Forest management after the economic transition – at the crossroads between German and Scandinavian traditions[1] (manuscript)

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Abstract
Germany and Scandinavia represent two paradigmatic forest management traditions, based on management for volume and management for profit, respectively. This study examines the prevailing silvicultural regimes and resulting economic outcomes in Germany and Sweden as benchmarks, and then corresponding analyses are performed for post-transition EU countries, represented by Poland, Lithuania and Latvia. The analyses reveal a regional gradient where Poland stands closest to the German tradition, Latvia goes through a "scandinavisation", and Lithuania takes an intermediate position. Poland adheres to longer rotations and follows the principle of self-sufficiency, while economic efficiency has gained increased importance in Latvia. The observed gradient is likely to be sustained in the coming decades as the survey of key forest sector stakeholders reveals ideological patterns that correlate with the pace of reform of State forestry in Poland, Lithuania and Latvia.

Keywords: Forest management, profitability, stakeholders, comparative analysis

1. Introduction

Despite a great diversity in approaches to forest management, two historical strongholds or paradigmatic traditions can be distinguished in the European forestry practice. *Germany* is known as the cradle of science-based forestry shaped along the progressive ideas of the Enlightenment period (Ciancio and Nocentini, 2000). The focus on growing forests of high productivity reversed the frightening would famine of XVI-XVIII centuries (Schmidt, 2002). German foresters can be rightfully proud of elaborating silvicultural principles that withstood a test of centuries and are still for the large part valid throughout the Central Europe. Until as late as mid of the 19th century, forestry science was dominated by German names; moreover, in many countries, development of organised forestry was started either by German foresters or by nationals who graduated from forestry schools in Germany (Klose, 1985). Taking Russia as an example, its forestry was initially shaped by Germans invited by the tsar Peter the Great at the turn of XVII and XVIII centuries (Redko and Redko, 2002).

One of distinguished names in German forest science is Martin Faustman who developed the soil rent theory, taking into account the value of time in forestry investments (Faustmann, 1849). The theory did not find a wide-spread and sustained acceptance in its homeland (Mohring, 2001) but, a century later, was embraced in Scandinavia – the second stronghold that signifies economically efficient forestry. Forests for centuries played an important role in the Swedish economy, while, regarded at large, a heavy exploitative forest utilisation continued until as long as the middle of the XX century. By then, extensive forestry and declined supply of timber were seen as a threat for rapidly developing forest-based industries as well as for the rural employment (Enander, 2007). These were important contributing factors for the adoption of the new Forest Act 1948 that stressed the profitability and evenness of revenues as two guiding principles. They subsequently permeated forest management that has become a showcase for the Faustmanian theory as implemented in practice.

Where does the East European forestry stand in relation to these management traditions? Although at somewhat different periods, most countries in this part of Europe passed similar pivotal stages in their forest histories. Following the formation of national states (Maciejewski, 2002) and/or struggling with a rapid decline of forest resources, national forestry administrations and schools were founded in XVIII - beginning of XX century, inspired by the German tradition and often by graduates from Russia or Germany. Organised forestry

steadily develops, featured by growing share of artificial forest regeneration, scientific advancements in silviculture, etc. After enduring forest overutilization around both world wars, most East European nations adopted a conservationist paradigm reinforced by rigidities of the central planning economy (Brukas, 2000). For example, only some 25-30 percent of annual growth was utilised in Soviet Lithuania in 1970-1980s, around half of domestically used timber being shipped from the Russian Federation.

As the Soviet Union and Warsaw Pact collapsed in early 1990s, the freed States rushed towards the market economy. Should the transition imply a shift from biologically-oriented to a market-oriented management? The study aims to answer this question by first having a closer look to the German and Swedish silvicultural regimes and ensuing economic outcomes. Forest management can differ between countries in numerous ways. However, to examine the paradigmatic difference between "management for volume" and "management for profit" the analysis should spotlight the prevailing approaches to management at stand level. The defined regimes then serve as benchmarks in corresponding analyses for selected East European countries that have underwent the economic transition. In addition, this study looks at stakeholder preferences that represent the desired direction for forest management. As such, they might be indicative for overall tendencies in the coming years.

Poland, Lithuania and Latvia are selected to represent a range of features of the post-socialist realm in terms of the extent of the forest cover, significance of the forest sector in the national economy, forest ownership structure, and the pace of reforms in State forestry. With 38.5 million inhabitants (CIA, 2007), Poland is a large country on the EU scale. Forests cover 9.2 million ha or 30% of the land area (MCPFE, 2007), State forests dominate the ownership structure. According to official data MCPFE (2007), just 0.24 ha forest fell on average per Polish citizen, and the sector's contribution to GDP made 1.6 percent in 2005. Lithuania and Latvia are considerably smaller countries (3.6 and 2.3 million people, respectively) with higher forest area per inhabitant (0.64 ha and 1.37 ha) and considerably bigger sector's contribution to GDP (2.9 and 4.3 percent). Although having very similar starting conditions after regaining independence, forestry of the two Baltic countries have increasingly diverged, particularly due to reforms in State forestry (Lazdinis *et al.*, 2005).

