

Scoping Paper for

Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing

Important Notice: Working Document

This paper is a working document. It is sent to the Programme Committee for the Horizon 2020 Specific Programme for discussion in the context of the preparation of the Horizon 2020 Work Programme 2016-2017. As such, information and descriptions of activities indicated in this document may not appear in the adopted Work Programme 2016-2017, and likewise, new elements may be introduced.

1. Context

Incoming President Juncker's first priority is to "strengthen Europe's competitiveness and stimulate investment for the purpose of job creation." He believes that "we can make much better use of the EU budget and of the European Investment Bank (EIB) ... to stimulate private investment in the real economy". He also stresses the need "to bring industry's weight in the EU's GDP back to 20% by 2020, from less than 16% today". "This should ensure that Europe maintains its global leadership in strategic sectors with high-value jobs such as the automotive, aeronautics, engineering, space, chemicals and pharmaceutical industries."

The industry-centred 'Leadership in enabling and industrial technologies - Nanotechnologies, Advanced materials, Biotechnology, Advanced manufacturing and processing' (LEIT-NMBP) part of Horizon 2020 has been designed to serve these priorities by providing the support for four of the six key enabling technologies (KETs): Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing. These are areas of key industrial competence determining Europe's global competitiveness, creating jobs and supporting growth. By bringing key enabling technologies closer to applications, LEIT-NMBP addresses EU industrial policy goals and, at the same time, several societal challenges. One of the key concepts in LEIT is the support for "cross-cutting KETs", activities that bring together different KETs and have the potential to lead to unforeseen advances and new markets and goods.

In the first Work Programme (2014-2015), LEIT-NMBP focused on bringing KETs closer to applications and the markets, notably by supporting specific pilot lines and demonstration activities, with a special emphasis on cross-cutting KETs. The ground for this had been prepared in the last two years of the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013) (FP7). This approach is dependent to some extent on a solid support for more upstream R&D, notably under the Excellent Science priority of Horizon 2020.

The strategy of LEIT-NMBP for the next Work Programme (2016-2017) will focus on supporting **EU Manufacturing**, by developing and deploying technologies in order to ensure economic growth, job creation, climate and energy goals and environmental protection.

This will be in the context of dramatic changes in our working and living environments, often referred to as the '**4th Industrial Revolution**', arising from the rapid development of IT infrastructure, the evolution of smart devices, and the linking of the physical and the virtual worlds to form Cyber-Physical Systems (CPS). This offers huge potential for increasing flexibility, efficiency, resource productivity etc. in the production and service sector, but also in our everyday life. The manufacturing industry in highly industrialised countries is in danger if no action is taken, as devices become commodities and functional differentiation becomes more difficult.

LEIT-NMBP will make a substantial contribution to a possible policy initiative on **Additive Manufacturing (AM)** ("**3D Printed in Europe**"). Additive Manufacturing, including 3D-Printing, holds the promise of transforming the manufacturing value chain, allowing a shift from mass production to full customisation and local production. It can provide a wide array of goods, even with complex shapes and functionalities, maximising production flexibility and minimising waste and the use of resources. AM has the potential to bring production closer to the location of demand and strengthen regional economies, small and medium-sized enterprises (SMEs) and entrepreneurship. It can help to restore manufacturing and jobs to Europe ("re-shoring").

The underlying strategy is being developed by drawing on several sources:

- Consultations with European Technology Platforms (ETPs);
- Roadmaps developed by the three contractual Public-Private Partnerships (cPPPs) in the LEIT-NMBP area: Factories of the Future (FoF), Sustainable Process Industry (SPIRE), and Energy-efficient Buildings (EeB);
- Roadmaps developed by "cross-ETPs", combining input from several ETPs relevant to the LEIT-NMBP activities, and similar groupings: Materials Summits, Alliance for Materials, Nanofutures, Biomaterials roadmap, Metallurgy roadmap, Nano High-Level Group, Energy Materials Industrial Research Initiative (EMIRI), and the Nanosafety cluster;
- Recommendations of the *High-level Group on Key Enabling Technologies*;
- Roadmap for Cross-cutting KETs;
- Input from the *LEIT-NMBP Advisory Group*; the Group has been asked to address the questions developed for all parts of Horizon 2020; has considered the input from industrial stakeholders, Research and Technology Organisations (RTOs), academia and innovation specialists; and has taken stock of the experience from the first calls for proposals of LEIT-NMBP in Horizon 2020; and
- Bilateral discussions with the EIB.

