WHAT DIGITAL CAN DO FOR THE PAPER INDUSTRY
“Further opportunities exist for tissue makers in working closely with the packaging industry, the FMCG industry, and retailers in an integrated value chain. The paper industry, packagers, printers and customers could be working together to deliver mass customised products.”

*Paper company Owner*

“In the future, the entire logistics process will be more efficient and more coordinated. Also, quality data will be transferred across the whole process.”

*Chief Information Officer*

“Traditional IT was usually characterised by high costs yielding mediocre results which were easy to replicate. Industry 4.0 is about agility: lower costs and higher impact. This is much more difficult to copy.”

*Executive Vice-President Technology*

“The greatest potential roadblock is having a convincing success story for this challenging, game-changing concept.”

*Paper company General Manager*
## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>5</td>
</tr>
<tr>
<td>What can Industry 4.0 do 4U</td>
<td>6</td>
</tr>
<tr>
<td>Paper Industry 4.0: A vision</td>
<td>8</td>
</tr>
<tr>
<td>Introducing Industry 4.0</td>
<td>10</td>
</tr>
<tr>
<td>Examples from across Europe</td>
<td>13</td>
</tr>
<tr>
<td>We are at the start</td>
<td>20</td>
</tr>
<tr>
<td>Opportunities</td>
<td>22</td>
</tr>
<tr>
<td>Expected benefits</td>
<td>24</td>
</tr>
<tr>
<td>Potential challenges ahead</td>
<td>26</td>
</tr>
<tr>
<td>Next steps</td>
<td>28</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>30</td>
</tr>
</tbody>
</table>
Central to this next level of transformation is the abundance and utilisation of mass data, the ability to connect across the value chain in real-time, mass customisation and smart factories.

More than simply another ‘buzzword’, industry 4.0 represents the next industrial revolution. This will contribute to Europe’s re-industrialisation and industry’s increased competitiveness.

Very soon, industry 4.0 will link product customisation with large production series, linking products to services and machines to machines. This will lead to faster, more flexible and more efficient manufacturing processes and shorter supply chains, so allowing an unprecedented level of ‘mass individualised’ customer service.

Today, the European pulp and paper industry is in full transformation. Both market and consumer needs have evolved, while policy pressure and global competition have increased. Therefore, industry has to innovate to remain competitive.

Innovation can address not only processes, services and products, but also business models, workforce training and education. Consequently, our industry sees huge potential in ‘digital’, instead of treating it as a trend we are forced to compete with.
Today, the world is facing numerous challenges. Environmental issues, structural demographic changes and resource scarcity are affecting us globally. At the same time, competition is increasing, continuously forcing companies to become ever more effective and putting increased pressure on high cost regions like Europe. Industry 4.0 and the digitalisation of manufacturing will play a key role in helping develop solutions to these challenges. It represents the best driver to maintain and expand a strong manufacturing base in Europe.
Industry 4.0 has many names: for example, “Smart Manufacturing” in the US, “Industrie du Futur” in France, “Fabrika Intelligente” in Italy and “Smart Industry” in the Netherlands. It is a digital manufacturing revolution, leveraging the huge unrealised value potential available from the digitalisation of industrial processes, products, and services.

Digitalisation is the main driver of the next industrial revolution. Everything that can be digitalised will be digitalised. The complete process of papermaking will be revolutionised; from forests to end consumers, the complete eco-system will be driven by real-time communication. Equipment will be smart: It will interact with its environment through sensors, communicate with other machines and trigger actions and/or reactions. Even though resources are scarce, digital data is not. The winning companies and industries will be those most quickly able to adapt to the digitalised world and fully exploit its opportunities.

In the face of continuously increasing costs, European industries have to manufacture with the highest possible value-added.

Industry 4.0 will give European industry the necessary competitive edge and a much needed head start as it enters into a new industrial era. It will help to reduce costs, so allowing a closing of the current competitiveness gap. As a result, Industry 4.0 is expected to lead to an important and much needed increase in industrialisation across Europe.

