1. The planned economies before 1989

It is still conventional wisdom that the planned economies of Eastern Europe and Russia were failures in all important respects: they could not generate economic growth, they wasted resources and created ecological disasters, their agriculture was inefficient and could not supply sufficient amounts of bread grain, and their leaders were kleptocratic and concerned mainly with personal enrichment. But in reality, “real existing socialism” was quite different.

Planned economies vs. market economies. Concerning economic growth, the achievements were rather similar in the planned economies and in western countries. Thus in “the golden age” of economic growth from 1950 to 1973 average annual growth rates of GDP (Gross Domestic Product – an indicator for total production in the country) per capita were 2.2% in the USA, 3.6% in the USSR, and 2.9% in Denmark, and in the period 1973-1989 the growth rates were 1.6%, 1.0% and 2.5% respectively. In Japan and China per capita annual growth rates were 8.0% and 3.7%, respectively, from 1950 to 1973, and 3.1% and 5.7% from 1973 to 1989. Since 1980 the Chinese GDP growth rates have been among the highest in the world, about 10%, and at the same time population growth has slowed from more than 3% to about 1% annually. With the exception of Romania and Albania, the populations of Eastern Europe and the USSR belonged to the wealthiest quarter of mankind.

Therefore, in the late 1980s two outstanding American textbooks on comparative economic systems concluded from a comparison of planned economies and western market economies that the “… dynamic efficiency of the two systems appears similar. … The important differences in growth rates appear not between the systems but rather among the nations within the same economic system” (Pryor, 1985:101; cf. Gregory & Stuart, 1989:414).

Ecological damage. The planned economies consumed the same amounts of natural resources per capita in the late 1980s as did western countries, and pollution levels from greenhouse gases were also similar, but the efficiency was less, and energy consumption per unit output was 2-3 times higher than in Western Europe; air pollution was heavier, even per capita, particularly sulphur pollution, which was approximately as it was in Western Europe 20-30 years ago and furthermore more concentrated in the big industrial centres. But agricultural pollution with nitrogen and pesticides was less.

The fact that economic planning contrary to the market causes ecological disasters is a popular, often repeated illusion. In any system, ecological damage is related to productive activity and thus to political and economic priorities. However, basic economic theory tells us that pollution and other environmental effects are often external to the polluter, so that
no market agent will notice it. The planned economies had the necessary policy instrument to control environmental damage, but failed to use them. The ecological crisis is not caused by any economic system, but by our common wish for economic growth which is also completely dominant in Eastern Europe and Russia: “For all the apparent gulf between the market-dominated economies of the West and the centrally planned economies of the communist world, when it comes to attitudes to the natural world their outlook turns out to be remarkably similar” (Ponting, 1991:153; cf. Aage, 1998b).

Economic inequality was not so great in Eastern Europe and the USSR than in western countries, in part because of the absence of the small and exorbitantly rich economic élite of western countries. Members of the nomenklatura had privileges like a dacha, a four-room flat and a car, all typical middle-class goods in the west, and the privileges were not inheritable. Free public services, including health care and education, as well as cheap public transportation and full employment also contributed to income equalization.

It is true that the USSR was not self-sufficient with grain, which was imported in increasing amounts. However, the reason was not lack of bread, but rather that consumption of meat, and thus the use of grain for fodder, increased by 63% per capita from 1965 to 1990, because the population became more wealthy. The grain harvest increased from 130 million tons annually in 1961-65 to 209 million tons in 1986-90, while the share of the labour force employed in agriculture decreased simultaneously from 29% to 18%.

The planning system functioned. It did not collapse as is often asserted; it was dismantled. But the problems were enormous, and furthermore they were instructive concerning one of the major questions of economics, namely the proper balance between private activity and central control, i.e. the economic role of the state. One conclusion is about the difficulties of creating efficient economic incentives in a politically controlled system as demonstrated by the attempts at using wage incentives, which are in many respects similar to the wage systems now being introduced in the public sectors in western countries.