The recommendations from the LEIT-NMBP Advisory Group will help accelerate the innovation process and maximise the impact of funded projects. These include:

- Enhanced synergies with Societal Challenges;
- Better and more targeted coordination and support actions (CSAs) and mechanisms that work on shorter time-scales (e.g. workshops with clusters of projects);
- Fine-tuning of the expected impacts of topics and corresponding evaluation and monitoring (e.g. with regard to business scenarios);
- A concerted effort to identify new opportunities for international cooperation, mostly based on the general opening of Horizon 2020, beyond the established activities (e.g. in nanosafety) and potentially leading to new markets.

2. Strategic orientations for 2016-2017

The aim of all the activities is three-fold: to develop innovative technologies bringing them closer to the markets (including a progress towards higher Technology Readiness Levels (TRL)); to leverage additional investment, both public and private, notably by synergies with European Structural and Investment Funds (ESIF) and the EIB; and to facilitate solutions addressing societal challenges, which can in turn lead to further markets. This will help the manufacturing sectors, especially SMEs, to adapt to global competitive pressure by improving their technological base. For SMEs in particular, it is important to ensure a full involvement in industrial value chains, and access to pilot lines and RTOs, or technology infrastructures offering services to SMEs (including in the SME Instrument).

The general approach to achieve the policy goal of manufacturing in the EU is to support “Factories, Process plants and Buildings” of the future, as these three areas together represent a large part of the EU GDP and employment, and thus have significant socio-economic and human resource potential.

To be successful, the approach relies on strong links to sources of investment, to ensure that the results of successful research and innovation projects are fully exploited in Europe. With the results of previous research projects becoming available, now is the time to devote effort to the innovation part of the programme and build on those results through further investment. Europe's economy cannot create a sustainable recovery without a strong and profoundly reshaped manufacturing base. LEIT-NMBP will provide essential technology building blocks in the form of advanced products and their manufacturing processes in strategic European value chains. In addition, important European policy goals depend on the timely availability of new technologies and innovation through KETs. It is manufacturing capabilities which will be the key in delivering solutions in health, energy, transport and environmental protection, in addition to competitiveness and jobs. LEIT-NMBP will thus contribute to the climate and energy goals, identified as another key priority by the Council and in the new Commission's agenda.

The following three flagship areas will be supported using the cPPP approach:

i: The Factories of the Future cPPP (FoF) initiative will help EU manufacturing enterprises, including SMEs, to adapt to global competitive pressures by developing and deploying the necessary key enabling technologies to support EU manufacturing across a broad range of sectors. It will help European industry to meet the increasing global consumer demand for greener, more customised and higher quality products through the necessary transition to a demand-driven industry with less waste and a better use of resources.

This cPPP, receiving its support from the LEIT-NMBP and 'Leadership in enabling and industrial technologies - Information and Communication Technologies' (LEIT-ICT) parts, will concentrate on increasing the technological basis of EU manufacturing through the development and deployment of enabling technologies, such as innovative technologies for adaptable machines, ICT for manufacturing, de-manufacturing and novel industrial handling of advanced materials. These research and innovation activities will strengthen Europe's industrial competitiveness and sustainability.

The priorities for the period 2016-2017 will be on AM; energy and resource efficiency in manufacturing, including end-of-life issues and de-manufacturing (thus contributing to a Circular Economy); on human-centred manufacturing, such as designing attractive work environments; on customisation through increased flexibility; on customer-focused added-

value manufacturing through the linking of products and processes to innovative services; on enhancing process optimisation/modelling/simulation; and on ICT for manufacturing environments in SMEs. International collaboration will be envisaged to maximise the benefit for European industry and society, including the Intelligent Manufacturing Systems initiative (IMS).

ii. The Sustainable Process Industries cPPP (SPIRE) initiative, based on an alliance of eight industrial sectors: cement, ceramics, chemicals, engineering, minerals and ore, non-ferrous metals, steel and water, will address industrial processing, reducing the consumption of energy and resources, and minimising waste. Across all process industry sectors, the innovative technologies developed in the SPIRE initiative should be capable of achieving: a reduction in fossil energy intensity of up to 30% from current levels by 2030; a reduction of up to 20% in non-renewable, primary raw material intensity compared to current levels by 2030; and a reduction of greenhouse gas emissions by 20% below 1999 levels by 2020, with further reductions up to 40% by 2030.

