



International Institute for  
Applied Systems Analysis  
[www.iiasa.ac.at](http://www.iiasa.ac.at)

# **Development Options for the Lower Angara Region (LAR) in Siberia**

**Malov, V.**

**IIASA Working Paper**

**WP-96-115**

**October 1996**



Malov V (1996). Development Options for the Lower Angara Region (LAR) in Siberia. IIASA Working Paper. IIASA, Laxenburg, Austria: WP-96-115 Copyright © 1996 by the author(s). <http://pure.iiasa.ac.at/id/eprint/4912/>

**Working Papers** on work of the International Institute for Applied Systems Analysis receive only limited review. Views or opinions expressed herein do not necessarily represent those of the Institute, its National Member Organizations, or other organizations supporting the work. All rights reserved. Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage. All copies must bear this notice and the full citation on the first page. For other purposes, to republish, to post on servers or to redistribute to lists, permission must be sought by contacting [repository@iiasa.ac.at](mailto:repository@iiasa.ac.at)

# Working Paper

## **Development Options for the Lower Angara Region (LAR) in Siberia**

*Vladimir Malov*

WP-96-115  
October 1996



International Institute for Applied Systems Analysis • A-2361 Laxenburg • Austria

Telephone: +43 2236 807 • Telefax: +43 2236 71313 • E-Mail: [info@iiasa.ac.at](mailto:info@iiasa.ac.at)

# **Development Options for the Lower Angara Region (LAR) in Siberia**

*Vladimir Malov*

WP-96-115  
October 1996

*Working Papers* are interim reports on work of the International Institute for Applied Systems Analysis and have received only limited review. Views or opinions expressed herein do not necessarily represent those of the Institute, its National Member Organizations, or other organizations supporting the work.



International Institute for Applied Systems Analysis • A-2361 Laxenburg • Austria

Telephone: +43 2236 807 • Telefax: +43 2236 71313 • E-Mail: [info@iiasa.ac.at](mailto:info@iiasa.ac.at)

## Contents

0. Introduction	1
1. Siberia and Lower Angara Region (LAR)	2
1.1 International and Interregional Relations	2
1.2 The Water Way for Entering the World Market	4
1.3 LAR Under New Geopolitical Conditions	5
1.3.1 The LAR Geography	6
1.3.2 The LAR Resources	9
2. The Program of the LAR Development	14
2.2 LAR as a part of East Siberia	15
2.2 Coordination of Interests	19
2.3 Preliminary Suggestions	22
3. Forest Resources and Forest Industry of LAR	23
3.1 Forest Industry in LAR Economy	24
3.2 Development Options	27
Conclusions	30
References	32

## Foreword

This is the time Siberia's forest sector has recently gained considerable international interest. IIASA, the Russian Academy of Sciences, and the Russian Federal Forest Service, in agreement with the Russian Ministry of the Environment and Natural Resources, signed agreements in 1992 and 1994 to carry out a large-scale study on the Siberian forest sector. The overall objective of the study is to focus on policy options that would encourage sustainable development of the sector. The goals are to assess Siberia's forest resources, forest industries, and infrastructure; to examine the forests' economic, social, and biospheric functions; with these functions in mind, to identify possible pathways for their sustainable development; and to translate these pathways into policy options for Russian and international agencies.

The first phase of the study concentrated on the generation of extensive and consistent databases for the total forest sector of Siberia and Russia. The study has now moved into its second phase, which encompasses assessment studies of the greenhouse gas balances, forest resources and forest utilization, biodiversity and landscapes, non-wood products and functions, environmental status, transportation infrastructure, forest industry and markets, and socio-economic problems. This report by Dr. V. Malov, from the Institute of Economics and Industrial Engineering, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, was produced during his stay at IIASA which was sponsored by the National Science Council, The Netherlands. The report deals with the development options of the forest sector in a region in Siberia and is a contribution to the assessment study "forest industry and markets."

# **Development Options for the Lower Angara Region (LAR) in Siberia**

*Vladimir Malov*

## **0. Introduction**

The LOWER ANGARA REGION (LAR) of Siberia is a typical problem region, but has many natural resources which could be important for the development of the region, Siberia and Russia. The new economic conditions have dramatically changed the methods and approaches to regional development in Russia. It means a transition from a central administrative planning system to more market economic approaches for management, and the necessity to take into account the various interests of various stakeholders and participants in the regional development process.

In spite of the fact, that LAR has a unique set of different natural resources, it was not really of any strategic interest of the USSR industry. After the break-up of the USSR the interest and significance of the LAR resources have greatly increased. Research (mainly at the Institute of Economics and Industrial Engineering, Siberian Branch of the Russian Academy of Sciences (IEIE SB RAS) and a new geopolitical situation in Russia and Siberia have become good stimulus for the Federal Government to support a program for the development of the LAR region. A Program of the LAR development was approved by the Government of the Russian Federation in Jan.16, 1995.

Of reasons for the new interest by the Russian government for the LAR region, the following can be emphasized:

- increased significance of the resource potential and changed geopolitical conditions;
- a possibility for the region to become a major industrial base ;
- a development of the LAR region will also stimulate the development of adjacent regions' resources and
- there are favorable conditions for carrying out initial stages of development.

The impact of the exploitation of lead, zinc, magnesites and others metals on the development of the region could be substantial. For gold, the possible extraction is very localized in space and (may be ) in time. The Boguchany hydro power station, is currently one of the most important enterprises in the LAR, but it has only 2.500 employees involved. One may ask what will happen with the LAR society, when the most attractive deposits are exhausted and the boom around oil and gas complexes in Evenkiya (neighboring the LAR region) is over? There are limited possibilities to regard the service sector as a specific branch in the LAR. The tourism may only take exotic forms (hunting, fishing, etc.) and the revenue for the residents will not be sufficient.

The most reliable base for sustainable development would be the forest resources and enterprises using forest raw materials. Forest resources (in various forms) are reproducible, if sustainably managed. Today, more than half of the LAR employees work in the forest sector. The quality of the LAR forest resources is rather high. That is why a program for forest sector development is emphasized in the governmental LAR program. The forest sector development has to be carried out in tandem with the development of other sectors of the LAR economy (including the oil and gas complex of Evenkiya).

In my work at IIASA I used some data from the book "Lower Angara Region: a new approach to regional development in Russia" (eds: M.Bandman, G.A.van der Knaap, E.Weaver and V.Malov)". It gives me the ground to consider M.Bandman, G.A. van der Knaap and E.Weaver as my consultants. The figures are made with the help of T. Yessikiva and O. Basargina. This research was supported by the National Science Council (NWO, The Netherlands). I want to thank the staff of IIASA Siberian Forest Study for helping me with this report, especially Prof. Sten Nilsson and Dr. Charles Backman for giving useful advice in editing and correcting the text.

## **1. Siberia and Lower Angara Region (LAR)**

### **1.1 International and Interregional Relations**

The break-up of the Soviet Union and the establishment of the sovereign state of the Russian Federation (Russia) brought about fundamental changes in the assessment of the geopolitical and economic-geographic positions of the country as a whole and its individual parts. One Russian region that will be heavily influenced by the disintegration of the USSR and the new geopolitical situation in the country is Siberia (Bandman,1993).

The maintenance of economic relations between Siberia and the world Market, especially with the countries of Europe, the Atlantic basin and Middle East, presents increased difficulties, which can be explained by at least two factors (Figure.1.1).



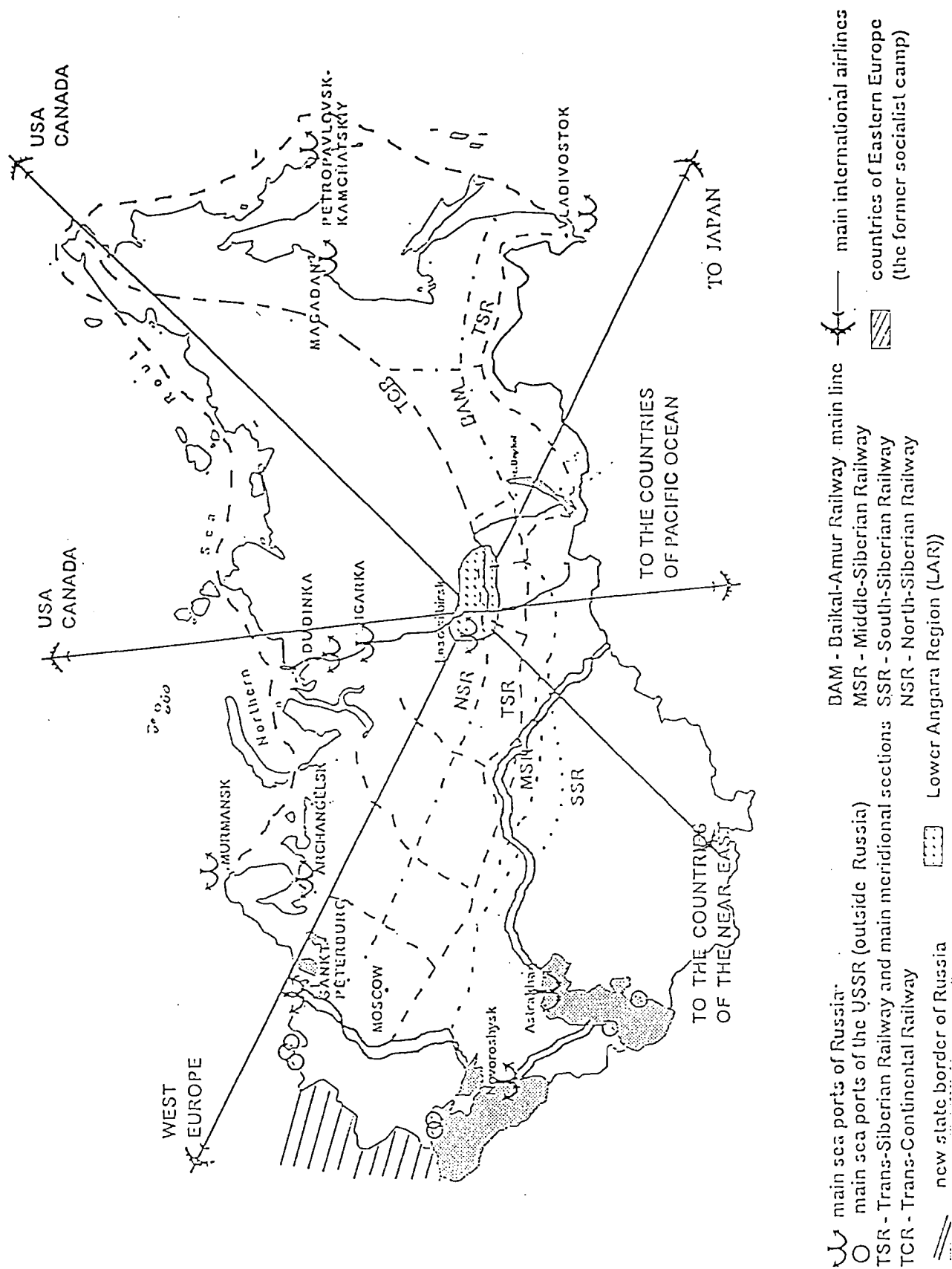


Fig. 1.1 The Change in geopolitical and economic-geographic position of Siberia and Lower Angara Region

