost calculation for wages of the wood harvesting workers

Cost calculation of wages for logging workers was based to the average salaries in this field in 2005. For example, the average salary for lumberman was 12000-15000 RUR per month in 2005. Extra payment to salary for the Nordic machinery operators was 20 % for work during evening and 40 % during night shifts.
The basic tariff for wages derives from the minimal salary approved upon for 01.03.2003 in the Russian Federation and from the uniform tariff directory of works and working trades. It is also compared and correlated with the actual data from one of the logging companies in Northwest Russia. Deductions on the social tax are done at the rate of 35.6%, and voluntarily health insurance have been 3.9%. The wages increaced up by about 8.0% for operators from Finland in the period from 2003 to 2005. The wages cost for harvesting options are illustrated in Table 15.

Table 15. Wages for wood harvesting in RK

Harvesting options	Costs					
	EUR/yr		EUR/h		EUR/m^3	
	2003	2005	2003	2005	2003	2005
Tree-length method						
1. ”Ural”+TDT- 55A +”Tayga-245”+PL-1V	24415		10.32		1.49	
2. ”Ural”+TDT -55A +LP-30G+PL-1V	26682		11.30		1.04	
3. “Ural”+TB-1MA-15 +LP-30G+PL-1G	26997	28965	11.43	12.64	1.03	1.2
4. LP-17+LP-30G+PL-1V	25716		11.06		0.93	
5. “Ural”+TLT-100A +LP-30G+PL-1G	26682	28670	11.30	12.5	1.04	1.17
Cut-to-length method						
1. ”Ural”+”Tayga-245” +TB-1M-16	18295	27742	7.61	9.10	1.35	1.58
2. ”Ural”+TDT-55A +LO-120+TB-1M-16	28841		12.26		1.52	
3. LP-19+LT-154A +LO-120+TB-1M-16	35881		15.58		1.38	
4. John Deere 1270D + John Deere1010D (operator from Russia)	29436	38675	11.06	10.35	0.74	0.69
5. John Deere 1270D + John Deere 1010D (operator from Finland)	92441	108312	51.27	58.71	3.36	3.91
6.”Ural”+TLT-100A +LO-120+TB-1M-16	28841		12.26		1.52	
7. Husqvarna 365 SP + John Deere 1010D		27664		7.78		2.72

5.9 Other costs calculation

Organisation and the account of expenditures for transportation of forest workers from the place of living to the cutting area have some special features in Russia. Traditionally workers are brought transported to a cutting area by bus to all logging crews. Costs here are calculated for one machine day and it makes 0.1 EUR per day for one machine. In the

future, if a worker who has his own harvesters and works with a logging company under the contract, and the harvester moves from his home to a logging site, it will be necessary to take into account transfer expenditure for each machine or mechanism. It may then correspond to the sum of covering these costs depending on the distance from the house to the cutting area, and it will be stipulated separetely in the working contract.

Wage costs also include costs of meals for workers per person. In average they made 2.0 EUR per worker a day in 2003 and but have increared to 6.0 EUR per one working shift in 2005. With the use of cut-to-length harvesting method by contractors from Finland in Northwest Russia conditions, especially in the RK, here mean other costs included some extra costs, for example the cost for a visa and customs costs for moving Nordic machinery from Finland to Russia.

5.10 Cutting area costs calculation

The cutting area costs (CAC*) (zatraty na kompleks lesosechnikh rabot)* for Russian TL harvesting method was calculated by the formula (12). The main idea for calculating CAC for CTL harvesting method is the same as for TL harvesting method. The CAC for CTL harvesting method consisted of a fixed sum and variable costs for each part of harvesting operation, The rates for hourly CAC for CTL and TL harvesting methods are depended on the technological options used. The results of CAC calculations for different options are shown in (Figures 31-36).

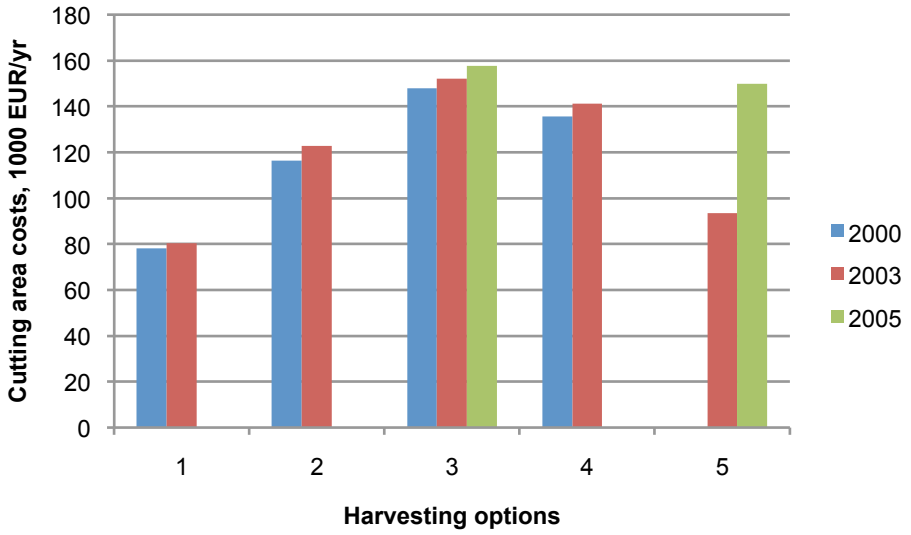


Figure 31. Development of annual CAC for TL harvesting options in the RK in 2000 -2005
Harvesting option 1="Ural"+TDT- 55A+"Tayga-245"+PL-1V, 2= "Ural"+TDT -55A+LP-30G+PL-1V, 3="Ural"+TB-1MA-15+LP-30G+PL-1G, 4= LP-17+LP-30G+PL-1V, 5="Ural"+TLT-100A+LP-30G+PL-1G

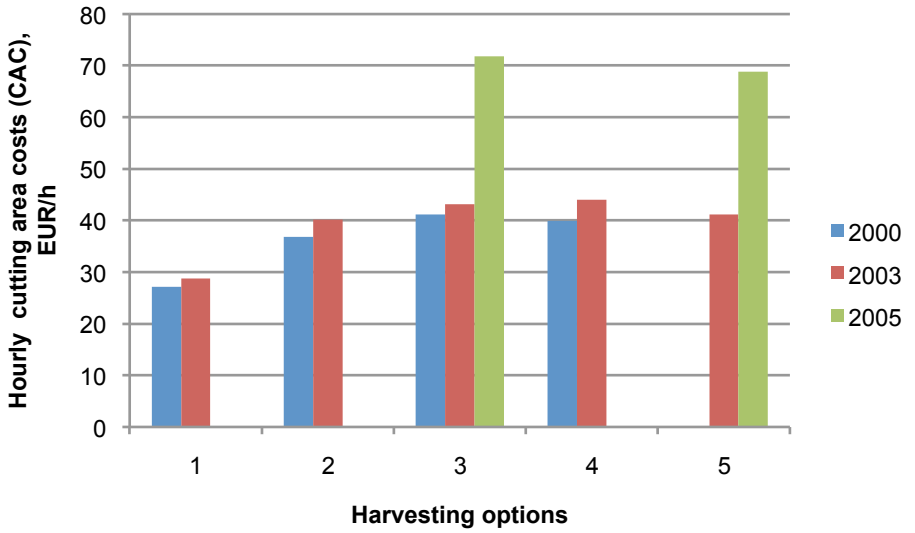


Figure 32. Development of hourly CAC for TL harvesting options in the RK in 2000-2005 Harvesting option 1="Ural"+TDT- 55A+"Tayga-245"+PL-1V, 2= "Ural"+TDT -55A+LP-30G+PL-1V, 3="Ural"+TB-1MA-15+LP-30G+PL-1G, 4= LP-17+LP-30G+PL-1V, 5="Ural"+TLT-100A+LP-30G+PL-1G

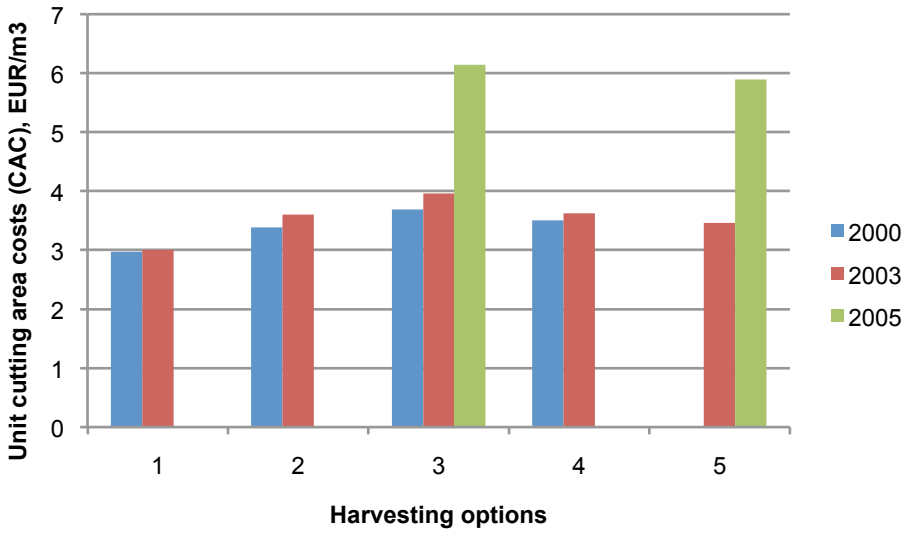


Figure 33. Development of unit CAC for TL harvesting options in the RK in 2000-2005 Harvesting option 1="Ural"+TDT- 55A+"Tayga-245"+PL-1V, 2= "Ural"+TDT -55A+LP-30G+PL-1V, 3="Ural"+TB-1MA-15+LP-30G+PL-1G, 4= LP-17+LP-30G+PL-1V, 5="Ural"+TLT-100A+LP-30G+PL-1G

In 2003, new forest machinery was used more efficiently than in 2000. The annual CAC for options 1-4 with TL harvesting method in 2003 were a bit higher than in 2000. TL harvesting method does not contain calculations for CAC for option 5, because skidding tractor TLT-100A had not been in common use in RK before 2001. The rate of CAC per m^3 has constantly been growing up for CTL as for TL harvesting technologies using Russian machinery. In this study, the CAC includes an extra 5.0% payment for health risk and other in business activity for traditional Russian Machinery and Russian operators for John Deere, and 10% for contractors from Finland. In reality, at present in Karelian logging companies there is no insurance on logging machinery and no payments for workers for risks at harvesting work.