The SPIRE cPPP will receive most of its support from the LEIT-NMBP part, with contributions from the Societal Challenges 'Secure, clean and efficient energy' and 'Climate action, environment, resource efficiency and raw materials'.

The priorities for the period 2016-2017 will be in areas such as adaptable processes able to use different feedstocks; reduction and re-use of waste; innovative processes leading to CO₂ reduction; green technologies to develop novel materials; industrial processes reducing water use; and technology uptake within/between sectors.

iii. The Energy-efficient Buildings cPPP (EeB) initiative will support a high-tech building industry which turns the need for energy efficiency into an opportunity for sustainable business, fostering EU competitiveness in the construction sector at the global level. The drive of the EeB cPPP to promote high standards of energy efficiency ties in with wider employment, competitiveness and environmental objectives — and all Europeans stand to benefit from its achievements. This wide scope is reflected in the cPPP's leading principle: "People, Planet, Profit", in line with the Horizon 2020 objectives of global reduction in energy use and greenhouse gas emissions.

The EeB cPPP will receive most of its support from the LEIT-NMBP part, with contributions from the Societal Challenges 'Secure, clean and efficient energy' and 'Climate action, environment, resource efficiency and raw materials' (and will complement activities on energy efficiency).

The priorities for the period 2016-2017 will be in topics such as new materials for energy-efficient building components, nanotechnology-based approaches for heating, ventilation and air conditioning (HVAC) systems, energy-saving technologies, retrofitting solutions and near-zero-energy building renovation for cities and districts, as well as ICT for energy-efficient buildings and energy-positive neighbourhoods.

Beyond the activities of the three cPPPs above, the priorities identified for 2016-2017 will be served by:

iv. Advanced materials and nanotechnologies for high added value products and process industries

This approach meets the challenge of enabling inventive combinations of materials, process industries, business models, and links to public-private partnerships in delivering innovative products to markets and customers that demand them. Research and innovation activities

(including pilot lines) will focus on high precision processing and fabrication of smart materials structures and systems; nanotechnologies and advanced materials converging systems as a basis for next generation of high added value products in a wide range of application fields, such as transport (in particular also related to "Green Vehicles"), civil engineering, mechatronics, bio-medical and health, textiles and packaging.

Processing is a key to deliver value in new markets with new (nano)material enabled products and materials. Meeting the challenge of scaling up and achieving ever increasing material and energy efficiencies would dictate volume, cost-competitiveness and sustainability criteria. Activities will focus on process technologies and management of resources based on high performance nanotechnologies and advanced materials science with the aim of making chemical processes "smarter", "cleaner" and "intelligent", contributing to the Circular Economy. Research will cover "from atoms to parts and components"; new material functionalities induced by intelligent processing technologies; multi-material systems process engineering; and advanced engineering of nanotechnologies and advanced materials systems for process industries, including AM.

v. Key enabling technologies for societal challenges

The societal benefits deriving from the LEIT-NMBP technologies and their convergence¹ (including with the other key enabling technologies) will be showcased in two important areas, healthcare and energy. These areas can demonstrate the value of vision-inspired science, and technologies brought to bear on critical societal issues. Efforts in these areas are also justified by the relative maturity of the underlying technologies. New production and business models will support climate and environment goals.

- ***Advanced materials and nanotechnologies for healthcare (nanomedicine):*** Nanomedicine activities aim at shortening the long research, development and regulatory approval process, reducing the associated costs, so as to deliver safe, efficacious and cost effective products to meet the demands for improved healthcare. Operationally, they should target translation of new products from "lab-to-bedside". This should apply to all aspects of nanomedicine, including biomaterials for tissue engineered products, nanosystems and nanodevices for targeted drug delivery, diagnosis and molecular imaging, etc. Activities will be positioned with respect to the activities of Societal Challenge 'Health, demographic change and well-being' (including Micro-Nano-Biosystems and e-Health), the European Research Council (Frontier Research), Research Infrastructures, involvement of the European Medicines Agency, and others. In particular, it is expected that the societal challenge 'Health, demographic change and well-being' will provide support for the clinical investigations for nanotechnology-derived approaches and products.