2. Materials and methods

The analysis is carried out in three main steps. First, the German and Swedish approaches to management at stand level are examined, eliciting the cash flow for selected main commercial tree species, Norway spruce (*Picea abies (L.) H. Karst.*) and Scots pine (*Pinus sylvestris L.).* To make proper comparisons, the measure of the average height of dominant trees at the age of 100 years (H_{100}) is used for modelling stands of a similar productivity, based on available most-up-to-date yield models (cf. Bormann, 2004; Sallnäs and Nilsson, 2006; Ekö, 2006; Hanewinkel and Navarro, 2005). Productivity of Scots pine is H_{100}=24-25 in both Sweden and Germany. The productivity of spruce in Sweden corresponds to average site conditions with H_{100}=28. Due to lack of data, H_{100}=35 for spruce in Germany, i.e. a significantly more productive stand was modelled for the latter. General administrative costs as well as risks of calamities are disregarded. Economic performance is compared using the Internal Rate of Return (IRR) criterion that takes into account the relevant costs and revenues throughout rotation and also accounts for the value of time. Along with the net present value, IRR is a suitable criterion for investment analysis (e.g. Klemperer 1996) and provides an unambiguous measure for comparison between countries in our study. Calculations are carried out on pre-tax basis, employing estimates of costs and timber prices (prevalent in 2005-2006) that are

assumed to rise together with the level of inflation. The economic figures are then linked to some important facets of the forestry sector, such as the set-up of State forestry and level of forest utilisation. The analysis employs empirical data from numerous national and international sources.

Second, identical analyses are carried out for Poland, Lithuania and Latvia, aiming to locate each country in relation to German and Scandinavian traditions. Site productivity is H_{100}=24-25 for pine and H_{100}=27-28 for spruce. To estimate the prevailing silvicultural practices, the normative forestry documents have been explored in detail; forest scientists as well as forestry practitioners were consulted in each country. Additional effort is made for identifying the most important changes during the period of transition, comparing main trends in forestry as a whole.

Third, the study examines attitudes of forest sector interest groups in Poland, Lithuania and Latvia, based on structured questionnaire on forest utilisation. Purposive sampling was employed (Patton, 2001), selecting respondents who have the highest power and/or the best relevant information, as these are the decisive factors for positioning of interests in a policy arena (Krott, 2005). The selection criteria were operationalised by selecting respondents that take senior positions within their organisations and/or are salient representatives of respective interest groups, as revealed by contributions to national professional and popular media, membership in relevant decision-making bodies, etc. Taking the group of State forest enterprises as an example, the Lithuanian sample included the senior staff from the General Directorate of State Forests and those State enterprises that are represented in the national Forestry Advisory Board at the directorate (the board includes 10 representatives out of totally 42 enterprises); in addition, the sample represented all four major regions in Lithuania. Totally, seven groups were covered: national forestry administrations, forestry administrations or enterprises at local/regional level, forest inventory and management planning organisations, non-governmental environmental organisations, forest scientists, forest industries and representatives of private forest owners. The questionnaire was submitted to equal number of respondents within a stakeholder group in each country. 21, 35 and 21 responses were received in Poland, Lithuania and Latvia, respectively.

The identified respondents were first contacted by phone, arranging an appointment for mailing the survey and scheduling a meeting in person or phone interviews to follow up written responses to the structured questionnaire. The survey was conducted in autumn 2006 by interviewers who were nationals of respective countries elaborating comparative MSc theses on policies on forest utilisation, cf. (Linkevicius, 2007) and (Wypij, 2008) for further details.

The question of particular relevance to this study was formulated as follows:

"*In your personal opinion, the future forest management practice in [respondent's country] should be closer to the* ***German*** *management school/tradition (rather passive utilisation, long rotation ages, continuous cover forestry, high standing volumes, negative economic result) or* ***Scandinavian*** *management school/tradition (intensive utilisation, short rotations, even-aged management, low standing volumes, positive economic result)?"*

Only two options (German/Scandinavian) were deliberately included to compel the respondent to express a preference for a defined tradition instead of trying to favour an intermediate stance. Each respondent was subsequently requested to provide reasons for

choice, rendering qualitative data that were analysed applying meaning condensation as well as contrast and comparison approaches (Miles and Huberman, 1994).