The principle in the so-called bonus systems was to reward fulfilment and overfulfilment of one or more success indicators, first of all gross production, in relation to the plan, provided that a number of other plan requirements were fulfilled as side conditions. These immediately followed many problems of the planning system: defective information from enterprises in order to obtain an easy plan, poor plan fulfilment in order to prevent plan increases next year (the ratchet effect), wasteful use of resources, poor quality and neglect of consumer preferences, late or failing deliveries of inputs, lack of technological innovations, missing or distorting work incentives. The problems originate in disregard of everything except the success indicators, but there are other explanations as well, among them that responsibilities were not clearly defined, that relative prices were not realistic for political reasons, and that sanctions like the closing down of enterprises and ensuing unemployment were avoided for social reasons, so that enterprise restructuring was not compelling, because
enterprises had soft budget constraints and could count on being bailed out by the government in case of difficulties.

The planning system was “further perfected”, as it was officially announced, several times after 1965, but the reforms did not solve the problems of efficiency, which were presumably primarily related to unclear assignments of responsibility, inside and between enterprises. Employment policy and work discipline were presumably less austere in socialist enterprises as compared to capitalist ones, and enterprises had no well-defined competitors, but were parts in a political game with planning authorities and ministries, where rules were obscure and budget constraints soft. Political infiltration was omnipresent, and the degree of honesty and social consciousness in the system was not sufficient to prevent considerable problems. A further economic strain was that military production absorbed a significant share of the resources, probably 15-20% in the USSR.

2. The transition economies

Actually, all the miseries usually ascribed to the planning system – poor economic growth records, ecological disasters, agricultural crisis, and kleptocratic régimes – have become much more genuine in the transition economies than they were in the former planned economies, with the exception that the environmental situation has improved since 1990, because of the decline of industrial and agricultural production, which in the Baltic countries reduced energy consumption as well as pollution from sulphur and carbon dioxide by half and eliminated the use of fertilizer and pesticides in large areas (Aage, 1998b).

Concurrently, with far-reaching institutional changes and progress towards marketisation and democratisation (cf. Table 39) the European and former Soviet transition countries have experienced a historically exceptional, deep depression. Output declined by 17-60% during the years after 1990 (cf. Table 40). In most East European countries production has now recovered to the levels of 1989, in Poland it is even 22% higher, but in the former Soviet republics GDP is still much below the 1989 GDP, thus 23% below in Estonia and 43% below in Russia. In several respects the transition countries achieved impressive reductions of the macro-economic imbalances in the early 1990s. Government deficits have been reduced, and annual inflation rates are about 5% or lower, except in Russia and Belarus where inflation rates in 2000 were about 100% and 200% respectively, but there are still considerable unemployment rates and serious current account deficits (cf. Table 40 and tables in Chap. 50 and 24).

The production structure has changed, as the production decline is most pronounced in industry. This was partly intentional, because large parts of industry had a negative value added according to international prices. Presumably, this applied to 20-24% of industrial production in Poland, Hungary and Czechoslovakia in 1989 and even more in Russia (Aage, 1998a). But service production, which was very low under communist rule, has increased, particularly due to the growing number of small, private enterprises. Agricultural production has declined in some countries even more than industrial production for many reasons, including lack of inputs and adverse prices. In some areas in the Baltic countries restitution of agricultural lands to former owners has created a structural problem with small unprofitable farms with inexperienced owners. In Russia the grain harvest has declined from about 100 million tons in 1986-90 to a level of about 65 million
tons. The private plots, which were also important in the Soviet era, contribute increasingly to the survival of the population.

Table 39. Production and institutional reform in Baltic area transition economies 1989-2000

<table>
<thead>
<tr>
<th></th>
<th>GDP per capita</th>
<th>Institutional reform 1999</th>
<th>Private share of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1989 USA=100</td>
<td>large priv.</td>
<td>int. trade</td>
</tr>
<tr>
<td>Russia</td>
<td>31</td>
<td>3.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Belarus</td>
<td>26</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Estonia</td>
<td>37</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Latvia</td>
<td>35</td>
<td>3.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Lithuania</td>
<td>32</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Poland</td>
<td>29</td>
<td>3.3</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Notes: Figures for GDP per capita in 1989 are an attempt to rank countries using different and contradicting computations of GDP in purchasing power parities. The following three columns indicate various indices for degrees of institutional reform in 1999 as computed by the EBRD based on subjective estimates on a scale from 1 to 4, for large scale privatisation, liberalisation of foreign trade, and a total index for the scope of market reforms, which is an unweighted average of several indices (large and small privatisation, enterprise restructuring, price liberalisation, foreign trade liberalisation, competition policy, banking and financial institutions). The last two columns show the share of private production in GDP in 1989 and 2000.

