

A COMPREHENSIVE SURVEY OF HARVESTERS AND PROCESSORS IN ITALY: WHAT, WHERE, HOW

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Abstract: *The Authors conducted a comprehensive survey of mechanized harvesting and processing machinery in Italy, with the purpose of understanding if the close-to-nature small-scale forestry typical of this country may prevent a reasonably intense utilization of modern technology, or entail a significant increase of its operating cost. Despite the challenging work conditions offered by Italian forestry, modern forest technology has already made significant inroads, as witnessed by a small yet substantial harvester and processor fleet, counting about 90 units, 75 % of which mounted on general-purpose carriers. Utilization levels are lower than those reported for northern and central Europe, but still in excess of 1000 hours year⁻¹, at least for the prime movers. Insurance, repair and maintenance costs are significantly lower than generally reported in current literature. However, empirical data on machine costs is very scarce, and most studies report estimates rather than measured values. Such estimates are often obtained with the same basic methods derived from agriculture, thus raising the question of whether their adaptation to forestry use should be further refined.*

1. Introduction

The prevalence of non industrial private forestry (NIPF) and the very limited success of owners' associations may hinder the introduction of mechanized harvesting to Italian forestry. In fact, the small scale of most Italian logging firms is likely to reflect their dependence on NIPF sources, and results in a limited investment capacity. Nevertheless, mechanized CTL technology has made significant inroads into Italian forestry, and it is increasingly frequent to encounter logging firms that have just purchased their second machine. Therefore, it may be interesting to characterize the Italian harvester and processor fleet, by describing its composition, development and utilization patterns: this may provide a very useful example of how Nordic technology can be introduced to a very different economic, social and physical environment, indicating what are the main opportunities, obstacles and success factors. Besides, it may be very useful to determine how the local economic, social and physical conditions of Southern European NIPF can affect the utilization and the cost of mechanized harvesting technology. In this respect, Italy represents an ideal case study, due to the prevalence of NIPF and to the existence of a sizable machine fleet. Both the Italian machine users and the foreign producers have much interest in understanding if such conditions may affect the composition of the Italian machine fleet, and cause significant deviations from the mainstream European trends. Similarly, both may want to know if the close-to-nature small-scale forestry typical of this country prevents a reasonably intense utilization of CTL technology, or entails a significant increase of operating cost through the excessive incidence of machine relocation expenses. Therefore, the goals of this study were: A) to characterize the Italian harvester and processor fleet, describing its usage pattern and its development over the past 10 years; B) to determine the annual utilization level of mechanized CTL technology in Italy, and to compare it with the utilization levels commonly reported for other European countries; C) to determine the cost sustained by the Italian logger for the insurance, relocation, repair and maintenance of their harvesters and processors.

2. Materials and methods

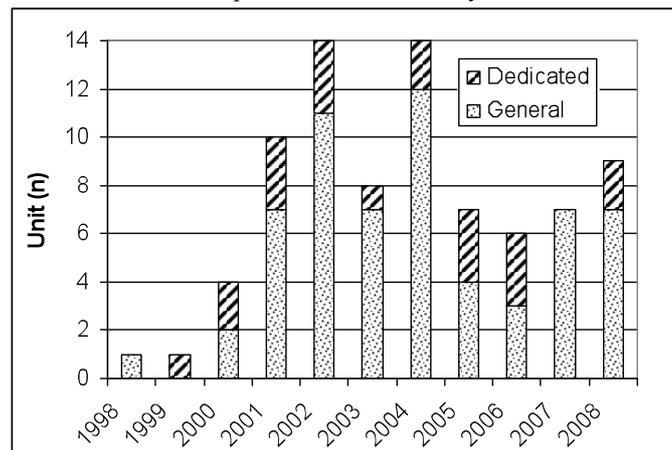
First of all, a general survey was conducted in order to identify and locate mechanized operators. This was done by contacting the many mechanized firms with which the National Council for Research (CNR) has been working for about a decade, since the first harvesters were introduced to Italy. Hence, the Authors could already count on a large and established network of mechanized firms, through which they could be introduced to further operators. The final list contained 87 units, 6 of which owned by foreign firms and excluded from the count, since operation in Italy occupied only a minor part of their annual schedules. Furthermore, 7 of the Italian machines were too recent for obtaining reliable data about utilization and costs. The remaining 74 machines were considered representative, and their owners were contacted in order to obtain utilization and cost figures. In most cases they were also visited in the field, while they were working. Each was given an interview form, asking data about machine age, total machine hours, annual insurance cost and annual repair and maintenance cost. Furthermore, data was asked about relocation mode, frequency and cost. The form was left with the owners, so that they could check their books and provide accurate figures. Valid data were obtained for 53 machines, i.e. over 70 % of the surveyed pool. 34 of the respondents could actually provide annual lists of the repair, maintenance and relocation expenses, whereas the others only offered average annual figures.

