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Proceeding Paper

Smart Manufacturing in Timber Production †

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Abstract: Traditional manufacturing units face a lot of challenges in coping with growing demand. With the more demand, maintaining the quality of the product is another challenge. Industry 4.0 can be utilized to meet the growing demand without sacrificing the quality of the product. The aim of this research is to analyse the improvement in production capabilities when implementing smart manufacturing. Woodford Timber Products has streamlined its production processes and increased its operational efficiency by embracing innovative technology and techniques. The digitisation of manufacturing processes through sophisticated software is capable of designing, rendering, analysing, and converting to machine language for multi axis CNC machines. The organisation derives significant insights from enormous volumes of data using product data management optimising manufacturing schedules, minimising waste, and improving product quality.

Keywords: smart manufacturing; industry 4.0; sustainability; automation

1. Introduction

The Irish housing issue has arisen as a major concern, offering considerable challenges to both governments and construction-related enterprises [1]. The growing need for cost effective and environmentally friendly housing options has forced a paradigm change in traditional manufacturing processes. In response to this significant challenge, Woodford Timber Products has taken creative steps to modernise the timber sector by combining smart manufacturing principles within the framework of Industry 4.0. The housing crisis has resulted in escalating property prices and a severe lack of housing units across Europe in recent years. This has driven the search for new and efficient construction technologies to fulfil rising demand.

Smart manufacturing, enabled by Industry 4.0 technology, provides a possible answer to these difficulties by improving productivity, resource efficiency, and product quality [2]. Woodford Timber Products has been at the forefront of this transformational journey, utilising cutting-edge technology to simplify manufacturing processes and improve operational efficiency. The implementation of industrial automation has allowed real-time data collection and analysis, providing the organisation with vital insights to support proactive decision-making and predictive maintenance plans.

Woodford Timber Products has adopted advanced software solutions like as SolidWorks, SWOOD, BTL, BTL CAM, and Driveworks SOLO to attain accuracy in their manufacturing operations. These software solutions enable multi-axis CNC machines to perform seamless design, rendering, analysis, and translation to machine language, assuring maximum accuracy and efficiency in their timber production processes. This paper delves into Woodford Timber Products' success story, examining how the incorporation of smart

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manufacturing concepts and advanced software solutions within the context of Industry 4.0 has not only modernised the timber sector but also contributed to addressing Ireland's pressing housing crisis. The potential influence of smart manufacturing in transforming conventional industries is highlighted, and sustainable solutions to contemporary concerns are provided by exploring the organisation's journey and technical advances.

2. Process Pipeline

Woodford Timber Products' integration of SolidWorks, a powerful computer-aided design (CAD) software, has been instrumental in streamlining their manufacturing processes and optimising resource management. Utilising SolidWorks in timber production sets Woodford Timber Products apart, as the software's application is atypical within the industry. This innovative approach underscores the distinctiveness of their challenge and the sophistication of their success. With SolidWorks, the company efficiently generates accurate bills of materials (BOMs), production drawings, and comprehensive instruction manuals, facilitating seamless communication between the design, production, and assembly teams.

2.1. Bills of Materials (BOMs)

SolidWorks enables the creation of detailed and comprehensive BOMs for each product variant. The software's parametric modelling capabilities ensure that any changes made to the design are automatically reflected in the BOM, reducing the risk of errors and inconsistencies.

2.2. Production Drawings

SolidWorks allows Woodford Timber Products to generate precise and standardised production drawings for each component and assembly. These drawings provide detailed information on dimensions, tolerances, material specifications, and manufacturing processes. With clear and accurate production drawings, the company's production teams can seamlessly translate design concepts into tangible products, minimising manufacturing errors and ensuring product quality.

2.3. Production Drawings

Leveraging SolidWorks, comprehensive instruction manuals can be created for all products. These manuals include step-by-step assembly instructions, visual aids, and safety guidelines, facilitating smooth and efficient assembly processes for both in-house production and end-users.

