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HOW TO DETERMINE PRODUCTION UNIT COST FOR A CUBIC METRE OF WOOD MASS PER FOOT

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Abstract: *The development of any forestry activity calls the attention on the need to determine in advance productive consumption, costs evolution and to compare them with the level already established by the Forestry Administration according to which they plan wood mass public sales (for forestries in the system) as well as with the level achieved by private forestries which have already become a strong competitor on the market. We may also mention the need to supervise effectively the expenses, to know their volume and structure, to determine as soon as possible the deviations from the established level and the causes which have lead to such deviations, and to identify the place where they occur.*

In this way we may speak about the need to reconsider the management accounting methods and costs calculation as a main factor for an efficient organization of the economic activity, which should be able to provide adequate information for an efficient management of the forestry activities in a market economy. In the present market economy, forestry managers should be concerned with costs reduction, having in view the interdependence and inverse proportionality that exist between products costs obtained and the profit, as an essential objective of any entrepreneur. They have in view obtaining the smallest cost or one as small as that of competitive units, avoiding unjustified deviations and losses and finally achieving a maximum profit, either by a high price that can assure other services, or by a small profit and a high volume of sales, that is a quick rotation of production factors – product – consumption recovery – plus value.

JEL classification: D24, M41

Keywords: secondary wood mass products, wood species, unit cost, equivalent unit cost

The wood mass spore that is to be gathered every year, known under the name of wood resource, as well as the surfaces which are to be gathered, so that to assure the continuity and improvement of the stationed potential, is mentioned not only in the forest planning in force stipulated by the National Forestry but also by every local Forestry, as a forest planning specific to each production unit. According to the household measures

mentioned in the forest planning, every year exploitations volume has to be equal with the wood quantity that grows annually. Products obtained from forests wood are generally divided into wood products (main products, secondary, accidental and hygienic ones) and non-wood products (forest flowers, berries, mushrooms, etc.).

For determining the cost of a cubic meter of wood per foot with Calimanesti Forestry we determined the overall expenditure for materials and the standard manual labor that correspond to forest workings according to the present forest planning, working involving wood mass spore gathering, as well as the budget concerning indirect production expenditure. Such workings are known under the name of « forest care, security and protection works » and they consist in the followings: forest regeneration, care and management of forest stands, various expenditure on protection and care, forests planning, forest roads (maintaining and repairing). As such expenditures are closely related to the activity object, they are commonly known as direct expenditures.

I. **FOREST REGENERATION** - under such title are known the followings forestry works : improving natural regeneration, regeneration works (forestations of empty places belonging to forestry fund, forestations of certain surfaces that are to undergo regeneration cuttings, forestations of places that are to undergo inadequate stands cutting and replacing) ; completing stands that haven't reached maturity, taking care of young stands. As a general rule, through such works of forest regeneration, silviculturists have to control the relation between seeds level and other levels of vegetation, to adjust the relations between the seeds of valuable species and those of inadequate ones, between seeds and brushes, between usable seeds and unusable ones and to prevent the unwanted effects of some damaging factors (climatic, abiotic and biotic).

No matter the regeneration type (natural, artificial, mixed); it refers to the complex ensemble of operations through which the installation, growing and developing of the material out of which a new cultivated forest is made is seriously directed¹. The character, the complexity and the cost of such projects are determined by the actual ecological environment where the process of regeneration takes place. The efficiency of these projects that have in view the regeneration process is conditioned by the way in which the whole project is chosen and completed in time and according to different criteria, on ecological bases correctly fundamented, so that to avoid certain operations that could increase regeneration costs unreasonably.

¹ I.Florescu. N.V. Nicolescu – “Silvicultură- vol II silviatehnică”, Publishing House Transilvania University, Braşov, 1998, p.11

The cost of these projects is assumed by the conservation and regeneration fund which is formed according to article 63, Law 26/1996 « Forestry Code », including subsequent changings and supplements. The National Forest Administration constitutes a conservation and regeneration fund, subject to earning interest, out of the following types of resources : the equivalent value of plots of land that do not belong any more to the forestry fund ; the equivalent value of growth losses determined by brushes exploitation before time as well as the compensation paid for damages caused to the forestry fund ; tariffs for favorable effects determined by the forest protection functions ; 20-25% from cashing collected from main and secondary wood products ; allocations from the state budget. This fund for forests conservation and regeneration will be used for afforesting empty plots of land, for regenerating areas where tree cutting were in progress, managing especially certain forests with special protection functions, covering certain damages caused by calamities and spent on purchasing plots of land according to legal provisions. Forests regeneration costs do not influence the wood mass cost as the money settlement is done from a specially constituted fund.