Industry 4.0 is a logical development in manufacturing, currently being driven by macro-societal trends underpinned by recent technological developments. Many macro-societal trends are currently drivers of change, such as the increasingly networked economy, shifts in age demographics, demand for individualisation, climate change and environmental regulations. Industry 4.0 will be a crucial enabler for European industries to tackle these challenges.

This revolution is already taking place and will be a game changer for many industries. At the same time, it also represents the emergence of a new paradigm that will redefine the competitiveness of not only industries but also whole nations.
With the digitalisation of production processes, new roles and responsibilities will be created, potentially requiring different skill sets. Replenishment and operational purchasing functions might be reduced to a minimum, as equipment and production sites as a whole are able to interact and make “their own” decisions, ordering required materials without human interaction.

Many opportunities exist when thinking about the future possibilities of Industry 4.0 in the paper industry’s value chain, from raw materials to the consumption of the product by customers.

Starting from raw materials real-time information could be gathered about the amount, condition, and maturity of the tree...
reactive maintenance practices would be replaced with failure prediction analytics so that downtimes could be reduced, efficiencies increased further and preventive maintenance completed at minimal cost.

**Logistics** can become more self-organised and flexible based on real-time information about shipment requirements, allowing for a better allocation of capacities, higher fill rates, increased shipment accuracy and therefore lower claim levels. Additionally, route planning can be optimised further based on available real-time information about conditions at pick-up and recipient sites.

**Customers** will be able to access real-time information about supply and demand. Direct and open communication between end-consumers, customers, paper producers, and suppliers will allow for better planning and fulfilment against requirements. Any kind of wastage will be reduced. Information about demand changes can be transmitted to all other supply chain participants, making it possible for them to deliver and produce accordingly. Better information about usage or the application of products can be incorporated into customer and product development processes.

While some of these opportunities may seem to be achievable only in a distant future, some of them already exist today. In this report you will find a number of ‘gold nuggets’ of Paper Industry 4.0. These are the forerunners of the opportunities that will exist for every company in the pulp, paper and packaging industry. Opportunities offering a huge potential if developed further.
INTRODUCING INDUSTRY 4.0

The term ‘Industry 4.0’ can be applied to three different situations: When people, machines, and industrial processes are intelligently networked and interact with each other; when components interact independently with a production plant whenever necessary; and when feedback is captured digitally and incorporated across the value chain, automatically triggering new events.

The Internet of Things will be a key enabler

Digitalisation – the fourth industrial revolution – will fundamentally impact all industries. One of the key enablers of digitalisation is the ‘Internet of Things’, referring to the widespread integration of wireless sensor networks feeding into cloud-based, big data analytics platforms and machine-to-machine communication interfaces. This will allow for new levels of control and automation in industrial processes, factory operations and the management of global manufacturing networks.

Increased levels of centralised remote management and automation combined with the growth of 3D printing, sensor-support, ultra-fast lasers, augmented reality, robotics and machine vision technologies will provide vastly increased flexibility in manufacturing processes. This will allow for a number of significant gains:

- Increased production efficiency through the control of plant operations and distribution processes
- Significantly increased efficiencies in energy consumption and the use of materials
- Minimal wastage through the monitoring of the supply chain in real-time
- Reduced error rates and maintenance costs due to the continuous monitoring of asset performance
- Highly customisable, on-demand manufacturing
- Maximised logistical efficiencies
- Enhanced communication with the consumer base
- Reduced air emissions due to the increased energy, material and logistics efficiency
Industry 4.0 rests on five pillars that, when combined, will enable companies to fully harness the gains in IT and telecommunications technology of the past two decades. These pillars consist of:

1. Smart equipment
2. Networking and connectivity
3. Value chain integration
4. Smart products
5. Data analytics

While only a holistically integrated Industry 4.0 strategy will enable companies to realise their full potential, investment in each of these pillars will give companies both an increase in efficiency and flexibility as well as a better strategic position than their competitors.