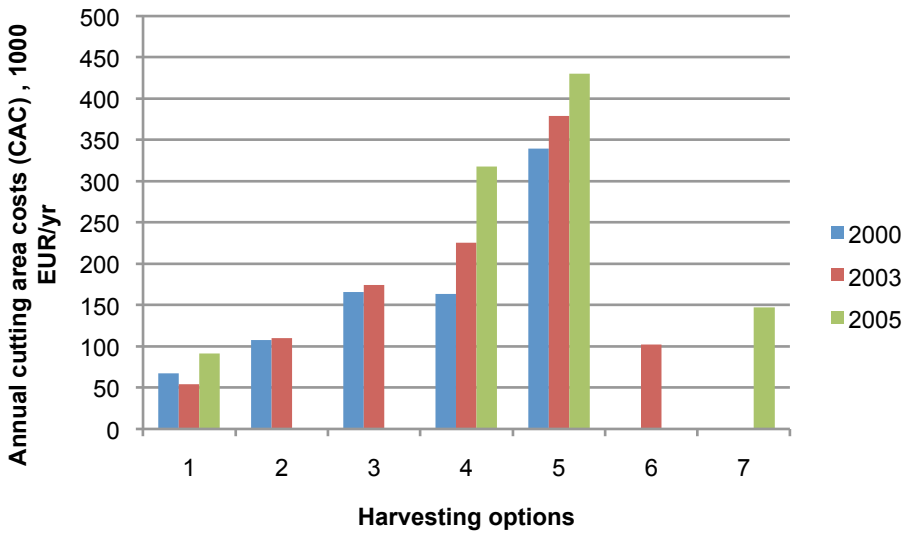


Figure 34. Development of annual CAC for CTL harvesting options in the RK in 2000-2005. Data comes from Valtimo Business school. Harvesting option 1="Ural"+"Tayga-245"+TB-1M-16, 2= "Ural"+TDT-55A+LO-120+TB-1M-16, 3= LP-19+LT-154A+LO-120+TB-1M-16, 4= John Deere 1270D+ John Deere1010D (operator from Russia), 5= John Deere 1270D+ John Deere 1010D (operator from Finland), 6="Ural"+TLT-100A+LO-120+TB-1M-16, 7= Husqvarna 365 SP+ John Deere 1010D

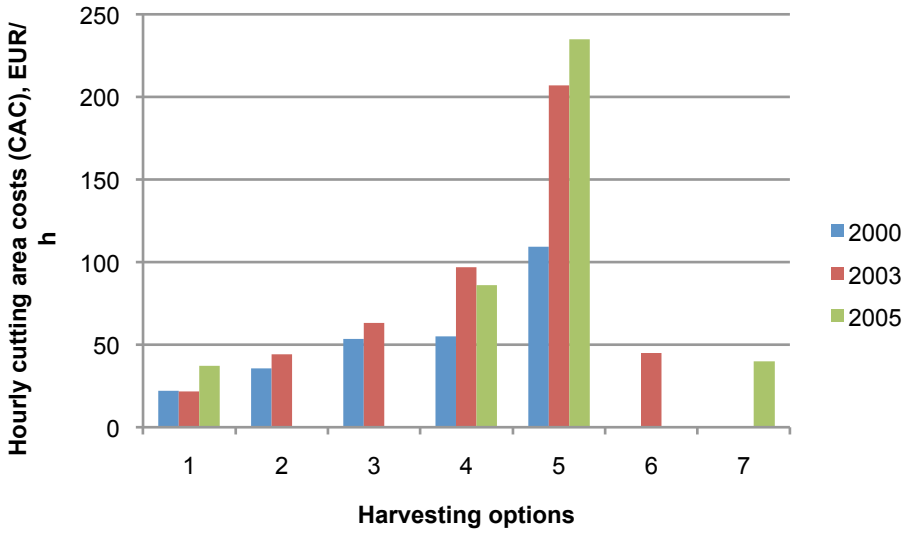


Figure 35. Development of hourly CAC for CTL harvesting options in the RK in 2000-2005. Harvesting option 1="Ural"+"Tayga-245"+TB-1M-16, 2= "Ural"+TDT-55A+LO-120+TB-1M-16, 3= LP-19+LT-154A+LO-120+TB-1M-16, 4= John Deere 1270D+ John Deere1010D (operator from Russia), 5= John Deere 1270D+ John Deere 1010D (operator from Finland), 6="Ural"+TLT-100A+LO-120+TB-1M-16, 7= Husqvarna 365 SP+ John Deere 1010D

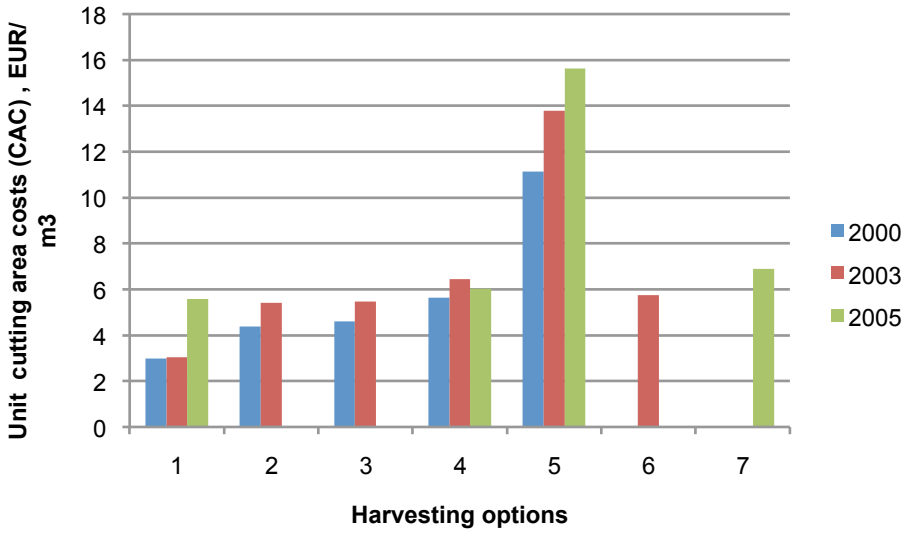


Figure 36. Development of unit CAC for CTL harvesting options in the RK in 2000-2005. Harvesting option 1="Ural"+"Tayga-245"+TB-1M-16, 2= "Ural"+TDT-55A+LO-120+TB-1M-16, 3= LP-19+LT-154A+LO-120+TB-1M-16, 4= John Deere 1270D+ John Deere1010D (operator from Russia), 5= John Deere 1270D+ John Deere 1010D (operator from Finland), 6="Ural"+TLT-100A+LO-120+TB-1M-16, 7= Husqvarna 365 SP+ John Deere 1010D

Option 5 includes special extra costs for example cost for car maintenance, car accommodation, spin-machinery, costs for visas, cost for guards, Russian customs tax for Nordic machinery transition and commercial risk increased up to 20%. This information comes from real experience of operations from Valtimo forest school.
The calculated amount levels annual, hourly and unit cutting area costs for study period from 2000 to 2005 for different technological options as for TL and CTL harvesting methods are presented in the Figures 30-35. The average level of annual cutting area cost for CTL wood harvesting method increased 77% from 169000 EUR in 2000 to 299 000 EUR in 2005. The average level of annual cutting area cost for TL harvesting method also increased but only 29% from 119000 EUR in 2000 to 154000 EUR in 2005. The average level of unit cutting area cost for CTL harvesting method increased from 5.74 EUR/ m^3 in 2000 to 8.53 EUR/ m^3 in 2005 and for TL method from 3.39 EUR/m^3 in 2000 to 6.05 EUR/m^3 in 2005. The reasons for considerable cost increases have been leasing payment, high wages and low productivity. Within last two years (2004-2005) the trend for convergence of unit CAC for two considered methods of wood harvesting was observed. In practice the difference between unit CAC for TL and unit CAC for CTL makes no more than one EUR.

5.11 Purchase price for domestic lorry and for diesel locomotive

For the costs of long-distance transportation the purchase prices of transport machinery is considered first. Traditionally in Northwest Russia tree stems in tree-length method were extracted from upper landing *(verhniy sklad)* to lower landing *(nizniy sklad)* by lorries (Blandon 1983). Modernization is also coming to round extraction and nowadays share of foreign "Sisu"-trucks is 40% of all roundwood transportation techniques in RK. The extraction by crews is the most common form of transportation in practice. The useful model of domestic lorry was Ural –43204-31 and more than 20 m long trailer KGB-9851+01. In this study this model is used as the option of log extraction for extraction cost calculation in tree-length method of wood harvesting. For extraction cost calculation the lorry depreciation guidelines and rules were used as well as the standard spare parts cost, repair and maintenance costs, and petroleum products costs. The purchase price came from price list JSC "Auto Builder Plant Ural" in Chelyabinsk city, and for study period it was in average 40000 EUR.

Log transportation by narrow-gauge railroads usually consisted of a diesel locomotive TU-6A and not more than 5 car couplers model 43-091 to prevent the train overturn. The

purchase price for this train was 96200 EUR in 2000. In Northwest Russia in Vologda and Arkhangelsk the logging companies use still narrow-gauge railways, but nowadays they are not used in RK. Before 2001 narrow-gauge railroad diesel trains had been used in the RK for round wood transportation, but they have not been in industrial use after 2003.

5.12 Extraction cost for TL method of wood harvesting

The mode for time concept with long logs extraction from the upper landing to the lower landing is the same as the mode for time concept for main logging works by TL method. Unit extraction cost for TL method increased in average from 0.62 to 2.00 EUR in period 2000-2005. During the study period from 2000 to 2005 the extraction run by lorry was in practice more than 8 hours for continuous working shift.

The working shift duration for diesel locomotive, used in accordance with relevant decision, was shorter for one hour, from 8 to 7 hours, because of difficult working conditions *(Pismo Minzdrava SSSR 1987)*. The diesel locomotive driver and his assistant were daily provided with vitamins and milk as they workers in unhealthy conditions *(Ob ohrane truda 1999)*. The extraction cost for this method of round wood transportation from upper landing to lower landing was 1 EUR/m^3 in 2000, and after 2000 it has not been calculated in the Republic of Karelia conditions.

5.13 Transportation cost calculation for CTL harvesting method

Transportation cost (TC) was calculated for commercial short round wood from the roadside terminal to two directions: to the domestic customer (options 1-4, 6 from table 10) and abroad, for export (option 5 from the same table). The transportation cost was also calculated for different transportation distances, i.e. 50, 100, 200, and 300 km. The option for short log transport used in this study is the truck SCANIA equipped with grab Forester 1310. This machines were used in practise in JSC ”LadEnso” and JSC ”Pyaozerskiy Lespromhoz” in RK in 2000-2005. The Metsäteho software ”AUTO” (Oijala et al. 1994b) was used for TC calculation. The TC calculation with this software was modified corresponding to the working mode in Northwest Russia conditions. Amendments that were made in this study include:

- 269 working days in 2000-2003 and 252 working days in 2005
- Prices for fuel and the petroleum products were used in the RK during 2000-2005
- Russian wages for options 1-4, and 6
- Russian quality of forest roads
- The cost of business risk was 5%
- Costs for different insurances and taxes

The result of the calculation are given in the annual, hourly and unit transportation costs, and illustrated in figures 37-42.