II. **FOREST STANDS CARE AND MANAGEMENT** - this type of projects applied to Calimanesti Forestry stands, according to the settled forest planning consist of : clearing and depressing ; weeding and thinning out ; hygiene measures. According to Calimanesti Forestry, general part, such projects will take place annually depending on the annual averages stipulated to be done in the present decade and on the functions specific for each production unit (U. P.), that is the care and management projects will be done according to priorities imposed by the present condition of stands and brushes. For each unit of production (U. P.) there is a concrete forest planning that includes all units proper to such arrangements (U. A.), components of the production units, areas, types of projects and possibilities. From this list there are chosen annually the units of arrangement that will undergo care and management projects, taking into consideration the annual average of projects stipulated by the annual forest planning, so that by the end of the decade all projects and areas proposed will have been completed.

Clearance projects have in view avoiding agglomeration and promoting valuable species. They also have in view balancing the relation between healthy, viable species and the deteriorated ones, generated by twigs, a project known as thinning out. The time for processing such workings is optimal between 15 August and 30 September. Clearance workings can be done either by cutting down or breaking extremities. From silviculturists' point of view the most efficient and less expensive method of clearance is that of breaking

extremities, the wood mass cost being closely influenced by labor work expenses and the materials necessary for clearing by extremities breaking.

Clearing projects have in view removing overwhelming species of little economic value as well as the uncorresponding ones, no matter the species type (bark blazing). Through such workings the process of elimination and natural selection is directed in order to obtain healthy, well proportioned and spaced stands, while the remaining stands can grow adequately. Such workings should not be done during vegetations periods or in late autumn when the removed stems can suffer because of early frost. Clearings are done by cutting down blazing species. They are gathered in piles in between the preserved species. The proper period for such workings can be any time of year for deciduous forests and between 1 August and 3 April for coniferous ones².

After cutting down blazing stands they are gathered in similar piles. Such piles are usually sold, the access being much easier in plain areas. For a proper calculation of wood mass in stere meters they usually proceed as follows : the pile length is multiplied with its width and its height, after which they proceed to a changing stere metres into cubic metres by means of factor cube($0,1\text{m}^3=1 \text{ m stere}$), a pile of 9 stere meters = a pile of $0,9\text{m}^3$. Arranging cut stands in piles is compulsory even if these piles will not be sold subsequently, as the field should not be agglomerated with these stands of small thickness. Calimanesti Forestry cannot sell further such pile.

Thinning out involves workings that have in view taking care of individual stands in order to increase the production and protective value of the cultivated forest³. They involve workings of positive individual selection, by choosing stands that should be promoted in future, taking into consideration their composition and removing deteriorated one or those of small value. The stands obtained after thinning out represent secondary products. For each unit of arrangement (U. A.) that will undergo such workings there will be completed a document of evaluation (APV), a document that constitutes the very base of selling and exploiting the wood mass. It has a technical, silvic and economic character and it includes all possible types that can be further obtained as well as different information about the surface (the cutting area)

Hygiene measures have in view maintaining or improving stands sanitary stage and involve workings of extracting dry stands or stands that are to get dry, fallen stands, broken or thrown down by the wind, snow, stands deeply deteriorated by mushrooms or insects, which

² O.G. nr.635/23 dec 2002

³ I. Florescu, N.V. Nicolescu – “ Silvicultură- vol. II – silvotehnică”, Transilvania University Publishing House, Braşov, 1998, p36

had suffered mechanical damages, as well as stands currently used in forest protection projects⁴. In forests where cultural operations and current treatments take place such hygiene measures are not necessary to be planned. Provided that in between two successive interventions there are unwanted phenomena (broken, fallen trees, normal dryings) and they are to be done with no delay, hygiene measures are to be taken in order to remove the stands that represent a danger for the healthy ones.

III. **FOREST PROTECTION AND SAFETY PROJECTS** will have in view all expenses involved by forests protection and safety measures (preventing and putting up fires, labor protection).