**SMART EQUIPMENT**

Smart equipment is defined as intelligent manufacturing assets that are autonomous and able to interact with their surroundings – often supported by sensors that trigger action. Process automation and smart equipment are the cornerstones of Industry 4.0. While a lot has already been achieved, the rise of the Internet of Things is offering even more opportunities. The shop floor of the future will be centred on intelligent manufacturing assets that are autonomous, able to interact with their surroundings through sensors, flexible and able to adapt to unexpected situations, and able to communicate both with each other and with human operators. All resources in a production plant – both humans and machines – will be connected through the Internet of Things, marking a new level of socio-technical interaction. Going one step further, the products themselves will be intelligent, managing their own production process and giving instructions to machines regarding next steps or special customisation features.

**NETWORKING AND CONNECTIVITY**

Networking and connectivity are based on decentralised IT systems that cover all aspects of production, serve as an ecosystem for integration of new applications and equipment, and are able to create a virtual view of production. To take advantage of the increased availability of information due to the digitalisation of the production processes, it is essential to connect all elements into a single decentralised system that covers all aspects of a company’s operations: from inbound logistics to product engineering, manufacturing, and outbound logistics. The role of such a system is to bridge the gap between the physical and digital world – hence, the name: cyber-physical system or CPS.
DATA ANALYTICS

Data analytics are advanced or predictive analytics used to improve maintenance and production activities by processing large amounts of real-time signals, which are usually collected in a cloud-based solution. In order to fully leverage the opportunities raised by the previous pillars, companies will have to develop or acquire data analytics skills. The application of statistical algorithms to real-time data will allow them to harvest the full potential of the vast amount of data that Industry 4.0 will provide. The potential gains from advanced analytics in a real-time environment extend from cost savings through predictive maintenance and the eradication of storage through predictive bottleneck analytics to the full utilisation of assets through production analytics and a more flexible and better-informed business strategy.

VALUE CHAIN INTEGRATION

Value Chain integration takes place with the integration of IT systems, including customers and suppliers across the value chain in order to improve information flow. It refers to the integration of “IT” and “automation”. Such a competency will enable companies to integrate their whole value chain into their operations in real-time and on a daily basis. Changes in demand and supply will automatically and directly be fed into the production system and therefore enable companies to react quickly and more efficiently to unpredictable volatilities. This will make companies significantly leaner and enable them to move away from traditional, static production models.

SMART PRODUCTS

Smart products are products that participate in the production process by providing data to equipment on next steps, requirements, etc. They have the ability to interact with customers, and provide additional benefits and services beyond their immediate function. If a company is able to combine and integrate the previous pillars into their activities, they will be able to identify new customer needs faster and react to these insights in less time than they currently can. In addition, they will be able to see new revenue streams outside of their core competencies – such as shared production assets, cloud services, or global knowledge and competency transfer.
EXAMPLES FROM ACROSS EUROPE

Although Industry 4.0 is still in its infancy, many companies have already recognised its potential and are pushing innovation to gain competitive advantage. Industry 4.0 can be implemented across the value chain from raw material and equipment suppliers to outbound logistics and customer service. In many cases, companies are at an early stage of Industry 4.0 development, focusing on only a few of the five pillars. There is, however, significant potential for further integration across all pillars of Industry 4.0: smart equipment, networking and connectivity, value chain integration, smart products and data analytics.
A business activity that starts as an equipment solution for remote services but has the potential to evolve into a holistic remote monitoring system, controlling and supporting machines and the production network while improving productivity, reducing downtimes and reducing maintenance costs through predictive analytics.

A pilot project enabling customer integration and flexibility to change orders, enabling full customer transparency about the production schedule and outbound supply chain with the ability to track, trace, and adjust orders within given parameters. Real-time dynamic pricing and costing information will therefore drive supply and demand balancing. Real-time and dynamic information about asset conditions and productivity can also be integrated into planning systems and changes and/or re-allocations can automatically be made in case of bottlenecks. Pro-active and automatic provision of up-to-date information to customers also represents an additional side benefit.

An integrated supply chain solution across multiple partners can become a full chain-of-custody data set about products, their conditions and components. Information about a product can be built-up simultaneously as it is created. Product-specific and environmental information about the product will be routed through the supply chain and passed on from stage to stage. This allows customers to better understand the origin of the product and suppliers to improve the management of customer requirements.