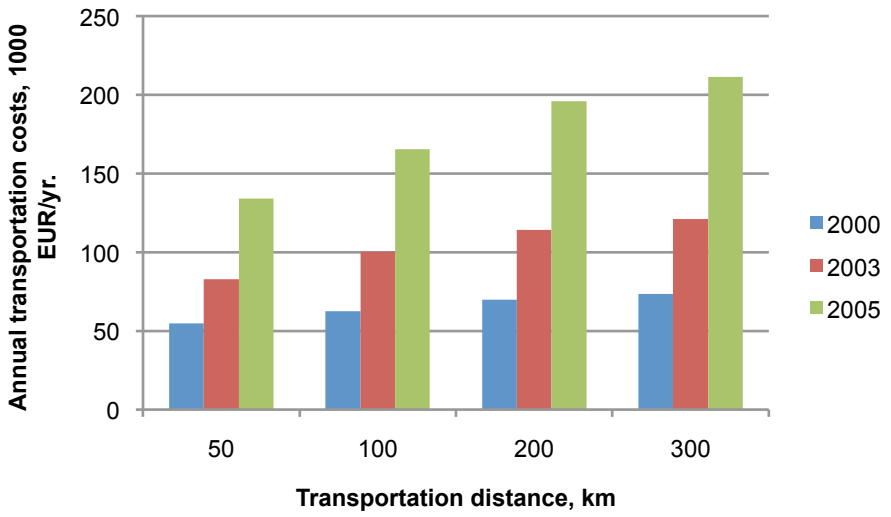


Figure 37. Annual transportation costs for operator from Russia for CTL method of wood harvesting

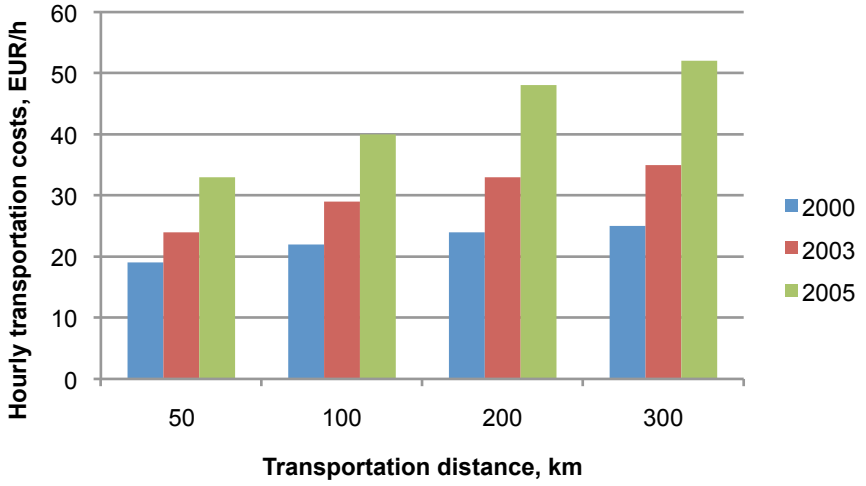


Figure 38. Hourly transportation costs for operator from Russia for CTL method of wood harvesting

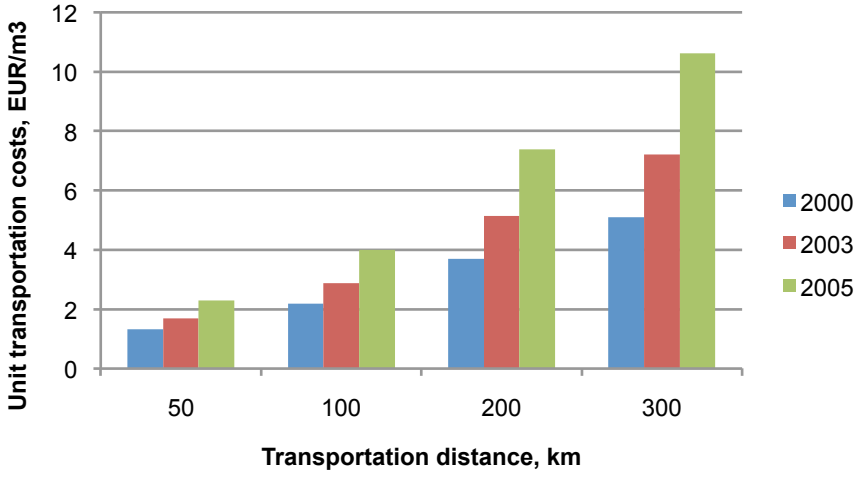


Figure 39. Unit transportation costs for operator from Russia for CTL method of wood harvesting

By comparing the costs in the Figures 37-42 it is important to notice two following moments:

- The average wage cost level of contractors from Finland was more than 30% higher than Russian workers.
- Increase of annual, hourly and unit costs was examined both of Russian workers and contractors from Finland during the study period.

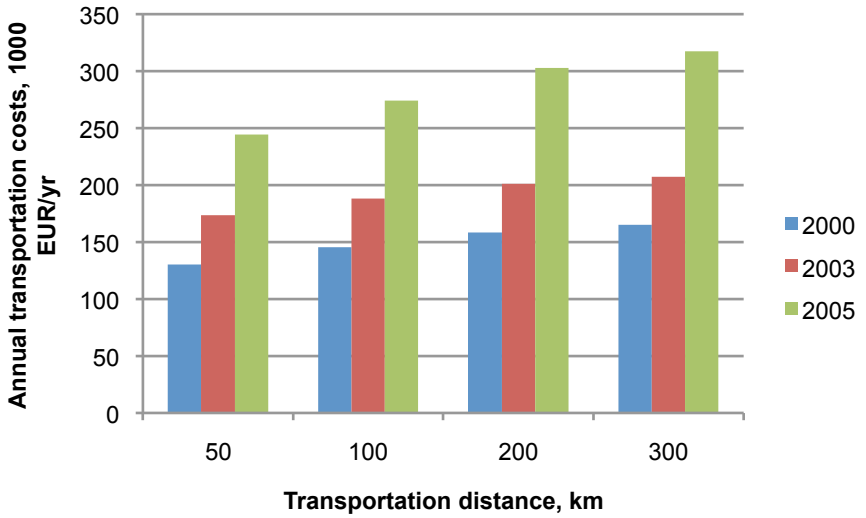


Figure 40. Annual transportation costs for operator from Finland for CTL of wood harvesting

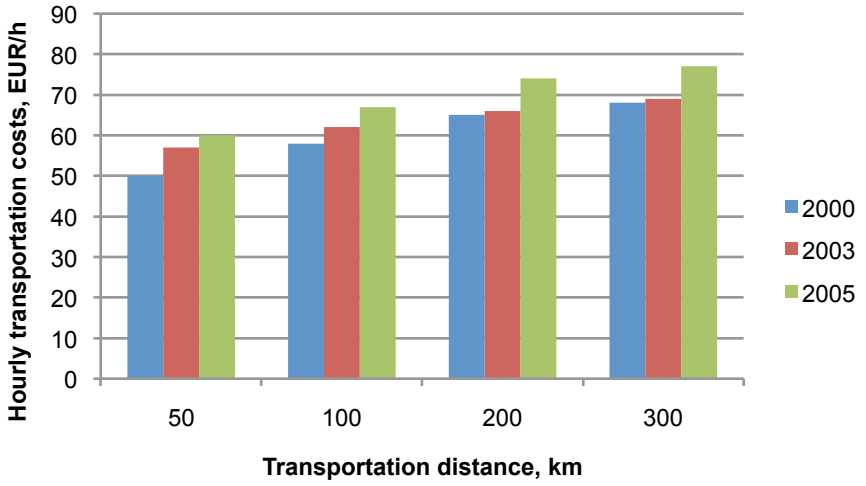


Figure 41. Hourly transportation costs for operator from Finland for CTL method of wood harvesting

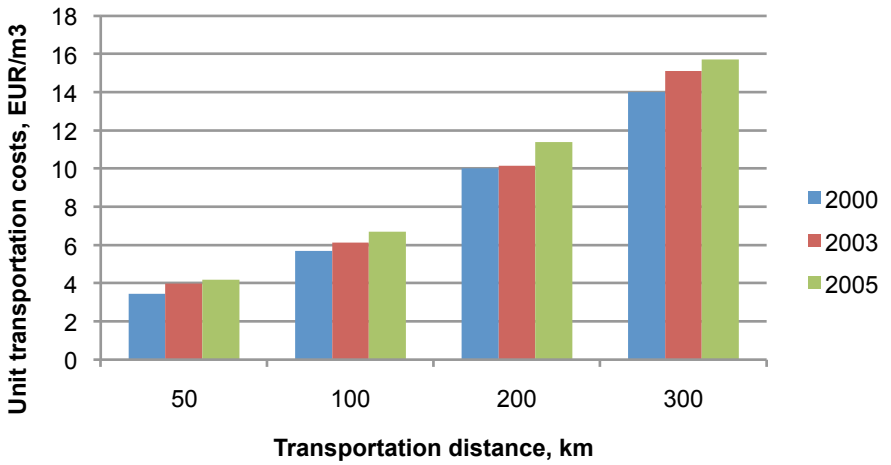


Figure 42. Unit transportation costs for operator from Finland for CTL method of wood harvesting

Alongside with the considered model in the round wood transportation used also timber trucks Volvo and novelties such as combinations of the base machine Ural with different models of Finnish firm KESLA.

5.14 Results of unit wood harvesting cost in calculations for CTL harvesting method

The development of wood harvesting cost for different distances of commercial round wood transportation have been calculated using formula (2). How it can be seen in Figure 43. "The unit WHC in 2005" option 1 and 4 for assortment transportation for domestic market are completely same, and this mean from economic point of view that level of costs is the same. The difference between domestic options: same options 1 and 4 and different option 6, is about one euro. Options are the same as described in Table 10.

According to data from official site President of Russia (www.kremlin.ru) the average transportation distance in Russia for CTL harvesting method increased from 60 km. in 1990's to 200-250 km in 2005.

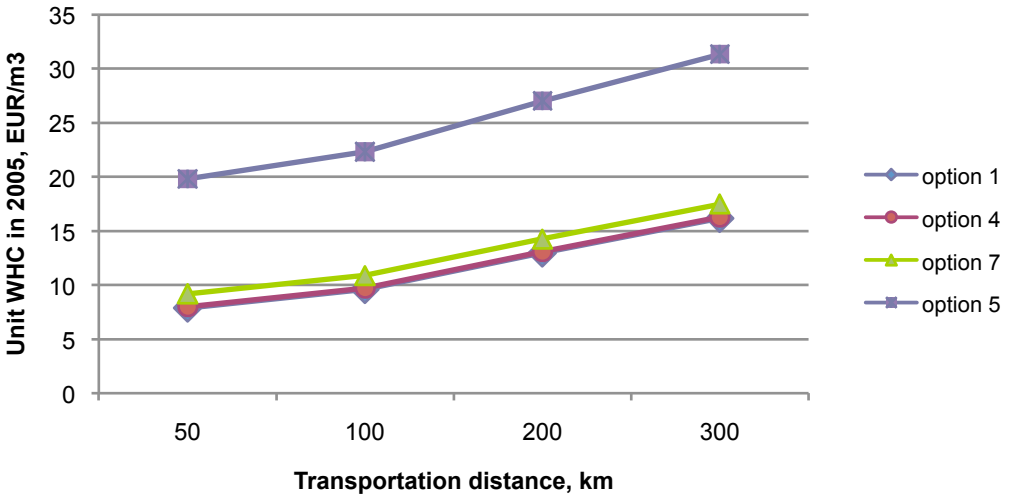


Figure 43. Relations between unit wood harvesting cost and transportation distance in 2005.
Harvesting option 1.="Ural"+"Tayga-245"+TB-1M-16, 4= John Deere 1270D+ John Deere1010D (operator from Russia), 5= John Deere 1270D+ John Deere 1010D (operator from Finland), 7= Husqvarna 365 SP+ John Deere 1010D

Historically the customer is located far away from cutting areas in Russia and also in Karelia. Wood harvesting cost for foreign market is (option 5 from the figure 42) is above 2.5 times higher than for domestic market level due to the using special increasing coefficient for export activities and also western level of wages, western price for petroleum products, and cost for insurance and working visa.