Siberia is now separated by two belts that are difficult to cross – those of the former COMECON countries and the former republics of the Soviet Union. Much of the foreign trade of Siberia is conducted by air-, railways and pipelines passing across the territories of those countries. Many Black Sea and Baltic ports that were used earlier to connect Siberia with the world market are now on the territories of other sovereign states. The conditions for transport of oil and gas to the European countries are particularly important both for Siberia and Russia as a whole. Oil and gas have been the main stable source of hard currency income for the region during the last three decades. Russia is interested to retain its position in the world market despite a country-wide decline in oil production. It is all the more important now when Russia has to compete not only with the Middle East, North Africa, Central and South America but also with the former Soviet republics of Kazakhstan, Turkmeniya and Azerbaijan. However, the latter are also confronted with serious difficulties. None of them have their own pipelines to deliver their products to the world market directly (Kuleshov and Bandman, 1992).

The conditions for maintaining the economic relations within Russia – between Siberia and the Urals and the European part – have also deteriorated. Of the three main railways linking Siberia to the west of the country, only one – the Transsiberian – is now virtually all on the territory of Russia. Two railways – the Middle Siberian and the South Siberian – have been left outside Russia on the territory of the sovereign state of Kazakhstan, by the break-up of the USSR. Yet to use those railways, signing of intergovernmental, financial, institutional, legal and technical agreement are required. Moreover, even the Transsiberian railway has a short section of its main line, between Omsk and Yekaterinburg (Sverdlovsk), passing through the territory of Kazakhstan in the vicinity of Petropavlovsk. The second line of the Transsiberian railway between Omsk and Yekaterinburg (via Tyumen) is technically underdeveloped. On the whole, the Transsiberian railway within Eastern and particularly Western Siberia lacks reserves of carrying capacity and the provided freight capacity between western and eastern regions of Russia is reduced.

## **1.2 The Water Way for Entering the World Market**

West and East Siberian seaports can serve as the region's gateway to the world market, while the Ob and Yenissei rivers can act as major transportation routes linking inland territories. Considering the navigability of the Yenissei river and the opportunities for river-to-sea shipping, Yenissei has the possibility to become the main transportation link to the world market with mass cargo from entire Middle Siberia. This forecast is corroborated by the presence of nuclear-powered ice-breakers in the Arctic and river ice-breakers on the Yenissei, and reinforced ships for ice navigation as well as the experience of prolonged navigation in the western sector of the Northern Sea Route (Bandman, 1993, Granberg, 1995).

Provided this river variant is realized, Lesosibirsk (in the LAR region) will remain the second largest (after Krasnoyarsk) river port on the Yenissei and grow into a major sea port in the hinterland of Siberia. It will become a major transshipment base for intermodal transportation by railway (Achinsk-Lesosibirsk and, the North-Siberian in the future) to the river and back. Dudinka will remain as an important river and sea port in the Norilsk industrial region.

The idea to integrate the Northern Sea Route into a system of global transportation network appeals not only to the northern countries (Sweden, Finland, Canada and the USA), but also to the Pacific Rim Countries. The transportation time along the northern route from Sweden to Japan would be two times less than the transportation time along the southern route via the Suez Canal. The organization and functioning of the international sea transportation line along the Arctic coast are widely discussed by academics and businessmen in different countries. To establish the project, it is proposed to set up a joint stock company based on capital from the members of an international nongovernmental organization "Northern Forum" (Granberg, 1995).

### **1.3 LAR Under New Geopolitical Conditions**

Analyses of the geopolitical situation in Russia and Siberia give grounds to consider the western part of the Lower Angara region as one of the most favorable areas for the establishment of a major transcontinental air cargo distribution terminal. In this place the North-Siberian railroad crosses the Yenissei river (cities Yenisseisk and Lesosibirsk). The terminal could be built in the first quarter of the 21st century. This conclusion is based on the following:

- the Near North will be a new economic zone of Siberia in the 21st century;
- the North-Siberian railway is the main latitudinal transport route in the Near North of Siberia ; and
- the Yenissei river is the major waterway of the meridian direction in Middle Siberia.

The geopolitical and economic-geographic significance of Siberia increased after the break-up of the USSR. The region has got new stimuli for further development and is going to be actively involved in the international economic life (Cooper and Avatare, 1994). The LAR is believed to take an active part in the above development due to an advantageous composition of resources and it's location at the intersection of the main transportation routes of the early 21st century in the center of the Asian continent (Kuleshov & Bandman, 1992, Bandman, 1993.)

### 1.3.1 The LAR Geography

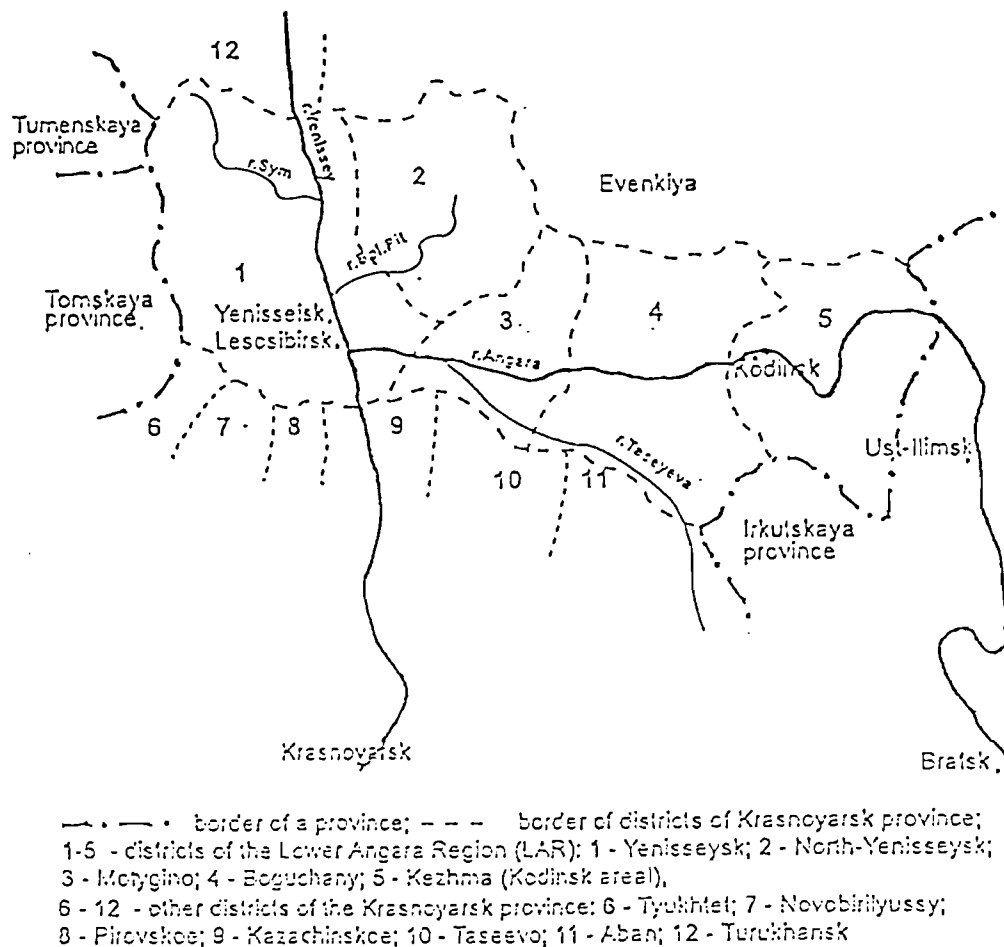
LAR is situated in the center of the Eurasian continent and presents the northern part of a larger area where the Angara-Yenisei program is being implemented (Figure 1.1). The Angara-Yenisei program is a federal long-term program for the development of significance and in various documents the Angara-Yenisei program has had different names: Krasnoyarskoe Priangarie, and the Lower-Angara Territorial-Production Complex. The territorial composition of the region has also changed over time. These changes are a result of changes in goals, participation and functions of different parts of the economy and the formation of an enormous base for electric power engineering, ferrous and nonferrous metallurgy, non-organic chemistry, and wood processing.

According to the system of administrative and territorial division established in Russia, the region is considered as a composition of five administrative districts of the Krasnoyarsk province (krai): Kezhemy, Boguchany, Motygin, Yeniseisk and North-Yeniseisk districts adjoining the lower stream of the Angara river and the middle part of the Yenisei (Figure 1.2). The region covers 261,000 km<sup>2</sup> and the population, as of 01.01.93, is 237,700 people.

The LAR has a humid climate with a moderately warm summer and a moderately cold winter. The average length of frostless days (sufficient for basic vegetables to ripe) is 80-100 days. In some places this period lasts up to 140 days. The area of the agricultural land is only 1.3%, forests account for 97 %, the rest is urban areas, roads etc. There is no permanent permafrost in the region.