Leveraging big data related to energy consumption evokes the image of company-wide management of energy supply, demand, and costs. Combined with pricing information, real-time consumption information will allow optimisation of production, re-allocation of capacity and adjustments to procurement and hedging strategies.
A CASE FOR SMART EQUIPMENT

Papermaking 4.0
Better and more environmentally friendly control

CHALLENGE

- Low operating efficiency
- Underperforming production
- High raw materials and energy costs
- Unstable production
- Constant maintenance need

SOLUTION

**OnEfficiency DIP**: balances out raw material quality fluctuations in the deinking process by real-time adjustments of flotation and bleaching chemical dosing. Results in improved quality of final stock and thus higher paper machine efficiency.

**OnCare**: facilitates the maintenance management of the paper machine, from planning, servicing and documentation through cost control to spare parts management.

**OnEfficiency DIP**
- Field experience 3 (170.00 T/y DIP for NP)
- OnE DIP impact on yield and energy

**OnCare**
- Helps to prevent unscheduled and costly machine downtimes, and to improve planning of maintenance tasks.

BENEFITS

- **OnEfficiency DIP**: customer achieved savings of 3.55 Mio € / year as a result of:
  - Increased fiber yield by 2.5%
  - Reduced energy consumption of flotation pumps by up to 35%
  - Reduced dosage of bleaching chemicals and additives (1.24 Mio € / year)

OnCare: helps to prevent unscheduled and costly machine downtimes, and to improve planning of maintenance tasks.

Source: Voith
AN EXAMPLE OF NETWORKING & CONNECTIVITY

“Connected inside & outside”
Remote monitoring enabling proactive maintenance practices to reduce downtime and costs and increase overall OEE

<table>
<thead>
<tr>
<th>CHALLENGE</th>
<th>SOLUTION</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connected customers</strong></td>
<td>• Full online access to “order book” (ERP)</td>
<td>• External: customers can see and change delivery dates&lt;br&gt;• Internal: no manual handling process required</td>
</tr>
<tr>
<td>• Customers had no transparency&lt;br&gt;• Manual internal coordination required</td>
<td>• Automatic coordination process&lt;br&gt;• Customers can change their orders directly into system until truck is loaded</td>
<td>• External: higher machine reliability&lt;br&gt;• Internal: less outages through better planning and feedback-loop</td>
</tr>
<tr>
<td><strong>Connected maintenance</strong></td>
<td>• Implemented 900 RFID chips in different locations at PM8</td>
<td>• CAGR +11.1%</td>
</tr>
<tr>
<td>• Maintenance task planning cumbersome&lt;br&gt;• Quality: duplication or omission of task</td>
<td>• Full and adaptive maintenance plan on tablet. Each task and its results triggers changes in plan</td>
<td></td>
</tr>
</tbody>
</table>

Source: Saica

1997 2014

INCREASED REVENUES BY MORE THAN 11% PER YEAR
VALUE CHAIN INTEGRATION

“Integrated supply chain across multiple partners”
Supply chain transparency: integrated RFID chips in cardboard box

CHALLENGE

• Identification of articles via classic barcode scanners → slow
• Supply chain planning based on forecasts → low accuracy

SOLUTION

• Integrated RFID chips along the entire supply chain
• Simultaneous cardboard registration
• Valuable information about the articles is accessible:
  • Production history
  • Ingredients of the articles
  • Best-before date

BENEFITS

• Reliable information for planning through real-time data
• Stock reduction
• Increased availability of goods
• Real-time inventory on article-basis
• Increase in revenues along the value chain – especially for retailers

Source: Selected value chain participants
A SMART PRODUCT

“Smart connected packaging”
Intelligent and connected pharmaceutical blisters or pill dispensers send information to track dosage and usage

**Patient adherence:** patients don’t stick to their medication as prescribed

- Causing significant costs for national healthcare systems, e.g. because of unnecessary hospital treatments in selected diseases
- Lost sales of pharmaceutical companies by un-filled prescriptions
  - **€ 178bn**
  - **€ 41bn**

**Printed conductive traces**
on premium cardboard based blister inlay (free of metals) connected to a GSM/GPRS device

- Tracks each single pill in real-time and using GSM/GPRS cellular networks delivering data to Mevias IT systems (can be connected to third party systems)

