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EIT RawMaterials – Digitalisation in the Raw Materials Sector

The Green Deal manifests Europe's decisive move toward a clean and green society with a neutral CO_2 footprint and a zero-waste circular economy. The **digitalisation of the raw materials sector along the entire value chain** is vital to achieve these ambitious goals and offers smart solutions that benefit all of us.

> Europe's current and future sustainable economic growth and societal wellbeing increasingly draw on value created by data." (European Commission White Paper on Artificial Intelligence, 2020)

The raw materials sector is connected by materials, innovation and economic needs, by people and by societal and environmental requirements. However, most inherently, **data serves as the fundamental connector and enabler** from smart mining to a truly circular economy. The collection and analysis of vast quantities of data from various scales of observation, over variable timeframes and across thematic areas is at the very core of the digital transformation in all societal and economic sectors. Advanced models and optimised processes based on smart algorithms, connectivity and autonomous designs are the future of the raw materials sector and one of the **cornerstones of Europe's new Industrial Strategy** (table 1). Furthermore, technologies such as 3D printing and smart materials offer new and exciting solutions for technical problems and provide new pathways toward a circular product lifetime from the early design stage.

EIT RawMaterials' Role

Availability of infrastructure, an educated workforce, and strategic raw materials to build and maintain Europe's sustainable growth and industrial competitiveness are essential aspects of the digital transformation and feed back into EIT RawMaterials' vision to **develop raw materials into a major strength for Europe**. With an exceptional network of stakeholders in industry, academia, research organisations and start-ups that are leaders in the digital transformation and experts actively researching, developing and employing digital solutions along the entire value chain, EIT RawMaterials is uniquely positioned to:

- discuss and highlight trends;
- identify industry needs and develop innovative solutions;
- network for project and strategic alliances;
- engage with digital natives – the next generation of raw materials professionals;
- provide funding opportunities;
- offer knowledge creation and dissemination across our network and beyond;
- engage with decision-makers and wider society.

Acting on Data

The **benefits of digitalisation on existing infrastructure are immense** and have already been demonstrated. The way we collate, analyse and act on data can be drastically improved, leading to double-figure efficiency increases in mining and processing operations.

> It's estimated that mine digitalisation could save $370 billion per year by 2025… raising productivity, reducing waste and keeping mines safe..." (McKinsey & Company).

Leveraging innovative technologies

The concept of **circularity should be part of process design and operation from the very beginning** – big data analytics and cross-sector data integration can achieve this ambitious goal. The entire supply chain can generate, organise and share essential performance data for a more collaborative, streamlined, efficient, cost-effective and, most importantly, sustainable operation – **leveraging innovative technologies to transform the raw materials sector**. Furthermore, the shift from a purely data-centred approach to process-oriented analytical methods, i.e., process mining, offers further opportunities for the sector to achieve technology-driven improvements. Here, the relationship and interface between humans and automated processes play a pivotal role.

People and Processes

The digital transformation also poses significant challenges concerning the security of data, the education of the workforce and the overall societal impacts. These aspects deserve equal attention and, if addressed appropriately, can help **rebuild trust in the raw materials sector**.

> Digitalisation is more than just a technological revolution; the digital transformation also depends on people and processes." (ABB)

The six main pillars of the digital transformation in the raw materials sector to support the new Industrial Strategy for Europe (Table 1)

Artificial Intelligence and Machine Learning	Virtual and Augmented Reality	Automation and Autonomous Design	IOT and Digital Infrastructure	Data Security & Societal Impact	Digital Natives
(i) Advanced and more reliable exploration models (ii) Optimised processes based on big data analysis and deep learning strategies (smart algorithms, Digital Twins, etc.) (iii) Enhanced safety and predictive solutions for monitoring and maintenance (iv) Integration of single elements of the value chain into a truly circular model	(i) Provision of safe and comprehensive training environments (ii) Display and analysis of advanced exploration models (iii) Visualisation and optimisation of processes along the entire value chain to increase resource efficiency (iv) Education 4.0	(i) Robotics in exploration, mining and processing (ii) Enhanced safety (iii) Optimised efficiency and productivity (iv) Unmanned Aerial-Ground-Under water Vehicles (v) Reduced operational costs	(i) 5G (ii) Reliable server infrastructure and software solutions (iii) Cloud-based solutions and edge computing (iv) Unlocking of business2business and customer relations (v) Blockchain (vi) Certification - Trustworthy, secure and seamless tracking of raw materials from source to product	(i) Secure and reliable data (ii) Impact of the digital transformation on society (iii) Human-Technology interfaces	(i) Education – from schools and universities to wider society learning and lifelong learning (ii) Fostering of young talents (iii) Knowledge creation and dissemination

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