5.15 Lower landing cost calculation for TL harvesting method

The common situation in Karelia is the prolongation of logistic chain by using the lower landing opportunity. Supplementary costs for commercial round wood reloading and storage payment in 2003 and 2005 are 2.00 and 3.00 EUR/m^3. The sum of unit wood harvesting cost has increased correspondingly.

In Russia, the lower landing (*nizniy sklad)* was close to the railway belonging to the Ministry of Railways and Communication. In 2000-2003, in the Republic of Karelia the lower landings with heavily depreciated equipment prevailed. In this study the choice of the equipment was made for the modelling lower landing according to the branches (*otraslevie)* technique typical to forest industry, as described by Burdin (ed.) et al. (1985).

The formula (20) was used for recalculating the wholesale prices of 1985 into the prices of 2000 for the main assets of the lower landing equipment. In this study central measure of inflation was used instead of wholesale price index. In 2000, the lower landing cost for constructions and accompanying objects was more than 50% of its purchase prices.

$$P_{2000} = (P_{1985} \times k)/ k_1$$
$$k = 37$$
$$k_1 = 4 \qquad (20)$$

where, k – central measure of inflation
k_1 - exploitation period of lower landing equipment years

Table 16. The traditional Russian equipment for main operations of lower landing

Main lower landing operation	Applied lower landing equipment	Average number of employees in brigades
Unloading	LT-62	1
Dragging	RRU-10M	2
Cross-cutting	LO-15-S	2
Sorting	B-22-U-1	1- 2
Piling &loading	KB-578	4

Traditionally lower landing works (Table 16) carried out on the basis of some technological streams row material flows grouped on territory of a lower landing. The lower landing technology in operation in Karelia is lower landing equipment of works with longitudinal submission of logs and their individual processing. It allows receiving a wide assortment of commercial products. From the Soviet time the lower landing technological streams were based on system of stationary machines and installations. The operating mode for lower landing depends on the mode of round wood extraction.

Usually two working shifts per working day are used in lower landing works. The seasonal factor has had no direct influence for working process, because in the Republic of Karelia traditionally the logs stocks are done in the lower landings. The organisation of main lower landing operations is carried out by brigades from 8 up to 11 employees. The annual production capacity of traditional lower landings is constant value; annual planned wood harvesting volume was a variable one depending on annual allowed cut. In economic point of view it meant that annual planned wood harvesting volume had been assumed that all round wood cut (into different assortments) in lower landings during one year.

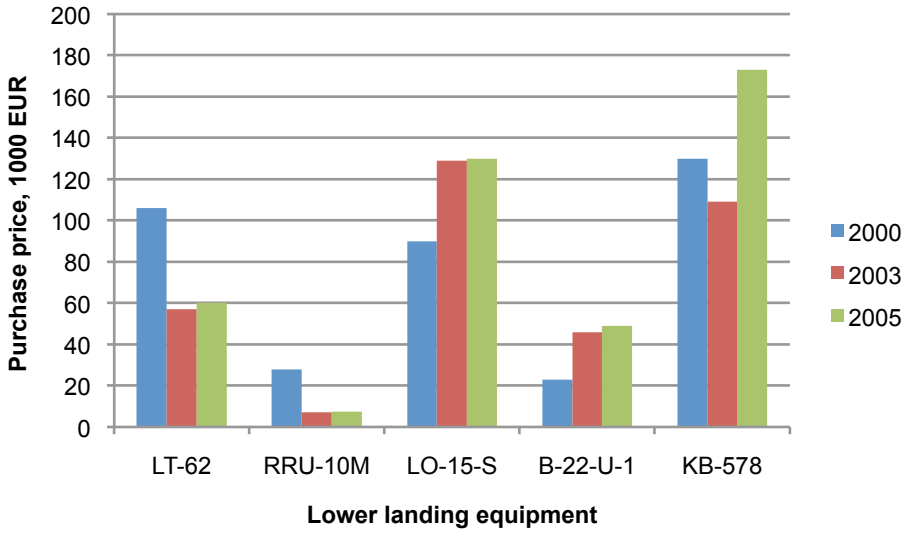


Figure 44. Development of purchase price for lower landing equipment in 2000-2005

Data from Lastochkin et al. (1990) for equipment capacity was used for lower landing cost calculation. The annual factor for dragging, bucking, and sorting equipment operated was 100% of capacity for this cost calculation. In loading round wood materials on railway cars the crane operated with 50% of capacity and in unloading from log trucks to piles by using double-cantilever gantry crane it was operated with about 90% of capacity. The billing tariff for electricity in RK was taken as 0.02 EUR/kWh in 2003 and equalled 0.03 EUR/kWh in 2005.

During the calculation period the constant growth of billing tariff for electricity was observed. Rate of tariffs has increased since Soviet times (1990´s) more than 20 times by 2005. However, during the study period in the Republic of Karelia had the lowest electricity tariff in the Northwest of Russia.

The wages calculation of the lower landing workers was defined in accordance with arrangement of workers, their qualifications and tariff rates. The wages for workers on auxiliary works such as clearing the territory around lower landing from waste products are not taken into account for total lower landing cost calculation.

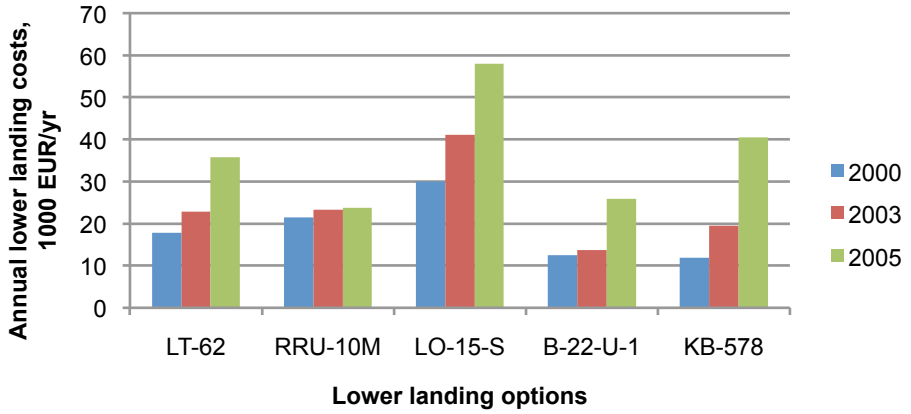


Figure 45. Annual lower landing costs for TL method of wood harvesting

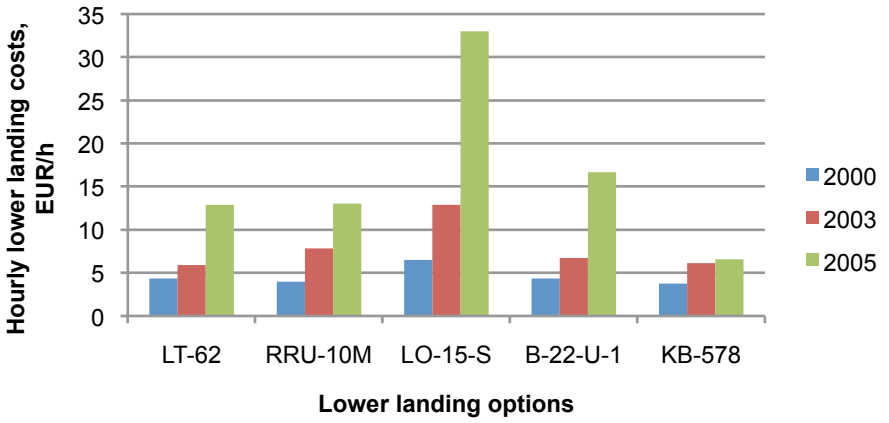


Figure 46. Development of hourly lower landing costs for TL method of wood harvesting

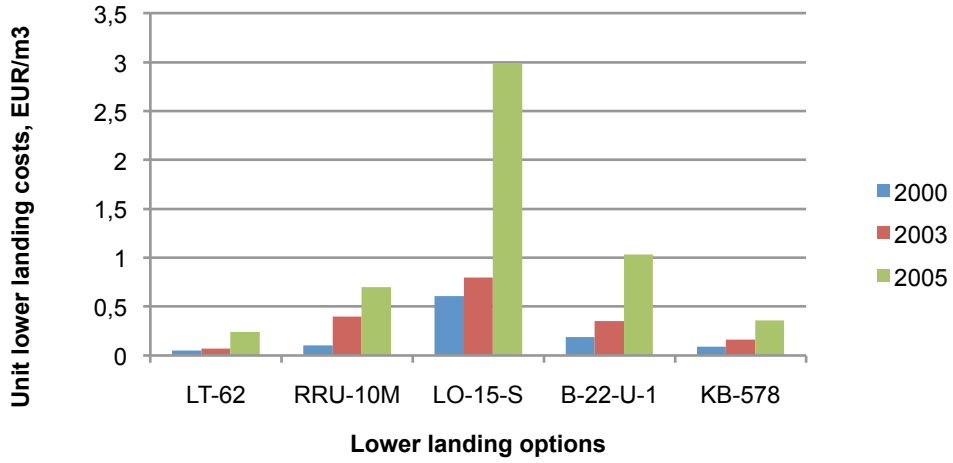


Figure 47. Development of unit lower landing costs for TL method of wood harvesting

The cross-cutting yearly, hourly and unit costs (Figures 45-47) increased more progressive than other main lower landing operation costs. The cross-cutting *(razkryazevka)* was made on mechanized racks on the following assortment programs: sawlogs and balances. The increasing of cross-cutting dued to increased repair costs.

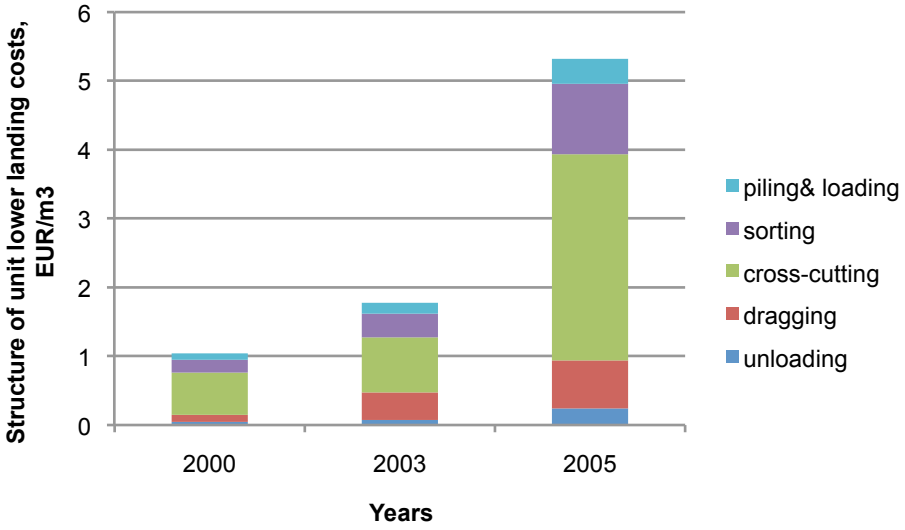


Figure 48. Development of main lower landing operation unit costs

An assembly of lower landing equipments considered in this study is traditional for conditions of the RK from Soviet time. The long-term unprofitable exploitation of outdated lower landing equipments is not available the current criteria of wood harvesting development. During many years the unprofitable lower landings activity were the main reasons of economic losses in logging industry. According to data of JSH "Karellesprom" (2006) in 2005 the total sum of economic losses in logging industry was 425 mil. RUR. RUB. The level of unit lower landing cost (LLC) also increased five times for study period (Figure 48) from 1.0 EUR/m^3 in 2000 to 5.2 EUR/m^3 in 2005.