**SOLUTION**

- Renewable, recyclable carton and **reusable** GSM/GPRS device with chargeable battery

**BENEFITS**

- Significant cost reduction for healthcare systems: Real-time follow-up possibility for healthcare service providers on patient compliance
- Reduced lost sales due to higher adherence to prescriptions:
  - Daily reminders towards patients such as voice call, SMS or personal visits when medication is not taken
- No electronic waste as the module is reused and the cardboard package is recycled

Source: Mevia
“Big energy data”
EOS – Energy Optimisation System – Tracking of energy consumption of individual consumers to optimise energy supply and demand

CHALLENGE

• Rising costs for energy and for energy related environmental costs
• Volatile energy price development and complexity in energy generation and consumption

SOLUTION

BIG DATA
EOS – Energy Optimisation System
ALGORITHM

• OPTIMISATION: EOS calculates the operation point of lowest cost of supply of steam and power and provides guidance on how to operate most cost effectively
• SELF-LEARNING: Learns from the comparison of optimised situation to actual situation and adjusts accordingly
• INTEGRATION: Provides a direct view on correlations between energy consumption, quality and efficiency parameters; instrument to run the production at optimal balance of quality, efficiency & cost

BENEFITS

• Reduced energy costs & other production costs
• Solid “make or buy decisions” on long-term (> 1 year) and short-term (next day, next hour) view
• Enhanced quality & efficiency
…by having answers to questions like:

“What is the impact of a higher gas demand to a special quality parameter (e.g. gloss level) and to the rate of broke generated for this mother-reels?”

“What is the energy cost effect of the change in the ash content of the paper by 1%?”

Source: Sappi
WE ARE AT THE START
We are at the start

The pulp and paper industry is still at an early stage with regards to Industry 4.0. It is building up strategic awareness and starting single, as yet unconnected projects. Other sectors such as IT, aerospace and the automotive industry have already reached the stage of business plan development. Industry 4.0 is still too much about these sectors. Currently, the benefits for basic manufacturing remain huge but underexploited.

For this publication a European-wide survey of companies was conducted with additional participation from companies outside of Europe. More than 300 participants represented not only the pulp, paper, packaging and associated industries, but also other industries to obtain a broader picture about the true state of Industry 4.0. Equally, survey respondents represented the widest range of countries and company sizes.

By examining the companies’ current project activities, further insights were gained: predictive analytics and supply chain integration are taken up already. Smart products are in the development stage, with the first products now entering the market. Expected benefits are the emergence of new business models and achieving greater energy efficiency.

To move further towards Industry 4.0, one of the three most important steps mentioned is the identification of opportunities related to Industry 4.0 itself. Almost half the respondents believed that a second necessary step is clearly communicating these opportunities, the need to receive a clear “yes” for moving towards Industry 4.0 from customers and understanding precisely why this is important for them.

In short, we have found that industry 4.0 is still a black box for most. This publication aims to shed the first light to show how clear gains can be made when a suitable structure and a strategy are put in place.

The case studies prove that the concept can have a clear value for our sector. Equally, much can be also learned from other industries that have already taken initial steps and advanced towards the implementation of the future-shaping Industry 4.0 concept.
Opportunities

Industry 4.0 will change the way people communicate, consume and do business by connecting all the participants in the value chain. This offers huge opportunities for the pulp, paper and packaging industry. The societal changes brought by global digitalisation will open up new markets, the industry having the chance to identify, trigger and fulfil newly-arising customer needs and develop tailored solutions to best meet them.

The opportunities of Industry 4.0 for the pulp, paper, and packaging industry can be divided into four categories:

**Improved offerings to the current market:** Through increased value chain effectiveness, the industry will be able to understand and serve customers better. This can result in mass customised products which consider individual customer needs while, at the same time, retaining the benefits of mass production and economies of scale. A further possibility includes the provision of value-added by-products or services to strengthen customer satisfaction and loyalty.

**Improved performance of current offerings:** Increased value chain efficiency will allow the industry to analyse and optimise its production processes. This involves leveraging smart factories and interconnectivity further to facilitate improvements in production analytics and/or targeted sales.

