# Challenge and Ambition

## *WP7 FERTILISERS*

## CHALLENGE

**Technological Innovation**
Transitioning to low-emission and resource-efficient fertiliser production requires major technological advancements. Integrating carbon-reducing technologies, digital process optimisation, and alternative production routes (e.g., green ammonia, nutrient recovery, precision fertiliser formulations) remains technically complex. Many plants operate legacy equipment, making retrofitting difficult and costly.

**Economic Costs**
The high upfront investment for clean technologies, digital infrastructure, hydrogen-ready equipment, and automation poses a significant barrier —especially for small and medium-sized producers. Additionally, volatile energy and raw-material prices intensify economic uncertainty. Without sufficient financing instruments, industry uptake may remain uneven.

**Education and Training**
Both producers and end-users need new skills to adopt and benefit from greener and smarter fertilisers. Operators need training in digital systems, emission-reduction technologies, hydrogen handling, and quality control for secondary materials. Farmers require knowledge about application methods, precision tools, and the advantages of sustainable fertilisers.

**Market Acceptance**
Farmers and agri-businesses may be hesitant to adopt greener fertilisers and advanced fertiliser products if they perceive them as costly, less effective, or unfamiliar. Ensuring trust and demonstrating long-term benefits (soil health, productivity, reduced emissions) is essential but requires time, data, and targeted education.

**Supply Chain Adaptation**
The shift toward low-carbon and bio-based fertilisers requires new supply-chain configurations—such as sourcing biological feedstocks, integrating recycled nutrient streams, and establishing hydrogen supply infrastructure. Coordinating multiple actors across these chains is challenging and may slow down the transition.

**Data Management**
Smart fertiliser production and precision fertiliser use generate large volumes of data. Data collection, integration, and interpretation require sophisticated digital systems and skilled personnel capable of working with automation, AI, and advanced analytics.

**Multi-disciplinarity Requirements**
Developing sustainable fertilisers requires collaboration across chemistry, biology, engineering, environmental sciences, and social sciences. Integrating these perspectives and ensuring that the workforce is capable of operating in multidisciplinary settings remains a structural challenge for the sector.

**Research and Development**
Developing reliable, eco-friendly fertiliser alternatives demands advanced scientific research, including long-term trials on soil health, crop yield, and environmental impact. The R&D cycle is lengthy and requires multidisciplinary expertise and substantial funding.

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**Regulatory Compliance**
The fertiliser sector faces rapidly evolving environmental and product regulations. Compliance with EU climate targets, the Fertilising Products Regulation, IED updates, and circular-economy standards requires deep process changes, new documentation systems, and enhanced quality control. Regulatory divergence across regions further increases complexity.

**Cooperation and Multi-stakeholder Alignment**
Effective transition requires cooperation between governments, producers, technology suppliers, agricultural organisations, and research institutions. Fragmentation, differing priorities, and lack of harmonized skill standards often slow joint progress.

**Access to Resources**
Bio-based and circular fertiliser production depends on steady access to biological and recycled feedstocks. Availability varies across regions, making consistent and scalable production challenging. Resource competition with other industries (bioenergy, materials) can further limit supply.

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## *WP7 FERTILISERS*

## AMBITION

**1. Accelerate the Transition to Low-Carbon and Circular Fertiliser Production**

The fertiliser industry aims to scale up technologies such as green ammonia, carbon capture integration, digitalised production lines, and nutrient-recycling processes. By 2030, the ambition is to significantly reduce greenhouse-gas emissions from fertiliser production and increase the use of recovered nutrient sources. CHEMSKILLS will help define the competency frameworks required to support this shift, ensuring operators, engineers, and technicians are prepared for new workflows.

**2. Build a Digitally Enabled and Data-Competent Workforce**

A major ambition is to digitalise production, quality control, and supply-chain operations through automation, advanced analytics, predictive maintenance, and data-driven decision-making. The subsector seeks to develop a workforce able to manage digital twins, AI-supported production optimisation, and precision application systems. CHEMSKILLS will provide shared digital-learning pathways and mobility-friendly training standards across Europe.

**3. Strengthen Innovation Capacity through Multidisciplinary Skills**

The sector aims to foster stronger collaboration between chemistry, biology, materials science, engineering, agronomy, and social sciences to develop next-generation fertilisers with improved efficiency and reduced environmental impact. This requires training programmes that stimulate interdisciplinary thinking, systems innovation, and collaborative problem-solving.

**4. Improve Market Acceptance and Stakeholder Literacy**

An ambition is to increase the adoption of sustainable fertilisers by educating farmers, distributors, and advisors on correct use, performance, and long-term soil and climate benefits. Through CHEMSKILLS, the sector will create learning tools and knowledge platforms to support understanding, transparency, and trust.

**5. Develop a Resilient, Sustainable Supply Chain**

The industry aims to reorganise its supply chain to incorporate recycled materials, alternative feedstocks, and green energy sources. Collaboration with logistics, biotech, recycling, and hydrogen sectors will be strengthened, supported by workforce skills in supply-chain risk management and digital traceability.

**6. Enhance Sector Attractiveness and Talent Mobility**

Finally, the subsector aims to become more attractive to young professionals by promoting modern, purpose-driven careers linked to sustainability and digital innovation. CHEMSKILLS will harmonise qualification frameworks and skill passports to facilitate mobility of workers and create a more unified European labour market.

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