3. German versus Swedish approaches to management

3.1 Germany: management for volume

A cornerstone of the German forest science had been the theory of the "normal forest" aiming at continuous timber flow from forest of possibly highest productivity. Since timber of large dimensions historically was valued most, long rotations became a norm in Germany (Hofmann et al., 2000, p. 115). In result, the following management is typical for an even-aged conifer stand: young plantations of high density are established (Table 1), aiming for a high quality of the future stand. Frequent thinnings are carried out (Figures 1 and 2) to gradually remove the inferior trees. Another concept concentrates on improving growth conditions for a small number of selected trees of promising quality. Trees earmarked for the final harvesting can build up volume of high quality assortments until the harvesting age of 120-140 years is reached. Such schedules lead to impressive amounts of standing timber (Table 1). The average age of Norway spruce is 65 years and the average standing volume is 404 m^3/ha. The respective numbers for Scots pine are 70 years and 282 m^3/ha. The timber inventory is continuing to increase. Between 1987 and 2002, 48% of total annual growth was harvested in the Western part of Germany (BELV 2004; BELV 2007).

[Insert Table 1 about here]
[Insert Figures 1 and 2 about here]

For a long time, German forestry has been based on the integrated model of the State forestry administration, i.e. policy-making and forest management functions are carried out by the same agency (Krott, 2005). Today, the separated model has been realized in several *Bundesländer* with the goal to make forestry more market-oriented. The principle economic goal still is self-sufficiency, implying that State forestry should self-finance its activities without a substantial contribution to or from the State budget. This principle has been followed until 1960s. Since then, the raising costs of labour caused a negative gap between incomes and expenses and State forestry had to be subsidised. During the period from 1991 to 2002, the net earnings of State forest enterprises amounted to minus 120 euro per ha on average (Bormann et al., 2005). For an economist, this is an expected outcome, when as much capital is tied up in forest stands exceeding economically optimal rotations.

3.2 Scandinavia: management for profit

A Scandinavian forest owner or manager acknowledges that time has value and applies standard investment analyses techniques in scheduling silvicultural activities (Klemperer, 1996). Currently, Swedish and Finnish forestry typically uses the discount rate of 3 percent, which either is believed to be an appropriate opportunity costs for long-term investments with a similar risk profile, or probably is a trade-off between the opportunity costs and feasible limits for profitability of forestry investments (Brukas et al., 2001). This implies that priority is given for Norway spruce that produces valuable assortments in relatively short time, while Scots pine usually occupies sites too poor for spruce. Plantations are established with relatively low spacing to reduce costs for planting and tending as well as to reach higher diameter growth at relatively low ages; consequently, commercial thinnings start earlier compared to German stands (Figures 1 and 2). A typical rotation for spruce varies from 55 to 75 years and for pine from 80 to 120 years, depending on site productivity and climatic conditions.

Forest utilisation is not heavily tied to rotations, owner can adjust harvesting decisions according to situation on the market. The harvest/increment ratio in Sweden was in the range of 70 to 80 percent in late 1990s. In mid 2000s it has risen to 80-85 percent due to increasing demand for timber on domestic as well as foreign markets. Profit-oriented stand treatments, low rotations and large-scale use of productive harvesting machinery counterbalance the growing labour costs and reasonable profitability is still achieved. On the downside, forest management based on coniferous monocultures and low harvesting ages has caused significant loss of biodiversity (Mikusinski and Angelstam, 1998), which is now an important concern in Swedish and Finnish State forest policies. In 1999, the Swedish government set an aim to double the forest area special focus on environmental objectives, by taking away 900,000 ha forest from forestry production until 2010. In 2004 alone, SEK 85 million (around € 9.5 million) were channelled for the purpose (Boman *et al.*, 2007).

3.3 Robustness of the presented models

Besides obvious differences of forest policies and silvicultural practices at sub-national level, concerns might be raised about how well the presented models reflect today's reality and expected trends. Indeed, since 1990s, German forestry has been undergoing an ideological shift to "close-to-nature management" implying that uneven-aged management have to a considerable degree replaced even-aged management; more broadleaved and mixed stands are planted at the expense of coniferous monocultures. Being connected with enormous financial strains, this kind of *Waldumbau* is still taking place especially in public forests (Baumgarten and von Teuffel, 2005). In Sweden, the media debate on the need to diversify forest management practices has particularly intensified after heavy storm damage of spruce in 2005 (e.g. Alternativ 2008).