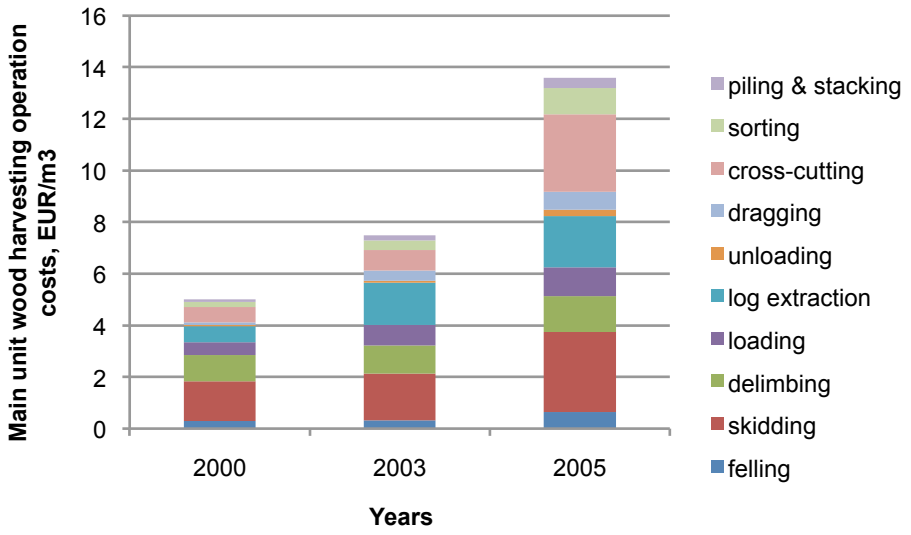


Figure 49. Development of main unit operation costs content for options 2 (Table 13) TL method of wood harvesting

The main average unit operation cost was 4.5 EUR/m^3 in 2000 and 13.5 in 2005. This study revealed that in the period 2000-2005 in the RK the unit cost for main harvesting operations increased 2.5 times. Unit skidding cost grew due to the increased distanse, and cross-cutting grew due to increased tarifs. The next step in logistic cycle is commercial round wood transportation by railway. Usually in Russia commercial roundwood assortments are transported from the lower landing to the customers by railway.

5.16 The cost calculation for railway transportation of commercial roundwood

In this study transportation cost was calculated for railway transportation of commercial roundwood materials from lower landing to domestic market customers and for transportation abroad, to the border of EU countries. The shortest route to the destination is identified with specification of its path, distance, terms of delivery and cost of transportation of the given cargo in the given type of a railway platform including all discounts, inflation and reduction indexes and the fee for obligatory cargo guard. All relevant calculations are made on the basis of Tariff Guide No. 1. (2003) For railway transportation the cost calculation was made on the basis of the railway tariff for cargo rail transportation and Price-list 10-01 (2003) of Federal Energy Commission of Russia. The railway cost calculation for export was calculated only until the railway station on the Russian State border for example, Russian Wärtsilä (Vyartsilya) 2000-2005. During the period of study the average transportation distance from lower landings to domestic customers in Russia was 700 km by railway. That long railway transportation distance for commercial roundwood transportation is not possible applay from economic point of view in the current conditions. This distance is planned to reduce to 400 km in near future *(Strategiya razvitiya… 2008)*. In the conditions of Karelia railway distance was about 300-400 km in average *(Strategiya sosialno-eknomitcheskogo… 2007)*. The unit railway

transportation cost in this study was calculated with using Russian aggregative method of cost accounting for transportation distance 100, 500 and 1000 km by railway wagons.

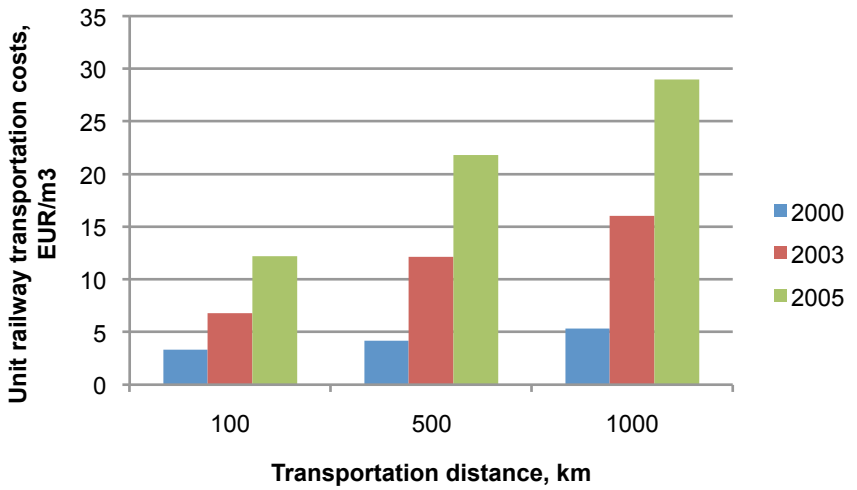


Figure 50. Development of unit railway transportation costs for export market of TL method of wood harvesting

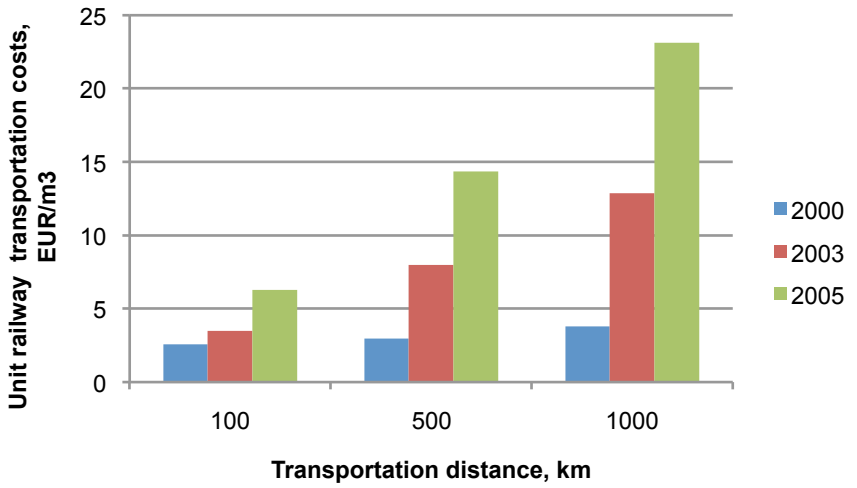


Figure 51. Development of unit railway transportation costs for domestic market of TL method of wood harvesting

The growth of the annual railway tariffs for domestic market have increased the size of railway transportation costs 3.5-4.0 times in the Northwest Russia in 2000-2005. Railroad tariffs are increasing constantly. The major factor for railway cost calculation is the distance of commercial round wood railway transportation. Also railway export tafiff is is deppended on assortiment (pulpwood, sawlog), tree species (birch, coniferous) and type of wagon (semi-wagon, platform, forest wagon). In this stydy was used only assortiments and platform to better comparision between TL and CTL methods.

The guard tariff in railway transportation during the transportation time of commercial round wood has also increasing constantly. This tariff means minimum cost for guards during the whole wood transportation by railways, and this term is widely used in Russian trade policy and also in Western economics. The protection tariffs are different for domestic market and export. Guard tariff for foreign market is higher than tariff for domestic market. Transportation time influences to dimension of the guard tariff (longer transportation time then higher extra cost for guards). In this study the extra costs for guards were not calculated.

In current situation the level of railroad tariffs for domestic market is coming nearer to level of export tariffs. In RK the rate of domestic tariffs was less about 30 % than level of export tariffs in 2000-2005, due to the tariffs of railway policy in Russian Federetion. The rising tendency for domestic tariffs are higher costs and extra costs for guarding.

Unprofitable lower landing activities and higher railway transportation costs for TL harvesting method have redused the economic eficiency of using TL wood harvesting method in the near future.

5.17 Unit costs of wood harvesting for TL harvesting method

Unit wood harvesting cost for TL harvesting method for domestic market and export were showed in Tables 16-17 This economic parameter has been calculated using the formula 21.

$$UWHC=HWHC/HP \quad (21)$$

where,
UWHC = Unit wood harvesting cost (EUR/m^3)
HWHC = Hourly wood harvesting cost (EUR/h)
HP = Hourly productivity (m^3/h)

For period 2000-2005 the rate of unit wood harvesting cost was increased for all harvesting options using TL harvesting method.

Table 17. Unit wood harvesting cost (WHC) for domestic market when long-distance transportation was made by railway in 2000-2005, EUR / $м^3$. Options from Table 8.

Harvesting options	2000			2003			2005		
	Railway transportation distance, km			Railway transportation distance, km			Railway transportation distance, km		
	100	500	1000	100	500	1000	100	500	1000
1	6.5	6.9	7.8	8.6	14.0	17.9			
2	7.1	7.5	8.3	8.0	14.4	18.3			
3	7.5	7.9	8.8	9.2	14.7	18.6	19.8	27.8	36.6
4	7.2	7.6	8.4	9.1	14.6	18.5			
5				9.0	14.5	18.4	19.2	27.6	36.3

1 =”Ural”+TDT - 55A+”Tayga-245”+PL-1V, 2= ”Ural”+TDT -55A+LP-30G+PL-1V, 3= “Ural”+TB-1MA-15 +LP-30G+PL-1G, 4= LP-17+LP-30G+PL-1V, 5 = “Ural” +TLT-100A+LP-30G+PL-1G.

Only small differences in unit WHC between different harvesting options for TL harvesting method was observed. In 2005 the difference in unit WHC between option 3 and option 5 was 0.5 EUR / m^3 on the average (Table 16). From economic point of view both harvesting options (option 3 and option 5) can be used for practise in wood harvesting in the future. The final decision in favour of either of the harvesting options for TL harvesting method depended on the priorities of the top managements of the concrete logging company in the RK.

Table 18. Unit Wood Harvesting Costs of TL when long-distance transport is done by railway for export in 2000-2005, EUR / m^3.