Data processing was relatively simple, and consisted of calculating the basic descriptive statistics for the valid pool of data. Regression analysis was applied to the repair and maintenance cost time series, to check whether annual repair and maintenance cost varied over time (SAS 1999). All cost figures in annual series were adjusted to 2009 values using the living cost index list published on the national statistics (ISTAT 2009).

3. Results

The annual sales of harvesters and processors show a growing trend, with peaks in 2002 and 2004 (Figure 1). The overall annual average amounts to 7 new units per year, but this figure swells to almost 9 units if one starts the count from the new century and excludes years 1998 and 1999, which can rightly be regarded as a “test” period, during which the very few machines in Italy were being looked with much attention by many potential users, who still had to win initial diffidence.

Figure 1. Harvesters and processors sold in Italy between 1998 and 2008



Three quarters of the machines sold in Italy are mounted on general purpose prime movers, especially excavators. Dedicated harvesters are much less popular, and represent the remaining quarter. Regardless of type, 27% of the prime movers are pre-owned, but almost half of them have been fitted with new heads. Sizewise, 70% of the heads fall into the heavy harvester class, with a nominal cutting capacity of 60 to 70 cm. At least 12 brands are represented on the Italian market, but Konrad is by far the most popular, followed at a distance by John Deere, Kesla and Keto.

Almost two-thirds of the Italian mechanized CTL fleet is concentrated in the northern regions, and especially in the Autonomous Provinces of Trento and Bolzano (respectively 15 and 12 units). Another quarter of the fleet is deployed in central Italy, with the highest concentration in Tuscany and Emilia-Romagna. Only 6 units are owned by southern companies, with at least two of them actually working in central Italy.

The average machine utilization for the 53 sampled units is 1328, 753 and 382 hours year⁻¹, respectively for dedicated, excavator-base and tractor-mounted units. About 20% of the owners of excavator-base and tractor-mounted units in the sample declared that their base machines are often used for jobs other than harvesting and processing, such as bunching, loading and digging. Overall, 75% of the Italian harvester and processor fleet actually sampled has a utilization level above 500 hours year⁻¹. Statistical analysis could not detect any significant difference in the utilization of new and pre-owned units.

Insurance cost ranges between 100 and 2600 € year⁻¹. Over half of the machines are included in an overall insurance policy covering all the company's fleet for liability against damage to third parties. The average cost of such policy goes from 1900 to 2600 (mean 2200) € year⁻¹, and it is very difficult to disaggregate the total figure and calculate the insurance cost of the harvester or the processor only. The remaining companies have stipulated individual insurance contracts for their mechanized CTL machines, at an average cost of 712 and 2060 € year⁻¹ depending on whether the machine is only insured against damage to third parties, or also against fire, theft and vandalism.

The cost reported for repair and maintenance averages 4097 € year⁻¹, ranging from as little as 258 € year⁻¹ to a more substantial 22371 € year⁻¹. Dedicated harvesters carry a higher annual maintenance cost than excavator-base and tractor-mounted units, but that only depends on their higher annual utilization. In fact, no significant differences can be found between machine configuration classes when analyzing hourly R&M cost, which averages 4 € hour⁻¹. Similarly, no such differences are found between new and pre-owned machines.

Two-thirds of the harvesters and processors used in Italy are compact enough to be transported on public roads without any specific authorizations. The remaining third exceeds the legal road limit for width, and the transport must be authorized by the road administration, often on an annual basis. Only 5 units are so wide as to require an escort when transported on public road. Tractor-mounted units are the only ones authorized to drive on public roads and are often relocated without the need for a transport truck, at least on short distances (generally up to 30 km). Over half of the companies are equipped for relocating their harvesters and processors on their own. To the purpose, they often use a second-hand low-bed trailer hitched to one of their log trucks. At times, the trailer is also used for transporting short-wood, loaded cross-wise. Cost reduction is only one reason for internalizing machine relocation, the other being operational flexibility: confronted with the unpredictable occurrences of logging jobs and intent on making an intense utilization of their machines, most operators find it difficult to plan their relocation slots with enough accuracy to book their transport, and at the same time they do not want to wait too long before a transport is available.

Specialized moving firms charge their services by the hour or by the km. According to the interviews, hourly rate range between 75 and 135 € hour⁻¹, with most responses clustering around 85-90 €. Reported kilometer rates vary between 1 and 1.5 € km⁻¹. However, operators can strike special deals with movers, and pay considerably less than that: this is the case of package deals (so many transports per year) or of service returned (e.g. loading the log trucks owned by the same transport firm as soon as they appear, interrupting any other ongoing tasks).