There are at least two reasons to maintain the validity of the described models. First, for the purposes of this study, it is more important to rely on the long-standing prevailing tradition as a measure stick, instead of focusing on the latest shifts in Germany or Scandinavia. Second, these shifts could be regarded as actual or supposed fluctuations within an established tradition without too revolutionising the actual management *in situ*. For example, both German and Swedish forestry seem to adhere to the established ages of harvesting that are the decisive factor for economic outcomes of stand management (Brukas *et al.*, 2001). In case of Sweden, the short-rotation (50-75 years) spruce management is becoming even more prevalent during the latest years. In Germany, it is not clear yet of how much the close-to-nature management is a politically-bound label and whether the modified silvicultural measures will establish themselves as long-standing and widespread forestry practices. Looking at large, commercial forestry in Germany will likely hold fast on management for volume, while Scandinavia will maintain the management for profit approach.

4. Main trends in Poland, Lithuania and Latvia

4.1 Transition of the forestry sector

Due space limits, this section only elicits overarching impacts of the economic transition:

(i) Transition *from centrally regulated prices to free market* on timber products took place in all three countries, with a certain reservation in Poland, where the General Directorate of State Forests defines minimum prices at which State enterprises can sell valuable timber assortments.

(ii) *Restitution of forest ownership* in Lithuania and Latvia raised private forests from zero to a significant share of forest area (Table 2), bringing about owners with little experience, fragmented estates and related structural problems. On the upside, the timber supply as well as forest policy arenas have been diversified. Poland had maintained 16-18 percent share private forests during and after the socialist period. Despite heated debates, no restitution to pre-war owners had taken place. The private sector plays a minor economic role, annually providing less then 5 percent of total timber supply in Poland (Wypij, 2008).

[Insert Table 2 about here]

(iii) The pressure to *reform State forestry administration* was endured with different outcomes. In Poland, largely unchanged hierarchical administration integrates forest management as well as State policy implementation functions within one entity. The guiding economic principle is self-sufficiency, i.e. State forests as the whole should operate with zero profit, without subsidies and neither making substantial contributions to the State budget (Wypij, 2008). Moreover, profits between enterprises are redistributed via the so-called State forest fund. The self-sufficiency principle essentially guides also Lithuanian State forestry (Linkevicius, 2007); however, individual State enterprises have greater freedom in economic decisions. State forestry in Latvia underwent a radical reform in 2000, when forest management and policy implementation functions were separated to two organisations. Rigid profitability requirements are set to the State joint stock company LVM that generates a considerable contribution to the State budget; in 2006 it amounted to EUR 33.4/ha on commercial forestland (LVM 2007).

(iv) The transition induced the tension *between the growing demand for timber versus environmental values*. Despite rather weak public attention to forestry, national administrations followed the increased global environmental concerns by joining relevant conventions; ENGOs gradually have become more influential as well. The annual harvest level increased substantially since 1980s, creating public impression of overutilization. Timber industries are expressing increased concerns for lacking raw materials (e.g. Morkevicius, 2007), while the timber inventory is being built up at impressive pace, as, officially, only $^{1}/_{2}$ to $^{2}/_{3}$ of gross annual increment is utilised (Table 2). The actual intensity of utilisation is probably even lower, since the current level of increment is likely to be underestimated in Latvia and particularly in Poland (Wypij, 2008).

4.2 Management practice at stand level

From the socialist period, Poland, Lithuania and Latvia inherited rigid legal regulation of silvicultural measures, thoroughly specifying the initial plant spacing, timing and intensity of thinnings, etc. The silvicultural practices in those three countries appear to take an intermediate position between German and Swedish traditions. Polish silviculture resembles German practices, with quite intensive thinnings in coniferous stands in age of 45-85 and then conducting the final felling at about 100 or, less frequently, 110-120 years (Table 3). Lithuania and Latvia follow a kind of "Russian-Baltic" tradition with rather infrequent thinnings until the age of 50-70 years and then stopping commercial thinnings for some 25-40 years, hoping to accumulate maximum possible volume for the final felling.

[Insert Table 3 about here]

A decade ago the initial spacing of Scots pine was defined to range from 5,000 to 12,000 trees/ha (in Poland up to 15,000) depending on site conditions. However, it was realised that the presumed gains in timber quality can hardly justify high initial costs due to tight spacing. The most significant reduction of planting density took place in Latvia, followed by Lithuania (Table 3). The rotation age in Poland is adjusted every 10 years for each forest district according to inventory data, fluctuating between 100-120 for pine and 80-100 years for spruce, most typically 100 years for both species. In Lithuania, minimum allowable rotation is strictly defined irrespective of site productivity. For pine, it practically remained unchanged at 100 years, while for spruce reduced from 80 to 70 years. Latvia has introduced the concept of minimum allowable stand target diameter and rotations might differ depending on stand productivity. Having lower rotations, discounting less severely affects the major income from stand (e.g. Brukas et al., 2001). This, reinforced by lower costs of establishment, leads to the result that Latvia shows the best economic performance as measured by IRR.

