

# **Limitations and barriers to the development of forest firms providing timber harvesting and transport services in Poland**

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## ■ **Abstract**

Compared with EU countries, Polish forestry features one of the highest proportions of forests under state ownership reaching nearly 80% of the country's forested area. At the same time, all the operations related to timber harvest and transports are performed by private contractors. The private contractors have no development strategies. This is caused by a number of factors, such as economic, environmental and social, as well as lack of competition on the services market. Unit rates of 4.4 EUR/hour to 4.9 EUR/hour for harvesting operations and 4.2 EUR/hour to 4.6 EUR/hour for timber skidding differ significantly from those in European Union states reaching for some operations 10–20% of the rates applied in Sweden or Germany. The low fees and the high costs of equipment purchase and use, as well as the difficulties in ensuring an adequately large and stable scope of work are the barrier in the development of service firms.

## ■ **Key words**

Forest firms, timber harvesting, services

## ■ Introduction

Compared with EU states, Polish forestry features one of the highest proportions of forests under state ownership reaching nearly 80% of the country's forested area. At the same time, all operations related to timber harvest and transport are performed by private contractors.

There were 4,718 forest firms operating in Poland in 2006, of which 1,233 were one-person businesses. Among multi-person firms hiring labour on permanent job-contracts, most of them (2,100 firms) employed 2–5 workers. Only 14 firms were classified as large, multi-person forest businesses employing more than 50 permanent workers. The possibilities of development for these firms are not only related to economic, environmental and social factors, but are also influenced by the lack of competition on the internal forest services market.

## ■ The purpose of the study and the scientific approach

Identification of the causes and effects of the undeveloped competition on the forest services market in the area of timber harvest and transport in Poland is the key to the understating of the situation, which prevails on the forest services market in Poland.

It is considered necessary to make analytical and logistic evaluations within the entire forest services market concerning both the principles of forest management, applied equipment, work techniques and technologies, employment and, first of all, facilitations in establishing the mechanisms of competition based on environmental and economic effectiveness.

The questionnaire survey was carried out throughout Poland by selecting the appropriate number of firms providing forest services, using criteria such as technical equipment level, employment and management structure, work and pay conditions, as well as financial status. Moreover, the performance of those firms was assessed on the basis of tree damage in a stand, as well as damage of topsoil layers (Nowacka et. al. 2006 and Zastocki 2001). Sixty firms performing timber harvest and transport works in Poland were surveyed. In the questionnaire survey, the work method developed for the needs of the Ergowood's research was applied (Paschalis et. al. 2005, Moskalik et.al. 2006). The paper presents the main results of the survey whose subject matter is indicated in the title.

## ■ Research results and discussion

### Legislative and natural conditions

Poland's Forest Policy is a program document specifying the strategy and tactics of managing and administering forest resources on the basis of Polish Forest Law, also taking into consideration the most prominent achievements in the area of international forest policy. In operational sense, the Forest Law is a legal instrument applied in forestry for all kinds of forests, regardless of their ownership form. It divides the competencies related to forest management supervision with regard to the criterion of ownership relationships. In forests being the property of the State Treasury, forest supervision is carried out by the

empowered environmental minister, while forests not owned by the State Treasury are supervised by a local governor.

The main rules governing forest management in the State Forests National Forest Holding are set in the Forest Management Plans drawn up every ten years for all Forest Inspectorates, ensuring the continuity and uniformity of procedure over long-term periods. This also pertains to forest utilization at a level resulting from silviculture and protection needs, as well as from the principles regulating the species, age structures and the standing volume structure.

Recapitulating, it should be stated that, apart from the general regulations governing safety and hygiene at work, and the current labour law, there are no adequate legislative acts covering the whole range of operations related to timber harvest and transport. Moreover, the weakness of the Polish forestry observed till the present day is that the principles of forest sustainability and multifunctionality are not reflected in the Polish legislation system, particularly in the budgetary, tax and ownership laws. As far as executional aspects are concerned, forest service providers are left without any vital legal, logistic or organizational support.