The five districts have special features which, on one hand, allow the integration into one region and, on the other hand, make the integrated region distinct from territories adjoining both in the north and in the south. Officially, the status of the environmental and economic-geographical conditions, have resulted in a federal governmental rating of all the five districts of the LAR equal with the areas of the Far North.

Figure 1.2 Lower Angara Region and its Surroundings.



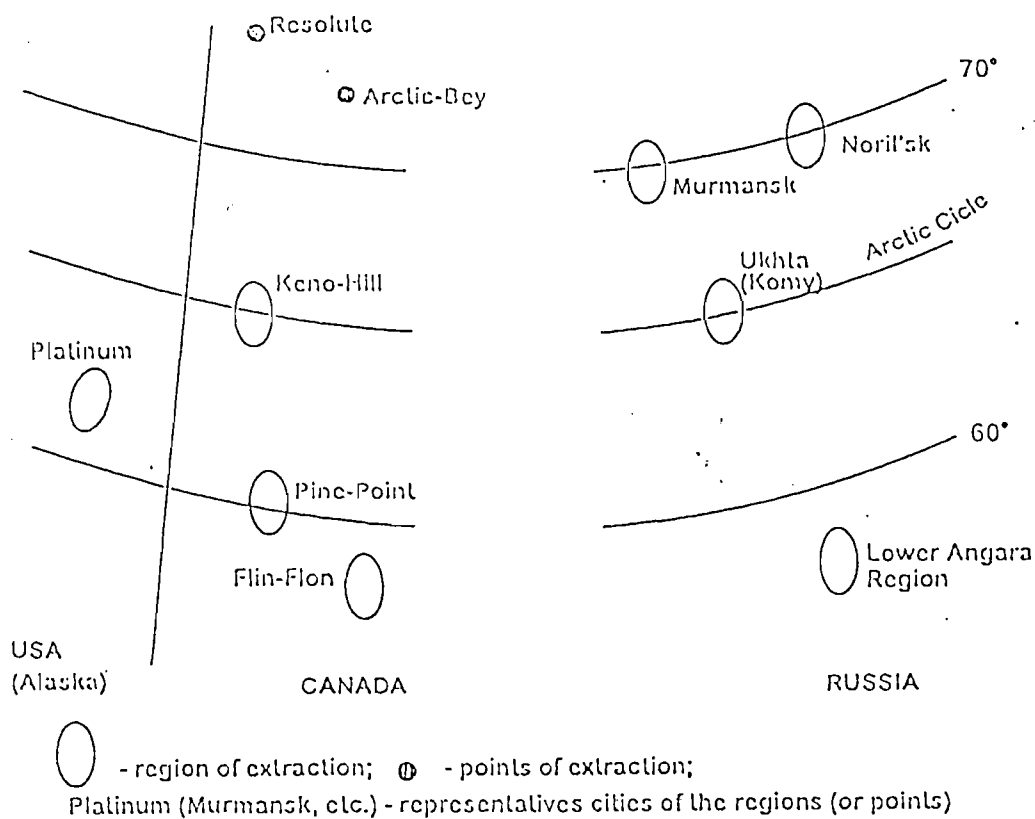
However, this does not mean that the LAR districts present "an isolated state" capable to carry out a program of resource development on its own. To be able to handle various problems, the development program should involve not only the adjacent territories, but also other regions of Russia:

- without possible flows of agricultural products from the southern to the central regions of the Krasnoyarsk krai and interaction with building companies scattered around the krai, it is infeasible to explore the ways of formation of food and construction bases in LAR;
- utilization of the water of the Angara river and its tributaries' for hydroelectric power engineering or water supply, for recreation aspects, and for fishery, requires measures of protection of the quality of water, within a development program for the entire Angara river basin;

- the development of the oil and gas deposits in southern Evenkiya will require that a support base for geologists, oil and gas workers are set up within the LAR. This means that the scale of the development of the regional infrastructure will be defined with regard to services rendered by Evenkiya production units. These units are expected to build pipelines across the LAR and construct enterprises using oil and gas as raw materials.

Thus, the LAR programme has for the management of the resource development strict territorial boundaries. But at the same time, it is necessary to take into account functional interactions with other territories. In comparing the natural-climatic conditions of the LAR with similar resource regions of the world one may say that LAR is quite suitable for exploitation (Figure 1.3) (Duck, 1990).

Figure 1.3 Regions comparable to the LAR in terms of resources.



### 1.3.2 The LAR Resources

The region's resources have been known for a long time. Several attempts have been made to launch intensive exploitation. However, until recently, the region remained an economically poorly developed part of the Krasnoyarsk province. After the break-up of the Soviet Union, the conditions of resource supply within the country were altered. This led to a re-estimation of the importance of the LAR's resources, and of the conditions for their development. In the new context, the region's resources are regarded as crucial for manufacturing of export and import-substituting products in Russia (Figure 1.4). Considering the opportunities for navigation on the Yenissei, the region may have easier access to the world market than many other hinterland areas in Russia and Siberia. Furthermore, the region is considered as the support base for the establishment of the Krasnoyarsk segment of new oil and gas complexes in Eastern Siberia (Bandman et al., 1994; Cherezova et al., 1995).

Undoubtedly, we cannot disregard the fact that the LAR is situated far from processing industry centers, which are the principal markets for the raw materials of the region. Moreover, the region is a high cost labor region. However, when considering all the pros and cons of developing the LAR, the "pros" appear to be strong.

To purchase something on the world market Russia currently needs hard currency, to get this currency Russia has to export products. Each country tries hard to ensure that imports do not exceed exports and a balanced trade balance is a necessary condition for a country to maintain a strong relationship with the world. The USA-Japan relationship provide a convincing example of very tense relations currently due to the negative US trade balance with Japan.

The key Russian export items are oil, gas, timber, minerals, metals and diamonds. To increase imports of scarce raw materials of the country, the exports of the above products have to be increased. This is the case when it is cheaper to extract these latter resources than to organize new production of products currently imported. However, a possibility always exists that world prices on both export and import markets will suddenly fluctuate. Moreover, we should not forget about constant rise in costs of the extraction of many natural resources (for example oil and gas) in Russia. In this situation, the best strategy seems to be **participation** in the formation of world prices both for export and import products. This could be achieved through the creation of **reserve** capacities for extraction of a wide range of resources at any fluctuations of world prices. It means extended domestic production at increasing export prices and reduced domestic production when prices fall.

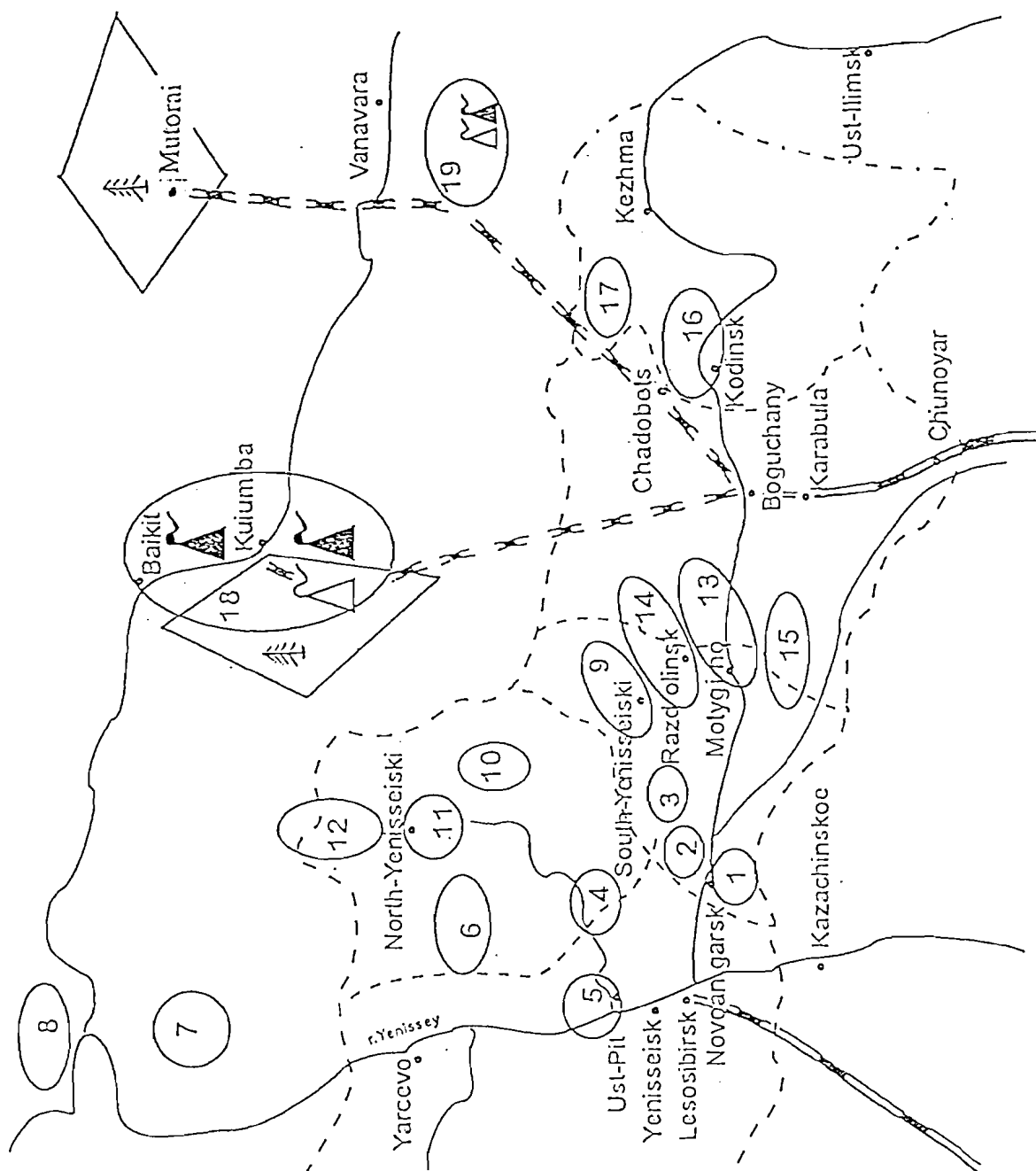






Figure 1.4 LAR deposits and new zones of forest resources.