Sources: EBRD, 2000:14; IMF:2001:134; Aage, 1998a

Table 40. Economic growth in Baltic area transition economies 1989-1999

<table>
<thead>
<tr>
<th></th>
<th>Smallest GDP</th>
<th>GDP 1999=100</th>
<th>Investment 1999=100</th>
<th>Unemployment pct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1989 year</td>
<td>1999</td>
<td>1999</td>
<td>1999</td>
</tr>
<tr>
<td>Russia</td>
<td>1995</td>
<td>55</td>
<td>57</td>
<td>17</td>
</tr>
<tr>
<td>Belarus</td>
<td>1995</td>
<td>54</td>
<td>80</td>
<td>59</td>
</tr>
<tr>
<td>Estonia</td>
<td>1994</td>
<td>64</td>
<td>77</td>
<td>137</td>
</tr>
<tr>
<td>Latvia</td>
<td>1993</td>
<td>52</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1993</td>
<td>39</td>
<td>62</td>
<td>149</td>
</tr>
<tr>
<td>Poland</td>
<td>1991</td>
<td>82</td>
<td>122</td>
<td>171</td>
</tr>
</tbody>
</table>

Notes: The two first columns indicate year and size of the smallest GDP in the years 1989-1995. The following two columns indicate real GDP and real fixed gross capital formation, both as a per cent of the level in 1989. The figures should be evaluated in relation to their trends; thus GDP is generally increasing and unemployment decreasing and the figures are already outdated, e.g. the unemployment figure for Poland, which is likely to have decreased.

Sources: EBRD, 2000: 65; ECE, 2000:161; Aage, 1998a

Poverty is not extreme because of a functioning social safety net, but the number of people living below the poverty line of four USD at the 1990 exchange rate (i.e. the real value that 4 dollars had in 1990) a day increased from 14 million (3% of the population Central and Eastern Europe and the former Soviet republics) in 1987-1988 to more than 150 million (30%) in 1998 (IMF, 2001:100; EBRD, 1999:13-19). In Central and Eastern Europe the percentage of poor people is about 10%, in the Baltic countries 35%, and in Russia 45%. The reason is first and foremost the depression of production rather than the simultaneous escalation of inequality; the Gini-coefficient, which measures inequality on a scale from .00 to 1.00 has increased everywhere (and also in western countries), and in Russia it has increased from about .25 in 1989 (as in the Nordic countries) to above .50
(as in some Latin American countries), that is from one end of the global spectrum to the other. Mortality has increased in many countries.

A wealthy new élite has emerged swiftly. Everywhere in the transition economies, with the Czech Republic as a possible exception, privatisation has given members of the former élite an opportunity to gain a degree of control over the wealth of society that they did not even dream of during the former regime. The nomenklatura has transformed itself into a kleptoklatura. The profound transition of society has been a fertile soil for corruption and, particularly in Russia, also for extensive, organized and most violent criminality.

Privatisation has progressed rapidly everywhere with few exceptions, notably Belarus and other former Soviet republics (cf. Table 39). The privatisation of small enterprises has been fast and successful and a large number of new firms have been created. Some large enterprises have been privatised as well and the Baltic countries and the Central European countries have succeeded to some extent in dispersing ownership rights and in improving corporate governance.

Privatisation was implemented by means of various mixtures of a variety of methods:
1) **spontaneous privatisation** (in many places in the initial phases),
2) **mass privatisation** through distribution of vouchers to the public (main method in Lithuania; Russia 1992-94; also used in Poland, Estonia, Latvia),
3) **insider privatisation** or management-employee buy-outs (predominant in Russia 1992-94; also in Poland; some sales to employees on preferential terms in most countries),
4) **direct sales of shares** by tender, usually with restrictions for foreign investors (main method in Poland, Estonia, Latvia; also used in Lithuania; Russia 1994-96),
5) **restitution to former owners**, mostly concerning agricultural lands (partly used in Estonia, Latvia, Lithuania),
6) **political privatisation** (as in the Russian shares-for-loans scheme in 1995 where a small group of financiers with political ties, the so-called oligarchs, financed government activities and received shares in return).