The effect of legislative and natural conditions on harvesting operations and, consequently, on their technical and technological sophistication level, includes first the necessity to perform work in accordance with the forest management requirements adapted to the high natural forest diversity in Poland. Polish forests are dominated by coniferous stands – 5.4 million hectares (77% of total forested area), with the predominating pine – 70% of the area (4.8 million ha), while broadleaved forests covering 1.6 million hectares represent 23% of the total area of forests with oak and birch species predominating (Report: Forests in Poland. 2006).

The average stand volume in Polish forests amounts to 213 m<sup>3</sup>/ha; in forests managed by the State Forests it is much higher (222 m<sup>3</sup>/ha) than in privately-owned forests (119 m<sup>3</sup>/ha). Total timber sales in 2007 amounted to 30.8 million m<sup>3</sup>, about 2% up over the preceding year. The increase reflects an enlivenment on the timber market and an unprecedented high demand on this raw material observed for several years (GUS.2007).



FIG. 1. Dimensions to the harvest of gross merchantable timber in the State Forests, by type of utilization (DGSF)

The silviculture regimes and the principles governing forest operations in Poland require that operations related to timber harvest, improvement cuts, or early and late thinning be repeated several times during a stand lifespan. In addition, removal of a mature stand involves sophisticated group selection felling operations, spread over time and space (Fig. 1) (Report: Forests in Poland. 2006).

In 2006, early cleaning operations were performed on an area of 62.8 thousand hectares, late cleaning operations on 82.5 thousand hectares, early thinning operations on 159.9 thousand hectares, and late thinning operations on 324.2 thousand hectares. Final cuts were carried out in a clear cutting system on an area of 23.9 thousand hectares and in a complex cutting system on an area of 17.7 thousand hectares (GUS 2007).

All the above mentioned timber harvest operations took place on fragmented areas totaling 700,000 hectares, where concentration of timber raw material (in m<sup>3</sup>) harvested from 1 hectare of forestland was usually low.

### Technical and technological conditions

With relatively low capital expenses incurred by contractors, most of the timber harvesting and transport operations are performed with chainsaws, farm tractors, horses (less often) or medium- and high-tonnage vehicles. This technical level was reflected in nearly 97% of the performed work. The machine-aided timber harvesting and haulage technologies, using high-tonnage vehicles, are applied for about 3% of timber raw material.

The data in Table 1 clearly show both, an increased number of applied mechanical equipment and a change in its structure which took place in the past several years. Despite the still low level of mechanization of harvesting operations compared with most of the European Union states, the current change dynamic indicates another technical level of forests services evolving in Poland. A more than double growth of forwarder purchases and an about 25% growth of skidder purchases, with a simultaneous, over 10% decrease in the number of farm tractors and an over 31% decrease in the number of horses used for skidding operations clearly marks a strong trend towards a shift from motor-manual, to fully mechanical work.

TABLE 1  
Technical equipment of the private firms (Source: GUS 2007)

Year	Tractors			Micro tractors	Harvesters	Forwarders	Add equipment of the farm tractors		Medium-tonnage vehicles	High-tonnage vehicles	Horses
	Farm tractors	Skidders	Caterpillars				Trailer crane	Hoisting winch			
Multi-person firms											
2002	3088	356	29	60	22	20	172	538	52	37	121
2006	2066	444	48	57	26	45	357	688	39	22	884

Motor-manual work still dominates in timber harvesting. Timber extraction is carried out mainly by skidders, poorly equipped farm tractors (about 70% of them have no additional extraction devices) or horses. In private forests, with small average area (about 1 ha), most of the timber harvesting work is done by forest owners themselves using their own technical means. Due to a relatively low level of mechanization of timber harvesting in Poland, an average productivity rate expressed as a cubic meter volume of timber harvested in an hour (technological and extraction operations together) is lower than in other West European countries. Last years, productivity in Poland has been running at 4.5 m<sup>3</sup>/work day. However, there are great differences in productivity under many different forest conditions.