Ore clusters:

- 1- Gorevski (pbzn)
- 2- Blokhinski (polymetals)
- 3- Rassokhinski (Tatar nephelines  
Middle-Tatar bauxites,  
rare-metal little deposits)
- 4- Tokminski (pbzn)
- 5- Orlovski (pbzn)
- 6- Kiiski (phosphate-rare-metal-  
rare-earth complex)
- 7- Ioakovski (Fe)
- 8- Porozhinski (Mg)
- 9- Tatarski (gold ore, Tatar  
phosphate-niobium, bauxites,  
Udereisk gold-antimony,  
vermiculite, limestone)
- 10-Panimbinski (gold ore)
- 11-Yenashiminski (Olimpiadnensk  
gold, Fe)
- 12-Sovetski (gold)
- 13-Verkhoturovski (bauxites,  
magnesites)
- 14-Razdolinski (Udereisk group  
of magnesites, Kirgiteisk talc,  
hematite Fe ores, bauxites)
- 15-Kokuiski (coal, gypsum,  
black coal)
- 16-Tatarski (Fe)
- 17-Chadobetski (bauxites, Chukto-  
konsk niobium and rare earth  
elements)
- 18-19 - oil and gas fields

 - new zones of forest resources

 -new railway (according to programme of ROSLESPROM)

There is nothing new in such policy. We could refer to the experience of the conservation of the oil deposits in the USA, the deposits have been known and prepared (particularly in Alaska), and can be put into operation immediately. This is one of the factors deterring a rise in prices of oil. It looks like the same situation is at hand for nonferrous metal deposits in the far north of Canada, on islands beyond the 75-degree latitude.

The very notion of the resource independence implies not just availability of own resources but an opportunity for immediate access of the resources: to buy, sell, exchange or produce own resources. This enables to influence the bargaining conditions.

The mineral and raw material base of the LAR represents a "concentration" of resources vitally important for the national economy. They are characterized by a relatively concentrated location, high quality and with rather good conditions for extraction. This is why the LAR resources are a strong competitor to many other deposits in Russia (Table 1.1). For Russia, exports of raw materials will remain a necessity for many years until more value added products can be exported.

Table 1.1 Mineral Resources of Russia and LAR<sup>1)</sup>

RUSSIA LOWER ANGARA REGION				
Types of Commercial raw material	Percentage of demand for the product in Russia (in 1993)	Proportion (%) in reserves of Russia/Eastern Siberia	Sources of raw materials	Main minerals
GOLD	unlimited	no data	Ledge deposits in the North-Yeniseisk region (the main ore Olimpiadinskoe) and placer deposits in the South-Yeniseisk gold-producing region	rare earths
POLY-METALS				
LEAD	13.4%	40.0/56.8	Gorevskoe lead and zink deposits and numerous small deposits	silver, cadmium
ZINC	43.0%	2.0/4.9		
RARE METALS		2.0/5.0	Tatarskoe phosphate-niobium deposit	apatite, vermiculite
NIOBIUM	40-50%			
TALC	Import up to 90 ths.tons (75%)	10.6/55.5	Kirgiteiskoe, Talskie, Verkhoturovskoe and other deposits	
STIBIUM	100% (processing Yakutian ores in Kirgizia)	12/1/100.0	Udereisk stibium cluster	gold
MAGNESITES	65%	2.2/29.7	The udereisk magnesite bearing cluster	
MANGANESE	0	no balance reserves	Porozhinskoe deposit	

<sup>1)</sup> By V. Ionova (Kuleshov and Bandman, 1992)

The LAR has small oil and gas deposits, which are of limited importance so far. But in the immediate vicinity of the LAR, in the south of Evenkiya, there are deposits discovered, regarded as the new oil and gas base second to that in West Siberia. The development of these deposits could partly satisfy the domestic demand in Middle Asia and release part of West-Siberian oil and gas for export purposes in the near future. The LAR is considered as the infrastructural base for the development of the oil and gas fields in Evenkiya (Table 1.2).

The LAR is not the only place in Russia where it is possible to expand gold production. Yakutia and the Magadan province have larger reserves, however, so far they have used cheap labor in the form of prisoners. Presently, the cost of such labor may turn to be too high to justify the gold production. In addition, both these regions have always experienced difficulties in transportation and energy supply, which are increasing the costs. The LAR has considerable advantages in this regard although it has smaller reserves than Yakutia and Magadan. Another strong competitor is the Sukhoi Log deposit in the Irkutsk province (Bodaibo region). But all of these development opportunities will not fully meet Russia's needs for the formation of a gold stock (Cherezova et al, 1995).

Table 1.2 Oil and Gas Recovery in the Baikit District of Evenkiya.

OIL RECOVERY IN THE BAIKIT DISTRICT OF EVENKIYA				
<b>Deposits</b> (in million tons)	1995	2000	2005	2010
1. Yurubchenskoe	0.04	1.41	5.64	6.80
2. Terskoe		0.05	0.26	0.33
3. Kuiumbinskoe		0.04	1.10	2.72
Total:	0.04	1.50	7.00	9.85

OIL RECOVERY IN THE VANAVARA DISTRICT OF EVENKIYA				
<b>Oil Fields</b> (in million tons)	1995	2000	2005	2010
1. Sobinskoe	0.09	0.12	0.11	0.11
2. Paiginskoe	0.04	0.06	0.06	0.04
Total:	0.13	0.18	0.17	0.15

NATURAL GAS PRODUCTION IN THE VANAVARA DISTRICT OF EVENKIYA				
<b>Gas Fields</b> (billion m <sup>3</sup> )	1995	2000	2005	2010
1. Sobinskoe		2.06	5.51	7.00
2. Paiginskoe		0.04	1.29	2.00
Total:		2.10	6.80	9.00

Electric power is, above all, regarded as the main source for ensuring sustainable development of the entire economic complex of the LAR. In addition, it deserves to be considered as an export item. The electric power surplus in East Siberia could be transmitted to Altai to replace electric power generated at Ekibastuz (Kazakhstan), which could be bought at a cheaper price by enterprises in the Urals and other parts of Russia. To get the Boguchany hydro in LAR into operation within the shortest possible time will result in a so-called hydropause and will allow the replacement of economically and ecologically obsolete equipment at thermal stations in Eastern Siberia. The electric power generated at Boguchany hydro could also be exported to China, which already has been decided upon in governmental agreements.

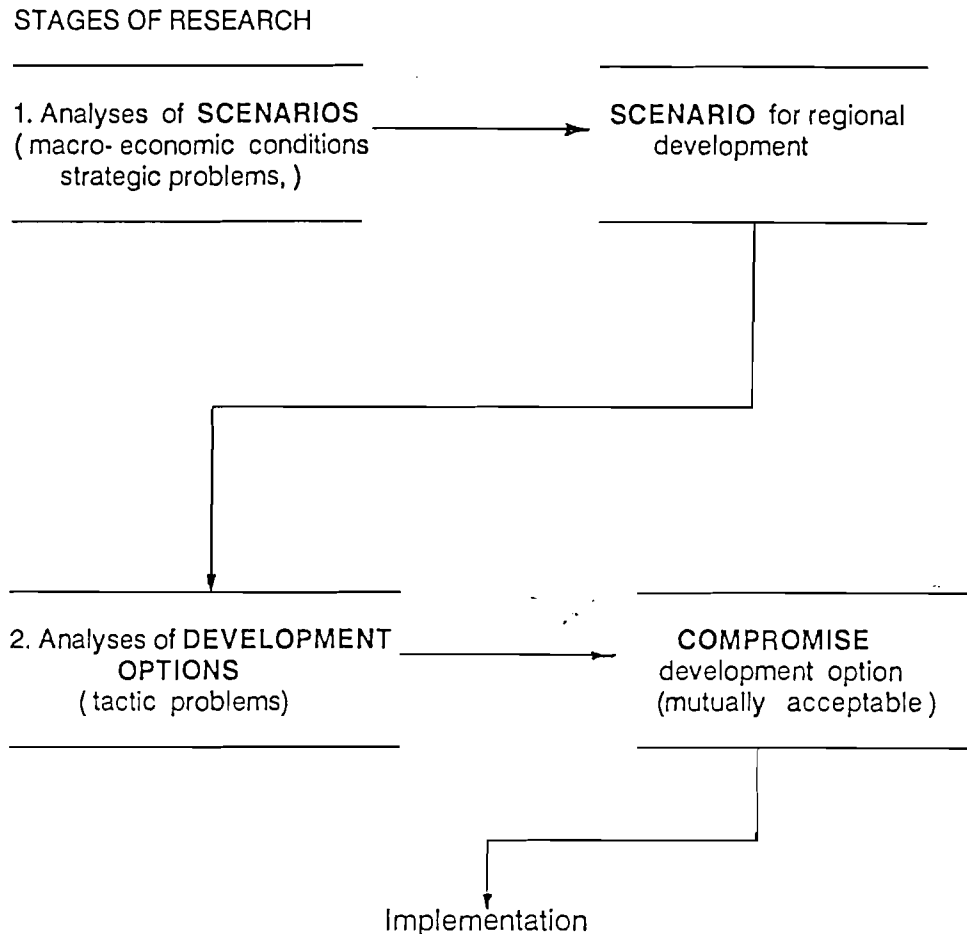
Traditionally, the LAR has been one of the main suppliers of wood for export. The construction of the North-Siberian railway and the possible turning of Yenisei river into a main link for Siberia's access to the world market will bring LAR's forests closer to customers and help to reduce transportation costs. Main competitors – the Komi Republic, Arkhangelsk province and southern areas of the Far East – have limited opportunities for increased logging. Finally, the quality of Angara pine is beyond any competition and the entire Middle-Asian market (formed by the ex-Soviet republics) is distinctly attracted to Siberian forests. The forest resources will be described in more detail later.

