Data Analytics in the Hardwood Industry: The Impact of Automation and Optimization on Profits, Quality, and the Environment

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ABSTRACT

Numerous innovative technologies are available to assist the struggling hardwood lumber industry adapt to changing market demands and environmental concerns. However, most mill owners do not utilize automated lumber systems because they do not realize how substantial volume and value gains can be. Thus, there is a need to quantify improved efficiencies while also providing reliable information about how these measures translate into profitability for the mill. This study highlights new hardwood sawmill technologies, specifically in the areas of information systems and visualization technologies, and assesses the environmental impacts alongside the practicality of widespread application. Results from on-site testing were combined with other research in the field, concluding that properly applying visualization, optimization, and information technologies across the manufacturing process can significantly improve overall yield values. Combining engineering technologies with IS and strategic supply chain management leads to reduced waste and increased profits, benefiting local economies and forest resources across the globe.

Keywords: Forest Industry, Green Information Systems, Optimization, Visualization

1. RESEARCH OBJECTIVES

This study, combined with other research on the topic aims to address the following objectives:

1. To show that the application of modern hardwood lumber manufacturing scanning technology is able to maximize revenues and minimize waste, which will in turn positively impact the environment and profit margins for small and large sawmills
2. To demonstrate that incorporating 3D scanning optimization algorithms and automation technologies with current market information can facilitate manufacturing

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decisions that dramatically increase profit margins, especially when incorporated with innovative supply chain management based on information systems

3. To apply direct calculations for ROI when using different scanning systems to experimental data collected during actual sawmill application

4. To compare figures obtained in objective 3 to hardwood sawmill owner attitudes and industry needs to assess the viability of system adoption

Throughout this paper, for reproducibility and widespread understanding, all data, saw timber prices, and related statistics will be presented using the international 1/4-inch log rule as this method is based on the most accurate mathematical formula, is the most widely recognized globally, and is the most consistent method when compared to other timber measurement methods.

2. INTRODUCTION

Timber harvesting is one of the oldest natural reserve industries in the world. The United States’ forest industry continually seeks a balance between conserving and utilizing forests, while also appeasing the public by protecting wildlife and providing natural areas for recreation. Across the globe, forest resources impact society: ranging from producing wood for building materials, to cleaning the air and regulating for climate, all the while providing employment opportunities for millions of workers. Optimized timber production has minimal negative environmental impacts, with studies conducted by the CORRIM (Consortium for Research on Renewable Industrial Materials) showing structural wood products have the most energy-efficient life cycle of any construction material. Because wood is a renewable resource and a carbon neutral energy source, the significance of the forest industry in future global society becomes even more important as populations continue to grow and finite resources, such as oil, are depleted and seen as less environmentally sound.

Technologies that improve the efficiency of the lumber industry are of the utmost importance for the future of sustainable forestry. The incorporation of Green IS practices alongside more sustainable manufacturing practices can have a significant impact on the lumber industry at both local and global scales. Lumber manufacturers of today must maximize their efficiency by reducing the amount of waste produced while also producing the highest quality, or “grade lumber” possible; and this must be done for each log processed through the mill. There is a strong need for linking IS to new monitoring, visualization, and optimization technologies used in the lumber industry. This study explores the direct impacts imaging and information technologies can have on decreasing waste in hardwood sawmills while also improving profits, bringing new sustainable life to an old industry.

Hardwood lumber prices depend on the type of wood, the cut of the board, and its quality, or grade. These prices are highly volatile, fluctuating daily with changing market conditions. Because each tree is unique, necessitating individualized cutting plans tailored to both the log and the market, specific information about market demands and product pricing communicated through novel IS will have substantial impacts on profit margins and reduce material waste products. Supply chain management structures that incorporate IS from real time market fluctuations and apply this to individual tree processing through visualization and optimization technology have already shown much promise in the European lumber industry and created more of a pull economy, reducing waste and producing higher priced goods that are in high demand on real-time markets.

There is currently a large spread in the degree of technologies and business practices used in hardwood sawmills. Most waste from lumber production is due to poor technology and human error and, thus, would be reduced by automation. Since the 1990’s, most mills do utilize computer controls and some form of
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