Generally privatisation has boosted enterprise restructuring in Central and Eastern Europe, especially where ownership is concentrated to strategic, domestic or foreign, investors, but it has been less successful in Russia and other former Soviet republics. In Poland, the most successful transition economy, large scale privatisation started late and progressed gradually (as it did in Hungary), but in Russia the early and fast privatisation has turned out to be chaotic (cf. Reddaway & Glinski, 2001). So there is no clear relationship between privatisation methods and later outcomes.

It is increasingly acknowledged that privatisation is not sufficient for restructuring and growth. An elaborate institutional framework, which is not easily created, is required, including legal institutions and mores, financial institutions and financial discipline, institutions and standards for competition and corporate governance (IMF, 2001:105-106).

In addition to macro-economic stabilization and privatisation the transition reforms also include liberalisation, internally (free prices, competition, elimination of subsidies) and externally (free trade, liberalisation of capital movements, currency convertibility). Political democracy was also an important element in the institutional reforms. Together, this was intended to create prosperous, democratic market economies.

Even when institutional preconditions are created, future growth is not possible without the necessary investments, and in this regard also prospects differ between countries. In Poland the current account deficit is about 7% of GDP, but the inflow of foreign direct investment is almost of the same magnitude, and the level of investment has nearly doubled compared to 1989 (cf. Table 40). Russia, on the other hand, has experienced
a decade with dwindling investment, despite a comfortable current account surplus of 5-10% of GDP, but capital flight has moved large private funds out of the country, probably about 20 billion dollars a year since 1994, so that total private, external assets may now exceed the Russian (public) external debt of 160 billion dollars. The disappearance of investment is a direct and, to a large extent, quite legal consequence of the reforms: when property is privatised, when capital movements are liberalised, and when domestic political and economic prospects are risky, rational capital owners tend to move investment abroad.

A protracted drop in production, particularly technologically advanced production, erodes not only physical capital, but also human capital. It is more simple to transform a doctor of science into a street vendor than the other way round.

3. Transition and economic growth

What are the lessons from the ten years of transition? The prevailing view is that “liberalization has indeed been a good investment” (World Bank, 1996:29), and “that more and faster reform is better than less and slower reform” (Fischer & Sahay, 2000:17). In the light of Table 40, this conclusion may appear strange, and it is certainly not undisputed. The view has been vindicated that the correlation between growth performance and scope and speed of reforms is a spurious one, because it materialises when initial conditions in 1989 are omitted from the analysis, when only growth after the bottom of the depression is considered, and when government expenditure is omitted. Also, the validity of conclusions from comparisons of transition countries should not be overrated, because their reform strategies were rather similar, with minor differences in scope and speed. Thus, the former GDR is the only example of genuine shock therapy, and China is a highly successful example of a gradual strategy, but they are normally excluded from statistical analyses.

The important variables of transition are economic growth, democracy, economic reform, stabilization (low inflation), government expenditure, external agents (particularly anticipated EU membership), and initial conditions in 1989 (size of countries, cultural traditions, historical experiences, earlier dependence on CMEA trade, mineral wealth, economic structure, prior reform experience as well as foreign assistance, cf. Aage 1998a). The statistical correlations can be roughly summarised as follows: (Fisher & Sahay, 2000; Popov, 2000)

- 50-60% of the variations in GDP performance 1989-98 are explained by different initial conditions; the explanatory power of initial conditions disappears in the late 1990s;
- comprehensive and fast reforms explain 30% of GDP variations, but this correlation disappears when initial conditions are introduced;
- together with initial conditions, government expenditure explains 70% of GDP variations;
- there is a strong correlation between stabilisation (low inflation) and high GDP growth, and if inflation is introduced in addition to initial conditions and government expenditure, 80% of GDP variations are explained;
- democratisation is positively correlated with economic reforms, but has no direct effect upon GDP growth.