Despite intermediate silvicultural regimes, the East European countries utterly outperform the German and slightly also Swedish IRRs. The key reason is considerably lower labour costs in East European countries, which is likely to change at a rapid pace in coming years. The increasing costs would press the IRR down severely as demanding manual work is typically required during the early stages of forest rotation.

5. Stakeholder views in Poland, Lithuania and Latvia

Table 4 presents counts of opinions by Polish, Lithuanian and Latvian respondents on whether the country's forest management practice in future should be closer to German or Scandinavian tradition. Many respondents did not agree to select either model, arguing for own national tradition, created within the country's historic settings. National approaches are often regarded as a "golden middle" between the German and Scandinavian extremes. In particular, several interviewees noticed that a good balance is achieved through division of forest areas according to their functions, with different degrees of management restrictions. Some of the indecisive respondents still admitted that selected features of the "extreme" approaches could be introduced, such as a more market-oriented timber harvest and trade, characteristic for the Scandinavia. 58 percent of respondents were able to indicate preference to either German or the Scandinavian model.

[Insert Table 4 about here]

Pearson chi-square test shows convincing evidence that preferences differ between the three countries. Polish and Latvian respondents prefer the German and the Scandinavian model, respectively, while Lithuanians resume an intermediate position (Table 4). However, it should be born in mind that statistical inference cannot be made to entire forest stakeholder communities, since purposive sampling was used.

Supporters of the German model often note that natural and social conditions in the home country are more similar to Germany (Table 5). Reasonably, higher density of human populations and a smaller proportion of forest area create higher societal pressure for more ecologically oriented forestry, while contiguous areas of boreal forests suit better for large-scale management. Nevertheless, authors of this study strongly doubt the presumed importance of natural conditions. In Southern Sweden, where natural conditions rather well resemble settings in Latvia, Lithuania and Poland, forests are managed most intensively and

with lowest rotations. The plain reason is an efficient utilisation of higher site productivity compared to the boreal north. Some arguments represent fundamental beliefs explaining the adherence to certain management tradition. As stated by a senior officer in a State forest enterprise in Lithuania, the German model is preferred due to "*not too intensive management and volume accumulation, leaving only the good trees*". Several Polish and Lithuanian respondents point out the importance of traditions that are much closer to the German than to Scandinavian school.

[Insert Table 5 about here]

Supporters of the Scandinavian school most frequently refer to the economic efficiency. There are however noticeable differences between Polish and Baltic respondents. In Poland, only one respondent directly supports the Scandinavian approach; part of indecisive respondents just indicate that the German model wastes resources and does not ensure efficient utilisation of forest. Lithuanian supporters of the Scandinavian model are mostly concerned with the overall performance of the forestry sector, arguing that forestry should make a positive contribution to the national wealth. Many Latvians consider that forest management should be based on economic principles. As a supporter of the Scandinavian model puts it: "*forests should be very well managed and the incomes from the forestry sector could lead to its development as well*". The length of rotations is stressed as an important parameter by a substantial share of respondents. Noticeably, arguments for shortening of rotations prevail, backed up by several economic and silvicultural reasons.

6. Discussion

As the study undertakes a multifaceted comparison between countries, some words need to be said about the appropriateness of the chosen methodology. The Net Present Value could have been used for assessing the economic performance, as a solidly grounded criterion in the economic theory (e.g. Klemperer, 1996). However, the difficulty to decide on appropriate discount rate would obstruct the comparison between countries (Brukas et al., 2001). IRR is a theoretically defensible measure for evaluating typical forestry investments (Klemperer 1996) and suitably serves for a straightforward comparison in this study. A greater concern is the difficulty to define the most typical, prevailing silvicultural regimes. For example, Jasinevicius (2008) found that silvicultural treatments in Lithuania are rigidly prescribed in normative documents, but there is considerable difference between the actually performed thinnings and the normative ideal. The presented regimes (Table 3) should by no means be regarded as "fixed truths"; however, they approximate the current practice to a sufficient degree for a meaningful comparison of the economic performance. The examination of stakeholder preferences towards the German and Scandinavian models involves value judgements and stands in sharp methodological contrast to the rigid economic analysis. While such mixture of quantitative and qualitative research might be difficult to accommodate for a researcher entrenched in either tradition, we, on the contrary, see a great value of an approach that yields contrasting insights into issues of interest.