Harvesting options	2000			2003			2005		
	Railway transportation distance, km			Railway transportation distance, km			Railway transportation distance, km		
	100	500	1000	100	500	1000	100	500	1000
1	8.5	8.9	10.1	11.2	18.2	23.3			
2	9.2	9.8	10.8	10.4	18.7	23.8			
3	9.8	10.3	11.4	12.0	19.1	24.2	25.8	36.2	47.6
4	9.4	9.9	10.9	11.8	19.0	24.1			
5				11.7	18.9	23.9	25.0	35.9	47.2

1 =”Ural”+TDT - 55A+”Tayga-245”+PL-1V, 2= ”Ural”+TDT -55A+LP-30G+PL-1V, 3= “Ural”+TB-1MA-15 +LP-30G+PL-1G, 4= LP-17+LP-30G+PL-1V and = “Ural” +TLT-100A+LP-30G+PL-1G.

For study period 2000-2005 the difference in unit WHC between different harvesting options for foreing market was on average 1.0 EUR / m^3 illustated in Table 17. European trade policy and the international system of commercial round wood certification can affect the selection priorities of the chosen wood harvesting options for TL harvesting technology.

5.18 Comparison of unit wood harvesting cost for TL and CTL harvesting methods.

One at the most important result in this study was a unit wood harvesting cost comparison between TL and CTL harvesting methods (Figure 52). For study period the average distances of delivery of commercial round wood logistical cycle “cutting area – customers” for RK was 300 km.

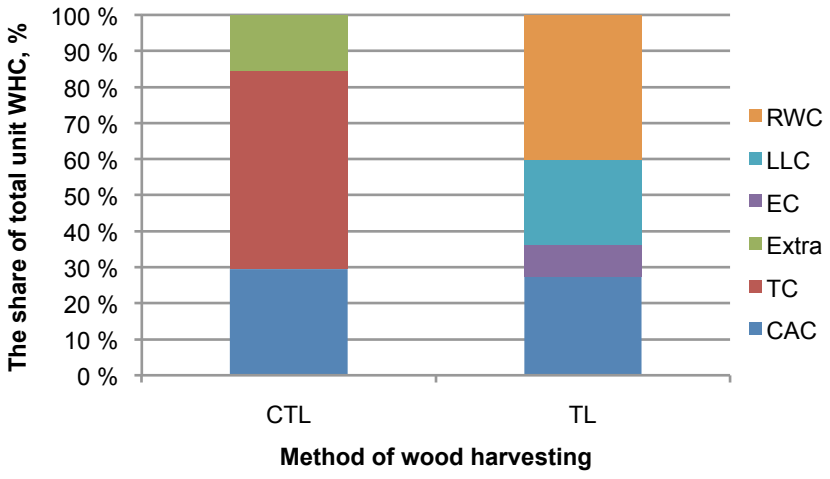


Figure 52. Comparison between structures of the total unit wood harvesting cost (WHC) in 2005
CAC= cutting area costs, TC=transportation costs, Extra= extra costs, EC= extraction costs, LLC= lower landing costs, RWC=railway transportation costs.

Total unit cost of each parts of logistical cycle was calculated as a proportion of total units cost of all cycles. The small difference in the share of CAC of the whole unit WHC between CTL and TL wood harvesting methods can be seen. In practice this difference in logging activity made 1.0 – 2.0 EUR/ m^3 on average in 2005. The distinction in other shares of WHC structure is caused by specificity of technological process and transportation distance from the upper landing to the customer. For TL harvesting method, the share of RWC was 40 % of the WHC. The amount RWC is twice as high as the sum of CAC, TC and LLC. For CTL harvesting method the rate of extra cost is also very high

about 15 % of the WHC. Extra costs are costs of transformations from one car to the other or to the exterminales during the whole transports.

Table 19. Comparision alternative cost acccounting (CA) methods when using the same machine in Russian conditons

Forwarder John Deere 1010D	Nordic CA method	Soviet/Russian CA method
Accounting year	2005	2005
Purchase price EUR	190 000 EUR	190 000
Duration of working shift (h)	10-12	7
Calendar time (days)	252	269
Gross effective time (h)	3856	3766
	Annual Variable cost (EUR)	
Wages	19233	7184
Unit Tax 40 %	7693	2873
Fuel and lubricants	39769	15571
Maintenance service and repairs	15 000	23468
Total annual Variable cost	81695	49096
	Annual Fixed cost (EUR)	
Depreciation	29457	29335
Leasing 12%	17233	
Insurance (in Russian territory)		
Other	4037	2101
Total annual Fixed cost	50727	31436
Risk 5%	6236	
Annual TOTAL EUR/yr	138656	80532
EUR/h	36	21
EUR/m^3	2.39	1.42

There is one euro difference between this methods in unit cost, because of leasing, risk and low-lever wages. The insurance is theoretically set of amounting sum not ecceeding the actual value of insurance property according to contract with insurance company. Comparison of harvesting methods for the period from 2000 to 2005 show a steady growth of unit wood harvesting cost in real prices (Tables 20, 21).

Table 20. Unit wood harvesting cost for TL harvesting method, EUR/m^3

Railway transportation distance, km	Domestic market			International market		
	2000	2003	2005	2000	2003	2005
50	8	12	17	10	16	22
100	11	16	18	14	21	24
150	12	17	19	16	22	25
200	13	18	20	17	24	26
250	14	20	21	18	26	27
300	15	21	25	20	27	33

Table 21. Unit wood harvesting cost for CTL harvesting method, EUR/m^3

Truck transportation distance, km	Domestic market			International market		
	2000	2003	2005	2000	2003	2005
50	8	10	12	14	18	21
100	9	11	14	17	20	23
150	10	12	16	19	22	25
200	11	13	17	21	24	28
250	12	14	19	23	27	30
300	13	15	20	25	29	32

It is visible that wood harvesting cost for study period has increased for both harvesting methods in the RK at least 2.5 times from current price in the Tables 20 and 21.

The real cost during 2000, 2003 and 2005 was recalculated in 2006 money (Table 22). For this purpose the indexes of inflations were used. One can see, that in real terms the unit costs have grown only 1.5 times (without deflation).

Table 22. Unit wood harvesting cost for two different cost acconting methods with transportation distance from 0-300 km in cutting season in 2006 money

Harvesting method	Unit wood harvesting cost, EUR/m^3					
	2000		2003		2005	
	Nordic method	Russian method	Nordic method	Russian method	Nordic method	Russian method
TL	13 - 22	19	15 - 24	20	16 - 32	24
CTL	12 - 35	17	9 - 36	16	10 - 37	18

6. DISCUSSSION ON THE RESULTS AND CHALLENGES IN MANAGEMENT AND WOOD HARVESTING COST ACCOUNTING IN THE REPUBLIC OF KARELIA

6.1. Discussion on results and challenges related to cost accounting

The cost price calculations above ends up to the year 2005. Very recently Gerasimov et al. (2009) presented cost calculations for Nordic machinery for the year 2008. Their data came directly from the logging companies such as holding company "Karellesprom", which has collected those information from integrating logging companies using CTL method of wood harvesting. The results show that forwarding costs and whole CAC have a bit increased from 2005 level, but mostly they are in line with this study.

According to Russian cost accounting method the wood harvesting cost has been calculated only for total average transportation distance as whole. Using Nordic cost approach all procedures of the wood harvesting cost can easily be calculated in a more comprehensive way so that cost management will be more effective. A simple example of such an approach applied for CTL combining cost centres and integrated cost elements has been shown earlier (Table 22). As the basic logic of forming cost centres along the logistic phases of the supply chain is similar in Russia and in the Nordic countries, this type of combinations are easily to be done (and perhaps are already applied in practice). That is why applying ideas from the Nordic cost accounting practices can be very useful for increasing profitability in wood harvesting.

In fact there are numerous objective reasons taking place in the wood harvesting, which are influencing the harvesting costs to increase. The most important objective economic reasons of growth of wood harvesting cost have been:

1. Rise in purchase prices for machinery
2. Rise in prices for fuel materials
3. Rise in prices for railway transportation
4. Rise in wages and salaries

For each logging company in the RK perhaps the most common economic reason continues to be the rise in wages and salaries, while other cost increase pressures may be more fluctuating. Interaction between logging company managers, banks and municipal government is also very important for wood harvesting cost management. In any case it is the continuous improvement of current Russian operational management and cost management systems, which is necessary.

Concerning the prices of logging machinery, the period of "monopoly" of Russian machinery in wood harvesting has ended in the Republic of Karelia as elsewhere in Russia. The further development of new Russian logging machinery is possible only in the competition with Nordic machinery. The share of cut-to-length technology and the use of the Nordic machinery in wood harvesting are increasing. This has partly been due to the increased export of round wood to Finland but as the calculation has demonstrated - also due to the cost advantages the cut-to-length (CTL) method has offered in the conditions of smaller size of harvested growing stock and the needed better allocation of wood assortments. Anyway, if development in logging machinery sales to Russia leads to the marginalization of the Russian production of logging machinery, it also may end up to new " monopoly" situation if domestic logging alternative is not available in larger scale.

Development of the cost management for wood harvesting cost accounting is necessary for the future development of the market economy conditions. For a logging company, decreasing of the costs and search of optimum technology are individual decisions. Continuous improvement of professional management knowledge and development of the new software for cost calculation of wood harvesting activities in small, middle-size as well as in large logging companies are needed. In future, a new cost factor – or a possible cost saving depending on the way wood purchase is organised – is the cost of capital related to the value of purchased and paid wood to be procured. An increased speed of wood procurement ("hot supply chains") will save the interest costs related to the capital employed for wood purchased. As seen, in this study this cost is not included in the calculations.

The normative method of cost calculation that was used in the Soviet Union for wood harvesting is still in principle – although in updated and improved form - utilized in Russia. For the staff of a logging company a standard procedure is available what as such is a good thing. How efficiently cost accounting and management is used may largely depending from wood harvesting volume. The present study aims to contribute to the development of cost accounting in wood harvesting in Russia in future. The cost standards and in particular their real life and real-time applications in the changing Russian conditions requires more advanced research in the future both for cost calculation of tree-length (TL) and cut-to-length (CTL) wood harvesting methods. It is hoped that he basis of the method of wood harvesting costs (WHC) calculation used in this study can inspire new development not only in the one republic but also in other regions of Russia. Nowadays any logging company in the Republic of Karelia and elsewhere regardless of the orientation to domestic or foreign markets has the right to choose their harvesting technology and other parameter of their business . In the RK the use of the new Nordic machinery has been useful in increasing of economic efficiency of wood harvesting by means of both local forces and perhaps through the transfer of the contractor model in wood procurement widely used in the Nordic countries and other countries.

6.2. Discussion on the challenges of wood harvesting management

There are a number of other more broad economic factors, besides those given above, which are essential for further development of logging and wood procurement in general, and not only in Karelia but also elsewhere in Russia. These factors have influence both on the strategy of wood harvesting (and wood procurement) development and on the decision-making of the operational logistic systems. The factors identified in the following can be seen as challenges, on which the logging companies, processing forest industries and in part the whole forest industry related administrative system at regional and federal levels need to give increasing attention.

a) *Increased competition in forest industries*

This challenge has already become apparent during the period of transition to market economy. Competition is an essential part of all functioning markets and it is present every day in all market economies However, markets and companies become more and more international and global. As wood costs represent the largest single production cost item in particular in wood product and pulp and paper industry, it is necessary that logistical wood supply system are economically efficient. In countries, where private forest ownership is prominent, the pressure for efficient logging comes also from the sellers of roundwood. While state as the forest owner in Russia has also other ambitions than private owners, it has also a need and an aim to get better stumpage price for roundwood sold to secure the financing of sustainable forestry.

b) Differentiation and interaction of export and domestic roundwood markets

Although the export of roundwood (Toppinen and Toropainen (eds.) 2004, Vinokurova et al. 2005), lumber and forest industry products has always been part of Soviet / Russian forest sector, the differentiation of roundwood supply for export and domestic markets has became more pronounced during the increased roundwood export.