## **2. The Program of the LAR Development**

On the elaboration of a program for regional development there is a lot of experience in the Siberian Branch of the Russian Academy of Sciences (see for example Bandman, 1962; Granberg, 1973; Bandman, 1975; Bandman, Malinovskaya and Malov, 1981; Bandman, 1980; Gukov, 1981; Aganbegyan, 1984). However, the transition to a market economy and the introduction of new regional policies made it necessary to dramatically change earlier approaches for evaluation of the regional program development. Now, it is evident that not only the interest of the state (federal) should be taken into account, but the interests of all stakeholders of the region need to be accounted for. Therefore, the following scheme for the LAR program evaluation has been proposed (Figure 2.1). Here I give a simplified variant of the scheme (for the complete scheme, see Bandman et al., 1995).

There are two major stages of required research: analyses of scenarios for East Siberia (possible future of the East Siberian economy) – stage 1, and analyses of development options (variants of LAR economic development) – stage 2.

Figure 2.1 Analytical Approach



## 2.2 LAR as a part of East Siberia

The LAR is part of East Siberia (ES) and ES is part of Russia. So the future of LAR is dependent on the conditions, which may evolve in Russia as a whole and in the ES economy in particular. In order to estimate the role of ES (and LAR as well) in the Russian economy I used results of calculations based on an optimization model (Malov, 1992). In that model possible development options for different branches and various parts of ES were estimated based on scenarios of the ES economic development. These overall scenarios refer to different alternatives for the macro-economic development of East Siberia and Russia as a whole. A continued federal financial support of some of the industries and some of the regions has been viewed as being the most realistic alternative. Based on this framework a scenario has been

developed based on an intensified utilization of the LAR resources in a sustainable manner .

Three major options for this scenario have been developed:

- A. Keep the current structure of the LAR economy and a low rate of new investments for further development (Evolutionary);
- B. Maximize the utilization of the LAR resources in the ES and Russian economies (Maximum);
- C. Use the resources in the most economical way and radically change the structure of the LAR economy (Radical).

In the analyses of each of the above mentioned options the interconnection between branches, districts and the infrastructure of the LAR economy have been examined (Kuleshov and Bandman, 1992). In addition, for these scenarios a number of options concerning funding strategies and the degree of administration have been investigated.

The different analyses are summarized in Table 2.1.

Table 2.1: Structure for the analysis

<u>Scenarios</u>
A. Keep the current structure of the LAR economy and a low rate of new investments for further development (Evolutionary).
B. Maximize the utilization of the LAR resources in the ES and Russian economies (Maximum).
C. Use the resources in the most economical way and radically change the structure of the LAR economy (Radical).
<u>Strategy Options for Funding</u>
D. A strong state support (Nonretrievable)
E. Orientation towards private investments (Retrievable)
F. Mixed state and private strategy funding (Combination)
<u>Administrative Status</u>
G. The current system of laws, taxes and benefits (Central).
H. The current system of laws, taxes and benefits but with a higher degree of freedom for enterprises (Entrepreneurial).
I. The current system of laws, taxes and benefits but more beneficial for regions (Regional).

In the orientation towards the radical scenario (C), which is the platform for our further analysis, the first step is to search for a compromise between the desire for a rapid development, improved sustainability of the living standard, and to limit the investment by the state. Success or failure of the development depends largely on whether it is possible or not to coordinate the interests of the main stakeholders (participants) of the development process in the LAR (Bandman et al., 1994).

In general, the interests of the stakeholders are rather diverse and constitute a multicomponent vector. However, to make quantitative comparisons it is often necessary to show the result in a scalar form. This can be achieved through various linearization procedures. We suggest the following parameters for the description of the different interests in a possible development program:

- For the society – increased consumption possibilities for increased living standard.
- For the region (district administrations) – transfers to the district budgets;
- For the state (the Federation) – transfers to the federal budget;
- For enterprises (firms) – acceptable profitability level (the acceptable profit level is defined as a percentage of the maximum profit level possible under given conditions).

To achieve the target of any appreciable change of the living standard in the society it is imperative to restructure the economic activities in the region and to use the natural resources of the region extensively. The calculations made, based on the radical scenario, show that in order to raise the living standard of the population it is necessary to increase the per capita gross production by 2-3 times (i.e. no less than 1.4 million rubles per year at 1993 price level) by 2010. Only then can the income of the region's population rise by 2.5-2.8 times and amount to 190-220 billion rubles per year, i.e. a level, which provides qualitative changes in the living standard. As a result, the per capita consumption possibilities could increase from 437,000 rubles per year (conservation of the current structure) to 690-825,000 rubles per year (with the radical development option), i.e. by 1.4-1.7 times. The establishment of multiprofile profitable enterprises in the region will facilitate the development of the social sector employing all forms of ownership<sup>1</sup>.

---

<sup>1</sup> A first step in this direction has already been made in the LAR: several joint stock companies (Stalmag, Sitalk, Niobi) have been established. Discussions with Canadian firms are under way about funding of the first developing stage of the Boguchany Hydro, and with Austrian firms concerning construction of wood processing enterprises.

The creation of a developed social sector in the region will promote a higher quality of life for most of the population of the region. A good-quality housing stock will amount to 8-11 m<sup>2</sup> per person. It should be emphasized that the alternative by the current economic structure (A) in place, will only provide 4-6 m<sup>2</sup> per person. The restricting factor for the higher development option is the availability of financial resources to be used for the needs of increased civil construction. The calculations made based on the radical scenario (C) show that the growth in the high-quality housing stock can be accompanied by a principal change in the forms of ownership: private –from 40 to 70%, departmental – from 2 to 17%, municipal – from 15 to 60%, depending on the region's status chosen (see section 2.2). The sharp rise in the proportion of private housing is mainly driven by the privatization of the former public housing stock (Malov and Yesikova, 1993).

The implementation of the radical option (C) of the program will ensure a 4-5 time increase in local budget (district authorities) revenues. Accordingly, the local authorities will have better opportunities to influence the developmental process in the region. The local budgets will not increase dramatically through a more extensive use of the natural resources but through a more comprehensive use of the natural resources and by value added processing. Over 70% of the increase in transfers to the local budget will come from profit taxes paid by enterprises and income taxes paid by the society. Transfers to the local budget by enterprises will rise by 4-16 times .

The LAR transfers to the federal budget are certainly modest in percentage. However, while developing the LAR under the conditions of the radical scenario, the state could get parts of its needs satisfied (by delivery of resources, semi-finished products and hard currency etc.) and reduce the expenses of social aid to residents of the region, which will be unavoidable in the case of economic stagnation in the region. It is of strategic and long-term interests of the state to cease the migration of the people from the northern and eastern parts of the country. It will cost less for the state to create conditions for an increased number of jobs. To maintain the present situation in the LAR will have a higher cost than to implement at least the evolutionary development option (A).

The annual transfers by the region to the federal government will account for about 15.4 billion rubles, by year 2010, while the state must reallocate 17.1 billion rubles to the region (in the form of state subsidies and grants) by maintaining status quo. Targeted investment in this region will allow for both increased transfers by the LAR to the federal government and create conditions for a stable self-development of the region. For instance, in the case of the evolutionary development option (A), transfers to the federal government and to centralized funds can increase by more than 3 times (or about 49.6 billion rubles). While the implementation of the radical development option (C) will result in 9 to 10 times higher transfers (153 billion rubles). The opportunities to enlarge the hard currency resource of the region will grow substantially by this latter option .



## 2.2 Coordination of Interests

The possibilities to satisfy the interests of the different stakeholders of the region and the possibility to coordinate them depend largely on the choice of strategy for funding and the administrative status of the region (see Table 2.1).

The options of strategies for funding of the development differ in the origin of the financial resources. The possible sources are: federal government (federal budgets), local authorities (local budgets), various economic agents (state enterprises, private enterprises, banks, individuals etc.) and foreign firms. For the analysis, we have chosen the following strategies as the most suitable for a development program of LAR:

- D. a strong state support (Nonretrievable ),
- E. orientation towards private investment (Retrievable ),
- F. mixed (Combination).

The administrative status of the subregions of the LAR vary by the degree of administrative activities. The administrative activities is defined by the state and local government involvement through the system of standards and legal acts. They include: taxes and transfers, subsidies and subventions, granting privileges, etc. Among most suitable options concerning laws and taxation for a region, we have chosen the following:

- G. consistent with the current system of laws, taxes and benefits (Central);
- H. the same set of laws, taxes and benefits, but with a higher degree of freedom for enterprises (Entrepreneurial);
- I. the same set of laws, taxes and benefits, but more beneficial for regions (Regional).

Different financial strategies and options for a regions' legal status will direct to what extent the interests of the stakeholders will be satisfied.

When choosing the nonretrievable strategy (D) within the radical scenario (C) (the strong state support for funding), over half of the total demand of financial resources are assumed to come from federal sources. In the case of applying the retrievable strategy for funding, approximately 80% of the required investments are provided by internal and borrowed funds. Of these 80%, 30-40% can be covered by internal funds of the LAR enterprises established. Over 30% of the capital investments should be financed by long-term credits, while the finances provided by krai and local budgets, centralized assets of the federal budget, and federal funds on a gratuitous basis do not exceed 10 %. When choosing the mixed strategy for funding, 33% of the total need

should be subsidized by centralized assets of the federal budget and federal funds (e.g. a regional development fund), 9% – by krai and local budgets, 21% – by long-term credits. Of the total need, 37% will be covered by internal funds of investors representing all forms of ownership (including foreign investments) (Figure 2.2).

The orientation towards the retrievable strategy for funding does not meet the interests of several stakeholders of the development program. For example, the possibilities to increase the living standard is very limited: salaries are decreased by 30-60%, the per capita consumption possibilities decreased by 20-35%, and the provision of good quality housing is 25-65% lower (compared with the nonretrievable strategy for funding).

The calculations show that the share of federal funding of the investments should not be less than 30% (directed towards investments in infrastructure and risk funding of big projects). Only under this condition there is a possibility to guarantee that none of the areas of the region will experience a decline in the initial living standard.

A system with the current structure for taxes and benefits (central status) within the radical scenario seems to be the most preferable with regards to the interests of the Federation. It ensures maximum support to the federal budget. During the first years, however, the transfers to the federal budget, will be rather modest. The transfer to the federal budget will increase only after production units are established and put into operation, i.e. by the end of the period under review. Therefore, it serves the interests of the state to grant privileges either to the enterprises [(H) entrepreneurs], or to the territory [(I) region] in order to boost the development of the region (Figure 2.3).