Forests protection – involves workings of detecting and foreseeing causes of stands damages that can have unfavorable effects on the proper sanitary condition.

Forests protection estimated costs – involve costs related to forests protection, fire extinguishes and labor protection. The forestry staff (forest guards, district superior, drivers) is remunerated the same way as the technical staff. The forestry staff, no matter the function, should wear the proper uniform and the special signs established by the central public authority in charge with forestry.

IV. **FORESTS ARRANGEMENT PROJECTS** – include all the costs involved by planning arrangements. Arrangements are done separately, for each unit of production that represents a component of the local forestry. The costs involved by such projects will be assumed gradually in the next 10 years when the arrangements are available. Arrangements workings value consists in the costs involved by field analysis, writing down and completing arrangement plans, achieving arrangements workings with the forestry's own staff and specialists I.C.A.S.

V. **FOREST ROADS** – in the year 2006 Calimanesti Forestry was in charge with a network of forest roads (DAF) with a total length of 136.62Km, 28, 9 Km of the road being in conservation process that year. Because from functional point of view, the road, the bridges and other constructions form a unitary ensemble, being closely related to each other, we are entitled to speak about “forest road” while referring to road, bridges and other constructions. Fixed assets include the “special constructions” category. The “forest roads” category includes forest roads maintenance and repairing workings which are done with the Forestry National Administration, therefore we may not take into account amortization as they are not subject to taxation. Forest roads building is assumed out of a specially formed fund.

⁴ Florescu I., Nicolescu N.V. – “Silvicultură - vol. II- silvotehnică”, Transilvania University Publishing House, Braşov, 1998, p.58

The technical department of the local forestry is in charge with monitoring such roads, their condition and the maintenance necessary workings, as well as with submitting such information to superior authorities. Maintaining these roads in a permanent good condition represents an objective necessity, of major importance, as the roads technical condition has a direct influence on the exploitation costs required by the vehicles used in wood transpiration and other forestry projects, fuel consumption, tires and spare parts, accidental repairing. For planning maintenance and repairing workings for forest roads and their costs, including the costs involved by materials, they use the present Regulations available for maintaining and repairing forest roads and the working regulations that correspond to such workings⁵, which were published by the Environment Protection, Water and Forests Ministry. This category includes:

➤ Forest roads maintaining workings are done permanently, all over the year, involving all types of forest roads, in order to avoid premature deteriorations and to adjust inherent ones, that usually appear during exploitation, with the purpose of maintaining these roads in an adequate technical condition, proper to assure an uninterrupted, comfortable and completely safe circulation. Such workings have in view the forest roads complete length, no matter if they are or not used frequently at the moment.

➤ Forest roads current repairing workings are done frequently, in between two major repairing projects, in order to compensate partially or even totally the deteriorations caused on roads, bridges and other constructions of the type and to bring them again to adequate exploitation conditions. When doing current repairing workings they can have in view the possibilities of improving the technical features of some elements of the road. Roads modernizing workings increase the value with which that very road contributes to the national patrimony, therefore it does not affect the value of the planned projects. The roads or the districts that undergo such current repairing workings do not have in view any other maintaining workings, as the latter are included in the first type.

➤ Forest roads capital repairing workings are done frequently, at certain intervals of time, in order to compensate totally or partially the physical and moral deterioration of the road and to improve the technical characteristics so that to satisfy the traffic requirements, according to every functional category that road belongs to. They include the roads in their full length without causing interruption in traffic on that road. Whether such workings involve very long roads with many repairing needs, they include a longer period of 2-3 years. Once the project started they do not allow it to be interrupted and started again. The roads of the

⁵ M.A.P.P.M and RNP –“Working regulations for forest roads maintaining and repairing workings”, Bucharest, 1999

districts that bear such workings cannot undergo current repairing workings or maintaining ones as they are included in the capital ones.

According to the Regulations concerning forest roads maintaining and repairing workings and to those concerning the traffic on these roads, the forest roads that belong to the second category (Calimanesti Forestry roads are classified like this) are to undergo 11 current repairing working during 100 years (every 6 years) and 5 capital repairing workings (every 18 years). After two successive repairing workings there is a capital one. Roads maintaining workings can be planned but they can also be accidental, generated by force majeure cases. The costs involved by repairing forest roads and bridges that were deteriorated by a natural calamity do not influence the value of the other projects. The costs involved by maintaining and repairing workings are included in the production cost.