The technological efficiency of harvesters is varied, and mainly depends on a cut single tree volume, different cutting system and harvester type. Harvester average productivity in first thinning ranges between 4–9 m<sup>3</sup>/h; in late thinning it reaches 15 m<sup>3</sup>/h and in final cutting – 25–35 m<sup>3</sup>/h. Forwarding efficiency also depends on a single tree volume, hauling distance, machine type and assortment variety. Average values for different machines, 400 m – distance hauling and pulpwood range between 4.5 to 11 m<sup>3</sup>/h. The total workload for every harvester model depends on machine efficiency and forest conditions causing a wide productivity range.

Transportation and technological unit costs for every harvester depend on hourly cost and productivity, which vary under different conditions. For stands with average single tree volume up to 0.2 m<sup>3</sup>, the cutting and bucking costs amount to ca EUR 10. When a single tree volume is rising, the costs decrease. In final cutting, the costs are under 3 EUR/m<sup>3</sup>. Direct unit costs of forwarders oscillate between 2.5–8 EUR/m<sup>3</sup>. Therefore, a wide cost range principally depends on the hauling distance. It should be noted that under the same forest conditions all the analyzed costs of forwarder operation are similar. Work day length and the amount of working days per annum have an impact on the unit costs of harvesting. Costs become lower when efficiency and total working hours per annum rise.

Average unit prices for individual services differ significantly from those in the European Union states reaching, for some operations, 10–20% of the rates applied in Sweden or Germany (Table 2). Particularly worthy attention are the very low unit rates, ranging from 4.4 EUR/hour to 4.9 EUR/hour for harvesting operations, and from 4.2 EUR/hour to 4.6 EUR/hour for timber skidding and haulage. In addition, rates for tending treatments are low. Combined with the high costs of equipment purchase and operation, as well as with the difficulties to ensure an adequately large and stable scope of work, the development of service firms is particularly difficult. As a result of so many negative factors, also work mechanization development related to timber harvesting and transport is slow and, in many cases, economically ineffective.

The structure of hourly machine costs indicates that machine price represents almost 50% of all costs. Labor cost is insignificant and does not exceed 10%. Such a cost structure is different from the traditional hourly costs of manual harvesting with a power saw, as wage is the main cost component and, in Poland, it amounts to 60–70%. An inevitable wage increase in the future will make fully mechanized harvesting relatively commercially valuable.

The present harvesting unit rates offered by the State Forests on the basis of direct costs allow for fully mechanized harvesting during thinning treatments when harvester productivity exceeds 15,000 m<sup>3</sup> per annum. Practically, it means that a harvester should

have a productivity of about 5 m<sup>3</sup>/h. The carried out research shows that this is possible when a single tree harvested volume is bigger than 0.08 m<sup>3</sup>. In mature, final cutting stands, productivity should exceed 55,000 m<sup>3</sup> per annum. Fully mechanized timber harvesting is connected with the use of heavy truckloads, which requires good quality forest roads. About 80% of Polish roads are trails that are not prepared for carrying such heavy loads. There is a need to design an optimal road density in forest environment in order to invest in road quality improvement.

TABLE 2  
Average unit prices of selected services performed by private one-person and multi-person forest firms in 2005 (source: GUS 2007)

Firms	One-person firms	Operation							
		Timber harvesting	Skidding	Afforestation	Soil tending	Early cleaning	Late cleaning	Timber haulage	Soil preparation prior regeneration
		€/m <sup>3</sup> *		€/ha*				€/ha*	€/ha*
One-person firms	1233	4,35	4,63	394,63	87,51	87,56	99,06	4,74	162,91
Multi-person firms	3495	4,79	4,13	336,26	31,39	87,01	96,93	4,38	183,99

It should also be emphasized that a large volume of harvested timber come from windbreaks, dead trees and windfalls, that is from low commercial quality timber harvested in tough terrain conditions (Fig.2). Carrying work under such stand structure conditions is, in most of the analyzed cases, unprofitable for service contractors.