Logging companies search for business partners in the European market. Specific feature of the Republic of Karelia is its cross-border geographical position. Therefore, it is not surprising that for the given region foreign market is dominant, and the basic buyer of roundwood has been Finland. During the transition period 1992-2006, supply of unprocessed timber of coniferous species and birch pulpwood on the foreign market became the only way of gaining net capital for investing both in the development of domestic market and renewing permanent assets of existing logging companies. Rates of growth of the domestic market have been lower than the rates of growth of the foreign market, but for the majority of logging companies' domestic market will remain the main one, notwithstanding that the prices at domestic market are lower than those at the foreign market.

However the special changes of Russian market economy have considerably changed the market situation for logging companies. In Karelia and elsewhere the drastic although

stepwise establishment and increase of tariffs on exported roundwood from Russia (Government Regulation no.158 2006) in 2007 has practically almost closed the export markets of coniferous roundwood to Finland and other countries. The extra tariff cost has mode it unprofitable for Finnish companies to export and Russian logging companies to export wood. As roughly half of cutting volume in Karelia has been exported, this kind of state cost management has significantly reduced earnings and employment in the logging sector. As the logistical chains for roundwood export are assumed to have been rather effective, it might be possible to have only marginal improvements in logistical chains to compensate tariffs, but as such it is a reminder that not all costs are under the control of companies. Whether the domestically oriented forest industries have got a boost to develop their activities to some extent compensate the employment and income losses is yet to be seen[2].

c) Flexibility of production

The changes, even less drastic than the above, are always part of economy. Flexibility of production is an economic variable with has an effect also on the profitability of logging companies and on their ability to react quickly to market conditions. Flexibility is determined by the ability to adapt quickly to changes. The Nordic machines used in the Karelia have provide basis for flexibility. From the economic side this means competitive advantage received both in the domestic and export markets. The different log length grades and quality of wood processing, especially quality of delimbing, correspond easily to existing or changing Russian or export standards.

d) Attraction of loggers to the production management

Drawing loggers to the production management has a big influence on the system of decision-making as a whole. In logging companies it has been started to bring responsibility to lower levels and delegate the solution of industrial

[2] Very recently, the freezing of further tariff hikes has been continued until 2011. Problems to the bottom levels of industrial structure. The reason for such tendency is the recognition of competence of the workers in issues of production and ability to contribute and develop the production system.

e) Company reformation in process

Standard program of reforming the commercial company was developed by the Ministry of Economics of the Russian Federation in the middle of 1997. This program includes actions, some of them obligatory, which should be implemented by commercial company in order to make its operations relevant to existing legislation and other normative acts. Other actions are only recommendations, and their necessity depends of the industrial activity of the company. Program includes a tool which helps to analyze economic requirements of production management and recommendations for choosing optimum way to achieve the objective. Compulsory requirements are as follows:

1. Transfer the function of running the register of shareholders to an independent registering clerk, what will allow to create the systems of shareholders' rights registration as well as the rights to use and command property.
2. Revision of the charter of the company and clarification of the contract with the manager with the aim to clearly delimitate power and responsibility between the founders and the manager.
3. Elaboration of measures on reducing not-monetary settlements.
4. Development of a specific program of measures on liquidation of debts for salaries.
5. Transition to charging the VAT and excises in process of shipment, the date of shipment being the day of transferring appropriate negotiable document of title, and the date of performance is considered the day when their performance is actually declared.

Despite that reforming of the company is not an obligatory condition for its further existence, it is only after reforming that they will be involved in commercial highly effective investment projects. Such companies will have an opportunity of additional crediting by means of acceptance by the state of a part of financial risks within the

framework of the budget and development when getting credits from banks (*Programma restruktarizatsiy 1998).*

f) Environmental issues

Control over pollution of the environment (Kortelainen 2002), and processing of waste are the key questions of the forest logging industry. Laws and decisions regulating these questions become more and more completed; and penalties for non-observance of ecological norms can be very severe (State committee… 1994-1996, 1998) Consequences for neglecting environmental issues are well visible in different regions of the former Soviet Union.

Forest fires, insects and diseases cause significant loss for logging activity. In Russia the area of forest fires annually exceeds 1 million hectares. Many years of ignoring problems have resulted in deterioration of the condition of the environment, and many years and enormous amount of money are required to correct the situation.

g) *Vertical integration in forest sector*

Since the beginning of transition period, which brought breakup of integrated organisations in forest industries also in Karelia, vertically integrated structures are developing again also in Russia. Further processing of raw material will provide better economical output to the companies. The basic purposes of integration for the present-day Russian forest sector companies are:

- balance of incomes and costs in the chain "logging company-customer"
- cost reduction
- strengthening of position on promising markets
- expansion of geographical borders of economic efficiency of high technologies and new machinery
- increase of competitiveness of production
- creation of new jobs and attraction of investments to the developing countries
- Practical use of the principles of strategic long-term planning and forecasting

Current economic situation in Russia, however imposed certain restrictions on integration processes of forest sector companies. These are the factors that hinder the process

1. Present political and economic instability.
2. Insufficiently organized mechanisms of state regulation of economy.
3. High level of corruption in the society and also in administration.
4. Great difference in living standards between various social groups of the population in Russia.
5. Lack of qualified administrative staff appropriate to the task in question and incomplete comprehension of management problems by the owners of vertically - integrated structures.

All abovementioned factors are significant obstacles for creating sound vertically integrated structures. Organizational construction of these requires three components: financing, manufacturing and trading. In current conditions of vertically integrated structures, one of this three components usually dominate, and as a result either a group of industrial companies is formed or a bank holding with a set of controllable or industrial company (Kondratuyk 2004, Bulatov and Shegelman 2004, Shiskin and Ponomarev 2004). In 2000 the basic scheme of management structures, coordination and regulation in the forest sector of the Russian Federation was offered by the experts of the Open Joint-Stock Company "*NIIPIEIlesprom*" from Moscow (Burdin et al. 2000).

In the Republic Karelia the integrated structures were generated during 2000-2001. There are four big vertical integrated structures in RK nowadays. They are illustrated in Figure 52. Oldest one is JHC "Karellesprom", which includes more than 20 different joint-stock companies. Second one Investlesprom, which was founded in 2006 and is the biggest player in forest sector in RK. It includes *Segezha* pulp and paper mill, *Segezha* sawmill, *Ilìnskiy* sawmill, Karelia wood–board mill, *Medvezhegorsk*y, Muezersky, *Kostomukshsky, Lendersky, Severny* logging companies. The third one Stora Enso includes *Ladenso, Olonetsles* and Impilahti sawmill, and also IKEA (Swedwood logging company, sawmill and solid board mill).

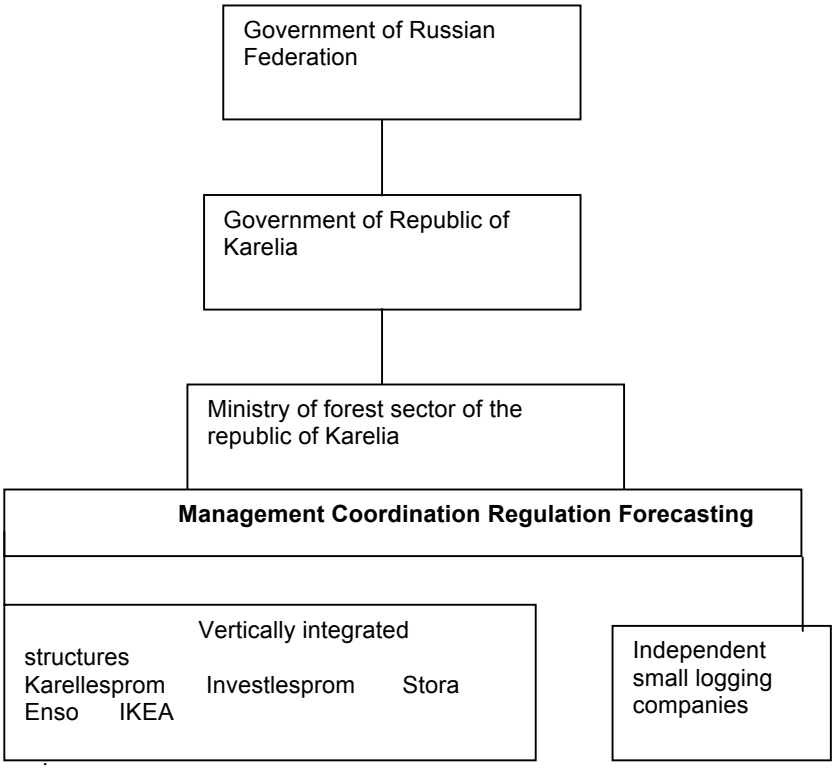


Figure 53. The current management scheme for logging industry in the Republic of Karelia

A theoretical attempt has been made, without the pretence of being indisputably true, to consider the questions of integration of logging companies with other companies and associations of the Republic of Karelia and foreign partners. Modern large logging companies in the Republic of Karelia can be characterised as:

1. Improvement of management and increase of the responsibility of managers.
2. Integration of means for development; research, testing and engineering developments and purchase of know-how.
3. Decreasing competition by means of rationalization of sales and distribution.
4. Concentration of capital basis and expansion of manufacture what in turn will promote the establishment of stable industrial connections among associated partners in.
5. Decrease of the unit cost and tax payments; creation of conditions for ensuring flexibility and the opportunity for manoeuvring resources in favour of the interests of the preferable choice of strategic positions in competitive struggle and social and economic consequences.

New type of logging company may be produced with formation of holdings and corporations in Russian forest sector. Alongside with positive points in the development of integration process a number of negative points can arise too. For example, management gets more complicated and becomes of higher quality when the structure of integrated companies company gets more sophisticated. The loss of trading reputation of partners is possible and the problem of practical realization of integration can appear to be difficult for a number of subjective and objective reasons. Integrated structures require appropriate system of parameters, which should be developed, for estimating their efficiency and stability.

h) New management mission of a logging company

Generally speaking, the major task of management is the establishment of the purposes for the sake of which a company forms, functions and develops as a complete system. Under new economical conditions the management function of Russian logging companies starts from identifying the mission, which would express the philosophy and meaning of its

organization and existence. The mission specifies the status of the logging companies, and declares principles of its operations. Large logging companies did not need to identify their missions in the Soviet period, because all goals and objectives came from the higher rank level via the system of planned targets and the forest resources were allocated and used centrally. Today definite rules of economic objects' behaviour are required, i.e. promulgation of the main mission for all logging companies in the Republic of Karelia, without any contradictions. The main question for Russian logging companies is to find the answer - what is the general aim of the company for today and for the future?

