

S A A S
T A M O
I S E N
S Ä Ä
T I Ö



Wood-based businesses in the next era of manufacturing

NOFOBE & NB-Nord Meeting “Industrial Scale Bioeconomy and its Requirements”

Lappeenranta, June 14, 2017

Prof. Teppo Hujala (UEF, Joensuu, Finland) & Prof. Eric Hansen (Oregon State University, Corvallis, Oregon, USA)

UEF // University of Eastern Finland

Contents

Motivation

Objectives

Analysis

Summarizing insights

UEF // University of Eastern Finland

Motivation

Pulp, paper and packaging companies anticipate over a 3% increase in revenue and over a 4% decrease in costs, annually, over the next five years **due to digitization** (PwC 2016)

Internet of Things (IoT) and other Industry 4.0 (I4.0) features will **soon become commonplace** in industrial business

I4.0 represents a critical **culture-changing phenomenon** that is essential for the future competitiveness of forest sector companies operating in the bioeconomy of tomorrow

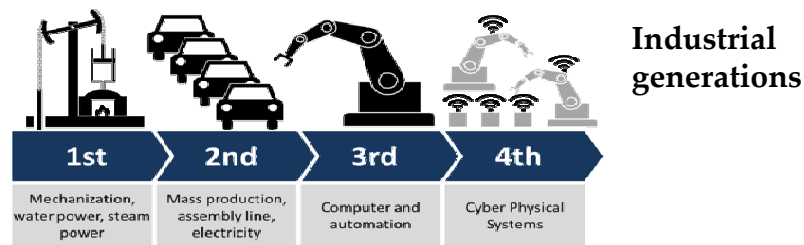
Where do wood industry companies stand as regards I4.0 and **what does it mean to their businesses?**

UEF // University of Eastern Finland

Objectives

- To provide an overview of the characterizing features of “Wood I4.0” to make sense of the already advanced and yet-to-be-revolutionized parts of forest-based bioeconomy
 1. a desktop study: the current discourse linking forest/wood industry with I4.0
 2. comparison of I4.0 in wood-based businesses and general I4.0 literature
 3. examples of tallwood buildings and furniture business
 4. outlining the key benefits of wood-based manufacturing industry embracing the I4.0 as well as relevant research foci

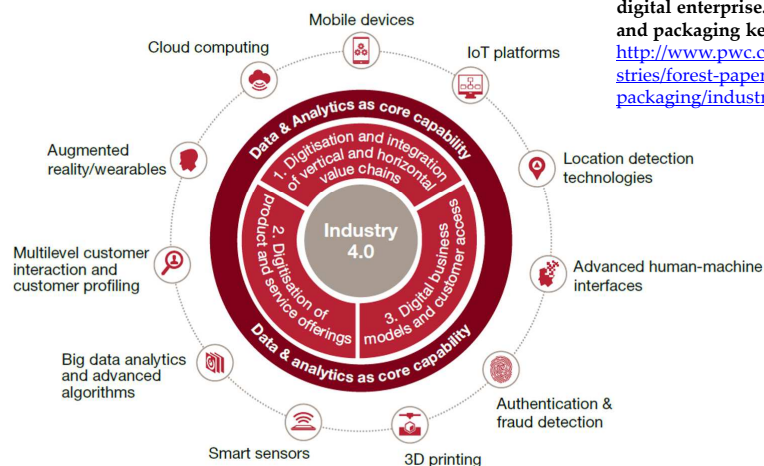
UEF // University of Eastern Finland



Manufacturing has undergone many evolutionary stages and paradigm shifts. The paradigm shifts in going from a craft industry to mass production, then lean manufacturing, and finally to agile manufacturing and mass customizations.

The digital age in manufacturing is giving rise to output devices that allow rapid customization and manufacturing, revolutionizing how we design, develop, fabricate, distribute, and consume products.