Figure 2.2 Level of satisfaction by stakeholders under different strategies for funding.

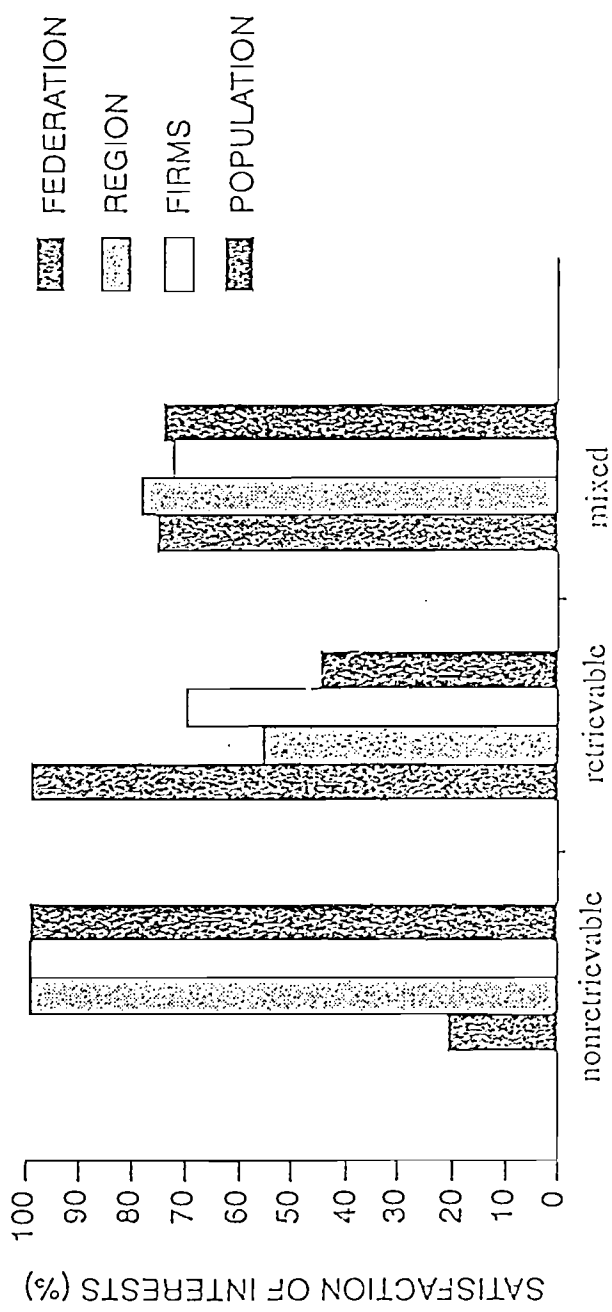
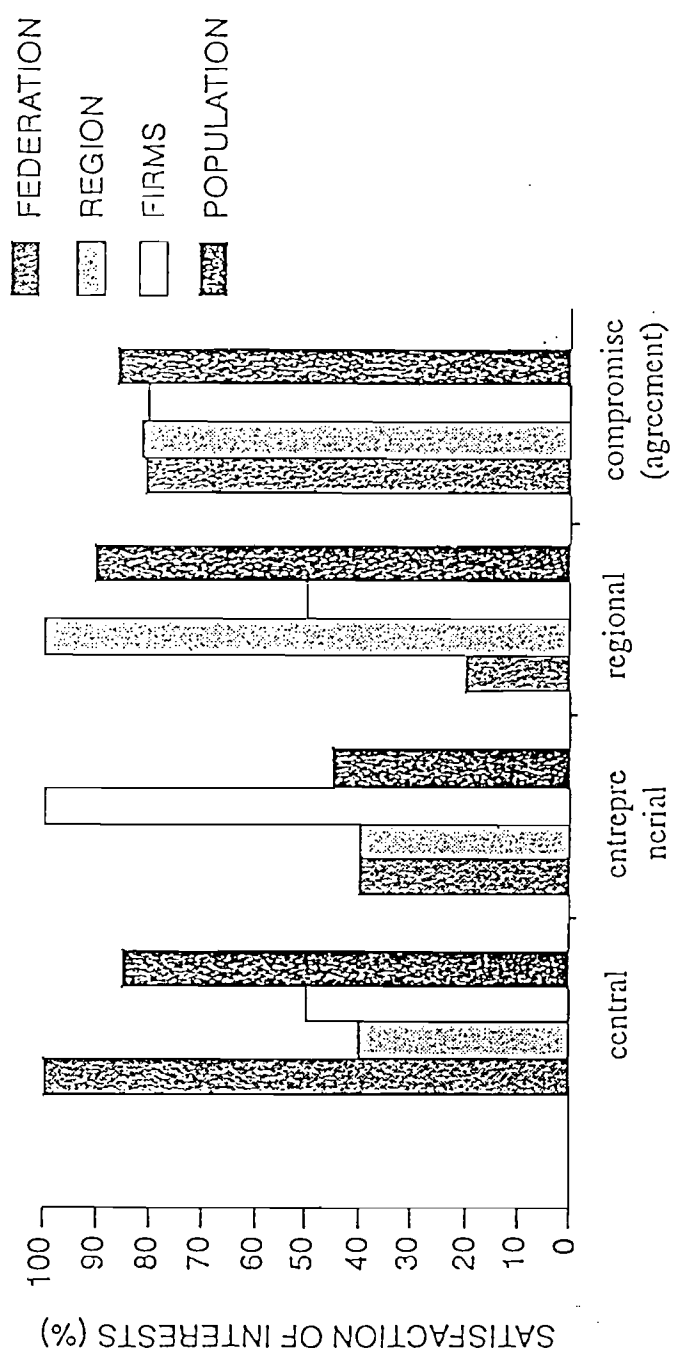


Figure 2.3 Level of satisfaction by stakeholders under different statuses and formation of compromise (agreement) status.



The adaptation of a regional administrative status (I) would give more opportunities to orient the economic structure towards the interests of the majority of the region's population. By changes in the conditions for management of the region's economy, it is possible to ensure a 20% growth in consumption possibilities. The local population will be encouraged to make their own financial contribution by this option. No matter how small, it will be important from the psychological point of view, as a stimulus to retain personnel.

Establishment of the entrepreneurial status (H) will slow down the growth in well-being of the population considerably initially. This can be identified in the level of the consumption possibilities. Consequently, social tension will quite possibly increase. In this case the opportunities for the local authorities to stimulate the development will be constrained significantly: local budget revenues will be 30-70% lower than under other options.

## **2.3 Preliminary Suggestions**

On the whole, the calculations have shown that the administrative status of the region and the strategies for funding are interrelated and interdependable. Below are some of the conclusions made:

1. A strong state support strategy for funding [(D) nonretrievable] may ensure a stable development of the region with a high level of satisfaction by the population and an acceptable development of the economy of the region. If the region is given the entrepreneurial status (H) all profits may go to the entrepreneurs. The regional status (I) is acceptable under the condition that a significant portion of the state funding will come out of regional budgets and special funds for regional development. However, an adoption of the nonretrievable strategy (D) for funding of a development program of the LAR is hardly possible currently due to the economic crisis in Russia.
2. Choosing the retrievable strategy (E) for funding will initially be followed by a noticeably lower level of satisfaction by the stakeholders. A comparable level of satisfaction by the stakeholders to the nonretrievable strategy (D) can only be achieved under a mixed strategy (F). Notably, in this situation there will not be a need for the creation of any special conditions for the management of the economy, the region is recommended to accept the central administrative status (G). If the entrepreneurial administrative status (H) is chosen, the satisfaction of the interests of the state and the population will initially be reduced substantially, however, there will be good possibilities for improvement of the operation of the enterprises. Under the regional administrative status (I), the satisfaction of the interests of the

population will increase considerably, the conditions for the local government and the enterprises will improve, however, the conditions will become worse for the state.

3. It is probably unrealistic to expect that the introduction of world prices will dramatically improve the results for any of the strategies for funding. Even the mixed strategy can not compensate for unfavorable changes under market conditions.

Based on the above analysis, it is possible to formulate a **compromising variant**, mutually acceptable by all stakeholders of LAR. The mutually acceptable variant is formed in close collaboration with the Administration of the Development Program. This variant suggests the following strategy for funding and administrative status of the region in order to overcome the differentiation in the level of satisfaction by the different stakeholders.

The compromise variant is based on the assumption that every stakeholder is willing to sacrifice some of its interests for the sake of others (Figure 2.3). By this variant, it is possible to meet the interests of all the stakeholders at 85-90% of the maximal level. It can be done through changing the conditions for the economic management. For the LAR it is suggested to lower the profit tax rate by approximately 2 times in comparison with the current conditions of taxation (e.g. fixation to a 15% level, not at 32% as under the central administrative status and 10% as in the entrepreneurial one, and to decrease export duties to 12%, etc).

The compromise variant offers more power to the Administration of the Development Program (or the local authorities) from the beginning of the program's implementation. Later on, as soon as the economic potential of the region is improved (e.g., in 5-7 years), it would be sensible to grant privileges to entrepreneurs. This will ensure a rapid creation of a major group of industries. Later, when enterprises have attained stable modes of operation (in about 10-15 years) it will be possible to adjust the administrative status. It is not possible to give any more definite recommendations for the moment.

### **3. Forest Resources and Forest Industry of LAR**

The LAR forested area (closed forests) acceptable for harvest is about 9.2 million ha and the total growing stock is about 1.44 billion m<sup>3</sup>. The forest resources of LAR can be compared with Archangelsk, Komi Republic and other forest provinces and is one of the biggest regions of forest resources and wood industry in Russia. The growing

stock of LAR is also comparable with the stocks of Norway, Sweden and Finland (Table 3.1). Coniferous species of high quality dominate in the LAR, occupying 74% of the forested area and 86% of the growing stock; of which pine constitutes 30-32% respectively, larch – 15 - 18, cedar 14- 17 and fir, spruce and others 33-41%.

Table 3.1 The Lower Angara Region in Relation to other Forest Regions.