The effect of economic reforms was initially (1990-1991) to trigger the depression together with stabilization policy, as both reduced government expenditure and investments: “There can be no doubt that during the early transition there was a causal relationship between the rapid shrinkage in the size of government and the significant fall in output” (Kołodko, 2000:259).
Thus, it is remarkable that in 1999, among the former Soviet republics Uzbekistan, Belarus and Estonia came closest to the GDP levels of 1989, namely 94%, 80% and 77%, respectively; concerning the scope of reforms they were at opposite ends of the spectrum, with EBRD index values of 2.1, 1.5 and 3.5 respectively (cf. Table 39), but all had relatively small declines in government expenditures (Popov, 2000:35). In the period from 1992-1996 there is presumably no effect of reforms upon GDP performance, but in the most recent years there is some positive effect.

Differences between countries concerning institutional reform, stabilisation and GDP recovery are rather closely associated with the geographical distance between the respective capitals and Brussels, which is a strong predictor, probably because it reflects initial conditions, but presumably also because EU membership aspirations might have supported the political practicability of stabilisation.

Generally, determinants for economic growth are still not well understood despite intensive research, theoretical (on endogenous growth) and empirical (on convergence and international comparisons) in the past two decades. Widespread convergence, in the sense that poor countries tend to catch up with rich countries, has not been established, and growth is not correlated with inequality (cf. Aage, 1998b). Furthermore, historically there is not a very pronounced correlation between marketisation of the economy and economic growth (Gregory & Stuart, 1989:414; Pryor, 1985:101). Among the more robust determinants for economic growth is absolute latitude, i.e. distance from the equator, with Singapore as a conspicuous exception. A strong, efficient and uncorrupted government seems to be a characteristic associated with economic growth. On the other hand, rule of law in the sense of respect for human rights is not a necessary condition for growth. And although democracy is almost exclusively found in wealthy countries, democracy and economic growth are not closely correlated. Actually, the correlation is weakly negative (Barro, 1996:6).

There are strong arguments for an active role of government, not only as a guardian of economic freedom, but also as an agent of active economic policy. In two remarkable articles in the Russian newspaper Nezavisimaja Gazeta a number of distinguished Russian and American economists, including three Nobel Laureates, called for a much more active government policy, including government control over natural resources and capital movements. They criticise the IMF and the World Bank for “tying the governments’ hands concerning action to overcome depression and capital flight” in return for relatively small amounts of finance (Klein et.al., 1996, 2000).
4. Transition theory

The ten years of transition has been a challenge to economic theory, and it has initiated large-scale theoretical and applied research which has left its mark in various parts of economic theory.

Concerning stabilisation and macroeconomic imbalances, particularly inflation, the experiences of transition countries are fairly well understood in terms of conventional theory, where three main, complementary views can be identified: the orthodox emphasising the supply of money and budget deficits, the structuralist emphasising prices and real effects, and the heterodox emphasising expectations.

In spite of the fact that determinants for economic growth remain rather mysterious, international advice was given and reform strategies were designed precisely with the aim of supporting economic growth. Strong economic incentives are widely considered to be an efficient spur of economic growth, and this is the rationale of the global trend towards limiting the role of government in the economy, and particularly towards privatisation. The idea is that efficiency increases when risk follows the right to residual income. Whether this is true, has been investigated on the micro level by comparing public and private companies and on the macro level by comparing economies with different degrees of private enterprise. The results are not unambiguous, and a general conclusion is that the effects of ownership rights depend crucially upon the amount of market competition and upon the amount and type of government regulation that currently exists.

The firm faith in economic incentives and in the private market economy has had a strong ideological impact. Ideology presumably also played an active role through the adoption of what Stiglitz labels a widespread western “folk theorem”, namely that “anything the government can do the private sector can do as well or better” (Stiglitz, 1995:31; jf. World Bank, 1996:110).

Oddly enough the strong confidence in the market as an economic institution has appeared concomitantly with the development of institutional theory, which has highlighted the preconditions and limitations of the market and explored other types of institutions from various points of view: economic history, game theoretical experiments where purely economic incentives have proved insufficient for explaining the results, and the theory of economic organisation which describes transaction costs and principal-agent problems (i.e. the problems of constructing efficient economic incentives; for example, the bonus for overfulfilling the plan for gross output, used in the former planned economies, was not an efficient incentive) as motivations for other institutions than the market, especially enterprises (cf. Milgrom & Roberts, 1992).