Industry 4.0 Framework and Contributing Digital Technologies



PriceWaterhouseCoopers, 2016.
Industry 4.0: Building the digital enterprise. Forest, paper and packaging key findings.
<http://www.pwc.com/gx/en/industries/forest-paper-packaging/industry-4-0.html>

PwC 2016

Forest/wood industry in I4.0 – current emphasis

- **Digitization**
 - **IIoT** (Industrial Internet of Things), **Industrial automation**
 - **Plant analytics, plant cloud services**
 - **Integrated Manufacturing** in the Furniture Industry
 - Secondary industry – **digital design and fabrication**
 - New skills and competences needed to operate **smart factories**
 - **Paper Industry 4.0**: Innovation can address not only processes, services and products, but also **business models, workforce training and education**
 - **RFID for digital integration** in the wood and furniture industries
 - **automated goods checking** at point of receipt, **inventory control** solutions, **quality control**, workpiece processing and **logistics**
 - “Customized furniture factory”
-

Comparison: **Wood I4.0 versus general I4.0**

- Forest resource data and wood procurement logistics sections of wood-based value chains have been intensively developed (e.g. Forest Big Data projects in Finland)
- Mill automation is on advanced level and moving forward
- However, I4.0 promises are mostly yet unfulfilled in the customer/consumer sections of the wood-based value chains
- There is almost no refereed literature on cross-sectoral collaboration within the context of the forest industry
- The traditional culture of the forest industry drags down innovation efforts in general, including the digital technologies driving I4.0

Example: tallwood buildings

- Components derived from **digital design and digitally fabricated**
 - **Modular assembly** may take place in factory
- **Sensors installed** for a nearly unlimited number of monitoring options
- **Sensors integrated** into **smart building** concepts via internet of things
- To come: smart doors, windows, furniture, appliances, etc. **all interact**
- Ultimately, **spaces that adapt** based on user needs/habits

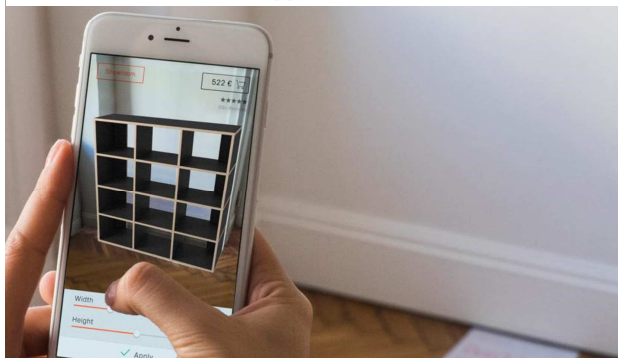
UEF // University of Eastern Finland

Example: furniture business

Where furniture meets the future

Our augmented reality app lets you see your furniture in your space before you buy.

Say goodbye to standardized furniture. Every home is different. At Tylko, we believe that yours should be filled with perfect-fit, functional furniture that happens to look great.



www.tylko.com

Tylko's philosophy is to bring a more personal approach to the furniture industry while **simplifying the lives of consumers**. The multi-platform solution offers the possibility to **design perfect-fit shelves** from the comfort of their homes. Thanks to its advanced technology based on **parametric design and augmented reality**, and an ecologically-sound **automated manufacturing** process, the company has **changed the face of the furniture industry**.

Key benefits of Wood I4.0

- Potential for **reducing costs**
 - Better inventory control, increased Just-in-Time delivery...
- Potential of **adding value**
 - Better market/consumer insight → meeting better customer needs
 - Interface with final customers to allow mass-customization
- Tool to **enable** enhanced **customer orientation**
- Tool to **enable cross-sector** collaboration
- Necessity to maintain **competitiveness**

UEF // University of Eastern Finland

Potential research areas

Critical assessment of assumptions behind the visionary I4.0,
e.g. social acceptability, innovation adoption, availability of skilled experts

The role of I4.0 in facilitating industry's change to the bioeconomy

Cultural differences between wood industry and architects, engineers,
designers...

Conversion of (nano) cellulose into a 3D printable form

3D Printing & Robotic Fabrication in Timber Construction

Digital Fabrication and Design in Mixed Realities Environments

Big data analytics for mills & applications in the woodworking industry