Region	Total Area million km <sup>2</sup>	Forested Area million ha	Total Growing Stock billion m <sup>3</sup> o.b.	Harvested volume million m <sup>3</sup> o.b. per year
LAR	0.27	9.2	1.44	10.0
Arkhangelsk oblast	0.59	15.1	1.38	25.3
Komi Republic	0.42	18.5	1.48	23.0
Finland	0.34	21.2	1.5	48.8
Sweden	0.45	21.9	2.0	60.0
Norway	0.32	8.2	0.43	8.5

The LAR has a leading position in Russia with respect to the concentration of the timber resources and accessibility. This region was one of the first and largest deliverer of wood products to the USSR and the world markets. Despite this, the forest industry in the LAR is poorly developed, especially with respect to value added production (Bandman et al., 1994).

### 3.1 Forest Industry in LAR Economy

Currently there are many problems connected with LAR forest industry and they include: 1) decrease of the general economic conditions, 2) high tariffs for transportation, 3) lack of investments. Nevertheless, the importance of the forest industry in the LAR economy remains significant (Table 3.2). For example, the employees of the forest industry account for more than half of the total employees of the LAR (which increases to almost 60% when hunters and other forestry-connected categories are included). About 80% of the transported goods are wood products.

Table 3.2 The Forest Complex in the LAR Economy (in percentage and in 1993).

Districts and cities	Employees	Revenue of Employees	Total Revenue of Employees <sup>1)</sup>
Kezhma district	59	70	78
Boguchany district	71	92	95
Motygino district	56	42	53
North-Yeniseisk district	17	10	17
Yeniseisk district	75	90	94
Yeniseisk city	18	17	25
Lesosibirsk city	52	65	67
Total	50	65	74

<sup>1)</sup> Total revenue of employees including the revenue from "personal home economy"

It is important to stress, that there are many settlements, where almost 100% of the residents are connected with the forest industry. In these communities, the service sector, education, and health are currently also strongly dependent on the forest industry. Moreover, some branches of the metallurgy enterprises are utilizing the forest resources, e.g. the Gorevsky mining company which produces about 5 tons of tall oil, some 2 tons more than the logging enterprises.

The importance of the forest industry for the LAR economy becomes more evident when revenues and local budgets are analyzed. More than 66% of the peoples' revenue in the region currently stems from the forest industry (Table 3.2).

The differences among the various districts of the LAR are rather striking. In such districts as Boguchany and Yeniseisk, for example, almost all revenues of the population and the local budgets (excluding subsidiaries) stem from the forest industry (Table 3.3). Important is the fact that the majority of the social infrastructure currently is part of the enterprises and is included in the financial accounts of the enterprises. Clearly, the life of many settlements and districts depend on the forest industry.

Table 3.3 Transfers to Local Budgets<sup>1)</sup> by Users of Natural Resources (in 1993).

Districts and cities	Forest Resources	
	Total million rub.	transfers million rub.
Kezhma district	180.7	180.0
Boguchany district	681.3	680.0
Motygino district	886.1	441.1
North-Yeniseisk district	877.6	25.2
Yeniseisk district	181.5	181.2
Total	2807.2	1477.5

<sup>1)</sup> In the total revenue of local budgets (excluding subsidies), the share of transfer by users of natural resources is about 30%.

Long term development of the forest industry is a complicated process related to harvesting level, the mechanical and chemical processing of wood; the degree of specialization, forest management, government policies and market conditions, and competitive position.

When evaluating the development prospects of the LAR, one can characterize the present structure of the forest enterprises as typically raw-material-oriented. One can not make any long-term plans based on the current structure, which is inefficient in terms of rational use of raw materials, has high transportation costs, low profitability and low productivity.

The world and the domestic experience show that the more developed the wood processing, and the pulp and paper industries are, the higher the rate of profitability and efficiency of the forest sector and, eventually, the contribution to the national economy.

Emerging market conditions for forest products, connected with the development of new ownership conditions and the status of the individual producers, will influence to a significant degree the need to look beyond the advantages of value added manufacturing in forest industry. Resources should be allocated to those industries, producing products for markets in which the region's forest industry has competitive advantages. This can be achieved by increased productivity, improved quality of final products in order to meet domestic and foreign market demands, and making full use of the qualitative advantages of the regions' forest resources.

Feasibility analyses suggest that advantages exists for establishment of manufacturing activities like sawmilling, plywood production, and pulp-and-paper production in the region.

The LAR has the advantage of neighboring the wood deficit republics of Central Asia with a population of 50-60 million people. The rapid economic development in China should also be taken into account. The future forest products market in China is assumed to be quite large. China can probably consume all forest exports from the Far East and Siberia, including those from the LAR, and the entire forest industry in East Siberia (Bandman et al., 1994; Backman, 1995).

The development of the forest industry in the LAR will call for technical re-equipment of the facilities already in place and a large amount of machinery and equipment for new establishments. The Krasnoyarsk province has a strong scientific potential, a base for training of engineers and workers (sector research institutes: the Siberian Research Institute of Forest Industry, the All-Union Institute of Forestry, the Academy of Sciences' Institute of Forest and Timber, the Siberian Technological



Institute, forest-technological schools etc.), as well as a unique machine-building base of converted former military enterprises ("Krasmach", "Sibtiashmach" etc.), untapped resources of the Krasnoyarsk heavy excavators plant, the Krasnoyarsk and the Abakan forest machinery plants, and a number of other enterprises. Therefore, the Krasnoyarsk province is capable of establishing production of any type of logging machines and equipment for harvesting and processing of wood in the LAR, the Krasnoyarsk krai, Siberia and the Far East (Bandman et al., 1994).

### **3.2 Development Options**

The factors discussed above have a decisive impact on the selection of a strategy for future organization of the forest industry, with respect to manufacturing, forest management and combining different forest enterprises into industrial complexes. The core of such complexes should be pulp and paper mills oriented towards processing of raw materials at one industrial site, and sawmill and plywood mills.

Considering the current conditions, it would be beneficial to distribute all forest resources of the LAR among several major industrial complexes, providing them supply securities for a longer period. The distribution should depend on the established legislation for main and intermediate harvests. The management of such enterprises could benefit from relevant experiences of similar organizations in other boreal countries. Individual enterprises of the complexes, belonging to different owners, could establish their property relations with respect to the raw material on the basis of cooperation, integration and coordination oriented towards common interests and maximizing the common gain ( Kuleshov and Bandman, 1992).

The current location of production capacities is closely connected with the forest raw material supply to the sawmill enterprises. In the interest of the LAR forest sector, the current supply of raw material for the existing sawmill industry should be reduced gradually, while the resources should be allocated to processing at the enterprises of the Lesosibirsk industrial node. In this connection, special consideration should be given to the development of Igarka, Dudinka and Lesosibirsk as basic ports in order to increase the established, nearly 70-year old, export of wood products to the European market through the North Sea Route (Bandman, 1993).

The main characteristics of the LAR forest industry development according to the three previously discussed development scenarios are shown in Table 3.4. The radical development scenario has been judged as the optimal one. For this development scenario, preliminary calculations on the revenue for the population and the contributions to the local budgets have been done. The results are illustrated in Figure 3.1.

The development of the oil and gas deposits may have a significant, but not long-term effect on the LAR economy, due to the fact that the main deposits are in Evenkiya and consequently, the main taxes will be transferred to the Evenkiya region, Krasnoyarsk province and to the federal government. Some new railways, roads and pipelines will appear and all of them will cross the LAR territory, but the largest share of the increased economic activity will not occur to LAR.

Table 3.4 Forest Industry in 1992 and Forecasts for 2010.

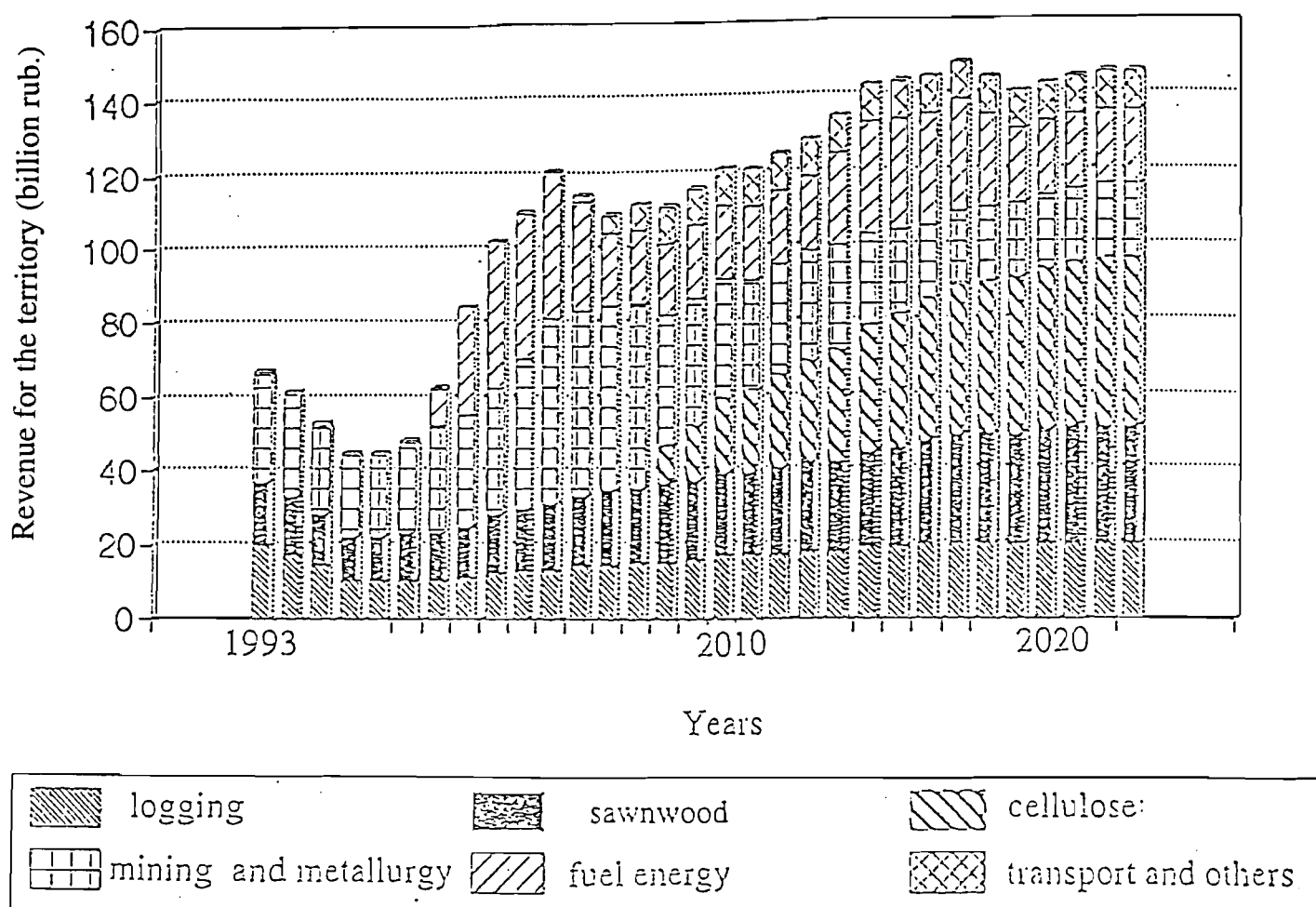
Indicator	Unit of Measure	1991	2010 Development Scenario		
			Evolutional (A)	Maximum (B)	Radical (C)
Gross national product at 1990 prices	billion rubles	0.6	0.62	1.02	1.44
Export of timber	million m <sup>3</sup>	8.0	10.0	15.0	20.0
<b>Production:</b>					
sawn timber,					
excluding sleepers	"-	2.1	2.5	2.5	3.0
plywood	1000 m <sup>3</sup>	--	60.0	150.0	300.0
compressed wood	million m <sup>3</sup>	26.4	48.0	60.0	80.0
prefabricated houses	1000 m <sup>2</sup>	20.1	25.1	35.0	50.0
furniture	million rubles	1.3	15.0	30.0	50.0
chemical pulp	1000 tons	--	100	200	405
ground-wood pulp	"-	--	60	147	462
newsprint	"-	--	100	140	440
cardboard	"-	--	--	35	75
Employees	1000 persons	50	36	43	48