- ***Advanced materials and nanotechnologies for energy applications:*** Activities will focus on providing advanced materials and nanotechnologies solutions in support of implementing the European energy policy which addresses the energy system as a whole with focus on its sustainability and security of supply while generating affordable energy. Cost reduction through the development of new technological options for promising energy technologies considering the whole value-chain, in an approach that takes into account consumers and market factors, successful diversification of energy sources, increasing the share of energy

¹ Convergence of nanotechnologies, materials and other KETs is defined as the escalating and transformative interaction among seemingly different disciplines, technologies, communities, and domains of human activity to achieve mutual compatibility, synergism and integration, and through this process to create added value and branch out to meet human needs and shared goals.

production from renewables, decentralising energy production, development of flexible energy storage and decarbonisation of fossil energy sources rely on cross-cutting KETs. Relevant innovations in advanced materials and nanotechnologies that would contribute to address the energy challenges leverage the FP7 project portfolio and project clusters for reaching market deployment and activities will also contribute to implementation of the integrated roadmap with support of all relevant stakeholders, such as EMIRI. Clear performance and deployment targets are being identified, in the context of a complete portfolio for energy, coordinated with the activities under the Societal Challenge 'Secure, clean and efficient energy'.

- *Eco-design and new, sustainable business models:* Cross-sectoral cooperation in concepts and methodologies for "knowledge-based", specialised production can boost creativity and innovation with a focus on business models in customised approaches that can adapt to the requirements of globalised value chains and networks, changing markets, and emerging and future industries.

The priorities for 2016-2017 will be in the eco-design and industrial strategies for helping industry, especially SMEs, to implement new production systems and technologies within their industrial processes and to support them for expanding existing markets and for the creation of new markets in the global competition.

vi. Knowledge-based nanotechnologies and advanced materials for industrial value chains

The industrial eco-system that would deliver nanotechnologies and material technologies to the customer and citizen, requires new strategies encompassing open innovation, accelerated approaches from the idea to the product, system-level engineering and new supply chains. The FP7 portfolio analysis shows that SMEs represent the motor of enabling systemic innovation. The overall target is to strengthen the competitiveness of European industry by leveraging existing research activities, empowering investments and product development, capable of entering the market in the 5 to 7 year time horizon; by building up complete industrial value chains and strengthening networks among stakeholders for further R&D+I activities for market; by reducing technical and production development risk by increasing the knowledge intensity of especially smaller companies and entrepreneurs. Actions will principally be implemented as cross-cutting KET pilot activities building on previous research that is ready to be progressed towards industrial-scale processes, combining smart, digital fabrication technologies with smart (nano)materials.

vii. Biotechnology

Under “Biotechnology-based industrial processes driving competitiveness and sustainability”, activities aim to bridge the gap from lab to market. This includes new approaches to valorising new feedstock resources and increasing overall bioprocess efficiencies. Under “Cutting-edge biotechnologies as future innovation driver” and “Innovative and competitive platform technologies”, activities will contribute further to sectors such as health, chemicals and agriculture by developing new technological platforms related to biocatalysis and biodesign. The overall Leitmotiv for these activities is to facilitate cross-sectoral transfer of know-how to speed up innovation.

The biotechnology activities supported under LEIT-NMBP, having a focus on technology development and demonstration will be complemented by related applications under the Societal Challenges and the Bio-Based Industry Joint Technology Initiative (BBI JTI).

viii. Actions to support developments in, and acceptance of, nanotechnologies, advanced materials and biotechnology***- Modelling for the development of nanotechnologies and advanced materials***

Materials and product developers have the need for information and knowledge-based systems that combine physical, chemical, biological and processing data around models that simulate and engineer future materials, processes and products interfaced with product life management (PLM) systems for fast development.

The principal aim is to stimulate the use of existing materials modelling software by the European manufacturing industry. Activities will focus on delivering materials modelling software and making it available to industrial end-users, including service provision (research done for industry with these software packages); translator services, to generate new solutions and support technology transfer through materials modelling, characterisation, accompanied by relevant metrology, instrumentation, standardisation as well as business decision support tools.

- Science-based risk assessment and management of nanotechnologies, advanced materials and biotechnologies

The current debate on the potential benefits and risks associated mainly with nanomaterials, but relevant also to advanced materials and biotechnologies, including the adequacy of the regulatory framework, may become a major barrier to innovation with negative effects on the development, uptake and exploitation of new technologies and applications and may result in consumers' lack of confidence and investors' reticence. Hence, establishing the grounds for a safe and sustainable development of nanotechnologies, advanced materials and biotechnologies is an important market enabler for the European manufacturing industry. A science-based and cost-efficient risk management system is a long-term objective which was pursued throughout FP7. The level of safety is established by legislation in order to ensure public health and environment protection and to ensure a level playing field for industry. In particular, further nano-safety research is needed to get the science (and the skills) right and complete for the legacy and next generation nanomaterials, for both hazards and exposure. The part on regulatory research is to translate such knowledge into a compliant and appropriate regulatory environment in line with the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and other specific legislation. Such advances will deliver safety-by-design protocols and methods that would make an evidenced-based regulatory environment a reality.