**Completely new offerings creating new markets:** New technologies and digitalisation will open up opportunities for completely new product innovation, driving the emergence of entirely new markets. This is where real ‘disruptive’ solutions can emerge, such as adaptive mass-customisation or new connected services triggered by smart products.

**Synergy offering across industries:** While the business eco-system is re-formed and re-shaped through the advent of digitalisation, industry players will have a chance to question and re-organise their value systems. This can lead to entirely new forms of cooperation between industries, companies and customers, so opening up new potential synergies.
EXPECTED BENEFITS
Expected Benefits

On the cost side, the main opportunities provided by Industry 4.0 are based on optimised processes and the efficient use of available resources. This will be made possible both by the availability of smart equipment and vast amounts of data, supported by the ability to analyse it. Companies will become more flexible to changing market circumstances and customer needs by eliminating the boundaries between the different players in the value chain and improving the flow of information among them.

Companies will therefore be able to create leaner structures and eliminate the need for excess inventories or assets. Remote and centralised monitoring of machine networks will enable production optimisation. Predictive maintenance practices and remote support will also lead to new levels of efficiency and capacity utilisation.

In addition, higher revenues can be expected from full customer transparency regarding production schedules and outbound supply chains, offering customers the ability to track and trace and adjust orders within given parameters. Supply and demand balancing driven by real-time dynamic pricing and costing information also promises a potential boost in profitability.

Higher efficiency will also be driven by information about asset conditions and productivity levels. Such information could be integrated into planning systems and even lead to automatic cost-optimised re-allocations in case of bottlenecks. Utilising this by proactively providing information to customers is yet another opportunity for businesses. Additionally, optimised processes will increase energy efficiency and support the sustainable use of natural resources, providing long-term positive impacts.
POTENTIAL CHALLENGES AHEAD
Potential challenges ahead

There are a number of challenges ahead before Paper Industry 4.0 can be widely implemented. The first, most fundamental obstacle is the general lack of awareness about the potential benefits of Industry 4.0. But the following elements also need to be addressed:

**Standards:** Internationally accepted common technical standards, like measuring units or electric voltage, facilitate the creation of global value chain networks between humans, machines, and systems. In this context, the standardisation of interfaces is certainly relevant, but agility might be seen as a competitive advantage.

**Legal:** Data privacy and protection of intellectual property remains an unsolved issue. The efficiency of global value chain networks could be increased significantly if data were to be shared and analysed jointly across network partners. This, however, violates the current understanding and regulation of data protection.

**Organisational aspects:** Strong research and development capabilities and pro-active innovation management are core requirements to successfully introduce and develop Industry 4.0 in a company. A forward-looking company culture, openness to change, and continuing education are all necessary for driving process change.

**Costs:** High investment cost for modern machinery hamper the shift towards cross-linked production systems. Sufficient funding is therefore required to implement innovation projects and invest in digitalised assets. The difficult estimation of return on investment represents a further obstacle facing investment decisions in Industry 4.0.

**IT:** Security of information technology is one of the most important prerequisites for the sustainable success of Industry 4.0. In today’s industry, secure IT infrastructure is mostly site-specific. The more connected value chains are, the more critical the risk of cyber-attacks across the chain becomes. There are potential security issues like cyber-attacks, corporate espionage, phishing, botnets and hacktivists. These, as well as other malware/viruses e.g. through email, USB devices or internet connections, pose a threat to a company’s operations and intellectual property. At the same time, inadequate IT security systems may raise concerns about the potential risks with the use of enhanced technology, so hindering adoption and implementation of Industry 4.0.

Furthermore, the implementation of Industry 4.0 requires an advanced and stable technology infrastructure. The system includes numerous components of hardware and software, sensors, networking infrastructure, process control systems, as well as data management and redundancy solutions. The necessary network and bandwidth requirements, together with the stability and reliability of algorithms used, all need to be considered. The technology used has to fulfil the advanced technical requirements of Industry 4.0, while also ensuring the continuity of interconnected operations.