New mining and (probably) metallurgical enterprises based on the LAR resources will appear during the program horizon. But the long-term sustainability of these activities is uncertain (the most effective deposits may be exhausted and there will not be any new ones).

The transportation sector, even taking into account the new North Siberian Railway and new possibilities for Yenisey river, can only create some 2000 jobs and generate some limited revenue to the LAR. The same situation is probably valid for the service sector .

In such a situation, the most sustainable source for revenue is the forest industry, especially the production of more value-added products. Forest resources are reproducible (under sustainable management) and could probably provide a suitable living standard for the LAR society.

Figure 3.1 The share of different sectors of the LAR economy. Total revenue for the territory of the radical development scenario (C).



## Conclusions

The forest industry of the LAR should develop in cooperation with other industries utilizing the raw material potential available in the LAR (gold, polymetals, coal, gas, oil etc.). The industry in general should invest in the construction of new transportation infrastructure, such as the Karabula-Yarki-Kodinsk and the Yarki-Lesosibirsk railways and in roads. Investments should be made in power stations, power transmission lines and other facilities for promotion of the infrastructure, which can serve different industries. Considerations also have to be made for ecological issues. To make the Angara river cleaner, the elimination of the seasonal timber floating and rafting have to be terminated and all year-round types of transportation, and large terminals for storage of products between navigation periods have to be introduced

For future economic development of the LAR, the Federal Government can use different strategies:

- “a hard” strategy – the federal government will not give any privileges to any enterprises in the LAR, and the scheme of taxes is the same as in other regions;
- “a soft” strategy – the federal government will give some privileges, but only for new enterprises and only as far as their future incomes are concerned;
- “a stimulating” strategy – the federal government will, in addition to the “soft” strategy, give support to the whole LAR economy at an initial stage (a good example of such support is the TVA program in USA, see Knop, 1979).

A “hard” strategy leads inevitably to a collapse of the whole LAR economy, including the forest industry. The productivity of many LAR enterprises today is close to zero, mostly due to transportation and energy taxes, and, consequently, the industry can not generate their own capital. So in the near-term it might be necessary “to freeze” the life of many settlements. The social negative consequences of this strategy are tremendous.

A “soft” strategy can not lead to any radical (structural) change in the LAR economy, however the decline of the LAR economy will not be dramatic during the first 10-12 years. However, it will only be possible to increase the living standard in a very slow mode. Therefore, the majority of highly skilled workers may leave the LAR, and there will be no possibilities to implement any new technologies and value added production of forest raw materials. In this case, any LAR development will probably not be realized.

The only strategy, which could lead to radical and structural changes in the LAR, is the “stimulating” one. In this case, the federal government allows to use (during a fixed program period) part of the taxes from oil and gas complexes, mining and other enterprises to establish value added forest industrial production, along with support of the LAR social and economic infrastructure.

## References

- Ganbegyan, A.G. (Ed.), 1984, Territorial'no-proizvodstvennye komplekсы: Planirovanie i upravlenie (Territorial Production Complexes: Planning and Management), Nauka, Novosibirsk (In Russian).
- Backman, C.A., 1995, The Russian Forest Sector: An Analysis by Four Regions. Working Paper 95-44, IIASA, Laxenburg, Austria.
- Bandman, M.K. (Ed.), 1962, Krasnoyarskoe Priangarie (Lower Angara Region in the Krasnoyarsk province), IEIE SB RAS, Novosibirsk (In Russian).
- Bandman, M.K., 1980, Territorial'no-proizvodstvennye komplekсы: Teoriya i praktika predplanovykh issledovaniy (Territorial Production Complexes: Theory and Practice of Preplanned Research), Nauka, Novosibirsk (In Russian).
- Bandman, M.K., M.A. Malinovskaya and V.Y. Malov, 1981, Some Findings from the Optimization of the Spatial Structure of the Sayany Territorial Production Complex. In: Aganbegyan A.G. (Ed.) Regional Studies for Planning and Forecasting: the Siberian Experience, Mouton Publishers, pp.245-262.
- Bandman, M.K., 1993, The geopolitical position of Siberia after the break-up of the USSR. IEIE SB RAS, Novosibirsk (In Russian).
- Bandman, M.K., T.N. Yesikova and V.Y. Malov, 1994, Koordinatsiya interesov v programme osvoeniya regiona (Coordinating Interests in a Regional Development Program).// Region: ekonomika i sotsiologiya. No. 4, pp.42-60 (In Russian).
- Bandman, M.K., I.N. Voevoda and V.A. Vagner (Eds.), 1994, Gorno- metallurgicheskii i lesnoy komplekсы (Mining, metallurgy and timber complexes). In: 'Lower Angara', vol.5\*, IEIE SB RAS, Novosibirsk (In Russian).
- Bandman, M.K., T.N. Yesikova and V.Y. Malov, 1995, Logika razrabotki programmy osvoeniya problemnogo regiona the (Logics of the Elaboration of a Development Program for a Problem Region) In: 'Lower Angara', vol.7\*, IEIE SB RAS, Novosibirsk.
- Bandman, M.K., G.A. van der Knaap, E. Wever and V. Malov (Eds.), 1995, Lower Angara Region: A new approach to regional development in Russia". Netherlands Geographical Studies -198, Utrecht/Rotterdam, The Netherlands.
- Cherezova, V.S., V.A. Vagner and V.I. Bragin, 1995, Ispol'zovanie mineral'no-syr'evogo potentsiala regiona v rynochnykh usloviyakh (Uses of the mineral and resource potential of a region in market conditions).//Region: ekonomika i sotsiologiya, N3. Novosibirsk (In Russian).
- Cooper, H.B.H., and A. Avatare, 1994, The future role of the Bering strait tunnel and railway project on the economic integration of commodity transport with the railroad transportation system network of the North-Central and North-Western United States, Seattle, USA.
- Ducks, G. (Ed.), 1990, Devaluation and Constitutional Development in the Canadian North, Ottawa, Canada.
- Granberg, A.G., 1973, Optimizatsiya territorial'nykh proporzii naridnogo hozyaistva (The optimization of national economic proportions). Ekonomika, Moscow (In Russian).
- Granberg, A.G., 1995, Transkontinental'naya magistral' i tonnel' cherez Beringov proliv (The Transcontinental railway and a tunnel under the Bering Strait).//EKO, N1, pp. 142-167, Novosibirsk (In Russian).

- Gukov, V.P. (Ed.), 1981, Problemy ekonomiki Vostochnoi Sibiri (Problems of the East-Siberian economy), Nauka, Novosibirsk (In Russian).
- Knop, H. (Ed.), 1979, The Tennessee Valley Authority: a field study. CP-76-2 IIASA, Laxenburg, Austria.
- Kuleshov, V.V. and M.K. Bandman (Eds), 1992, Territorial'no-proizvodstvennye komplekсы: Nizhnee Priangarie (Territorial Production Complexes: The Lower Angara region), Nauka Novosibirsk (In Russian).
- Malov, V.Y., 1992, Lokal'nye territorial'nye sistemy (Local Territorial Systems), Nauka, Novosibirsk (In Russian).
- Malov V.Y. and T.N. Yesikova, 1993, Analiz rezultatov raschetov po zadache koordinatsii interesov the (Analysis of Results from Calculations used in the Interest Coordination Task) In: 'Lower Angara', vol.4\*, IEIE SB RAS, Novosibirsk (In Russian).
- Malov V.Y., T.N. Yesikova and V.D. Smirnov, 1993, Koordinatsiya interesov uchastnikov osvoeniya problemnogo regiona (Coordinating interests of participants in the development of a problem Region) In: 'Lower Angara' vol.3\*, IEIE SB RAS, Novosibirsk (In Russian).
- \*) Series 'Lower Angara' vol. 1-12 "Materialy k gosudarstvennoi programme osvoeniya Nizhnego Priangaria" (Materials for the Federal program of the LAR development). Nauka publisher.