- Innovative and responsible governance of new and converging enabling technologies

An effective and informed dialogue with all stakeholders is an essential element of safe and responsible governance of nanotechnology, advanced materials and biotechnologies and their applications, enhancing public confidence. Their governance will deal with long term, global issues: integrating knowledge and technology for human potential (more creative and productive, better learning, active ageing); life security (sustainability, health, safety); and understanding and addressing the different value systems in society, concerning the deployment of technologies for societal benefits. The ethical and legal realities arising require sophisticated means to engage civic society. There is a need to improve the communication of risks and benefits and to address risk perception. Hence Social Sciences and Humanities (SSH) are particularly relevant to this area.

Since certain areas such as synthetic biology raise potential ethical concerns, ethical issues will be embedded in the corresponding topics. Where developments would target individuals or groups of people, the gender dimension will be considered.

Making the best use of available public and private funding: As technologies and their applications move to higher TRLs, the amounts of investment required far exceed the volume of Horizon 2020. It is therefore of paramount importance to create a dynamic within the innovation chain to develop financing models using synergies with structural funds or EIB; or to develop dedicated funding approaches depending on the TRL and market readiness. Projects should be carried forward by bank loans or private investors.

This process will be supported by including topics that are particularly suitable for complementary funding. Enhanced synergies between H2020 and national or regional programmes will be explored.

Important Projects of Common European Interest (IPCEIs): In March 2014, the Council called for “KETs of high industrial interest, such as batteries for electro-mobility, intelligent materials, high performance production and industrial bio-processes [to] be strengthened by swiftly identifying projects of European interest”. The LEIT-NMBP and other parts of Horizon 2020 already provide appropriate support to the areas identified as examples by the Council, and this scoping paper sets out highly relevant priorities. Other areas may be identified in due course. Meanwhile, the Commission gave guidance on the assessment under State aid rules of public financing of IPCEIs. Thus, the building blocks necessary in making further progress are being put in place.

International cooperation: International cooperation is important in all areas of LEIT-NMBP industrial activities. Consortia applying for funding will need to optimise their composition, by considering also the need for international elements and knowledge contributors in their proposals. At TRLs up to 5, international cooperation would be welcome, to create EU added value, while for higher TRLs this has to be decided on a case by case basis against a background of increasing competition and different regulatory settings. This approach is especially critical in creating EU added value from the LEIT-NMBP part, keeping in mind the predominantly high investments and long-term payback of investments. On the other hand, solutions for societal challenges should have the opportunity to build on European KETs as much as possible, also to ensure technology leadership, enhance export opportunities and reduce dependencies on imports.

3. Translation into calls 2016-2017

As noted in the previous section, the key enabling technologies in LEIT-NMBP enable applications in several different areas, suggesting numerous synergies with societal challenges. The potential of the LEIT part to develop and provide building blocks, which can be used in a shared approach in demonstration and integration activities in the societal challenges, should not be overlooked.

Such synergies or integrating areas need to be more than collections of topics falling under a common heading – instead they should focus on the entire value chain and enhance EU leadership. As a complement to focus areas, it is important to identify groupings of related activities in different calls of Horizon 2020, and complement these with dissemination activities, e.g. workshops based on particular groups of projects, and other synergies (these groupings could be described as “virtual focus areas”, which would not entail dedicated calls and could overlap with each other).

Focus areas involving contributions from LEIT-NMBP should target not only the respective societal challenges, but the goal of EU Manufacturing. This can be done through the development of scaled-up production of advanced technology components or products, as well as through demonstrators, and should be complemented by innovative public procurement and other innovation activities that catalyse further investment, primarily private.

Hence, *EU Manufacturing should be seen as an overarching priority*, encompassing the activities in the LEIT part as well as in different Societal Challenges, notably where KETs and manufacturing capabilities are essential enablers for Europe's competitiveness and ability to achieve its policy objectives. Horizon 2020 is a key instrument to spearhead the set of measures to be deployed for "A New Start for Europe".