Turning to results, German and Scandinavian models lead to very different economic outcomes in spite of comparable levels of labour costs and timber prices. The decisive reason is the salient difference of rotations periods. Historically, a striking feature is the resistance to changes in German silviculture. In 1960s, when the German forest economy entered the sustained period of negative proceeds, State forestry made little effort to rethink its approaches to management. Our hypothesis is that the tradition persisted due to endogenous

factors, i.e. deeply-rooted professional ideology of management for volume with the result that rotation periods were kept high and "thick trees" have been aimed for even in times of crisis (Leonhardt 2006); but not due to exogenous pressures, such as budgetary requirements to avoid losses. Exogenous forces start considerably impacting German forestry only in 1990s, when pressure of environmental interest groups brought forward the paradigm of close-to-nature forestry, adding even more strain on economy (Weber *et al.*, 2000). The Scandinavian tradition has withstood environmental concerns with relatively minor changes to forestry practices, such a voluntary set-asides in less productive areas and, leaving shelter trees and more deadwood on clear cut sites. The fundamentals of silviculture practically remained unchanged, while, ironically, Scandinavian forestry enjoys a much better public image, as being more environmentally responsible than in Germany and other central European countries (Rametsteiner, 1999).

The comparison of Poland, Lithuania and Latvia reveals a clear regional gradient. The Polish forestry is closest to the German tradition with the weakest potential for change. Latvia is drifting away from management for volume to management for profit approach, while Lithuania takes a middle ground.

Is the shift from the management for volume to management for profit paradigm desirable in the post-transition countries? This is a value question, not subject to a positivist rigour. Authors of this study hold the view that the post-socialist societies would benefit from reforming forestry administrations, raising their capacity to effectively integrate environmental values and profitability. Under current cost structure and timber prices, it is certainly possible to achieve more than just fulfilling the principle of self-sufficiency. Dynamic but fragile post-transition economies need a positive contribution from forestry, of course, with due regard to environmental and social values. Unscrupulous shift to management for profit paradigm entails the risk of biodiversity reduction. The latter can be countered by further developing functional forest zoning already present in most post-transition countries. As shown by Brukas et al. (2001) it is more rational to have effective management in commercial forests, matching the economic yields with additional non-market benefits from adequate proportion of non-commercial forests, rather than applying an ill-defined and costly "standard solution" for balancing timber and non-timber values on each and every forest area.

Post-transitional forestry faces increasing tensions. The rising level of labour costs puts the self-sufficiency principle under pressure, and even the most powerful State forest administrations will face quests for raising efficiency. Expanding timber industries lack raw material and increasingly question the rationale for low levels of forest utilisation. These pressures will be counterbalanced by public environmental concerns along with reinforced advocacy by ENGOs. State forestry administrations can conveniently highlight those concerns to resist reforms targeting higher efficiency. To this end, an important factor will be the density of ideological filters (Schanz, 1999), i.e. to which degree individual beliefs and organisational cultures will "filter out" alternative paradigms, such as the Faustmanian understanding of the value of time in the long-term forestry ventures.

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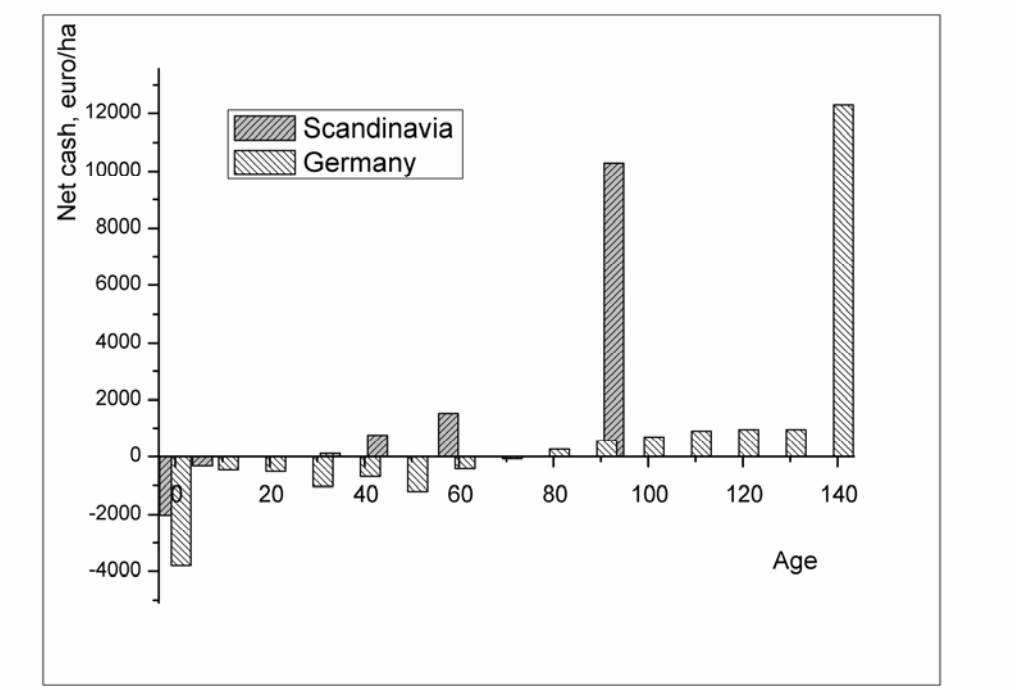