From our point of view capital repairing workings cost should not be included in the production cost and they should be considered as assets for the following reasons:

- The capital repairing working prolongs the forest road using period of time;
- The production quality is substantially improved (it has a direct influence on the exploiting costs of the vehicles involved in wood transportation and other forestry projects);
- The road performance is also improved.

From the technical department, the forest roads office, we shall take over the present condition concerning the planned workings for forest roads for the year involve in financing projects. They provide data about necessary workings (mentioning the unitary production average), necessary materials (according to standard consumption quotas), the type of road involved in such projects, the type of projects (maintaining workings, current repairing ones, capital repairing ones). They also proceed to taking over the costs registered in advance (current repairing workings take longer than financial reports do, so they are considered costs in advance and they will be gradually reported). Before maintaining and repairing workings begin the building site and the technical documentation should be prepared (projected). The final cost of maintaining and repairing workings also includes the costs involved by the building site preparation (about 1,5% of the final value) and the costs involved by projects (the quota is about 2% of the total value)⁶. The building site organization quota includes all expenses determined by purchasing huts and bedroom wagons necessary for accommodation

⁶ The Ministry for Environment Protection, Waters and Forests, Forests National Administration, - 'regulations for forest roads maintainance and repairing projects and the traffic adjustment on these roads ', Bucharest, 1999, pag.37

workers (in areas that are too far away from other type of lodgings), by the workers transport and storehouses necessary for storing tools, working equipment and technical materials.

The workers involved in maintaining and repairing workings are pavers, carpenters, bricklayers, machine workers (graders, ifron, lift loader, compressor, moto-compressor). The manual labor costs are determined according to the technical documentation (the road's technical condition, measurements for the necessary workings, etc.) provided by the Forestry Department within Calimanesti Forestry. Such maintaining and repairing workings are coordinated by the district superior. The machine workers are subordonitated to a superior and all workers are coordinated by a team supervisor. There also technicians in charge with workings of repairing and maintaining.

The stone materials necessary for maintaining and repairing forest roads are taken from ballast machines and local stone quarries situated nearby so that the transport distances to be as short as possible. If those regions do not have stone materials supplies a third party would be involved in providing suitable materials. The activity of producing stone materials from ballast machines and stone quarries, necessary for such workings of maintaining and repairing, is organized like an auxiliary production activity with separate budget and own registration.

VI. OTHER DIREST COSTS – include *costs* involved by fixed assets liquidation (buildings, equipments used for doing forestry workings that have in view wood mass molding for economic agents and other interested people) as well as costs involved by maintaining and repairing fixed assets. Fuel and lubricant costs were included in the cost of each working.

The domain that has in view „plans concerning transport and forestry buildings” mentions repairing workings only for Production Unit IV at Lotrisor forest cottage. The other production units were not mentioned to undergo such projects as the existent buildings are considered to be enough. Moreover, as they are very close to other human rural and urban dwellings, accommodation can be easy accessed without supplementary costs. Such repairing workings also have in view Lotrisor cottage modernization so the costs will be considered assets and they will not be included in the cost of production.

With a view to the costs involved by forestry equipment maintenance and repair, they are planned by the technical department and we included only the equipment working hours costs. Similar proceedings were done concerning these equipments liquidation. Our opinion is the same when speaking about capital repairing concerning other types of fixed assets used in forestry workings: these costs should be considered assets and included gradually after

liquidation. The costs involved by maintaining and repairing these fixed assets are high enough as a consequence of car park age and of the equipment used for such forestry activities. Many of them are still functioning although their functioning period has already been completed. Their use involves high costs for maintain ace and repairing, while from liquidation point of view such costs are inexistent.