The necessary elements for modes of cooperation (incl. focus areas) between the parts of Horizon 2020 with an emphasis on manufacturing are:

- Industrial capacities;
- Markets;
- Supporting policy objectives (including possible regulatory incentives);
- Maturity of the KETs;
- Concrete added value through integration (by addressing missing activities);
- Creating momentum for innovation; and
- First impacts of projects in a time horizon of 3-5 years.

With this in mind, a single, major focus area is proposed (with major contributions from LEIT-NMBP and Societal Challenge 'Climate action, environment, resource efficiency and raw materials', and not having a centre weight in a particular part of Horizon 2020):

Industry 2020 and Circular Economy

This focus area will be at the heart of how Horizon 2020 contributes to boosting and renewing Europe's industrial capacities and the real economy, by taking a circular economy approach, ensuring economic, environmental and social sustainability.

It has the strategic objective of demonstrating the economic and environmental feasibility of the circular economy approach and at the same time giving a strong impetus to the re-industrialisation of the EU, by developing and deploying new approaches and technologies. The focus area will implement Communications "Towards a circular economy: A zero waste programme for Europe" (COM(2014)398) and "European Industrial Renaissance" (COM(2014)14); and reflect the Council conclusions of March and June 2014, in particular the Council's call for cleantech; and contribute to two of President-elect Juncker's 10 priorities: 'A new boost for jobs, growth and investment' (including the goal of increasing the weight of EU industry to 20% of GDP); and 'A resilient Energy Union with a forward-looking climate change policy'.

The expected impact of this focus area is a leap towards a more resource-efficient and hence competitive European industrial economy, through a reduction of costs, energy, emissions and raw materials, low-carbon technologies for energy-intensive industries, optimisation of processes, as well as by exploring new markets. Systemic solutions will be examined, developed and demonstrated throughout value chains, and by addressing all influencing factors (policies and framework conditions, business models, industrial manufacturing and

processing, developing new skills, eco-innovation in a wide sense, energy efficiency, reduction of Greenhouse Gas Emissions, new and efficient use of raw materials, finance, organisation, social innovation, and new forms of consumer behaviour). While the engagement of industry is essential, full success will depend upon a systemic approach, including new production, consumption and behaviour patterns, with strong multi-stakeholder involvement, engagement of civil society and the active contribution of SSH disciplines.

Actions in this focus area will include research and innovation tackling the gap between potential solutions and their societal and industrial take-up and deployment. This will include support for industrially driven R&I projects, including pilot lines and demonstration activities. Actions will have an integrated and cross-sectoral approach and address different levels of implementation, from plant up to regional scale. Exchanges of best practice at international level will be pursued to the benefit of European business: to foster the potential of strong markets for European technologies and businesses. In addition to grants, the instruments used will include financial instruments, prizes, possibly Pre-Commercial Procurement and Public Procurement of Innovative solutions, as well as ERA-NETs, while capitalising on effective synergies with ESIF.

Major contributions will come from the Societal Challenge 'Climate action, environment, resource efficiency and raw materials' (as support for the overall goal of **circular economy** and **systemic eco-innovation**) and LEIT-NMBP (as support to the process and manufacturing industries via the cPPPs **SPIRE** and **Factories of the Future**). These will be complemented by a set of activities designed to implement the proposed policy initiative of **Additive Manufacturing (“3D Printed in Europe”)**; and nanotechnology pilot lines. Clean-tech will be specifically addressed in the waste and water sectors and in support of sustainable manufacturing. The Societal Challenge 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bio-economy' will contribute with the bio-economy aspects. Further contributions are expected from the Societal Challenges 'Secure, clean and efficient energy' and "Climate action, environment, resource efficiency and raw materials' (related to energy efficiency in the process industry) and LEIT-ICT (related to Factories of the Future). A set of support actions will complete the focus area, designed to address, e.g., standardisation, SSH issues, clustering of projects and industry-targeted dissemination.

The focus area will be supplemented by

LEIT-NMBP enabling technologies call – covering R&D+I in the four key enabling technologies and ancillary issues not falling under the focus area on EU Industry 2020 and Circular Economy.

Energy-efficient Buildings call – covering the activities of this cPPP.

Furthermore, the following contribution of LEIT-NMBP to a focus area under the Societal Challenges is proposed:

Competitive Low-carbon Energy – contributions related to nanotechnology and advanced materials for energy applications.