Automation in the 4.0 age

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How are technologies changing the world?
• The industrial world seeks to improve its production processes with an aim to qualify its products and curb costs;

• China, USA, Germany, South Korea, and Japan;

• Practice in the **Industry 4.0.**
The urgency of starting the Journey (BR)

- Mercosur countries surely know that their industries are losing their share in global markets and it is necessary to urgently start a Journey to enhance local companies’ global competitiveness;

- They incorporate little technology in their production processes;

- It is necessary to modernize the industrial processes and increase competitiveness;

- Focus should be put on small and medium players, making them more competitive on a global scale.
Concerns

- Standardized architecture to streamline communication among the different players;
- Management of complex systems;
- Reliable broad band infrastructure;
- “Open” communication security;
- Work design and organization;
- Constant professional development and training;
- Legal and regulatory framework;
- Resource efficiency;
- Knowledge base monitoring and maintenance.

Source: CNI (2016)
Opportunities provided by Industry 4.0

Feeding the world and population growth

In 2050, the world population will be around 9.6 billion people and demand the double of the current global crops and 70% more food than today.

A higher quality of life is another factor behind the increasing resource consumption and requirement. The agribusiness should meet the growing demand using just 5% more land, while minimizing the use of resources.

Preservation of scarce natural resources and production growth

Agriculture consumes 70% of the world's fresh water and produces 25% of the CO₂ emissions.

As production increases to meet the growing demand, the current emissions and the pace of use of natural resources are not sustainable.

As a result, companies “should” seek ways to enhance the final product yield and simultaneously reduce energy consumption and waste water.

Competition requires operational excellence

In response to changes in industry, companies need to adopt a new operational paradigm – short, highly efficient production life cycles.

Boosting equipment utilization, minimizing interruptions in the procurement chain, and promoting scalability.
Short-term global risks brought up during the 2017 World Economic Forum (Davos – Switzerland)

- Potential climate change impacts;
- Immigration;
- Environmental disasters;
- Terrorism and the required controls to prevent it;
- Data theft and computer fraud;
The industrial revolutions

1st Industrial Revolution
Mechanical loom / steam. Mechanical production systems, plants driven by water and steam

1784

2nd Industrial Revolution
Electric power / internal combustion engines. Mass production based on division of labor, driven by electric power

1870

3rd Industrial Revolution
1st PLC. Introduction of electronic systems, IT and industrial robots to increase the production automation

1969

Nowadays
Industry 1.0
Industry 2.0
Industry 3.0

4th Industrial Revolution
Based on cyber physical systems, AI, IoT.
What is the fourth industrial revolution?

• The term “Industry 4.0” emerged at the 2011 Hannover fair to describe how advances in technology would revolutionize the organization of global chains of value;

• By making smart factories possible, the fourth industrial revolution creates a world in which physical and virtual manufacturing systems cooperate in a global, flexible way;

• The outcome is full product customization and establishment of new business models;

• However, the fourth industrial revolution is not just about intelligent, connected machines and systems. It covers from genetic sequencing to nanotechnology, from renewable energies to quantum computing;

• It is the fusion of these technologies and their interaction across the physical, digital and biological domains that make the fourth industrial revolution fundamentally different from previous revolutions (Klaus Schwab).
According to Klaus Schwab, this revolution differs from previous ones and goes far beyond just absorbing disruptive, revolutionary technologies.

One such difference would be innovation potential and the comprehensiveness of varied scientific fields in which such innovations take place;

Nowadays, innovations are conceived in a much faster way than in any other time in history and over a broader scope;

Broader integration of divergent technologies, disciplines and fields.
Digital Transformation and the 4th Industrial Age

- **26%** of the leaders in digital transformation are **76%** more profitable \(^1\)
- **86%** of the CEOs take digital transformation as their **number-one priority** \(^2\)
- **30%** of the companies will have begun changing their information into value \(^3\)

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2 & 3 Top 10 Strategic Technology Trends for 2016: Information of Everything, Gartner, Mike Wlaker, 26 February, 2016
- Energy
- Health
- Urban mobility
- Industry
- Consumer goods
- Sustainability
Industry 4.0 Technologies (CNI)

- Robotics
- IoT
- Biotechnology
- Nanotechnologies and Photonics
- 3D simulation
- Horizontal and vertical integration
- Smart interfaces, psychometrics (Augmented reality)
- Cyber physical systems
- Additive Manufacturing and 3D print
- Cloud
- AI, cognitive machines
- Big data and Analytics
- Cyber Security

Biotechnology, Nanotechnologies and Photonics, 3D simulation, Horizontal and vertical integration, Smart interfaces, psychometrics (Augmented reality), Cyber physical systems, Additive Manufacturing and 3D print, Cloud, AI, cognitive machines, Big data and Analytics, Cyber Security
The Base of Corporate Management - Innovation

Management innovation

People

Businesses

Technologies

Innovative Experience

Product or service innovation

Process innovation
Humans Resources

• The new ways of producing as a result of Industry 4.0 require professionals with a background different from the existing ones.