VII. INDIRECT COSTS – are closely related to the forestry management activity, as forestry units represent main units of production. These costs will be distributed according to certain criteria for every activity which is to take place (here are some activities: forest protection and safety, forest seeds, forest seed beds and samplings, beekeeping, hunting, fish breeding , berries and mushrooms, pheasant preserving, other products (osier willow knitting, wood primary procession, goods and lands renting). At Calimanesti Forestry there are also other activities besides the basic one of forest protection: forest seeds, berries and mushrooms, other products for which there is a separate registration of indirect costs (material manual labor, other direct costs) registered the same way as the main activity, according to the unitary regulations specific to forestry activities. From our point of view, registering indirect costs in relation to manual labor costs is much more equitable because this is a characteristic common for all these activities, of much importance. Materials and equipment costs can be included or not in these costs, to a larger or a smaller extent, and activities distribution with the forestry should be done by using the only additional factor process (table no 1). At Calimanesti Forestry, according to the study we have done, we have come to the conclusion that they use structure relative figures method, which involves establishing the importance detained by each activity in the final costs, followed by an adequate costs distribution on activities. The only additional factor process involves first of all determining a distribution coefficient as follows:

$$K = \frac{\sum \text{total costs allocated}}{\sum \text{criteria chosen based distribution}} \text{ total costs to be distributed chosen}$$

criterion distribution base

If when calculating the distribution coefficient we obtain a decimal result, we shall proceed as follows when determining costs on units: for n-1 costs bearers the amount will be obtained by comparing the distribution base to the distribution coefficient while for determining the quota for the last level of costs (cost bearer) we shall proceed to making the difference between total costs which are to be distributed and the already distributed costs.

Table no.1. « Indirect costs distribution according to the supplement process at Calimanesti Forestry»

Classified list of activities	Direct costs on salaries	K	Indirect distributed costs
Forest care, security and protection	782.984,62	0,34	266.282,34
Forest seeds	10.527,51	0,34	3.580,26
Berries and mushrooms	2.032,06	0,34	691,08
Other products forest	38.177,65	0,34	12.983,70
TOTAL DISTRIBUTED COSTS			283.537,37

The total costs of wood mass per foot will include direct production costs which consist in total direct materials costs, total manual labor costs and other direct costs plus indirect costs distributed for the base activity having in view wood mass spore (table no. 2).

Table no.2. « Determining total costs for wood products – the main product »

TOTAL DIRECT COSTS	1.232.780,66
Costs afferent to stands care and management projects:	
- Clearance	9.032,44
- Clearings	42.736,04
- Thinning out and hygiene	33.560,03
Security and protection :	
- protection	606.873,58
- security	7.767,75
Forests planning (10% total planning costs)	71.052,74
Forest roads	261.720,57
Other direct costs (liquidation; equipment functioning and maintaining costs; services provide by third parties)	200.037,51
INDIRECT DISTRIBUTED COSTS	266.282,34
WOOD MASS TOTAL COSTS	1.499.063,00

The registered statement of wood products (quantities, types), as well as the note of expenses for main and secondary wood products, is provided by the forestry budget department. According to this statement we can proceed then to distributing the total expenses registered by the local forestry on products. First of all we have to determine the percentage of wood mass for main and secondary products and then to deduct total expenses afferent to the wood mass. By multiplying this percentage with the total expenses afferent to the wood mass we can obtain the total expenses for main and secondary wood products (table no 3):

Table no.3. « Determining the unit cost for main and secondary wood products »

Explanations	Quantity (m ³)
Main products volume (Q _{pp})	49.360
Secondary products volume (Q _{ps})	21.910
WOOD MASS TOTAL VOLUME (Q=Q _{pp} +Q _{ps})	71.270
Main products percentage: $\eta_{pp} = \frac{Q_{pp}}{Q}$	$\eta_{pp} = \frac{49.360}{71.270} = 0,7$
Secondary products percentage: $\eta_{ps} = \frac{Q_{ps}}{Q}$	$\eta_{ps} = \frac{21.910}{71.270} = 0,3$
Main products expenses: $CT_{pp} = \eta_{pp} \times CT$	$CT_{pp} = 0,7 \times 1.499.063,00 = 1.049.344,10$ lei
Secondary products expenses $CT_{ps} = \eta_{ps} \times CT$	$CT_{ps} = 0,3 \times 1.499.063,00 = 449.718,90$ lei

After distributing total expenses afferent to main and secondary wood mass products, we have to distribute expenses for wood species (table no 4):

Table no.4. « Total cost of main wood products and species»

Main species/ products	Wood mass gross volume(m ³) acc. to the note of expenses	Percentage: $\eta_{pp_i} = \frac{Q_{pp_i}}{Q_{pp}}$	Expenses afferent to the species : $CT_{pp_i} = \eta_{pp_i} \times CT_{pp}$
FA	38.400	0,7780	816.389,71
GO	5.330	0,1080	113.329,16
BR,MO,PI	1.650	0,0334	35.048,09
CA	160	0,0032	3.357,90
DT	3.130	0,0634	66.528,42
DM	540	0,0110	11.542,79
DR	150	0,0030	3.148,03
TOTAL	49.360	100%	1.049.344,10

Expenses afferent to secondary wood products are determined in the same way.