Figure 1. Typical cash flow of Scots pine average productivity in Scandinavia (IRR = 2.1%) and Germany (IRR = 0.6%)
Based on estimations by Per Magnus Ekö (personal communication) for Scandinavia and Bormann (2004) for Germany

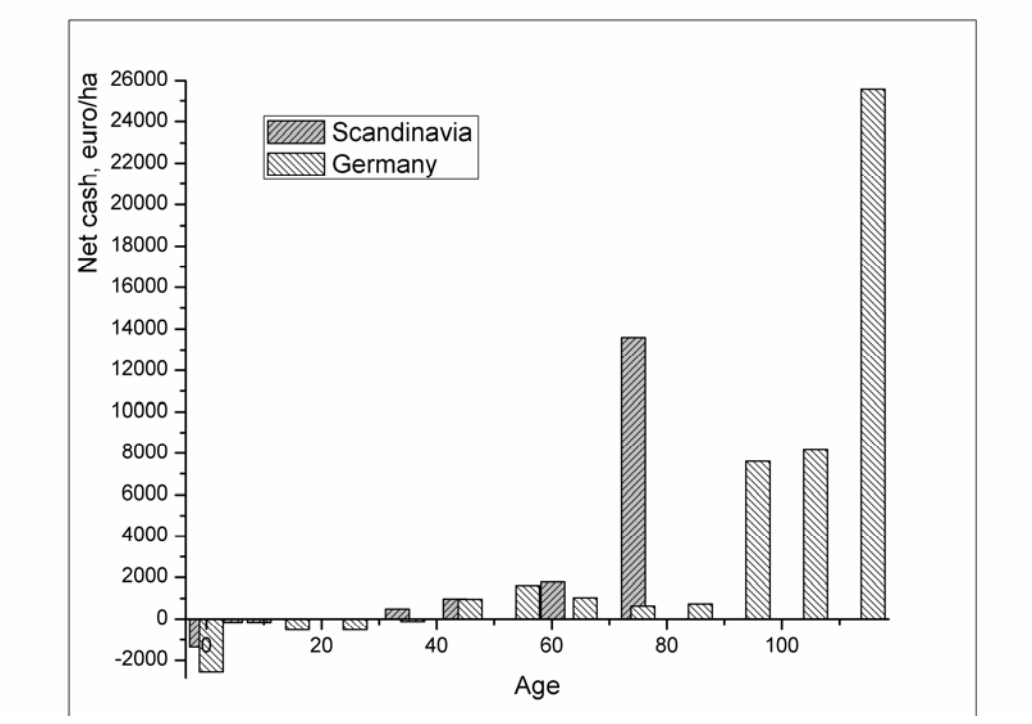

Figure 2. Typical cash flow of average productive Norway spruce in Scandinavia (IRR = 3.5%) and highly productive spruce Germany (IRR = 2.7%)
Based on estimations by Sallnäs and Nilsson (2006) and Ekö (2006) for Scandinavia and Hanewinkel and Navarro (2005) for Germany

Table 1. Selected features of German and Swedish forestry

Feature	Germany	Sweden
Initial spacing on a typical average site, trees/ha	Norway spruce: 1200-2500 Scots pine: 10.000-13.000	Norway spruce: 3000 Scots pine: 2500
Allowable or typical rotation in commercial forests, years	Norway spruce: 80-120 Scots pine: 100-140	Norway spruce: 55-75 Scots pine: 80-120
IRR from an average forest stand, %	Norway spruce: <2 Scots pine: <1 (typically negative)	Norway spruce: 3-4 Scots pine: 1.5-2.5
Average standing volume, m^3/ha (year)	317 (2002)	111 (2005)
Harvest/ increment ratio, % (average during time span)	52* (2003-2007)	76 (1995-2005)
Set-up of State forestry administration	Integrated: policy-making and forest management functions within the same agency (being separated in some Bundesländer)	Separated: Policy-making and forest management functions separated
Guiding economic principle in State forestry	Self-sufficiency: income should cover costs	Opportunity costs: forest should give earnings comparable to alternative investments

*based on an annual increase of 93 million m^3 (realistically the annual potential is restricted to 80 million m^3) and a harvest of 48 million m^3

Table 2. Selected features of forestry in Poland, Lithuania and Latvia, as of 2005

