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[F] PhD Extended Abstract Form

OPTIMIZING THE WOOD SUPPLY CHAIN IN CALABRIA: FROM HARVEST SITE TO THE MILL OF WOOD PROCESS

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Extended Abstract

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This PhD thesis aims to develop, through innovative approaches, and to integrate systems to make competitive and environmentally compatible logistics, harvesting and transport of wood assortments up to destinations in treatment and industrial processing. In this PhD thesis a three-step experimental procedure was set up by performing in sequence the following independent tests: (i) Acoustic evaluation of wood quality using non-destructive technologies;(ii) Monitoring and to determine of the productivity and cost in the innovative work sites using Skidders, Forwarders and Cable Crane; (iii) Determination of the parameters in the wood processing to the sawmill.

During recent years, novel technologies and methods for the utilization of wood have been suggested and introduced so as to enhance the wood supply chain. The demands for sustainably produced wood as a raw material for a variety of end uses is placing increased pressure on the forest resource. Knowledge of the timber properties of trees and logs is important to ensure that harvested wood is directed to its most appropriate end use. Current harvesting practice in the Italy means that trees are often felled, processed and dried before the timber is strength graded by machines at the sawmill. The phases of harvesting and wood processing provide decisive technological innovations to improve quality, to reduce costs, to create new types of products to enhance the end-uses of the raw material and wood. In particular, wood harvesting has always represented one of the most important management interventions, not only in meeting production objectives but also to favour the biodiversity of the forests. Several harvesting methods was monitored: the full-tree, tree-length, and cut-to length systems. The applicability of each one system has depended on several variables related to stand characteristics (such as trees density, average tree volume or thinning intensity), by every single tree (volume, height, branch size and state of pruning) or terrain (slope, soil or state of roughness). For the purpose of an overall improvement in the efficiency of labour, economic analysis and comparison of solutions, this study has been conducted using the interaction between operating costs of labour of machinery but also the analysis to the overall consumption resources participating in the process chain. After the highlighting of the most critical points of wood supply chain, in the results possible actions have been indicated to overcome them. The activity aims to disseminate the most appropriate classification techniques within forest to reach a classification of wood assortments evaluated by a qualitative characterization.

1. Chapter 1 - Acoustic evaluation of wood quality using non-destructive technologies

The objective was to determine if the effects of silvicultural practices on wood quality can be identified using acoustic measurement to assess the wood quality with non-destructive method in standing trees of Calabrian pine and chestnut. For this purpose, two different instruments were applied and five hundred and ten standing trees in six sites were non-destructive tested using a time-of-flight acoustic wave technique.

2. Chapter 2 - Monitoring and to determine of the productivity and cost in the innovative work sites using Skidders, Forwarders and Cable Crane

The objective was to provide sound data for permitting the formulation of models of the cycle time for extraction operation (skidder, forwarder and cable crane) in a small-scale forestry. The specific objectives were: (1) to calculate production rates (m3 h-1) and costs (€ m-3) of wood harvesting in southern Italy, (2) to develop models of cycle time and productivity, and (3) to determine the most influential factors for each work phase. In addition, only for the study of forwarder productivity, have been compared different results obtain in different Country. In fact, during the third year of my PHD, I studied the same methodology in NZ at School Forestry in Christchurch (New Zealand). For this purpose, several sites were tested, located in Calabrian region. Furthermore, skidder and forwarder machines were monitored by using

GPS/GSM technology.

3. Chapter 3 - Determination of the parameters in the wood processing to the sawmill

The objective of the third chapter was the study of the parameters in the wood processing to the sawmill. In fact, to complete the study of Calabrian wood supply chain this third activity has determined a good model for the wood raw material predicting quality distribution of the sawn products resulting from the volume of trees. In particular, in all kind of production the efficiency of the process is crucial. This applies both in terms on how efficient the people producing the products are and on how efficient the process itself is. In the latter case one important parameter is how efficient the use of the raw material is. For this purpose, this study was conducted in a midsize sawmill, with a production 8,000 – 10,000 m^3/year of lumber, located in Calabrian Region. This study showed that the factors influencing the production yield are various and random between the sawing of logs with human operational decisions, errors along the sawing line and in measuring that affect the sawing yields.

Final remarks concerning the competition benchmarks and strength points

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The outcomes of this thesis can be useful for forestry operators, stakeholders involved in forestry management as well as for technicians and decision makers to support the development of a specific subsidy framework and choice of logging operations or different wood utilization with the lowest environmental impact. Though related to forestry operations carried out in Southern Italy, the achieved results can be upscaled to other geographic forestry areas with similar characteristics in terms of productivity, slopes and road network.