Direct principles in forming the mission for modern logging companies can be formulated as follows:

1. Achievement of good economic results at all phases of forest harvesting process and wood transportation.
2. Harvesting technology of the wood must be economical and flexible.
3. International standard systems of wood quality certification should be adopted
4. Professional use of management function.
5. Monetary support of new ideas.
6. Team work
7. Free information exchange.

Two first principles requires improved cost accounting while the other are to be developed through better management skills.

Currently the mission of any Russian logging companies nowadays is depending on:

- current financial condition of the logging company
- its organizational structure
- existing forms and methods of work on the main harvesting operations

The existing constraints mean that the development to the new mode of management can only be a slow and gradual process. However, there are numerous management orientations developed in the management sciences, which can be more systematically used to support the suggested changes. In the following only one is introduced as it is widely used, clearly formulated - and not far from existing systems of management.

i) Management by objectives

Different forms of missions for logging company form the momentum for identifying overall goals of integrated structure, their subdivisions and functional subsystems. Goals are specifications of the mission of a company in the form accessible to the management of their implementation process. For them the following features and properties are characteristic for their goals.

Precise orientation to a certain time period.

Concreteness and measurability.

Consistency and coordination with other goals and resources.

Addressing and controllability.

The objectives are set and achieved according to strategy, current and operative development of the company. They imply solution of problems in economic, social, organizational, scientific and both technological and unforeseen situations. Classification of goals allows to concretize objectives and use appropriate mechanisms and methods aimed at different groups of goals.

Drawing up target models represents the initial stage of management by objectives. This concept is a used in modern Western management theory (Rumyantseva et al. 1995). The essence of the given concept consists of the following: the control system is guided by the achievement of all goals and objectives set for the logging company.

Each manager of a logging company clearly sees the goals as they are coordinated at all levels of management in advance. The management body of logging company has installed the main company goals.

The whole process of management according to goals consists of the four stages:

The range of power and duties of managers of all levels is defined.

Management goals and objectives are developed and coordinated in the framework of the established duties by levels and persons.

Practical plans for achieving the goals set.
Control and assessment of work and results achieved by each manager is made; tasks and resources are modified by the feedback channels, what may require new approval of goals.

Thus, if development and adoption of a goal is the beginning of any administrative activity, then its obligatory continuation is definition of kinds of work and resources, which are necessary for achieving these purposes. The management system of logging companies not only makes and adopts plans, but also organizes their execution by forming structures, processes and methods on the basis of which a joint work with executors is organized as well as its effective implementation. The execution then is estimated at the level of executors, subdivisions and the whole company. The benefits of the system are due to the fact that each manager has a clear idea of both his goals and the goals of his company on the whole. Motivation to work is strengthened as a result of direct participation of managers in setting and approving of the goals and objectives. Under these conditions each manager feels personal interest in achieving the goals. As a rule, during realization of the concept, mutual relations between managers and staff are improved, and the systems of monitoring and assessing the work of each employer are enhanced.

However, this system of management does not bring success at a badly organized and badly managed company where imposing goals from higher rank levels is a rule, and where managers of other levels and executors are not involved in the process of developing, formulating and agreeing upon these goals. It does not work if control system is not organized properly, paperwork limits initiatives and creativity, goals are turned into forced tasks and any assignments are regarded as undesirable. Management according to goals gives effective result only if sustainable management is in place, i.e. if there are appropriate conditions for it and the conditions where the attention of higher managers concentrates on the achievement of current and short-term results not to the detriment of long-term goals.

To summarize, the goals and objectives define the quality and type of management works, which ensure their achievement. The e functions, which are integral part of any managerial process regardless of special features (size, purpose, and patterns of ownership) are planning, organization, coordination, control and motivation. Their interrelations are presented in Figure 54.

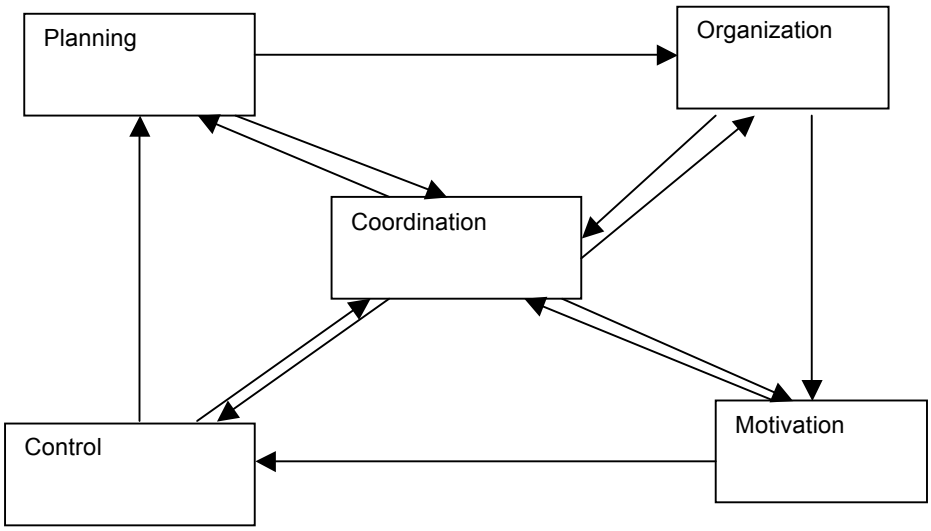


Figure 54. Interrelations of main management functions in Russian logging industry (Murashkin et al. 2010)

In the process of management, variety of ways, approaches, and techniques are used that allow to effectively organization the execution of the functions, including also the stages, procedures and operations necessary for decision-making. All together they act as methods of management, which are interpreted as ways of realizing management activity that are used for setting and achieving goals.

This whole chapter 6 is illustrated as bridge between theoretical concepts and large-understanding management practice.

7. GENERAL CONCLUSIONS

A general objective of this study on the development of the management and cost accounting of wood harvesting in the Republic of Karelia, was to analyse changes in the cost accounting systems, describe and discuss this changes in management system, that occurred during the transformation of the economic structures from the Soviet period up to the present market economy. Another objective was to study the theory and practice of cost accounting as it was applied to wood harvesting during the same period of transformation. Through these objectives the aim was to provide the background necessary to allow an assessment of possible ways of increasing the profitability of Russian logging, through the development of progressive management and with improved methods of cost accounting and cost management for harvesting.

The following general conclusions can be drawn from this study.

1) Wood harvesting in the Republic of Karelia has had a long history of development and the constant demand for commercial roundwood from domestic and foreign markets has continued up to the present. A domestic market orientation has dominated the trade in roundwood for quite a long time, however, roundwood exports gradually increased and with them the share of cut-to-length (CTL) technology used. Karelia's geographical location and the accessibility in the region to productive forest resources that need silvicultural cuttings, have been important to the development of CTL harvesting. Application of Nordic CTL methods has been very important during the development of the market economy in the Russian forest sector. The relative share of Russian wood harvesting machinery used in Karelia has been significantly declining over the last few years. The demand for domestic machines has declined to such a level that their production has drastically decreased. Thus from an economic point-of-view, development of new Russian machinery for wood harvesting is possible only under such conditions that they compete well with available Nordic machinery. There will however, be a need for the development of a domestic market between the large or middle-sized logging companies for the resale of used Nordic machinery, but this is not expected soon. For the development of such a resale market, it is necessary to make an economic analysis of the cost-effectiveness it would have on harvesting.

2) The status of the traditional lower landing has been transformed, along with the traditional Soviet term for it; a lower landing "*nizniy sklad*" has been changed to a stock market "*birgza.*" It is has been necessary for those logging companies using the TL method to reconsider the status of the lower landing by updating the terminal area. Total abolishment of the lower landing to decrease costs is impossible for two reasons: the first is to maintain female employment in forestry settlements, while the second is to aid in the timely detection and removal of logs with heart rot.

3) The Soviet theory and method of normative cost accounting has, as such, been a representative approach in the sphere of the application and development of the standard cost accounting for wood harvesting. It has remained,although as updated in principle in the same form, through the transition to the market economy. This normative method for cost-price accounting can be seen also as a Soviet/ Russian model of direct-costing, and can be used as basis to develop new normative in future. In principle, it presents a standard form of costing, which is commonly used in process costing when masses of identical or similar units of output are produced (Bhimani et al. 2008). This normative system of direct-costing that was used earlier as a strategy to control costs, is now applied by Russian logging companies for management accounting, to make day-to-day decisions, in the same way it is usually used in the West. As was concluded earlier, here is no fundamental structural difference in the definition of the concept of wood harvesting costs between Russian and Nordic methods, since in both cases this concept implies cost centres along the supply chain and the sum of fixed and variable costs. There are, however, some dissimilar features to the Russian and the Nordic methods of cost calculation. For example, the Nordic method accounts for commercial risk and for insurance of mechanical equipment. The potential of cost management accounting should also be explored and utilized. The correct calculation of a unit machinery cost and of a machinery exchange value are some examples of cost accounting and cost management development.

4) Soviet/Russian cost calculation norms for harvesting equipment were developed for domestically produced machinery designed for tree length (TL) harvesting. These domestic norms were created and have developed over time only for the normal machinery service time *(srok sluzby)*. Under Russian conditions, a theoretical, economically efficient, normal service time for domestic machinery was considered to be about 5 years. In practice, especially during the period from 1992-2007, the real service time for domestic machinery has been more than two or three times longer than the theoretical one. In this "extra long-term" use of domestic machines the theoretical domestic norms that were developed for this equipment cannot be considered to be adequate. According to an earlier report by Rantapuu (1999), the cumulative working shift productivity for this extra long-term use of domestic machinery is in reality less than two times the norm. If the profitability of logging is to be increased, it would then be necessary to take this into account in real applications and also develop an updated domestic normative data base for logging work.

5) The system and structure of management for wood harvesting that has been used during many decades has influenced the profitability of logging companies. Some elements from the Soviet economy have remained up to the present, for example the Joint Stock Company (JSC) "Karellesprom" still has the position as a coordinating element for harvesting in the region. However, in cuttings areas a new form of organisation for logging work can also be seen. In 2006, a 24-hour work period was made the standard for cutting areas; this replaced the 7-hour standard that had been in place for 50 years. The productivity of Nordic machines can be improved by increasing the duration of a working shift. A 10-hour shift is recommended as the optimal duration to apply to Nordic machines. There is also a growing interest in the quality and efficiency of production among machine operators. This is related to a shift in the organisation, to small efficient harvesting teams. Another specific practical recommendation for improving management is that the transportation costs for roundwood be calculated (using software) for each 10 km of distance. Correct delegation of power, choosing the right objectives, and teamwork is necessary for the further development of wood harvesting. Continuing the development of a more effective model of management for wood harvesting is a necessary prerequisite for progress, in addition claims that nepotism is present in management require some concern. Increasing the profitability of wood harvesting is the current crucial economic task for the forest sector of Russia.

In future studies, the costs accounting could be understood as a part of management accounting and thus as a tool for the better controlling of costs by the management. Parallel with studying management accounting in practise could be also be a further revisions of the details of the normatives related to the major cutting area and other harvesting operations in the Russian Federation.

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