• Integration among the various forms of knowledge, which is typical of this new production system, will demand multidisciplinary teams with a high level of technical expertise and capability of interacting with different fields of knowledge.

Propositions (CNI)

• Setting up new technical courses to meet specific requirements;

• Redesign of courses in the field of engineering, business administration and others, with an aim to meet the requirements arising from new technologies;

• Setting up multidisciplinary production management courses, with a focus on Industry 4.0;

• Encouragement to implementation of technological training programs at the companies.
Digital Transformation / Disruption

- Past
  - Typewriter
  - Print media
  - Analog photograph

- Present
  - Travel / Hotels
    - Taxi
    - TV
    - Telephone
  - Production
    - Energy
    - Automobile

- Future
  - Banks / insurance
    - Medicine (health plan, life expectation, diagnostics, GMO / stem cell ...)

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Humankind had created 5 exabytes ($10^{18}$) of digital information up to 2003 (Source: E. Schimd, DP da Google). In 2013, we produced 5 exabytes every 10 minutes.

Trends that are shaping the future: The future is wisdom, not knowledge;
Mobile and virtual reality have become a parallel world;
Technology is means, not the end.
The Exponentiality

Source: Castelli, 2016, ABTCP Annual Congress
Impacts (Klaus Schwab)

- **Economy**: changes in GDP;
- **Aging**: world population will reach 8 Bi in 2030 and 9 Bi in 2050. The Industry 4.0 will enable a longer, healthier and more active life;
- **Productivity**: TFP (Total Factor Productivity) is set to increase;
- **Jobs**: there will be demand for new goods and services; we will have to relocate our skills to meet new demands;
- **Work replacement**: mechanical and repetitive;
- **Skills**: social and creative skills. Decision making in times of uncertainties;
- **Developing economies**: increasing social inequality and economic growth rate;
- **Purpose**: care about being happy with what you do;
- **Business**: increasing rate of change in businesses;
- **National and global**: it will affect the way countries and governments relate with each other;
- **Society**: how to accommodate today’s modernity.
What’s happening in practice?

1. New interfaces (Google glass);
2. Wearable technologies;
3. Ubiquitous computing (everywhere);
4. Supercomputer in your pocket;
5. Storage for everyone;
6. IoT;
7. Connected homes;
8. Smart cities;
9. Big data and decision making;
10. AI;
11. Robotics and services;
12. Bitcoin and blockchain;
13. Sharing economy (airbnb);
14. GMO;
15. 3D printing;
16. Cyber security improvements;
17. Self-driving vehicles;
18. Designed beings;
What the P&P industry has done in this context:

1. Server virtualization;
2. Digitalization of plants;
3. Remote forest surveillance;
4. Mobility;
5. IoT applicable to forest machines;
6. Drones;
7. Forestry mechanization;
8. GMO (forest research, nanocellulose, lignin, and others)
9. Training people for the new industrial revolution;
10. Renewable energies;
11. Technological upgrading of industrial control systems;
12. Industrial process modernization;
13. AI / ANR in production lines.
Fibria’s lignin portfolio allows the development of different applications

### Development of Potential Applications
Fibria Innovations + Partners

<table>
<thead>
<tr>
<th>Petrochemical commodity</th>
<th>Friction</th>
<th>Wood Products</th>
<th>Adhesives</th>
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<tbody>
<tr>
<td>Reinforcing Rubber Filler</td>
<td>Insulation</td>
<td>Composite Materials</td>
<td>Films</td>
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<tr>
<td>Foundry</td>
<td>Molding Compounds</td>
<td>Coatings</td>
<td>Carbon Fiber</td>
</tr>
</tbody>
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Source: Castelli, 2016, ABTCP Annual Congress
1. What’s the future of the pulp industry over a ten-year timeframe?

2. How can AT and IT contribute?
Literature suggestions to start “right now”
Questions &
Discussion

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