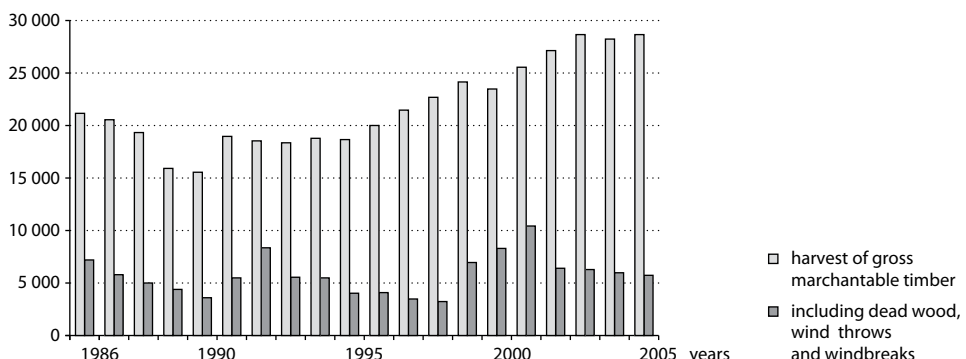


FIG. 2. Share taken by harvest of dead standing wood, windbreaks and wind throws in overall utilization in the State Forests ( in '000m<sup>3</sup> of gross merchantable timber)

### Social and economic conditions

Starting from 2002, the number of private firms providing forest services has dropped significantly, with a concurrent employment increase in the segment of 6–20 persons in a firm, but still, most of enterprises doing business for forestry are small or very small firms (Table 3).

Table 3  
The number of multi-person private forest firms employing the permanent manual workers  
(Source: GUS 2007)

Year	Multi-person firms	Permanent manual workers				
		2–5 persons	6–10 persons	11–20 persons	21–25 persons	>25 persons
2002	4252	3004	796	330	55	67
2006	3495	2133	866	415	33	48

Investment activity is a reliable indicator of the economic situation both for the entire economy and for individual enterprises. Detailed data on this subject are practically unavailable. Only some trends can be determined.

As it reads from the questionnaire surveys (for Poland-Questionnaire-ZUL-M) and Interview Ergo Wood for France-question B4 (Nowacka at al. 2006). Do you plan any large investments in forestry in the near-medium future; let's say within the next 3 years?) most of the contractors/operators consider investing in a forestry firm, in its development (Fig. 3). Forest Inspectorates, nearly the sole contracting parties for forest works, play the role of promoters of certain systemic solutions. The obtaining of a positive financial effect by private firms depends largely on rational forest management and the application of the economically justified rates for labor. Thanks to these instruments, the State Forests has great influence on private firms operating on the home market. By selecting firms under the public procurement program and by applying the appropriate criteria, they decide about the structure and equipment of, as well as the manner of performing tasks by firms.

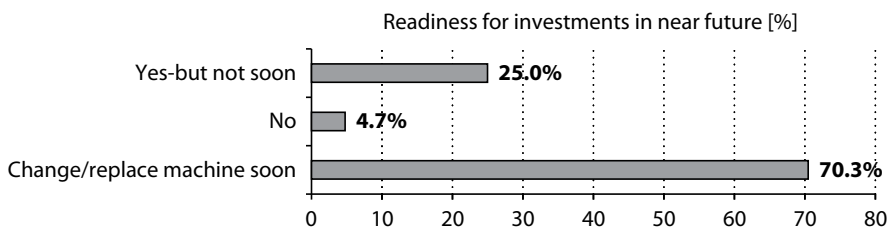


FIG. 3. Tendencies regarding investments and expansions of firm in near future (Source: Nowacka and Moskalik 2005)

Taking into consideration the value of capital expenses per enterprise, differences are unveiled in the volume of these expenses paid by individual groups of enterprises. On average, large entities have the largest capital budget. The unit investment amount of these

entities was usually over 10-times higher than the investments of medium-sized firms and some scores time higher than in the case of small firms. A similar or even more drastic situation is in the private services sector in forestry (Grodecki, Kubiak 1997, Kocel 1997). From the point of view of a unit – the forest inspectorate- it is important that firms cooperating with the State Forests become stronger (e.g. employ more people). Such firms give then a greater guarantee of, good service quality and stability, as well as investment potential.