The new political economy is also concerned with institutions, and it extends economic analysis to more fundamental political decisions, as well as the formation of institutions. The
point of view has often been that institutions emerge more or less spontaneously. There is an interesting trend of regarding emerging organized crime as an acceptable phenomenon, as it provides the missing services of contract enforcement, although by unauthorised means, despite adverse effects such as migration, privatisation of tax collection, low investment rates and capital flight. It is argued that institutions should be “incentive compatible” and therefore that “legal reform should begin with the adoption of legal rules that the courts find usable and that private parties find cheaper to rely on than other methods of resolving disputes” (Hay, Shleifer & Vishny, 1996:562, cf. Shleifer & Treisman, 2000; Reddaway & Glinski, 2001).

Sociological theory has also been invoked in order to improve the understanding of transition, including Habermas’ distinction between life world and system world as well as the triad – very popular among sociologists – of state, market and civil society.

In the application of sociological theory, the formation of social norms is the central question, and this also applies to the growing literature on the concept of social capital, which is an attempt at establishing a missing link for understanding social trends and very much adopted by the World Bank. Social capital is vaguely defined as mutual trust and ability to cooperate among members of society, and it fits nicely as a counterpart to physical, human and natural capital, but exactly how it is a concept of capital or how it is a factor of production is not obvious. Physical capital is characterised as a factor of production by being accumulated in the form of investment, by being used during several periods of time, and by depreciating when used. Natural capital is not accumulated, and human capital does not depreciate when used. Concerning social capital it is not known how it accumulates, and it does not seem to depreciate when sensibly used. In any case social capital is closely related to well-known concepts, notably social norms, with which sociology has grappled for many years without reaching particularly definitive conclusions.

In 1989, on the eve of the period of transition, the prevailing view among large parts of the economics profession was that the planned economy was a perversion of economic life, the elimination of which was not only a necessary, but also a sufficient condition for returning to the natural state of economic life, namely a well-functioning, democratic market economy.
Subsequent events have modified this simplistic view, and a broader geographic and historical perspective revealed that the well-functioning market economy is, maybe, an exception rather than the rule. It is not an original, natural state of economic life, but requires a complex system of legal, political and social structures which are not easy or quick to establish. Thus, from the precarious years in thirteenth century Northern Italy, it took 500 years for western European capitalism to develop, and it required another 200 years to become a civilized, socially acceptable system, as described in the institutional approach to economic history.

5. Conclusions

The prevailing view among economics professionals concerning the decisive question of the proper balance between market and government in the economy has changed through history. Perhaps the current change of mind is best understood as an ideological surge. Of course, the perception of the real world is always structured through a theoretical filter, but theory transgresses the borderline between science and ideology when it no longer helps to understand reality, when it no longer tries to draw a distinction between 1) what we know, 2) what we believe, and 3) what we wish and hope for.

The current faith in liberalism and private activity is not the first one in the history of economic thought. About 1870 the strongly liberalistic and ahistorical Manchester-school of economics was dominating. Government should restrict itself to establishing the legal framework for certain institutions, notably for private property. Even the use of language gives strong contemporary impressions of déjá-vu. During the following decades the extreme liberalism lost momentum, e.g. in Germany where the government had an active role in industrialisation and in social policy, but once more it became strong about 1930, and now – after a prolonged Keynesian spell – about 1990. It is embarrassing for a social science that in a fundamental question it is subject to oscillations of fashion with a period of approximately 60 years and an amplitude that apparently increases explosively.


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Kogut, Bruce, 1996. Direct Investment, Experimentation and Corporate Governance in Transition Economies, in: Frydman et al. (eds.): Corporate Governance in Central Europe and Russia – Banks, Funds and Foreign Investors, vol. 1, Budapest: Central European University Press


States – Democratization and Economic Reform Policies. Umeå University, Research Report No. 2


Research Report, no. 125, Dept. of Industrial Engineering and Management, Lappeenranta University of Technology, Finland