According to dimension types: thick GI, GII, GIII; middle MI, MII, MII; thin wood and wood for fire we can now determine the wood mass cost for functional species and categories. The rind is considered to be unusfull waste and it will influence the unit cost of wood mass per foot. The equivalence indexes principle – is available only when the same raw material, within the same technological process, we obtain more types of products different in their format, dimensions, technological and chemical properties, with no possibility for

delimiting or differentiating production costs on products types. We know four ways of applying the same method: simple equivalence indexes method, complex equivalence indexes method, aggregate equivalence indexes method, reversed equivalence indexes method.

Using equivalence indexes on dimension species and types involves mainly running through the following methodological stages⁷:

- determining the equivalence value for each type on functional categories :

$$K_i = \frac{\text{feature product "i" amounted}}{\text{standard product feature}}$$

- turning production into conventional measure units, by multiplying the physical quantity obtained of each type with the adequate equivalence index or value:

$$Qechiv_i = Qfizica_i \times K_i$$

- determining the conventional unit cost – comparing the total production

expenses to the equivalent production quantity : $cu_{echiv} = \frac{CT}{\sum Qechiv_i}$

- determining the unit cost for each product unit (functional type), by multiplying the conventional unit cost with the equivalence value : $cu_i = K \times cu_{echiv}$

We shall exemplify our method for the main products, beech wood species, using the simple equivalence indexes method (table 5). The simple equivalence index is determined as a relation between the characteristic of the product to be validated and the characteristic of the product chosen as sample. No matter the sample product the cost level is not affected. As a rule the product with the smallest characteristic is chosen. The trees rind will not be taken into account. The characteristic taken into account by our present analysis is the average thickness of the functional type “i”. The total cost has been noted CT and the main product total cost for beech wood - CT_{pp_i} . We shall determine the unit cost for each functional type, by multiplying the equivalent unit cost with the equivalence value:

Table no.5. “Determining the unit cost – equivalence indexes method”

Main beech types « i »	Average diameter (cm)	Physical quantity (m ³)	Equivalence value K _i	Equivalent quantity (m ³)	Equivalent unit cost (lei/m ³)	Type unit cost (lei/m ³)
G.I	78	12.950	14,18	183.631,00	2,46	34,88
G.II+III	51	11.250	9,27	104.287,50		22,80
M.I+II+III	28	6.920	5,09	35.222,80		12,52
thin	12,5	2.480	2,27	5.629,60		5,58
Fire+branches	5,5	3.500	1	3.500,00		2,46

⁷ Călin O., Cârstea Gh. – “Contabilitate de gestiune și calculația costurilor”, Ed. Genicod, București, 2002, pag 137

TOTAL	332.270,90	*	*
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Reconsidering management accounting methods and costs calculation is one of the main factors of efficient organization of the economic activity which should be able to provide information adequate to efficient management process requirements of forestry activities in the market economy. Information about production costs occupy a central position, determined by their implications on the present situation and on the future evolution of the unit activity. So, an efficient management process at forestry units cannot be envisaged without assuring an adequate informational system that can meet the requirements of a modern production management activity, that can allows decisions and operational measures quick adoption at the right time and on thorough bases. In the present market economy, forestry managers should be concerned with costs reduction, having in view the interdependence and inverse proportionality that exist between products costs obtained and the profit, as an essential objective of any entrepreneur. They have in view obtaining the smallest cost or one as small as that of competitive units, avoiding unjustified deviations and losses and finally achieving a maximum profit, either by a high price that can assure other services, or by a small profit and a high volume of sales, that is a quick rotation of production factors – product – consumption recovery – plus value. The price will include the total cost (the unit cost twill be adjusted according to the accessibility level plus a 20-25% quota for constituting the forests conservation and regeneration fund) and a profit expected by the unit.

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