Feature	Poland	Lithuania	Latvia
Average stocking level, m^3/ha	203	190	204
harvest/increment ratio, min-max annual values, %; average in 1995-2005, %	38-68 average: 54	48-62 average: 56	41-81 average: 68
Share of forest area under State ownership, %	82	50	51
Set-up of State forestry administration	main functions integrated within one agency	separated nationally, integrated at enterprise level	fully separated since 2000
Guiding economic principle in State forestry	self-sufficiency	self-sufficiency	rigid profitability requirements

Sources: (Linkevicius, 2007; State Forest Service, 2006; Wypij; 2008)

Table 3. Typical silvicultural treatments and economic outcome in Norway spruce and Scots pine stands on average sites for species, as of 2006

	Spruce			Pine		
	Poland	Lithuania	Latvia	Poland	Lithuania	Latvia
Initial spacing, trees/ha	4-6,000	2-2,500	2-2,500	8-10,000	4-7,000	3,000
Regeneration costs, €/ha	0: -784	0: -570	0: -480	0: -1158	0: -522	0: -451
Cash flow of stand treatments: cleanings, pre-commercial and commercial thinnings, Age (years): net result (€/ha)	2: -112 3: -112 8: -78 15: -78 26: 348 45: 1462 55: 1584 65: 1730 75: 1901 85: 1949	1: -73 1: -73 3: -73 7: -164 15: -164 25: 188 45: 1364	2: -62 4: -79 10: -115 35: 792 52: 2315	1: -149 2: -149 3: -97 5: -83 12: -90 16: -70 21: 123 45: 991 55: 1049 65: 1078 75: 1137 85: 1185	1: - 100 2: -100 3: -100 15: -152 25: 130 45: 954 65: 1488	1: -99 3: -79 6: -79 9: -57 37: 740 62: 1836
Allowable rotations in commercial forests, years	(80)-100	70	80-100	100-(120)	100	100-115
Typical final felling, age (years): net result (€/ha)	100: 16418	75: 8520	81: 12549	100: 12266	105: 9222	100: 13884
IRR, %	4.1	3.5	4.7	2.9	3.1	3.8

Sources: (Linkevicius, 2007; Wypij, 2008; State Forest Service 2006), relevant national regulations (for forest regeneration, thinnings, etc.), personal communication with experts in respective countries (Janis Donis, Andis Lazdins, Gediminas Jasinevicius, Aleksandra Bis)

Table 4. Respondents' preferences towards German and Scandinavian forestry schools

	German school	Scandinavian school	indecisive ("own way")	Total
Poland	10	1	10	21
Lithuania	11	13	11	35
Latvia	1	8	12	21
Total	22	22	33	

Table 5. Respondents' arguments for the German model (G) versus Scandinavian model (S)

	Arguments for G and against S	Arguments for S and against G
Poland (PL)	-nature conditions more similar in PL & Germany (6) > ecological orientation, better nature protection (3) -tradition, > experience with G (2) -sustainability, durable ecosystems (2) ->people/forest area, few private forests in PL (2) -economics justifies lesser use in private forests (2) -better stand structure & species composition (1) -production of high quality timber (1)	-economic efficiency, economic result (5) -G is not optimal for Scots pine and poorer sites: too long rotations, too small clear cut areas (3)
Lithuania (LT)	-different nature conditions from Scandinavia (3) ->people/forest, forest sector < important in LT (2) -Lithuanian tradition closer to G (2) -orientation to multiple-use and social needs (2) -G calms down ill-informed and skeptical society (2) -S: technological control of biology, no purpose (1) -S destroys own and world's forests (1) -Scandinavian machinery don't fit LT conditions (1) -forests should accumulate volume of good trees (1) -profits from forest impossible in LT (1)	-LT cannot afford to subsidize forestry, but rather should receive a positive economic result (5) -large/increasing demand for timber (2) -S creates more employment (1) -calamity risks in overstocked forests (1) -mentality, cultural links to Scandinavia (1) -rotation for spruce should be lowered to avoid decay of valuable timber (1) -LT has > coniferous, cut-to-length technology is more apt (1)
Latvia (LV)	-G better fulfills environmental requirements (2) -rotation should not be too low, also in intensively managed forests (2) -non-monetary values become more important (1) -forest industry should be supported by State due to social and ecological values (1)	-intensive forest management based on economics, positive economic outcomes (5) -shorter rotations would increase profit, decrease overmature aspen and birch, < spruce damage (2) -forestry has a task to provide round wood (1) -development of efficient technologies (1) -similar forest conditions in parts of Scandinavia (1) -Scandinavian societies have a higher regard to the forestry sector than elsewhere in Europe (1)

Note: Numbers in parentheses indicate the numbers of respondents whose arguments are in line with the appropriate condensed statement. One respondent can stand for more than one statement