The average annual costs for the relocation of a harvester or a processor are 3167 and 4342 € year⁻¹, respectively for the companies that use their own trucks and those who contract a professional mover (Table 1). The latter relocate their machines less frequently (6 times a year vs. 11), but more often on distances longer than 100 km. Seeking work outside the region of origin is not rare, and a couple of companies occasionally work abroad, in Austria, France and Germany. In general, the average cost of a single move is estimated to 306 € if the job is done with own means, and to 790 € if a professional mover

is contracted. The higher cost of using a professional mover also depends on the longer distance covered in that case.

Table 4. Relocation cost, frequency and distance

	Transport	Mean	Std.Dev.	Min.	Max.
€ year ⁻¹	Own	3167 ^a	2358	240	7500
	Rented	4342 ^a	3877	158	13621
Trips year ⁻¹	Own	11.1 ^a	6.2	2	20
	Rented	6.3 ^b	5.5	1	21
€ trip ⁻¹	Own	306 ^a	160	100	605
	Rented	790 ^b	651	158	2313
% Long distance	Own	2.2 ^a	5.3	0	18
	Rented	23.1 ^b	24.2	0	67

Note: % Long Distance is the % of trips covering distances in excess of 100 km.

4. Discussion and conclusions

The Italian harvester and processor fleet is still very small compared to those deployed in neighbouring states such as Austria (237 units, Pröll 2005), Bavaria (177 units, Borchert and Kremer 2007) and France (ca. 500 units, Nguyen The et al. 2005). In fact, the Italian forests offer challenging work conditions, due to a peculiarly unfavourable combination of rough terrain, ownership fragmentation and low product value. Besides, the traditional close-to-nature continuous-cover forestry generally adopted in Italy may not encourage the use of modern industrial equipment (Mason et al. 1999), unless these same principles are applied with some flexibility (Price and Price 2006). However, a major technology shift is occurring in Italy, propelled by such vital needs as cost reduction, increased work safety, and labor shortage. Mechanization offers significant benefits in all these fields, and is getting established in Italy as well. The introduction of mechanized CTL technology to the Italian market is a work in progress, as witnessed by the dominant role of excavator-base units: these are indeed the first choice when the new technology is being introduced to a developing market, whereas mature markets prefer high-output dedicated units (Gellerstedt and Dahlin 1999).

Table 2. Annual utilization of harvesters and processors in some European countries

Hours year ⁻¹	Country	Data type	Source
1560	Austria	Published	Pröll (2005)
1435-2277	Austria	Raw Data	Stampfer (2009 Personal communication)
2574	Finland	Estimate	Kärhä (2009 Personal communication)
1725	France	Estimate	Poissonnet (2009 Personal communication)
ca. 1750	Germany	Published	Forbrig (2000)
ca. 1900	Germany	Published	Denninger (2002)
2036-2800	Germany	Published	Findeisen (2002)
1865	Germany	Published	Nicks and Forbrig (2002)
ca. 1300	Germany	Published	Drewes and Jacke (2005)
1700-2000	Ireland	Estimate	Lyons (2009 Personal communication)
2000-2700	Sweden	Estimate	Bergkvist (2009 Personal communication)

The utilization figures found in our survey are compatible with the different intensity of use expected for the dedicated and general-purpose units, and are significantly lower than those reported in bibliography for other countries. However, it must be stressed that international scientific bibliography offers very little hard data about machine utilization. Table 2 was compiled from these materials, and integrated through direct interviews with competent foreign colleagues. Dedicated harvesters dominate all the national fleets in the table, and a direct comparisons between utilization levels are most appropriate only when using the average utilization data obtained in Italy for the dedicated units, and equal to 1328 hours year⁻¹. This

figure still represents half of the annual utilization obtained in Finland and Sweden, but already about 75% of the level reached in France and Germany. In any case, readers must be warned against a strict interpretation of these comparisons, whose accuracy may suffer from differences in the data collection methods. Many reports do not specify whether the data for machine utilization comes from the machine's own hour meter or from the operator time sheets, the two always returning different figures.

The average cost of 4 € hour⁻¹ sustained for the repair and maintenance of Italian CTL units seems very small compared to the figures reported in foreign studies, but there are two possible explanations. First, the largest majority of Italian machine owners perform most maintenance and repair on their own and generally do not account for the cost of labor, but only for the expenses sustained to acquire spares and consumables. The second explanation is simply that the calculation methods currently used to estimate the cost of machine repair and maintenance are inaccurate and tend to overestimate real costs. In fact, all the figures found in bibliography have been estimated by the respective Authors and not actually measured.

In general, our study could open a fundamental debate on methodology. It is possible that the methods currently used to estimate utilization, insurance and R&M costs need some refining. The results of just one empirical study cannot provide conclusive evidence of the potential inaccuracy of commonly used methods, but they send a warning sign which can be neither confirmed nor disconfirmed in the absence of further such studies. In order to produce accurate cost estimates and comparisons, forest engineers need a larger corpus of empirical data on machine utilization and cost, as well as a new reference standard on the methods for recording these data.

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