In a great majority of mini-enterprises, capital outlays are financed from their own resources. Lack of liquidity affecting the smallest firms more strongly than the bigger ones is probably the main reason for that. Another possible, though probably less important reason behind the status quo, is the relatively low propensity of small entrepreneurs to take risks. Therefore, mini-enterprise owners first accumulate the required funds, and only then, they invest. That is why the one-off expenses for investments are relatively small.

At the same time, the structure of the costs incurred by multi-person forest firms clearly indicates a shift of burdens onto worker wages and costs of maintenance of technical equipment (Table 4.).

Table 4  
Structure of costs incurred by multi-person forest firms in 2005

Number of multi-person firms	Structure of costs			
	Worker wages with mark-up	Salaries with mark-up for supervision staff and firm manager	Maintenance and operation costs of technical equipment	Taxes and insurance
	in % total costs			
3 495	44,0	6,5	20,7	8,1

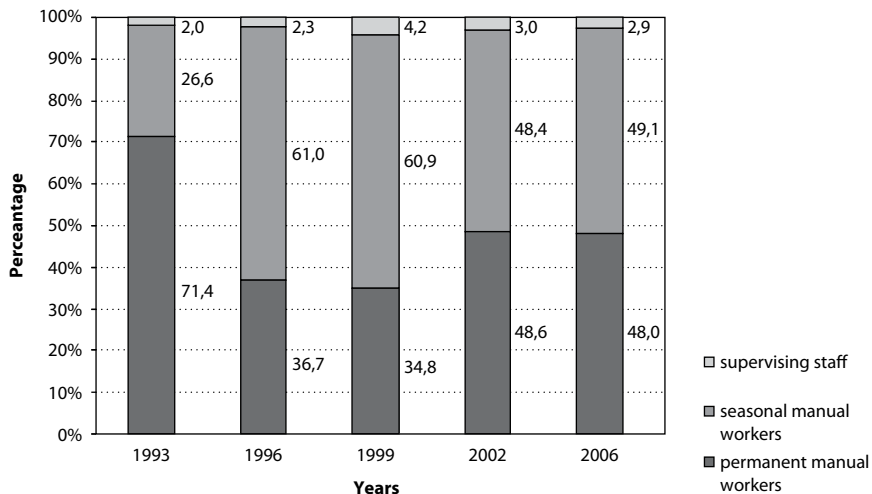


FIG. 4. An employment structure of the multi-person private forest firm (Source: Paschalis P., Nowacka W. et. al. 2006)



This is in accordance with the trends observed in all European Union states. Employment structure in forest firms is a valid indicator which has remained at an almost unchanged level in Poland since 2002 (Fig. 4). Therefore, it can be assumed that the employment structure in firms providing forest services including about 48–49% of permanent and temporal workers and 2–3% of supervising staff is optimal under the Polish forestry sector conditions.

## ■ Conclusions

1. The number of forest firms operating currently in Poland amounts to 4,718 of which nearly one fourth are one-person firms and no more than 14 firms are classified as large ones, with more than 50 permanent workers. At the same time, employment structure in forest service departments oscillates about 48–49% of permanent and temporal workers) and 2–3% of supervising staff.
2. Timber harvest and transport take place on fragmented forest areas totaling 700,000 hectares with a usually low concentration of harvested timber raw material per hectare.
3. A nearly double increase of forwarder purchases and an about 25% increase in the purchase of specialist skidders observed in recent years, with a simultaneous over 10% decrease in the number of farm tractors and an over 31% decrease in the number of horses used for skidding operations clearly marks a strong trend towards shifting to another technical level, from motor-manual to mechanical.
4. Unit rates of 4.4 EUR/hour. to 4.9 EUR/hour for harvesting operations and 4.2 EUR/hour to 4.6 EUR/hour for timber skidding and haulage works differ significantly from those in European Union states reaching for some operations 10–20% of the rates applied in Sweden or Germany.
5. Lack of legal regulations enabling concluding long-term contracts, lack of real possibilities of crediting machinery and equipment purchases by the State Forests NFH, lack of adequate infrastructure for engineering management of forests, as well as the current sophisticated system of calculating fees for the work done are the main barriers to the development of the forest services market in Poland.