2.4. Generating BTL Files with SWOOD

For enhanced manufacturing process efficiency, SWOOD software is employed to translate SolidWorks' design data into machine-readable instructions, often in the form of BTL files. However, instances arise where SWOOD's capabilities do not achieve the desired precise conversion. This prompts the need for sophisticated development work, exemplified by the use of BTL Editor, to effectively align with the specific requirements. BTL CAM software then interprets the geometric data from the BTL file and generates toolpaths, defining the precise movements and operations required for CNC machines. Figure 1 shows the process pipeline for automating the tasks required for smart manufacturing.

By utilising BTL CAM software, the process eliminates the need for the manual programming of CNC machines allows for offline programming, significantly reducing setup time, and minimises the potential for human errors. This automated process ensures consistent and precise manufacturing, leading to higher product quality and increased productivity.

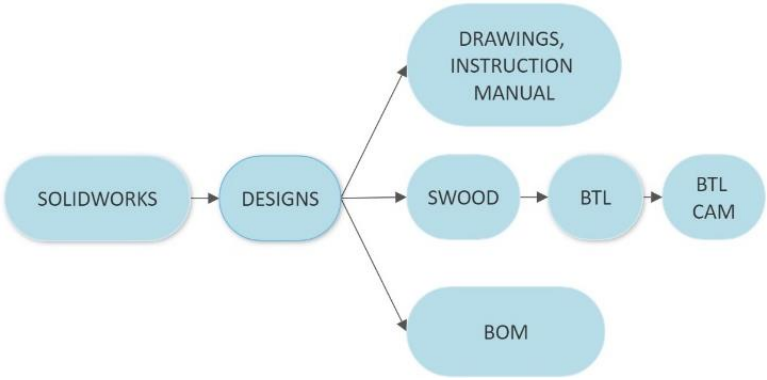

Figure 1. Process pipeline.

3. Industry 4.0

Woodford Timber Products has embraced some key Industry 4.0 principles throughout this process by utilising cutting-edge technology like Driveworks SOLO, as part of the SolidWorks family. This technology enables the automation of the design and development processes by inputting precise cabin specifications like length, breadth, and door/window combinations. This user-friendly input system enables anyone, regardless of design expertise, to generate customized production drawings, instruction manuals, and BOMs, which streamlines the manufacturing workflow. The capacity of the software to generate exact designs and the necessary drawings based on user-defined inputs boosts efficiency, saves lead times, and maintains consistent quality among cabin variations. Figure 2 details the pipeline for the Industry 4.0 approach to designing, building, and supplying outdoor wooden housing.

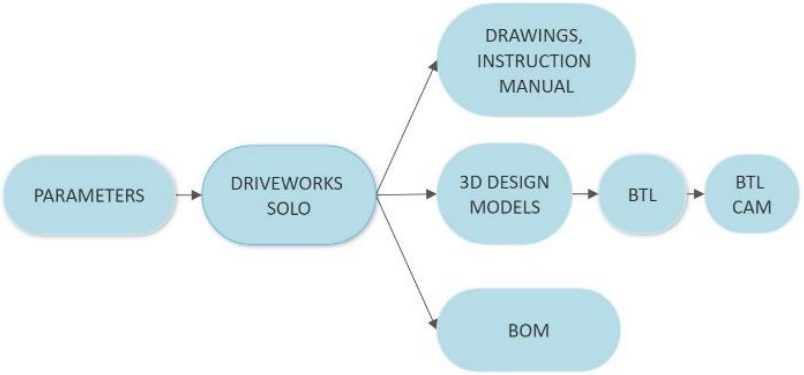

Figure 2. Industry 4.0 pipeline.

The adoption of Driveworks SOLO by Woodford Timber Products demonstrates their dedication to being at the forefront of contemporary production techniques, tackling issues in the timber sector, and contributing to solutions for the housing crisis.

4. Conclusions

In conclusion, the company has realised the full potential of Industry 4.0 by using Driveworks SOLO, transforming their production processes. This strategy improves efficiency, shortens lead times, and assures consistent quality. Therefore, customers looking for custom cabin solutions can request a price using the company's website, acquiring all relevant design specifications as well as pricing information.

In the future, Driveworks SOLO is to be upgraded and integrated directly with the website. Customers will be able to not only obtain quotations but also produce designs and obtain prices directly from the website with unrivalled ease and real-time modification choices. This integration is a proactive move toward increasing customer involvement and keeping the organisation at the forefront of current production techniques.

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