Finally, building up and maintaining the necessary IT framework for Industry 4.0 requires the adequate allocation of resources. Central, comprehensive coordination of all IT and automation activities across systems, sites, and networks is essential and know-how has to be built across the whole value chain.
NEXT STEPS
Next Steps

The pulp, paper, and packaging industry is still at an early phase of developing and participating in Industry 4.0. However, some promising cases of businesses taking their first steps towards it already exist, offering key opportunities for the future.

Companies should further develop their existing Industry 4.0 pilot projects and continue to seek new ways to develop and unfold their accumulated skills and experiences. An Industry 4.0 strategy should be set up not only at the company level but also across the whole value chain: from raw materials to end-consumers.

The industry can study and learn what other industries are already doing and explore how it can apply these to its own activities. Communicating with and connecting to other industries will help the pulp, paper, and packaging industry learn, whether it is in the form of conferences, common pilot projects or informal information exchanges.

Additionally, industry players can enhance their relationships and strengthen liaisons with customers through development of jointly-funded Industry 4.0 pilot projects. The industry should seek greater collaboration with suppliers, customers and other stakeholders, motivated by the overarching goal of creating a common agenda to drive development towards Industry 4.0.

Funding will be needed, some with government support. Development of Industry 4.0 will not happen on its own. The new Digital Economy initiatives of the European Commission and member states can help move this development forward.

The three most important steps that need to be taken to move forward towards Industry 4.0

<table>
<thead>
<tr>
<th>Step</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify opportunities related to Industry 4.0</td>
<td>70%</td>
</tr>
<tr>
<td>Clearly communicate the opportunities offered by Industry 4.0</td>
<td>48%</td>
</tr>
<tr>
<td>Receive a clear sign from customers that Industry 4.0 is important to them and understand why</td>
<td>41%</td>
</tr>
<tr>
<td>Create a roadmap for the implementation of Industry 4.0</td>
<td>36%</td>
</tr>
<tr>
<td>Agree on common technical standards</td>
<td>26%</td>
</tr>
<tr>
<td>IT systems and infrastructure</td>
<td>26%</td>
</tr>
<tr>
<td>Ensure funding for development/implementation</td>
<td>24%</td>
</tr>
<tr>
<td>Machinery/equipment</td>
<td>9%</td>
</tr>
<tr>
<td>Organise industry-wide research projects</td>
<td>6%</td>
</tr>
<tr>
<td>Support development of policies</td>
<td>6%</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENT

Sitra, StepChange and CEPI would like to thank all those who have contributed to making this report.

Andritz
Manuela Wagner

DG Connect – European Commission
Francesca Flamigni

Futura
Marco Dell’Osso

Heidelberg
Tom Oelsner, Kerstin Rabbel

Ifoodbag
Karl Fallgren

Igepa
Elmar Schätzlein

Hansa-Heemann
German Reichert

Lauri Lemmenlehti

Linja
Eljas Perheentupa, Ville Pohjola

MAN Steyr
Karl-Heinz Rauscher

Mars
Mareika De Boer

Metro

Metsä
Mira Iso-Markku (Tieto)

Metsäteho
Pirjo Venäläinen, Tapio Räsänen, Jarmo Hämäläinen

Metso
Anne Rantanen

Mevia
Jesper Hassel

Mondi
Burkhard Vogel, Armand Schoonbrood

Nestlé

Procter & Gamble

Pulsar
Angelo Bertini

Reijo Pankka

RWTH Aachen
Kerem Oflazgil

Saica
Fernando Pelegrín Gallardo

SAP
Alfred Becker, Niels Ebers

Sappi
Max Oberhumer

Sitra
Ernesto Hartikainen

SKF
Franz Hammelmüller

T-Mobile
Stephan Imre

TU Graz
Wolfgang Bauer

Valmet
Lotta Forssell

Voith
Peter Eisen, Simone Rampmaier

UPM
Jyrki Ovaska

US Department of Agriculture’s Forest Service Smart Forest Network and University of Helsinki SMEAR Research Station
Lindsey Rustad
CONTACT US

CEPI – Confederation of European Paper Industries
mail@cepi.org

Sitra – Finnish Innovation Fund
sitra@sitra.fi

StepChange Consulting
office@stepchange.com