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## ■ Streszczenie (Summary)

### Ograniczenia i bariery w rozwoju firm usług leśnych wykonujących pozyskiwanie i transport drewna w Polsce

Możliwości rozwoju firm usług leśnych wykonujących pozyskiwanie i transport drewna w Polsce uwarunkowane są nie tylko czynnikami ekonomicznymi, środowiskowymi i społecznymi, ale również – brakiem wewnętrznej konkurencyjności na rynku usług na operacje leśne oraz brakiem, z zewnątrz, istotnego wsparcia prawnego, logistycznego i organizacyjnego.

Obecnie w Polsce działa 4718 firm leśnych, z których blisko 1/4 jest firmami jednoosobowymi, a zaledwie 14 firm zaliczanych jest do dużych, zatrudniających powyżej 50 robotników stałych. Jednocześnie, struktura zatrudnienia w zakładach usług leśnych stabilizuje się na poziomie około 48–49% pracowników stałych i sezonowych i 2–3% nadzoru właścicielskiego. Struktura kosztów poniesionych przez wieloosobowe firmy leśne, wskazuje na przesunięcie ciężarów obciążeń na płace robotników i koszty utrzymania środków technicznych.

Pozyskiwanie i transport drewna odbywają się na rozproszonych powierzchniach lasu, obejmujących w sumie ponad 700 000 ha, o zazwyczaj niskiej koncentracji ilości surowca drzewnego pozyskiwanego z 1 ha, dodatkowo, znaczny rozmiar pozyskanego surowca drzewnego pochodzi ze złomów, posuszu i wywrotów, a więc drewna o niskiej jakości technicznej i pozyskiwanego w trudnych warunkach terenowych. W wyniku nałożenia się tak niekorzystnych czynników powoduje, rozwój mechanizacji prac przy pozyskiwaniu i transporcie drewna w Polsce jest powolny i w wielu przypadkach, ekonomicznie nieefektywny.

Średnia cena jednostkowa, za określoną usługę odbiega znacznie od porównywalnych danych w krajach unijnych, osiągając, przy wykonywaniu niektórych operacji 10–20% wysokości stawki otrzymywanej w Szwecji lub Niemczech. Szczególnie zwracają uwagę bardzo niskie stawki jednostkowe, wynoszące od 4.4 EUR/godz. do 4.9 EUR/godz. przy pracach pozyskaniowych i od 4.2 EUR/godz. do 4.6 EUR/godz. za prace przy zrywce i wywozie drewna. Wzrost ponad dwukrotny, na przestrzeni ostatnich 4 lat, zakupów forwaderów oraz o około 25% specjalistycznych ciągników zrywkowych, z równoczesnym ob-

niżeniem o ponad 10% ilości stosowanych ciągników rolniczych i o ponad 31% koni przy operacjach zrywkowych, wyraźnie zaznacza silny trend przechodzenia na inny poziom techniki pracy: z ręczno-maszynowego – na maszynowy.

Brak regulacji prawnych umożliwiających zawieranie kontraktów długoterminowych, brak realnych możliwości kredytowania przez Lasy Państwowe zakupów maszyn i urządzeń, brak odpowiedniej infrastruktury inżynierskiego zagospodarowania lasów oraz skomplikowany system ustalania stawek za wykonaną pracę, stanowią główne bariery w rozwoju rynku usług leśnych w Polsce.

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